# CHEETAH CONSERVATION FUND: HABITAT RESTORATION FOR THE NAMIBIAN CHEETAH

## ENVIRONMENTAL IMPACT ASSESSMENT

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[1] Capacity Development and Linkages for Environmental Impact Assessment in Africa

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**ABBREVIATIONS**

| | | |
|---|---|---|
| CCF | - | Cheetah Conservation Fund |
| CITES | - | Convention on International Trade in Endangered Species |
| CLEIAA | - | Capacity Development and Linkages for Environmental Impact Assessment in Africa |
| DEA | - | Directorate of Environmental Affairs, Namibia |
| EA | - | Environmental Assessment |
| EAAIA | - | Eastern Africa Association of Impact Assessment |
| DRFN | - | Desert Research Foundation of Namibia |
| EIA | - | Environmental impact assessment |
| ENCAP | - | Environmental Capacity Building Programme |
| FSC | - | Forest Stewardship Council |
| IEE | - | Initial Environment Examination |
| IUCN | - | World Conservation Union |
| NAPCOD | - | National Programme to Combat Desertification |
| PD | - | Professional Development |
| SADC | - | Southern Africa Development Community |
| SAIEA | - | Southern Africa Institute for Environmental Assessment |
| SRK | - | Stefan, Robertson and Kirsten |
| USAID | - | United States Agency for International Development |

## EXECUTIVE SUMMARY

## 1.0 INTRODUCTION

### 1.1 Purpose of the EIA

A project on Cheetah Habitat Restoration through partial debushing of *Acacia mellifera*, *A*. *tortilis* and *Dichrostachys cinerea* has been proposed by the Cheetah Conservation Fund (CCF), a Namibian non-governmental organisation. The aim of CCF is to ensure the long-term survival of the cheetah and its ecosystem through a multi-disciplinary and integrated conservation programme of research and education. The Waterberg Conservancy in the Otjiwarongo area has proposed a project of debushing invader bush species as a way of controlling bush encroachment and consequently habitat restoration for the Namibian Cheetah. This project is to be funded under a Congressional Directive to protect cheetahs through USAID/ Namibia. CCF hopes to realise its long-term goal of enhancing the long-term survival of cheetah and other key indigenous wildlife on Namibian farmlands, through the proposed project, by developing a habitat improvement programme that is both ecologically sound and economically viable.

Prior to implementation of the project, EIA was recommended in accordance to the Namibian laws and constitution, as well as the USAID funding requirements. Article 95 of the Namibian Constitution emphasises the state's commitment to maintenance of ecosystems, essential ecological processes and biological diversity and the utilisation of natural resources sustainably for the benefit of the present and future generations. Namibia's Cabinet-approved EA policy (August 1994) emphasises the need for Environmental Assessments to be carried out for all major projects, programmes and policies.

An Initial Environmental Examination (IEE) conducted by USAID on the proposed project in August 2001 recommended that an EIA be done to systematically review the impacts of the proposed project activities and to examine the possible alternatives to the project.

The terms of reference for this EIA were developed by SAIEA based on the CCF project proposal for the project with the objective of identifying the key environmental issues relating to phases 1 and 2 of the proposed project, assessing their significance, identifying key stakeholders and their concerns, and recommending mitigative measures. This EIA study is also to advise whether the project contains any major weaknesses or even "fatal flaws" from an environmental point of view, and highlight the strengths of the project as guided by Namibia's EA policy and USAID's EA directives.

### 1.2 Project Rationale

The goal of the project is to enhance the long-term survival of the cheetah, and other key indigenous wildlife on Namibian farmlands by restoring habitat for the indigenous biota of Namibia. Although cheetah have thrived on commercial farmland in Namibia, in part because of the establishment of permanent water and increased numbers of wild ungulate species, bush encroachment may cause potential problems that are specific to cheetah populations. These problems include reductions in hunting

efficiency, reductions in prey species abundance and distribution, and increased farmer's intolerance that results from increased economic problems including increased hunting of livestock by the cheetah. In addition, much of Namibia's biodiversity is found outside of the formal protected area network, where changes in land use practices and resulting bush encroachment. Bush encroachment may best be defined as the invasion and or thickening of aggressive undesired woody species resulting in an imbalance of the grass/bush ratio, a decrease in biodiversity, a decrease in carrying capacity and concomitant economic losses. This may fragment cheetah populations and affect their abundance and distribution.

The cheetah (*Acinonyx jubatus*) is an internationally declared endangered species, currently listed as an Appendix I species (Endangered) under the Convention on International Trade in Endangered Species (CITES), and listed on the World Conservation Union (IUCN) species survival commission Red List of Threatened Species. The free ranging cheetah population is estimated at only about one tenth of its number of a century ago. Currently, only two free-ranging population "strongholds" exist, one in eastern Africa (Kenya and Tanzania) and the other in southern Africa (Namibia and Botswana).

Namibia has the largest remaining population in the world, estimated at 2,500 (Marker *et. al*. 1999). Ninety percent of Namibia's Cheetah occurs outside of the state owned protected reserves, primarily on commercial livestock farmlands and private game ranches. About 1,000 farmers control the fate of the cheetah due to the cat's conflict with livestock farming interests. The cheetah's range covers about 50% of the surface area of Namibia, encompassing most of central Namibia. The heartland of the cheetah habitat is centred around Otjiwarango and the Waterberg Conservancy, near which the Cheetah Conservation Fund has established an extensive Research and Education Centre.

### 1.3 Social economic Rationale

Over ninety percent of the Namibian population's income is generated from dry-land commercial cattle farming which loses over 100 million Namibia Dollars each year due to the effects of bush encroachment (Quan, 1994). In northern commercial farms around Otjiwarongo and Grootfontein, bush encroachment alone affects between 8 to 10 million hectares of land at an annual loss of over 8-10 million US Dollars. Because of the rapid growth of the bush, these figures are estimated to increase at an exponential rate over the next decade.

Bush encroachment, thought to be the most serious single problem facing cheetahs in Namibia, is especially prevalent on commercial farmlands in central Namibia. The closing in of open spaces, is measurably reducing the economic productivity of the Namibian livestock industry. Farmlands in Namibia still harbour a diverse assemblage of native species and have substantial potential as refuges for Namibia's biota. For example, the majority of Namibia's populations of native large ungulates (over 80%), and the largest remaining population of cheetahs in the world are found on commercial farmland, outside of the formal protected area network. Considerable conservation efforts and government wildlife policies are focused on these large mammalian species.

This project is designed to provide direct linkages between biodiversity conservation and economic development, with particular emphasis on targeting historically disadvantaged demographic groups of Namibians. CCF proposes to develop an entrepreneurial framework that will allow local people to economically benefit from habitat restoration efforts. The resulting product (wood briquettes) will be marketed in the name of the cheetah and will be distributed with conservation labelling.

## 2.0 EIA Methodology

In addition to receiving introductory lectures, the group undertook literature review, consultations with stakeholders and site visits as the main methods of information and data collection during the EIA study.

Lectures were received on following subjects - International conventions on environment, USAID's environmental policy and regulations, environmental law and regulations of some SADC countries, ecology and range management in Namibia, bush encroachment in Namibia and environmental economics.

A wide range of literature was reviewed on the following areas: Background and extent of bush encroachment, socio-economic implications of bush encroachment to the Namibian economy, Namibia's EA policy framework and draft legislation, Namibia's health regulations, CCF project reports on bush encroachment and cheetah management.

Open- ended questions and checklists techniques were used during consultations with the following stakeholders: Farmers, Public health officials, Town Clerk of Otjiwarongo, CCF, Farm workers and Agriculture officials.

The EIA team visited the CCF and the field sites for the project where they were briefed on major CCF activities and observed varying degrees of bush encroachment respectively. The team also visited the site for the factory at Otjiwarongo.

Potential impacts of the project were identified and summarised for each project activity using an evaluation criteria provided in the USAID Source Book (1996).
However, the team, in carrying out this exercise, relied heavily on background information and secondary data for the EIA due to the fact that only one month was available to accomplish the task. The team also did not conduct an economic validation of the project because of lack of data on cost of production and machinery, and also the site for the factory was not yet definite. Hence the EIA team relied on the project assumption that the project is economically viable.

This EIA addresses experimental phases 1and 2. Scaling up to phase 3 will depend on the results of the experimental phases. This EIA therefore, without data and information from pilot phases, is not in a position to comment and/or predict the likely impacts of phase 3.

Not all stakeholders could be consulted due to their unavailability at the time. However, it is considered that the most important stakeholders were consulted and that no serious information gaps exist.

Whilst more information could certainly have been obtained, it is the opinion of the authors that sufficient information has been provided to enable decision making on the future of the project.

## 3.0 Description of the Project

The proposed project will be located in Otjiwarongo district about 45 km east of the Otjiwarongo town. The CCF plans to test and monitor methods of harvesting the encroached bush and then design a scheme that is appropriate to farmland habitat and is beneficial to the landowners. CCF will develop an international market for bush-based products that assures the long-term sustainability of appropriate levels of harvest. Within Namibia, CCF proposes to market the fire log as an affordable alternatives to wood harvesting (CCF Project Proposal).

The project is designed in three phases:

Phase 1 proposes to clear about 400 ha of bush encroached land in 4 commercial farms ((Cheetah View, Elandsvreugde, Clifton, Boskop and Osananga farms). Harvesting of bush will be carried out within 4 cattle grazing camps on these farms. Experimental plots will be in the form of paired treatment areas located within the same grazing camps. Clifton experimental plots will be subjected to livestock grazing at controlled stocking rates and Cheetah View plots will be subjected to grazing and browsing from wildlife species only. Experimental design will be independently peer-reviewed before harvesting commences. Details regarding experimental design of the phase 1 and 2 of the project appear in appendix V. The project proposes to hire and train personnel in all project activities. Harvesting units will be established and supported by chipping and transport units. These units will be established to clear bush encroached land and to supply initial production material to the fire log, pellets and briquettes processing factory. These business units are expected to become independently owned and profitable businesses, within 2 to 4 years and will be ecologically certified. Initial harvest areas will however be according to experimental design

The project proposes to establish contact with the Forest Stewardship Council (FSC) and appropriate local government and non-governmental organizations to facilitate certification, training and environmental education aspects of the project.

Phase 2 of the project proposes to lease the refining facility (site for processing machine) in the General Industrial Zone of Otjiwarongo town. Staff for refining and associated business activities will be employed by the project.
The project will also initiate business processes associated with fuel log manufacturing and associated activities, including establishing foreign export markets, creating business infrastructure and revising the existing business plan. The main activities under this phase are proposed to be

- Fund the development and implementation of the fuel log manufacturing plant in the town of Otjiwarongo.
- Establish infrastructure related to manufacturing fuel logs from pellets.
- Establish manufacturing plant design, purchase fuel log production equipment, lease manufacturing facility and hire appropriate staff including a project manager.

- Begin manufacturing and export of fuel logs. Fuel Logs will be produced according to commercial business principles, i.e., net income will be earned from the operation. While initial start-up subsidies may be required to get operations running, and to demonstrate the concept's feasibility, an important objective is to make the operation commercially viable, if possible, during phase 2. Wood products used to produce the fuel logs will only be purchased from suppliers whose harvesting practices have been "certified" as environmentally sustainable.
- Explore markets and development of alternative bush products to wood energy
- Continue ecological monitoring and data collection.
- Train additional harvest units as necessary for production of raw materials.
- Start equipment leasing to certified harvesting and/or chipping units.

The final phase (3) is proposed to evaluate the results of phase 1 and 2 and also developing an adaptive management system. Should it prove to be ecologically and economically viable, phase 3 will involve an extension on the area for habitat restoration and adaptive management for cheetah conservation. This would also provide a long-term income generating, self-sustaining conservation development project for the CCF.

## 4.0 Description of project alternatives

Various project alternatives based on the proposed project activities were explored including no action alternative;

### 4.1 No Action Alternative

The phenomenon of bush encroachment over the last thirty years has significantly decreased the productivity of nearly one third of Namibia's livestock farmlands. In commercial farms around Otjiwarongo and Grootfontein, bush encroachment alone affects between 8 to 10 million hectares of land, resulting in an annual loss of between 8-10 million US Dollars (CCF, Project proposal). Besides the increasing bush encroachment is increasingly causing problems specific to Cheetah which include the reduced hunting efficiency, reductions in prey species abundance and distribution, and conflict with livestock farming interest (Marker et al, 1996). Available information indicates that 29% of cattle losses and 3% of small stock losses were attributed to Cheetah between 1986 and 1994 (Marker et al, 1996). The no action project alternative can only aggravate the situation further leading to increased intolerance of the cheetah.

### 4.1 Bush harvesting

CCF has proposed to use mechanical bush clearing methods that will include hand clearing with axes and machetes, power driven hand machine and combine harvester.

#### 4.1.1 Possible bush harvesting alternatives and their limitations

Fire has been used as a range management tool in many rangelands of the world. However, fire does not seem to have been widely used in the commercial farmlands

in Namibia. The main reason why fire was not a tool of choice was that in order for fire to be effective, it requires a certain amount of fuel load, mainly composed of thick grass layer and other thickets, which would have to accumulate after a certain rest period. Fire in low grass biomass often results in poor kill rate of the trees, most of which have evolved in the presence of fire in the African savannas and therefore require high temperature fires. Most farmers consider burning of such grass biomass as a wasted cattle forage. The use of fire is also risky requiring experience and skills in order to be effective. Fire management is also not a one-time management tool. It often requires repeated application with careful choice of appropriate season and fire breaks, and is therefore an expensive and risky alternative. Most of the targeted sites in the four farms have medium to large thickets with little or no grass biomass necessary for an effective fire. Also, since the sites are being cleared for experimental purposes, the use of fire might not necessarily lead to the same results as selective hand clearing.

The use of herbicides as an alternative may have far reaching negative ecological consequences if the application rates have been miscalculated. Herbicides take long to show effects and have the potential of eliminating useful plant and animal species. USAID funding requires stringent adherence to safety where herbicides and pesticides are being used. Where a project includes assistance for procurement or use, or both, of pesticides registered for the same or similar uses by USEPA without restriction, the initial Environmental Examination for the project should include a separate section evaluating the economic, social and environmental risks and benefits of the planned pesticides use to determine whether the use may result significant environmental impact. Furthermore the use of herbicides might be inimical to ecological sustainability that this project is trying to achieve. USAID funding in this particular project excludes the use of pesticides, unless specific justification and documentation on mitigation and Integrated Pest Management alternatives is produced consistent with USAID's Pesticide Procedures (22 CFR 216.3(b)). Besides, use of pesticides might lead to other primary or secondary effects on other organisms, which might interfere with the experimental design proposed in this phase of the project.

