Desert Research Foundation of Namibia

7 Rossini Street, Windhoek West
P.O. Box 20232, Windhoek, Namibia
Fax: +264-61-230172; Tel: +264-61-377500
Email: drfn@drfn.org.na Web page:
www.drfn.org.na

The Adaptation Fund Board Secretariat 26th July 2019
1818 H Street NW
MSN P4-400 Washington, D.C., 20433 - U.S.A.
E-Mail: Secretariat@Adaptation-Fund.org; fmadziwa@adaptation-fund.org
shansmoevi@adaptation-fund.org;

Dear Secretariat,

SUBMISSION OF PROJECT CONCEPT PROPOSAL BY NAMIBIA

The Desert Research Foundation of Namibia (DRFN) as the Namibian National Implementing Entity (NIE) hereby submits the following project concept proposal for your consideration:

> **Nutritional Security in Namibia's Rural Food Production Systems in the Face of a Changing Climate with** the Namibia Nature Foundation (NNF) as Executing Entity.

The following documents are attached:

a) Project Concept Proposal, Main Body
b) E-Mail Communication by NIE of 27 June 2019 "Intention to submit"
c) Letter of Endorsement by the Designated Authority, Environmental Commissioner, Ministry of Environment and Tourism of 23rd July 2019.
d) Endorsement of requests for both, PFA and PFG grants by the Designated Authority dated 23rd July 2019.
NB: "*NIEs may request both PFA and PFG simultaneously when they submit proposals using the two-step proposal approval process, that is, when they submit a project concept for consideration of endorsement by the Adaptation Fund Board*."

The Desert Research Foundation of Namibia has also taken note of the AF communication of Wednesday, 12 June 2019 circulated to all NIE's with the subject:
Adaptation Fund Project and Programme Submissions: Deadlines and other important information concerning AFB34. Our intention to submit above mentioned project concept was communicated to the AF on 27th June 2019.

We trust that our submission will be favourably considered and look forward to hearing from you.

Yours Sincerely,

Dr M.B. Schneider, Executive Director

ADAPTATION FUND

PROJECT PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT INFORMATION

Project Category:	Regular
Country:	Namibia
Title of Project:	**Nutritional Security in Namibia's Rural Food Production Systems in the Face of a Changing Climate**
Type of Implementing Entity:	National Implementing Entity
Implementing Entity:	Desert Research Foundation of Namibia
Executing Entity:	Namibia Nature Foundation
Amount of Financing Requested:	4 998 000 (in U.S Dollars Equivalent)

Short Summary

Seventy percent of the population of Northern Namibia relies on the goods and services provided by intact ecosystems to support their livelihoods, with food being the most important of these. The primary protein resource for most people in the Northern regions is livestock and selected wild-caught fish species. However, although these food sources have met the needs of many people in the past, malnourishment, principally protein shortages, are prevalent. In addition to the lack of adequate access to existing protein sources, threats to food security come from climate risks linked to ecosystem goods and services (Archer, et. al. 2018[1]). Thus, there is a need to look at more resilient and dependable protein sources adapted to a variable climate.

To increase outputs and overcome malnutrition in a changing and variable environment, transformations are needed to harness the latent resilience of communities by facilitating their ability to utilize food resources that are locally available but underutilized. The project aims to increase socio-ecological resilience through enhanced ecosystem-based adaptation to ensure well managed, healthy freshwater and dryland ecosystems that support livelihoods and wellbeing of people in the Northern regions of Namibia along the rainfall gradient extending from Kunene, through Omusati, Oshana, Ohangwena, Oshikoto, Kavango West and East up to the Zambezi Region.

It specifically aims to increase **ecosystems-based food security** through the diversification of food (emphasizing protein) options beyond a primarily livestock-based resource and the improved sustainable utilization of existing but underutilized or unsustainably-utilized protein resources (e.g. freshwater fish) and other nutrients. It will achieve the former by establishing the production potential and parameters for upscaling several indigenous natural food types, particularly alternative protein sources such as insects (e.g. mopane worm) and other veld foods that are adapted to arid conditions and theoretically more resilient to climate shocks. For the latter, the project will improve the current management practices of freshwater and dryland ecosystems in northern Namibia to secure the food and nutrient resources produced by these ecosystems. The basic management approach will be adaptive and flexible to accommodate future climate changes, that are expected to occur in northern Namibia. The primary objective is to develop methods to produce intact, resilient ecosystems that can provide ongoing ecosystem services, such as the provision of food resources to communities reliant on these services.

[1] Archer, E., Engelbrecht, F., Hansler, A., Landman, W., Tadross, M., Helmschrot, J. 2018. Seasonal prediction and regional climate projections for southern Africa. *Biodiversity & Ecology*, 6, 14-21.

Table of Contents

Abbreviations and Acronyms

AFOLU	Agriculture, Forest and Land-Use
CBNRM	Community-Based Natural Resource Management
CBOs	Community-Based Organizations
ESS	Environmental and Social Safeguards
EUS	Epizootic Ulcerative Syndrome
GCM	Global Climate Model
GDP	Gross Domestic Product
ITCZ	Inter-Tropical Convergence Zone
MET	Ministry of Environment and Tourism
MFMR	Ministry of Fisheries and Marine Resources
MW	Mopane Worms
NACSO	Namibian Association for CBNRM Support Organizations
NBSAP	Namibia's Second National Biodiversity Strategy and Action Plan
NC	North-Central
NDC	Namibia Development Corporation
NDP	National Development Plan
NE	North-East
NGO	Non-Governmental Organization
NNF	Namibia Nature Foundation
NUST	Namibia University of Science and Technology
NW	North-West
NSA	Namibia Statistics Agency
N$	Namibia Dollar
NTFPs	Non-Timber Forest Products
SADC	Southern African Development Community
SEEB	Socio-Economic and Ecosystem Baseline
TK	Traditional Knowledge
UNICEF	United Nations International Children's Emergency Fund

1. Project Background and Context

1.1. The Problem to be Solved by the Project

Seventy percent of the population of Northern Namibia relies on the goods and services provided by intact ecosystems to support their livelihoods, with food being the most important of these. The primary protein resource for most people in the Northern regions is livestock and selected wild-caught fish species. However, although these food sources have met the needs of many people in the past, several threats to the secure supply of adequate nutrition are materializing or growing. For example, climate models predict that large parts of northern Namibia will be rendered unsuitable for livestock or standard agropastoral practices. At the same time, exponential growth in demand in African markets is putting intense pressure on Namibia's freshwater fisheries. As a consequence, malnourishment, principally protein shortages, are prevalent. Studies have shown that 42.3% of the population is undernourished, wasting in children under five years is 7.1% and stunting in children under five years is 23.1% (The Namibian, 2017).

In addition to the lack of adequate access to existing protein sources, threats to food security come from climate risks linked to ecosystem goods and services, where for example future predictions indicate impacts on agriculture (maize yield reductions caused by higher temperatures and lower soil moisture) and livestock production (higher livestock mortality due to temperature stress; rangeland degradation) (Archer, et. al. 2018[2]). Resilient ecosystems lie at the heart of food security for rural communities. Threats to these critical ecosystems consequently increase the risks and decrease the food security of a large part of Namibia's population. The 2018 UNICEF Climate Landscape Analysis for Children in Namibia suggests that "climate-driven reductions in agricultural production will impact the poorest and most vulnerable and will exacerbate poverty and raise food insecurity and vulnerability" (Willemse, 2018[3]).

[2] Archer, E., Engelbrecht, F., Hansler, A., Landman, W., Tadross, M., Helmschrot, J. 2018. Seasonal prediction and regional climate projections for southern Africa. *Biodiversity & Ecology*, 6, 14-21.
[3] Willemse, N. 2018. *Climate landscape analysis for children in Namibia*, Final Report. UNICEF, Namibia.

Traditional Knowledge (TK) is used by communities to respond to environmental shocks, providing short term adaptation mechanisms, with communities resuming subsistence farming activities when possible. Current livelihood options are constrained by Namibia's climate and environment as these are not suited to support intensive agriculture. Communities need to adapt to a changing environment and increased frequency of disasters, which are predicted to occur under climate change, but for which short term TK solutions are insufficient. To date most efforts have focused on adapting existing agricultural regimes, e.g. conservation agriculture and climate smart grazing, but little has been done on diversification as a mechanism for adaptation. At the same time, work on Indigenous Natural Products has focused largely on commercial viability for export markets and not local and national markets (e.g. Marula, Devils Claw, *Commiphora wildii* essential oils).

Namibia's Climate

Namibia is one of the driest countries in Southern Africa. Its climate is driven by the cold upwelling Benguela current flowing north along the Namibian coast and a high-pressure system over the South Atlantic. Through most of the year, this results in rain suppression caused by the subsidence of cold dry air over the country. In the summer months, the continent heats up and the southerly shift in the Inter Tropical Convergence Zone (ITCZ) draws in moisture and rainfall from the tropics over northern and eastern Namibia (Dirkx, et. al. 2008). This results in a short rainfall season from approximately November to April. The average mean temperature of Namibia ranges between 12.5 - 25°C (Fig 1a) and the average annual rainfall ranges from <50mm at the coast to just over 650mm in the north east of Namibia (Fig 1b).

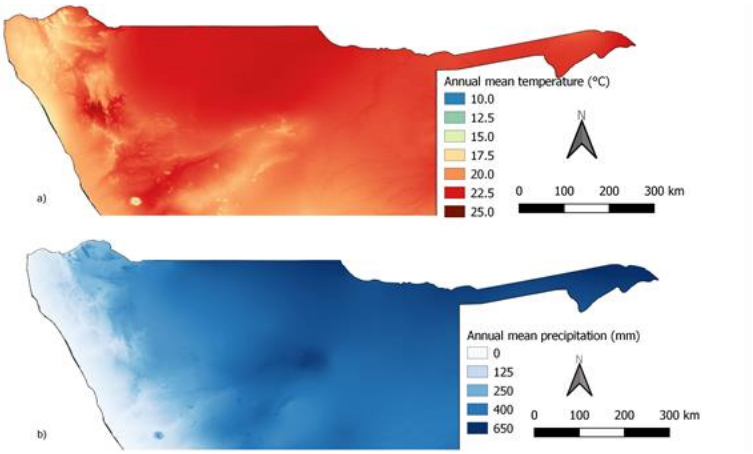


Figure 1: Annual long term (1970 - 2000) climatic variables: a) average temperature and b) average precipitation for northern Namibia (Data source: Fick, et al. 2017)

1.2. How the Project will Solve the Problem

To increase outputs and overcome malnutrition in a changing environment, transformations are needed to harness the latent resilience of communities, by facilitating their ability to utilize food resources that are locally available but underutilized. This requires unlocking the potential of existing but poorly managed or poorly utilized

alternative sources of protein and other nutrients and adapting utilization regimes and management of those resources. The development of this unlocking process to increase utilization by putting in place effective adaptive management steps will ensure the sustainability of these resources in the face of future climate change.

To this end, there are several protein and nutrient resources in northern Namibia that are currently underutilized, under-recognized and/or under managed. These resources, specifically insects, fish, non-timber forest products (NTFPs) and other wetland and dryland products are available and well-known by communities. The reasons for the underutilization of these resources are multi-fold, but include elements related to climate insensitive adaptations of society, policy and other circumstances (such as stigmas, access to the resources, or financial and legislative limitations). By diversifying protein sources, expanding access and adding value, food security and livelihoods for rural families/communities will be improved.

