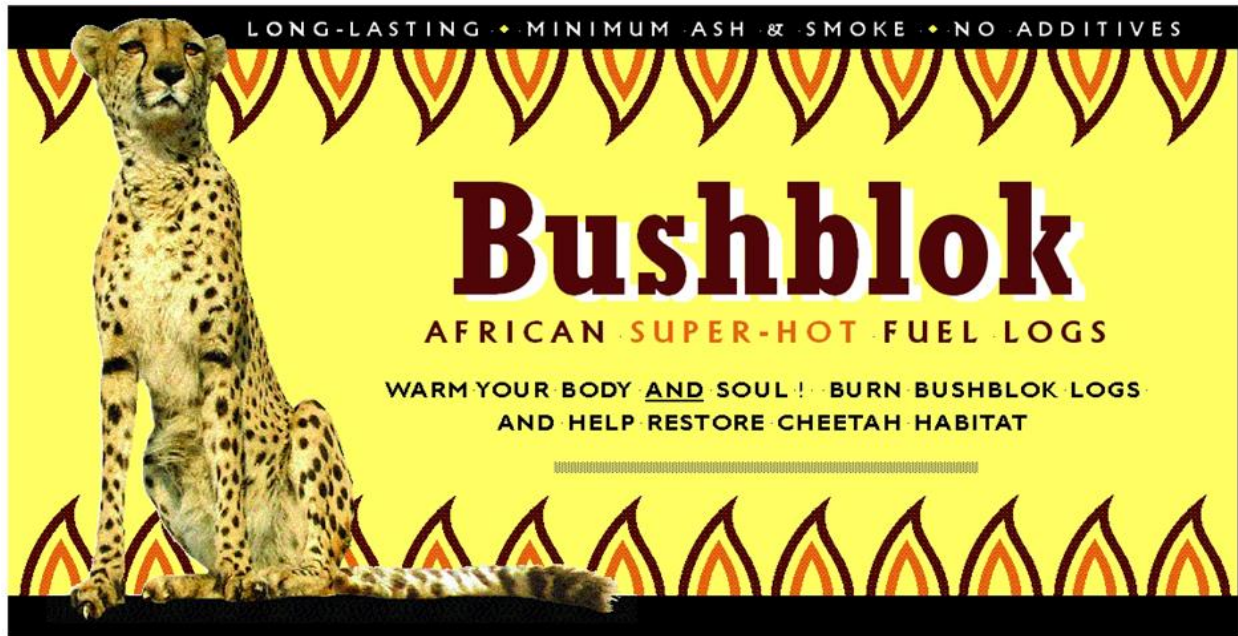


The Environmental Management plan for the Cheetah Conservation Fund's BUSH PTY LTD, Otavi constituency, Otjozondjupa Region



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1. Introduction

The Cheetah Conservation Fund (CCF) Environmental Management Plan (EMP) aims to provide a management framework for the activities of the CCF. It aims to ensure not only compliance with the Namibian Environmental Management Act but to meet global standards of best practice in conservation.

CCF founded in 1990, has as its mission “to be an internationally recognized centre of excellence in research and education on cheetahs and their eco-systems, working with all stakeholders to achieve best practice in the conservation and management of the world’s cheetahs”. CCF maintains a major public education program and creates and disseminates education materials worldwide; conducts programs of community upliftment and predator conflict resolution; assists in the management of captive and free-ranging cheetah throughout the world; and publishes scientific papers on its research findings.

1.1 CCF organizational structure

CCF is an international organisation with registered not for profit organisations in several countries and international headquarters in Namibia. In 1991 CCF in Namibia became a Namibian Voluntary Trust and in 2002 completed registration as a not-for-profit Namibian Section 21 Company. CCF’s Namibian Board of Directors is comprised of leaders in the local community, business, and academic sectors. Additionally, there is an International Science Advisory Board that assists in planning and advising on research projects. CCF’s Executive Director is assisted in the management and operations of CCF by a core professional staff, short-term volunteers, and students.

CCF’s base of operations is in Namibia, which has the largest and one of the few sustainable populations of free-ranging cheetah in the world. The cheetah’s survival depends on a total ecological system of farmland management, prey species management, and habitat stability. CCF’s Namibian focus is to work with livestock farming communities to develop ways to reduce conflict. This is achieved by devising a conservation plan that secures habitat for the species, while still accommodating farmers’ land use needs. CCF carries out scientific research programs in areas such as cheetah population biology, cheetah ecology, cheetah health and reproduction, and human impacts on the cheetah. CCF researchers develop, test, and promote alternative land-management practices such as conservancy development, non-lethal predator control, relocation of problem cheetahs, and eco-tourism. Additionally, CCF conducts both Namibian and international education programs to raise awareness of the cheetah’s endangered status. These illustrate ways in which the species can be protected and encourage worldwide support.

CCF strives to promote Namibia’s vision 2030 through the sustainable utilisation and management of natural resources in accordance with the Forest act 2001, and the Namibia forest development policy of 1998. To that end CCF operates a model farm and goat dairy and has created the

BUSHBLOK program which promotes the sustainable use of Namibian thornbush. This program is run by CCF Bush Pty Ltd, which also has published a Management Plan. That plan prescribes methods of harvesting, suggests harvesting targets, multiple monitoring programs (ecologic, & socio-economic), and land use objectives.

To assure that both plans meet international criteria for conservation CCF has obtained and maintained Forest Stewardship Council certification since 2002. This requires an annual audit by one or more outside environmental professionals.

1.2 Operating principles

1.2.1 Management

Goal: a management process that ensures a sustainable approach to achieve the Vision.

On behalf of the Board of Directors the Executive Director manages the staff through a General Manager and Assistant Director – Research. Staff have contracts and CCF is registered with the EEC. Yearly goals are promulgated at a general meeting and annual and mid-year reports are published. Finances are audited by a registered Namibian firm.

1.2.2 Conservation activities

Goal: to be a centre of excellence in conservation practices.

Conservation is our core business. In addition to our extensive on-campus and outreach education and activities such as the Livestock Guarding Programme and Bushblok habitat restoration, we act as the research advisor to the Waterberg Conservancy and help organize their conservation efforts. All conservation activities are outlined in the CCF annual reports available at www.cheetah.org.

Energy-saving fixtures and appliances are used wherever possible. Efforts are made to constrain campus development within a 1000 meter radius to minimize vehicular impact. Air conditioning is only for laboratories and food storage.

1.3 Location and environment

CCF's International research and education centre is in prime cheetah habitat within the Waterberg Conservancy, which encompasses over 175,000 hectares of private farmland surrounding the Waterberg Plateau Park: a national game park dedicated to rare and endangered species. The conservancy's farmers cooperatively manage the land's wildlife for long-term sustainability that in turn provides habitat and prey base for the cheetah. The Waterberg conservancy is a member Greater Waterberg Landscape, an area comprising 16,000 km², or close to 2 million hectares,

around the Plateau and four communal conservancies including Ozonahi, Okamatapati, Otjituuo and African Wild dog. Both Cheetah view and Babson guest lodges are located on farm Elandsvreugde, located approximately 44 km on D2440. Other farms include Osonanga, Boskop (Khayam's Kopje), Cheetah View, Bellebenno, Janhelpman, Bynadaar, Padberg and Otjenga totaling 56,790.6 hectares. CCF's Centre provide a model for farmers and relevant stakeholders to demonstrate that they can live harmoniously with cheetahs.

