ADAPTATION FUND

PROJECT/PROGRAMME PROPOSAL TO THE ADAPTATION FUND

PART I: PROJECT/PROGRAMME INFORMATION

Programme Category:	Small-sized
Country:	Namibia
Title of Programme:	Strengthening traditional approaches for coping with climate variability by small-scale farmers
Type of Implementing Entity:	National
Implementing Entity:	Desert Research Foundation of Namibia (DRFN)
Executing Entity:	Gobabeb Research and Training Centre
Amount of Financing Requested:	USD 989,140

Short Summary

Projected climate-induced stress from rising temperatures and increased variability and unpredictability of wet seasons is likely to exacerbate the vulnerability of small-scale subsistence farmers in Namibia. Traditional farmers from four rural constituencies (Mashare, Ndiyona, Daures and Walvis Bay Rural) in the Kavango East and Erongo regions will participate in this programme. Activities will document, analyse, adjust and strengthen traditional on-farm production by integrating scientific and institutional risk management interventions. The beneficiary crop and livestock farmers are some of Namibia's most vulnerable communities with least resilience and adaptive capacity. They are already characterised by severe poverty; acute inequality (assets, health, education, geography); limited alternative sources of income and marginalisation. Successful adaptation measures in these areas are expected to have a significant cascade effect on Namibia's predominantly rural population, with over 70% of Namibia's people relying on agriculture for their livelihoods, whether as producers, labour, retail or service providers. Namibian agriculture is already vulnerable to climate variability and change as production in the most arid country in sub-Saharan Africa relies almost exclusively on rain-fed crops or rangelands. Various global analyses have thus resulted in dire predictions regarding the socioeconomic consequences of climate change for Namibia.

Improving the immediate preparedness and adaptive capacity of small-scale crop and livestock farmers may allow more long-term adaptation efforts to mature. The objective is therefore to address specific information needs and strengthen traditional systems to ameliorate the impact of climate variability on household agricultural production as determined through participatory consultation with farmers in various regions of Namibia. The programme activities will concentrate on (i) improved knowledge and use of traditional crop landraces and seed availability; (ii) better understanding of livestock and rangeland dynamics and management; and (iii) building capacity for area-specific agrometeorological forecasting. This will be achieved by combining traditional and scientific knowledge in an integrated approach to promote skills transfers, climate awareness, improved risk management, and institutional support mechanisms. The Mashare and Ndiyona constituencies represent some of the most challenging areas for crop production, while the Daures and Walvis Bay constituencies are marginal livestock production areas. The programme will address some drivers of vulnerability and build response capacity and improve the ability of managing climate risk by beneficiary communities in these areas. Effective local measures to improve household income from agriculture and greater resilience to climate variability will therefore be transferable elsewhere in Namibia.

Table of Contents

Abbreviations and Acronyms

AAP	Africa Adaptation Programme
ABS	Access and Benefit-Sharing
ADC	Agriculture Development Centre
AF	Adaptation Fund
AMTA	Agro-Marketing and Trade Agency
CA	Conservation Agriculture
CBD	Convention on Biological Diversity
CBNRM	Community Based Natural Resource Management
DARD	Directorate of Agricultural Research and Training (MAWF)
DAPEES	Directorate of Agricultural Production, Extension and Engineering Services (MAWF)
DEA	Department of Environmental Affairs (MET)
DoF	Directorate of Forestry (MAWF)
DoP	Directorate of Planning (MAWF)
DRFN	Desert Research Foundation of Namibia
DRSPM	Directorate of Regional Services and Parks Management (MET)
EE	Executing Entity
EIA	Environmental Impact Assessment
EPS	Ensemble Prediction Systems
ESP	Environmental and Social Policy of the Adaptation Fund
EU	European Union
EWS	Early Warning System
FAO	Food and Agriculture Organization of the United Nations
FFG	Farmers' Focus Group
FPIC	Free, Prior Informed Consent
FSP	Farmers Support Project
GCOS	Global Climate Observation System
GDP	Gross Domestic Product
GEF	Global Environmental Facility
giz	Deutsche Gesellschaft für Internationale Zusammenarbeit
GM	Genetically Modified
GPS	Global Positioning System
GRN	Government of the Republic of Namibia
GSM	Global System for Mobile Communications
HIV/Aids	Human Immuno-deficiency Virus / Acquired Immuno-Deficiency Syndrome
IFRC	International Federation of Red Cross and Red Crescent Societies
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
JICA	Japan International Cooperation Agency
LAC	Legal Assistance Centre
LSU	Large [Live]Stock Unit
MADI	Mashare Agricultural Development Institute
MAWF	Ministry of Agriculture, Water and Forestry
MCA	Millennium Challenge Account
M&E	Monitoring and Evaluation
MET	Ministry of Environment and Tourism
MoU	Memorandum of Understanding
MPI	Max Planck Institute
MWT	Ministry of Works and Transport
N$	Namibian Dollar
NAB	Namibia Agronomic Board
NAFOLA	Sustainable Management of Namibia's Forested Lands (GEF Project)
NASA	National Aeronautics and Space Administration (USA)
NAU	Namibia Agricultural Union
NBRI	National Botanical Research Institute
NBSAP	National Biodiversity Strategy and Action Plan
NCA	Northern Communal Area
NCCC	National Climate Change Committee
NCCSAP	National Climate Change Strategy and Action Plan
NCRST	National Commission on Research Science and Technology
NDVI	Normalized Difference Vegetation Index
NGO	Non-Governmental Organisation
NHIES	Namibia Household Income and Expenditure Survey
NIE	National Implementing Entity
NMS	Namibia Meteorology Services (MWT)
NNF	Namibia Nature Foundation
NNFU	Namibia National Farmers Union
NNP	Namib-Naukluft Park
NOAA	National Oceanic and Atmospheric Administration (USA)
NPGRC	National Plant Genetic Resources Centre
NPGRCom	National Plant Genetic Resources Committee
NPP	Net Primary Productivity
NQA	National Qualifications Authority
NSA	Namibia Statistics Agency
NWP	Numerical Weather Prediction
PC	Programme Coordinator
PGRFA	Plant Genetic Resources for Food and Agriculture
PMU	Programme Management Unit
RS/GIS	Remote Sensing/Geographical Information System
SADC	Southern African Development Community
SAP	Strategic Action Plan
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management

SAWS	South African Weather Service
SCORE	Scaling up community resilience to climate variability and climate change in Northern Namibia, with a special focus on women and children (GEF Project)
SF	Stakeholder Forum
SGP	Small Grants Programme
SPGRC	SADC Plant Genetic Resources Centre
SWFDP	Severe Weather Forecasting Demonstration Project
TA	Traditional Authority

TK	Traditional Knowledge
ToR	Terms of Reference
TTA	Topnaar Traditional Authority
UNDP	United Nations Development Programme
UNFCCC	UN Framework Convention on Climate Change
UNAM	University of Namibia
UP	University of Pretoria
USD	United States Dollar
WMO	World Meteorological Organization

Project Background and Context:

Namibia's economy is highly dependent on climate sensitive sectors like agriculture[1,2] and thus highly vulnerable to the effects of climate change. Various global socioeconomic analyses[3,4] therefore suggested that the impacts of climate change on Namibia may be particularly severe as its cumulative effects erode the country's ability to respond. That dire prognosis is further compounded by a low adaptive capacity to be able to respond to climate change risks and impacts due to inadequate financial resources and human capital[5]. Already classified as a dry, sub-humid country with limited agricultural potential, climate projections indicate that agriculture, as defined in the most conventional terms, may not be viable in future. Climate-related risks[2] such as increased frequencies of severe floods and droughts, changes in seasonal rainfall and precipitation patterns; increased evaporation and evapo-transpiration ratios; higher day and night temperatures; and changes in wind regimes will negatively affect the agricultural sector. Other natural resource-based production systems and associated economic sectors will also decline. Tragically, it is small-scale farming communities, already living under relatively harsh conditions and dependent on the natural resource base for survival and livelihoods, which are most vulnerable to the risks and impacts associated with a changing climate[1].

According to the latest analysis on crop prospects and food security[6], Namibia's agricultural production (both crop and livestock) has again performed below par in terms of the expected crop harvest, grazing availability, and water for livestock and urban centres due to drought. In the communal crop producing regions, most farming households face food shortages as repeated dry spells experienced during the critical period of ploughing and germination (December to February) caused crop failures. Early measures for emergency food relief are being advocated for 2015.

Projected climate risks and vulnerabilities

Most climate projections for Namibia predict a consistent rise in temperature over the next century, albeit with varying degrees of warming[7]. An increase of around 1°C during the 20th Century and a consistent increase in daily maximum temperatures have already occurred in Namibia; and mean annual temperatures are predicted to increase by a further 3.5°C to 2065 and up to 6°C by 2100. Such temperature increases will have a complex cascade effect on natural and agricultural ecosystems, but of particular concern is an associated increase in evaporation by *ca*. 5% per 1°C temperature rise, and the associated water stress caused by warmer temperatures in agricultural systems. A general temperature increase is predicted across Namibia, which is expected to be most extreme in the inland areas (Figure 1a). The greatest increase in temperature is predicted for September-October-November[8].

[1] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.
[2] Dirkx, *et al*., 2008. Climate Change Vulnerability and Adaptation Assessment Namibia. Windhoek.
[3] Reid, *et al*., 2007. The economic impact of climate change in Namibia. IIED Discussion Paper 07-02. London.
[4] DARA, 2012. Climate Vulnerability Monitor: a guide to the cold calculus of a hot planet. Madrid.
[5] Kaundjua, *et al*., 2012. Community perceptions of climate change and variability impacts in Oshana and Ohangwena Regions. *Journal for Studies in Humanities and Social Sciences* 1: 1–32.
[6] MAWF, 2015. Crop prospects, food security and drought situation report. Windhoek.
[7] MET, 2011. Namibia Second National Communication to the UNFCCC. Windhoek.
[8] Davis, 2011. Climate Risk and Vulnerability: A handbook for Southern Africa. Pretoria.

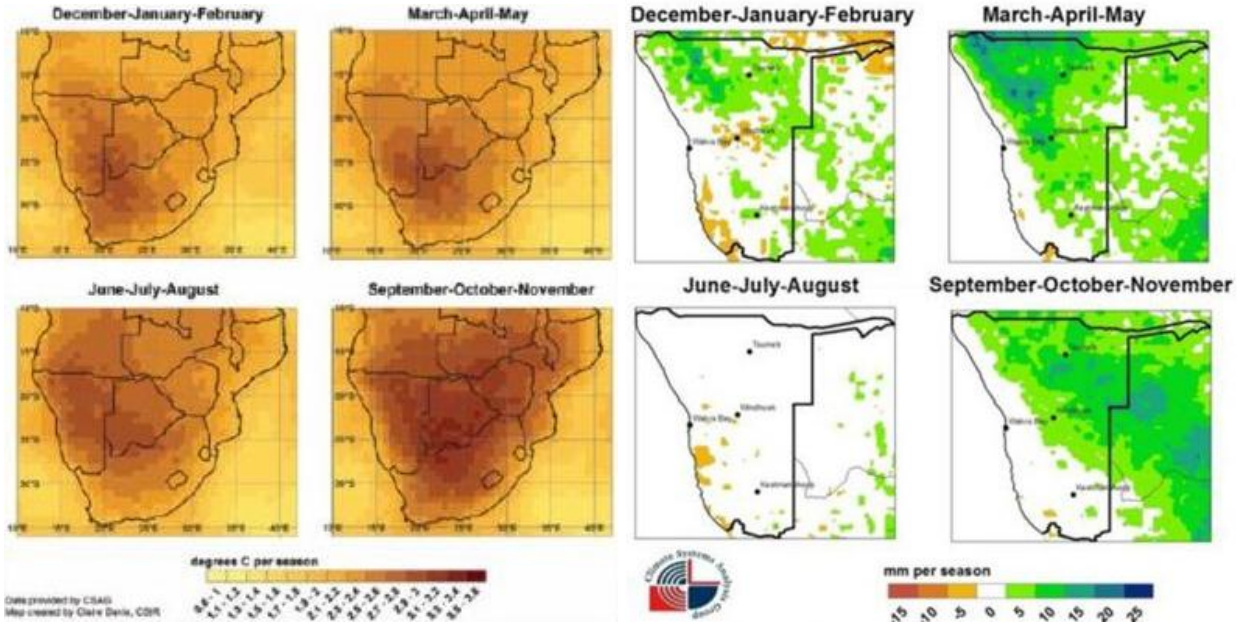


Figure 1: Projected changes[8], based on statistical downscaling, over the next 50 years in (a) seasonal temperatures, and (b) seasonal rainfall.

Model simulations to project future rainfall at global scales also do not yield consistent results and clear trends are rarely apparent, thus any projections of future rainfall trends should be used with caution. Namibia's National Climate Change Strategy and Action Plan[9] therefore indicates that variability of rainfall will remain of most concern for the country. For example, one model simulation suggests that by 2050 much of the northern and central parts of the country are likely to receive an increase in rainfall (Figure 1b), from the onset of the wet season during September-October-November to its end during March-April-May, while models based on dynamic downscaling suggest a decrease in rainfall[10]. Along the western parts of the country very little change is expected. It would be prudent to consider early measures to monitor and potentially exploit improved rainfall conditions as an adaptive measure to improve household income in poverty-stricken rural farming communities through increased production. Poverty alleviation is an effective adaptation measure, particularly since the consequences of climate change are likely to continue beyond the next century.

It is not only the amount of rainfall, but also the duration of the rainfall season and the variability and intensity of rainfall that are important for agriculture. A shorter rainfall season, a significant decrease in the number of consecutive wet days, and increases in rainfall intensity have already been observed in Namibia[11]. Inter-annual variability is already a concern for Namibian farmers, which is likely to increase[7]. For example, subsequent to the 2013 crisis, the 2014/2015 season was also very poor with below normal rainfall throughout the country relative to the long-term mean[12], with abnormally frequent and prolonged dry spells in January and February. Those two months are critical for Namibian agriculture as it

[9] MET, 2013. National Climate Change Strategy and Action Plan (2013–2020). Windhoek.
[10] Davis, 2011. Climate Risk and Vulnerability: A handbook for Southern Africa. Pretoria.
[11] MET, 2011. Namibia Second National Communication to the UNFCCC. Windhoek.
[12] MAWF, 2015. Crop prospects, food security and drought situation report. Windhoek.

is the planting season, while rangeland conditions for the rest of the year are determined by vegetative growth during these months.

The projected climate change impacts on Namibia's vegetation[13] suggest a decrease of between 0.5 to 1 t/ha in Net Primary Productivity (NPP), with NPP decreasing least in the northeastern regions. It is predicted that changes in the species composition of natural vegetation are very likely in the northeastern regions of Namibia, while a 25–30% decrease in permanent river discharge and substantial reductions in wetlands and floodplain areas from lower rainfall in catchment areas are also projected. This will affect livelihoods based on non-farming natural products and increase dependence on subsistence agriculture. Elsewhere[14], projections suggest that desert and arid shrubland vegetation will expand by 43% over the next century, mostly at the expense of grassy savanna vegetation types. The greatest impact of changes in grazing availability will be experienced in the livestock producing areas of Namibia, where cultivation is not possible.

It is therefore feasible to predict that future climate change will cause: (i) small-scale farmers in the northern regions of Namibia to become increasingly dependent on crops and social support systems for food security; (ii) dietary contributions from non-farming products such as fish, wild fruit and nuts, and wetland corms and indigenous vegetables to decrease; (iii) pressure on woodlands and rangelands for alternative sources of income to increase; (iv) livestock production to shift towards desert and arid-adapted modes of herding; (v) some well-known species of cultural significance to decrease in abundance or disappear; and (vi) viability of irrigation agriculture to decrease.

As most farmers in Namibia keep livestock, such projected impacts on rangelands may have severe consequences. In northern Namibia, livestock is highly regarded as a symbol of wealth; a mode of saving and building capital where access to banks and opportunities for and knowledge of other types of investment are rare; a flexible source of cash; and a dietary supplement (e.g. dairy products for early child development). Elsewhere in Namibia, representing 70% of the territory, livestock is the main agricultural focus. As with cropping systems, climatic effects have the greatest impact on the poorest livestock owners. Most of the impacts on livestock production are expected to be associated with a rise in temperature, but reliable information on the effects of temperature is deficient.

It is predicted[15] that climate change will cause (i) a decline in grazing availability and quality; (ii) more bush encroachment; (iii) decreased livestock reproduction and growth; (iv) greater disease and parasite impact; (v) increased demand for water associated with rising temperatures; (vi) more pressure for new wells to tap underground aquifers and provide more water; (vii) grazing distances to decrease as livestock will remain closer to water; (viii) increased environmental degradation around water points; and (ix) increased forcing of livestock keepers into fragile marginal areas in search of grazing areas for their stock.