Big browsers in the commercial ranches in Namibia, including Rhinos and elephants were eliminated early in the last century, for purposes of trade and ostensibly for causing diseases to livestock enterprises. The introduction of the same browsers may not be a practical option in this project.

### 4.2 Chipping site alternatives

The possible alternative to the chipping site would be a factory site and this would however be more costly in terms of transport. The non-chipped wood is voluminous and would cost more trips to transport than the chipped wood.

### 4.3 Transport alternatives

There is no possible alternative for transport in the field and to the factory since rail and air transport are not possible, and there is only one major road from the field sites to Otjiwarongo (D2440).

### 4.4 Product alternatives

Natural logs are possible alternatives to the processed products. However, they will be difficult to pack, transport and sell, and have low economic value.

Charcoal production if practiced under a good management system (e.g., under FSC certification system) is a good alternative product with similar or more established market. Charcoal production and marketing does not seem to have been adequately explored under this project. Since the potential market and cost benefit analysis for the proposed fire log is yet to be established, charcoal based enterprises produced in environmentally friendly and sustainable manner might still offer a good alternative (See Appendix VII for FSC certification on environmentally sustainable utilisation of forest products)

Other potential products including Chipboard and Wood cement do not seem to have established local market and might not effectively compete in international market due to shipping and other handling costs.

### 4.5 Drying method alternatives

The most logical alternative to air-drying is mechanical extraction of moisture to the required levels. But since this would, however, require considerable capital investment, air-drying seems to be the most affordable option for the initial phase of the project. It would also consume considerably more energy.

### 4.6 Compression Machine alternative

The project intends to use the piston driven extruder for processing the wood chips into final products. The project could also use the screw driven extruder. The screw driven extruder is however, more expensive to operate and maintain. In addition, the screw driven extruder produces only fire logs whereas the piston driven extruder produces a wider range of products.

## 5.0 DESCRIPTION OF ACTIVITIES, IMPACTS AND MITIGATION MEASURES

The identified potential impacts were categorised as either direct or indirect, by duration, according to their contribution (either positive or negative) and whether they are likely to be cumulative or not. Various characteristics of the impacts were used to assess the severity of the identified impacts. The main impact descriptors were; magnitude (low, moderate or high); direction; (negative or positive); extent: (low, moderate and high); duration (short term or long term); reversibility; (low, moderate, and high); and likelihood of occurrence (low, moderate and high). The impacts for the various activities are as follow (Table 1.0).

## Table 1.0: Evaluation of potential impacts under the various project activities

| Activity | Impact | Level of significance | Mitigation/enhancement measures |
|---|---|---|---|
| Bush harvesting | Aesthetic improvement | M + | • No mitigation necessary |
| | Habitat improvement | H + | • No mitigation necessary |
| | Grass productivity | M + | • No mitigation necessary |
| | Biodiversity | M + | • No mitigation necessary |
| | Health risk | M - | • Provision of protective gear like hand gloves, eye masks, overcoats or overalls to all workers |
| | Regrwoth/ resprouting | M- | • Regular harvesting every 5 to 7 years |
| | Fire Hazard | M | • Training workers in fire management.<br>• Constant supervision of workers<br>• Proper selection of camp sites.<br>• Construction of fuelbreaks surrounding the camps sites. |
| Chipping | Fire Hazard | M - | • Training workers in fire management.<br>• Constant supervision of workers<br>• Proper selection of camp sites.<br>• Construction of fuelbreaks surrounding the camps. |
| Transport | Damage to road | M - | • Regular road repair and maintenance |
| Processing | Hazardous material (used oils, batteries) | M - | • Abiding by health regulations for waste management.<br>• Routine collection and disposal of refuse. |
| | Solid waste | M - | • Abiding by health regulations for waste management.<br>• Routine collection and disposal of refuse |
| | Liquid waste | M - | • Abiding by health regulations for waste management. |
| Marketing | Cheetah conservation awareness | H + | • Advertisement and labelling of products to include ecological and economic information about Cheetah conservation.<br>• Increase awareness creating programs |
| | Improvement in Cheetah Conservation | M + | • Advertisement and labelling of products to include ecological and economic information about Cheetah conservation<br>• Increase awareness creating programs |
| | Tourism promotion | M + | • Advertisement and labelling of products to include ecological and economic information about Cheetah conservation<br>• Increase awareness creating programs |
| | Income to CCF | M + | • Constant product market survey<br>• Produce and maintain high quality and environmentally friendly products. |

Key : L = low; M = moderate; H = high; + = Positive - = Negative

## 5.1 Bush harvesting

The main activities involve hiring about 4-8 workers for the bush clearing. The proposed techniques are manual hand clearing, power driven machine and a bigger tractor type machine that will be compared to assess both ecological and economic viability. The project proposes to remove between 20-80% of the target species (*A. mellifera*, *A. reficiens* and *D. cinerea*) while leaving bigger trees of certain minimum diameter. Evidence from other similarly cleared fields show that re growth of the cut brush to about 1.5 to 2 metres normally takes place within 5 to 7 years after the initial cutting. The project assumes a repeat harvesting cycle closely related to this period. The cut bush will be placed in piles 20 metres apart. The workers engaged to harvest the bush are likely to camp in the field, to be close to the cutting areas and to reduce transport costs and impacts.

### 5.1.1 Impact evaluation of bush harvesting

Only habitat improvement was rated to be a positive impact of high significance. Other identified positive impacts of medium significance are likely to include improvement of the aesthetics, improved grass productivity (due to reduced canopy shading and competition for nutrients), and improved biodiversity. However, possible health risks during the operation ( mainly cuts from thorns), and potential illegal hunting and fire hazard (from smoking and cooking) were identified as negative impacts of moderate significance. All the other identified impacts were analysed and are considered to have low impacts on the environment.

It is expected that in the long term, regular harvesting cycles of 7 to 10 years would reduced the thickets and result in improved hunting efficiency for Cheetah. Better distribution of prey may also increase.

Safety risks for workers are likely to be high because encroached bush are thick, thorny and may cause injuries to workers during handling.

### 5.1.2 Mitigation measures proposed for the bush-harvesting phase.

The CCF project management needs to provide protective gear like hand gloves, eye masks and overcoats or overalls to all workers. Also the workers should construct fire breaks around camp sites.

## 5.2 Chipping

The chopped wood will be chipped on site using a chipper which will be driven by tractor from site to site. The chopped wood from about 10 m radius ranging from 0.3 meters to 3 metres high will be piled together, from where it will be transported to the fuel log processing factory. The total area expected to be harvested during the experimental phase is 400 hectares with a likelihood of scaling up to other farms, if the commercial value of the fuel log gets established. CCF estimates an output of 75 metric tons of chips per week during the experimental phase.

### 5.2.1 Impact evaluation of chipping.

The only major risk is likely to be accidental bush fires caused by the work teams (cooking and smoking). The wet piled chips are not likely to be a fire hazard

### 5.2.2 Mitigation measures during chipping

The suggested mitigation measures include training, constant supervision, proper selection of sites and construction of firebreaks around the campsites.

### 5.3 Transport

The chipped wood will be transported by trucks from the field to the factory using the existing routes (D2440). Trucks and railways will be used for transporting the end product to the market destinations. The high density of bush along the road from the Cheetah Foundation to Otjiwarongo poses a threat to the drivers.

### 5.3.1 Impact evaluation of transport

The significant impact during transportation is likely to be the deterioration of the gravel road to Otjiwarongo, especially in the long term when the project scales up. The road drainage system is also likely to be affected in the longer term.

### 5.3.2 Mitigation measures during transport.

It is proposed that the road be regularly repaired and maintained particularly after the rainy season. The Ministry of Works and Transport, should maintain the roads. CCF has been granted a licence to clear the roadside bushes and thickets along their properties, which it is using to evaluate the best chipper and clearing method. The removal of the road reserve thickets (about 20 meters on each side of the road) should be done regularly along the whole stretch from CCF to Otjiwarongo and should involve proper after care to keep the brushwood down, by the Ministry.

Truck drivers must adhere to road use regulations including road weights, speed and general courtesy to other road users.

### 5.4 Factory operation (processing of the wood chips to fuel logs)

The project proposes to sun dry the wood chips to a moisture content of about 15% . The chips will then be compressed to fuel logs using a Piston excluder at Otjiwarongo. The prototype identified for this kind of work is already in use in Europe for similar kind of work, and normally uses electric mortars. There will be no chemical additives foreseen for this phase.

### 5.4.1 Impact evaluation of factory operations

Hazardous materials are more likely to become a problem in the long term due to handling of used oils and used battery acids.

Solid wastes in the form of packaging material, pieces of broken metal from machine repairs and some pieces of chipped wood are easily disposed as long as CCF abides by the municipality regulations for waste management
Liquid wastes in the form of waste-water from cleaning are easily disposed as long as the CCF factory has proper connections to the sewage system.

### 5.4.2 Mitigation measures of factory operations

The CCF needs to abide by the health regulations for waste management and the municipality needs to maintain routine collection and disposal of refuse.

## 5.5 Marketing

CCF plans to label the products to enhance global conservation education through conservation-oriented marketing and informational labelling.

### 5.5.1 Impact evaluation of marketing

- Improved global awareness of the importance of conserving Cheetah.
- It is expected that the current Cheetah-farmer conflict will be reduced and the Cheetah population can be maintained and/or increased.
- Namibia's tourism industry is likely to be boosted.
- Income from product sales will likely support ongoing CCF conservation programs.

# 6.0 Recommendations and Conclusion

## 6.1 Recommendations

The suggested mitigation measures should be explored and implemented by CCF management in the context of ;

- Satisfying all applicable laws; during harvesting in form of legal licences and permits to clear the bushes; recruitment of contracted labour force to chop the bushes, chipping and processing phase of the project; handling of used and unused oils, lubricants at the processing phase, and battery acids according to the municipal health hazard act; transport regulations, etc by CCF project manager. All the applicable laws and statutes must be followed throughout the life of the project.
- The CCF project manager should work out a project management plan to showing the main activities of the project, size of the area to be cleared and specific location, the number of people engaged at every level and their status (permanent employees or contracted labour), the type and number of machinery purchased for the purpose of the project, the transport type preferred, marketing and advertisement plan, and responsibility at each level of the activity. The Management plan should be drawn before the main project work begins.
- The CCF project management should engage in regular monitoring of the project activities, with a view to monitor the ecological changes noted at the field level, and also to note the progress of the project implementation. This

will be useful in phase 3 of the project where the results of phases 1 and 2 will be used to scale up the project to other neighbouring farms.

- The CCF management should start a management plan to maximize wildlife values and minimize pressures on natural woodland for long-term sustainability in cheetah habitat restoration. While the plan should be started immediately, it should have a long-term focus to bear any results.
- The CCF project manager should identify, define and develop biodiversity conservation targets and indicators for ecological monitoring. This should be done as part of the experimental design at the beginning of the project.
- The CCF management should strive to collect baseline-monitoring data including vegetation patterns (i.e. grasses, woody and herbaceous plants) and relative abundance and distribution of target species before the bush clearing starts and after the bush clearing.
- CCF project management, recognising the experimental nature of this project should endeavour to build scientific capacity for bush encroachment studies, during the field phase of the project.
- The CCF project management should also, design and implement an adaptive management framework, whereby ecological monitoring results can directly influence future management practices including harvest locations, cut block size and rate and methods of harvesting

## 6.2 Conclusion

On the basis of the examined potential impacts, the proposed project's phases 1 and 2 are not likely to have severe or significant negative impacts on the environment. However the environmental effects of scaling up the project beyond the experimental phase to a regional project will need to be evaluated based on the monitoring and experimental results in the two initial phases. On the other hand there are a number of significant positive impacts that are likely to result from this project among increased biodiversity, cheetah habitat restoration, and improved grassland productivity.

## 1.0 INTRODUCTION

Environmental Impact Assessment (EIA) is a tool used to identify the ecological, social, and economic impacts of a project prior to it's implementation. It assists decision makers at an early stage in project planning and design, to reduce adverse impacts, shape the project to suit the local environment and present predictions and options to decision makers. An EIA should also strive to enhance a project positive impact.

A project on Cheetah Habitat Restoration through partial debushing of *Acacia mellifera*, *A*. *tortilis* and *Dichrostachys cinerea* has been proposed by the Cheetah Conservation Fund (CCF), a Namibian non-governmental organisation. The aim of CCF is to ensure the long-term survival of the cheetah and its ecosystem through a multi-disciplined and integrated conservation programme of research and education. The Waterberg Conservancy has proposed a project of debushing invader bush species as a way of controlling bush encroachment and consequently habitat restoration for the Namibian Cheetah. This project is funded under a Congressional Directive to protect cheetahs through USAID/ Namibia. CCF hopes to realise its long-term goal of enhancing the long-term survival of cheetah and other key indigenous wildlife on Namibian farmlands, through the proposed project, by developing a habitat improvement programme that is both ecologically sound and economically viable.

The EIA is necessitated by USAID funding requirements. It is USAID policy (defined by 'Regulation 216') to ensure that the environmental consequences of USAID financed activities are identified and considered by both USAID and the host country prior to the implementation of the project and that appropriate environmental safeguards are adopted (Knausenberger *et al* 1996). USAID policy also emphasises assisting developing countries in strengthening their ability to appreciate and effectively evaluate potential environmental effects of proposed developmental projects.

In Namibia, natural resource management is an important policy issue. Article 95 of the Namibian Constitution emphasises the state's commitment to the maintenance of ecosystems, essential ecological processes and biological diversity and the utilisation of natural resources sustainably for the benefit of the present and future generations. It provides for the security of the people by encouraging the adoption of policies that conserve and maintain ecosystems and ensure sustainable utilisation of natural resources.

Namibia's Environmental Assessment (EA) Policy outlines issues to be addressed in order to achieve environmental protection and sustainable development. The Cabinet approved EA policy emphasises the need for environmental assessments to be carried out for all major projects, programmes and policies.

During the course of this EIA study reference has been made to the Initial Environmental Examination (IEE) conducted by USAID on the proposed project in August 2001. The (IEE) recommended categorical exclusions on activities that did not have a direct effect on biophysical resources, a negative determination with conditions on physical changes associated with ecological research on bush encroachment, pilot restoration trials on cheetah habitat by clearing woodland bush

trees and re-establishing grass rangeland on privately owned (communal and individual) land; and a deferral for approval of Phase 2 operations pending the outcome of the review of Phase 1, and preceding adaptive management trials and biodiversity research. The IEE also recommended that an EIA be done to systematically review the impacts of the proposed project activities and to examine the possible alternatives to the project.