The most common land-use practices are integrated farming with wildlife, livestock, ecotourism, and bush biomass production. Cattle farming is practiced on farms Cheetah view, Boskop, Elandsvreugde, Bynadaar, Bellebeno, Otjenga, Padberg and Janhelpmann. No cattle farming is practiced on mall herd (≤ 250) of goats and sheep, no cattle farming is practiced on farm Elandsvreugde. Commonly observed ungulate species are kudu (*Tragelaphus strepsiceros*); oryx (*Oryx gazella*); red hartebeest (*Alcelaphus buselaphus*); Eland (*Tragelaphus oryx*); warthog (*Phacochoerus africanus*); steenbok (*Raphicerus capensis*); duiker (*Sylvicapra grimmia*) and aardvark (*Orycteropus afer*). The common carnivore species include jackal (*Canis mesomelas*); caracal (*Felis caracal*); cheetah (*Acinonyx jubatus*); leopard (*Panthera pardus*); brown hyena (*Hyaena brunnea*); aardwolf (*Proteles cristatus*); honey badger (*Mellivora capensis*); bat-eared fox (*Otocyon megalotis*); striped polecat (*Ictonyx striatus*) and small-spotted genet (*Genetta genetta*).

The area receives a mean annual rainfall of 400 mm (30 – 40% var.), with the main season occurring between November and April. The overall mean temperature range is 20°C - 21°C (coldest month: 4°C - 6°C, hottest month: 32°C - 34°C) (Mendelsohn & el Obeid, 2005).

The farms have several man-made semi-permanent water reservoirs which allow access to surface water for livestock and wildlife year-round. Water resources occurs in two main forms i.e. surface (earth dams and underground water sources. Water availability is disadvantaged by unpredictable climatic conditions and the underlying geology of the area. For most of the CCF farms (apart from Jan helpman) underground water aquifers are weak and have a limited production capacity. Borehole developments on CCF farms were recorded to date back as far as the 1930's. Farm Janhelpman is situated on an underground geologic marble rock formation "Omarrasa" that provides a rich water resource (Naude, 2005 pers.com). No water is currently sourced from Janhelpman to the CCF main campus due to its remoteness. Water sources available on CCF farms are shown in Table 1.

Table 1. Farm statistics and neighbors

Farm name	Project area (Ha.)	Ownership	Land use	Livestock	Water points	Farm owner Contact	Immediate Neighbor Contact
Elandsvreugde (17.022739 ° E, -20.484254 ° S)	1250	Private	Livestock, Wildlife ecotourism, Wood biomass	Goats = 258 Sheep = 117 Horse = 6	Boreholes = 4 Earth dams = 6 Troughs = 4	Cheetah Conservation Fund C/O Bruce Brewer General manager Tel: 067 306225 Cell: 0811247799 Johan Britz General Farm manager Cell: 0811247800	Harry Schneider Waterberg 149, Farm Okosongomingo,
Boskop (16.985182 ° E, -20.514437 ° S)	1250	Private	Livestock, Wildlife, Wood biomass	Goats = 100 Sheep = 250 Cattle = 2 Horse = 14 Donkey = 15	Boreholes = 7 Earth dams = 5 Troughs = 6		
Cheetah View (16.889426 ° E, -20.575799 ° S)	1250	Private	Livestock, wildlife, wood biomass	Horse = 3 Donkey = 2	Boreholes = 3 Earth dams = 5 Troughs = 4		Francois Roberts Farm Manager Ozondjahe Cell: 0812559347
Bynadaar (16.995661 ° E, -20.452338 ° S)	250	Private	Livestock, Wildlife, wood biomass	Goats = 12 Sheep = 2 Cattle = 120 Donkey = 4	Boreholes = 3 Earth dams = 5 Troughs = 10		Harry Schneider Waterberg Box 149, Farm Okosongomingo,
Jan Helpmann (17.006103 ° E, -20.256621 ° S)	250	Private	Livestock, Wildlife, wood biomass	Cattle = 500 Donkey = 2 Horses = 5	Boreholes = 10 Earth dams = 2 Troughs = 21		Alf Walter, Frans Indongo Lodge, P. O. Box 1093, Otjiwarongo Phone: 067 307 946

Otjenga (16.973865 ° E, -20.348534 ° S)	250	Private	Livestock, Wildlife, wood biomass	Cattle = 300 Donkey = 3	Boreholes = 2 Earth dams = 4 Troughs = 4	
Bellebenno (17.055022 ° E, -20.330737 ° S)	250	Private	Livestock, Wildlife, wood biomass	Cattle = 120 Horse = 3	Dams = 10	Harry Schneider Waterberg Box 149, Farm Okosongomingo,
Padberg (16.907198 ° E, -20.504424 ° S)	250	Private	Wildlife, wood biomass		Boreholes = 3 Earth dams = 3 Troughs = 5	Johan Dohman, Aloegrove safari lodge, Otjiwarongo, Namibia
Total	5000			Cattle = 1042 Goats = 270 Sheep = 369 Donkey = 26 Horses = 31	Boreholes = 32 Dams = 40 Troughs = 54	

The most prominent geological feature is the Waterberg Plateau, located on the eastern periphery of the CCF farms. All CCF farms are located within the *Damara sequence* geologic stratum, the oldest in the Waterberg region formed about 500 - 850 million years ago. Soil types fall into two main associations: - *Eutric Regosols* and *Chromic Cambisols* (MET, 2002). The soil substrate is predominantly sandy loam and loamy sand. The topography is generally flat, with elevation ranges between 1501m – 1701m above sea level (MET, 2002). Consequently, water runoff during the rainy season is slow and is mostly evident in low lying areas near seasonal streams. All farms occur within the *moderate* soil erosion risk region of Namibia (DRFN soil erosion map, undated).

Vegetation is classified as semi-arid thornbush savanna, dominated by both Blackthorn (*Senegalia mellifera*) and Sickle bush (*Dichrostachys cinerea*) woody vegetation (de Klerk, 2004). Bush encroachment, the general increase in the biomass of native woody plants from vegetative growth of existing plants and establishments of new individuals in a particular area, is a common phenomenon on CCF farms. A complete checklist of the local fauna and flora found on CCF farms appear in appendix 1 (A – E).

2. Description of the bush encroachment problem on the land

Bush encroachment is defined as the invasion and thickening of aggressive undesired woody species which results from an imbalance in the grass-bush ratio (de Klerk, 2004). The encroachment is a result of historic land use practices which led to alterations in the ecological balance of the farmland ecosystem. As an example, fences were constructed in order to control the movement of livestock, resulting into reduced local migrations. Additionally, the creation of semi-permanent water points for livestock caused most species to become resident. There are known causes of bush encroachment and are identified according to primary and secondary factors (de Kerk, 2004). Primary determinants of bush encroachment such as rainfall, soil types and nutrients are inherent to a specific geographical area and thus beyond the farmers control (de Klerk, 2004). Secondary determinants although natural, were influenced by human activity which started with the introduction of livestock such as cattle, goats and sheep, exerting pressure on the natural grazing systems due to continuous grazing practices. Continuous livestock grazing and aggregation around water points are one of the factors leading to overgrazing and trampling of the soil, resulting in land degradation. Natural migration systems for most wildlife species were disrupted by the creation of permanent water resources (earth dams and boreholes). Certain large bodied mammal species such as the African elephant (*Loxodonta africana*) and black rhino (*Diceros bicornis*), which utilize bush, are locally extinct and natural fires - which characterized savanna ecosystems, were suppressed. This was partly due to the highly unpredictable climatic conditions, inherent low rainfall and productivity of the farmlands which influenced farmers' perception on fires as an event which destroys grazing. It is believed that the frequency and intensity of veld fires were altered due to the manner in which the rangeland is managed.