[13] Midgley, *et al*., 2005. Assessment of potential climate change impacts on Namibia's floristic diversity, ecosystem structure and function. Climate Change Research Group, South African National Biodiversity Institute. Cape Town.

[14] Turpie, *et al*., 2010. Climate change vulnerability and adaptation assessment for Namibia's biodiversity and protected areas system. Windhoek.

[15] Kuvare, *et al*., 2008. Research on farming systems change to enable adaptation to climate change. Windhoek.

A review[16] of 19 model projections on the impact of climate change on cereal crops suggest that an average decline of -30% of maize (*Zea mays*) and pearl millet (*Pennisetum glaucum*) yields can be expected in southern Africa by 2100. Even with appropriate adaptation measures (suitable varieties; adapted crop calendars; fertilisers; conservation agriculture), the majority of models still predict an overall decline in cereal crop yields (*ca*. -18% for maize), but then only with severe rising temperatures towards 2100. All these studies commonly cite the development and appropriate use of suitable crop varieties, tolerant to heat and low soil moisture, as appropriate measures to cushion smallholder communities from climate impacts and declining cereal yields. Such adaptation measures may even improve yields and livelihoods of small-scale farmers towards 2100 due to the likelihood of improvements in agricultural production methods, farmer education, agricultural information systems and technological innovations in the next century. Namibia has already produced improved pearl millet varieties from local germplasm. Additional screening and testing of landraces in consultation with local farmers has obvious potential for adaptation[17].

Component 1 of this programme will focus on small-scale crop farmers in northeastern Namibia to quantify the diversity of local crop varieties and their yields under different conditions to promote participatory adaptation processes[18]. This area was selected as (i) small-scale subsistence crop farmers are likely to be most severely impacted by climate change in Namibia; (ii) studies by the FAO indicated that traditional landraces are a key element to climate change coping mechanisms and climate-smart agriculture[18]; (iii) rural crop farmers of the Kavango East region are some of the most severely impoverished and least resilient communities in Namibia[19]; and (iv) very few climate change adaptation interventions have addressed communities in the Kavango. This component will strengthen traditional smallholder agriculture as a first step towards systematic change in production methods; improve early warning communication; and develop participatory approaches to farmer education and use of crop varieties.

Component 2 of this programme will investigate potential climate change impacts and coping mechanisms that may assist small-scale pastoralists to improve rangeland management practices in arid western Namibia. Results of these participatory investigations have potential as possible behavioural adaptation strategies for pastoralists and rangeland management elsewhere in Namibia and Africa. The focal area was selected as (i) the ≠Aonin Nama or Topnaar and Damara communities have been farming with livestock under extreme conditions for centuries; (ii) temperature conditions in western Namibia already approximate model predictions for the future Namibia; (iii) rural Topnaar are an impoverished, marginalised people[20], as are the Damara[19], thus their ability to respond to climate hazards is very low; (iv) no climate change adaptation interventions have addressed rural farming communities in the Erongo region; (v) income from livestock is a major

[16] Zinyengere, *et al*., 2013. Crop response to climate change in southern Africa: a comprehensive review. Global and Planetary Change 111: 118-126.
[17] FAO, 2015. Coping with climate change – the roles of genetic resources for food and agriculture. Rome.
[18] FAO, 2013. Climate-smart agriculture source book. Rome.
[19] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.
[20] Dieckmann, *et al*., 2013. Indigenous peoples and climate change in Africa. Report on case studies of Namibia's Topnaar and Hai//om communities. Windhoek.

element of household economies in most farming communities in Namibia; (vi) the impact of increased temperatures on livestock production under rangeland conditions is unclear; (vii) results may serve to improve and strengthen participatory approaches for communal rangeland management and monitoring as a coping mechanism for pastoralists elsewhere in Namibia. This component will strengthen pastoralists' ability to cope with increasing temperatures through communal rangeland management and climate-smart herding practices; increase communal resilience by promoting climate change risk management planning; improve early warning communication; and develop effective stakeholder-scientist communication feedback mechanisms.

Improved access to science-based information, in particular agrometeorological forecasts and dissemination of reliable climate information, complemented by enhanced access to extension services, has often been identified[21] as an immediate practical adaptation measure that can be employed. Early warning systems such as forecasts have visible short-term benefits through improved timing of planting, informed selection of varieties to be used during a specific season and judicious interventions such as fertiliser applications and pest management. Being able to exploit predictions of rainstorms, or having a fair degree of certainty about likely conditions during the productive season, are desired by almost every Namibian farmer. This was borne out by recent participatory consultations during which farmers highlighted that their vulnerability is exacerbated by their inability to predict likely weather conditions. Traditional precautionary measures of spreading risk and communities' reactive responses to emerging threats may also be strengthened by early warning systems.

Component 3 of this programme is intended to develop and introduce specific agrometeorological early warning for Namibian farming areas by producing short-term weather predictions that are not yet available for the country. This addresses the need to (i) develop necessary skills for predictive forecasting in order to empower existing Namibian institutions; (ii) develop accurate short-term weather forecasting services to cope with climate variability as identified by farmers and pastoralists in the target areas; (iii) improve early warning communication for broad-scale application across all sectors in dealing with climate risk; and (iv) initiate recommended actions identified in the NCCSAP[22]. This component will prompt further development of down-scaled, short-term weather forecasting for specific areas in Namibia as confirmed by local competent service-providers, e.g. NMS; and improve the ability of small-scale farmers and pastoralists to respond to likely weather conditions.

Adaptation of subsistence cereal farming has already been accomplished by developing improved pearl millet varieties from local germplasm. An unintended effect is that some traditional varieties are less common than a decade ago[23], suggesting that some genetic diversity may be irretrievably lost if practical steps are not taken. Component 1 will strengthen on-farm conservation of traditional crop varieties and explore initiatives for

[21] Twomlow, *et al*., 2008. Building adaptive capacity to cope with increasing vulnerability due to climatic change in Africa – A new approach. Physics and Chemistry of the Earth 33: 780–787.
[22] MET, 2013. National Climate Change Strategy and Action Plan (2013–2020). Windhoek.
[23] Gobabeb, 2015. Assessment of the status of on-farm conservation of PGRFA in northern Namibia (draft). Windhoek.

accelerated investigation of the suitability of such traditional varieties under various conditions[24].

Socio-economic context

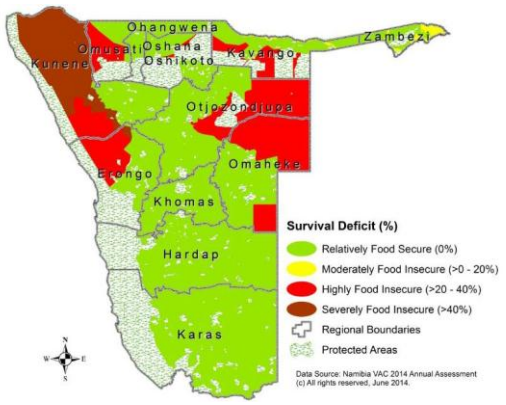


Figure 2: Food security in Namibia[21]

Agriculture plays a pivotal role in the socio-economic base of the country's population. Over 70% of Namibia's 2.1 million people depend on agriculture in some way or other for their livelihoods (Figure 2[25]). The agricultural sector is also the single largest employer of labour, which together with a large number of small-scale farmers, results in a predominantly rural population[26]. Namibia has a dual agricultural sector: commercial agricultural production on freehold farms (*ca*. 43.3% of available land) for export and food processing industries; and subsistence farming by small-scale farms on communal land (*ca*. 37% of available land) that mainly support individual households and extended families. A significant number of freehold farms have switched to wildlife and tourism or been acquired by government for land reform and resettlement, while large parts of communal land have also been designated as conservancies or communal forests through participatory processes and for the benefit of their respective communities. Farming in conservancies is discouraged as it impacts negatively on wildlife and associated tourism opportunities, and may result in human-wildlife conflicts. This, in combination with climate effects, has resulted in a net decrease in annual contribution by the agricultural sector to the national account[27].

Namibian agricultural systems rely almost exclusively on rain-fed crop or rangeland production at different geographical or socio-economic scales. Irrigation agriculture is limited and expansion is severely constrained by a lack of water. As a result, agricultural production is volatile and particularly prone to climate variability and change, e.g., 2013 recorded the worst drought situation in 30 years and the lowest GDP contribution by agriculture[28]. The livestock subsector declined by 37.6%, while crop farming declined by 9.6%. However, during 2014 a growth of 8.0% and 4.8 %, respectively, were attributed to these two subsectors[29]. It is evident that a single year's growth under improved conditions, as during 2014, is unable to mitigate the losses incurred during a crisis year. Agricultural production was again impacted by a poor 2014/15 wet season, where forecasts expected crop production would be 33% below average and nearly 30% lower than the 2013/14 season[30]. For the three major staple crops in communal areas, maize production was predicted to drop by about 35% below average and 12% lower than last season's harvest;

[24] FAO, 2013. Climate-smart agriculture source book. Rome.
[25] UNOCHA, 2014. Namibia rural food and vulnerability forecast.
[26] NPC, 2012. Namibia's 4th National Development Plan 2012/2013 to 2016/17. Windhoek.
[27] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.
[28] NSA, 2014. Preliminary Annual National Accounts 2014. Windhoek.
[29] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.
[30] National crop production forecast for 2013/14 was 132.100 metric tonnes on aggregate.

pearl millet over 51% below average and 35% lower than last season's harvest; and sorghum by 60% below average and 23% lower than last season's harvest[31].

Prevailing poverty, inequality and limited opportunities and skills for alternative sources of income, further increase the vulnerability of many rural communities to climate-induced stress[25]. Although traditional farming systems are remarkably proficient to cope with inter-annual climate variability, e.g. from extensive flooding as in 2011 to debilitating drought as in 2013 and 2015, an essential component of those response systems relied on mobility that is no longer feasible. In the past, both crop and livestock farmers would move to different areas during climate emergencies where they could clear land to raise at least some crops, e.g. on river floodplains or in wetlands, or where enough grazing was available for their herds to survive. Increases in populations, exclusion from proclaimed conservation areas or freehold farms, and international borders no longer allow unrestricted migration. However, traditional agriculture did not depend on migration alone. Crop farmers still make use of a suite of landraces to buffer production against climate calamities, while also relying on other produce from their plots and the surrounding areas to cope with variable and unpredictable conditions[32,33]. Archaeological and historical accounts suggest that the Topnaar people have been raising livestock under extreme desert conditions for hundreds of years without migrating to other areas. This suggests resilience and traditional coping mechanisms that are poorly understood and a potential foundation for adaptation to the increasing uncertainties and extremes of climate change.

While recognising that much progress has been made in identifying research and capacity needs in broad terms in Namibia, a recent review[34] suggests that the status of Climate Compatible Development knowledge and research is inadequate for the responses that are required. This programme will develop a bridge between local knowledge and scientists to improve traditional resilience to climate variability and harness local knowledge to improve adaptation capacity.

[31] MAWF, 2015. Crop prospects, food security and drought situation report. Windhoek.
[32] FAO, 2015. Coping with climate change – the roles of genetic resources for food and agriculture. Rome.
[33] Gobabeb, 2015. Assessment of the status of on-farm conservation of PGRFA in northern Namibia (draft). Windhoek.
[34] Urquhart, *et al.*, 2014. Climate Change Counts mapping study, 1. Knowledge Co-production Framework. Johannesburg.

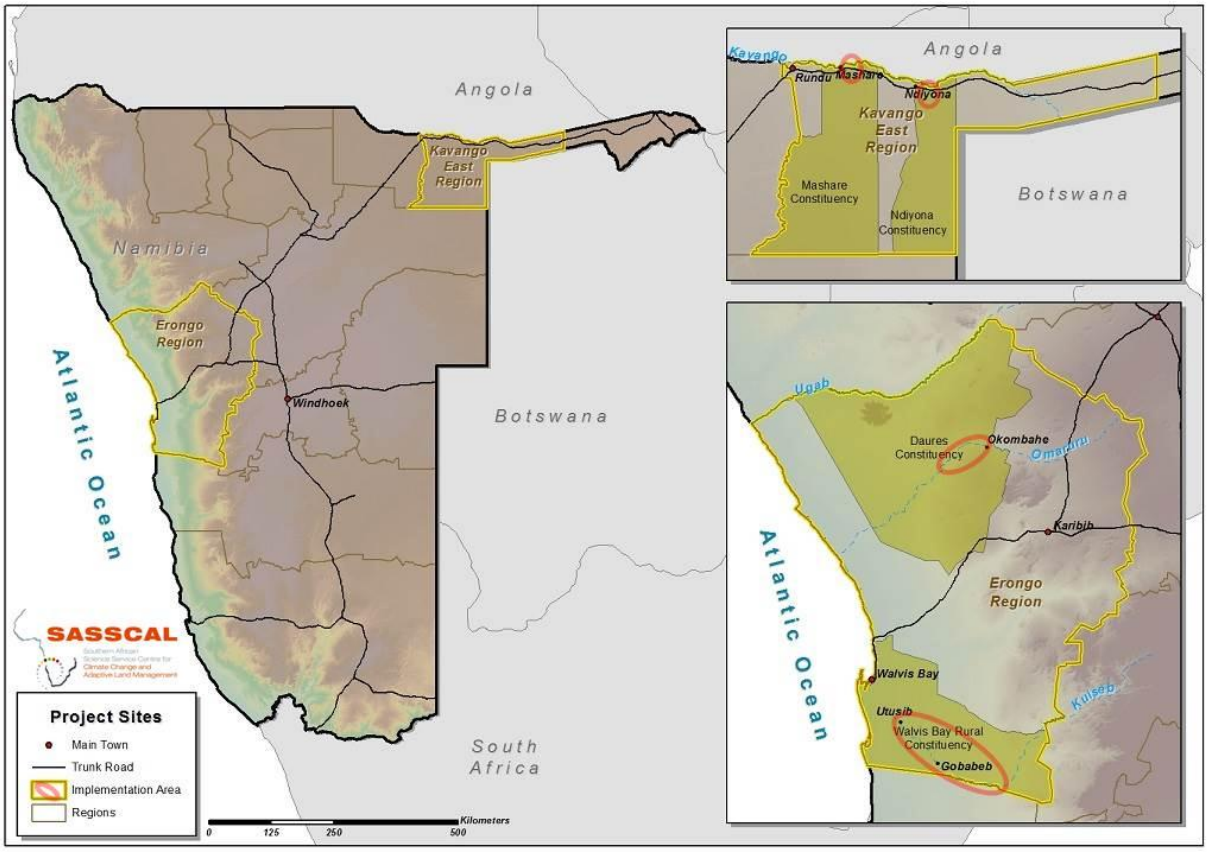


Figure 3: Programme locations in Namibia.

Description of programme sites

The programme will be implemented in four different areas (Figure 4): the Mashare and Ndiyona constituencies in the Kavango East region (Components 1 and 3); and the Walvis Bay Rural and Daures constituencies in the Erongo region (mainly Component 2).

The Mashare and Ndiyona constituencies are situated in the semi-arid parts of north-eastern Namibia. The Kavango East region is 22,699 km^2 in size and borders Angola to the north along the Okavango River, one of the few perennial rivers on Namibia's borders. The average maximum temperatures are above 30°C in summer, whilst average minimum temperatures average 8–10°C. The mean annual rainfall in the two constituencies is around 550 mm along the Okavango River, and rarely less than 250 mm[35]. The two constituencies extend from the Okavango River in the north, across extensive woodlands to the south, with mean annual rainfall progressively decreasing southwards to around 450 mm.

Most residents are concentrated along the river, with a total population in 2011[36] of 15,688 in the Mashare constituency, of which 8,234 were female and 7,454 male, and 20,633 in Ndiyona constituency, of which 11,135 were female and 9,498 male. Mashare constituency covers 9,175.4 km^2 with a density of 1.7 persons/km^2, most of which are administered by the Shambyu Traditional Authority. The Ndiyona constituency is slightly larger at 8,119.7 km^2 with a density of 2.5 persons/km^2, mostly administered by the Gciriku Traditional Authority. Most traditional farmers speak Rumanya/RuGciriku, with a minority speaking

[35] Mendelsohn, *et al*., 2002. Atlas of Namibia: A portrait of the land and its people. Cape Town.
[36] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.

Rukwangali or Runyemba. Small numbers of San people from the neighbouring communal area administered by the !Kung Traditional Authority reside on the south-western, inland edge of the Mashare constituency. Farmers belonging to the minority vaNyemba people, who immigrated over the last 50 years from neighbouring Angola due to war, are intermingled with the main Shambyu and Gciriku people in the northern parts of these constituencies. Less than 10% of the population of these constituencies resides in urban areas, of which Ndiyona village with its secondary school, hospital and other government infrastructure is the largest.