### 1.1 TERMS OF REFERENCE FOR THE EIA

The terms of reference for this EIA were developed by SAIEA based on the CCF project proposal for the project. The main objective of this EIA is to identify the main environmental issues relating to phases 1 and 2 of the proposed project, to assess their significance, to identify key stakeholders and their concerns, and to recommend mitigative measures. This EIA study is to advise whether the project contains any major weaknesses or even “fatal flaws” from an environmental point of view, and highlight the strengths of the project as guided by Namibia’s EA policy and USAID’s EA directives.

The report forms a basis of a bigger EIA study that is to be undertaken if the implementation of the pilot project is successful for it to be done on larger scale. This report is a presentation of the expected significant environmental impacts of the project, analyses of alternatives to and within the project, and recommendations for mitigation considered in the EIA study. Details of the terms of reference are presented in Appendix I.

## 2.0 Project Rationale

### 2.1 Ecological Basis

The goal of the project is to enhance the long-term survival of the cheetah, and other key indigenous wildlife on Namibian farmlands by restoring habitat for the indigenous biota of Namibia. Although cheetah have thrived on commercial farmland in Namibia, in part because of the establishment of permanent water and increased numbers of wild ungulate species, bush encroachment may cause potential problems that are specific to cheetah populations. These problems include reductions in hunting efficiency, reductions in prey species abundance and distribution, and increased farmer’s intolerance that results from increased economic problems. In addition, much of Namibia’s biodiversity is found outside of the formal protected area network, where changes in land use practices and resulting bush encroachment may fragment populations and change patterns of abundance and distribution.

The cheetah (*Acinonyx jubatus*) is currently listed as an Appendix I species (Endangered) under the Convention on International Trade in Endangered Species (CITES), and listed on the World Conservation Union (IUCN) species survival commission Red List of Threatened Species. The free ranging cheetah population is estimated at only about one tenth of its number of a century ago. Currently, only two free-ranging population "strongholds" exist, one in eastern Africa (Kenya and Tanzania) and the other in southern Africa (Namibia and Botswana).

Cheetahs are solitary and do not live in groups. The vast majority of the cheetahs live in small isolated populations or sub-populations outside of protected areas.

Rapidly declining cheetah populations result in a smaller and less diverse gene pool. Healthy populations may therefore be found in fewer than half of the countries where cheetahs still occur.

Namibia has the largest remaining population in the world, estimated at 2,500 (Marker *et. al.*1999). Ninety percent of Namibia's cheetah occur outside of state owned protected reserves, primarily on commercial livestock farmlands and game ranches. About 1,000 farmers control the fate of the cheetah due to the cat's conflict with livestock farming interests. The cheetah's range covers about 50% of the surface area of Namibia, encompassing most of central Namibia. The heartland of the cheetah habitat is centred around Otjiwarango and the Waterberg Conservancy, near which the Cheetah Conservation Fund has established an extensive Research and Education Centre.

**2.2 Social economic rationale**

Recent human-mediated impacts include overgrazing, fire suppression, fragmentation of historical migration routes, establishment of permanent water sources and extirpation of the largest herbivores and top carnivores. As a result of these ecological changes grasslands and savannas have been converted to dense, acacia-dominated thickets with little grass cover (referred to as "bush"), a desertification process known as "bush encroachment" and "thickened bush." This phenomenon in this instance is the result of indigenous species expansion, not exotic species invasion.

Over ninety percent of the Namibian population's income is generated from dry-land commercial cattle farming which loses over 100 million US Dollars each year due to the effects of bush encroachment (Konrad, 2000). In northern commercial farms around Otjiwarongo and Grootfontein, bush encroachment alone affects between 8 to 10 million hectares of land at an annual loss of over 8-10 million US Dollars. Because of the rapid growth of the bush, these figures are estimated to increase at an exponential rate over the next decade.

Bush encroachment, thought to be the most serious single problem facing cheetahs in Namibia, is especially prevalent on commercial farmlands in central Namibia. The closing in of open spaces, is measurably reducing the economic productivity of the Namibian livestock industry. Bush encroachment may cause reduction of farmer's tolerance that results from increased economic problems. All these factors are linked together and result in increased farmer removals of cheetahs. Drought cycles tend to exacerbate these problems and linkages between these potential problems. This project can be viewed as a step towards breaking these cycles, all of which end in cheetah removals from farmlands. Farmlands in Namibia still harbour a diverse assemblage of native species and have substantial potential as refuges for Namibia's biota. For example, the majority of Namibia's populations of native large ungulates (over 80%), and the largest remaining population of cheetahs in the world are found on commercial farmland, outside of the formal protected area network. Considerable conservation efforts and government wildlife policies are focused on these large mammalian species.

This project is designed to provide direct linkages between biodiversity conservation and economic development, with particular emphasis on targeting historically

disadvantaged demographic groups of Namibians. CCF proposes to develop an entrepreneurial framework that will allow local people to economically benefit from habitat restoration efforts. The resulting product will be marketed in the name of the cheetah and will be distributed with conservation labelling. Other expected longer-term results include:

- Economic and social empowerment for local people through benefit from bush harvesting and manufacturing activities as well as learning new entrepreneurial skills.
- The environment (the bush encroached areas) are managed in a sustainable manner.
- Cheetah habitat is improved, cheetahs are protected, hunting and trapping decrease and cheetah numbers increase
- Revenue generated by marketing fuel logs in Europe, will be used for continued cheetah research and for the development of additional educational centres in Namibia and the Southern Africa region.

It is expected that the results of this project will encourage farmers to undertake similar projects themselves. The lessons learnt during this project will thus be of considerable value to future efforts in the country and region.

## 3.0 METHODOLOGY

### 3.1 The EIA team

This EIA was conducted by a multidisciplinary team of four – two economists from Malawi and Tanzania respectively, an ecologist from Kenya and a botanist from Zimbabwe. The four members are Fellows engaged under the Capacity Development and Linkages for Environmental Impact Assessment in Africa (CLEIAA) initiative, undergoing a Fellowship program with support from USAID. The primary objective of the program is to build African professional capacity and strengthen professional EIA networks. USAID's Environmental Capacity Building Program (ENCAP) initiated the program in 2001. CLEIAA assumed the lead role for the Program in collaboration with the Southern African Institute for Environmental Assessment (SAIEA) and the Eastern Africa Association of Impact Assessment (EAAIA). This EIA has been conducted with guidance and supervision from SAIEA. Details regarding procedures for CLEIAA Fellow selection and summarised curriculum vitae for the EIA team have been put in the Appendix II and III respectively.

### 3.2 EIA method

Different techniques were used to collect information and data for the EIA. They included receiving introductory lectures, undertaking literature review, consultation with stakeholders and site visits.

Introductory lectures covered the following subjects -

- International conventions on environment,
- USAID's environmental policy and regulation,
- Environmental law and regulations of some SADC countries,
- Ecology and range management in Namibia,

- Bush encroachment in Namibia,
- Environmental economics;

A wide range of literature was reviewed on the following areas and subjects

- Background and extent of bush encroachment,
- Socio-economic implications of bush encroachment to the Namibian economy
- Namibia's EA policy framework and draft legislation,
- Health regulations
- CCF project reports on bush encroachment and cheetah management

A number of stakeholders were consulted, including:

- Farmers,
- Public health officials,
- Town Clerk of Otjiwarongo,
- CCF,
- Farm workers
- Agriculture officials.

Open- ended questions and checklists techniques were used during consultations with the stakeholders.
The list of stakeholders consulted and their views appear in Appendix IV.

The team visited the CCF and the project field sites during the period from 28th February to 6th March 2002. At CCF, the team was shown the main activities undertaken by the CCF. The team visited two farms (Cheetah view and Elandsvreugde) owned by CCF where varying degrees of bush encroachment were observed. The team inspected the site for the proposed factory at Otjiwarongo.

The team also visited the Jumbo charcoal factory outside Okahandja and had discussions with the director about his views on the proposed CCF partial de-bushing and processing project.

Impact analysis was done based on information and data collected, stakeholders' views about the project, the planned project activities and the team's professional judgement. Potential impacts of the project were summarised for each project activity. Impact evaluation criteria were as provided from the USAID Source book (1996) The results have been summarised in a table form. Categories of low, moderate and high were used to evaluate the significance of the impact.

### 3.3 Limitations of this EIA

The team relied heavily on background information and secondary data for the EIA due to the fact that only one month was available to accomplish the task. The team was not able generate primary data because this would require more time to set the experiments.

The EIA did not conduct an economic validation of the project because of lack of data on cost of production and machinery, and also the site for the factory was not yet leased. Hence the EIA team relied on the project assumption that the project is economically viable.

This EIA addresses experimental phases 1and 2. Scaling up to phase 3 will depend on the results of the experimental phases. This EIA therefore, without data and information from pilot phases, is not in a position to comment and/or predict the likely impacts of phase 3.

Not all stakeholders could be consulted due to their unavailability at the time. However, it is considered that the most important stakeholders were consulted and that no serious information gaps exist.

Whilst more information could certainly have been obtained, it is the opinion of the authors that sufficient information has been provided to enable decision making on the future of the project.

## 4.0 PROJECT DESCRIPTION

The project will be undertaken in the Otjiwarongo district about 45 km east of the Otjiwarongo town and will initially focus on the sites to be de-bushed in phase 1 and 2 (CCF Project Proposal). The CCF partial de-bushing project intends to enhance the long-term survival of the cheetah, and other key indigenous wildlife on Namibian farmlands by developing a habitat improvement programme that is both ecologically sound and economically viable.

CCF plans to test and monitor methods of harvesting the encroached bush and then to design a scheme that is appropriate to farmland habitat and is beneficial to the landowners. CCF will develop an international market for bush-based products that assures the long-term sustainability of appropriate levels of harvest. Within Namibia, CCF will market the fire log as affordable alternatives to wood harvesting (CCF Project Proposal).

The overall design of the project is a pilot study that integrates ecological studies with community-based conservation through economic development. The resulting processed products will enhance global conservation education through conservation-oriented marketing and informational labelling, and the areas cleared will directly and/or indirectly benefit cheetahs, by restoring habitat and providing income to CCF.

### 4.1 Project phases

The project will be undertaken in three phases (figure 1). The first and second phases will mainly be for testing the ecological and economic viability of de-bushing. Phase three will be undertaken depending on the ecological and economic results of the first two phases.

#### 4.1.1 Phase 1 Ecological research and experimental harvesting and refining: 2001 – 2003

The CCF project will cover about 400 ha of bush encroached land. Commercial farms will be used as experimental areas (Cheetah View, Elandsvreugde, Clifton, Boskop and Osananga farms). Harvesting of bush will be carried out within 4 cattle grazing camps on these farms. Experimental plots will be in the form of paired

treatment areas located within the same grazing camps. Clifton experimental plots will be subjected to livestock grazing at controlled stocking rates and Cheetah View plots will be subjected to grazing and browsing from wildlife species only. Experimental design will be independently peer-reviewed before harvesting commences. Details regarding experimental design of the phase 1 and 2 of the project appear in appendix V.

The project will hire and train personnel in all project activities. Harvesting units will be established and supported by chipping and transport units. These units will be established to clear bush encroached land and to supply initial production material to the fire log, pellets and briquettes processing factory. These business units are expected to become independently owned and profitable businesses, within 2 to 4 years and will be ecologically certified. Initial harvest areas will however be according to experimental design.

The project will establish contact with the Forest Stewardship Council (FSC) and appropriate local government and non-governmental organizations to facilitate certification, training and environmental education aspects of the project.

The project will implement business processes associated with bush refining (i.e. conversion of bush chips into a pellet form that is storable and can be further processed into fuel logs, or other materials) and associated activities. The CCF will purchase bush-refining equipment appropriate for the type of bush to be processed. The project will also lease the refining facility (site for processing machine) in the General Industrial Zone of Otjiwarongo town. Staff for refining and associated business activities will be employed by the project.

The project will initiate business processes associated with fuel log manufacturing and associated activities, including establishing foreign export markets, creating business infrastructure and revising the existing business plan.