Overgrazing reduces the availability of grass fuel load, therefore lowering the prospects of a high intensity (hot) fire necessary to control woody species.

Namibia supports much of the free ranging global cheetah population estimated at 2000 – 3000 individuals, with 95% living on commercial farmlands (ref.). Approximately 45 million hectares of Namibian farmlands are affected by bush encroachment (SAIEA, 2016). Thus, loss of suitable habitat through encroachment is a challenge to the cheetah’s survival because of reduced hunting efficiency, prey density and change in prey distribution patterns (Marker et al., 2003b; Muntifering et al., 2006; Marker et al., 2007; Marker et al., 2008). In addition, the farmland is hampered by poor rangeland productivity due to reduced grazing carrying capacity, consequently, economic losses of more than NAM\$700 million per annum was reported to affect the beef industry, affecting approximately 65 000 communal households and 6283 commercial farmers and their employees (de Klerk, 2004). This phenomenon has potential to lower food security and nutrition; increased effort to living standards; high demand on wages and income transfers; as well as unemployment (de Klerk, 2004). Lowered habitat visibility due to bush encroachment also affects the ecotourism industry negatively since game viewing is hampered by thickened bush, and tourists may opt to visit other places with a high diversity of species and habitats.

CCF is concerned about the loss of suitable habitat due to encroachment as this could directly and indirectly affect the long-term survival of the cheetah. Reversing encroachment through bush thinning could restore savannah productivity, thereby turning a perceived problem into a potentially valuable opportunity for the livestock and biodiversity conservation sectors. Consequently, farmers’ negative attitudes, perceptions and tolerance towards economic losses due to predators can be counteracted. This can be achieved by increasing the current carrying capacity through bush thinning, thereby promoting diversified land use options on the land through ecotourism and bush biomass utilisation.

2.1 Tree species causing problems

Species responsible for encroachment include *Senegalia cinerea*, *Senegalia mellifera*, *Vachellia reficiens*, *Vachellia tortilis* and *Dichrostachys cinerea*.

At least 3 density estimates for the area to be thinned.

Table 2 Density estimates of the proposed harvest area

Density/1ha. Mean (±95%)	Tree equivalent/1ha. Mean (±95%)
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Cheetah View	866.18	180.66	995.35	264.3
	1712.48	336.96	2525.93	905.04
	1443.64	304.62	2034.28	447.28
Boskop	1300.54	362.03	1218.63	353.34
	2085.91	436.88	2642.63	1807.50
	1129.38	448.94	1366.38	396.32
Bynadaar	1340.77	274.08	1851.85	538.87
	1485.55	334.54	1926.28	568.55
	1610.03	367.84	1965.18	869.37
Elandsvreugde	1782.45	710.63	3398.05	1317.00
	1337.58	239.60	1602.50	371.82
	1149.02	299.57	1361.93	315.66

2.2 Description of past efforts to manage the bush encroachment problem on the land

During 2001, CCF secured funding from the United States Agency for International Development (USAID) in order to set up a pilot project known as CCF bush PTY Ltd. The primary goal of CCF bush PTY Ltd.'s habitat restoration program is to create an ideal habitat for cheetahs and other local biodiversity, demonstrate sustainable harvest methods, biomass technologies, and value addition of Namibia's bush biomass. In 2003, harvesting was initiated on CCF farms, and a factory for processing wood chips, located in Otjiwarongo was acquired. The factory was officially inaugurated in 2005 in Otjiwarongo. CCF also registered for FSC accreditation to ensure that harvesting operations and general farm management comply with approved international and local standards. The FSC inspections are conducted annually to ensure CCF's conformity with acceptable sustainability standards. Bush harvesting was mostly targeted along fence lines, roads and some grazing camps. Harvesting is done using manual felling with axes and mattocks; harvested wood is left to dry in the sun for more than one month. Dried harvested wood is piled into windrows and an industrial mechanical chipper is used to refine it into raw wood chips before they are transported to the factory for further processing. A wood briquette, known as bushBlok is produced from the harvested wood and is sold to the retail market as an energy product. Past efforts were mainly concentrated along farm routes, fence lines and small grazing camps. Pre and post-harvest assessments were conducted in targeted areas in order to determine biomass availability and botanical species composition. Biodiversity surveys in targeted areas were also done in order to determine the harvest impacts and responses of the soils, mammals, birds, reptiles, and vegetation regrowth. Economic viability of different harvest methods and equipment were also trialled with the Finnish VTT institute on CCF farms.

In 2016, major progress was made for the relocation of the Otjiwarongo based bush factory to the CCF main centre at Elandsvreugde. The relocated facility will be known as the Biomass Technology Demonstration Centre (BTDC). It will include the BUSHBLOK factory, a carbonizing

kiln, and eventually a biomass fuelled power plant. Relocation is necessary in order to reduce costs related to the transport, production and processing of woody biomass and also serve as a demonstration centre open to the public.

2.3 Description of the proposed bush thinning project

2.3.1 Size of area to be thinned

CCF bush PTY LTD proposes to harvest a total area covering 5000 hectares on the eight farms (Table 1). The total areas to be harvested per annum does not exceed 500 ha. due to limited capacity. The current harvest operations do not exceed 100 hectares per annum, and it would take 50 years to thin 5000 hectares of encroached habitat if the harvest capacity remains the same.

2.3.2 Expected duration of the project (years)

The bush biomass harvesting project will be ongoing and activities will be subjected to constant monitoring and evaluation. Project approval will be based on annual audits which will include key aspects of social, environmental, political, and financial factors. Based on annual audits, adaptive management strategies will be implemented, and project renewal will be done periodically.

2.3.3 Species to be thinned.

The following species were identified for harvesting

Table 3 Species to be harvested

Scientific name	Common name
<i>Senegalia cinerea</i>	Sandveld acacia, blade-thorn, mungamba
<i>Senegalia mellifera</i>	Black-thorn acacia, swarthaak, omusaona
<i>Vachellia reficiens</i>	Red umbrella-thorn, rooihaak, rotrindenakazie
<i>Vachellia tortilis</i>	Umbrella thorn
<i>Dichrostachys cinerea</i>	Sickle-bush, omutjete, sekelbos, papwielbos, farbkätzchenstrauch

2.3.4 Approximate density of trees to remain after thinning

The overall tree/shrub density to remain following harvesting will be 600 - 750 tree equivalents consistent with the recommended TE for an annual rainfall region of 400 – 450 mm/year

(MAWF, 2006). Therefore, it is expected that on average, 1276.2 (68%) of the available tree equivalents per hectare is potentially available for harvest (Table 4).