1.3. Background on the Project Location

1.3.1. Future Climate Projections for Northern Namibia

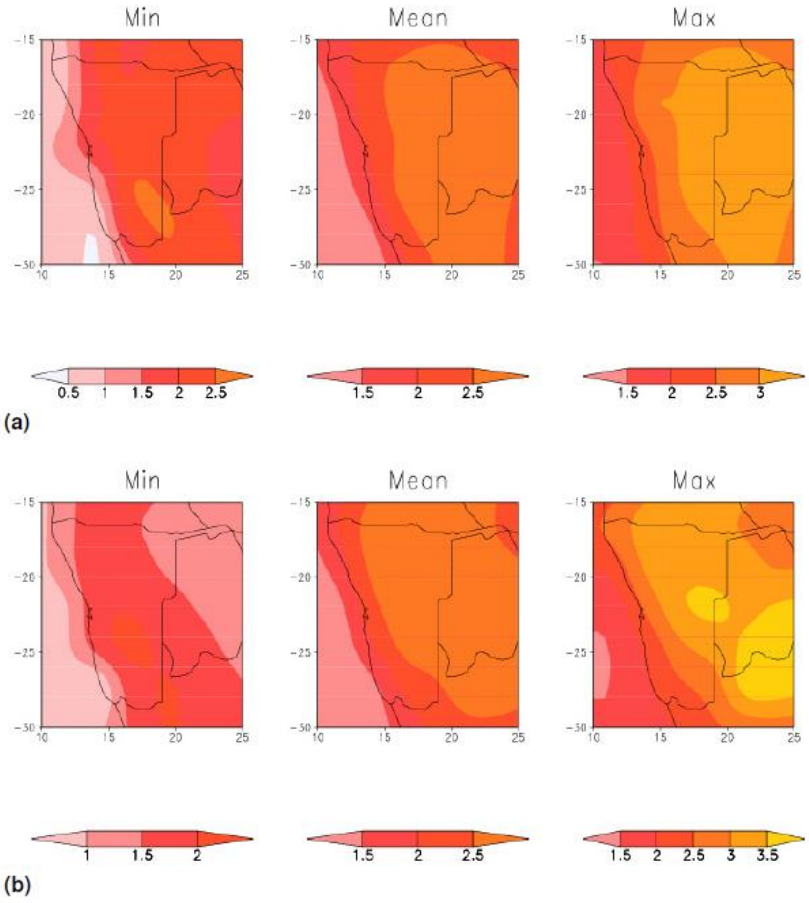
Based on an average of statistically downscaled Global Climate Models (GCM), where at least 3 of the models indicate drying / wetting and factoring in increases of less than 10mm month-1 (i.e. the projected increase in potential evapotranspiration), it is projected that for central Namibia rainfall will increase for the months December to April. In the north-east of Namibia projected increases of rainfall are expected in March and April, and a small decrease in December (Dirkx, et. al 2008[4]). However, on a year-on-year basis, based on low mitigation inputs, it is predicted that annual rainfall within the region will decline significantly (Archer, 2018[2]).

For the north-central (NC) and north-east (NE) of Namibia, it is projected that on average temperatures will increase by approximately 2 - 2.5°C in both the summer and winter months although in some regions this may be greater (Fig 2).

[4] Dirkx, E., Hager, C., Tadross, M., Bethune, S., and Curtis, B. 2008. Climate change vulnerability & adaptation assessment, Namibia. Report for Government of Namibia, Ministry of Environment and Tourism.

1.3.2. Socio-Economic Background within the Study Region

Figure 2: Minimum (left), mean (middle) and maximum (right) projected change in a) January to March and b) July to September mean surface air temperature (°C) from 13 GCMs for the period 2046 to 2065 (Dirkx, et. al. 2008[Error! Bookmark not defined.]).



In the 2011 population census (NSA, 2011[5]), 57.2% of Namibians were registered as rural dwellers with this sector of the population being reliant on subsistence agriculture. Agriculture is listed as the 6th most important contributor to the national GDP. In the review of the potential impacts of climate change on the agricultural sector (Dirkx, et.al, 2008[4], Archer, 2018[2]), it is evident that the sector and especially communal / subsistence farming is particularly vulnerable to climate factors.

Livestock, in particular cattle, is an important resource in NC and NE Namibia, as a significant contributor to the national GDP and from a social perspective. Changes to rangelands caused by climate change have not yet been modelled. However, based on the proposed climate models with the projected changes in rainfall and temperature, it is expected that there will be significant changes in the vegetation structure. A study by Midgely et al. (2005[6]) has projected a significant decline in C4 grasses in the NC and NE of Namibia and a substantial increase in C3 grasses and shrub cover by 2080 (particularly when CO_2 is added to the models). It is expected that the increase in shrub cover will reduce available grazing land. In addition to these potential implications on the rangeland

[5] Namibia Statistics Agency, 2011. Namibia 2011 Population and Housing Census Main Report. 214 pp

[6] Midgley, G., G. Hughes, W. Thuiller, et al. (2005). Assessment of Potential Climate Change Impacts on Namibia's Floristic Diversity, Ecosystem Structure and Function. Cape Town, South African National Biodiversity Institute, Kirstenbosch.

quality, it is expected that livestock production will be negatively affected because of their reduced ability to cope with environmental and physiological challenges associated with heat and water stress, nutritional and thermal changes and exposure to diseases and parasites. Whilst livestock is considered one of the most important sources of protein across northern Namibia, other alternative protein sources are often utilized by the population living in these regions (Marais, 1996[7]; Kamwi, 2015[8]). These alternative resources (non-timber forest products - NTFPs and freshwater systems) are either used by households as a coping mechanism during times of hardship (e.g. irregular rainfall, drought, fire, food shortages – Kamwi, 2015 [9]) or based on the availability of natural resources. Amongst the resources utilized are alternative protein resources such as edible insects or fish (these are region dependent).

With this background livestock can be considered climatologically expensive in terms of greenhouse gas emissions, economically expensive in terms of production per unit area of land and ecologically expensive in respect of the degradation of ecosystem services. This is further exacerbated when considering future climate scenarios projected for Namibia (Dirkx, et.al, 2008[4], Archer, 2018[2]).

1.3.3. Alternative Protein Sources in Namibia

In considering alternative protein sources we will initially focus on fish and insects; the former is a known source of protein and an important livelihood option that is under threat from climate change and over exploitation. The second, insects, are widely utilized in Namibia but lack any formal structures through which they are harvested and utilized as a direct source of protein or for livelihood options. These two sources of protein exhibit a gradient across the north of Namibia, with fish dominating in the north east of Namibia and insects having highest potential in the north west of Namibia.

Edible Insects of Namibia

Jongema (2015[10]) produced an extensive global list of edible insects. Although this list is not exhaustive, 13 different edible insect species were identified as being consumed in Namibia. Most of these belong to the family Saturniidae (order Lepidoptera), consumed

[7] Marais, E., 1996, June. Omaungu in Namibia: *Imbrasia belina* (Saturniidae: Lepidoptera) as a commercial resource. In *Phane. Proceedings of the first multidisciplinary symposium on phane* (pp. 23-31).

[8] Kamwi, JM. 2015. Dynamics of Land Use and Land Cover Changes: Impacts on Rural Livelihoods in the Zambezi Region, Namibia. PhD Thesis, University of Pretoria.

[9] Kamwi, JM, Chirwa, P.W.C., Manda, S.O.M., Graz, P.F., Kaetsch, C., 2015. Livelihoods, land use and land cover changes in the Zambezi region, Namibia. Population & Environment 37(2). DOI: 10.1007/s11111-015-0239-2

[10] Jongema, Y., 2015. List of edible insects of the world. *Wageningen: Wageningen UR*, pp.1-75

in the larval (worm) stage of these insects. Within the southern African region *Imbrasia belina* (Westwood, 1849), commonly referred to as the mopane worm (MW), is one of the most frequently consumed insects. *Imbrasia belina* is the larval stage of the emperor moth. The MW has been extensively studied within the region -in particular in Zimbabwe, Botswana and South Africa- and there has been significant effort to develop this resource into a commercial product. Within Namibia this resource has been recorded to be widely utilized by 7 of the 10 ethnic groups (Marais, 1996[Error! Bookmark not defined.]). It is therefore an alternative protein resource that is widely accepted as a food resource. Other insects are consumed within Namibia, including for example termites, and larvae of *G. maja* and certain beetle species, but none of these approaches the volumes of MW.

Imbrasia belina Biology and Ecology

In Namibia, the MW is recorded across much of the north-central region with some occurrences extending into the Zambezi Region (Fig 4). The densest occurrence is within the Kunene and Omusati Regions. Much of the distribution range of the MW is aligned with its primary host plant, *Colophospermum mopane*. However, the MW has also been associated with other hostplants including: *Ozoroa spp, Sclerocarya birrea, Vachellia karoo,* and within regions with *Schotia brachypetala* and *Brachystegia/Julbernardia*. These tree species -besides being hostplants to the MW- are also utilized extensively within the region for timber and firewood.

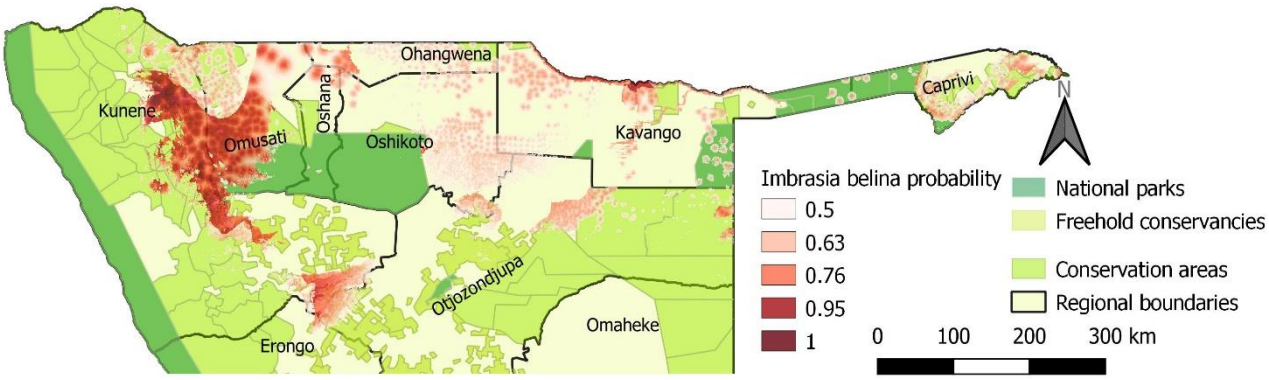


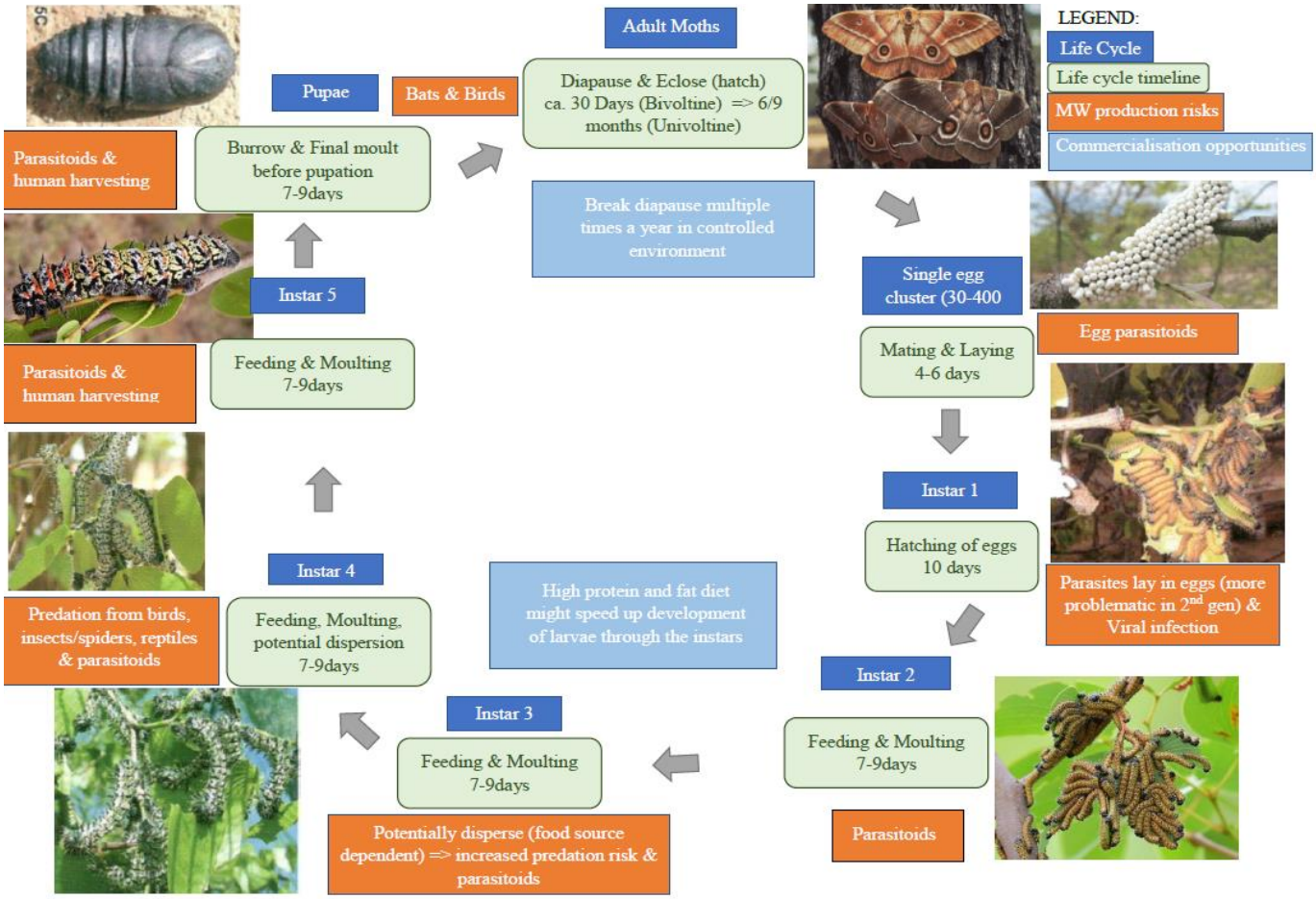
Figure 3: Modelled distribution of *Imbrasia belina* within Namibia -derived from museum (National museum – Windhoek) locational data points. The location of the species distribution is shown in relation to regional boundaries and conservation areas within northern Namibia.