### 4.1.2 Phase 2. Bush processing, manufacturing and export: 2001 – 2005

**Phase 2 will seek to:**

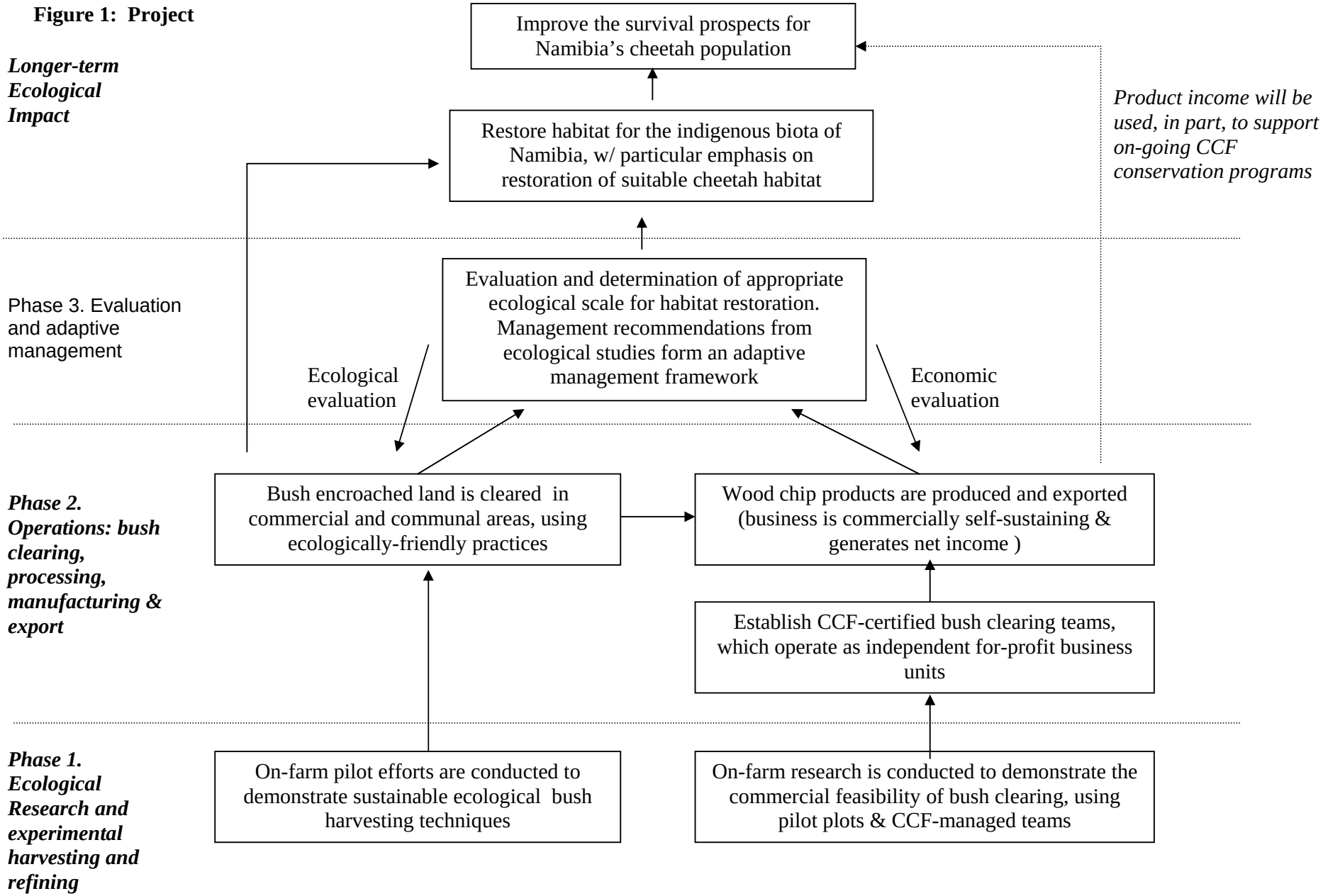
- Fund the development and implementation of the fuel log manufacturing plant in the town of Otjiwarongo at an existing defunct brick factory.
- Establish infrastructure related to manufacturing fuel logs from pellets.
- Establish manufacturing plant design, purchase fuel log production equipment, lease manufacturing facility and hire appropriate staff including a project manager.
- Begin manufacturing and export of fuel logs. Fuel Logs will be produced according to commercial business principles, i.e., net income will be earned from the operation. While initial start-up subsidies may be required to get operations running, and to demonstrate the concept's feasibility, an important objective is to make the operation commercially viable, if possible, during phase 2. Wood products used to produce the fuel logs will only be purchased from suppliers whose harvesting practices have been "certified" as environmentally sustainable.
- Explore markets and development of alternative bush products to wood energy

- Continue ecological monitoring and data collection.
- Train additional harvest units as necessary for production of raw materials.
- Start equipment leasing to certified harvesting and/or chipping units.

### 4.1.3 Phase 3

This phase will involve evaluating the results of phase 1 and 2 and also developing an adaptive management system. Should it prove to be ecologically and economically viable, phase 3 will involve an extension on the area for habitat restoration and adaptive management for cheetah conservation. This would also provide a long-term income generating, self-sustaining conservation development project for the CCF. If this project results in a widespread replication on other farms in the area and beyond, a more strategic environmental assessment (SEA) will be needed to guide this bigger programme. The lessons learnt during this project will thus be of value to future efforts towards de-bushing and bush processing in the country and region.

**Figure 1: Project**




Source: CCF Project Proposal 2001

## 5.0 DESCRIPTION OF ALTERNATIVES

### 5.1 No Action Alternative

The world Cheetah population estimated at 100000 in 1900 catastrophically dropped to as low as 12000 by 1995 and 20-30% of these are found in Namibia (Marker et al, 1996). Ninety percent of Namibia's cheetah live outside of state owned protected reserves, primarily on commercial livestock farmlands and private game ranches. Over-grazing, extensive fencing and natural events are among major factors that have encouraged severe bush encroachment and this has caused potential problems that negatively affect cheetah. These problems include reductions in hunting efficiency, reductions in prey species abundance and distribution, and conflict with livestock farming interest (Marker et al, 1996). Available information indicates that 29% of cattle losses and 3% of small stock losses were attributed to Cheetah between 1986 and 1994 (Marker et al, 1996). The phenomenon of bush encroachment over the last thirty years has significantly decreased the productivity of nearly one third of Namibia's livestock farmlands. In commercial farms around Otjiwarongo and Grootfontein,Otavi and Tsumeb bush encroachment alone affects between 8 to 10 million hectares of land, resulting in an annual loss of between 8-10 million US Dollars (CCF, Project proposal).

Maintaining habitat and developing strategies for maintaining free ranging Cheetah populations outside the protected reserves are critical for long term survival of the species and reduction of farmer's economic problems. The CCF partial de-bushing project is therefore, a step towards solving these problems through restoring habitat for the indigenous biota of Namibia, with particular emphasis on creating suitable cheetah habitats. The project also provides direct linkages between biodiversity conservation and economic development.

The no project alternative is thus the maintenance of the status quo, which is an undesirable situation.

### 5.2 Within project alternatives

CCF has proposed mechanisms for bush clearing, chipping and processing and the following section briefly discusses alternative mechanisms relative to the proposed ones.

#### 5.2.1 Bush harvesting

The project proposes to use mechanical harvesting methods. There are three proposed methods for bush clearing namely: hand clearing using axes and pangas, power driven hand machines and the use of large combine harvesters that would cut the bush and chip it at the same time. The project intends to test the ecological and economic viability of the three methods. The first two

methods will be used in the field while the combine harvester will be used along the roadsides where they will clear all bush except big trees. The following are possible alternatives to mechanical bush harvesting:

#### 5.2.1.1 The use of fire

Fire has been used as a range management tool in many rangelands of the world. However, fire does not seem to have been widely used in the commercial farmlands in Namibia. The use of fire as a means of controlling bush encroachment has ceased in many cases due to the fact that fires become ineffective in the absence of grass cover which normally fuels fires (Smit 1993, as cited by Wolters, 1994). The main reason why fire was not a choice tool for the commercial farmers was that in order for fire to be effective, it requires a certain amount of fuel load, mainly composed of thick grass layer and other thickets, which would have to accumulate after a certain rest period. Fire in low grass biomass often results in poor kill rate of the trees, most of which have evolved in the presence of fire in the African savannas and therefore require high temperature fires. Most farmers consider burning of such grass biomass as a wasted cattle forage. The use of fire is also risky requiring experience and skills in order to be effective. Fire management is also not a one-time management tool. It often requires repeated application with careful choice of appropriate season and fire breaks, and is therefore an expensive and risky alternative. Most of the targeted sites in the four farms have medium to large thickets with little or no grass biomass necessary for an effective fire. Also, since the sites are being cleared for experimental purposes, the use of fire might not necessarily lead to the same results as selective hand clearing. The CCF project intends to selectively clear the encroached bush based on type, category (endangered or protected species) and size (height and diameter) of the bush.

#### 5.2.1.2 Use of herbicides

The effectiveness of herbicides vary according to climatic and soil conditions. USAID funding requires stringent adherence to safety where herbicides and pesticides are being used. Where a project includes assistance for procurement or use, or both, of pesticides registered for the same or similar uses by USEPA without restriction, the initial Environmental Examination for the project should include a separate section evaluating the economic, social and environmental risks and benefits of the planned pesticides use, and integrated weed management alternatives, to determine whether the use may result significant environmental impact. Furthermore the use of herbicides might be inimical to ecological sustainability that this project is trying to achieve. USAID funding in this particular project excludes the use of pesticides, pending completion and approval of a Pesticide Evaluation Report and Safer Use Action Plan consistent with USAID Pesticide Procedures (22 CFR 216.3(b)). Besides, use of pesticides might lead to other primary or secondary effects on other organisms, which might interfere with the experimental design proposed in this phase of the project.

#### 5.2.1.3 Introduction of browsers

Big browsers in the commercial ranches in Namibia, including Rhinos and elephants were eliminated early in the last century, for purposes of trade and ostensibly for causing diseases to livestock enterprises. The introduction of the same browsers may not be a practical option in this project. However, where finances and infrastructure allows experimental use of the browsers could be tried to maintain the bushes and thickets down, but not to eliminate bushes.

### 5.2.2 Chipping

Once the bush has been harvested, it will be cut into chips by a grinding (chipping) machine. This will be done in the field where bush will be harvested.

The possible alternative to chipping on site would be chipping at the factory site in Otjiwarongo. Carrying natural logs from harvesting sites to the factory would, however, be more costly compared to carrying chipped wood. Furthermore, the noise of chipping would affect more people in Otjiwarongo than in the field where people are absent.

### 5.2.3 Transport

The project proposes to use tractors to move the chipper from one site to another and trucks to transport chipped wood to the factory. There is no possible alternative for transport in the field and to the factory because of the limited infrastructure. The project intends to use rail for shipping final products to the international markets and trucks for local market. Airfreight would be an alternative for transporting products to international markets but it may not be financially justifiable given the value and quantity of wood to be produced during the initial experimental phases.

### 5.2.4 Processing

The project proposes to produce pellets, fire log and briquettes. The processing will likely add economic value to wood and hence fetch high market prices. To achieve this, CCF intends to purchase a piston driven extruder to produce the products. There are possible alternatives to the proposed products and method of production as briefly outlined below:

#### 5.2.4.1 Product alternatives

##### 5.2.4.1.1 Natural logs

Natural logs would not be easy to pack, transport and sell. Naturally, wood products have low economic value and are thus likely to fetch low market prices.

#### 5.2.4.1.2 Charcoal making

Charcoal production if practiced under a good management system (e.g under FSC certification system) is a good alternative product with similar or more established market. Charcoal production and marketing does not seem to have been adequately explored under this project. Since the potential market and cost benefit analysis for the proposed fire log is yet to be established, charcoal based enterprises produced in environmentally friendly and sustainable manner might still offer a good alternative. An internationally accepted system for sustainable management of tropical forests exist under Forest Stewardship Council (FSC) . The Forest Stewardship Council (FSC) is an independent, non-profit, non-governmental organization. It was founded in 1993 by a diverse group of representatives from environmental and conservation groups, the timber industry, the forestry profession, indigenous peoples' organizations, community forestry groups and forest product certification organizations from 25 countries.

The FSC supports environmentally appropriate, socially beneficial and economically viable management of the world's forests. It promotes responsible forest management by evaluating and accrediting certifiers, by encouraging the development of public education and information about independent, third-party certification as a tool for ensuring that the world's forests are protected for future generations.
Although the Namibian bush land does not qualify as a forest par se, there is a FSC certified charcoal making operator in Okahadja region. The FSC certification method normally requires the operator to adhere to several conditions including; meeting all applicable laws; having legally established rights to harvest; respecting indigenous rights; maintaining community well-being; conserving economic resources; protecting biological diversity; having a written management plan; engage in regular monitoring; etc. (see Appendix VIII for full details on FSC)

#### 5.2.4.1.3 Chipboard and Wood cement

Other potential products including Chipboard and Wood cement do not seem to have established local market and might not effectively compete in international market due to shipping and other handling costs.

#### 5.2.4.1.4 Using wood for artisanal purposes

The artisans require specific tree characteristics like hardness and size. The invader species targeted in this project may not be the preferred trees for artisans.

#### 5.2.4.2 Drying method alternative

The most logical alternative to air-drying is mechanical extraction of moisture to the required levels. But since this would, however, require considerable capital investment, air-drying seems to be the most affordable option for the initial phase of the project. It would also consume considerably more energy.

#### 5.2.4.3 Machine alternative

The project intends to use the piston driven extruder for processing the products. The possible alternative to this machine is the screw driven extruder. The screw driven extruder is however, expensive to operate and maintain. It requires service every 30 hours of running compared to about 300-500 hours for the piston driven extruder. In addition screw driven extruder produces only fire log whereas the piston driven extruder produces a wider range of products (pellets, fire logs and briquettes).

It is thus concluded that the methods proposed by the CCF are most appropriate under the circumstances.

## 6.0 DESCRIPTION OF THE ENVIRONMENT

### 6.1 Biophysical Environment

#### 6.1.1 Project Location

The study will be located on farms owned and operated by the Cheetah Conservation Fund, located in the Otjiwarongo district of the Otjozonjupa region. The farms include Cheetah View (#317), Elandsvreugde (#367), Osananga (#368) and Boskop (#324). Additional study sites in the region may be utilized with permission of the owner of commercial farm (e.g in Clifton farm) or through permission of headman of communal areas. These farms are typical of the region, and are each between 4000 - 8000 ha in area (Marker, 1999). The farms have no perennial rivers, but each farm has a number of check dams and boreholes, which provide year-round water. Historical farming practices on these farms include both livestock and indigenous large ungulate herbivory. A number of large carnivores (lions, spotted hyenas and African wild dogs) and the largest herbivores (elephants and rhinoceros) have been locally extirpated.

#### 6.1.2 Geology

Otjiwarongo lies on the rocky central plateau of Namibia, and is centrally located between the landforms “Plateau with ridges”, in the south, and “Karst and hard Damara limestone” to the north. The geological map of the area shows the area to be underlain by rocks of the Damaran Sequence, predominantly schist, marble and quartzite. Kopjies dotted all over the region rise above a surrounding matrix of flatland, which has virtually no exposed rock. The Waterberg Plateau, a 4100 $km^2$ sandstone uplift is the dominant geological feature of the region. The CCF research center lies adjacent to the plateau at around 1600 metres above sea level.

#### 6.1.3 Vegetation

The region is situated in the Thornbush Savanna vegetation zone. Vegetation is typical of xeromorphic thornbush savanna with dominant woody plant genera consisting of *Acacia*, *Dichrostachys*, *Grewia*, *Terminallia*, and *Boscia*. Understorey vegetation is relatively sparse, although ephemeral forbs are present following rain. This region has been extensively modified over the last century through human-mediated causes compounded by natural climatic fluctuations. Some native woody species such as *A. mellifera*, *A. tortillis*, and *D. cinerea* have proliferated resulting in thickened bushes, a phenomenon refered to as bush encroachment. On the other hand perennial grasses have been reduced throughout this area to the extent that only remnant patches of historic open savanna habitat exist.