Table 4 Approximate tree/shrubs to remain after thinning

Farm	Mean tree equivalents/ha	% Potential harvestable
Cheetah View	1851.85	68
Boskop	1742.55	66
Bynadaar	1914.44	69
Elandsvreugde	2120.83	72
Padberg	1742.55	66
Bellebeno	2120.83	72
Otjenga	1742.55	66
Janhelpmann	1742.55	66
Overall (mean)	1876.2	68

2.3.5 Methods of bush thinning to be used.

Pre harvest assessments will be conducted in targeted areas in order to identify the density and composition of the vegetation and any potential threats to the habitat or local biodiversity. Bush thinning will be conducted by means of three main techniques including manual, semi-mechanized and mechanized methods. Manual harvesting will be done by employing harvesters operating hand tools including axes, pangas and non mechanised saws. Semi-mechanised harvesting will involve the use of a polesaw operated by a harvester. The fully mechanized technique will be done with a skidsteer saw and forest harvest machine (VIMEK 400) operated by a driver. Aftercare treatment will be applied on all freshly chopped stems to suppress resprouting.



a) Pre harvest assessment



b) Manual harvesting



c) Vimex Forest harvester



d) Polesaw

e) Skidsteer

Figure 1 Methods of bush thinning (a – e)

2.3.6 Equipment / machinery / chemicals to be used during bush thinning

Table 5 List of equipment and machinery to be used

Item description	Number of units
<u>Manual</u>	
a) Axe	30
b) Panga/Machette	30
c) Files for sharpening tools	5
<u>Semi mechanised</u>	
a) Polesaw	1
<u>Mechanised</u>	
a) Skidsteer with saw	1
b) VIMEK forest harvester	1
<u>Chemical for aftercare treatment</u>	
a) Access (Picloram)	Variable, depends on tree/shrub density
b) Roundup (Glyphosate)	

2.3.7 Number of staff to be employed.

A total number 30 field workers will be employed including 23 harvesters and seven people responsible for chipping bush. In addition, two people from the chipping team will serve as drivers for the tractor and delivery truck during field operations.

2.3.8 How staff will be recruited

Staff are recruited from the immediate area around Otjiwarongo. CCF has a non- discriminating policy against sex, race, politic or gender and candidates are selected based on whether they have satisfied the competencies of the job.

2.3.9 Where staff will live

All harvesting and chipping crew member have own permanent housing in Otjiwarongo. CCF will provide transport daily (Mon – Fri) from town to CCF centre.

2.4 What contractual arrangements will be made with staff

Staff are hourly employees with signed contracts. Employees will enter into a contract agreement as arranged by CCF bush PTY LTD and in accordance with the Labour Act (Act No. 11 of 2007). Probation will be three months, and a permanent contract will be issued afterwards should the employee satisfy all necessary competencies and wish to remain employed by CCF Bush PTY LTD.

3. Description of the bush Value-adding project

3.1 Felling and chipping

Tree/shrubs are felled using manual, semi mechanised and mechanised techniques by the harvesting team. Once felled, the harvested biomass is left in the sun to dry for a period not exceeding three months. This is done to reduce the moisture content thereby prevent clogging of the chipper stout during chipping. In addition, drying also reduces biomass weight and this allow ease when the bushes are dragged over longer distances to the chipper, or when they are being piled into windrows. Once sun dried, harvested biomass is arranged into windrows by the chipping team. The team is also responsible to feed harvested biomass to a Morbark mechanical chipper which remains stationary in specific locations on the existing roads or created extraction routes. The chipper generates its own power from diesel and is moved around by an ordinary tractor or truck. Chipped wood is loaded onto containers and these are transported to the bushblok factory for further drying, storage and processing.



a) Felled trees in windrows



b) Chipping



c) Offloading and further drying of raw wood chips



d) Raw wood chips

Figure 2 Felling and chipping methods (a – d)

3.2 Expected duration of the project

As part of the CCF's long-term vision to secure habitat for the cheetah and its prey, project duration is dependent on the scale of bush encroachment and conservation needs. Thus, the project is permanent, with periodic renewal and will be subjected to ongoing research, monitoring and evaluation activities (at least three-year cycles). Based on annual audits, adaptive management strategies will be implemented.

3.3 Size of area where value addition project will be located

Since 2016, major progress has been made to relocate the factory to the CCF main centre on farm Elandsvreugde. The relocated facility is known as the Biomass Technology centre (BTDC) and covers an area size 1 hectare. The facility include the BUSHBLOK factory and the carbonizing kiln. Additional facilities at the BTDC include two sheds, a canteen, generator building, diesel storage area and a genset. The genset produces power for the main campus and is connected via cables to back feed battery power from the main centre to BTDC. Communication cables and wireless access were installed to allow monitoring.

3.4 Methods of production to be used

3.4.1 Processing

Raw wood chips are fed to a hammer mill and grinded to produce smaller sized biomass particles, also known as ground wood chips. This product is dried further by blowing hot air over it in order

to reduce its moisture content before it undergoes extrusion. The ground wood chips are fed to a Shimada extrusion press via a conveyer belt system, and through this process, a compact fuel briquette is produced. The process uses heat and pressure to recombine the wood with no artificial additives. CCF bush PTY LTD branded this fuel briquette as BUSHBLOK.

Another value-added product produced from the processed wood fuel briquette is a carbonized wood fuel briquettes and charcoal. Raw wood and wood fuel briquettes are placed in a CK-3 carbonizing kiln and undergo pyrolysis, utilizing high temperature and lack of oxygen for a fixed time. Through this process, wood biomass is converted into carbon, while retaining its quality. The carbonized wood fuel briquette is also convenient to market due to its longer shelf life and is more economical to transport due to the reduction in weight. For this reason, it is suitable to use in homes and restaurants because of its smoke free nature.

All products undergo quality inspection, and are sorted, packaged, and stored in a shed at the factory. Appropriate labels are attached to each product.



a) Loading chips into the hammer mill



b) Ground wood chips



c) Extrusion press process



d) Banding, Packaging, Labeling

e) CK-Carbonising Kiln

Figure 3. Production methods used (a-e)

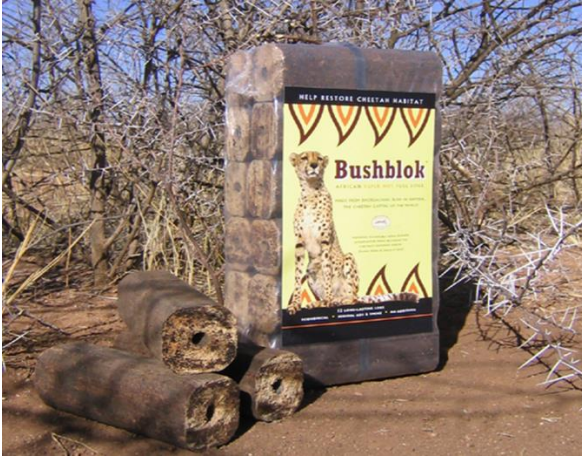
3.4.2 Equipment to be used

Table 6 List of equipment to be used

Item description	Number of units
Shimada Extrusion press	4
Hammer mill	1
Tractor	2
Cut off saw	1
CK-3 carbonizing kiln	1
Skidsteer	1
Genset	1