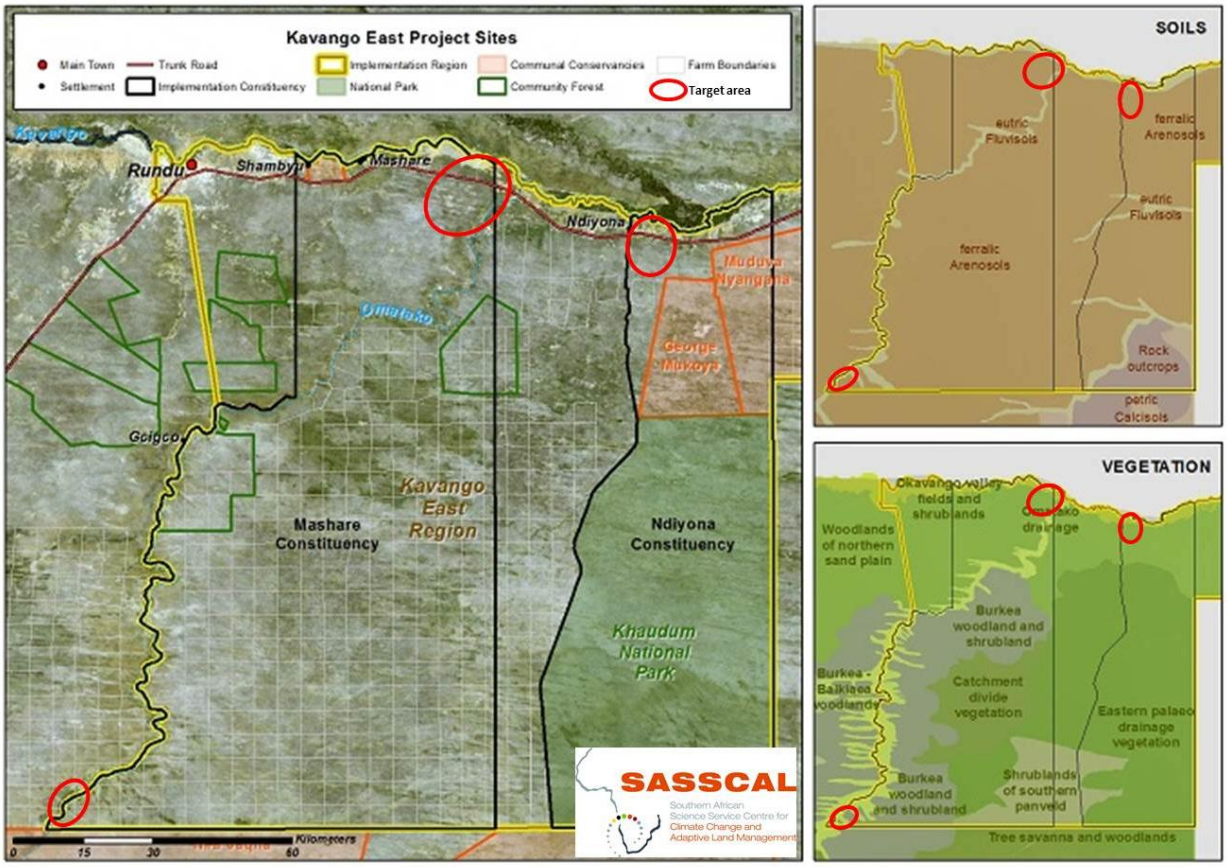


Figure 4: Programme sites in the Kavango East region of Namibia.

Most of the area is flat (980–1220 m amsl) and covered by a mantle of deep Kalahari sand arenosols (Figure 4). The more fertile soils (fluvisols, anthrosols) are concentrated along the Okavango River. The deep sand of the interior has a low nutrient and low silt and clay content (<10%) and therefore low fertility. The anthrosols closer to the river with more clay and silt, and a better moisture holding capacity, have been modified by repeated ploughing and more organic matter from crop remains, but are still poor in nutrients. Trials in the area indicated that crop yields can be improved significantly by nitrogen and phosphate fertiliser application during crop growth. However, small-scale farmers in the area rarely buy fertilisers due to the cost, poor knowledge about when to apply fertilisers, and rapid leaching of nutrients during heavy rains.

In both constituencies, residents are subsistence farmers, growing rain-fed crops such as pearl millet, maize, sorghum (*Sorghum bicolor*), bambara nuts (*Vigna subterraenea*) and other legumes and indigenous vegetables. The dominant crop is pearl millet, with <5% of cultivated plots planted with other crops. Vegetables and legumes are often planted

between millet. The area cultivated by each household varies between 2–4 hectares closer to the river and 3–6 hectares further inland[37]. This is partly a rainfall effect, with areas closer to the river receiving higher amounts of rainfall, but also an effect of population density and access to alternative sources of food, particularly fishing.

Figure 5: Small-scale crop farmer households in the Kavango East region are close to each other. Pearl millet is the dominant cereal crop. Most farmers plough with oxen or with hoes. Traditional landraces include a variety of melons.

More than 85% of farmers will plough their fields only after the first good rains have fallen, even though <50% of farmers own oxen or ploughs[38]. Women are more engaged in cultivation and carry out most of the work during the growing period, while men do most of the land preparation and ploughing. Reported risk management entails the planting of batches of crops after each extended rainfall event[33]. This would allow at least some portion to yield a harvest if extended spells of dry weather during part of the season reduce yields, while also resulting in less labour intensive harvesting by extending the harvest period over a longer period. Most farmers use seed from traditional crop varieties retained from the previous season for planting (Figure 5). An initial pilot study indicated that farmers are aware of the resilience and performance of different landraces to seasonal weather conditions[39], but it is difficult to apply farmer observations without actual data from crop trials.

[37] Mendelsohn & el Obeid, 2003. Sand and Water: A profile of the Kavango Region. Cape Town.
[38] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.
[39] Gobabeb, 2015. Assessment of the status of on-farm conservation of PGRFA in northern Namibia (draft).

Many farmers in the region keep cattle or goats (59% and 51%, respectively)[40], with the regional cattle herd double the size of the goat herd[41]. Only small numbers of pigs, donkeys, horses and sheep have been reported (<2% LSU – large [live]stock unit). No accurate recent livestock census numbers were available. The average number of animals per household varies considerably for those that have livestock, with *ca*. 9 cattle and goats, respectively, for households along the river and >20+ of each for individuals living deeper into the interior[36]. Joint ownership of cattle is common, while very few farmers own large herds (only 6% of farmers have 50 or more cattle). There is little difference between the number of animals kept by male and female-headed households, though *ca*. 30% more male-headed households have cattle than female-headed[36], mostly ascribed to income from wages invested in cattle.

There is fairly good evidence that livestock are rarely sold or traded, even between community members[37]. This may be attributed to the great value of oxen as draught power for ploughing, hauling goods such as water, wood and other produce, as an investment and hedging insurance, and as a measure of status and negotiating power. Other activities that provide a source of income include pensions, informal business (thatch grass, craft, trading), cash remittances and disability grants[36].

The Kavango East region was ranked second in vulnerability with the least adaptive capacity in Namibia's most recent Climate Change Vulnerability and Adaptation Assessment[42]. Some 55% of its population was identified as poor and living below the poverty line of N$ 377.76 income per month[36], with 17% malnutrition in children under the age of five[37]. Poor living conditions are exacerbated by a lack of sanitation, limited access to safe water (obtaining water directly from the Okavango River is the main source of water for large numbers of people) and a high incidence of debilitating diseases such as HIV/Aids, malaria, bilharzia and diarrhoea. It is estimated that most people will contract malaria at least once every wet season, while a survey of school children indicate >80% have intestinal or urinary bilharzia[36]. These parasitic infections that cause lassitude and sap energy are most prevalent during the wet season, which is also the most labour-intensive period in the agricultural calendar.

Drought is the most visible and readily felt weather-related hazard for inland farmers; and flooding for farmers along the Okavango River[38]. Droughts were more common in the last five years compared to the previous decade, which, though not diverging from the long-term norm, are an immediate concern for subsistence farmers without access to forecast information.

[40] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.
[41] Mendelsohn & el Obeid, 2003. Sand and Water: A profile of the Kavango Region. Cape Town.
[42] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.

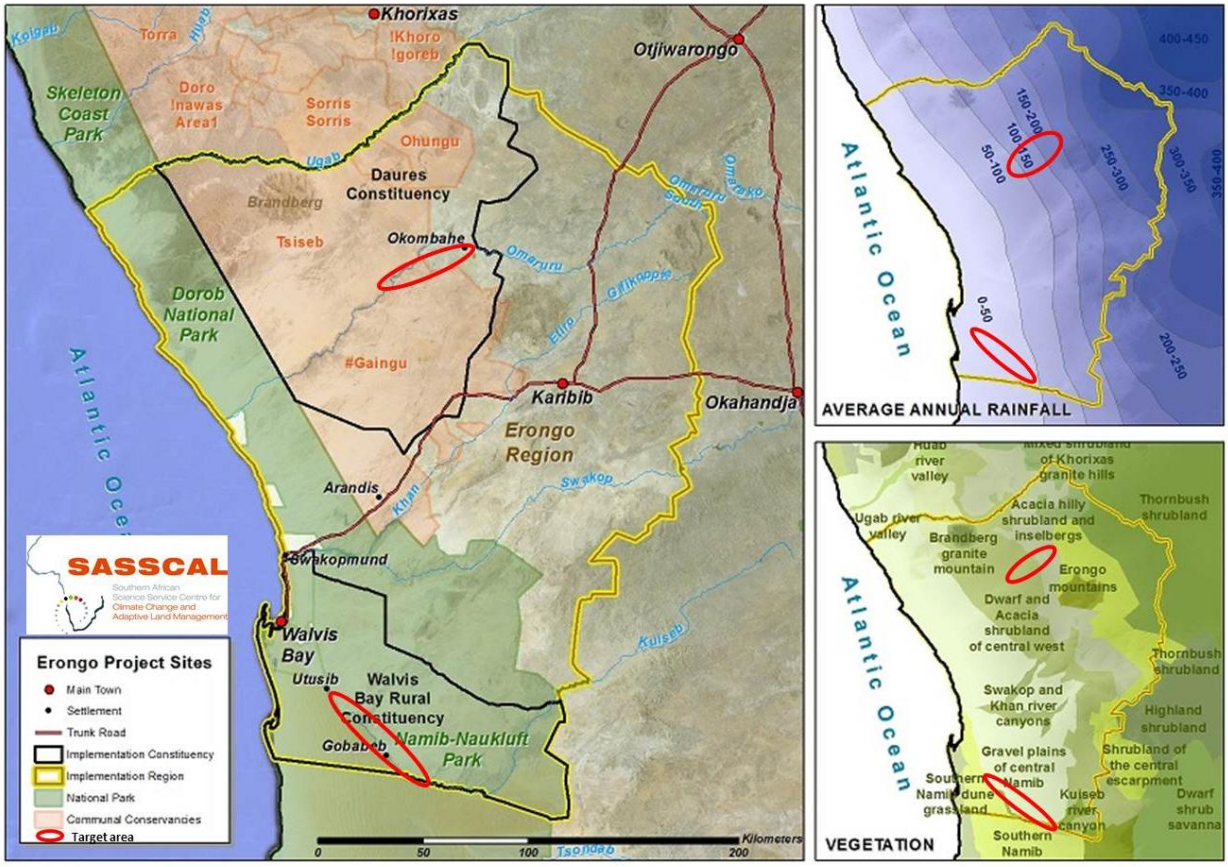


Figure 6: Programme sites in the Erongo region of Namibia.

The indigenous herding practices under desert conditions in the Walvis Bay Rural and Daures constituencies of the Erongo region cannot be more different (Figure 6). Dryland crop production in these areas is impossible, even though many households maintain small kitchen gardens with few vegetables for own consumption.

The ≠Aonin Nama or Topnaar people in the Walvis Bay Rural constituency reside along the Lower Kuiseb River in the Namib Naukluft and Dorob National Parks[43]. The Namib-Naukluft Park has been in existence since 1907, the Dorob Park since 2011. Both parks were established to conserve and protect the fragile ecosystems of the hyperarid Namib Desert. Mean annual rainfall varies between <20 mm and <50 mm, though during most years little or no rainfall occurs. Daytime temperatures range from the low forties during September to November and March to April, dropping to less than 10°C at night during the same period. Many of the Topnaar people have migrated to nearby urban centres in search of employment, e.g. Walvis Bay with its port and growing importance as a regional transport hub, and Swakopmund and Arandis serving the mining and tourism sectors. However, many Topnaar farmers still rely on traditional means of subsistence along the Kuiseb, where the narrow ribbon of riparian vegetation is the mainstay for their livelihoods.

The !Oegan Damara in the Daures constituency are predominantly livestock farmers under somewhat improved, but still marginal conditions. The Daures constituency covers some 17

[43] Dieckmann, *et al.*, 2013. Indigenous Peoples and Climate Change in Africa. Report on case studies of Namibia's Topnaar and Hai||om Communities. Windhoek.

752 km^2 of rugged topography, ranging in altitude from around 500 m amsl to more than 2500 m amsl, as it encompasses Namibia's highest mountain peaks. However, mean annual rainfall varies between 75 mm in the west to around 125 mm in the eastern parts, but with large variation in the amount and distribution of rainfall[44]. Daily temperature variation is less extreme than in the Namib Desert as night-time temperatures do not drop as rapidly, but the thermal environment may be even more challenging due to prolonged high temperatures from October to January in excess of 40°C during the day and more than 20°C at night. The area is dissected by numerous small drainage systems, all dry, and has shallow soils. The area is more vegetated than the Namib Desert, ranging from sparse desert shrubland in the west to arid thornbush savannah in the east. The sparse vegetation is mostly dominated by thorny shrubs and low densities of grass. As with the Topnaar, people from this area also migrate to urban centres in search of better opportunities, but over much larger distances.

Figure 7: Rural ≠Aonin Nama or Topnaar live in isolated settlements along the Lower Kuiseb River in the Namib Desert. Small-scale farmers keep livestock that are sustained by riparian vegetation

The rural Topnaar who still continue traditional lifestyles live in isolated farms and settlements along the Lower Kuiseb River (Figure 7) where traditional wells, and now boreholes that were drilled and equipped by government, provide water for households and livestock. Accurate statistics on this community are difficult to untangle and much of it is

[44] Mendelsohn, *et al*., 2002. Atlas of Namibia: A portrait of the land and its people. Cape Town.

inaccurate. There are around 130 households[45], 50 of which rely solely on farming[46]. Official figures suggest around three people per household[42], while other estimates indicated around 450 residents[41]. Livestock census data reflect that farmers kept a combined total of 540 cattle, 269 donkeys and horses, 2,219 goats and 148 sheep in 2014[41]. There is one primary school and clinic at Utuseb that serves a community spread along 130 km of river, with secondary schools and hospitals in the Walvis Bay harbour town. The interests of this Khoekhoegowab-speaking community are represented by the Topnaar Traditional Authority (TTA).

Figure 8: Rural !Oegan Damara live predominantly along the Omaruru River and its tributaries. Grazing is only available after adequate rainfall. Livestock are mostly sustained by sparse, shrubby vegetation.

The !Oegan Traditional Authority represents a Khoekhoegowab-speaking Damara community that live on scattered farms, informal settlements, villages and towns in the Daures, Omaruru and Karibib constituencies, though most !Oegani live in the Okombahe area (Figure 8). Population density in the Daures constituency[42] is only 0.6 persons per km^2, which is one of the lowest for an inhabited area in the world, with only 6,932 adult residents in 2011. Some 23.6% of households in the Daures constituency reported farming as their main source of

[45] Gobabeb unpublished data from irregular surveys 1998–2014.
[46] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.

income, although 53.8% of households kept livestock. About 48.3% of households live in traditional households, while 84.8% predominantly cook food on wood fires[47]. These 2011 demographic statistics illustrate the relative importance of livestock for food security in an area with very limited agricultural potential.

Both the Kuiseb and Omaruru Rivers in the Walvis Bay Rural and Daures constituencies, respectively, are ephemeral rivers that only flow for brief periods during exceptionally wet years[48]. These brief floods almost never reach the sea as most of the discharge is absorbed into the sandy river beds. However, water extracted from the subterranean aquifers of these two rivers sustains large towns and Namibia's desert mining sector. The subterranean flows also sustain large trees along their river banks. These belts of vegetation are considered linear oases in the desert and semi-desert ecosystems of Namibia (Figure 9). Livestock and wildlife mainly depend on browse from the trees and shrubs along these rivers and the small subsidiary feeder rivers as grass on the adjacent rangeland is sparse and rapidly dries out at the end of the brief wet season (February to April). Adequate grazing is only available during rare, exceptionally wet years.