### 6.1.4 Climate

The region has a semi-arid climate and lies between the 400 mm and 450 mm annual rainfall isohyets. On average there are 45 rain days per year in Otjiwarongo with the rain season extending from October to April. The wet season is pronounced and characterized by extensive thundershowers and flooding, with considerable variation in the amount of precipitation between years. Namibia has three seasons, namely a hot dry season from September to December, a hot wet season from January to April and a cold dry season from May to August. Annual rainfall is highly variable, with the majority of rain falling between November and April. The region is relatively arid; mean annual rainfall in the Waterberg study area over a 40-year period was 123.4 mm (+ 27.8) for the hot dry season, 348.6 mm (+ 58.3) for the hot wet season and 2.8 mm (+ 7.4) for the cold dry season. Conflicting with these long-term averages is the current data from Otjiwarongo and its immediate surrounding area. Rainfall data recorded over the last decade indicate that a worsening drought has been in effect for the last nine years (SRK, 1999). The average daily maximum temperature for the hottest month is 33 °C - 34 °C, and the average daily minimum temperature for the coldest month is 4 °C - 5 °C (Van der Merwe, 1983).

The dominant wind directions throughout the year are from the north, north-east and east. However, strong westerly winds occur during two pre-summer months August, of September and October.

### 6.1.5 Topography

The local topography is typical savannah grassland and is generally flat with small rolling hills. The landscape is interspersed by small isolated granitic outcrops called kopjies. These outcrops rise above a surrounding matrix of flatland, which has virtually no exposed rock. The farms proposed for this project are situated on a flat surface with slight undulations occurring at some parts of the farms at the foot of the Waterberg Plateau, a 4100 $km^2$ sandstone uplift, lying on the southern periphery of the study area and the dominant geological feature of the region. Several shallow ephemeral rivers exist within these farms flowing from the east to the west.

### 6.1.6 Wildlife

A study conducted by SRK Consulting (1999) in Otjiwarongo region indicated that birds and reptiles represent more than 300 species despite the relatively homogenous nature of the arid *Acacia* thornbush woodland habitats. Of the 89 reptile species predicted to occur in the general Otjiwarongo area, 2 are tortoises, 46 are snakes, 31 are lizards, 2 are chameleons and 8 are geckos. In addition 14 amphibian (frog) and 57 mammal species are predicted to occur in the area. There are no permanent natural freshwater bodies within the

Otjiwarongo area. A number of artificial permanent freshwater bodies occur at the municipal sewerage works, but any fish or fauna in them are alien and introduced and are thus of little conservation value. No specific distribution information for invertebrates is available for the Otjiwarongo area

Larger animals include cheetah (*Acinonyx jubatus*), leopard (*Panthera pardus)*, brown hyaena (*Hyaena brunnea*), black-backed jackal (*Canis mesomelas*), Kudu (*Tragelaphus strepsiceros*), Oryx (*Oryx gazella*), Eland (*Taurotragus oryx*), Red Hartebeest (*Alcelaphus bucelaphus*), Warthog (*Phacochoerus aethiopicus*), Steenbok (*Raphicerus campestris)*, and common duiker (*Sylvicapra grimmia*).

Surveys conducted under the auspices of CCF in the surrounding commercial farms (Boskop, Cheetah View, Elandsvreugde, Gross Hamakari, Hebron, Nogverder, Okosongomingo, Ombujomatemba, Oros, Osonanga, Padberg, Uitsig and Vaalwater) suggested that the region has about 3500 Warthogs, 3200 Kudu, 300 to 1500 Oryx, 500 Eland, 700 Steenbok and over 600 Duiker.

Research conducted in CCF (Muroa, 2000, Marker, 2000, Richardson and Julie, 1998) have shown that the grazer's biomass is the highest in open savannah type of habitat and bush encroachment can have an adverse impact on their density. Disappearance of palatable grasses and an increase in woody species reduces the quality of the habitat for grazers such as hartebeest. Bush encroachment on the other hand benefits the browsers such as kudu and duikers. Eland in the study area are more grazers than browsers and will not benefit from bush encroachment.

### 6.2 Socio economic profile of the Otjiwarongo

Otjiwarongo is situated approximately 250 km north of Windhoek. The town has a population of about 25 000 (SRK Consulting 1999) and is the seat of the Otjozondjupa Regional Council, whose area is estimated to be over 105 28 km² in extent. According to the 1991 census figures, the town's growth rate is estimated at about 3.5% per annum (SRK Consulting 1999).

The town of Otjiwarongo has over 147 businesses, 28 professional services (attorney practitioners, medical consultant rooms, financial services, etc. (SRK Consulting 1999) and 103 industrial, light industrial, building suppliers and warehouses. In addition, the town houses all the regional government departments. The business sector of Otjiwarongo serves the community, hinterland and the entire Otjozondjupa Region. Industrial activities in this town include an abattoir and small industries such as joiners, brick making and engineering works.

Agriculture (cattle farming) and hunting farms are the main economic activities of the district. Cattle farming is the most important economic activity in Otjiwarongo and the highest number of cattle in Namibia occur in this region. Approximately

36.7% of the working class in the region is employed by the agricultural sector. Currently, 88% of commercial ranches are owned by local white ranchers (SRK Consulting (1999), whereas communal lands are collectively used by local people, including the Ovambo, Herero, Damara, and the San (Kaufman *et al*, 2000).

The commercial farms have a much lower human population and are managed for livestock as well as wildlife. In 1967, the apartheid – era government granted commercial land owners proprietary rights over resident wildlife, thus enabling them to legally derive economic benefits from game species inhabiting their lands through lucrative hunting revenues from foreign hunters. This accounts for the fact that many of the commercial ranches of Otjiwarongo are managed to sustain ungulate populations while on most communal lands where there has been little incentive for local inhabitants to manage their lands for wildlife (due to the land still being owned by the government,), the number of wildlife species has dwindled tremendously. Game species like the Cheetah, Oryx (*Oryx gazella*), eland (*Taurotragus oryx*), and red hartebeest (*Acelaphus buselaphus*) only remain on commercial ranches while on many communal areas in Namibia they have been reduced or eliminated (Marker, *et. al.*1996).

### 6.3 Wood Fuel Products processing site

The proposed factory will be based at Ojtiwarongo, in the general industrial zone portion S1603 (See the attached map). The site is located near a railway head and opens to a paved street. The factory will be based in a converted brick-making factory and will not involve erecting new buildings. The site measures 600 $m^2$, with a built up area of about 480 $m^2$. The area beyond the two buildings is not paved and stretches to the back to the east of the plot. The site is fenced with barbed wire on at least 3 sides and the front side is fenced by prefabricated concrete wall of 12 ft. The portion opens up to Hightlin street and borders residential quarters on one side. The portion adjacent to the right, though semi developed for a factory, was not operating at the time of the visit.

The site has ample space for receiving raw materials, and air-drying the chips, adequate parking areas, raw material stores, solid waste storage areas, finished product stores and dispatch areas. The factory yard has security points and a workshop/maintenance structure outside the two main buildings.

The two main buildings have adequate manufacturing and processing areas and offices and administration wing. The factory buildings are also well connected with effluent drains, storm drains, transformers, capacitors and electric switchgear, in addition to high voltage yards.

## 7.0 DESCRIPTION OF ACTIVITIES, IMPACT AND MITIGATION MEASURES

The potential impacts were identified using checklists within each main project activity. The identified impacts were then categorised variously as either direct or indirect, by duration, according to their contribution (either positive or negative) and whether they were cumulative or not.

Since impacts often have distinct characteristics, the severity of the identified impacts was predicted separately to give a complete picture of the anticipated change due to this project.

The main impact description used was as shown below adopted from USAID Source book (1996)

- Magnitude: absolute or relative change in size or value in environment; categorised as **Low, Medium** or **High**
- Direction means the trend the impact might take in the long term; impacts were categorised as either positive or negative
- Extent: whether the impacts occur on a scale limited to the study area (**Low**) locally (**Medium**) or regionally (**High**)
- Duration: time period over which the impact will be felt. Categorised as **Short term** (within the project period), or **Long term** (permanent)
- Reversibility; refers to the permanence of the impact, and categorised as **High** (easily reversible), **Medium** (moderately reversible) and **Low** (impacts not easily reversible).
- Likelihood of occurrence; referred to the possibility of a particular impact occurring as forecast. **High** (high probability) **Medium** (moderately likely to occur, and **Low** (unlikely to occur)
- The results of the above prediction are summarised in a table based on the main project activities, and the significance of the impact rated as Low, Medium or High. Only those impacts rated as Medium and High were further discussed with a view to recommending mitigating measures. The impacts rated Low were deemed to have insignificant negative effects on the environment.

### 7.1 Bush Harvesting

The project proposed to hire about 4-8 workers in total to do bush clearing. The proposed techniques were (1) manual hand clearing, (2) power driven machine and a (3) bigger tractor type machine. The purpose of using the three techniques of bush harvesting during the experimental phase is to test the most ecologically appropriate technique as well as test economic viability. The project proposes to remove between 20-80% of the target species (*A. mellifera*, *A. reficiens* and *D. cinerea*), in those plots where no other species are found and up to 100 % if other bush species exists.

Since the primary purpose of the bush removal was to restore the cheetah habitat, the project proposes not to remove the target species of certain predetermined diameter. The diameter was, however not set because it was to be recommended by the research team. The cut bush will be piled about 20 metres apart from where the chipping will take place.

The workers engaged to harvest the bush are to be ferried from a 'workers camp' at the early stages of the project but later on camping in the field where bush clearing will be taking place. During the camping in the field the project proposes to use mobile houses, as well as constructing mobile toilet and bath room facilities including long drop toilet facilities for the workers.

### 7.1.1 Evaluation of impacts during bush harvesting

Predicted impacts resulting from bush clearing activities are summarised in the Table 7.0 below. Only habitat improvement was rated to be a positive impact of high significance. Other identified positive impacts of medium significance included improvement on the aesthetics, improved grass productivity, and improved biodiversity. There was no negative impact rated high. However, possible health risks (including HIV/AIDS transmission) and fire hazard during the operation, and potential illegal hunting were identified as negative impact of moderate significance. All the other identified impacts were analysed and were considered to have low severe impacts on the environment.

**Table 7.0: Evaluation of potential impacts during bush harvesting**

| Impact | Direct | Indirect | Short Term | Long term | Cumulative | Magnitude | Extent | Reversibility | Likelihood of occurrence | Level of significance |
|---|---|---|---|---|---|---|---|---|---|---|
| Noise | √ | | - | | L | L | L | H | H | L |
| Soil erosion | | √ | - | - | L | L | L | M | L | L |
| Aesthetic | √ | | | + | M | M | M | NA | H | M |
| Oil spillage | √ | | - | | M | L | M | M | L | L |
| Loss of habitat | √ | | - | | L | L | M | H | L | L |
| Habitat improvement | √ | | | + | H | H | M | NA | H | H |
| Grass productivity | | √ | | + | H | M | M | NA | M | M |
| Illegal hunting | | √ | - | - | L | L | L | H | M | L |
| Biodiversity | √ | | | + | M | L | L | NA | M | M |
| Employment | √ | | + | + | L | L | M | NA | M | L |
| Sanitation | √ | | - | | L | L | M | H | M | L |
| Health risk | √ | | - | | M | L | L | H | L | M |
| Fire hazard | √ | | - | - | M | L | L | H | M | M |

Key : - = negative; + = positive
L = low; M = moderate; H = high
√ = direct or indirect; NA = Not Applicable

### 7.1.2 Mitigation measures during bush harvesting

**7.1.2.1 Safety and health risks**;

- Provision of protective gloves, arm protectors, appropriate shoe and clothing wear. It was noted that even where these were provided, in many cases, the workers tended not to wear them for a variety of reasons including ignorance, deeming them unnecessary and inconvenient, etc. It is imperative that proper training accompany the issuance of the protective wear.
- Recruitment of local labour, adherence to the relevant labour laws, to ensure time off, and social and recreation time. This will avoid a situation where immigrant labour might influx the area with possible spreading of sexually transmitted diseases. According to the Namibian labour law, the duty to ensure the safety, health and welfare of employees at work is unconditional. Steps taken to comply with this statutory duty must be borne solely at the employer's cost.
- Sanitation within workers camps, though rated low in the final summary table is an issue that will need to be incorporated in the management manual. Facilities provided for the use of the workers, should include, water, bathing and toilet facilities. Management rules should ensure that these facilities are actually provided, in good order, and most importantly, that they are actually utilised.
- CCF should have awareness and training sessions on HIV/AIDS for workers.

**7.1.2.2 Hunting**

- Although the project proposed to use local labour, with whom they were familiar, risk of hunting game illegally was identified as a potential risk of moderate significance. While there is no certain mitigation measure that could be employed to dissuade a determined hunter, the project should consider a series of de-motivating factors including regular provision of meat, this was common among most of the commercial farmers interviewed. Constant surveillance is probably the most effective measure, accompanied with impromptu inspection visits to workers sites and villages.
- The rules against hunting should be included in the workers contracts, with a clear management responsibility and disciplinary measures well outlined against which the contracted or hired labour could be made to sign.

**7.1.2.3 Fire hazard**

The following are the suggested mitigation measures to minimise the chances of setting the bush on accidental fire

- The workers should be trained in fire management.
- The workers should be regularly supervised.
- Camp sites should be properly selected (eg those in areas with less grass cover).
- The workers should also construct firebreaks surrounding the camps.

### 7.2 Chipping

The chopped wood will be chipped on site using a chipping machine. The chipper will be driven by tractor from site to site where the harvested bush will be piled. If the project proves to be economically and ecologically viable, CCF will purchase a tub grinder to chip larger amounts of the wood. CCF estimates an output of 150 metric tons of chips per week during the experimental phase.

### 7.2.1 Impacts evaluation during chipping

Among the many possible impacts evaluated (Table 7.1), the only major risk in chipping is likely to be fire hazard depending on the way workers will manage fire for cooking and/or cigarette smoking. This may result in accidental bush fires.

**Table 7.1: Evaluation of potential impacts during chipping**

| Impact | Direct | Indirect | Short term | Long term | Cumulative | Magnitude | Extent | Reversibility | Likelihood of occurrence | Level of significance |
|---|---|---|---|---|---|---|---|---|---|---|
| Dust emissions | √ | | - | | L | L | L | H | L | L |
| Inhalation of dust by workers | √ | | - | - | M | L | L | H | M | L |
| Noise to workers | √ | | - | - | M | M | L | H | M | L |
| Noise impact on community | √ | | - | | L | L | L | H | L | L |
| Fire hazard | √ | | - | | L | M | M | M | M | M |
| Oil spillage | √ | | - | | L | L | L | L | L | L |

Key : - = negative; + = positive
L = low; M = moderate; H = high
√ = direct or indirect

### 7.2.1 Mitigation measures during chipping

The following are the suggested mitigation measures to minimise the occurrence of accidental bush fires:

- The workers should be trained in fire management.
- The workers should be regularly supervised.
- Camp sites should be properly selected (eg those in areas with less grass cover).