3.4.3 Products to be produced (description, quantity)

The main products to be produced will include the BUSHBLOK wood fuel briquettes, carbonized BUSHBLOK wood fuel briquettes and charcoal. Occasionally, fence droppers will be sourced from encroaching sickle bush *D. cinerea*, however this is not a main product of this project. The estimated bush biomass yield is 12 ± 3 tons per hectare. A biomass yield of 10 tons per hectare will be used to estimate harvestable biomass yield. Therefore, it is expected that an annual harvest of area of 100 hectares would potentially produce 1,000 tons of bush biomass. It is estimated that the proposed 5,000-hectare area will have a minimum biomass yield of 50,000 tons.



a) BUSHBLOK fuel briquette



b) Carbonised wood

Figure 4 Produced products (a – b)

3.4.4 What liquid or solid waste will be generated (type and quantity)

Potential waste associated with the harvesting of bush biomass in the field and processing at the factory include plastic, glass bottles, wood ash, engine oil, diesel/petrol spillage, paper, printing cartridges, cigarette butts, metal (tins), chemical spillage, grey water, black water, battery acid, old spare parts, old containers, styrofoam, tar, old tyres and saw dust.

3.4.5 Where the waste will be disposed.

All recyclable materials are taken offsite e.g., to the Otjiwarongo municipal dumpsite, printer cartridges are taken to other destinations including Windhoek and abroad. Non-recyclable waste will be disposed in fenced dumpsite located within 1 km on farm Elandsvreugde. Liquid waste such as old engine oil, and tar are kept in secured containers for further recycling. Sawdust and ash are used in garden compost. All wastes generated in the field during harvesting and chipping are collected and disposed either at the dumpsite or recycled. Any spillage from chemicals or hydrocarbons is treated readily following FSC approved procedures. All diesel/petrol storage tanks have leak-proof bunds with sufficient volume to contain the entire storage contents as a precautionary measure for major accidental spillage.

3.4.6 Where the water will come from

Field teams will be provided with water in containers. Water will be sourced from boreholes available on each farm which are replenished by seasonal rainfall (Table 1). In the event of an unexpected water shortage, water may be sourced from one of the boreholes available on other CCF farms.

3.4.7 How much water will be used?

Currently, the water consumption for the field teams will not exceed 200L per day. Water consumption at the BTDC is mostly for bathing and toilets and less than 1000L per day is used. Conservatively, not more than 1000 liters of water is used daily and installing monitors for water consumption specifically at BTDC is being proposed.

3.4.8 What air emissions will be generated

Potential air emission associated with this project include sawdust from ground woodchips, smoke, and noise from the genset, smoke from the CK carbonising kiln, chemical emissions when applying aftercare or during the carbonising process, exhaust emissions from vehicles, noise and dust when chipping and hammer milling, smoke from the extrusion presses.

3.4.9 How the product will be taken to market

Products will be transported from the factory to the Otjiwarongo BUSHBLOK depo by 5-ton Mercedes Benz truck. Additionally, 5-ton trailers attached to a tractor will be used.

3.4.10 Who and where the off-taker/market is

The products are sold locally and abroad for household uses such as heating, cooking and barbeques. The offtake markets are in Otjiwarongo, Windhoek, South Africa, and Europe (via Walvis Bay).

3.4.11 Number of staff to be employed

A total number of 22 people are employed at the factories, 14 are based at the BTDC and eight at the BUSHBLOK factory in Otjiwarongo.

3.4.12 How staff will be recruited.

Similar methods of recruitments as indicated in earlier sections will be followed in the recruitment process i.e. Employees are recruited from the immediate area around Otjiwarongo and surrounding. CCF has a non-discriminating policy against sex, race, politic or gender and candidates are selected based on whether they have satisfied the competencies of the job.

3.4.13 Where staff will live

All factory employees have own permanent housing in Otjiwarongo. Employees are provided with transport daily (Mon – Fri) from a central location in town to the BTDC.

3.4.14 What contractual arrangements will be made with the staff.

Similar arrangements as described in earlier sections will be made for all employees at the BTDC i.e. a contract agreement shall be entered into between CCF bush PTY LTD and a job candidate.

4. Bush biomass harvest and processing activities and associated environmental impacts

4.1 Logistics

Transport to and from the worksites and moving of mobile equipment are major logistical needs for the bush project. As indicated in previous sections, employees are provided with transport on a daily basis to and from the workplaces and the distance travelled per month is approximately 2700 km (45 km x 2 x 30 days). Transport is also provided to the otjiwarongo based employees to and from the BUSBLOK factory. Field teams are also provided with basic food rations (milk, tea, maize meal, cooking oil, meat) weekly and water daily. Teams and equipment are also rotated constantly to new sites depending on the completion of harvesting and chipping activities. Chipped containers are hauled from the operation sites to the factory by a tractor or truck. At least two containers of approximately 5 tons are filled each day with raw chips and this is hauled to the factory upon filling. Therefore, the overall distance for the operations on a monthly basis may not exceed 5500 km. Supplies including fuel and food are sourced once a week from town and adequate stock is kept in a storeroom. Stock inventory and control is regularly conducted, and this ensures a constant supply of products. Stock control also ensures that the products do not exceed their expiry dates and wasted, are damaged or react with each other and cause danger to the users.

The handling and storage of stock requires a specific method in order to avoid damage by keeping products beyond expiry or from contaminations. Thus, bad storage and poor stock control can increase pollution from the number of trips to the market, fuel consumption and generate more garbage in the environment.

The following are considered potential risk factors in logistics:

- i. Transport to and from the worksites will increase energy consumption and vehicle wear.
- ii. Mishandling of the production equipment (e.g. tractor, chipper, kiln, hammer mill) may cause irreparable damage
- iii. Mishandling of products when loading or offloading or at storage could cause product damage.
- iv. Incorrect storage of chipped wood or processed products especially during the rainy season will result into the products becoming wet and this could accelerate wood decay or create fire.
- v. Incorrect labelling and storage of wood chips and other products in the sheds, on the shelves or in the refrigerators.
- vi. Lack of awareness amongst staff regarding correct procedures of storage.
- vii. Poor production capacity may lead to shortages of wood chips which could affect all operations at the factory and increase production costs.
- viii. Safety and hygiene in receiving and storing products.
- ix. Increase in the number of town trips and between the different worksites will pollute the air, water and soil.

4.2 Bush biomass harvesting and chipping

Field teams consisting of harvesters and chippers operate in selected encroached areas for a number of days and will move between sites, depending on bush availability and logistical needs. Therefore a makeshift camp is erected at each operation site where open fire cooking takes place, water is kept and equipment are stored. Manual harvesting is the most common harvesting method used and harvesters are required to have basic identification knowledge of the five encroaching species. In addition, the harvesters are also required to have a knowledge about the local flora and fauna in the area, first aid and at least understand the purpose of bush harvesting. The chipping team is primarily responsible for the production of wood chips and collects dried bush from the harvest site to the chipper. This team is also expected to have similar knowledge comparable to the harvest team. Both teams usually operate in similar areas and camps are usually not more than 300m apart.