Compared to studies that have occurred within the southern African region, the MW has been poorly studied in Namibia, where the generally drier conditions and different soils are likely to translate to a substantially different biology and relationship with its host plant and climatic factors. Considering the life cycle and potential for implementing a

sustainable harvesting system within Namibia (Fig 4), there are some critical knowledge gaps that need to be filled to efficiently manage the production and beneficiation.

Some issues that stand out include its reproductive pattern, its life cycle ecology in Namibia's drier and shallower soils and its relationship to leaf water potential. Within most of Southern Africa, the MW is bivoltine[11]: the adult moths emerge in December / January and again in February / March. However, most records for Namibia indicate that the moths only emerge from their pupae (i.e. ecloses) once a year in approximately February / March. The reasons for this, and the implications that one emergence per year holds for viability of production, are unclear. Additionally, while the biology and ecology of *C. mopane* is relatively well-known, its physiological tolerances to critical environmental factors such as temperature and soil moisture – the factors most likely to change under future projections – are not.

Figure 4: Life cycle of *Imbrasia belina* detailing the different life cycle stages, the approximate time lines associated with each of these stages, potential risk factors associated with the different stages, and possible interventions for commercialization of the process (Source: Adapted from Gardiner[20]).



[11] Meaning that it has 2 emergences from pupae per year

Inland Fish and Fisheries

Riverine communities are dependent on the flood cycle of the Kavango, Zambezi and Chobe Rivers and floodplains for their livelihoods. These freshwater ecosystems provide a wide array of goods and services, such as flow regulation, inland fisheries, edible aquatic plants, sediment transport, waste assimilation, regulating water quality and transport services, all of which stand to be impacted by climate change. However, the impacts of climate change are likely to vary temporally as well as spatially even within a river basin. This, compounded by the uncertainty of these impacts, complicates the current adaptation process by communities.

Some of the predicted impacts of climate change on Namibian rivers systems include: Lower flow rates; Higher evaporation that will mostly impact on small water bodies used by communities; Higher maximum and average temperatures; More intense floods; Higher floods will result in higher sediment transport as well as higher soil erosion; Delayed flood pulse and shorter floodplain inundation periods; and Lower groundwater levels.

The Inland Fisheries Policy (MFMR, White Paper, 1995) states that fish resources should be for the rural communities that have been dependent on them from time immemorial. Furthermore, the Inland Fisheries Resources Act (No1 of 2003) further stipulates how these resources should be harvested. Controls to date have been largely effort-based with restrictions to mesh size, net length, number of nets and how these nets can be used. The restrictions are such that only the large-sized fish species are targeted, especially the bream species, which are arguably the most important cultural, gastronomic and livelihood species.

Currently the value of Inland Fisheries in Namibia is valued at approximately N$ 109 million (Forsythe et al., 2018[12]) providing livelihoods to an estimated 100 000 people (4% of the Namibian population) (Simasiku, 2014[12b]), five times more than game and trophy hunting combined on communal land. This is spread across the three main perennial rivers of the north east, namely the Zambezi/Chobe, the Kwando and the Kavango rivers. Less

[12] Forsythe, K., Letley, G. and Turpie, J. 2018. Namibia TEEB study: The development of strategies to maintain and enhance the protection of ecosystem services in Namibia's state, communal and freehold lands. Vol I. A national assessment of Namibia's Ecosystem Services. Anchor Environmental and Namibia Nature Foundation Draft Report 104 pp.

[12b] Simasiku, E.K. 2014. Assessment of the Lake Liambezi fishery, Zambezi Region, Namibia. MSc thesis. Rhodes University, Grahamstown, South Africa.

is known about the impacts of fisheries in the seasonably flooded Cuvelai system of north central Namibia. Further descriptions of these systems are outline below.
Local fishermen have perceived/noted a decline in their catches. In response to this, several community members have approached the Namibia Nature Foundation (NNF) and the Ministry of Fisheries and Marine Resources (MFMR) to assist in regulating the fishing in their regions. The request is mainly to facilitate the establishment of Fisheries Reserves managed by the community, usually through a conservancy with the necessary infrastructure.

Upper Zambezi and Chobe Rivers Floodplains

The Zambezi River originates in the northwest of Zambia with some major tributaries originating in the Angolan highlands with high rainfall contributing to the annual run-off. The River forms the international border between Namibia and Zambia for approximately 120 km with major floodplain habitats on the Namibian side of the river and probably the most important inland fisheries in Namibia (Fig 6).

The floodplains, situated in Namibia, are usually inundated between February and May when the rainfall from the catchment areas reaches it. The floodplains connect the Zambezi with the Chobe River during this period forming a sea of water at some places 70 km wide. During high floods, water may reach Lake Liambezi, an ephemeral lake that floods periodically during exceptional high floods, creating a major bream fishery providing for the export of large quantities of bream to neighboring countries.

The flood cycle is the driving force of productivity in this system. Nutrients accumulated on the floodplains during the dry season are transferred to the aquatic ecosystem when flooded during the wet season. The flood itself is extremely variable both inter- and intra-annually (up to 8m difference recorded in Katima Mulilo, the region's capital). The Zambezi and Chobe Rivers are actually very low in nutrients and depend on the floodplains to increase the nutrient levels in these rivers.

The fisheries in this region are the most important inland fisheries in Namibia with an estimated value of N$ 32.5 million and N$ 33.5 million respectively for the Zambezi / Chobe floodplains and Lake Liambezi (when full) (Forsythe, 2018[12]). Initially, fisheries were mainly for subsistence with some surplus sold on the Katima Mulilo and Kasane fish markets. Flooding of Lake Liambezi resulted in an increase in fish prices which hasn't declined since the lake dried up, making the resource unaffordable for the poor living in the urban centers in this region.

Monofilament gillnets, that are more than three times as effective as multifilament gillnets (Simasiku, 2014), started to become the dominant gillnet type in this region and by 2012 multifilament gillnets nearly disappeared from the fishery (Tweddle et al., 2015[13]). According to these authors, this led to a 90% decline in the fish stocks (mainly bream species) in the Zambezi and Chobe Rivers. Since then, the Ministry of Fisheries and Marine Resources (MFMR) amended legislation, banning monofilament gillnets. The Ministry has now initiated an annual closed fishing season between the beginning of December and the end of February that corresponds with the closed season on the other side of the river in Zambia. Regardless of these initiatives, illegal fishing is still ongoing, rendering these steps ineffective. The conventional control through a government institution is very difficult in such a complex ecosystem with a maze of channels, backwaters and swamps.

Since 2009, communities have been approached to discuss the idea of setting up Fisheries Reserves managed by the communities -mainly through conservancy structures- to halt the decline and even increase the fish stock levels. Meanwhile, two Fisheries Reserves (Sikunga and Impalila Fisheries Reserves) have been gazetted and are managed by communities with some success. This idea has now been recognized by the communities as a tool to assist them in conserving this valuable resource for future generations.

Kavango River

The Kavango River (as it is known in Namibia) originates in the central highlands of Angola where it flows in a south, south-easterly direction towards Namibia forming the international border between Angola and Namibia from Katwitwi for approximately 400 km (Fig 7). It then turns south towards Botswana where the water evaporates and sinks into the Kalahari sand in the Okavango Delta. The catchment area is steep forming a channel-like river but flattens off when it reaches Namibia where large floodplains are present with some rocky outcrops scattered along the river. It forms the panhandle of the Okavango Delta before leaving Namibia with large floodplains and papyrus characteristic of the delta.

A major tributary, the Cuito River, joins the Kavango River approximately 110 km east of Rundu, nearly doubling the run-off of the Kavango River (Hay et al., 2000[14]). The Cuito

[13] Tweddle, D., Cowx, I., Peel, R and Weyl, O. 2015. Challenges in Fisheries Management in the Zambezi, one of the great rivers of Africa. Fisheries Management and Ecology, 22: 99-111.

[14] Hay, C., Naesje, T., Breistein, J., Hårsaker, K., Kolding, J., Sandlund, O. and van Zyl, B. 2000. Fish populations, gill net selectivity and artisanal fisheries in the Okavango River, Namibia. Recommendations for a sustainable fishery. NINA-NIKU Project Report 010: 1-105.

River forms large floodplains in Angola. The flood arrives along the Namibian section around December, reaching its peak in March / April. The primary source of water is also in the highlands of Angola. Thus, the flood cycle depends on the seasonal rainfall in Angola rather than local rainfall.

Very little is known about the fisheries along the Kavango River in Namibia. The only data on the fisheries originates from the early and mid-1990s. The estimated annual value of the fish harvested from the Namibian section of the Kavango River is N$ 12.9 million per year (Forsythe, 2018[12]) although figures to calculate this were derived from van der Waal (199115). Traditional fishing gear was still common in the 1990s, but this has probably changed since very little traditional fishing gear has recently been observed when moving along the river (pers. obs.).

The Mahangu Game Park is situated along the river bordering Botswana and has been closed to fishing since 1986. The Ministry of Fisheries and Marine Resources did surveys at selected areas on the Kavango River over a period of 26 years and their results show that this protected area yields more and bigger fish than the unprotected areas. However, whether this is true for all fish species with different life history cycles, still needs to be determined.

Kwando River

The Kwando River originates in the eastern parts of Angola. Large floodplains (Silowana plains) are present in the upper reaches in Angola delaying the flow of water towards Namibia (Fig 8). Water storage in these plains can delay the flood downstream by as much as one to two years. The flood usually is delayed in Namibia compared to the Kavango and Zambezi Rivers and peaks around May / June at Kongola. The flow rate is slow, and the river consists of numerous bends, large floodplains, oxbow lakes, isolated pools and swamps (Naesje et al., 2004[16]).

After entering Namibia, the river flows in a south-easterly direction, forming the international border between Namibia and Botswana. It turns into a north-east direction linking up with the Linyanti River that flows into Lake Liambezi during good rainy seasons.

[15] Van der Waal, B. 1991. A survey of the fisheries in Kavango, Namibia. Madoqua 17(2): 113-122.
[16] Næsje, T.F., Hay, C.J., Nickanor, N., Koekemoer, J.H., Strand, R., and Thorstad, E.B. 2004. Fish populations, gill net catches and gill net selectivity in the Kwando River, Namibia. - NINA Project Report 27. 64pp

The floodplains in Namibia support many wildlife with the Bwabwata National Park flanking the river on the southwestern side and the Nkasa Rupara National Park on the north-eastern side of the river. Both these national parks contribute to the large number of wildlife grazing the floodplains, playing an important role in the nutrient cycle of this ecosystem. The Kwando River is considered the most pristine river in the Zambezi Region with very little anthropogenic impact.

The smaller flood recycles fewer nutrients into the river, leading to lower nutrient productivity, this in turn will impact on fish growth rates. These fish populations are therefore more vulnerable to overfishing. This combined with a much smaller river can easily lead to declining fish stocks if fishing is not correctly managed (Jones, 2017[17]). Few people consider themselves full-time fishermen, but 70% do consume fish indicating the importance of fish for communities living near the Kwando River. A variety of fishing gear are used from dishes and grass kraals by women to gillnets with some having mesh sizes smaller than the legal limit (Jones, 2017[17]). Others are using mosquito nets, although illegal, and others hook and line. Most of the people agree that there has been a decline in fish stocks and that something must be done. Limited fisheries data is available for the Kwando River despite the fishing taking place and the importance for communities' livelihoods.

Cuvelai System

The Cuvelai System is wedged between the Kunene River that flows westwards to the Atlantic Ocean and the Okavango River that flows eastwards to the Okavango Delta in Botswana. It is likely that only the central parts in the upper reaches of the Cuvelai system may have permanent water bodies. The parts further south are only flooded periodically during the rainy season when the shallow, broad channels -locally known as iishanas- flood. They keep water for two to four months depending whether it is local rain or water coming from the upper reaches of the system during high rainfalls (Hipondoka et al., 2018[18]).