The major source of livelihood for ≠Aonin Nama and !Oegan Damara farmers is livestock farming (cattle, goats and sheep). Donkeys and rarely horses provide for most of their transport needs as vehicles are uncommon. Of particular interest is that keeping large livestock is not considered feasible in desert ecosystems such as the Lower Kuiseb due to (i) very poor availability of grazing, mostly none at all; (ii) the perceived adverse impact of cattle on desert ecosystems; (iii) the limited availability of water at very few locations; (iv) and poor production due to the physiological stress that high temperatures impose on cattle. Yet historical reports suggest that the Topnaar have kept substantial herds of cattle in the past[49], while livestock numbers in the Lower Kuiseb have steadily increased over the past decade[50]. The results of rapid rangeland assessments carried out by Gobabeb in recent years to evaluate the impact of increased livestock numbers on the environment were unable to confirm adverse impacts. That does not imply that such impacts do not occur, but rather that either the ecosystem is more robust than previously presumed; or livestock impact is less detrimental than expected.

In the Okombahe area, the !Oegan Damara follow the more traditional stock-post herding pattern. Different to the Topnaar, their animals do not rely on the riparian vegetation alone, but browse and graze every day in a wheel-spoke pattern away from the central water-point and night-time enclosure. Grazing distances, and grazing impact, of different livestock species differ. Over time, the impact of this grazing pattern may become noticeable, e.g. bush encroachment and an increase in unpalatable species, but currently there is almost no reliable information to evaluate this impact. On communal rangelands it is not the area potentially available for grazing that is important, but the actual area as determined by water availability; the grazing distance of different species; the frequency of grazing; and the number of livestock[51]. Abundant information on these variables has been determined and is

[47] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.
[48] Jacobson, *et al*., 1995. Ephemeral rivers and their catchments. Windhoek.
[49] Kinahan, 2001. Pastoral nomads of the Namib Desert: the people history forgot. Windhoek.
[50] Gobabeb unpublished data from irregular surveys 1998–2014.
[51] MAWF, 2012. National Rangeland Management Policy and Strategy. Windhoek.

applied by commercial livestock producers in Namibia, but information applicable to small-scale farmers is deficient in quality and replicability.

The main forage resource in the target areas is the presence of relatively abundant riparian vegetation. Along the Lower Kuiseb, productive rainfall events are exceptions to the desert climate. During rare years when rain occurs, the desert plains may be transformed into lush grassland. Most of these grasslands, however, are not accessible to the small-scale Topnaar livestock producers. They live in a national park, thus the areas in which they may pursue livelihood activities are prescribed. More importantly, there is no water, so the grazing is effectively unavailable for livestock. The Topnaar livestock mostly eat pods produced by *Faidherbia albida* (Family Fabaceae), the most important riverine fodder tree. Farmers may assist the animals in times of scarcity by knocking down pods. Contrary to expectations, floods therefore cause deterioration in livestock condition by washing away pods and limiting access by livestock to browsing areas[52]. Topnaar farmers consider floods as a major climate hazard as they rarely receive early warning about flood events. Floods may result in livestock losses by drowning in addition to the collateral decline in livestock condition.

Livestock are mostly reared to supply meat and are marketed when ready. She-goats will be milked to supplement household diets, but there is no market or transport system to support dairy production. There are a few communal farmers with large numbers of livestock, but most farmers in the target areas only have a few animals.

Topnaar and Damara farmers distribute some animals to extended family, while accepting animals in return, thus spreading the risk of losing all their animals to droughts, disease or persistent predator attacks. The keepers of such borrowed animals may use the milk and receive some of the progeny. However, the majority of the offspring still belongs to the owner. Small-scale farmers therefore often look after animals belonging to richer relatives, mostly wage-earners in urban centres, thus livestock numbers do not represent the real socioeconomic situation of these farmers. These livestock farmers usually examine prevalent conditions to decide their management practices. Returns from livestock production are a long-term investment of labour as it takes a year or more for animals to mature. Despite their experience, farmers remain forever hopeful for a good season, thus are often caught unprepared by drought. The condition of their animals then slowly deteriorates as they are unmarketable. When the animals eventually die, the farmers may lose years of investment.

Historically, people migrated with their animals to where some pasture was still available[53], but that is no longer feasible. Water is essential as most livestock have to drink at least once a day. However, almost all water-points on communal rangelands now have permanent residents. Commercial livestock producers on freehold land have their own challenges during droughts, thus they will rarely accommodate small-scale farmers. Extensive areas of freehold land have also been converted for game farming or tourism, which is widely considered to be incompatible with livestock production. The traditional risk management strategies of these small-scale livestock producers have therefore been constrained to only a few elements: (i) lending animals to extended family elsewhere; (ii) cutting down branches or collecting pods for feeding animals; (iii) hoping for a good wet season or government drought relief, and; (iv)

[52] Dieckmann, *et al.*, 2013. Indigenous Peoples and Climate Change in Africa. Report on case studies of Namibia's Topnaar and Hai||om Communities. Windhoek.
[53] Jacobson, *et al*., 1995. Ephemeral rivers and their catchments. Windhoek.

keeping as many young female animals as possible for more resilience, to replenish herds and for dairy products.

These small-scale livestock farmers cannot depend on their herds alone. Production is low, so only a few animals are sold every year or slaughtered to sell the meat. Only some milk is used. Most households grow some vegetables, but the area is too dry and water too valuable for extensive gardening. Most households therefore also gather natural products – the traditional harvest of the Topnaar is !nara melons and various berries, while the Damara people traditionally harvested a range of berries and grass seeds from harvester ants nests. In both groups the harvested products were traditionally processed and then dried to feed the household over the next year, but are now often sold to provide some cash income. A major source of income is old-age pensions paid to elders, while food aid, remittances and rare employment as casual labour also contribute to household economies[54].

Unpredictable and varying rainfall patterns in a marginal landscape are the most important cause of vulnerability in these communities. Relative food insecurity and malnutrition contributes to their vulnerability, particularly during periods of drought when food prices may rise rapidly and prices for livestock fall just as rapidly[55]. Impoverished communities do not have the economic resilience to cope with such price fluctuations and communities that are already malnourished are likely to be worst affected. In addition, weak linkages between producers and markets and lack of transparency in local markets further reduce resilience. Judicious management of rangelands in the vicinity of water sources are therefore the most important adaptive strategy that these small-scale livestock farmers can adopt, while appropriate measures to improve their interactions with markets and more effective insurance against price fluctuations may increase their resilience.

Programme Objectives

The main objective of this programme is to improve the preparedness and adaptive capacity of small-scale farmers in Namibia by addressing their specific information needs and strengthening appreciation for and use of traditional mechanisms to ameliorate climate variation in agricultural systems. The most vulnerable Namibian communities at risk from climate change all rely on small-scale farmers in their surrounding areas, thus appropriate climate adaptation measures to support farmers can be expected to have a broader cascade effect. As most Namibian small-scale farmers rely on livestock as well as crops for their livelihoods, the relative importance of each varying according to the climatic conditions in their area, this programme will focus on the shared needs of the dual production systems, as identified through consultation.

Small-scale farmers are conservative in adopting new information and prefer to continue tried and tested traditional farming methods as they do not have the resilience to risk failure to produce in any given year, while scientifically trained agricultural officers often have a poor understanding and appreciation of traditional farming systems, and associated risks. Elsewhere it has been demonstrated that traditional practices lead and inform the

[54] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.
[55] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.

development of scientific innovations. Bridging that communication gap through appropriate interventions is a vital element required for climate-smart agriculture at the local level, i.e. integrating local and scientific knowledge systems to increase resilience and adaptive capacity for coping with climate uncertainty at appropriate time frames.

As climatic conditions and traditional practices in Namibia vary hugely, the programme will develop appropriate agricultural information and communication interventions under different conditions, as determined by prevailing subsistence farming systems. Two distinct farming systems dominate, i.e. crop and livestock production, with shared weather related risks and climate change vulnerability. The programme will contribute to the main objective through the following outputs (Table 1):

Output 1.1: On-farm retention of crop varieties to reduce vulnerabilities and strengthen adaptive responses of subsistence crop farmers. This will improve household food security and income generation by validating and incorporating traditional crop varieties and alternative crops into agricultural production systems, promoted through official and NGO agricultural extension services. These services are currently mainly focused on promoting improved crop cultivars and conventional agricultural production practices.

Output 1.2: Improved information on the agronomic potential of traditional crop varieties and their attributes for climate adaptation will allow agricultural extension and research programmes to recognise and incorporate validated information on traditional varieties, cultivation systems and alternative crops for the adoption of climate-smart adaptation measures by traditional small-scale farmers.

Output 2.1: Greater efficiency in livestock and rangeland monitoring practices will increase resilience of indigenous herders in marginal desert areas to climate variability. This will support the effective implementation of Namibia's rangeland management and livestock production policy and improve income generation by indigenous herding communities in desert ecosystems, in particular. It will also assist livestock producers throughout Namibia to confront the future effects of predicted climate change by offering appropriate risk management measures for adoption, with special reference to small-scale pastoralists.

Output 3.1: Improved short-term (1–7 day) and seasonal agrometeorological forecasting by local specialists for Namibian agricultural production areas is vital for farmers to respond to expected weather conditions and adverse climate conditions. As this is not yet available, this element will develop local Namibian capacity to interpret and model weather patterns for agrometeorological forecasting and early warning advisories at appropriate timescales to farmers, agricultural extension officers and local authorities. Competent national agencies exist but require skills development in order to improve weather forecasting and early warning advisories.

Output 3.2: Local communication and dissemination networks will empower agriculture extension officials and small-scale farming communities to respond timeously to seasonal forecasts. This will initiate the implementation of the Namibia's National Climate Change Strategy and Action Plan by testing appropriate communication and dissemination systems, as well as provide for feedback from users on the accuracy of forecasting communiques.

Tested protocols will allow for expansion and implementation at the national level by competent agencies.

Programme Components and Financing

Table 1: Programme components, outputs and expected outcomes.

Programme Components	Expected Concrete Outputs	Expected Outcomes	Amount (USD)
Component 1: Promote preparedness and adaptive capacity of small scale crop farmers to climate change and variability through on-farm conservation of traditional crop varieties by integrating scientific and local knowledge.	**Output 1.1:** On-farm retention of crop varieties to reduce vulnerabilities and strengthen adaptive responses **Output 1.2:** Improved information on the agronomic potential of traditional crop varieties and their attributes for climate adaptation	**Outcome 1:** Improved food security and income generation from promoting validated traditional varieties, alternative crops and cultivation methods based on advance warning on appropriate time frames	**312,700**
Component2: Promote climate-smart herding practices for indigenous herding communities in desert farming areas	**Output 2.1:** Greater efficiency in livestock and rangeland monitoring to improve resilience by indigenous herders in marginal desert areas	**Outcome 2:** Improved rangeland management and livestock production by indigenous herding communities in marginal desert ecosystems	**237,750**
Component 3: Access to short-term and seasonal weather forecasting improves the resilience of small scale farmers to cope with climate variability	**Output 3.1:** Improved short-term (1–7 day) and seasonal agrometeorological forecasting for Namibian agricultural production areas provided by local specialists **Output 3.2:** Local communication and dissemination networks empower agriculture extension officials and small-scale farming communities to respond timeously to seasonal forecasts	**Outcome 3:** Established Namibian capacity to interpret and model climate patterns for agrometeorological forecasting with tested protocols for communicating forecast information to small-scale farming communities	**275,200**
Programme Activities Cost (A)			**825,650**
Programme Execution cost (B)			**86,000**
Total Programme Cost (A + B)			**911,650**
Programme Management Fee (C)			**77,490**
Amount of Financing Requested (A + B + C)			**989,140**

Projected Calendar

Milestones	Expected Completion
Start of programme (Inception workshop)	January 2016
Mid-term revue	April 2019
Programme closure	June 2021
Terminal review	April 2021

PART II: PROGRAMME JUSTIFICATION

A. Describe the programme components, particularly focusing on the concrete adaptation activities of the programme, and how these activities contribute to climate resilience.

This programme of work acknowledges that the production systems of traditional Namibian farming communities, and those in adjacent regions, have evolved over centuries to cope with the inherent uncertainties of arid ecosystems. These farming systems have not emerged to produce excess produce for commerce or to support large urban centres, though exchanging produce or trading excess for improving lifestyles is an inherent part of successful farming. Production is therefore geared towards self-sustainability and food security of extended families, with long-term 'storage' of excess produce to bridge unfavourable periods.

The programme takes into account that small-scale subsistence farmers always live with thin margins of safety, thus cannot afford the luxury of experimentation by adopting radically new production systems that they may consider unproven, or securing capital to invest in improvements with uncertain returns in such a high-risk arid environment. The understandable conservatism of traditional farmers results in a schism between the communities most at risk from climate variability and the various technological, extension and social structures endeavouring to advise on and introduce imperative and innovative alternatives.

Therefore, the programme will attempt to address this duality of (i) traditional farmers already incorporated mechanisms that, though not adequate, allow them to cope with immediate, short-term climate variability, but not the potential long-term effects of climate change; and (ii) continuous knowledge generation and improved communication for science-based agriculture allow for effective adaptation to future climate conditions, but often fails to transfer new information effectively to subsistence farmers. Demonstrations that take cognisance of and include relevant elements from both traditional agriculture and science will encourage the adoption of appropriate change in agriculture production; improved climate monitoring and prediction; effective adaptation measures; and organisational structures for intervention.

As a cross-cutting issue, the programme will also improve Namibia's human resources to deal with climate change by involving university students at pre-graduate and graduate level in information gathering and outreach activities. Products appropriate for climate change adaptation at the community level have already been produced through past adaptation programmes elsewhere in Namibia, but have yet to effectively penetrate many local communities. This programme will distribute these products to ensure that knowledge and appreciation about projected future impacts of climate change and potential household level adaptation measures are being communicated to all stakeholders.

Component 1

"*Promote preparedness and adaptive capacity of small-scale crop farmers to climate change and variability through on-farm conservation of traditional crop varieties by integrating scientific and local knowledge*"

This component will be implemented in the Kavango East region of Namibia, specifically the Mashare and Ndiyona constituencies. The effects of future climate change in this area are uncertain, but will most likely include increased temperatures and greater climatic variability. As the traditional cropping systems have evolved to cope with variability, the main focus of this component is to strengthen and support small-scale agriculture by encouraging agrobiodiversity conservation and providing agrometeorological information. The programme will glean information from farmers through participatory processes for evaluation by specialists and provide agrometeorological advisory services as identified by the farmers themselves. This component will furthermore contribute to develop information in terms of establishing a legal framework to recognise Farmers' Rights, updating the National Seed Policy, as well as further refining the Strategic Action Plan (SAP) for Plant Genetic Resources for Food and Agriculture (PGRFA) of the Ministry of Agriculture, Water and Forestry (MAWF). The objectives and activities are furthermore aligned to the Namibia's National Climate Change Policy and Strategic Action Plan (NCCSAP).

This programme component (project) will mainly be executed by a sub-Executing Entity, the Legal Assistance Centre (LAC) in Namibia, which has a local office in the Kavango East region and appropriate experience, supported by the overall EE, the PC/PMU, the Directorate Agricultural Production, Extension & Engineering Services (DAPEES) of MAWF, and the National Plant Genetic Resources Centre (NPGRC) at the National Botanical Research Institute (NBRI) of Namibia. The programme will liaise closely with and involve the farmer's clubs that are being established through the conservation agriculture initiative coordinated by the Namibia Nature Foundation (NNF) in northern Namibia, including the Kavango East region, as well as the Farmer Support Project of Namibia's Agribank/giz. Additional liaison with other stakeholders, such as universities, will be established during implementation of activities. Formal mechanisms for coordination and information exchange with other programmes and initiatives, as well as traditional and official governance structures, would be a high priority during the first six months of the programme to ensure synergies and avoid beneficiary 'workshop fatigue'.

More than 95% of the people in Mashare and Ndiyona constituencies live in distributed farming communities, consisting of 1,871 farming households (804 female-headed), numbering 6,021 women and 4,831 men. Households rely on a combination of crop production, livestock and natural resources for their livelihoods, with crops grown in small fields contributing most of the food and cash income. Livestock are predominantly used for draught power and milk; fishing to augment their diet; and seasonal opportunistic collection of edible fruit and nuts, thatch grass, and wood for household use and informal trading. There are no manufacturing, mines, town or village councils, or other medium to large industries that provide options for alternative income generation. The majority of people residing in this area are therefore dependent on agricultural outputs, particularly crop production, whether they are traders, artisans, service providers, farmers, or even tourism beneficiaries. Knowledge about the possible effects and penetration of adaptive measures are very low. High population densities, especially in favoured areas close to the Okavango

river and major highways; extreme poverty; poor nutrient soils; low availability of livestock dung and low compost input for improving soil fertility; poor knowledge of appropriate fertilisers and pesticides; high incidences of diseases; low levels of education and technical skills; and out-migration by men to other areas in search of employment contribute to degradation and poor crop yields in the area. These non-climatic drivers have been considered during programme design. However, dryland crops are still the major contributor to household economies.