The following are considered potential risk factors in the harvesting and chipping operations:

- i. Accidental offtake. This can be realised due to poor tree/shrub identification, fatigue, or in cases where the stems of targeted and non-targeted plants are growing next to each other or poor instructions regarding the correct species or size classes that are harvestable.
- ii. Overharvesting. Encroaching tree/shrubs will be thinned down to recommended levels i.e. 600 TE/ha and stratified harvest based on size classes will be done to allow natural

regeneration to succeed. Mature tree/shrubs will be left as prescribed by the MAWF, 2016.

- iii. Soil disturbances especially if mechanised equipment methods are applied. This can increase soil erosion and compaction.
- iv. Excessive energy usage: This can be realised if the chipper is allowed to run unproductively i.e. the engine is left to run without feeding it with any bush biomass. Similarly, energy consumption can be increased when engines of field vehicles are left to run for no reason.
- v. Veld fires. Unprotected cooking on open fires especially during the dry season is a potential threat to the environment.
- vi. Lack of environmental awareness amongst staff especially on the environment, pollution and recycling, or effects of hydrocarbons or chemicals spillages on the environment.
- vii. Health and safety. Inadequate knowledge on basic first aid training. Lack of first aid training is a risk since employees will not respond correctly to accidents or medical emergencies.
- viii. Poaching. Hunting of wildlife for meat or collection of animals especially pangolins and tortoises may occur. Any collection with no authorisation will be considered illegal.

4.3 Processing at the factories

The BTDC facility will be the main location for the production of BUSHBLOK, carbonised BUSHBLOK and charcoal.

The following are considered potential risk factors at the factory sites

- i. Excessive energy consumption: examples include leaving lights on when rooms are unoccupied, having multiple electrical equipment, vehicles and extrusion presses allowed to run unproductively.
- ii. Excessive water usage: examples include leaving taps open especially in the bathrooms, factory workers taking multiple or prolonged showers, dripping/faulty taps and leaking toilets, frequent flushing of the toilets and poor maintenance.
- iii. Mishandling of the production equipment (e.g. tractors, kiln extrusion presses, hammer mill) may cause irreparable damage
- iv. Mishandling of products when loading or offloading or at storage could cause product damage.
- v. Incorrect storage of chipped wood or processed products especially during the rainy season will result into the products becoming wet and this could accelerate wood decay or create fire.

- vi. Incorrect labelling and storage of wood chips and other products in the sheds, on the shelves or in the refrigerators will shorten the lifespan of products.
- vii. Lack of awareness amongst staff regarding correct procedures of storage.
- viii. Poor maintenance of the production equipment may lead to energy loss, water loss, accumulate wastes and pollutes the environment.
- ix. Safety and hygiene in receiving and storing products.
- x. Lack of environmental awareness amongst employees especially on the environment, pollution and recycling, or effects of hydrocarbons or chemicals spillages on the environment.
- xi. Health and safety. Inadequate knowledge on basic first aid training. Lack of first aid training is a risk since employees will not respond correctly to accidents or medical emergencies.
- xii. Stock control. Lack of records on the origin, amounts delivered, and inventory of available stock will compromise sales and forecasting.
- xiii. Generation of liquid and solid wastes that will contribute to environmental pollution.

4.4 Purchasing policy

An eco-friendly purchasing policy is required in order reduce pollution and wastage of resources, while at the same time promoting “green products” such as predator friendly beef, game meat and sustainable livestock and wildlife farming. CCF has procedures in place regarding the number of trips made and harvest sites are selected based on accessibility and availability of bush biomass. Shopping trips for merchandise are done ones per week, usually on Fridays, food rations are given in bulk, the number of trips to and from worksites are limited per day, Energy and water saving equipment are bought and installed e.g. energy saving bulbs at the factory, regular servicing of vehicles, and only FSC approved herbicides are applied for aftercare treatment as examples.

The following are considered potential risk factors:

- i. Buying products from shops that do not support environmentally friendly practices or biodiversity conservation.
- ii. Buying eco non- friendly products that do not support environmental conservation or products that cannot be recycled locally.
- iii. Buying products with a lot of packaging instead of single material packaging.
- iv. Using the equipment and products in a rational way (i.e. overuse leads to more trips to town and equipment are only used for their intended purpose.
- v. Inadequate stock taking, leading to multiple trips to town.

5. Detailed Environmental Management actions

5.1 Energy Management

Goal: Maximize use of renewable energy while minimizing overall energy consumption.

The campus is beyond the grid. Mains power is currently produced by diesel genset and a 75kw Photovoltaic power source on the roof of the CCF visitor center. Batteries have been installed so the gensets do not run continuously. Water is heated by solar collectors. Some borehole pumps are solar powered. Energy-saving fixtures and appliances are used wherever possible. Efforts are made to constrain campus development within a 1000 meter radius to minimize vehicular impact. Air conditioning is only for laboratories and food storage.

Table 7 Avoid excessive consumption of energy resources, reduce wastage and reduce carbon footprint

Impact /potential risk description		Mitigation measure	Indicators	Priority (1-3; low – High)	Responsible person	Deadline
Logistics	Transport of employees to and from worksites,	Limit the number of trips. Provide adequate supplies e.g. water, food, select specific camps/areas to concentrate on.	Adequate supplies are given and recorded. Develop annual harvest plans.	2	CCF Farm manager,	1 Month
	Frequent town trips	Regular stock control	Stock control records, Purchase lists records	2	CCF Farm manager, Assistant farm manager	Monthly, ongoing

Chipping	Morbark chipper is allowed to run unproductively The engines of field vehicles e.g. tractors and cars are left on for an extended period.	Ensure that adequate harvested materials are piled near the chipper before the engine is switched on, switch the engine of immediately when the chipper is not in use Switch off vehicles when not in use	Monitor the amount of Diesel consumption Keep records on fuel consumption	2	Farm Manager, Assistant farm Manager Chipper operators	1 month
Factory facilities	Room lights switched on for no apparent purpose	Avoid switching leaving on any light when rooms are unoccupied	Instructions on energy conservation provided to factory employees. Awareness on energy consumption provided to factory employees	2	Farm Manager, Assistant farm manager CCF education department	1 month

	<p>Multiple electrical equipment, Leaving engines running</p> <p>Extrusion presses and Hammer mill allowed to run unproductively</p>	<p>Limit the use especially during peak hours.</p> <p>Only operate the extrusion press and hammer mill when adequate bush biomass is available</p> <p>Install energy consumption meters at the factory</p>	<p>Awareness on energy consumption provided to factory employees.</p> <p>Energy awareness posters and other information is placed at the factory.</p>	2	<p>Farm manager Assistant farm Manager CCF education department</p>	3 month, ongoing
CK-Kiln	Wasted heat energy produced during the carbonising process.	Recycle heat generated for heating and electricity production.	<p>A written proposal on how the wasted heat will be recycled</p> <p>Implementation of recommended heat recycling as outlined in the proposal.</p>	2	General Manager CCF BUSH PTY	1 year
Bush biomass wastage	Incorrect storage of chipped wood or processed	Avoid exposure of chipped wood to rain.	Keep records of all incidences involving wasted	1	Farm Manager, Assistant farm manager	3 months

	<p>products. especially during the rainy season will result into the products becoming wet and this could accelerate wood decay or create fire</p>	<p>Store chipped wood and BUSHBLOK fuel briquettes in sheds</p> <p>All harvested bushes should be chipped as soon as it is sundried.</p>	<p>energy resources and take precautionary measures.</p>			
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5.2 Water management

Goal: promote the wise use of water resources.