The Cuvelai cannot be classified as a river or as a delta. It is mainly dry with no water in its shallow depressions. It consists of many small channels -instead of a single channel- that crisscross throughout the basin. The flood waters in the iishanas are extremely muddy

[17] Jones, B. 2017. Report on the Frame survey on Fisheries along the Kwando River, Zambezi Region, Namibia. Namibia Nature Foundation, Windhoek. 104 pp.

[18] Hipondoka, M., van der Waal, B., Ndeutapo, M. and Hango, L. 2018. Sources of fish in the ephemeral western iishana region of the Cuvelai-Etosha Basin in Angola and Namibia. African Journal of Aquatic Sciences. 43:3, 199-214. DOI: 10.2989/16085914.2018.1506310.

depositing the silt once the water flow slows down. The iishanas have too much clay for crops and thus cropping takes place on the slightly higher ground between the iishanas (Mendelsohn et al. 2013).

Fifty percent of the Namibian population lives in the Cuvelai basin making it the most densely populated area in Namibia. The population in the entire basin consists mainly of one ethnic group the Owambo people with 70% living in Namibia and 30% in Angola. Traditionally, households had small crop fields and vegetables with chickens, goats, donkeys and some cattle roaming the fields. The livelihoods were supplemented by wild fruits, fish, frogs and other wildlife. Households, particularly those living in remote areas, are still dependent on natural resources, especially those that are headed by women (Mendelsohn et al., 2013). During major floods, fish will move down with the floodwaters from Angola where people will catch these using nets at culverts. During this time, Bullfrogs are also an important protein source for the rural people. Mendelsohn et al. (2013) list 15 frog species in Etosha and the Cuvelai basin none of which are endemic. The Bullfrog seems to be the most abundant.

The Cuvelai System is impoverished when it comes to fish species compared to the Kunene and Kavango Rivers, most probably due to the ephemeral nature of the Cuvelai System and the harsh conditions such as poor water quality, high evaporation rates and high-water temperatures in smaller water bodies. Only the most opportunistic fish species will survive in the iishanas once they flood. Very little is known about the fisheries in Cuvelai, except that it is periodic depending on the size of the flood and lasts only for a couple of months. The regionally favored catfish is one of the large fish species frequently caught in the iishanas. These catches are supplemented by some dried catfish imported from the Zambezi Region where this species is not as highly valued as the bream species. In the Cuvelai area, horse mackerel from the coast is also imported in large quantities to supplement fish protein. This underlines the importance of fish in the regional diet, but also points to the relative lack of knowledge around the harvesting and management of fish within the region.

1.3.4. Community Based Natural Resource Management (CBNRM) in Namibia

The key entry vehicle for the project will be the Namibian community-based natural resource management (CBNRM) program. The program, which has been running since 1996, focuses on the devolution of rights to communities to manage their natural resources. It is underpinned by three main legislative and resource areas namely wildlife, forest resources and more recently fisheries.

Today, the program reaches some 192,000 rural Namibians (8% of the national population) and benefits have been steadily increasing year on year. The recorded benefits are worth over N$132,000,000 (NACSO, 2018[19]) but remain overly reliant on wildlife, both for non-consumptive and consumptive (hunting) wildlife-based tourism, which make up between 70% and 90% of income and benefits.

Whilst the CBNRM program has been successful, it must be recognized that there has been a lesser focus on forest resources and a smaller focus on fisheries (described above). The forest resource focus has been largely dominated by commercial opportunities (timber) and exportable non-timber forest products. Therefore, greater attention to this component can contribute significantly to the program and help the rural constituents involved to improve their resilience and adaptive capacity.

The community-based organizations and structures developed -namely Conservancies (wildlife), Community Forests and Community Fish Reserves- and their supporting entities -mainly government, civil society and research organizations- offer ideal structures for engagement and to improve the long-term sustainability of any interventions.

2. Project Objectives

The **overall objective** of the project is to increase socio-ecological resilience through enhanced ecosystem-based adaptation to have well managed, healthy freshwater and dryland ecosystems that support livelihoods and wellbeing of people in the Northern regions of Namibia along the rainfall gradient extending from Kunene, through Omusati, Oshana, Ohangwena, Oshikoto, Kavango West and East up to the Zambezi Region.

Specific Objectives

- *Objective 1:* To increase **ecosystems-based food security** through the diversification (i.e. beyond a primarily livestock-based food resource) and improved utilization of existing but underutilized protein resources and other nutrients;
- *Objective 2:* To improve the current management practices of freshwater and dryland ecosystems in northern Namibia and secure the food and nutrient (e.g. proteins) resources produced by these ecosystems. This management will be adaptive and flexible in nature to accommodate future climate change projections,

[19] MET/NACSO, 2018 The State of Community Conservation in Namibia, a review of communal conservancies, community forests and other CBNRM activities (Annual Report,2017). MET/NACSO Windhoek

that are expected to occur in northern Namibia. The primary objective of this **adaptive management** approach is to develop methods to produce intact, resilient ecosystems which can provide ongoing ecosystem services, such as the provision of food (protein) resources to communities reliant on these services.

The project will focus on two key ecosystems-based protein sources that have contrasting gradients of importance and/or potential across northern Namibia: insects from west to east and fish from east to west.

The project considers several aspects concerning the adaptive management of the identified protein resources (mainly fish and insects) that are related to adaptation in light of predicted climate change impacts. The first is the development and implementation of a monitoring system to ensure the timely adjustment of the management approaches to safeguard the protein resources against overexploitation. The second is the empowerment of the communities to manage their own resources for the benefit of the local communities. Thirdly, the project will adopt a socio-economic approach to ensure that the livelihoods of the relevant communities improve through a sustained fishery and edible insect population while protecting the ecosystem services on which these communities depend.

For these aspects the importance of traditional knowledge cannot be underestimated. Communities have practiced adaptive management approaches in the past due to the natural variability of these dryland and river ecosystems. However, it is predicted that in the long-term, the productivity of these systems will be reduced considerably due to prolonged droughts, In the short-term, severe events will increase in frequency. These are expected to occur at such an intensity that natural resource-dependent communities may have difficulty adapting to these circumstances. Lessons learnt from this project will be scaled up into the National Community-Based Natural Resources Programme and also disseminated and training workshops will be held throughout the region to ensure that capacity is built to enable communities to deal with these changes. Awareness campaigns will be run on a community, national and regional basis. The component parts that will be implemented are outlined below and further explained and justified in Section II.

3. Project Components and Financing

Project Components	Expected Concrete Outputs	Expected Outcomes	Amount (US$)
Objective 1: Ecosystems-based Food Security			
For All Components	1.0. Socio-economic baseline (including an environmental and social impact assessment) and comparable end-of project assessment of target communities with a focus on consumption of proteins and other nutrients.	Climate proof sustainable utilization of indigenous protein and nutrient resources. Improved household hunger index through the sustainable utilization (restore, secure, optimize) of currently underutilized indigenous protein and other nutrient resources. Empowered vulnerable groups especially women and youth who benefit from additional protein and other nutrients.	230 000
1.1. Dryland Ecosystems: Insect Production Systems	1.1.1. Description of the resources, their drivers and the resources' production potential in the face of climate change.	Strategy for production development and improved project implementation strategies.	790 000
	1.1.2. Piloted production systems at household and commercial level.	Lessons learnt for upscaling.	
	1.1.3. Commercial and household production systems for protein sources are implemented.	Increased number of households or entrepreneurs produce or consume MW.	
1.2. Dryland Ecosystems: NTFPs	1.2.1. Consolidated and evaluated traditional and science-based knowledge around Non-Timber Forest Products (NTFPs) and other dryland products and their processing and documented current value chains for selected products and intervention opportunities.	Recommendations on the feasibility of dryland resources for development. Strategy for product development and improved project implementation strategies.	670 000
	1.2.2. Piloted product development according to the strategy.	Lessons learnt for upscaling; upscaling strategy in place.	
	1.2.3. Processed NTFPs and other dryland products produced and consumed or marketed.	Increase number of households or entrepreneurs produce or consume NTFPs.	

		Improved resource base with increased and diversified protein sources.	
1.3. Freshwater Ecosystems	1.3.1. Analysis of factors that limit the more efficient utilization of resources (legislation, access to finances, preferences, markets, etc.); Evaluation of the feasibility of other wetland resources for development.	Recommendations for interventions to unlock their potential. Improved project implementation strategies.	980 000
	1.3.2. Piloted improved utilization according to recommendations.	Lessons learnt for upscaling; upscaling strategy in place.	
	1.3.3. Rollout of improved other wetland product utilization.	Increase number of households or entrepreneurs producing or consuming other wetland products.	
	1.3.4. Established fisheries reserves managed by local communities.	Empowered communities that are able to exercise rights over resources.	
	1.3.5. Amendment of current legislation for the sustainable utilization of fish resources.	Improved availability of preferred fish and wetland species for consumption and income generation.	
Objective 2: Adaptive Management			
2.1. Investigations and Action Research	2.1.1. Scenarios description of various protein sources and their likely trajectories under climate change conditions. Medium- to long-term management of protein sources in light of these future scenarios.	More climate resilient high potential alternative protein sources. Enhanced ecosystem services through adaptive management create stable ecosystems that deliver provisioning, regulating and supporting services.	430 000
	2.1.2. Market analysis (requirements, entry points, demands, etc.) for relevant selected products (both dryland and wetland).	Strategy for market development.	
2.2. Capacity-Building (Training and Education)	2.2.1. Training courses and workshops focused on **target communities** on business skills, production mechanism, management of resources and climate change.	Communities capable of improving their livelihoods in the face of climate change. Increased capacity of young Namibian professionals in the field of ecosystem-based adaptation.	450 000

		Innovators, future leaders and managers capable of making climate-smart decisions	
	2.2.2. Training courses and workshops to relevant **implementation stakeholders and regulators** on climate change, policy development and identified management and resource scenarios.	Informed implementing authorities capable of enacting change to policies to ensure improved livelihoods of target communities.	
	2.2.3. Integrated media and awareness campaign as a component of training, education and project documentation.	Strong community voices able to articulate their needs, progress and encourage others, coupled with a well-integrated media output.	
2.3. Policy Advice	2.3.1. Lessons learnt from pilot sites and desktop studies to provide science-based advice for legislation and policy adaptation	Removed current barriers resulting in current underutilization of indigenous protein and other nutrients	200 000
2.4. Monitoring, Evaluation and Learning	2.4.1. Development of adaptive ecosystem-based monitoring protocols and indicators to monitor ecosystem functionality and services, associated with the fishing, insect and NTFP products captured in the project, in the face of climate change.	Implementation of an ecosystem-based monitoring system indicating climate resilience. Functional adaptive management of Insect Production Systems, NTFPs, FW fisheries and other wetland species in place.	450 000
	2.4.2. Tracked consumption, income patterns and happiness of local communities against the socio-economic baseline.	Improved livelihoods and wellbeing of target communities.	
	2.4.3. Data to measure project progress based on process and output indicators.	Successful project implementation.	
	2.4.4. Consolidation of lessons learnt from the project implementation (guidelines, recommendations, toolbox, policy briefs).	Recommendations for later phases or future interventions.	
Project Activities Cost (A)			4 140 000
Project Execution Cost (B)			434 000
Total Project Cost (A + B)			**4 574 000**
Project Management Fee (C)			424 000
Amount of Financing Requested			**4 998 000**

4. Projected Calendar

Project Duration: 4 Years

Milestones	Expected Dates
Start of Project Implementation	01 October 2020
Mid-term Review (if planned)	28 February 2023
Project Implementation Completion	30 September 2024
Project Closing	31 January 2025
Terminal Evaluation	31 January 2025

PART II: PROJECT JUSTIFICATION

A. Project Description

For each of the components summarized in Table 2 below, a more detailed description is provided thereafter including the work packages making up each component. Within the work-package descriptions we provide further justification for these work packages followed by a table describing the specific adaptation activities and investigations that will be undertaken. Each work package is then completed with a description of the outputs expected from each work package and how these will lead to expected adaptive changes to the ecosystem services, communities and policies. All the listed project outcomes associated with each component are tabulated in Part 1: Project Components.

Table 2: Summary of project objectives, components and activities.