- The workers should also construct firebreaks surrounding the camps.

### 7.3 Transport

The chipped wood will be transported by trucks from the field to the factory at Otjiwarongo for further processing. The number of trips will depend on the production and marketing situation. It is expected that the number of trucks and trips will increase as the project scales up. The project intends to use the existing routes and there will therefore, be no construction of new roads.

#### 7.3.1 Impacts evaluation during transport

The significant impact from transport may be the deterioration of the road (Table 7.2). This impact is likely to occur in the medium to long term, if the project scales up and increase the number and size of trucks, and frequency of the trips. The effect may be more pronounced on the gravel road between CCF and Otjiwarongo during the wet season.

**Table 7.2: Evaluation of potential impacts during transport**

| Impact | Direct | Indirect | Short term | Long term | Cumulative | Magnitude | Extent | Reversibility | Likelihood of occurrence | Level of significance |
|---|---|---|---|---|---|---|---|---|---|---|
| Soil compaction in farms | √ | | - | | L | L | L | H | M | L |
| Traffic congestion to factory | √ | | - | - | M | M | L | H | L | L |
| Noise to Community in Otjiwarongo | √ | | - | - | M | L | L | H | L | L |
| Dust | √ | | - | - | L | L | L | H | M | L |
| Deterioration of farm roads | √ | | - | - | M | M | M | M | M | M |
| Disturbance to wildlife | √ | | - | - | L | L | L | H | H | L |
| Disturbance to institutions (schools, hospital,) | √ | | - | - | L | L | L | H | L | L |
| Oil leakage | √ | | - | - | L | L | L | H | L | L |

Key : - = negative; + = positive
L = low; M = moderate; H = High
√ = direct or indirect

#### 7.3.2 Mitigation measures during transport

It is proposed that the road be regularly repaired and maintained particularly after the rainy season. This is the responsibility of the Department of Works and CCF could play a greater role in prompting them to do regular maintenance. Other

strategies for reducing road damage include ensuring adherence to speed limits and avoiding over-loading of trucks.

### 7.4 Equipment installation

The project intends to lease a building in Otjiwarongo where it will install the processing machine. The proposed site is within the general industrial zone near railway terminal. It is expected that the factory will occupy about 600 sq. m.

### 7.4.1 Impacts evaluation during equipment installation

There is no foreseeable serious impact during equipment installation (Table 7.3). CCF proposes to lease a building in the general industrial zone that will be used as a factory. The building was used for cement making therefore, if CCF leases the building, it will need to seek approval from the municipality to change the use of the building. The municipality will have to evaluate the appropriateness of the building for the new use.

**Table 7.3: Evaluation of potential impacts during equipment installation**

| Impact | Direct | Indirect | Short term | Long term | Cumulative | Magnitude | Extent | Reversibility | Likelihood of occurrence | Level of significance |
|---|---|---|---|---|---|---|---|---|---|---|
| Noise on workers | √ | | - | | L | L | L | H | L | L |
| Noise on community (Otjiwarongo) | √ | | - | | L | L | L | H | L | L |
| Safety for workers | √ | | - | | L | L | L | H | L | L |
| Dust emissions | √ | | - | | L | L | L | H | L | L |

Key : - = negative; + = positive
L = low; M = moderate; H = high
√ = direct or indirect

### 7.5 Factory operation

The chips will be air dried to the specified moisture content according to the machine specifications (15% for the piston extruder). The material will be compressed under pressure using electric mortors. The project proposes not to use any chemicals and/or additives throughout the processing phase. The end products will be packaged for local and export markets. The project intends to employ about 8 people to operate the plant.

### 7.5.1 Impacts evaluation during factory operation

Factory operations may lead to the following impacts – handling of hazardous materials, solid and liquid wastes (Table 7.4).

**Table 7.4: Evaluation of potential impacts during processing**

| Impact | Direct | Indirect | Short term | Long term | Cumulative | Magnitude | Extent | Reversibility | Likelihood of occurrence | Level of significance |
|---|---|---|---|---|---|---|---|---|---|---|
| Noise to workers | √ | | - | - | L | L | L | H | M | L |
| Noise to community (Otjiwarongo) | √ | | - | - | L | L | L | H | M | L |
| Hazardous materials | √ | √ | - | - | L | L | L | H | M | L |
| Solid waste | √ | | - | - | M | M | L | M | L | L |
| Liquid waste | √ | √ | - | - | L | L | L | M | M | L |
| Health risks | √ | √ | | - | M | L | L | H | L | L |
| Water use | √ | | - | - | M | L | L | M | M | L |
| Employment | √ | √ | + | + | L | L | L | NA | H | M |
| Electricity use | √ | √ | | - | L | L | L | L | L | L |

Key : - = negative; + = positive
L = low; M = moderate; H = high
√ = direct or indirect

### 7.5.1.1 Solid wastes

The possible solid waste from the processing factory will be: the unused packaging material, pieces of broken metal from machine repairs and some pieces of chipped wood. These should not cause disposal problems if CCF abides by the municipality regulations for waste management.

### 7.5.1.2 Liquid wastes

The possible liquid waste from the processing factory will be waste water from cleaning: These should not cause disposal problems if CCF factory has proper connections to the sewage system.

### 7.5.2 Mitigation measures during factory operation

The CCF needs to abide by the health regulations for waste management. The municipality has routine collection and disposal of refuse. CCF should also train and raise awareness on HIV/AIDS for workers.

## 7.6 Marketing

The pellets, fire logs and briquettes will be sold in the local and international markets. CCF plans to label the products to enhance global conservation education through conservation-oriented marketing and informational labelling. Within Namibia, CCF will market fire logs as an affordable alternative to wood energy.

### 7.6.1 Impacts evaluation during marketing

The conservation-oriented marketing and informational labelling of the products are likely to have a positive impact on Cheetah conservation, environmental awareness, tourism promotion, and income generation for CCF (Table 7.5).

**Table7.5: Evaluation of potential impacts during marketing**

| Impact | Direct | Indirect | Short term | Long term | Cumulative | Magnitude | Extent | Reversibility | Likelihood of occurrence | Level of significance |
|---|---|---|---|---|---|---|---|---|---|---|
| Cheetah conservation awareness | | √ | | + | M | M | H | NA | M | H |
| Improvement in Cheetah Conservation | | √ | | + | M | M | M | NA | M | H |
| Tourism promotion | | √ | | + | M | M | M | NA | M | M |
| Income to CCF | √ | | | + | M | M | M | NA | M | M |
| Employment | √ | √ | | + | L | L | L | NA | H | M |

Key : - = negative; + = positive
L = low; M = moderate; H = high
√ = direct or indirect; NA = Not Applicable

Global awareness of the importance of conserving Cheetah is one of the important impacts of the project. It is expected that with proper cheetah conservation as well as awareness raised through marketing, the current Cheetah-farmer conflict will be reduced and the Cheetah population can be maintained and subsequently increased. This will likely boost Namibia's tourism industry. Income from product sales will be used to support ongoing CCF conservation programs.

### 7.6.2 Enhancement measures during marketing

CCF may consider that the labelling and other advertising techniques summarise the important ecological and economic aspects of Cheetah conservation. Care should be taken to maintain a perspective on the positive impact, so as not to exaggerate these and therefore invite criticisms later on.

## 8. 0 CONCLUSION

This EIA examined and identified potential impacts from the four main activities of the project in phase 1 and 2. The five main activities are bush clearing, chipping process, transport of materials both in the field and to the processing sites, factory sitting and operations and marketing.

## 8.1 Bush harvesting

Twelve potential impacts were identified as likely to occur during the process of bush clearing. The main major positive impacts examined were biodiversity improvement, improvement in grass productivity, and improvement in cheetah conservation. These impacts are in line with the projects stated goals and objectives. Among the potential negative impacts, illegal hunting and safety and health risks were rated as likely to have moderate level of severity. The other impacts examined included noise during the clearing, potential soil erosion as a result of bush clearing, possibility of soil fertility declining, oil spillage, loss of habitat for other species and sanitation for workers, all of which were predicted to have low level of severity and hence required little or no mitigation.

## 8.2 Chipping

Nine potential impacts were identified during this process; dust emission, noise to workers, noise on surrounding community, oil spillage, and fire hazard. Only the potential fire hazard during camping by the workers is likely to have significant impact on the environment. However, this is easily mitigated.

## 8.3 Transport

The EIA identified and examined eleven potential impacts which included dust emission, noise disturbance to sensitive institutions, disturbance to wildlife and oil spillage. Road damage was rated as moderate to severe if the project engages frequent and regular heavy transport vehicles from the field to the Otjiwarongo processing site. The damage is likely to be in form of ruts (channels, grooves and potholes) especially during the rainy season, and damage to roadside drains. Mitigation is easy, requiring regular road maintenance.

## 8.4 Factory: installation and operation

The impacts relating to this activity include noise to workers, noise to surrounding community, dust emissions, handling of waste materials, safety and health issues, use of water and electricity on Otjiwarongo. The potential impacts relating to the installation of machinery are not likely to be significant, while during the factory operation, handling of hazardous substances (including used and unused oil, lubricants, battery acid, etc), solid and liquid wastes are likely to be moderate to high in their severity. The other impacts are not likely to be significant either in the short term or the long term.

## 9.0 Recommendations

The suggested mitigation measures should be explored and implemented by CCF management in the context of ;

- Satisfying all applicable laws; during harvesting in form of legal licences and permits to clear the bushes; recruitment of contracted labour force to chop the bushes, chipping and processing phase of the project; handling of used and unused oils, lubricants at the processing phase, and battery acids according to the municipal health hazard act; transport regulations, etc by CCF project manager. All the applicable laws and statutes must be followed throughout the life of the project.
- The CCF project manager should work out a project management plan to showing the main activities of the project, size of the area to be cleared and specific location, the number of people engaged at every level and their status (permanent employees or contracted labour), the type and number of machinery purchased for the purpose of the project, the transport type preferred, marketing and advertisement plan, and responsibility at each level of the activity. The Management plan should be drawn before the main project work begins.
- The CCF project management should engage in regular monitoring of the project activities, with a view to monitor the ecological changes noted at the field level, and also to note the progress of the project implementation. This will be useful in phase 3 of the project where the results of phases 1 and 2 will be used to scale up the project to other neighbouring farms.
- The CCF management should start a management plan to maximize wildlife values and minimize pressures on natural woodland for long-term sustainability in cheetah habitat restoration. While the plan should be started immediately, it should have a long-term focus to bear any results.
- The CCF project manager should identify, define and develop biodiversity conservation targets and indicators for ecological monitoring. This should be done as part of the experimental design at the beginning of the project.
- The CCF management should strive to collect baseline-monitoring data including vegetation patterns (i.e. grasses, woody and herbaceous plants) and relative abundance and distribution of target species before the bush clearing starts and after the bush clearing.
- CCF project management, recognising the experimental nature of this project should endeavour to build scientific capacity for bush encroachment studies, during the field phase of the project.
- The CCF project management should also, design and implement an adaptive management framework, whereby ecological monitoring results can directly influence future management practices including harvest locations, cut block size and rate and methods of harvesting.

On the basis of the examined potential impacts, the proposed project's phases 1 and 2 are not likely to have severe or significant negative impacts on the environment. However the environmental effects of scaling up the project beyond the experimental phase to a regional project will need to be evaluated based on the monitoring and experimental results in the two initial phases. On the other hand there are a number of significant positive impacts that are likely to result from this project among increased biodiversity, cheetah habitat restoration, and improved grassland productivity.

## 9.0 REFERENCES

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## 10. APPENDICES

### Appendix I. Terms of Reference

*Objectives*. The main objective of the EA is to identify the main environmental issues relating to both phases of the proposed project, to assess their significance, to identify key stakeholders and their concerns, and to recommend mitigative measures. It should also advise on whether the project contains any major weaknesses or even "fatal flaws" from an environmental point of view.
*Environmental Assessment Requirements*. In conducting this EA, the PD Fellows (hereafter "the team") shall be guided by Namibia's EA policy and USAID's EA directives. Refer to the August 2002 USAID/Namibia Initial Environmental Examination on the activity "Habitat Restoration for the Namibian Cheetah: Phase 1 - Ecological research and experimental harvesting and refining (2001-2003)."
*Study Area*. The study area is located in the Otjiwarongo area, and will focus on the plots to be de-bushed in phase 1, the surrounding farms (labour source), the town of Otjiwarongo, the transport routes between Otjiwarongo and the farms and the export routes for the finished products. However, the team is permitted to consider impacts that are likely to occur beyond this area as appropriate.
*Team structure*: In line with the educational character of this Environmental Assessment, the team will constitute itself with respect to the mutally-agreed appropriate roles for the four team members, including a team leader, in consultation with SAIEA and USAID.

*Scope of Work and methodology*. It is recommended that the team visit the study area for at least one week, that they obtain and review all the relevant literature on the proposed project and the study area, and that they identify and consult with key stakeholders, including the farming community in the area, potential labourers or contractors, the local authority in Otjiwarongo, and national-level authorities (e.g. DEA, MAWRD, DoF). It is further recommended that the team consider the project in the context of the NAPCOD and National Biodiversity programmes, and that consultations be held with the DEA, DRFN and NNF. Additional pertinent sites may be visited, such as some of the Jumbo Charcoal harvesting and processing sites, which are certified by the Forest Stewardship Council.

*Task 1.* Description of the Proposed Project. Provide a brief description of the relevant parts of the project (i.e. those that are likely to cause significant environmental impacts), using maps (at appropriate scale) where necessary, and including the following information: location; general layout; size, capacity, etc.; project activities (including transportation of materials and equipment, role of Wood Clearers' Association); staffing and support; facilities and services; operation and maintenance activities; required offsite investments; life span, and potential expansion after and beyond the project *per se*.

*Task 2.* Description of the Environment. Provide a brief but conscise description of the following relevant environmental characteristics of the study area.
(a) Physical environment: topography; soils; climate and meteorology (especially climatic variability); surface and ground- water hydrology; existing road quality.
(b) Biological environment: flora; fauna; rare or endangered or endemic species; sensitive habitats, etc. (c) Socio-cultural environment (in Otjiwarongo and the target farmland): population; demographics; land use; planned development activities; community structure; employment; distribution of income, goods and services; public health. It is expected that farmers in the area will be concerned about the proliferation of cheetah, the movement of labourers and the deterioration of the road. Residents of Otjiwarongo are likely to be concerned about pollution (including noise) of the plant, increased traffic and the influx of workers. Whilst recent projects in the town (e.g. cement plant) have been controversial because of un-mitigated pollution emissions, it is expected that the Local Authority will welcome the project.