During recent consultations with farmers in the target community, it emerged that a variety of local phenotypes were cultivated (seven types of millet; three types of maize; five types of cucurbits). Farmers maintain a high level of crop phenotypes through traditional cropping systems with a low level of technology and use of agricultural interventions. The use of minor and or non-traditional crops such as wild spinach, beans, etc. was not assessed, as appropriate methodologies would need to be developed. However, it was observed that indigenous fruit and nut trees as well as a variety of edible plants were retained in fields or informally cultivated. All the farmers were using improved varieties of millet, but were also retaining and planting local phenotypes (or land races) for risk reduction and potential higher yields. A small percentage of younger farmers (<18%) were aware of improved agricultural methods (planned crop rotation and fertiliser application, conservation agriculture) and none were relying on agrometeorological information. Most farmers (>95%) recognised climate variability as a major concern, some of which (<30%) thought that some form of climate change may be occurring. However, all of the latter group were farming for less than 15 years.

The range of phenotypes and produce from small fields is evidently an important element of food security, yet the extension advice and services provided to these farmers are as yet unable to incorporate traditional coping mechanisms to not only deal with current climate variability, but also projected climate change. The FAO recognises that the retention of traditional crop varieties is an important reservoir for global food security, with local farming communities an important contributor to retaining agrobiodiversity. In the same vein, the conservation of orphan crops and wild crop relatives, as well as under-utilised crop varieties, with the concomitant recognition of the role of small-scale farmers in their development at local level, are accommodated in the mandate of the Regional SADC Plant Genetic Resources Centre (SPGRC) network, and the workplan of the NPGRC.

Output 1.1 will therefore focus on strengthening the informal system of maintaining on-farm conservation of PGRFA; improved understanding of traditional farming systems as an adaptation mechanism to climate variability; and imbedding monitoring mechanisms in farming areas to evaluate how traditional cropping systems and varieties perform over a period of time (Table 2).

Table 2: Activities and outcome of Output 1.1.

Output 1.1: On-farm retention of crop varieties to reduce vulnerabilities and strengthen adaptive responses		
Expected Outcome: Improved food security and income generation by validating and incorporating traditional crop varieties and alternative crops into agricultural extension services		
Activity 1.1.1	Collate information from farmers, agricultural extension and scientists on traditional agrobiodiversity coping strategies to	USD 42,400

	climate variability in the Kavango East Region	
Activity 1.1.2	Document current on-farm genetic crop diversity system in the Mashare and Ndiyona constituencies	USD 50,000
Activity 1.1.3	Develop suitable partnerships to maintain community seed banks of indigenous crops to enhance effectiveness for on-farm plant genetic conservation	USD 21,500
Activity 1.1.4	Strengthen seed exchange systems to enable a proactive response to agrometeorological climate information	USD 18,000

Activity 1.1.1

Some information on landraces that are currently being used by small-scale farmers in Namibia has been documented by various projects since independence, with additional anecdotal and *ad hoc* information scattered between various sources. This information has not been collated and is not easily accessible. Certain fundamental questions remain unaddressed, e.g. Which phenotypes are considered best under various rainfall and agroecological conditions; How often are these landraces planted and how extensively; Which alternative (or non-traditional) crops are harvested and what type of overt actions are taken by farmers in this regard; How are seed from different landraces stored and how do farmers characterise and/or identify these seeds; Do farmers exchange or trade in different types of seeds; How do farmers recognise a pending adverse or disastrous season and what measures do they implement to ameliorate impact? Information on these aspects, as well as additional questions that will be identified by collaborating scientists, are an essential part of planning follow-on activities within component 1.

This activity, which will consist primarily of participatory meetings with farmers, traditional leaders and knowledgeable specialists and community activists during 2016 and 2017, will therefore form a firm foundation for follow-on activities. It will collate information on farmer's perceptions on: (i) coping with and predicting short-term climate variation, e.g. which landraces are most suitable for specific conditions (agroecological, climate); (ii) what are the most significant alternative (non-traditional) farming produce; (iii) developing a traditional agricultural calendar; (iv) elucidating informal product exchange networks (especially for seed); (v) developing a climate history based on farmers' knowledge (droughts, high production, floods, notable temperature extremes, etc.); (vi) recollections of traditional and alternative crop responses to a farmers' climate history; and(vii) social consequences of farmers' climate history. The collated information will be made available through traditional and regional authorities to guide future development in the region. During this activity, specific farmers will be identified to participate in on-farm monitoring (Activity 1.2.1). This activity will also contribute to future consultation with farmers for the establishment of community seed banks (Activity 1.1.3) and seed exchange mechanisms for on-farm PGRFA conservation, in particular how these may be accomplished within the traditional agricultural system.

Activity 1.1.2

Information gleaned from participatory meetings with small-scale farmers and other informants (Activity 1.1.1) will be augmented by cumulatively surveying all farming households in 35 wards of the Mashare and Ndiyona constituencies to document on-farm PGRFA, seed storage practices, and alternative crops that are being utilised. All information will be recorded in accordance with established Prior Informed Consent practices in Namibia in which individuals have an inalienable right to selectively not provide elements or any

information. Personal information will remain confidential, except where individuals agree that some information may be shared for communication purposes with their immediate community, programme participants and other social development initiatives. Where information is used in reports, it will be depersonalised for statistical analysis or in rare cases with the consent of the individual for quotable exceptions.

This activity will be carried out over three growing seasons from 2017–2019. Observations on the performance of different landraces and other factors affecting crop production during the season, e.g. pests, weeds, diseases etc.; about specific alternative crops or natural products harvested, as well as observations on livestock production and natural phenomena will be recorded in consultation with farmer focus groups. These focus groups will be selected in consultation with the farmers themselves and additional advice from a coordination mechanism where other rural development initiatives active in the area will be represented. The composition of focus groups will specifically ensure an equal distribution in gender (40 female : 40 male) and age of active farmers. This will include a small focus group of !Kung San farmers at Kanovlei, some 170 km southwest of Mashare, to evaluate performance of traditional cultivation practices that have been transferred between groups. This will provide an initial comparative framework for spatial and cultural differences, and most importantly serve as a framework for transferring appropriate information, skills and resources to San minority farmers. Students from tertiary training institutions (universities and colleges) will assist in carrying out consultations with focus groups in order to develop a greater appreciation for the diversity of intangible cultural heritage knowledge, participatory research processes, and especially to promote climate change awareness. This inventory will provide a future baseline to determine the effectiveness of agrobiodiversity conservation in the region as part of NBSAP2; NCCSAP; and PGRFA SAP. The inventory will furthermore be the foundation for establishing and promoting community seed banks (Activity 1.1.3).

Activity 1.1.3

The draft Namibian PGRFA SAP recognises that effective on-farm conservation of crop landraces requires the participation of farmers, especially small-scale agronomists applying traditional methods. As previous surveys have shown that individual farmers rarely maintain the full range of local phenotypes, despite most experienced farmers being able to describe the different varieties, effective on-farm conservation should therefore be approached as a communal effort. As highlighted previously, the FAO identified on-farm conservation of PGRFA and the availability of seed as an important element of climate change adaptation.

This activity will specifically promote communication and sharing platforms in ten of the most promising wards (Activity 1.1.2), under the leadership of traditional structures (Activity 1.1.1), through which farmers can share information on the availability and performance of landraces; the most effective, low-cost storage mechanisms; and other agricultural information of interest. These incipient farmer associations will incorporate or expand similar local networking platforms such as the envisaged farmers' clubs for conservation agriculture (NNF) and various natural resources conservation committees (fish, timber, thatching grass, crafts, wildlife, etc.). The development of such platforms will lead to the establishment of at least six community seed banks, with inventory and user protocols. Technical support for this activity will be provided by the National Plant Genetic Resources

Centre within MAWF as part of their operational workplan. The NPGRC has been consulted and has confirmed their commitment to this activity.

These sharing platforms will also serve as an entry point for other forms of community development. The Facilitator and PC will communicate specific training needs, identified by participants themselves, to appropriate agencies for development assistance that may assist farmers in developing such networks into registered farmers' associations. A variety of other initiatives offer development assistance to communities, e.g. fiscal transparency, business planning, legal aid, organisational and leader training, computer skills, marketing, etc. The only requirement is that communities need to be sufficiently organised and have specific goals in order for such assistance to be scheduled. The FSP, consulted during programme preparation, for example, offers topic-related short courses and mentoring services that potentially could be directed to meet specific needs identified by the target community.

Activity 1.1.4

Previous surveys indicated that individual farmers, or even groups of farmers, may desire to obtain particular traditional varieties that may no longer be locally available due to a wide-scale uptake of various improved cultivars of staple crops. Seeds of such traditional phenotypes are usually available elsewhere, but farmers do not have the information network to know about such sources. In addition, farmers may wish to make use of agrometeorological forecasting to exploit favourable conditions or reduce risk when a difficult cropping season is expected by obtaining specific traditional varieties. Communal seedbanks (Activity 1.1.3) will enable farmers to exploit such opportunities by establishing appropriate communication and information exchange mechanisms between small-scale farmers in different areas. This should be effected mostly through informal trade, but has the potential to be monetised. The primary goal of such seed exchange mechanisms, however, would be to ensure that farmers can effectively communicate the availability of or desire for specific types of seed with each other. This activity will assist representatives of established community seedbank organisations to visit, exchange ideas and trade seeds with farmers from other regions of northern Namibia. This activity may serve as a template for the establishment of community seedbanks elsewhere.

Output 1.2 will focus on developing information on the production potential of traditional crops and farming systems for including relevant elements into adaptation measures to cope with climate variability; improving Namibia's capacity to investigate, understand and describe under-recognised PGRFA contributing to farmers' resilience; and providing agrobiodiversity information with imbedded monitoring mechanisms to evaluate information uptake by farmers and the performance of traditional cropping systems and varieties (Table 3).

Table 3: Activities and outcome of Output 1.2.

Output 1.2: Agricultural extension services include **i**mproved information on the agronomic potential of traditional crop varieties and their attributes for climate adaptation		
Expected Outcome: Agricultural extension and research programmes recognise, incorporate and further validate information on traditional varieties, cultivation systems and alternative crops to improve food security and income generation resilience		
Activity 1.2.1	On-farm trials by participating farmers on yields and performance of traditional varieties under different conditions for future testing	USD 30,000

	at agricultural development centres (ADCs) or research stations	
Activity 1.2.2	Develop local capacity to analyse crop genetic resources through genetic mapping of local maize landraces in north-central Namibia	USD 56,000
Activity 1.2.3	Contribute to germplasm and passport data collecting to fill gaps in national collection	USD 6,000
Activity 1.2.4	Develop knowledge on traditional agrobiodiversity systems by providing top-up bursaries for advanced study	USD 50,000

Activity 1.2.1

Participatory consultation and inventories (see Activity 1.1.2) are unlikely to result in sufficient information about traditional crop yields for incorporation into extension services and advice to farmers, or to inform effective adaptation action plans. In addition, available information on soil types and climate patterns in the Mashare and Ndiyona constituencies suggest that improved crop suitability zoning is required for both extension and on-farm performance monitoring of different landraces. This activity will be carried out through participation by farmer's focus groups (Activity 1.1.2), involving 40 female and 40 male farmers, by monitoring yields of selected landraces under different conditions along a north to south transect from the Okavango River into the Kalahari woodlands. These on-farm trials will be carried out on already cleared and well-established agricultural fields in 20 wards. Participating farmers will be encouraged to cultivate specific landraces over three growing seasons from 2017–2019 according to their normal farming practice. The same landraces will be cultivated at Mashare and Bagani agricultural research stations using more advanced production methods (fertilisers, conservation agriculture). The Directorate of Agricultural Research and Development (DARD) has been consulted and have committed to avail facilities and participate in this activity.

As small-scale farmers do not have the resilience to afford experimentation, but the data on yields by different phenotypes under different climatic and agroecological conditions are required for verification, monitoring of variations in production, crop development and other biophysical parameters shall be supported by appropriate compensation to participating farmers. On-farm and on-station assessments will be carried out by the farmers themselves as well as involving students and mentors from the nearby Mashare Agricultural Development Institute (MADI) as well as relevant campuses and departments of Namibian universities (facilitated through Activity 1.2.4). Some biophysical parameters shall require laboratory analysis. Information on the results from this monitoring activity will be archived together with voucher accessions at the NPGRC (Activity 1.2.3). The yield traits will be made available to community seed banks to assist farmers to select preferred landrace material. Monitoring trials will also serve as demonstration plots for informal and formal training in techniques and climate-smart planning from 2017–2020 for farmers from the Kavango East region and students from tertiary training institutions. These on-farm trials will generate information on desirable traits and potential yields under different conditions that may be incorporated into agronomical extension services and small-scale farmer risk management and adaptation planning. This knowledge will also be incorporated in printed information in local vernaculars as long-term advisories.

Activity 1.2.2

Molecular techniques to characterise PGRFA, whether domesticated or wild, are advancing rapidly world-wide. Some capacity exists in Namibia, but there is currently no molecular scientist with appropriate training and experience to carry out genetic characterisation of

cereals or grasses. Analysing and mapping molecular characteristics to elucidate the occurrence of various phenotypes for PGRFA is more accurate and cost effective over large areas and time than using morphological and physiological typology, and the standard for international comparison. Establishing Namibian expertise to develop and interpret molecular typologies is therefore a priority area for action in the draft PGRFA SAP. Molecular analytical services such as next-generation sequencing are commercially available and will be outsourced, thus knowledge rather than technology is the constraint.

This activity will focus on maize as a case study. Of the various staple crops, the rapid replacement of traditional maize landraces with highly improved varieties over the past decade is particularly noticeable, including genetically modified (GM) maize in neighbouring countries. Maize was probably originally introduced by Portuguese colonists to neighbouring Angola during the 16th–17th Century, thus the Namibian and Angolan traditional landraces may be more genetically diverse than elsewhere in the subregion. This activity will develop local expertise at a PhD level for future molecular analysis of traditional and alternative crops. The initial focus on local maize cultivars will clarify the impact of accelerated conversion to improved varieties as was observed over the last twenty years, which would augment information from Activity 1.1.2 to understand trends in loss of genetic diversity. This capacity development will be carried out in collaboration with the National Commission on Research, Science and Technology (NCSRT) to support future monitoring of transboundary GM contamination into maize producing areas in Namibia.

Predictions from crop modelling suggest maize to be severely impacted by climate change in southern Africa. The adoption of more appropriate cultivars for cereal production, specifically maize and millet, has been suggested as an appropriate adaptation measure. However, crop modelling studies were also criticised for not distinguishing between different cultivars and for using inadequate production information. Thus, in addition to the specific objective of this activity to develop local technical expertise in molecular typology of cereal landraces in Namibia, it will also contribute to climate change adaptation options in southern Africa. The technical expertise will allow for rapid screening for desirable traits in cereals in future, which may facilitate the development of additional improved cultivars from locally adapted landraces for the benefit of small-scale farmers.

Activity 1.2.3

Archiving voucher accessions and associated information of traditional crop varieties and alternative crops for future use will be an integral part of Activities 1.1.2 and 1.1.3. Voucher materials and associated passport data will be deposited in Namibia's national PGRFA repository in collaboration with the NPGRC. This activity will train and equip programme participants with the knowledge, skills and materials to improve and fill gaps in the national collection. Staff of the NPGRC will be encouraged to improve their professional skills through graduate studies (Activity 1.2.4). This will ensure that traditional cultivars are safeguarded and accessible if required by communities in future, particularly after disaster events. Community seed banks would also be able to draw on the information and expertise of the NPGRC.

Activity 1.2.4

Namibia may have the policies, institutions and commitment that allows appropriate climate change adaptation to take place, but is severely constrained in terms of qualified

human resources to start addressing the diverse information requirements to inform and monitor implementation of practical adaptation measures. For this reason, most of the previous climate change adaptation projects have focussed on (i) strategy and policy development; (ii) information dissemination and awareness campaigns; (iii) high level assessments and scenario development; (iv) technological development; and (v) other such measures that can be accomplished by drawing on a small community of specialists. Practical intervention through direct action requires skilled people to direct activities and to measure the outputs of those activities. This programme, for example, requires *inter alia* skills for sociological and anthropological interpretation to define household and cultural variables; agronomy skills for agroecological zoning, crop production and yield assessment; crop modelling and prediction testing; and assessing and describing morphological and molecular traits of crop cultivars.