Objectives	Components	Activities
Objective 1: Ecosystem-Based Food Security	Component 1.1: Insects	1.1.1. Investigate edible insect resources and generate an inventory on utilized resources within the study region.
		1.1.2. Implement pilot MW production system following the guidelines outlined by Gardiner (2008[20]).
		1.1.3. Based on the identified edible insect resources, model the distribution of both the resources and their associated food resources to determine which may be most promising in the face of projected climate change scenarios

	Component 1.2: NFTPs and Dryland Products	1.2.1. Investigate NTFP resources utilized within the study region and generate an inventory supported by traditional and scientific knowledge of these resources.
		1.2.2. Based on the above output, develop a value chain and feasibility strategy for economic development for different NTFPs. This will also include an investigation into the possible marketing chains for the NTFPs.
		1.2.3. Selection for implementation of at least 1 of the derived value chains produced above for a pilot trial in a selected community.
		1.2.4. Evaluation of the value chains (suggested and piloted) to determine if additional legislative frameworks need to be created to facilitate and manage NTFP delivery.
	Component 1.3: Freshwater Ecosystems	1.3.1. Assess the impacts of using small mesh gillnets and mosquito nets for harvesting small-sized fish.
		1.3.2. Assess the subsistence fisheries, the Katima Mulilo, Rundu and Oshakati fish/informal markets and the export of fish via Wenela border post.
		1.3.3. Establish of Fisheries Reserves and facilitate the management of these.
		1.3.4. Investigate other wetland products.
		1.3.5. Consider the amendment of the current inland fisheries legislation or the development of bylaws for specified communities without generalizing legislation.
		1.3.6. Remove ghost fishing nets.
		1.3.7. Reduce post-harvest waste and losses.
Objective 2: Adaptive Management	Component 2.1: Filling Knowledge Gaps	2.1.1. Fill existing basic knowledge gaps on the nature of critical ecological features of the ecosystem-based alternative protein sources, the climate and other factors that affect them and their functionality through focused investigations.
		2.1.2. Modell and assess scenarios for the development of underutilized protein sources (develop inventories of fish species, aquatic plants, NTFPs and other aquatic fauna that are resilient to climate change variability) and other nutrients (and their potential to supplement the current diet and as a source of income) under various trajectories of climate change.
		2.1.3. Conduct a market analysis (including requirements, entry points, demands, etc.) for relevant selected dryland and wetland products as a potential cash income with the aim of improving the chances of diversifying and expanding the

		number of income streams -especially for poor and vulnerable groups in the communities.
	Component 2.2: Capacity Building (Training and Education)	2.2.1. Develop training courses aimed specifically at households and communities and based on simple low-tech solutions to utilize, manage, process and market their resources (both the wetland and dryland resources).
		2.2.2. Develop training courses and workshops that target government and NGOs to highlight lessons learnt about the impacts of policy and legislative barriers, as well as environmental and social constraints that either facilitate or prevent the implementation of the derived value chains created during the project timeframe.
		2.2.3. Enhance tertiary institutions' input to different elements of this project by involving them in research projects to obtain knowledge on the ecosystems, the resources and the social impacts on these.
	Component 2.3: Policy and Legislation	2.3.1. Inform policy and legislation-relevant decision-makers based on science and on lessons learnt.
		2.3.2. Strengthen or amend legislation and policy to ensure that resources are exploited sustainably and directly benefit vulnerable groups within the target region.
	Component 2.4: Monitoring	2.4.1. Develop ecosystem-based monitoring protocols.
		2.4.2. Track consumption, income patterns and indicators of wellbeing of local communities. Collect data to measure project progress based on process and output indicators.
		2.4.3. Consolidate lessons learnt from the project implementation (guidelines, recommendations, policy briefs).

Objective 1: Ecosystem-Based Food Security

Communities in the north and north-east of the country are dependent on natural resources, all of which need a well-functioning ecosystem. Livestock and agriculture are sectors that have traditionally provided most of the food supply to these communities. Recent droughts (currently one of the worst droughts ever encountered) drastically reduced the production of animal and plant proteins. Livestock is indirectly affected through the availability of feed sources that are affected by low primary production of grazing and rangelands. Heat waves further stress animals and lower production. Low rainfall further causes soil and grassland degradation. It becomes more difficult to sustain communities on these communal lands. Unfortunately, the rural poor are very vulnerable to the effects of climate change and are not always able to sustain their livelihoods due to their dependence on natural resources.

These regions are dominated by dryland (woodland and savannah) and freshwater ecosystems which are home to several underutilized sources of protein and other nutrients, that will become vital for the survival of the communities considering the erratic weather patterns predicted for the future. These resources can potentially be unlocked and utilized for the benefit of local people for both consumption and income generation. This requires the establishment of an overarching Socio-Economic and Ecosystems' Baseline (SEEB) and an end-of-project assessment to understand sources of income and food resource reliance within the target population and the changes (expected and actual) over time. This includes the relevance of regionally available non-meat protein and other nutrient sources and their evaluation as protein sources options. It also includes the evaluation of the dryland and freshwater/riverine ecosystems in which the protein resources occur. The resilience and variability of these ecosystems must be considered in the development of sustainably adaptive resource management systems. In addition, the baseline study will assess potential positive and negative social and environmental impacts of the proposed project activities.

Dryland Ecosystems (Woodlands and Savannas)

These systems produce non-timber forest products (NTFPs) and other dryland products not typically classified as NTFPs, that can be highly relevant as climate resilient alternative protein resources. Sources of protein and other nutrients from these ecosystems include, but are not limited to:

Component 1.1: Insects

Insects are traditionally utilized as alternative protein resources. Based on work that has been done on the importance of Mopane Worms (MW) in the SADC region, testing and developing the insect protein resources in the Namibia will be done. This can be expanded to include other insects based on the SEEB findings. The findings of Jongema (2015[Error! Bookmark not defined.]) in combination with community stakeholder meetings will be used to determine which alternative protein resources are being utilized in the study region. From the onset a pilot project will be established within selected communities for the sustainable farming of MWs. The approach that will be implemented is provided below:

Commercialising Imbrasia belina

In his work, Gardiner (2008[20]) provides a comprehensive overview on how to develop sustainable small-scale MW harvesting systems. This framework and these guidelines will form the basis for the development of local household farming systems to be implemented within this project. The guidelines provide low tech and affordable options for all stages in the development of a farming system, which can be applied within selected communities in Namibia. While the guidelines provided are designed for small scale implementation, there are many opportunities within this system to enable upscaling into more complex systems should the smaller communal systems continue to grow. The guidelines have formed the foundation for numerous MW farming initiatives in Zimbabwe and Botswana and have been refined in some instances to upscale and develop communal processing plants to achieve a more sustained market and delivery system of MWs over the entire year as opposed to only during the MW season. Such an upscaling will ensure the resource would become available over a longer period and can improve income generation in vulnerable communities throughout the year.

The adaptation of these guidelines will be necessary to account for the observed differences in the life cycle seen in Namibia vs the other countries within the region. Through the first pilot project implementations these guidelines will be refined to suit the Namibian MW life cycle and communities.

Table 3: Activities under in Objective 1: Ecosystems-based Food Security

Component 1: Insects

Activities	Description
1.1.1. Investigate edible insect resources and generate an inventory on utilized resources within the study region	Working together with stakeholder communities a list of edible insects used in the region will be generated. In conjunction with this indigenous knowledge on these insects and their life cycles and production systems will be derived. This study will be further supplemented with desktop studies to determine current state of knowledge on these resources
1.1.2. Implement pilot MW production system following the guidelines outlined by Gardiner (2008[20]).	Working together with at least two selected communities in the region, training will be provided to identified households (targeting identified vulnerable households) and a community small scale farming system for MWs will be developed in these two communities. Within the community's variations in the implementation will be trialed to determine which system is most effective in their area.

[20] Gardiner, A. 2008. Mopane Worm Farming: a guide. Department of International Relations, Zimbabwe

1.1.3.	Based on the identified edible insect resources, we will model the distribution of both the resources and their associated food resources to determine which may be most promising in the face of projected climate change scenarios	Input from the stakeholder engagement in combination with the desktop study will be used to identify the most promising potential edible insect resources. Through species distribution modelling, forecasts will be made to determine projected distributions of these resources and identify other potential suitable alternative resources for targeted commercialization activities. For example, initial discussions with stakeholders have suggested that *Gynanisa maja* may be a more resilient and reliable food source in Namibia compared to the MW.

Output 1.1.1. in collaboration with communities in the region we will provide a comprehensive list of alternative protein resources utilized within the study region. This list will be supplemented by what is known about these resources from indigenous knowledge and supported by any available scientific studies. This information will be used to develop species distribution models and forecast models of both the protein resources and their associated food resources. Based on this information a publication (both scientific and a handbook) will be produced to highlight utilized available resources that are available in the region and could form the foundation for future sustainable climate adaptation food resources. Inventory products will feed into Outputs 2.1.1.

Outputs 1.1.2 and 1.1.3 will result in the implementation and refining of the sustainable harvesting and production methods for MW farming in northern Namibia. Through collaborative work in the identified households with two communities the MW production systems will have been piloted. In collaboration with the communities, additional means to upscale the systems to deliver a reliable and economically sustainable production system will be developed. This outcome will feed into outputs 2.1.2 (market analysis), 2.2.2 and 2.2.3 for training and capacity development.

Component 1.2: NTFPs and other Dryland Products

Are known and used traditionally, but in many cases are underrated when it comes to their nutritional value. Some NTFP examples include runner beans and cowpeas (by-product of Conservation Agriculture), wild orange (*Strychnos* spec), *Schinziophyton rautanenii* (Mangetti), *Berchemia discolor* (Bird plum or Embe), wild spinach (various species), *Sclerocarya birrea* (Marula), pumpkin (leaves and fruits), mushrooms, honey and other bee products.

All the proposed protein sources and other nutrients are being or have been utilized but are currently sub-optimally utilized. Mopane worms -as already discussed- are a delicacy in some regions, even beyond Namibia, and there is an unregulated market in place. There have been no attempts to domesticate or commercialize MW in Namibia, but it has been utilized through field collection. The MWs and many of the other edible insects that have been identified all rely on functioning ecosystems. In the northern region of Namibia, this generally applies to the open dry woodlands and riverine ecosystems. The dominant species composition across the NW-NE transect within this dry woodland system varies, but across the entire region there are multiple species which produce other potential products besides timber or food resources for insects. All listed species and NTFPs mentioned above are available and locally utilized. Most of these products are available in abundance, do not require major infrastructure investment or technology and knowledge transfer can be used for upscaled utilization. Here, value-chain development can largely build on local knowledge in conjunction with assistance from stakeholders, that can provide insight into the economics of sustainable and adaptable value chains. Bringing the production home will result in numerous benefits including: Food for local communities especially OVCs; conservation of all these protein and other nutrients as a local food specialty; it allows vulnerable groups to be close to their homesteads instead of collecting in the field and provide an additional means to generate income.

Table 4: Activities under Objective 1: Ecosystems-Based Food Security

Component 2: NTFPs and Dryland Products

Activities	Description
1.2.1. Investigate NTFP resources utilized within the study region and generate an inventory supported by traditional and scientific knowledge of these resources	In community stakeholder meetings across the region an inventory will be developed to determine what are the different NTFP resources utilized. The traditional usage, knowledge about the availability of the resources (spatial and temporal) will be ascertained. This information will be supplemented with science-based knowledge to develop a current state of knowledge on the different NTFP resources available. Although all resources will be considered the focus will be on resources utilized as food resources (broadly – not only protein resources).
1.2.2. Based on the above output a value chain and feasibility strategy for economic development will be developed for different NTFPs. This will	Together with stakeholders (NGO's) working with communities in the region and industrial engineers/product specialists from NUST potential value chains for selected NTFPs will be developed. Value chains will not be developed for all products identified in the previous study. Selection of products will be

also include an investigation into the possible marketing chains for the NTFPs.	based on potential climate adaptability of the resource, spatial extent (can it potentially be implemented across a wide area within the region), ease of production (and diversification) and acceptance for utilization by communities, and finally will the utilization of this NTFP aid in maintaining environmental resilience of the dry woodland ecosystems.
1.2.3. Selection for implementation of at least 1 of the derived value chains produced above for a pilot trial in a selected community.	In collaboration with a selected community (identified through stakeholder engagement meetings) a first selection from the value chains derived in the previous study will be made. From this selection an implementable marketing plan will be developed followed by a pilot implementation of this value chain as a small-scale project. An example of such a pilot project could be the development of a low-tech roadside nursery which could be used to produce and sell seedlings of indigenous trees (selected for their ability to produce food resources either directly for human consumption or as a food resource for insects) or the production of vegetables for resale (e.g. wild spinach).
1.2.4. Evaluation of the value chains (suggested and piloted) to determine if additional legislative frameworks need to be created to facilitate and manage NTFP delivery.	Together with the communities and the stakeholders engaged in community work the value chains will be assessed to determine if the current legislation enables the delivery of a marketable and sustainable NTFP production line. It is important in this assessment that consideration is given to ensure that OVCs and the communities will be able to benefit from the utilization of these products, thus ensuring that such communities can generate revenue from these products.