*Task 3.* Briefly describe the legislative and regulatory considerations pertaining to traffic and road use, town planning, vegetation clearing, EA, environmental protection, health and safety, land use management, etc.

*Task 4*. Determination of the Potential Impacts of the Proposed Project. In this analysis, distinguish between significant positive and negative impacts, direct and indirect impacts, and immediate and long-term impacts. Identify impacts which are unavoidable or irreversible. Characterize the extent and quality of available data, explaining significant information deficiencies and any uncertainties associated with predictions of impact.

*Task 5*. Analysis of Alternatives to the Proposed Project. Briefly describe alternatives that were examined in the course of developing the proposed project and identify other alternatives which could achieve the same objectives. The concept of alternatives extends to siting, design, technology selection, construction techniques and phasing, and operating and maintenance procedures. Briefly compare alternatives in terms of potential environmental impacts; suitability under local conditions; and institutional, training, and monitoring requirements. When describing the impacts, indicate which are likely to be irreversible or unavoidable and which can be mitigated.

*Report.* The EA report should be concise and limited to significant environmental issues. The main text should focus on findings, conclusions and recommended actions and a summary of references used. Organize the EA report according to the outline below:
Executive Summary
Policy, Legal and Administrative Framework
Description of the Proposed Project
Description of the Project Area
Expected significant Environmental Impacts

Analysis of Alternatives
Recommendations for mitigation
Appendices
Record of Consultations and Meetings
Contact Information and References

## APPENDIX II: CLEIAA Fellowship Program (July 2001)

The U.S. Agency for International Development Bureau for Africa and Regional Economic Development Services Office in conjunction with the "Capacity and Linkages for EIA in Africa" (CLEIAA) initiative

### Announce

Professional Development Opportunities in Environmental Impact Assessment for Africans in the Practice of Environmental Impact Assessment Practitioners

USAID is pleased to offer a limited number of professional development (PD) opportunities in environmental impact assessment (EIA) to Africa professionals iAfrican environmental and related disciplines. professionals. The PD opportunities will be of 1-6 months duration. in Africa, the US or Europe. They will provide hands-on experience in conducting or managing EIA or course-based training that has a strong-hands on component. The goal of the program is to enhance EIA capacity and to strengthen environmental professional networks in Africa.

Participants will gain practical EIA experience in specialized fields, such as road construction, water supply development, healthcare, irrigation, protected area and wetlands management, use of coastal resources, etc. Participants will have the choice of, or be assigned to, professional consulting firms, EIA agencies or organizations, or EIA teams in various African countries. Short or in-depth course-based training will also be considered, but learning-by-doing hands-on training is the considered to be particularly important under this program preferred option.

## APPENDIX III: CLEIAA Environmental Assessment Professional Development Fellows 2001-2002: Brief bibliographies

### Emma Kambewa

Ms. Kambewa is a Socio-Economist at ICLARM – The World Fish Center in Malawi. Previously, she served as a Natural Resource Management Institutional Development Specialist at Lynx Associates and has held several positions working with smallholder farmers. She holds a M.Sc. in Agricultural Economics and a B.Sc. in Agriculture (with a focus on Rural Development) from the University of Malawi. At ICLARM she conducts economic, social and environmental viability assessments of small-scale aquaculture systems and monitors and evaluates the adoption process and impacts of new technology on farmers families. In previous positions she conducted socio-economic assessments on a wide range of topics often relating to small-scale farming. She has requested a Fellowship in small scale agriculture and irrigation activities as these will best aid her in supporting ICLARM's activities in general and specifically ICLARM's component on IFAD and FAO's joint Integrated Irrigation Aquaculture project within the Small Flood Plain Irrigation project. Contact: ICLARM – The World Fish Center, P. O. Box 229, Zomba, Malawi. Tel. (265) 536 313; 536 274; 536 298. Tel/Fax. (265) 536 274. E-mail: ekambewa@sdnp.org.mw.

### David Kinyua

Mr. Kinyua is the Coordinator for Nareda Consultants in Nanyuki, Kenya. Previously he served as a Resident Scientist at the Mpala Research Centre, as a District Range Management Officer, and a District Livestock Marketing Officer. He holds a M.Sc. in Range Management from the University of Nairobi. Mr. Kinyua has experience applying a variety of analytical tools including Participatory Rural Appraisal, Sustainable Livelihood Approach, Rural Rapid Appraisal, and others. Mr. Kinyua has been actively involved in conducting EIAs, Resource Area Management Plans and CBNRM plans since joining Nareda Consultants in April 2000. Most recently he served as Lead Consultant in *End of Term Review for the Laikipia Wildlife Forum Capacity Building Programme* and for *Community Involvement in Reproductive Health Impact Assessment Study for Samburu Aid in Africa*. He has requested a Fellowship that would provide experience in EIAs of protected areas, wetlands, and conservation projects or alternatively, water supply development projects. **Contact:** Nareda Consultants (Coordinator), P. O. Box 1203, Nanyuki. Kenya. Tel. 0176-31875. Fax.. 0176-31875. Email: Nareda@Nbnet.Co.Ke

### Agnes Mwakaje

Dr. Agnes Mwakaje is a Research Fellow and academic staff at the Institute of Resource Assessment (IRA), University of Dar es Salaam, Tanzania. Previously she worked as an Agricultural Economist for the Ministry of Agriculture and Cooperatives. Agnes holds a Ph.D. in Agricultural Economics from the University of London. She has also a Masters Degree in Agricultural Economics from University of London in U.K and a Bachelor of Science in Agriculture from Sokoine University of Agriculture, Tanzania. In addition, Agnes has a Diploma in Environmental Management from Gallillee College in Israel. Her areas of specialization include agricultural marketing, environmental economics, transaction cost economics and agricultural policy analysis. She has published many research papers and reports including *A Study of Biophysical and Socio-economic Factors for Forest Reserve Encroachment* and *Poverty Focused Social Analysis.* EIA for Mobile phone network installation in Serengeti National Park and Ngorongoro Conservation Area in Tanzania. She is generally familiar with socio-economic impact assessment and activities and common impacts to forest reserves, protected areas, and smallholder farmers. As a Research Fellow IRA she is expected to be able to provide EIA consulting services to government and other development projects. For her Fellowship she requested a one month intensive formal EIA training course and three one month EIA team placements with EIAs of projects relating to irrigation and chemical application, mining, and development of wetlands areas. **Contact:** Institute for Resource Assessment, Univ. Dar Es Salaam, P.O. Box 35097, Dar Es Salaam, Tanzania, tel.: (+255-22) 241 0144. fax: (+255-22) 241 0393. E-mail: agmwakaje@hotmail.com.

**Ratidzayi Takawira**

Ms. Takawira is a Research Officer (Plant Taxonomy, Ecology) at the National Herbarium and Botanic Garden in Zimbabwe. Previously she worked as a Research Officer (Plant Taxonomy and Ecology) under Southern African Botanical Diversity Network (SABONET). She holds a Master of Philosophy in Plant Systematics from the University of Zimbabwe. Ms. Takawira has completed a week-long course on EIA for Botanists offered by the National Botanic Institute in Pretoria and subsequently trained fellow staff at the National Herbarium in EIA, but has little hands on experience conducting EIAs. In addition to research on biosystematics of the genus *Sanservieria* and pollination studies of other native plants, Ms. Takawira co-authored a checklist of Zimbabwean Vernacular Plant Names, published and distributed by the government. She has participated on a number of research project teams including an Eathwatch team which analyzed the vegetation and landscape of Kafue National Park in Zambia. As a Research Officer at the National Herbarium she is expected to carry out EIAs for clients. She has requested a Fellowship of up to 3 months that provides exposure to a range of subfields including EIAs of projects affecting wetlands, dry lands, deserts, forests, and savanna ecosystems. **Contact:** National Herbarium & Botanic Garden, P.O. Box A 889, Avondale, Harare, Zimbabwe. Tel 263-4-725313/744170, fax 263-4-708938. E-Mail: rtakaw@avu.org

## APPENDIX IV: Stakeholders consultations, views and concerns

| Name and Position | Address | Views and Concern |
|---|---|---|
| Mr. P. Haipare<br><br>Chief Executive Officer | Otjiwarongo Municipality P/B 2209, Otjiwarongo | • Welcomes the idea of the project<br>• Foresees no problems of dust, noise and transport congestion<br>• Need a written explanation of the whole project prior to equipment installation for future reference in case of need for reconsidering location for factory<br>• Project should specify water and electricity requirements in case the Municipality does not have enough to supply |
| Mr A. Bench<br><br>Acting Chief Health Officer | Otjiwarongo Municipality, P/B 2209, Otjiwarongo | • Welcomes the idea of the project<br>• Will inspect the building to verify if it meets the health regulations of the municipality<br>• Planners and engineers will evaluate the suitability of the building to bush processing.<br>• Project should abide by the health regulation to avoid unnecessary penalties |
| Ralf Hoffman<br><br>Commercial Farmer | Oros farm, Box 239, Otjiwarongo | • Admitted to have problems with bush encroachment on his farm and other farms<br>• Believes bush clearing would improve farm productivity from improved grass production. But this would be in the long term and farmers may not be patient to invest in bush clearing<br>• Land reform policies brings uncertainty over land ownership and hence affect long term investment decisions<br>• Understands bush encroachment results from overgrazing<br>• Indicated that farmers have problems to de-stock their livestock due to uncertainty with markets eg lack of capacity at abattoirs<br>• Thinks most farmers do not properly clear bush due to financial problems and that they are not sure whether they can recover the money spent<br>• If assured and market for bush products readily available he thinks most farmers would adopt<br>• Feels bush clearing would more labor and this may bring other problems to the farm like poaching, bush fires, diseases like measles, sanitation and accommodation.<br>• Also feels more Namibians may get employment<br>• Recommends that CCF should provide recreational facilities for the workers to avoid social problems and ensure optimum production.<br>• Would be willing to participate in the CCF pilot project<br>• Concerned that rules and regulation governing wildlife only protect animals but never compensate for the damage the animals do to farmers like killing of livestock<br>• Recommends partial to total de-bushing to give animals some shelter and also feed for animals that feed on some trees.<br>• Discourages use of fire because most farmers do not know how to manage it. Often fires go out of control and cause more damage than what was planned. To use fire one need to know time of setting the fire on, amount of burnable bush, strength of fire etc. |
| I. Galloway Director | Jumbo Charcoal | • Believes charcoal making is more environmental friendly than fire logs, pellets and briquettes because it only requires trees stems and leaves more biomass back to the soil.<br>• Claims that grass grow much better under cuts left on the ground after charcoal making.<br>• Believes processing all the cleared bush would eventually affect grass production<br>• Feels markets for fire logs, pellets and briquettes may be difficult |

| | | |
|---|---|---|
| | | to establish in Europe because other companies make them right there. |
| Paulus Mukoya, Ernest Johan Farm workers | C/o CCF | • Need protective wear<br>• Sharp hand axes and knives for clearing bushes |
| M. J. Wiesne Chief Agricultural Officer- Otjiwarongo area | Ministry of agriculture and rural development | • Bush encroachment is a recognized problem and the recommended methods of removal include chemical and mechanical |
| Esmeralda Klassen and Marianne Uiras | National Botanical Research Institute | • Species to be removed are not in the IUCN Red data list of threatened species |
| Dr. John Kinahan | Privete Consultant (archeology specialist) | • Selective removal of bush is unlikely to disturb archeological sites that might exist in the area. |

## APPENDIX V: Proposed Draft Project experimental design

1. Principle Investigator:
Richard M. Jeo, Ph.D.
Research Director, CCF Bush Project
The Cheetah Conservation Fund
PO Box 1755
Otjiwarongo, Namibia

Tel. 067 306 225/248
Fax 067 306 247

2. Title:
Bush Encroachment: Impacts on Namibian Biodiversity (Full proposal)

### Description of Proposed Research

### Summary

Bush encroachment is a major economic and ecological problem in Namibia. The goal of the proposed research is to implement an ecological monitoring plan to study the effects of bush clearing on indigenous wildlife and plant species of north central Namibia. Bush will be cleared using hand tools and will be converted to wood chips using portable chippers, in association with the CCF Bush Project (a project that is intended to investigate the economic feasibility of bush clearing enterprises for Namibian job creation and ecological restoration). We plan to study the effect of size and intensity of bush clearing on the abundance and distribution of a suite of target species assemblages that will initially include:

Annual and perennial grasses
Woody species
Small mammals
Avifauna
Herpetofauna
Ungulates
Carnivores

We believe that this study will benefit Namibian ecology as well as the Namibian economy, and is necessary to guide the management of future bush clearing enterprises. We have obtained permits from the Forestry Department and have a formal agreement with the Ministry of Agriculture, Water and Rural development to conduct this project.

## Background and Motivation

Although humans have influenced the natural environment in Namibia for thousands of years, changes in land use practices over the last century have severely altered natural ecological processes. Recent human-mediated impacts include overgrazing, fire suppression, fragmentation of historical migration routes, establishment of permanent water sources and extirpation of the largest herbivores and top carnivores from substantial areas of commercial and communal farmlands. A consequence of these ecological changes is the conversion of open savannahs to dense, acacia-dominated thickets with little grass cover (hereafter referred to as “bush”), a desertification process known as "bush encroachment." This problem is especially prevalent on commercial farmlands in central Namibia, to the extent that bush encroachment has measurably reduced the economic productivity of the Namibian livestock industry. Over ninety percent of the Namibian population’s income is generated from dry-land commercial cattle farming which loses over $100 million US Dollars each year due to the effects of bush encroachment. In northern commercial farms around Otjiwarongo and Grootfontein, bush encroachment alone affects between 8 to 10 million hectares of land at an annual loss of over $8-10 million US Dollars. Because of the rapid growth of the bush, these figures are estimated to grow at an exponential rate over the next decade.

Nevertheless, Namibian farmlands still harbor a diverse assemblage of native species and have substantial potential as refuges for Namibia's biota. For example, the majority of Namibia's populations of native large ungulates (over 70%), and the largest remaining population of cheetahs in the world are found on commercial farmland, outside of the formal protected area network. Considerable conservation efforts and government wildlife policies are focused on these large mammalian species. In addition, much of Namibia’s biodiversity is found outside of the formal protected area network, where changes in land use practices and resulting bush encroachment may fragment populations and change patterns of abundance and distribution.