Skilled practitioners in almost all these areas are rare in Namibia, but it is feasible to develop essential skills by engaging emerging and early career scientists. This activity intends a measurable improvement in the skilled human resources by training three women and three men to assist communities in practical measures for climate change adaptation. This activity will identify and engage appropriate university graduates as facilitators or early career professionals to pursue academic qualifications in relevant disciplines by analysis and interpretation of the various activities in component 1.

This activity will invite competitive applications for top-up bursaries, or study grants, through annual calls advertised at university campuses and collaborating institutions. These applications will be evaluated by a panel consisting of the Chief Executive of the EE, component execution Facilitators and Chief Executives of collaborating institutions, after screening by the PC. Applications will be evaluated based on direct value to activities; the quality of applicants; the relevance of the suggested study discipline; the syllabus of the suggested academic institution; and the academic mentorship that will be provided to the applicant. Study grants will be capped and favour direct engagement with the programme, while being weighed in favour of early career professionals, applicants from the programme area, and defined minority groups. At the same time the review panel will also evaluate and comment on the progress of previous grantees based on semi-annual progress reports from the grantees themselves as well as their mentors. Communicating the results of activities are important for climate change awareness and the global effort to adapt to climate change, as well as professional development, thus recipients of top-up grants and the wider academic community in Namibia will be encouraged to produce tangible products (e.g. academic papers for peers, communication products for local communities) through a competitive annual award for the best academic and awareness product.

This activity will engage a cadre of young professionals in providing scientific services to small-scale farmers. The training will be undertaken in a participatory manner with small-scale farmers to ensure reciprocal skills transfer and foster mutual appreciation. The knowledge generated through the qualifying research will benefit farmers in Kavango East region as it will generate factual, region-specific information that responds to a need for practical adaptation measures. It is envisaged that the expertise that has been established through this activity will continue to contribute to the National Agricultural Research System in the longer-term, particularly as regards to climate change adaptation.

Component 2

"Promote climate-smart herding practices for indigenous herding communities in desert farming areas"

Livestock production on natural rangelands is by far the most dominant agricultural activity over most of Namibia and an essential source of income for the majority of communities most vulnerable to climate change. Introducing effective adaptation measures would require a variety of approaches and understanding of likely outcomes at different scales. This component will contribute to the need to understand how climate change may affect livestock production, how attributes of local herding practices may change in response to changes in climate, and which practical rangeland management measures may be transferred and adopted by small-scale livestock producers that are most vulnerable. As indigenous Namibian people have been herding livestock for more than 2000 years across the spectrum of climate variability in Namibia, from hyperarid desert to mesic woodland savanna, understanding and communicating traditional approaches to cope with climate extremes may allow communities that keep livestock in areas that will experience more dramatic future changes to adopt appropriate practices.

This component will be implemented in two areas of the Erongo region of Namibia, specifically the Walvis Bay Rural constituency in the hyperarid Namib Desert and in the arid savanna of the Okombahe (/AGomeb) area of the Daures constituency. Distinct cultural entities of the Khoi minority in Namibia live in the two areas; the ≠Aonin Nama or Topnaar along the lower Kuiseb River in the Walvis Bay Rural constituency and the !Oegan Damara along the middle reaches of the Omaruru River in the Daures constituency. Although the total number of people in these two areas are small, with a low density of households distributed over a large area, rural households of these minority groups depend on small numbers of livestock or gathering natural products for their livelihoods with almost no recourse to alternative incomes apart from migration to urban centres or remittances from extended family. Yet the Topnaar people have been living along the lower Kuiseb for *ca*. 800 years and prospered in the past from livestock production, while livestock numbers owned by Topnaar farmers have been increasing over the past two decades without major discernible impacts on the rangelands and riparian vegetation utilised by their livestock. The !Oegan Damara in the Okombahe area have a similar long history of keeping livestock along the Omaruru River, but they utilise rangelands differently to the Topnaar and broadly similar to livestock production practices by small-scale Khoi farmers in the southern and western regions of Namibia. Other Namibian small-scale farmers with livestock are living in more mesic savanna areas than the two programme locations for this component and have different approaches to keeping livestock that are broadly similar to commercial livestock production of the early to mid-20th Century in southern Africa.

Changes in vegetation predicted from climate change effects are negligible in the Namib Desert but considerably more pronounced in Namibia's rangelands. The most pronounced effects are related to a considerable rise in surface temperatures, reduced range of minimum temperatures, increase in carbon-dioxide levels, and changes in the soil moisture balance from increased evaporation and evapo-transpiration. Some of these effects are, for example, implicated in the bush encroachment phenomenon, which negatively impacts grazer production systems. Studies to evaluate the effect of higher temperature regimes on

livestock suggest reduced productivity due to lower reproduction rates, decreasing yields of milk production, slower growth rates and a higher incidence of vector-borne diseases. Very low population densities in remote areas; extreme poverty; low levels of education; limited access to services; isolated water sources; and stocking of rangelands by non-residents contribute to vulnerability of these communities.

Topnaar farmers, and to a lesser extent farmers from other Khoi groups, have managed livestock under hot, arid conditions for centuries. Most of the available information on livestock production by Khoi herders was generated by anthropologists and archaeologists and not animal husbandry or rangeland specialists, thus specific information that may allow the transfer of traditional knowledge to other small-scale livestock herder communities is inadequate. This component will therefore develop a comparative framework and decision-making matrix to assess and quantify small-scale livestock production; to evaluate the quality and condition of key resource areas and critical resources (water, grazing); to evaluate the condition and performance of livestock; and to predict which interventions may effect change and at what cost. It is envisaged that simple monitoring tools, informed and developed through detailed scientific knowledge, would enhance the adaptive capacity and resilience of stock farmers in very arid, high-risk and marginal desert areas. This component will therefore also contribute directly by providing information on communal rangeland management practices and assist in developing community-based rangeland management actions in support of Namibia's National Rangeland Management Policy and Strategy that is being executed by the Ministry of Agriculture, Water and Forestry (MAWF), and will be aligned to the EU-funded project "Namibia Rangeland Management Policy and Strategy Implementation", hosted by the Namibia Agricultural Union.

This activity will be executed by Gobabeb, supported by the Directorate of Agricultural Research and Development (DARD) and local offices of the Directorate of Agricultural Production, Extension and Engineering Services (DAPEES) of the MAWF. Strong linkages will be pursued with the traditional authorities that are responsible for communal rangeland management in the two areas, the Farmer Support Project (FSP) of Namibia's Agribank/giz, and the EU-funded project on developing and testing a rangeland production early warning system with livestock farmers in Namibia that is being implemented through Agra ProVision. A consultative mechanism for coordination and information exchange with other programmes and initiatives, as well as traditional and official governance structures, would be established during the first six months of the programme to ensure synergies. The Facilitator will routinely liaise with the relevant traditional authorities, the FSP, DARD and DAPEES (MAWF) and the Directorate of Regional Services and Parks Management (within MET) while carrying out field activities. The broader Lower Kuiseb and Okombahe farming communities will be kept informed about progress and significant results through appropriate information channels.

Output 2.1 will therefore focus on evaluating and quantifying the livestock management practices of small-scale farmers in the Walvis Bay Rural and Daures constituencies of Namibia to introduce simple risk-mangement measures developed in collaboration with farmers and specialists. The measures will improve resilience to short-term climate variability and bring about greater efficiency in livestock production and improved rangeland management by small-scale farmers in marginally suitable desert areas (Table 4).

Table 4. Activities and outcome of Output 2.1.

Output 2.1: Greater efficiency in livestock and rangeland monitoring to improve resilience by indigenous herders in marginal desert areas		
Expected Outcome: Improved rangeland management and livestock production by indigenous herding communities in marginal desert ecosystems		
Activity 2.1.1	Document the livestock herding practices in the Lower Kuiseb (Walvis Bay Rural Constituency) and Okombahe (Daures Constituency) areas	USD 24,000
Activity 2.1.2	Track livestock activity with seasonal assessments of livestock condition in grazing areas	USD 59,600
Activity 2.1.3	Determine the seasonal availability and nutritional qualities of available feed in grazing areas	USD 55,150
Activity 2.1.4	Promote farmer's associations for small-scale livestock farmers, e.g. Lower Kuiseb and Okombahe Farmers' Associations	USD 23,000
Activity 2.1.5	Prepare Walvis Bay Rural and Daures constituency risk management / adaptation plans based on vulnerability assessments and seasonal livestock and grazing condition monitoring	USD 40,000
Activity 2.1.6	Test a livestock production forecasting information system in the Lower Kuiseb area	USD 12,000

Activity 2.1.1

The programme will be initiated at an inception meeting for all farmers, arranged under the auspices of the relevant traditional authority. As it is unlikely that all affected farmers will be able to attend, and as the informed consent of individual farmers is required, all households along the lower Kuiseb and the middle Omaruru rivers will be visited during the first two years (2016–2017) for permission to (i) carry out scheduled surveys on the condition and numbers of their livestock; (ii) evaluate the condition of their rangelands; (iii) monitor the movement of their livestock; (iv) verify the quality and condition of water sources; and (v) evaluate on-farm livestock management infrastructure.

Identified farmers will participate in on-farm monitoring and more extensive consultation through focus group discussions. The establishment of the Farmers' Focus Groups (FFG) will be facilitated and additionally supported by DAPEES and the FSP. Focus group consultation will consist primarily of participatory meetings with farmers and traditional leaders from 2016–2018 to document specific practices about the keeping and management of livestock. In addition, this activity will record farmer's perceptions on (i) how they cope with and predict short-term climate variation; (ii) animal responses to heat and drought; (iii) developing a climate history based on farmers' knowledge (droughts, high production, floods, notable temperature extremes, etc.); (iv) recollections of livestock responses to farmers' climate history; and (v) social consequences of farmers' climate history.

Regular feedback to farmers about findings from the programme will be scheduled in conjunction with notable meetings, e.g. traditional festivals, farmers' information days, etc. Information on these aspects is integral to developing and testing a practical decision-making matrix. The activity will involve students from universities to foster a better appreciation of future challenges for small-scale livestock producers that may emerge due to the effects of climate change. . The collated information will be made available through traditional authorities to guide future development of the communities. During this activity,

specific farmers will be identified to participate in rangeland and livestock monitoring (Activities 2.1.2 and 2.1.3). This activity will also contribute to future consultation with farmers for the establishment of farmers' associations (Activity 2.1.4) and constituency risk management planning (Activity 2.1.5).

Activity 2.1.2

The Topnaar livestock farmers seem to successfully keep livestock despite living in an environment with extreme temperatures and very low rainfall. The deliverables from this activity will contribute to a first approximation and quantification of this success. At present, information on how livestock behave and forage under such conditions are predominantly anecdotal and poorly described, though it can be surmised that the livestock themselves adjust their movement and foraging behaviour to avoid heat stress and exploit favourable microclimates. This activity will track livestock movement from 2016–2019 through GPS locator collars fitted to individual animals, augmented by recorders to measure ambient conditions and a miniature black globe thermometer to provide a dynamic assessment of the heat load within the microclimate selected by the animal. The collars will allow the monitoring of livestock movements across the landscape, as well as their use of different habitat types and key resource areas.

Participating farmers (20 female and 20 male pastoralists) will maintain livestock monitoring diaries from 2017–2019 in which they will record variables such as reproductive data, morbidity, mortality and health as well as applied livestock management procedures. Quarterly evaluations will include condition indices such as visual assessment, body mass and key morphometric variables, while also collecting samples such as hair and faecal, as well as plant samples for laboratory analysis, e.g. isotopes to evaluate nutrient sources, and downloading data from collars. Sampling will be augmented by direct observations of feeding behaviour. All methods will be non-invasive and will not cause any trauma to animals. This activity will be carried out in close collaboration with FFGs, but will mainly depend on trained field assistants or students from universities to record quarterly variables and collect samples, while the sample analysis will be carried out on contract at a university laboratory and interpretation by consulting specialists. Through this activity, farmers will be equipped to regularly monitor livestock condition for early decision-making and precautionary action. Scientific information regarding behaviour and rangeland use by their livestock during different seasons will improve their management practices. In addition, the information gleaned from this participatory monitoring may benefit pastoralists elsewhere in Namibia to adapt to increasing temperatures.

Activity 2.1.3

While the previous activity (2.1.2) will monitor livestock, this closely related activity, carried out by the same 40 pastoralists, will evaluate the condition and quality of the rangelands. This will be complemented by performance testing of livestock under natural conditions. This activity will tie in with an EU-funded programme (implemented by Agra ProVision) to evaluate rangeland condition by direct monitoring of livestock movement, condition and numbers, while also carrying out seasonal assessments of the availability and quality of grazing and browsing resources. In the EU project, rangeland condition will be monitored via remote sensing, using Modis NDVI as the basis. Although with a predominant focus on open rangelands, the Omatjette/Okombahe area has been selected as a pilot study area, to specifically resolve how to separate the woody and herbaceous contributions to green

biomass. Data from Activity 2.1.1 will be correlated with the Modis NDVI or Vegetation Condition Index.

In this activity, seasonal assessments on rangeland condition (availability and quality) will be carried out from 2017–2019 through participatory processes, augmented by selective analysis of the nutritional qualities and diagnostic chemistry of vegetation for comparison to results from Activity 2.1.2. This activity will be carried out in close collaboration with FFGs by trained field assistants and students, with progressively greater involvement by farmers themselves in order to transfer skills in rangeland assessment. In addition, university students will carry out performance testing of indigenous livestock breeds during 2019–2020. This will entail the determination of growth rates in feeding trials using forage available to the animals under natural conditions.

Farmers participating in this activity will be trained to carry out regular rangeland assessments and will be encouraged to transfer those skills to their neighbours. This will allow pastoralists in the programme area to further improve decision making and risk management by relating livestock condition to that of their rangelands. These participatory activities will furthermore allow for the compilation of toolkits on how to carry out rangeland and livestock monitoring, which will be translated into three vernacular languages for the long-term benefit of all farmers in arid western Namibia. Performance testing of indigenous breeds will provide them with relevant information to further improve decisions on managing their livestock assets. As in the previous activity, the knowledge generation through this activity has broader application for rangeland management as well as future climate change adaptation in the livestock sub-sector of Namibia.

Activity 2.1.4

The previous activities of this component (2.1.1 to 2.1.3) will be carried out by consulting and involving farmers, including skills transfer through short field training courses and *ad hoc* training. The Facilitator will consult with traditional authorities and FFGs regarding such participation. However, implementing community-based rangeland management and risk management plans will require a more permanent platform for consultation and information exchange with participation of all the farmers. Communal decision-making and management has been successfully implemented for the management of various types of natural resources in Namibia, e.g. water point committees at a smaller scale and conservancy (wildlife) or community forest (plant products) committees at similar scales to this programme. Encouraging pastoralists to organise themselves into representative bodies that may be registered in terms of appropriate agricultural legislation, e.g. cooperatives, will not only allow for mechanisms for communal rangeland management to be implemented, which is the envisaged long-term outcome of this component, but will also improve the negotiating power of these small-scale livestock producers (marketing, acquisitions, attracting investment, emergency assistance, veterinary support, etc.). In addition, that will provide a platform for consultation by other development initiatives and government agencies with participating farmers. The PC and Facilitator will therefore encourage and support the establishment of farmer's associations for the Lower Kuiseb and Okombahe areas. The PC will facilitate some inception meetings, in particular to direct specific requests for training and advice from an incipient representative body to relevant government and development agencies. Various initiatives are already in place to support rural producer

organisations, though the initiative and decisions would have to come from the farmers themselves to be successful.

Activity 2.1.5

Livestock production in the marginal desert environments of Walvis Bay Rural and Daures constituencies has little potential for natural buffering against adverse conditions, while the small-scale farmers themselves do not have the resources to cope with prolonged adverse conditions. A vulnerability assessment by the LAC, which included the Topnaar, highlighted the plight of some of these marginalised and minority groups. Yet, at the same time, farmers can survive and even profit under average or good conditions, while accurate information about the onset of adverse conditions may mobilise early emergency assistance through established mechanisms.

During 2020, the traditional authorities of the two areas will be assisted to draft risk management and adaptation plans based on information developed through this programme. The Facilitator will compile vulnerability assessments during 2019, while skills transfer and involvement of farmers in monitoring the seasonal condition of livestock and rangelands would have matured. Most monitoring during 2019 and all during 2020 will be conducted by the farmers themselves, verified by the Facilitator for quality assurance. Such monitoring would inform decision-making tools of farmers regarding seasonal risks and opportunities, developed during the programme, as well as the more elaborate short-term risk management and longer term climate change adaptation plans that will be developed in consultation with and for implementation by the relevant traditional authorities. The seasonal monitoring should be carried out and supported by farmers' associations. Alternatively the relevant traditional authorities will be advised about potential mechanisms to continue such monitoring. The formulation and adoption of the two risk management and adaptation plans will benefit 332 pastoralist households, 129 of which are female headed.