Water is sourced from boreholes and staff and visitors are reminded that it is a scarce resource. System pressure is kept low to minimize leaks. Swimming pools and bathtubs are discouraged. Garden watering is minimal and at is done during proper times. Grey water is collected and used for gardens and compost watering.

Table 8 Avoid water wastage

Impact /potential risk description		Mitigation measure	Indicators	Priority (1-3; low – High)	Responsible person	Deadline
facilities	Water wastage from prolonged showers.	Avoid taking longer showers Closing the taps when applying shampoo or soap Install showerheads that are water efficient. Inform guests about the importance of saving water.	Label reminders on water use placed in rooms and at taps. Efficient water showerheads installed.	1	Farm manager Assistant farm Manager	3 months
	Water wastage due to broken taps, pipe leaks, or not	Regular maintenance inspections	Records of maintenance jobs done and number	1	Farm Manager Assistant farm manager	Ongoing

	properly closing the taps.	Remind factory employees about the importance of saving water. Reduce water pressure. Install durable taps. Report broken taps to the Farm Manager.	of incidences are kept up to date. All reported cases are repaired immediately.			
	Water wastage from flushing the toilet frequently.	Encourage employees to reduce the number of flushing events and only do it when necessary Install water efficient cisterns.	Water efficient toilet cisterns are installed Labels reminding users on efficient water use are present in all bathrooms.	2	Farm Manager, Assistant farm Manager	Ongoing, 1 week
	Water wastage from Washing dishes or performing other duties under a running tap	Avoid washing dishes without filling water in a sink or bucket. Close taps tightly. Avoid washing single items and combine wash loads.	Instructions on proper usage of water Labels reminding cooks and cleaner staff on efficient water use are	2	Farm Manager Assistant farm Manager All factory employees	1 month, ongoing

			present at all water installations			
	Water wastage due to broken taps, pipe leaks, or not properly closing the taps.	All broken/leaking should be reported to the tourism maintenance manager. Close taps tightly	Records of maintenance jobs done, and number of incidences are kept up to date. All reported cases are repaired immediately.	1	Farm Manager, Assistant farm Manager	Ongoing

5.3 Waste management and purchase policy

Goal: reduce pollution and minimize use of resources.

Grey water is collected and used for gardens and compost watering. Black water goes into local sewage tanks at each facility. Bio waste from the kitchen and paper is collected and composted. Recycling containers and signage is prevalent. Metal and glass are recycled in Otjiwarongo. Printer cartridges and E-waste are taken to Windhoek. Non-recyclable waste is buried in our own, fenced, trash pit.

Table 9 Prevent pollution on the land, water and air

Impact /potential risk description		Mitigation measure	Indicators	Priority (1-3; low – High)	Responsible person	Deadline
Logistics	Frequent trips to and from the field sites and town	Avoid unnecessary trips	Number of trips and kilometers travelled are kept	2	Farm Manager, Assistant farm Manager	Ongoing, once monthly

	generate air pollution.	Stock control Rational use of production equipment merchandise	on record and updated regularly.			
Harvest and chipping Factory facility Logistics	Pollution of soil and water from waste products (e.g. bottles, metal, plastic, cooking oil, cigarette butts, Styrofoam), chemical spillages,	Use biodegradable products and encourage eco-friendly products. Ban the use of hazardous products Use effective microorganism (EM) used to speed up biological decomposition Recycle waste products e.g. grey water for garden and composting	Biodegradable products use encouraged. Water and soil quality tests are done (Obtain initial test results and use it as baseline to compare with follow up tests).	2	Farm Manager, Assistant farm Manager	Ongoing, 3 months
		Non-recyclable waste products should be disposed at a designated site. Hazardous products	Biodegradable products use encouraged.	1	Tourism Manager	Ongoing, 3 months

		<p>should be contained in such a manner that no leakages into water and soil occur.</p> <p>Start initiative where employees are encouraged to take their generated waste back to towns.</p>	<p>Water and soil quality tests are done (Obtain initial test results and use it as baseline to compare with follow up tests).</p> <p>Recycling bins with labels placed at the guest lodges.</p>			
	<p>Pollution of soil, water and air from waste products (e.g. carbon monoxide, oil, leaks, noise, dust, sawdust)</p>	<p>Regular maintenance of the production equipment and vehicles e.g. to prevent oil leaks, dangerous exhaust fumes and noise.</p> <p>Build bunds around storage facilities e.g. diesel tanks to contain any accidental spillages</p>	<p>All equipment and vehicles are serviced on time and records kept up to date.</p> <p>Bunds are built at all storage facilities</p>	1	<p>Farm manager, Assistant farm Manager</p>	<p>1 month, ongoing</p>

		Enforce speed limits to avoid dusty conditions. Recycle sawdust by composting it for gardens	Feedback from employees regarding the driver's adherence to speed limits			
	Pollution of air from smoking cigarettes	Restrict smoking in public or near non-smokers Designate smoking areas at the factory	Non-smoking signs are placed in the public places Employees are informed that the factory is considered a non – smoke zone	1	Farm Manager	3 months,
	Pollution of soil and water from chemicals (Accidental spillage of Access used in preventing regrowth)	Correct procedures of dealing with spillages are adhered to. All chemicals are kept in a safe room with appropriate labels. Only use FSC approved herbicides e.g. Access (Picloram active), Roundup (Glyphosate)	Records on incidences are kept All incidences are reported to the Farm manager Periodic surveys to sample water and soil contaminants in local areas.	1	Farm Manager Assistant farm manager	3 months, ongoing

5.4 Human resources

Goal: a staff that is trained and empowered to achieve the Vision.

Where skills are available CCF, employ local labor resources, thus ensuring the local distribution of employment and benefits. Interns are trained in both the sciences and vocational skills, a safe and harmonious working environment for employees is created thereby encouraging a prosperous, loyal and productive workforce. CCF invests in Health and Safety and enforce a Code of Conduct and have a fair disciplinary structure.

Table 10 Follow health and safety precautions

Impact /potential risk description		Mitigation measure	Indicators	Priority (1-3; low – High)	Responsible person	Deadline
Logistics	Product damage and loss of quality during delivery or storage e.g. loading, offloading, storage	Provide awareness on proper storage methods. Acquire delivery cart at the factory, use skidsteer for lifting heavy loads.	Evidence of records detailing training offered Delivery cart acquired and present.	1	Farm Manager, Assistant farm manager	1 month, ongoing
Harvest and chipping						
Factory facilities	Injuries sustained while on duty,	Provide protective gear as a preventive method against injuries and enforce its use (e.g. gloves, overalls, safety glasses)	Evidence of protective clothing on record.	3	Farm manager, assistant farm manager	1 month