Output 1.2.1. Like output 1.1.1, this component will include a comprehensive list of the NTFPs utilized across the region. This list will be supported by both the indigenous and science-based knowledge available on these different products. This knowledge will aim to capture not only physical and biological information about the resource, but also how it is utilized and processed. The information will be compiled into several publications (scientific and NTFP field guide). It will also provide the basis for ongoing research and explore which resources require further research to evaluate their potential as a future sustainable food resource. Inventory products will also feed into Outputs 2.1 In addition, documented development of full value chains will be conducted for selected NTFPs. These assessed value chains will include possible means of interventions and alternatives to expand their usage or elements that need to be considered for these resources to be used as an adaptation mechanism. The outcome of these value chains will be integrated into the market analysis of output of 2.1.2.

Output 1.2.2 and 1.2.3. Based on the findings from Output 1.2.1, a piloted NTFP value chain will be implemented in a selected community. The implementation and refinement of the strategy will be done in close collaboration with the respective implementing community/household and the team working on community engagement. This collaboration will result in a showcase example and development of production guidelines for the selected NTFP.

All the outputs for this component of the project will be integrated into the material that will be prepared and delivered in component 2.2 of this project.

Component 1.3: Freshwater Ecosystem

Most of the protein from freshwater ecosystems comes from fish, but currently the commercially favored species are overexploited, disregarding the fish species in the river systems that are not preferred for consumption or trade. This results in an unbalanced utilization pattern negatively impacting the fish species composition, which can lead to a downward spiral of the linked value-chain and nutritional patterns of the local people. Traditional usage of freshwater fish is an integral element of the society and culture and should not be compromised but rather recovered and effectively managed. On the other hand, several wetland resources are underutilized either due to legislation, by choice, or due to stigma.

The currently highly valued bream species (an important income and protein source for local communities) are under pressure due to intense fishing. At the same time, the life cycle of these bream species makes them extremely vulnerable to the predicted climate change impacts. The decline in the valued bream species can further be attributed to the influx of fishermen from outside Namibian borders, especially after the flooding of Lake Liambezi when a huge supply of bream became available. Fisheries in the region turned into a commercial undertaking overnight. This contradicts the Inland Fisheries Policy of Namibia, which states that the fish resource should be for the subsistence of rural communities as fish stocks are unlikely to withstand a commercial enterprise. However, a large portion of the fish stocks is not fully utilized mainly due to a low commercial value, preference and limitations put in place by the current legislation. Untapping these underutilized fish resources will benefit the local communities, especially women and youth that traditionally targeted these species. Adaptive management will ensure the optimal utilization of the fish resources and will provide access to previously inaccessible fish resources by vulnerable groups further enhancing their livelihoods. This, however, will require a

mind shift by all stakeholders including government to enable communities to utilize the previously disregarded fish species. Of interest is that these species traditionally played and still play an important role for the women and youth. Women will sometimes socially fish using mosquito nets or other traditional fishing gear targeting small-sized fish species.

Activities will focus on current fishing patterns and management approaches in place in the targeted areas. Fish are an available protein source even during droughts and are a quick cash converter compared to agriculture or even livestock. Unfortunately, these traits also draw people from outside the region to exploit this resource. As a result, benefits leave the region resulting in desolate local communities -especially women and youth- who are entirely dependent on the natural resources. Climate change is likely to exacerbate these circumstances.

Furthermore, erosion of the influence of traditional authorities leaves many communities vulnerable to the exploitation of these natural resources by immigrants. Emphasis will be placed on restoring the authority that communities can exert on the natural resources within their areas. Communities need to take full responsibility, but this can only be done through official channels that will provide them with the means to do so. One such tool is the establishment of Fisheries Reserves that are officially gazetted and allow exclusive management by the community with the support of government. However, the approach followed to establish these reserves must be done following a bottom-up approach, be gender-sensitive and should also be inclusive of the youth. This will embrace the ownership mentality necessary to successfully implement such a community-based endeavor.

A mindset shift is necessary for the communities that have been focusing on the utilization of the larger fish species such as the highly valued bream. These species are long-lived species with a parental care life history and a relatively slow turnover. These traits make them suitable for a more stable environment and much more prone to overfishing. On the other hand, most of the fish species in the Zambezi and Kavango Rivers are short-lived species with a large number of eggs and no parental care life history. These species with their r-selected life history have the ability to deal with a more unpredictable ecosystem predicted under climate change scenarios. This group of species is also likely to withstand the pressure of fishing much better than the bream species. For communities to be able to have access to fish protein, changing to the less preferred smaller sized species will become necessary. However, one particular

aspect of concern is that fishing needs to be selective to avoid the bycatch of immature bream species by using small mesh gillnets -used for small-sized fish species- in open water habitats.

Floodplains are the production engines of these rivers. During the flood season, nutrients are transferred from the terrestrial ecosystem to the aquatic ecosystem. These floodplains are critical for fish production and for breeding and nursery areas. During the receding phase of the flood, juvenile fish move from the protection of the floodplain vegetation back into the mainstream resulting in huge natural mortalities. Fish moving back from the floodplains to the main river are a mixture of long-lived and short-lived species. None of these fish are currently targeted by the subsistence fishery due to fishing gear restrictions in the Inland Fisheries Resources Act that forbids dragnets. Traditionally women used to harvest these small fish leaving the floodplains, which used to be an important protein source for the household. Unless traditional fishing gear are used, this is now prohibited. Studies will be conducted in a controlled environment, where the community is managing the fishery, to determine the impact small dragnets may have on this particular resource.

Fish production in floodplain rivers is closely interconnected with the annual flood cycle and any change of the hydrology of the river flow will influence the fish stocks. This is one of the key predicted climate change impacts for this region and could be a delay in the flood pulse, the magnitude or duration of the flood pulse. Other factors include water temperature increases which stress aquatic organisms as well as high evaporation rates with a subsequent rise in salinities. Any of these changes may facilitate the survival of alien aquatic animals or plants endangering the native fauna and flora. *Oreochromis niloticus* (alien Nile Tilapia), *Cherax quadricarinatus* (Australian Redclaw Crayfish) and *Salvinia molesta* (giant Salvinia or Kariba weed) are examples of alien aquatic animals and plants that are already in the Upper Zambezi River System. These species have the potential to endanger the survival of several native species, ultimately affecting the livelihoods of the communities. Alien species also have the potential to introduce diseases foreign to these rivers, for example the recently identified EUS (Epizootic ulcerative syndrome). The EUS is caused by an oomycete fungi originating from fish most probably imported for aquaculture or aquarium trade from outside the continent. This is one of the most serious diseases for finfish species. The fishery was closed once in the Zambezi Region due to an EUS outbreak. Such an outbreak threatens food security for the subsistence fishery. *Oreochromis niloticus* (a very aggressive invader) is known to interbreed with

Oreochromis andersonii, the most sought-after fish species in the Upper Zambezi River System. Genetically, this will eliminate *O. andersonii* from this system, replacing it with a hybrid that will have an unknown impact on the subsistence fishery.

Table 5: Activities under Objective 1: Ecosystems-Based Food Security

Component 3: Freshwater Ecosystems

Activities	Description
1.3.1. Impacts of using small mesh gillnets and mosquito nets for harvesting small-sized fish	Selected communities will be approached to assist in data collection where fishermen use small size gillnets in open water habitats and mosquito nets on floodplains within their area of control.
1.3.2. Assessment of the subsistence fisheries, the Katima Mulilo, Rundu and Oshakati fish/informal markets and the export of fish via Wenela border post	Selected areas will be identified where the catches from the local fishermen will be monitored. Local fishermen will be trained in data collection who will then visit landing sites to record catches. Monitoring of the fish/informal markets will provide information on the turnover and value chain. Fish leaving Namibia via Wenela border post will also be recorded.
1.3.3. Establishment of Fisheries Reserves and facilitate the management of these	Consultative meetings will be held with communities and stakeholders to establish a network of Fisheries Reserves throughout the study area managed by local communities.
1.3.4. Investigate other wetland products	An inventory of potential wetland products will be established after which selected organisms will be studied to determine their potential as alternative protein sources for the communities.
1.3.5. Consider the amendment of the current inland fisheries legislation or the development of bylaws for specified communities without generalizing legislation	The amendment of the current inland fisheries legislation will be considered to allow for the harvesting of alternative wetland resources as supplement protein sources. Alternatively, bylaws that will be specific to certain communities or habitats may also be considered
1.3.6. Removal of ghost fishing nets	Awareness programs and patrols will be initiated to eliminate ghost nets from the river systems
1.3.7. Post-harvest waste and losses	Assessing post-harvest losses and developing simple techniques to reduce these losses along the value chain

Output 1.3.1., 1.3.2. and 1.3.5. will provide information on the impact of small mesh-sized gillnets used in open water habitats on the high valued bream species. In addition, it will look at the impact of the use of mosquito nets on the floodplain

fish populations and assess whether legislation needs to be amended or bylaws developed to allow for the use of currently illegal fishing gear and methods. Some of these fishing methods are strictly gender-based with women tending to fish with mosquito nets or traditional fish traps or baskets targeting the smaller fish on the floodplains. The use of these fishing gear will probably be restricted to areas under control of local communities who show the ability to effectively manage the fishery in their particular area.

Output 1.3.3. will focus on aquatic species other than fish to provide the community with alternative protein sources. An inventory of wetland products will initially be acquired. Thereafter, the potential of each product as alternative protein source will be studied. Awareness programs will be organized to introduce the potential of these products as a protein source or to generate alternative income streams. Inventory products will also be included in Output 2.1.1.

Output 1.3.4. will focus on establishing a network of Fisheries Reserves across the study area under the management of local communities, preferably conservancies with the necessary infrastructure to enable them to manage these reserves. Gender will be considered during the process of establishing and managing Fisheries Reserves. Exchange visits will be organized between those communities that are already managing their Fisheries Reserves and those that are in the process of establishing reserves. The transfer of knowledge from lessons learnt from experienced communities will contribute to the sustainability of the process, an aspect that is most often neglected in such projects. This can encourage social capital between communities as all have the same goal in adapting to an uncertain future for the benefit of future generations.

Objective 2: Adaptive Management

Adaptive management is a standard and well-established management framework to address climate or other environmental uncertainties. It requires an understanding of the components and functioning of the ecosystem being managed, the development of specific environmental production or related objectives, continuous monitoring, evaluation of changes in indicators and decisions about the continuing appropriateness of existing management policies. The adaptive capacity of communities depends on several social factors that influence their ability to respond to environmental change and include aspects such as the level of infrastructure development, financial capacity, governmental support, capacity of traditional authorities to cope with change and their influence at community

level, the state of the natural resources in their areas and the overall wellbeing of the community.

Adaptive Management, risk and vulnerability assessment approaches will be used, founded on informed science, and including training of community members particularly those responsible for resource governance (Conservancy Committees) and resource managers (e.g. Conservancy managers, game guards & resource monitors) as well as all relevant stakeholders. This will create climate-smart managers and innovators. The consolidation of lessons learnt into policy briefs, toolboxes, guidelines and recommendations which will be made available to all stakeholders will enable the maximization of project outputs.

Component 2.1: Filling Knowledge Gaps

Adaptive Management requires a good understanding of the components and functioning of the ecosystem being managed. To improve the understanding of issues relating to the project context, critical investigations into the long-term sustainability and efficient utilization of alternative protein resources will be conducted. This includes for example, questions of life cycles and food resource utilization, which is ultimately linked to the productivity of the resource as a protein resource e.g. impact of different netting approaches for r-selected fish.

To fill knowledge gaps the following activities will be carried out:

Activities

1.1.4. Existing basic knowledge gaps on the nature of critical ecological features of the ecosystem-based alternative protein sources, the climate and other factors that affect them and their functionality will be filled through focused investigations. This will simultaneously be utilized to maximize capacity building, training and outreach opportunities through dedicated student projects, training courses and community engagement (see also below).

1.1.5. Scenarios for the development of underutilized sources of protein (develop inventories of fish species, aquatic plants, NTFPs and other aquatic fauna that are resilient to climate change variability) and other nutrients (and their potential to supplement the current diet and as a source of income) under various trajectories of climate change will be modelled and assessed. These scenarios will be used for communication with communities and will help them increase their understanding of climate -change risks, to allow them to take informed decisions;

1.1.6. A market analysis (including requirements, entry points, demands, etc.) for relevant selected dryland and wetland products as a potential cash income will be conducted with the aim of improving the chances of diversifying and expanding the number of income streams for especially poor and vulnerable groups in the communities.