Activity 2.1.6

One of the most daunting challenges for any livestock farmer in Namibia is to assess risks and plan accordingly because of extreme weather variability. Unlike more advantaged livestock farmers, indigenous small-scale pastoralists do not have access to global information tools and commercial agricultural support services. Developing and testing a agrometeorological forecast information system for livestock production in the highly variable arid environment of western Namibia, which can be improved and refined over time, would greatly assist pastoralists to cope with climate variability. As it is not clear whether such an outcome can be accomplished, it has not yet been attempted. This activity will be a first attempt as appropriate technology is now available.

Gobabeb Research and Training Centre currently maintains an array of weather stations to monitor meteorological conditions, while also having 50+ years of detailed 1st order weather station data and well-established interaction with a considerable number of weather and climate specialists as well as expert institutions (e.g. NASA, NOAA, MPI). The challenge is to evaluate whether such high quality of meteorological data, supplemented by livestock performance and rangeland condition data, can be used to develop and test livestock production forecasts. Results from this component, together with intensive weather monitoring, may therefore allow modelling of livestock production in the Lower Kuiseb. A

caveat for any attempt at model development is that only through the modelling process itself will it become clear as to what types of information are critical to inform the various algorithms that may be required, as well as what type of data should be monitored and at what timescales. This activity will be carried out from 2016–2020 by engaging with expert institutions that have experimental livestock production models, e.g. the Texas A&M University PHYGROW model for East Africa, to determine (i) which variables and at what intervals will inform appropriate models; (ii) what models perform best by tuning algorithms against verified information (Activities 2.1.2 and 2.1.3); and (iii) would a transfer of technology and skills to Namibia allow for further testing and improvement of appropriate model(s) or would it be premature.

Component 3

"Access to short-term and seasonal weather forecasting improves the resilience of small scale farmers to cope with climate variability"

This component is intended to strengthen and develop Namibian capacity to interpret and forecast short-term and seasonal weather patterns through the application of Numerical Weather Prediction (NWP) models, ensemble prediction systems, interpretation of satellite (remote sensing) information, and using appropriate climate models for downscaling global and regional forecasting products.

Currently almost all trained meteorologists in Namibia are employed by the Namibian Meteorological Service (NMS) in the Ministry of Works and Transport (MWT), with one agrometeorologist at the Ministry of Agriculture, Water and Forestry (MAWF). The NMS maintains a network of manned and automated weather stations in Namibia in collaboration with various government and private organisations and operates a receiving station for satellite imagery. The NMS is part of an African network of the Severe Weather Forecasting Demonstration Project (SWFDP) and the GCOS-WMO global network that communicates with other global or regional programmes through the Southern African Development Community (SADC) regional specialised meteorological centre at the South African Weather Service (SAWS). The MAWF also maintains a network of multi-sensor automated stations, as does Southern African Science Service Centre for Climate change and Adaptive Land management (SASSCAL) as part of the Weathernet array, with Gobabeb as a subcontractor to the SASSCAL programme. However, most of the weather and climate information is simply archived as the country has very little capacity to analyse data for more detailed local forecasting. None of the Namibian universities provide meteorological or climatological training beyond basic geographical understanding of weather and global climate. Currently most of the weather alerts and advisories issued by the NMS have been refined from interpretations and forecasts prepared by the SAWS for all SADC countries. The very small human capacity in Namibia and modest level of expertise does not allow the NMS to offer much more than distributing and providing daily weather forecasts to public media (newspapers, radio, television); training weather observers; carry out monitoring in terms of the World Meteorological Organisation's (WMO) Global Climate Observation System (GCOS); provide weather advisories, alerts and severe weather warnings to international air and ocean traffic; and liaise with emergency management and other services about seasonal forecasts and adverse conditions such as droughts.

Support systems at the local level, i.e. for constituencies and districts, to assist the most vulnerable communities to cope with current climate variations and adaptation to more variable climate in future require, however, improved short-term forecasting as elucidated in Namibia's National Climate Change Strategy and Action Plan. Understanding of how synoptic conditions and regional climate dynamics are expressed at smaller temporal and spatial scales requires well trained analysts and investigators to employ and even improve sophisticated atmospheric models, such as NWP models, to explain observations and validate forecasts systematically.

Namibia has an observation network that is particularly well developed in the Kavango East and Erongo regions, while consultations with the NMS and other local and international collaborators have confirmed their interest and commitment in developing and communicating improved short-term and seasonal forecasting. The NMS will also undertake training of inhabitants and local organisations to monitor weather phenomena and understand forecasts, while also recognising that more effective ways to communicate weather forecasts and climate advisories need to be developed. Currently the high penetration of GSM mobile phone networks that reach almost all but the remotest inhabitants is not yet utilised to distribute weather information, though a major reason for not utilising that network is the imprecise nature of short-term and seasonal forecasting in Namibia.

Participatory consultations with farmers, including focal group discussions on climate change in the Kavango East and Erongo regions, as well as vulnerability assessments for various minority groups, highlighted that seasonal and daily forecasts rarely reach affected communities as they do not have regular access to public media. In fact, even short-term severe weather and flood warnings are not received by marginalised communities, while the phraseology and language of forecasts and alerts are often incomprehensible. The National Climate Change Strategy and Action Plan identified climate variability, both the current reality, as well as intensified variability and greater frequency of severe weather events as is predicted under future scenarios, as one of the most important challenges to effective adaptation. This component links the other two components by emphasising the importance of weather for both crop and livestock subsistence farmers. It is a core component for practical adaptation measures, but its relevance has to be validated by beneficiaries.

This component will initiate downscaling and tuning of global and regional forecasts in order to provide more detailed local forecasts. This will require developing Namibian expertise in those fields, while also improving communication mechanisms to ensure that forecasts and weather bulletins penetrate more effectively. However, adaptation also requires confidence to respond timeously to forecasts and understanding of its inherent uncertainties, therefore this component will also test the quality and clarity of weather communications in preparation of wider roll-out across Namibia.

This component will mainly be executed by Gobabeb, which has been carrying out weather monitoring for over 50 years and has an extensive network of collaborating climate researchers and climate research institutions. In Namibia, the programme will liaise and collaborate closely with the NMS, SASSCAL Namibia, the Directorate of Agricultural Research and Development (DARD-MAWF), and the Climate Change office in the Department of

Environmental Affairs (DEA-MET). All these national institutions have confirmed their commitment to assist with developing and supporting the networks that will be initiated by this component.

Output 3.1 will focus on improving the seasonal forecasts provided by the NMS through monthly updates, as well as introducing short-term (1–7-day) agrometeorological forecasts informed by the knowledge and experience of Namibian meteorologists through access to appropriate technology and model interpretation (Table 5).

Table 5: Activities and outcome of Output 3.1.

Output 3.1: Improved short-term (1–7-day) and seasonal agrometeorological forecasting provided by local specialists on Namibian agricultural production areas		
Expected Outcome: Develop Namibian capacity with appropriate technology and knowledge to interpret and model weather and climate patterns for agrometeorological forecasting and early warning advisories at the time-scales required by farmers		
Activity 3.1.1	Develop Namibian human resources for agrometeorological monitoring and forecasting	USD 140,000
Activity 3.1.2	Develop Namibian agrometeorological modelling capacity based on real-time weather monitoring	USD 68,200
Activity 3.1.3	Establish forecasting information dissemination systems appropriate for use by small-scale farmers through participatory processes	USD 15,000

Activity 3.1.1

There are currently eight people in Namibia with primary degrees in meteorology, most of whom are employed by the Namibian Meteorological Service (NMS) for public or transport weather forecasting. This activity will provide qualifying training for an additional six Namibians (3 female, 3 male) with university degrees in meteorology. It will also support further professional development in weather and synoptic analysis; climate modelling for weather forecasting; and agrometeorological applications. Namibian university graduates will be recruited from 2017 to 2020 to enrol for the meteorological bridging programme offered by the South African Weather Service (SAWS) and University of Pretoria (UP) in order to qualify for advanced training in meteorology. Two Namibians accepted at a southern African university for a relevant Masters or PhD degree will also be supported in professional career development from 2018–2020. Candidates will be invited to submit competitive applications to pursue a meteorological career through annual calls advertised at Namibian university campuses. Applications will be evaluated by a panel consisting of the chief executives of Gobabeb, NMS, SASSCAL Namibia and the Chair of the National Climate Change Committee after screening by the PC. Applications will be evaluated based on the quality of applicants, the relevance of the suggested study, the syllabus of the suggested academic institution, and the academic mentorship that will be provided to the applicant. Study grants will be capped. Critical skills gaps that may be addressed through this activity include synoptic analysis; forecasting; applications of climate models to analyse results from current weather monitoring of Namibia; and predicting Namibian agricultural production from weather monitoring products. Applications will be weighed in favour of gender, people living with disabilities, defined minority groups, and early career professionals at a Namibian university, the NMS or MAWF. At the same time the review panel will also evaluate and comment on the progress of previous grantees based on semi-annual progress reports from the grantees themselves as well as their mentors. All grantees will be contractually obliged

to work at an approved Namibian institution for a similar period to that of the study grant to ensure knowledge and skills transfer. Communicating the significance of weather monitoring and climate variability is important for climate change awareness and professional development, thus meteorologists and climate specialists in Namibia will be encouraged to produce tangible products (e.g. academic papers for peers, communication products about climate observation) through competitive annual awards for the best academic and awareness products.

This new cadre of qualified Namibian meteorologists will provide the core skills for providing downscaled and tuned short-term and seasonal forecasts at district and constituency levels. Farmers will thus receive timely and accurate weather information to plan and execute agricultural activities. They will be absorbed by the NMS and other relevant national institutions to ensure sustained product delivery. The activity will almost double the number of trained meteorologists in Namibia and greatly increase the available skill set in the country, which will reduce the country's dependency on other centres to provide weather alerts. A greater number of skilled practitioners would also allow for more responsive services relating to climate monitoring and adaptation.

Activity 3.1.2

This activity will complement Activity 3.1.1 by recruiting and attracting essential skills while advanced Namibian capacity in climate analysis, modelling and forecasting are being developed. Qualified candidates from SADC countries that are studying towards a PhD on Namibian weather and climate, or that will develop analysis and products as postdoctoral students, will be invited to apply for internships to develop relevant products and knowledge about Namibian weather systems for meteorological and climate modelling and forecasting. PhD candidates will be attached as interns for at least a year at a relevant Namibian institution (Gobabeb, NMS or a university) for skills transfer, after which they may receive support for another year at the university where they are registered. Postdoctoral interns will be contractually obliged to deliver preliminary results on an approved analytical product or model application for forecasting within six months, and a fully developed result within a year. Priority will be given to dynamical and statistical downscaling of Numerical Weather Prediction (NWP) or ensemble prediction systems (EPS) products to the constituency level in Namibia for testing agrometeorological forecasting in the Kavango East region by 2018, and development of other downscaled products or refinement of previous downscaled products thereafter. Developing nominations for internships by citizens of SADC countries will be invited from senior faculty members at African universities offering meteorological or climatology courses at a PhD level. Candidate nominations will be evaluated by a panel consisting of the chief executives of Gobabeb, NMS, SASSCAL Namibia and the Chair of the National Climate Change Committee after screening by the PC. Applications will be evaluated based on the quality of applicants, the relevance of the suggested study, the relevance of their training and completed work, the academic mentorship that the applicant will or has received, and a proposed knowledge and skills transfer plan. Priority areas for interns include synoptic analysis, forecasting, and applications of numerical atmospheric models to Namibian agriculture.

This activity will introduce short-term (1–7-day) agrometeorological forecasts based on dynamic and statistical downscaling relevant to farmers in the Kavango East region. These products to guide decision-making by small-scale crop farmers should be ready for testing

by beneficiaries of Component 1 by 2018. Namibians trained through Activity 3.1.1. will be in position by 2019 to take over and continue forecasting services. The technology to absorb and continue these systems are already available at the NMS, but not yet utilised.

Activity 3.1.3

Effective utilisation of seasonal and shorter-term agrometeorological forecasts can only be accomplished if the information reaches beneficiaries timeously and in a useful format. This activity, further informed by Activity 3.2.1, will test the efficiency of various media of communication not currently being used (i.e. cellular phone, information boards, direct communication) for different types of users (individual farmers, farmer organisations, traditional authorities, extension and development facilitators, cooperatives, emergency planning offices) through participatory processes. Communication mechanisms will be progressively tested from 2017 to 2020, initially as seasonal forecasts and updates with subsequent introduction of shorter-term forecasts. The programme coordinator will coordinate the implementation with collaboration from the NMS, SASSCAL Namibia and project facilitators in the Kavango East and Erongo regions.

Since forecasts are based on statistical probabilities and thus easily misinterpreted and misunderstood, rapid roll-out and wide-scale dissemination is not advisable without associated knowledge on the limitations of such information. Misinterpretation may easily undermine confidence in potentially valuable information. A participatory process, mostly based on feedback from users that have been trained to understand the limitations of forecasts by facilitators and collaborating institutions of Output 3.1, and willing to observe and report on the accuracy and effectiveness of communications, will allow effective wider roll-out of forecast information by 2020. These para-meteorologists will be trained and equipped by the NMS with assistance from Gobabeb (Activity 3.2.2.).

This is the delivery system for the products developed under Activities 3.1.2 and 3.1.1 at maturity. It will develop and test the communication system that will allow forecasts to be delivered in five local languages via cellular phones to farmers in the Kavango East region. This activity will ensure timely and accurate weather forecasts to reach farmers who currently do not receive such information.

Output 3.2 will focus on developing and testing an effective agrometeorological communication system that will allow effective dissemination of the products developed through Output 3.1. The need to communicate weather forecast and climate projection information has been specifically identified in National Climate Change Strategy and Action Plan and therefore will make a direct contribution to Namibia's preparedness and ability to effectively reduce risks and to adapt to climate change (Table 6).

Table 6: Activities and outcome of Output 3.2.

Output 3.2: Local communication and dissemination networks allow small-scale farmers to respond timeously to seasonal forecasts		
Expected Outcome: Initiating a climate forecasting system for Namibia's climate change adaptation strategy		
Activity 3.2.1	Test a constituency-based agrometeorological forecasting system in the Kavango East Region	USD 5,000
Activity 3.2.2	Develop a constituency-based feedback system on crop	USD 12,000

	production and weather monitoring in the Mashare and Ndiyona constituencies	
Activity 3.2.3	Develop a constituency-based rangeland and weather monitoring feedback system in Walvis Bay Rural constituency	USD 12,500
Activity 3.2.4	Mainstream agrometeorological early warning and forecasting systems into agricultural extension services	USD 7,000

Activity 3.2.1

It is expected that short-term agrometeorological forecasting may have been sufficiently developed by 2018 to enable field testing. To be effective, forecasts need to be communicated to agricultural extension services and farmers themselves in such a way that it can be understood and applied. One component is the medium that will be used (Activity 3.1.3), the other is the language and clarity of climate advisories. This activity will be coordinated by the PMU to develop clear phraseology through key words in the local Rukwangali and Rumanyo languages in general use in the Kavango East Region. Key words and phraseology suitable for brief, low-cost transmission, with supporting information products to explain how phrases communicate the confidence levels of predictions, will be developed in consultation with linguistic specialists, development facilitators and teacher training colleges in the region. The clarity and usefulness of forecasts in indigenous languages will be tested and refined from 2018 to 2020 through participatory consultation and feedback from extension and development facilitators, traditional authorities and selected farmers participating in on-farm monitoring (Activity 1.2.1 and 3.2.2). This activity will deliver short-term weather forecasts and advisories to 5,979 households (2,493 female headed) in the Mashare and Ndiyona constituencies of the Kavango East region.

Activity 3.2.2

Improving agrometeorological predictions require information on the confidence level of such probabilistic predictions, which can only be accomplished by verification on the ground and the extent of variability. This activity will extend the current network of NMS and SASSCAL Weathernet stations in the Kavango East during 2017 and 2018 by introducing a farmer-based weather observation system in the Mashare and Ndiyona constituencies. The envisaged weather observation network will involve the same participating farmers as Activity 1.2.1., augmented by schools, tourism establishments, government offices, and other interested parties. Sixty farmers (30 female, 30 male) will be trained as para-meteorologists in basic on-farm weather observation and maintaining a weather diary through collaboration with the NMS and coordinated by the PC to improve the accuracy and reliability of agrometeorological forecasts. Various mechanisms for transmitting data, e.g. via mobile phone, weather observation coordinator trials, or other channels will be tested to allow rapid tweaking and refinement of the models used for delivering forecasts. This network is not anticipated to continue once it has achieved its purpose.