We have developed a project that integrates ecological studies with community-based conservation through economic development. We are currently developing entrepreneurial bush clearing enterprises create fuel logs for foreign export and local distribution. The development of these economic enterprises will allow the conversion of encroaching bush into clean burning wood fuel. Our business plan suggests that this project is economically sustainable, and combined with ecological monitoring, will provide an economically viable means of restoring cheetah habitats. We have begun to test these suppositions by developing and implementing bush harvesting, fire log manufacturing and export as a small scale, but economically sustainable, pilot project. If successful, the project could be expanded to a regional or national scale targeting cheetah habitat restoration, local job creation, reduction of desertification and global ecological education. Due to its vast negative economic impact, His Excellency

Dr. Sam Nujoma, President of Namibia, has made bush encroachment a priority of his administration and is strongly supporting the development of bush clearing enterprises and the manufacturing and export of fuel logs.

The overall objective of the proposed research is to implement ecological monitoring for bush clearing enterprises (described above). We hope the proposed research will result in specific management recommendations for bush clearing enterprises. Key questions include: 1) how does bush, grass and resident wildlife species respond to mechanical harvest, and 2) which species make effective ecological monitoring targets. We plan to implement medium- and long-term studies to address these broad questions.

**Project Locality**

The study will be located on farms owned and operated by the Cheetah Conservation Fund, located in the Otjiwarongo district of the Otjozonjupa region. The farms include Cheetah View (#317), Elandsvreugde (#367), Osananga (#368) and Boskop (#324). Additional study sites in the region may be utilized with permission of the owner of commercial farm or through permission of headman of communal areas. These farms are typical of the region, and are each between 4000 - 8000 ha in area. Each farm has a number of check dams and boreholes, which provide year-round water sources. Historical farming practices on these farms include both livestock and indigenous large ungulate herbivory. A number of large carnivores (lions, spotted hyenas and African wild dogs) and the largest herbivores (elephants and rhinoceros) have been locally extirpated.

The region is situated in the Thornbush Savanna vegetation zone defined by Geiss (1971). Vegetation is typical of xeromorphic thornbush savanna with dominant woody plant genera consisting of *Acacia*, *Dichrostachys*, *Grewia*, *Terminallia*, and *Boscia*. Understory vegetation is relatively sparse, although ephemeral forbs are present following rain. This region has been extensively modified over the last century through human-mediated causes compounded by natural climatic fluctuations (Louw, 1982; Prins and van der Jaeugd, 1993; Pallett, 1997; Hoffman, 1997). Some native woody species such as *A. mellifera*, *A. tortillis*, and *D. cinerea* have proliferated, and perennial grasses have been reduced throughout this area (Bester, 1996; Rhode, 1997) to the extent that only remnant patches of historic open savanna habitat exist where livestock grazing has been limited.

Dominant topographic relief within the study area is in the form of small (~1–8ha), isolated granitic outcrops (kopjes). These outcrops rise above a surrounding matrix of flatland, which has virtually no exposed rock. The Waterberg Plateau, a 4100km$^2$ sandstone uplift is the dominant geological feature of the region. The CCF research center lies adjacent to the plateau at around 5000 feet above sea level.

The study area is semi-arid and lies between the 400mm and 450mm annual rainfall isopleths. There is marked seasonality with most rainfall occurring between November and April. The wet season is pronounced and characterized by extensive thundershowers and flooding, with considerable variation in the amount of precipitation between years (Barnard 1998). Namibia has three seasons, as described by Berry (1980), namely a hot dry season from September to December, a hot wet season from January to April and a cold dry season from May to August. Annual rainfall is highly variable, with the majority of rain falling between November and April. The region is relatively arid; mean annual rainfall in the Waterberg study area over a 40-year period was 123.4mm (+ 27.8) for the hot dry season, 348.6mm (+ 58.3) for the hot wet season and 2.8mm (+ 7.4) for the cold dry season.

**Specific Objectives and Methods**

Objectives, key questions and hypotheses

Bush Clearing: Experimental Design and Vegetation monitoring

We plan to study the effects of mechanical clearing of bush on regeneration of woody stems, grass cover and herbaceous plant cover. We specifically plan to investigate of the effects of clearing on vegetation species composition and structural diversity. We will use cattle grazing camps as our primary study units. Cattle grazing camps make useful experimental units for several reasons: 1) grazing camps are typical management units for local farmers, 2) historical grazing regime and management is more similar within a cattle camp then between grazing camps, and 3) bush clearing enterprises will likely clear entire grazing camps.

Specific study units will be delineated after initial vegetation mapping. Mapping will be done by satellite image and air photo analysis, coupled with ground verification. We will use recent, cloud-free landsat-7 imagery (30m pixel size) and will initially employ unsupervised classification techniques (Arc View 3.2 and ENVI 3.0 image analysis software). Field verification data will then be collected from select locations within the image and used to re-train image classification. We expect to lump habitat types into 8-12 different vegetation types based on species composition, size and density of woody species. Satellite data will also yield up-to-date road, fence and waterhole locations. Subsequent vegetation map will be used to stratify experimental design for all aspects of the project.

We plan to have 4-6 replicate study units (grazing camps), each of which will be separated into experimental and control areas. Experimental areas will be cleared using hand tools. Areas to be cleared will be clearly marked using steel fence posts and plastic flagging tape. Cut materials will be removed from the

site. These study units will also provide experimental locations for other research projects.

We will place 4 square plots, each 1 ha in size, in each control and experimental area, for a total of 8 plots per study area. These plots will be placed randomly, but will be located at least 200m from the edge of the respective unit to avoid edge effects. Vegetation will be monitored 4 times per year. Species composition, height class, aerial cover estimates and biomass will be determined for each plots by sampling smaller quadrants placed within each 1 ha plot. Vegetation density and species composition will be monitored using 10m x 10m quadrants, and grass species cover and diversity will be monitored using smaller (approximately 2m x 2m) quadrants. We will use standard vegetation data collection and assessment techniques (for reviews see Southwood and Henderson 2000; Elzinga 2000).

Effects of Bush Clearing on Small Mammal Communities

Small mammals are often overlooked browsers and grazers of African savannah ecosystems (Keesing, 2000) and their impacts might profoundly influence the structure of savannahs in Namibia. We plan to study the effects of bush clearing on small mammal communities. We will conduct live-trapping in experimental study units (described above), by comparing paired cleared-uncleared experimental plots.

We will use standard small mammal trapping techniques, using sherman live traps. For short-term population studies, we will mark all captured animals using permanent ink markers, and release them at the site of capture. In this manner we can calculate density and diversity of small mammal species. For longer-term demography studies, we will mark small mammals using ear tags (in order to avoid the secondary effects of toe-clipping). We plan to conduct trapping 4 times per year. A small number of voucher specimen (< 5 per species) for identification purposes may be collected. Vouchers will be deposited in the National Museum of Namibia. No protected species will be collected and no animals will be removed from Namibia.

**Biodiversity Assessment using invertebrates**

Invertebrates will be collected using light traps and pitfall traps in cleared and uncleared areas using standard methods (see Southwood and Henderson for details). We will classify the collected specimens in cooperation with the National Museum of Namibia. Voucher specimens will be deposited in the National Museum. We will calculate species richness and diversity for each experimental treatment.

**Effects of Bush Clearing on Herpetofauna**

Herpetiles (reptiles and amphibians) make ideal experimental subjects for assessing changes in faunal assemblages associated with bush clearing. We will primarily conduct non-invasive sampling techniques that include visual surveys and call surveys. We will also do limited trapping of herpetiles using pitfall traps, dipnet surveys, hand collection and sticky traps. A small number of voucher specimens (< 5 per species) for identification purposes will be collected and deposited in the National Museum of Namibia. No protected species will be collected.

Effects of Bush Clearing on Avifauna
Effects of bush clearing on bird species will be studied using non-invasive techniques, that include point counts and nest surveys. No collection is planned.

Effects of Bush Clearing on Namibian Carnivores: Diet and Distribution
Carnivores will be assessed and monitored using scent-baited track station and remote-triggered cameras. We plan to compare areas in and around the study units with enroached (uncleared) areas. We will also conduct diet analysis using fecal analysis techniques. Fecal material will be collected and hair samples extracted and identified. We will attempt to document possible changes in carnivore assemblages and changes in diet associated with bush clearing.

Adaptive management for Bush Clearing enterprises
We will develop an adaptive management framework and mechanisms for ecological information to adjust (or even halt) harvest and manufacturing processing based on data from ecological monitoring studies, described above. We plan to identify a suite of species and/or ecological processes for long term monitoring. This framework will ensure that the long-term impacts of bush clearing are always evaluated on an ecological scale, which should precedence over economic considerations.

## APPENDIX VI: EIA Activity Calendar

| # | Activity | Who | When |
|---|---|---|---|
| 1 | Finalise SOW and budget | SAIEA in collaboration with USAID and CCF | Jan 20 |
| 2 | Hotel and airline reservations | SAIEA (hotel), Tallus (airline) | Jan 30 |
| 3 | Plan on-site accommodation, catering and transport in and around CCF and Otjiwarongo | CCF | Feb 10 |
| 4 | Prepare resource economics and environmental law modules | Dr Jon Barnes (Resource economist) and Ms Michaela Figuera (Environmental lawyer) will prepare materials and to provide a ½-day course each. | Feb 25 |
| 5 | Gather literature from DEA, DRFN, DoF, etc. and photocopy as appropriate | SAIEA | Feb 15 |
| 6 | Arrival of Walter in WHK and preparatory meeting (Walter to stay about 5 days) | USAID, SAIEA, CCF | Feb 17 |
| 7 | Collect Fellows from airport | SAIEA | Feb 19 |
| 8 | Day 1: Windhoek tour & familiarization, exchange money, essential purchases, read literature, lecture and discussion on "the fundamentals of EA" | SAIEA and USAID (Walter) | Feb 20 |
| 9 | Day 2<br>Literature review – CCF project<br>Lecture on bush encroachment and rangeland management in Namibia | <br>Fellows<br>DRFN | Feb 21 |
| 10 | Day 3<br>Lecture on Environmental law in southern Africa (emphasis on Namibia) (morning)<br>Literature review – CCF, NAPCOD, Namibian EA policy and legislation, USAID EA requirements | <br>SAIEA (Michaela Figuera)<br><br>Fellows with discussion at end of day with SAIEA and USAID | Feb 22 |
| 11 | Day 4: Planning meeting (finalise TOR and programme) | SAIEA, USAID, CCF, Fellows | Feb 23 |
| 12 | Day 5: Off day | | Feb 24 |
| 13 | Day 6: Lecture on EA and Economics<br><br>Literature review – CCF, NAPCOD, Namibian EA policy and legislation, USAID EA requirements | SAIEA (Dr Jon Barnes and DEA economists)<br><br>Fellows with discussion at end of day with SAIEA and USAID | Feb 25 |
| 14 | Day 7: Construct EA contents page and allocate tasks between PD fellows, compile list of stakeholders to be consulted, contact by telephone to make appointments | SAIEA and Fellows | Feb 26 |
| 15 | Day 8 & 9 : Visit and interview stakeholders in WHK (e.g. Dept. of Forestry, Dept. of Agric., DEA, DRFN, Charcoal Association) | SAIEA and Fellows | Feb 27 |
| 16 | Day 10: Travel to CCF and familiarize with operation | SAIEA and Fellows | February 28 |
| 17 | Day 11-15: Work in the field | Fellows, with periodic input from SAIEA and CCF | March 1 - 5 |
| 18 | Day 16: Return to WHK | SAIEA | March 6 |
| 19 | Day 17: Follow-up interviews | Fellows | March 7 |
| 20 | Day 18-20: Complete write-up and first draft | Fellows | March 8-11 |
| 21 | Return of Walter (or Tellus representative) for a few days to assist with wrap-up | USAID | March 12 |
| 22 | Day 21: Free day (while CCF, USAID and SAIEA read report) | | March 13 |
| 23 | Day 22: Excursion to Rössing and Navachab mines | SAIEA and Fellows | March 14 |
| 24 | Day 23: Workshop on "reviewing EA's" | SAIEA and Fellows | March 15 |
| 25 | Day 24 & 25: Off days (more time to read the report) | | March 16-17 |
| 26 | Day 26: Evaluation of report | SAIEA, USAID, CCF and Fellows | March 18 |
| 27 | Day 27 –29: Final draft completed in light of comments | Fellows | March 19-21 |
| 28 | Day 30 - Return home | | March 22 |
| 29 | Compile report on "PD Fellowship exercise – lessons learnt" | SAIEA | March 30 |

## Appendix VII: FOREST STEWARDSHIP COUNCIL

### What is The Forest Stewardship Council?

The Forest Stewardship Council (FSC) is an independent, non-profit, non-governmental organization. It was founded in 1993 by a diverse group of representatives from environmental and conservation groups, the timber industry, the forestry profession, indigenous peoples' organizations, community forestry groups and forest product certification organizations from 25 countries.

The FSC supports environmentally appropriate, socially beneficial and economically viable management of the world's forests. FSC promotes responsible forest management by evaluating and accrediting certifiers, by encouraging the development of national and regional forest management standards, and by providing
public education and information about independent, third-party certification as a tool for ensuring that the world's forests are protected for future generations.

The FSC defines "forest stewardship" in a set of Principles and Criteria for Forest Management. These principles are the basis by which certifiers are evaluated for accreditation.

Consumers buying products carrying an FSC label can be assured that their purchase comes from a forest which has been responsibly managed according to FSC Principles.

To encourage grassroots participation and decentralize its work, the FSC encourages the formation of national initiatives. FSC-U.S. is one such initiative. The FSC US office is located in Washington, D.C., and has a national presence through the work of its board, regional standards coordinators, and FSC members throughout the U.S.

The role of the FSC is to coordinate the development of forest stewardship standards throughout the country, to provide public information about certification and FSC, to provide a national dispute resolution mechanism, and to monitor certification organizations to ensure compliance with FSC requirements.

### Standards and Policies

The Forest Stewardship Council defines forest stewardship in a set of global Principles and Criteria. These Principles and Criteria, which apply to all forests worldwide, ensure that FSC-endorsed forests are managed in an ecologically sound, socially responsible and economically viable manner. These conditions include; Meet all applicable laws; Have legally established rights to harvest; Respect indigenous rights; Maintain community well-being; Conserve economic resources; Protect biological diversity; Have a written management plan; Engage in regular monitoring; Maintain high conservation value forests; Manage plantations to alleviate pressures on natural forests

**Appendix VIII: Map of Otjiwarongo town, possible factory site circled**