Component 2.2: Capacity Building (Training and Education)

To strengthen the adaptive capacity of communities, selected communities will be targeted and trained through informal workshops regarding the processing and marketing of alternative protein sources. These training workshops will also target government staff. The training will also cover the ongoing monitoring protocols (under Objective 2, Component 3) to ensure that the protein resources, environmental impacts, and business management aspects can be regularly assessed to evaluate if changes need to be implemented. This training will be delivered to communities and government officials. Students will be selected and trained with some filling managerial posts in future in government structures. Specific activities include:

Activities:

2.2.1. Training courses will be developed, aimed specifically at households and communities and based on simple low-tech solutions to utilize, manage, process and market their resources (both the wetland and dryland resources);

2.2.2. Training courses and workshops will also be developed to target government and NGOs, to highlight lessons learnt about the impacts of policy and legislative barriers, environmental, and social constraints that either facilitate or prevent the implementation of the derived value chains created during the project timeframe.

2.2.3. Enhance tertiary institutions: input to different elements of this project would be facilitated by the generation of knowledge obtained through research projects to understand the ecosystems, the resources and the social impacts on these. Students conducting these research projects will be selected and taught to, in the future, be able to fill critical managerial (principally at an MSc level) and innovator (principally at PhD level)-roles in the field of climate change adaptation, thus enhancing the sustainability of the initiative.

Component 2.3: Policy and Legislation

Through informal and formal interactions, training initiatives and based on scientific results and data generated by the project it is anticipated to:

Activities

2.3.1. Inform policy and legislation-relevant decision-makers based on science and on lessons learnt;

2.3.2. Strengthen or amend legislation and policy to ensure that resources are exploited sustainably and directly benefit vulnerable groups within the target region.

Component 2.4: Monitoring

A key part of the approach to adaptive management is appropriate monitoring. Currently, with single exceptions, the monitoring of environmental change in Namibia is weak. Climate change adaptation depends critically on adequate monitoring procedures being in place.

The goal of the project is to develop ecosystem-based monitoring protocols as well as manuals and guidelines to equip communities with these monitoring protocols. These monitoring protocols will be developed for monitoring both at the local level within the communities, and to facilitate monitoring by relevant government agencies. They will be developed in collaboration with the communities, and where relevant for regional monitoring protocols together with relevant government departments. One key component is documenting the value chain and the wellbeing of the communities.

Activities

2.4.1. Develop ecosystem-based monitoring protocols.

2.4.2. Track consumption, income patterns and indicators of wellbeing of local communities. Collect data to measure project progress based on process and output indicators.

2.4.3. Consolidation of lessons learnt from the project implementation (guidelines, recommendations, policy briefs).

Output 2.1.1 and 2.1.2. will provide information on the ecosystem services in the piloted areas as well as an inventory of underutilized protein sources that may have

the potential to survive future inconsistent climate patterns. Necessary information will be collected to develop strategies for market development of these products to enable communities to diversify their livelihoods.

Output 2.2.1., 2.2.2. and 2.2.3. will regulate the capacity building component that will contribute to the sustainability of the project. These training will be informally based to ensure hands-on training for the local communities providing further ownership and formally based to influence future policy and legislative decision-makers.

Output 2.3.1. will influence policy decisions and with the necessary science-based information remove legislative barriers currently preventing the harvesting of underutilized protein sources. Initiative must be taken to inform policy makers of the value of these currently underutilized sources and the motivation for this mind shift in resource utilization.

Output 2.4.1, 2.4.2., 2.4.3 and 2.4.4 will monitor the progress of activities and will provide tools for future monitoring processes by communities which are invaluable for the sustainability of these initiatives and to ensure that future generations benefit and are able to diversify their livelihoods with the challenges that climate change will bring. A monitoring procedure will be put in place to track the implementation process and the outcomes. Due to the uncertainty of the changes that are expected to take place, the management approach will be shaped by the circumstances at that particular time and space and by the specific needs of the community.

B. Social, Economic and Environmental Benefits of the Project

Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations. Describe how the project / programme will avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

In a good year in neighboring Botswana, the MW has been estimated to be worth US$3.3m and to employ up to 10 000 individuals (Styles, 1994 in Marais 1996**Error! Bookmark not defined.**). Although much less formalized, the similar acceptance and utilization of this resource by many Namibians -in addition to its ability to provide employment and have a high net worth- makes it a viable potential food resource to consider as an adaptation strategy in the face of climate change.

Approximately 4% of the Namibian population's livelihood depends on freshwater fisheries in the different river systems (Simasiku, 2014). The value of Inland Fisheries in Namibia is valued at approximately N$ 109 million (Forsythe et al., 2018), five times more than game and trophy hunting combined on communal land. The collapse of the fisheries will have dire consequences for these communities and will put an extra burden on government that is already stressed out financially. Fish are, compared to other livelihood sources such as agriculture and livestock, immediately accessible during emergencies which will most likely happen more often in future considering climate change predictions.

Women have always had a definite role in the fishery being the link between the resource (men are doing most of the gillnet fishing) and the consumer. Nearly 100% of the vendors at the Katima Mulilo Fish Market are women, many heading the household sometimes vending fish being a major source of income for them. Women are also the ones harvesting the small minnow-like fish species (currently underutilized resource) on the floodplains, mainly for household consumption. Currently, many factors prevent them from harvesting this underutilized resource. This resource will most probably become extremely important in future if the current trend in bream stocks continues, compounded by the predicted impacts that climate change will bring. This project aims to safeguard, especially women, against future erratic weather patterns that will impact negatively on the fish stocks. This will empower them to play a stabilizing role in the household through the ability to harvest an alternative protein source previously inaccessible.

Similarly, women and children are most frequently involved in the harvesting of MW in Namibia (Marais, 1996[Error! Bookmark not defined.]). Because certain areas have had the resources depleted this has meant it has been necessary to travel further afield to harvest the MW. By developing the small-scale MW farming within communities and house-hold level and securing and stabilizing the resources through adaptive management strategies, we would be ensuring that the farming/harvesting and production of the insects would take place close to the home, thus removing the need for the women or children to travel far distances to farm this protein resource.

Through the establishment of Fisheries Reserves, communities will have the capability to keep foreign fishermen out, a major problem, by including fish as an integral part of resource management in conservancies. Fish were originally not seen as part of the

resource management in conservancies as it fell under the jurisdiction of a different ministry. Fisheries Management Committees will be gender sensitive, providing a platform for women to influence future decisions.

As outlined in Section I, CBNRM has primarily emphasized the management of wildlife in conservancies. In this project through its development of community management and utilization of the fish, insect and NTFP resources we will diversify potential resource income pools for the communities. This will also enable communities that do not have access to the conservancies to make use of the Community Forest, and Community Fish Reserve legislation that has been established, but has not fully utilized or implemented. Strengthening communities' involvement in managing and utilizing their resources will provide them with a sense of ownership and desire to protect their resources. Implementing an CBNRM approach to adaptively manage the resources, we'd ensure that OVC's and the ecosystem services are both secured in the face of a changing climate.

C. Cost-Effectiveness of the Project

Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

The project will build on the basis and experiences of work done under the Namibian community based natural resource management (CBNRM) programme, this will significantly lower transaction costs by fitting into an existing programme and enabling environment. The collaboration with experienced field partners with existing relationships with the target communities will further support a reduction in transaction costs and improved reach. In the context of Namibia with low population densities and large distances, community engagement can be extremely costly when viewed per capita, however this project with its focused modalities and integration into the existing CBNRM programme will be extremely cost effective.

D. Consistency with National and Sub-National Strategies

Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.

The project is in line with all the relevant Namibian development strategies; to mention just a few:

- ✓ The overall goal of the National Climate Change Strategy and Action Plan (2013-2020) is: To further facilitate building the adaptive capacity of Namibia to increase

climate change resilience and to optimize mitigation opportunities toward a sustainable development path, guided by the National Climate Change Policy. The project supports three of the Specific objectives, Agenda A (adaptation) and two of its four pillars and also 6 out of 8 topics of Agenda C (Cross cutting issues concerning adaptation and mitigation).

- ✓ Namibia's Nationally Determined Contributions are based on specific contributions by sector and are heavily skewed to the Agriculture, Forest and Other Land Use (AFOLU) sector (81.7%) followed by energy (5.7%). This concept will rely on conservation and restoration of natural ecosystems to enhance their productivity and will thus fit closely with Namibia's NDC focusing on aspects such as; Reduced deforestation (59.8%), Forestation measures (12.3%) and Grassland restoration (6%)
- ✓ Namibia's Fifth National Development Plan (NDP5) 2017/18 – 2021/22 stresses the need for Namibia to move to low-carbon, climate resilient development and to sustainably manage its environment. It sets objectives in terms of (inter alia) food production, food security, rural development and sustainable fisheries management.
- ✓ It is in line with the National Biodiversity Strategy and Action Plan NBSAP (2013-2022) which requires that ecosystems most vulnerable to climate change and their anthropogenic pressures are identified, and appropriate adaptation measures are developed and implemented in priority areas
- ✓ Adaptive ecosystem management and unlocking protein and other nutrients are also in line with the Strategy and Plan of 2013-2020, Namibia Zero Hunger Strategy, Vision 2030 as well as the Harambee Prosperity Plan.

E. Relevancy to National Technical Standards

Describe how the project / programme meets relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and complies with the Environmental and Social Policy of the Adaptation Fund.

No structures are foreseen that will require environmental assessments and or building codes. The project falls within the national CBNRM Policy and framework and also the broader CBNRM Programme, which has built in principles and operating standards. These are in line with the Environmental and Social Policy of the Adaptation Fund. The Namibia Nature Foundation is a member of the Namibian Association of CBNRM Support Organisations (NACSO) with whom this project has been discussed and for which there is support.

The project also is within the scope of and foreseen to be compliant with the various laws governing community based natural resource management, namely the Nature Conservation amendment act of 1996, the Forest Act of 2001, the Inland Fisheries Resources Act of 2003 and the Environmental Management Act of 2007. This can be further verified through an independent Environmental and Social Safeguards review process to be carried out in advance of a full proposal being submitted.

F. Overlap with other Funding Sources

Describe if there is duplication of project / programme with other funding sources, if any.

There is no duplication of the project with other funding sources apart from a limited amount of funding currently available to the Namibia Nature Foundation for supporting the creation of some Fish Reserves (but not their establishment and management). As outlined above the aim is rather to complement other CBNRM work (focused largely on wildlife & tourism) to enhance synergies and reduce transaction costs.

G. Learning and Knowledge Management

If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

The aspect of learning and knowledge management is embedded in the adaptive management process, whereby three tiers of knowledge and learning management will be derived within the project. Hands on training (which includes training material development) within communities to develop the value chain systems to enable management and income generation from ecosystem derived protein and nutrient resources will be instrumental to ensure uptake of these food security measures. Training and engagement within communities at the onset of the project will also focus on working with the selected communities to facilitate their understanding of the implications of climate change and why there is a need for adaptation measures.

Further training and knowledge dissemination will be given to stakeholders (CBOs, line ministries, NGOs) to inform, train trainers, and highlight policy and legislative elements necessary to enable uptake of identified value chains and management protocols. Finally, development of climate smart innovators and future managers, through university research projects designed to fill knowledge gaps in the use of protein and other nutrients in the face of climate change.

H. Consultative Process of the Project

Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

At this stage of concept development and being cognizant of the risks of raising expectations, consultations on the project as a whole have been carried out at representative levels, with Chairpersons and committee members of a number of conservancies. With regards to fisheries demands for support have arisen from the communities and this is a direct response to those demands directed at the Namibia Nature Foundation. Namibia Nature Foundation has also worked closely with the Ministry of Fisheries and Marine Resources during the last 10 years and had be instrumental in several postgraduate studies conducted by staff members. With regards to other alternative protein sources (insects) we have engaged through NACSO the relevant NGO support partners who have long established relations with the respective target conservancies. For this we have been in discussion with the Integrated Rural Development and Nature Conservation (IRDNC) and Namibia Development Trust (NDT) whom are NGO's working within the north west and north central regions respectively. This has included an introduction to the concept at the Mudumu Landscape meeting of conservancies and community forests (Zambezi Region), direct engagement with leadership in a number of Conservancies and Community Forests in Kavango East and West (Maurus Nekaro, Kapinga Kamwale, George Mukoya and Muduva Muyangana). Whilst NDT have reached out to conservancies in north central (Sheya Shuushona and Ipumbu ya Tshilonga) and IRDNC have identified and engaged with a cluster of Conservancies in Kunene (Okongoro, Orupupa and Ehirovipuka).

Should the concept be accepted, in depth participator consultations will be carried out with the target communities, prior to submission of a full concept.