Logistics Harvest, chipping Factory facilities	Lack of knowledge about the environment (e.g. goals of CCF, basic ecosystem principles, sustainability, recycling)	Provide environmental education training to all at levels of all employees Expose all staff to partake in field exposure trips (conservation area, tourism area) in order to gain first hand experiences.	Evidence of records detailing training offered or excursions taken.	2	Senior Ecologist	3 months, ongoing
	Inadequate knowledge on health and safety emergencies, snake bites, scorpions, insect bites.	Provide first aid training at all levels of the employees	Evidence of records detailing training offered	3	Farm manager, assistant farm manager	3 Months
	Loss of life/injuries e.g., from, snake bites, local predators or during	No staff is allowed to approach, disturb, or handle any snake, scorpion, or other dangerous wildlife.	Evidence of incidences is kept on record	3	Farm manager, assistant farm manager	1 month, Ongoing,

	the production process.	No employee shall drive or operate any equipment unless approved by the farm manager.	Provide health and safety training and kept records. Provide staff training on the use of different equipment and keep records			
	Injuries sustained while on duty (e.g., thorns, insect stings, and from chopping tools).	Health and safety precautions is strictly adhered to while on duty and interacting with guests a) Protective clothing is mandatory while at work	Evidence of incidence events on record All staff concerned are using the required protective gear.	2	Farm manager, assistant farm manager	Ongoing

5.5 Avoid damage to protected trees and to rangelands

Table 11 Avoid damage to protected trees and to rangelands

Impact/potential risk description	Mitigation measure	Indicators	Priority (1-3; low – High)	Responsible person	Deadline
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Loss of protected tree species	Loss of protected tree species	<p>Tree/shrub identification training is provided to all field employees.</p> <p>Harvesting of protected trees is prohibited unless approved by the MAWF.</p>	<p>Valid harvest permit is acquired with a list of targeted species</p> <p>Written permission from the CCF farm manager is required in cases where products from trees are used for own consumption.</p>	3	BUSHBLOK administrator	3 month
	Loss of large trees	<p>No trees taller than 4 m, or greater than 18 cm diameter are harvested, unless a homogenous vegetation stand of the aforementioned size and height is dominant. In this case, thinning will be done in accordance with</p>	<p>Post-harvest assessments reveal remaining TE of 600 TE/ha left.</p>	2	<p>Farm Manager</p> <p>Senior Ecologist</p> <p>Assistant farm Manager</p>	1 Month, ongoing

		approved procedures.				
	Ecological imbalance due to over-harvesting	A stratified harvesting approach in thinning is followed i.e. harvesting should not target only specific bush species, sizes or height and a mix harvest is encouraged to promote structural and species diversity.	Post-harvest assessments reveal thinned vegetation with diverse species, sizes and height categories.	2	Farm Manager Senior Ecologist Assistant farm Manager	2 Months, ongoing
	Disturbance of sensitive plant habitats	Upon encounter, areas with significant densities of protected species per hectare or isolated communities will be considered as "special case habitat". Therefore no thinning	"Special case" habitats are demarcated and maps developed and shared with the harvesters. Pre assessments of harvesting sites will be conducted in order to determine	1	Farm Manager Senior Ecologist Assistant farm Manager	3 Month, ongoing

		operations should be conducted in such habitat.	associated risk factors. Post assessments of harvesting sites will be conducted to evaluate the impacts of the harvest operation.			
	Accidental offtake	Conduct periodic field inspections to verify species being harvested. Provide refresher species identification courses.	The number of incorrectly identified species are recorded and harvesters are retrained.	1	Farm Manager Senior Ecologist Assistant farm Manager	3 Month, ongoing

5.6 Avoid disturbance to wildlife and livestock

Goal: Protection of species, conservation of the environment.

CCF is concerned about the loss of prey due to poaching since this affect habitat suitability. Lack of prey escalates human wildlife conflict, illegal use of wildlife is non-sustainable. Livestock theft destroys the farming economy.

Table 12 List of impacts to wildlife and mitigation measures

Impact /potential risk description		Mitigation measure	Indicators	Priority (1-3; low – High)	Responsible person	Deadline
Harvesting and chipping, Factory facility	Loss of livestock and wildlife due to poaching	No employee is allowed set snares, kill or collect any wildlife without approval from the management. This is a criminal offence and is liable for prosecution. No employee is allowed to bring snares, weapons or firearms to the worksites	Evidence of the number of poaching events is on record. Evidence of compliance is kept.	2	Farm manager, assistant farm manager	Ongoing

	Disturbances of sensitive habitat and animals	<p>Avoid harvesting near breeding sites or removing cheetah playtrees.</p> <p>Respect that animals have a right of way</p> <p>Enforce a specified speed limit while driving in the reserve 40km/h</p> <p>Provide basic training on animal behaviour and the ecology of the CCF farms.</p> <p>Employ an anti-poaching unit</p>	<p>Incidences of snaring and poaching are recorded.</p> <p>Evidence of training given is kept on record</p>	2	Farm manager, assistant farm manager.	Ongoing, 1 month
	Escape of livestock and wildlife due to gates being left open or damaged fences.	<p>No fence removal, cutting or damage is allowed.</p> <p>Gates are to be left as they were found e.g. open gates are left open and closed</p>	<p>Number of incidences in which gates were left open or fences were damaged, number of</p>	3	Farm manager, Assistant farm manager	Ongoing, 1 month

		gates are left closed.	incidences in where livestock escaped from camps.			
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Avoid soil erosion and loss of soil fertility

Impact /potential risk description		Mitigation measure	Indicators	Priority (1-3; low – High)	Responsible person	Deadline
Soil erosion	Loss of topsoil because of bush thinning	<p>“ No bush cutting permitted on slopes steeper than 12.5% (i.e. 1-in-8).</p> <p>Bush cutting is also not recommended on slopes of 5 – 12.5% (i.e. between 1-in-20 and 1-in-8).</p> <p>Machinery should always</p>	Total incidences involving cutting on steeper slopes	1	Farm manager, Assistant farm manager	Ongoing, 5 month

		<p>move approximately along the contours, not directly up and down slopes.</p> <p>if slopes are significantly bush encroached it is recommended that they be set aside as part of the area that is not harvested” (MAWF, 2016).</p>				
	<p>“erosion or destabilisation of river banks as a result of bush thinning” (MAWF, 2016)</p>	<p>“No bush cutting permitted within 100 m of a watercourse, pan or spring. Two exceptions are permitted: – where bush has encroached into</p>	<p>Total incidences involving cutting within 100 m of a natural watercourse</p>	1	<p>Farm manager, Assistant farm manager</p>	<p>Ongoing, 3 month</p>

		seasonal pans, one may clear the floor of the pan but not around the outside margins.” (MAWF,2016)				
	Loss of soil fertility	“bush encroachment on sandy soil should be thinned less vigorously than on non-sandy soils, as the trees are responsible for most of the soil fertility. All sites where <i>Terminalia sericea</i> and <i>Senegalia cineerea</i> are dominant should be	“correct level of harvesting, adequate numbers of trees remain” (MAWF, 2016).	1	Farm manager, Assistant farm manager	Ongoing, 3 month

		harvested according to the formula te^* per hectare = $3 \times$ annual rainfall” (MAWF, 2016).				
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5.7 Prevent regrowth through aftercare

Table 13. Prevent regrowth of encroaching species following harvesting

Impact /potential risk description		Mitigation measure	Indicators	Priority (1-3; low – High)	Responsible person	Deadline
Aftercare	Encroacher species, will resprout following harvesting	Prevent bush regrowth by treating freshly cut stems with Access (Picloram), an FSC approved herbicide.	Thinned areas supports required tree/ shrub density	3	Farm Manager, Assistant farm Manager	1 month, ongoing

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