I. Justification for Requested Funding

Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

As outlined above, inland fisheries were valued at N$109 million (US$ 7.5 million), per annum. However, since this was based on earlier figure for catch effort and since then research has shown a 90% decline in fish stocks, so it is likely that this figure is now much lower and increasingly unsustainable. A stabilization and return of fish stocks to allow for values of N$109 million to be sustainably extracted, would therefore

represent a significant annual return on investment. In addition, formalizing the use of other protein sources (mainly Mopane Worm) could offer further returns on investment. For example, in a broadly comparable setting of Botswana Mopane Worms were estimated to be worth over US$3.3 million annually and even a small portion of this would represent significant value, with household level impacts. These are just the direct financial calculations and do not consider the value of increased resilience and enhanced ecosystems and improved health. The fish protection areas as functioning wetlands and conserved forests for mopane worms alone should generate high ecosystem values.

J. Sustainability of the Project

Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project / programme.

The project has a three-tiered approach to institutional and social sustainability, the first is the higher-level approach of engaging through the Namibian Community Based Natural Resource Management Programme, will facilitate that the work is incorporated into this long running programme with the possibility of leveraging longer term institutional backing. The second level is the process of engaging communities through long-term field partners who have a long-term objective of working with target communities on CBNRM. The final tier is that the project will directly target local CBOs such as conservancies, community forest and cooperatives. These already existing institutions will help sustain the project beyond its life span. Identifying local people with entrepreneurial spirit, engaging strategically and nurturing these businesses over four years will create developments that are business oriented and financially viable.

Overall the approach provides for an opportunity for existing support organizations to engage local communities in value-chain development according to their own interest, building on existing local conditions and already utilized resources. Once communities have comprehended that there are alternative protein sources and how to access and manage these, it will be a self-sustaining system. Increasing the utilization of most of the sources for domestic purposes does not require much technical advice or investment. This approach should facilitate economic sustainability.

By basing our interventions on the sustainable use of natural resources through ecosystem-based adaptation, we plan for the project not just to be environmentally sustainable but to contribute to enhancing environmental sustainability.

K. Risks, Environmental and Social Impacts

Provide an overview of the environmental and social impacts and risks identified as being relevant to the project / programme.

The Environmental and Social Policy of the Adaptation Fund is consistent with Namibian environmental and social policies and laws. Both aim to ensure that activities do not result in unnecessary environmental and social harms, whilst addressing issues related to gender and youth empowerment. As part of the baseline survey proposed in the Project Components and Financing section, a detailed assessment of potential environmental and social risks will be carried out and incorporated into the further activities of the project. If any risks are detected, a risk management plan aimed at mitigating these risks will be included. However, based on the background outlined in the previous sections and consultations with key stakeholders no adverse environmental or social impacts are expected. Thus, the project would be classified as a Category C project.

By engaging through the CBNRM programme the project will be bound within a programme that has long championed environmental and social safe-guards. The National CBNRM Policy (2013[21]) outlines the aims, objectives and processes for establishing, managing and supporting communities to self-organize and manage their resources. This includes a guideline for management of conservancies and standard operating procedures (2013[22]), which includes specific sections on good governance both for resource management but also towards ensuring participation and inclusion. This is further supported by targeted training on social and gender awareness, another on relevant policies and legislation and others covering various aspects of sustainable natural resource management and good governance (see, http://www.nacso.org.na/resources/training-manual). These are routinely delivered to CBO's by a combination of NGO staff and relevant line ministry staff.

If the consumption of certain protein sources is subject to local traditional or beliefs that could be violated and potentially cause conflicts detailed impact assessments will be carried out. All protein sources included are renewable resources, for which a quota needs to be established and monitored so that the off-take does not exceed the

[21] Ministry of Environment and Tourism, 2013, National Policy on Community Based Natural Resource Management, MET, Windhoek.

[22] Ministry of Environment and Tourism, 2013, Guidelines for Management of Conservancies and Standard Operating Procedures, MET, Windhoek

production. Should any adverse effect occur, it is likely to be restricted to a specific product, small in scale and reversible.

In respect of gender, the project aims at strengthening sources of protein and nutrients traditionally harvested and utilized largely by women, as opposed to grazing and extensive agriculture carried out largely by men. This should facilitate greater equity regarding food security, with respect to reliance and resilience. The table below outlines the main environmental and social principles outlined by the Adaptation Fund's "Environmental and Social Policy" and how these principles are governed or addressed by the project:

Environmental & Social Principles	**No Assessment Required for Compliance**	**Potential Impacts and Risks: Assessment/Management**
Compliance with the Law	The project complies with national laws and is in line with the relevant policies outlined above.	No negative legal consequences are anticipated. However, a functioning M&E system will consistently review this position
Access and Equity	The National CBNRM programme is designed to enhance access and equity and has a strong track record of doing so. All community conservation areas require formal adoption of benefit distribution plans which uphold these principles and ensure access and equity amongst all members.	Full consultations will be designed to ensure that this remains the case and will also be captured in the project M&E indicators
Marginalized and Vulnerable Groups	This project is designed to strengthen participation by marginalized and vulnerable groups, particularly women and youth. But in line with the CBNRM programme other groups are assured a process of being engaged and having meaningful participation.	Full consultations will be designed to ensure that this remains the case and will also be captured in the project M&E indicators
Human Rights	No activities or actions are identified that in any way infringe upon human rights as established in the Namibian Constitution and in fact the project is designed to strengthen the Art 951() of the constitution, which calls for *maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibian's, both present and future*…..	

Gender Equity and Women's Empowerment	The CBNRM programme is particularly strong on gender equity and female empowerment and this project seeks to maintain this.	Recognizing that some gender segregation exists with respect to the harvesting and use of some of the targeted protein sources, the project will work to ensure that such roles are not discriminatory and equal participation will be promoted.
Core Labour Rights	The project and its partners all respect and abide by the Labour Act of 2007 and the general Regulations of 2008.	Continuous M&E will ensure this remains the case.
Indigenous Peoples	Government is inclined to consider all Namibians of African descent to be indigenous. In the context of the characteristics set out by the African Commission on Human and Peoples' Rights. Under this definition the project reaches indigenous groups in a fair and equitable manner.	In this light, the focus is therefore on marginalized groups and populations, which are addressed above.
Involuntary Resettlement	No resettlement will be supported.	
Protection of Natural Habitats	The project is designed to provide ecosystem-based adaptation and thus aims to improve the protection and conservation of natural habitats and biodiversity	
Conservation of Biological Diversity	As above	
Climate Change	The project aims to enhance forests and conserve wetlands, which should help mitigate climate change.	
Pollution Prevention and Resource Efficiency	The project is not anticipated to have any pollution impacts and should help improve resource efficiency.	
Public Health	In targeting protein security, the project is designed to help improve public health	
Physical and Cultural Heritage	By targeting insects that are already utilized the project should help strengthen traditional knowledge and customs and by strengthening fisheries help maintain an important social and cultural activity and culinary mainstay of the riparian communities of north east Namibia.	
Lands and Soil Conservation	No negative impacts are expected	

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. Record of endorsement on behalf of the government[23]

Provide the name and position of the government official and indicate date of endorsement. If this is a regional project, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project:

Dr. Frederick Sikabongo *Deputy Environmental Commissioner* *Ministry of Environment and Tourism (MET)*	Date*: July 23rd 2019* ***NB: ATTACHED SEPERATELY***

B. Implementing Entity Certification

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project contact person's name, telephone number and email address

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans namely National Development Plan 5, National Policy on Climate Change for Namibia 2011 and National Climate Change Strategy Action Plan 2013-2014 and subject to the approval by the Adaptation Fund Board, commit to implementing the project in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project
 *Dr Martin Schneider, Executive Director*

6. Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT AND TOURISM

Tel: (00 26461) 284 2111
Fax: (00 26461) 232 057

Cnr Robert Mugabe &
Dr Kenneth Kaunda Street
Private Bag 13306
Windhoek
Namibia

Enquiries: Mr. P. Muteyauli
E-mail: petrus.muteyauli@met.gov.na

23 July 2019

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for the project concept "Nutritional Security in Namibia's rural food production systems in the face of a climate change."

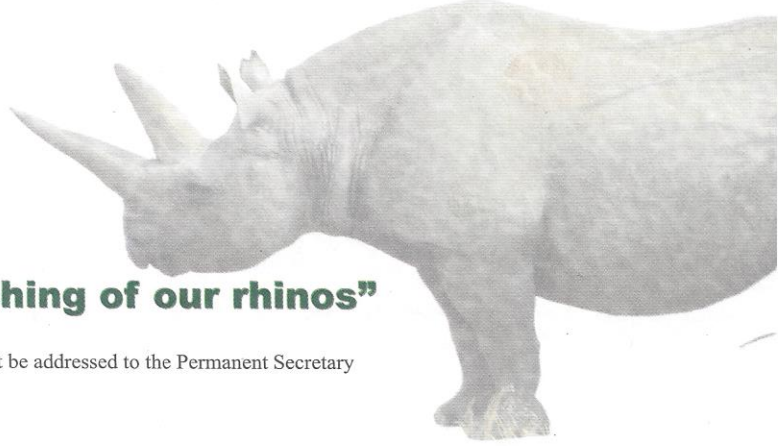
In my capacity as designated authority for the Adaptation Fund in Namibia, I confirm that the above national project concept proposal is in accordance with the Government's national priorities in implementing adaptation activities to reduce adverse impacts of, and risks, posed by climate change in Namibia.

Accordingly, I am pleased to endorse the above project concept proposal with support from the Adaptation Fund. If approved, the project will be implemented by the Desert Research Foundation of Namibia (DRFN) and executed by the Namibia Nature Foundation (NNF).

Sincerely,

MINISTRY OF ENVIRONMENT AND TOURISM P/Bag 13306 Windhoek, Namibia 2019 -07- 23 Office of the Environmental Commissioner

Dr. Fredrick Sikabongo
Deputy Environmental Commissioner



"Stop the poaching of our rhinos"

ADAPTATION FUND

Request for Project Formulation Assistance to undertake special technical assessments

Submission Date: 23rd July 2019

Adaptation Fund Grant ID:
Country: NAMIBIA
Title of Project/Programme: Nutritional Security in Namibia's rural food production systems in the face of a climate change.
Implementing Entity: Desert Research Foundation of Namibia (DRFN)
Executing Entity: Namibia Nature Foundation (NNF)

A. Timeframe of Activity

Expected start date of activity	**December 2019**
Completion date of activity	**March 2020**

B. Type of support requested

Describe the technical assessment(s) the implementing entity will undertake to support the design and development of adaptation projects and programmes

A Project Formulation Grant (PFG) is requested in order to develop the full proposal, including household level consultations and project planning to ensure a sound process and clear framework for coordination and integration into the national community based natural resource programme. Due to the high transaction costs of engaging with remote communities at household level we are requesting a full PFG of US$30,000.

In addition, a Project Formulation Assistance (PFA) grant is also requested to support the following key elements,
;

1. The development of project specific environmental and social safeguards
2. In line with the above, the development of a full monitoring and evaluation plan
3. Provide input for iterations for the Project Concept based on ESS findings

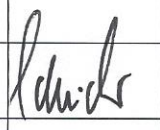
Type of Technical Assessment requested*.	Duration (months)	Type/name of provider for the requested support[1]	Requested budget (USD)
Project Specific Environmental and Social Safeguards	3	Louise Brown/Pauline Lindeque	US$12,000
Development of a full Monitoring and Evaluation Plan	1	Pauline Lindeque/Louise Brown	US$8,000
PFA Grant Requested (USD)			**US$20,000**
PFG Grant Requested (USD)			**US$30,000**

Footnote: Technical assistance could include EIA, VA, technical studies, gender assessment etc.

NIEs may request both PFA and PFG simultaneously when they submit proposals using the two-step proposal approval process, that is, when they submit a project concept for consideration of endorsement by the Adaptation Fund Board.

C. Implementing Entity

This request has been prepared in accordance with the Adaptation Fund Board's procedures

Head of Implementing Entity	Signature	Date (Month, day, year)	Implementing Entity Contact Person	Telephone	Email Address
Executive Director		23 July 2019	Dr Martin Schneider	+264-81-2460379	martin.schneider@drfn.org.na

[1] Specify if it is an institution, consulting firm or individual consultant. When possible, provide the name of the institution, firm or individual identified or selected.

D. Record of endorsement on behalf of the government

Provide the name and position of the government official, Designated Authority of the Adaptation Fund, and indicate date of endorsement. The endorsement letter must be attached as an annex to the request.

Dr. Fredrick Sikabongo *Deputy Environmental Commissioner* *Ministry of Environment and Tourism (MET)*	Date: *July 23rd 2019*

MINISTRY OF ENVIRONMENT AND TOURISM
P/Bag 13306
Windhoek, Namibia
2019 -07- 23
Office of the
Environmental Commissioner