Activity 3.2.3

A similar communication framework for communicating and monitoring weather forecasts as in activities 3.2.1 and 3.2.2, but in Khoekhoegowab, the vernacular of most small-scale livestock farmers in the Okombahe and Lower Kuiseb areas, will be developed during 2018. The variability in weather over the desert and arid regions of Namibia is much more variable, while livestock farmers require different advice than what is needed for agronomy, thus the advisories issued will be different. A farmer-based weather observation network and reporting framework, consisting of 20 farmers (10 female, 10 male), will be developed

in the same way as in Activity 3.2.2. From 2018–2020, Gobabeb in collaboration with the NMS, will test communication protocols for short-term forecasting of adverse weather (cold, extreme heat, extreme wind, rain, floods, rangeland condition) to the rural community along the Lower Kuiseb. Gobabeb will monitor the accuracy of forecasts through its weather station network, augmented by para-meteorologist reporting and feedback mechanisms that will also evaluate most effective communication media and which type of information most useful to widely spread and isolated livestock farmers. The most effective and useful forecasting advisories will be retained beyond 2020 as part of Gobabeb's social responsibility programme and ensure sustainable service provision to local farmers along the Kuiseb.

Activity 3.2.4

During 2019, the PC, in consultation with the NMS, will develop protocols for communicating short-term and seasonal forecasts. From 2020, all extension and research offices of MAWF, as well as other offices of development agencies, farmer cooperatives, farmer associations etc. will receive appropriate weather forecasts according to those protocols. In addition, the results from testing and evaluating seasonal and short-term weather forecasting to farmers, including an evaluation of the value of farmer-based monitoring networks, will be reported during 2020 by the NMS and Gobabeb at annual planning meetings of relevant directorates of MAWF and MET. Bound reports will be provided to relevant offices and managers. Atmospheric model software and protocols developed for tuning those models shall also be delivered to relevant offices, with provision for training on how to apply the materials to develop forecasts.

B. Describe how the 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 programme will avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

Subsistence small-scale crop farmers in the Kavango East region (Mashare and Ndiyona constituencies) and subsistence livestock herders in the Erongo region (Walvis Bay Rural [Lower Kuiseb area] and Daures [Okombahe area] constituencies) will benefit directly from this programme. The 2011 census data[56] suggests approximately 18,000 people (*ca*. 3000 farming households, of which 45% are headed by women) will benefit from Component 1 and Component 3 in the Kavango East region. Component 2 and Component 3 will benefit approximately 2,400 people (*ca*. 800 farming households, of which 39% are headed by women) in the Erongo region.

The programme will specifically address vulnerable households. Poverty in Namibia is most prevalent in the Kavango regions[57] (Figure 10 below), where 24% of households are classified as severely poor, while 5% of households in the Erongo region are classified as poor and 2% as severely poor, with 1.4% of households relying on subsistence agriculture for their income. Some other indicators of vulnerability are that 92% of households in the

[56] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.
[57] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.

target constituencies rely on wood and charcoal for cooking food, less than 5% have access to electricity for lighting and small appliances, almost none has toilets, and more than 98% live in traditional houses[52].

Vulnerability to climate change does not only depend on change in frequency or duration of climate conditions, but also the capacity to respond adequately to those changes[58]. Household income, income diversification, availability of labour, health status, and access to knowledge and technology are factors that determine vulnerability. The programme will therefore contribute directly to the capacity of locally significant Namibian institutions and facilities to assist communities by developing specific knowledge and technological competence to (i) translate and communicate science information; (ii) apply and adapt predictive models to better understand and monitor local impacts and responses; (iii) developing critical information needs to inform future adaptation measures; and (iv) improve networking in risk planning and management to ameliorate extreme climate impacts.

The indirect beneficiaries include the vast majority of >43,000 inhabitants of these two target areas as well as a considerable number of relatives living and working elsewhere, i.e. 71% of people in the Kavango East and 13% in the Erongo region live in rural areas[59] dependent on agriculture. At the national level, beneficiaries include MAWF and MET, institutions relying on forecasts provided by the Climate Analysis Unit from the NMS, the National Climate Change Committee, the University of Namibia, the Polytechnic of Namibia and a range of agencies providing development interventions and contributing to national imperatives. In the broader geographical context, the programme is likely to benefit the agricultural and environmental sectors throughout Namibia and southern Africa by improving appreciation of traditional climate-smart cultures, developing templates for community-scientific feedback mechanisms and testing local climate forecasting capacity. These outcomes will benefit most structures to ensure sustainable natural resource management such as rural stakeholder associations, traditional authorities, land and water management offices and organisations, implementers of conservation and tourism activities, etc. The envisaged outcomes are likely to result in rapid uptake and expansion of the programme's goals and duplication of its activities elsewhere (see *Section II.J*, p. 82).

Economic benefits

Agriculture is Namibia's largest provider of formal and semi-formal employment and directly and indirectly supports up to 70% of Namibia's people. However, agriculture ranks only sixth in terms of its contribution to GDP, with 3.5% of GDP contributed by commercial farmers and 1.5% by small-scale communal farmers[60]. Livestock production represents around 89% of the agriculture sector's contribution to GDP. The programme does not envisage having any noticeable impact on national GDP, although improving risk management, production scheduling through early warning systems and preparedness in the most climate sensitive sector of the Namibian economy may reduce some of its volatility. Of specific significance in this respect is clarifying the consequences for livestock production due to the rise in temperatures that is likely to occur.

[58] Dirkx, *et al*. 2008. Climate Change Vulnerability and Adaptation Assessment Namibia. Windhoek.
[59] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.
[60] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.

Abandoning livestock production in Namibia is an unlikely option for adaptation as it is Namibia's major agricultural activity and supports an extensive associated service network. Not only would it result in a significant impact on GDP, which would reduce the country's ability to deal with other consequences of climate change, but it would also result in greater migration of a largely unskilled labour force to urban centres in search of alternative livelihoods[61]. Any increased migration from rural to urban areas would add new stressors for employment creation, housing, sanitation, and further compromise dwindling indigenous extended family support systems. Shifting the economic emphasis over the greater part of Namibia to an alternative sector, e.g. wildlife and the associated tourism sector, is not viable in view of economic analysis that climate change effects may reduce that sector's GDP contribution by more than 25%[62].

Component 2 of this programme, with inputs from Component 3, is specifically intended to evaluate and introduce mechanisms to improve the resilience of small-scale livestock herders through informed decisions on rangeland and livestock management. These farmers do not currently have the technology, resources, support services and flexibility of commercial livestock producers. This same information may, however, also provide new insights through which other livestock producers may examine strategies to buffer a projected 20–50% reduction in Namibia's livestock production due to climate change[57].

More importantly, improved rural incomes would enhance the formal and informal economy as a whole and should also encourage new agribusiness opportunities. Currently the most important role of small-scale communal agriculture is to provide socioeconomic security until such time as other sectors can support more opportunities for earning wages. It also provides household food security that allows underage dependents to undergo the schooling and training to be more competitive in the labour market. The importance of schooling and acquiring new skills and knowledge to effect change in vulnerable small-scale farmer communities in the programme's target areas cannot be over-emphasised.

The crop cultivation system in the Kavango East region has been described as a low input-low output system[63]. Farmers invest very little in crop production, with less than 2% applying fertilisers and less than 8% compost or manure. As a result, the average yield is only *ca.*100 kg/ha, i.e. around 115 kg per household member due to the correlation between field size and size of households, which provides only around 87% of household needs. The productivity of farming households is strongly affected by gender, size, assets, and wealth. Households with more individuals cultivate larger areas than smaller households; male-headed households cultivate on average 25% more land than female-headed households; households receiving remittances or a cash income cultivate 25% more land than those without; households with their own oxen, ploughs or donkeys may cultivate double the area than those without[59]. More than 90% of cultivated land is ploughed by oxen, 5% by hand and <1% with tractors[64]. More male-headed households have cattle than female-headed, mostly ascribed to income from wages invested in cattle[59]. Around 37% of households are headed by women[60], though men from many of the other households have

[61] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.
[62] Barnes, *et al*., 2012. Expected climate change impacts on land and natural resource use in Namibia: exploring economically efficient responses. Pastoralism: Research, Policy and Practice 2012 2:22.
[63] Mendelsohn & el Obeid, 2003. Sand and Water: A profile of the Kavango Region. Cape Town.
[64] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.

some kind of work to earn wages, with the women in their households being responsible for on-farm production. Despite the fact that soil fertility is poor, the above account illustrates that there is potential for considerable improvement in household economies by collaboration with farmers.

Component 1 of the programme cannot attempt to work with all 3,000 farming households in the Mashare and Ndiyona constituencies, but will collaborate with 60 farmers, including headmen and headwomen of the wards where the farms are situated, to learn from farmers and impart new knowledge to bring about change. In addition, Component 3 will contribute advanced information that has not been accessible to these farmers before.

Social benefits:

Small-scale communal agriculture has provided socioeconomic security for Namibia's indigenous peoples for centuries. Improving the incomes and circumstances of rural households will therefore sustain Namibia's sociocultural safety net and reduce pressure on already strained sociocultural networks and public services. Improved food security also has direct relevance for supporting women-headed households, which also harbour on average 30% more orphans in Namibia than those headed by men[65]. Improved on-farm production will also (i) reduce malnutrition and poverty-related health issues; (ii) provide more flexibility in household expenditure and acquisition of assets; (iii) reduce reliance on emergency food relief; (iv) result in less need to migrate to urban areas as unskilled labour; and (v) increase the ability of households to escape the poverty trap.

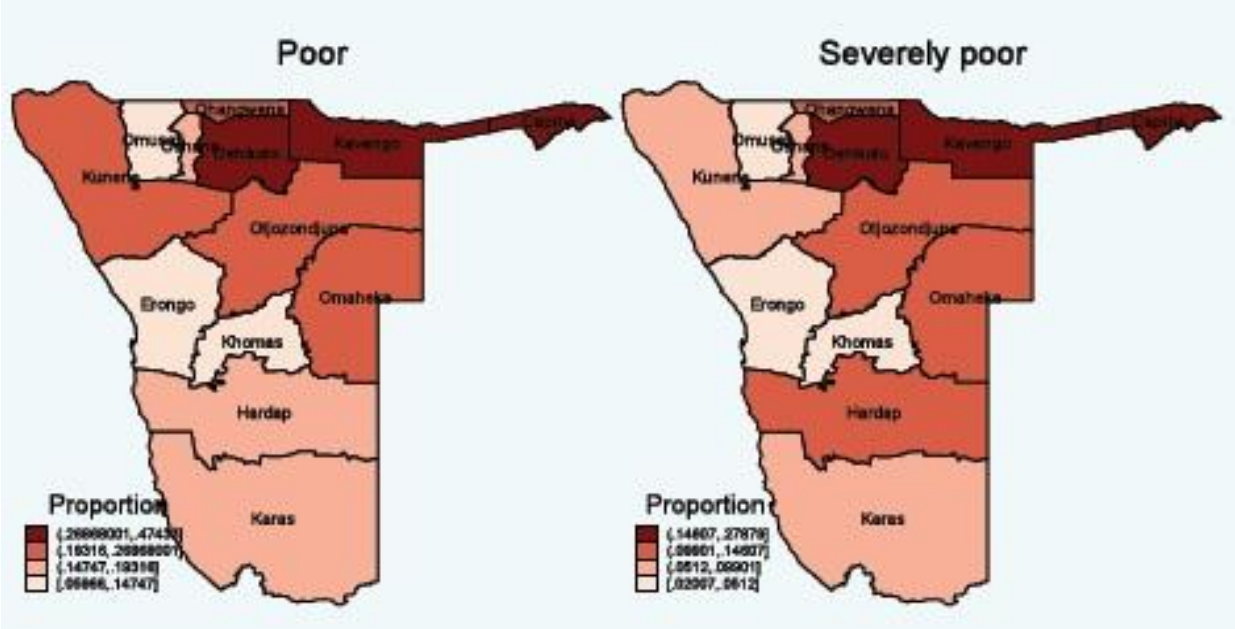


Figure 10: Poverty in Namibia[61].

The highest incidence of poverty in Namibia (Figure 10) is in Kavango (Kavango East and Kavango West), which includes the Mashare and Ndiyona constituencies, where 43% of households are classified as poor and 24% as severely poor[61]. The average annual rural household income in the two Kavango regions is N$ 28,787 (USD 2,360), which translates to a per capita annual income of N$ 4,542 (USD 387) as the average household size in these

[65] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.

constituencies is *ca*. six persons per household[66]. An estimated 49.5% of that income is spent on food for the household. When income is considered in terms of language as a proxy for cultural groups, Rukavango-speaking households have the lowest income in Namibia and spend the highest percentage of that income on food[67]. For example, the average household and per capita income for people belonging to the severely poor San minority is N$ 24,805 and N$ 6,392 respectively as household sizes are smaller[63]. As the cultivated fields do not produce enough to feed households[68] due to a combination of lack of implements, nutrient deficient soils, little use of fertilising strategies, high burden of diseases such as HIV/Aids, malaria, diarrhoea and bilharzia, and preventative risk management in the absence of early warning information, a substantial portion of available income is spent on food (Table 7).

[66] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.
[67] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.
[68] Mendelsohn & el Obeid, 2003. Sand and Water: A profile of the Kavango Region. Cape Town.

Table 7: Kavango Rural Household Food Expenditure[63] in Namibia Dollar (average household income N$ 28,787). The average annual household cash expenditure on food is *ca*. N$ 7,748.

Food type	Cash Expenditure (N$)	In-kind Expenditure (N$)
Cereals	2726	3960
Meat	1320	269
Fish	698	333
Vegetables	561	1583
Fruit, nuts, berries	133	941
Alcoholic beverages	160	-
Non-alcoholic beverages	503	-
Other food products	1647	

Component 1 and Component 3 will contribute towards improving the social circumstances of small-scale crop farmers, while also introducing measures to assist these farmers to adapt the impacts of climate change. Some 52.7% of households in the Mashare constituency and 48.4% in the Ndiyona constituency depend solely on subsistence farming for their livelihoods, with 65.5% and 60.9% of all households having crop fields[69]. However, only 34.2% of households have their own ploughs and 43.2% cattle that may be used as draught animals, with 15.8% households having donkeys, mules or horses[65]. Only 3.9% of farmers have access to tractors for ploughing[63]. Women head 44% of households in the Mashare and 46% in the Ndiyona constituencies[65]. Orphans are more prevalent in women-headed households, with 19.3% of all households giving shelter to orphans[63]. This is partly a result of a high prevalence of HIV/Aids infection, with *ca*. 20% of all women receiving antenatal care testing positive[64]. An associated social issue in the relevant constituencies is a very high rate of teenage pregnancies, where more than 30% of all women receiving antenatal care are under the age of 19 and 5–10% under the age of 15[64]. The drop-out rate of girls from school is therefore high, even though more females are reported to finish school than males, while the percentage of girls attending school in the 7–13 age group is marginally higher than for boys[63]. Most school-going learners only attend primary school and junior secondary school, with only one senior secondary school in each constituency. One vocational training centre and one teacher training college are the only tertiary education centres in the two Kavango regions. In terms of other relevant social demographics, 33.6% of households own goats; 65% own cellular phones; 60.5% own radios; and 7.5% own a motor vehicle[70].

The demographic statistics describe impoverished, vulnerable traditional societies without many alternatives and low resilience. The only way out for many is to travel elsewhere in search of a livelihood, often as unskilled labour. Such migration also affects the structure of households. The emigration from the Kavango regions to other areas is very high, with up to 5,000 people immigrating into the Khomas and Otjozondjupa regions annually[66]. This results in a shortage of adult labour and decreased food productivity, thus school-going children drop-out to help on farms. Women must often make up for the loss through additional work in the field that includes intensive tasks such as tilling and clearing.

[69] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.
[70] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.

Already limited by the low soil fertility, these farmers lack the resources and technical know-how to boost the productive potential of their fields. The lure of better returns from improved varieties, specifically introduced as an adaptation measure as the plants mature faster and thus may still yield a harvest under drought conditions, contributes to small-scale farmers slowly losing the indigenous knowledge and access to the diversity of landraces with which they managed risk in the past. The three improved varieties of pearl millet (*Pennisetum glaucum*) that are being produced and distributed through government extension offices were, in fact, developed from indigenous Namibian landraces, which serves to illustrate the value of the traditional knowledge that is being lost.

The activities in Component 1 will collaborate with small-scale crop farmers to record such knowledge, while also collaborating with them to test the production potential and performance of their traditional varieties and to develop appropriate technical support systems. Component 3 will contribute valuable early warning information and introduce measures through which the farmers can track conditions conducive to higher yields. In combination, the outputs from these two components are expected to contribute to strengthening the social fabric of the communities.

In comparison, the Erongo region has the highest household and highest per capita income in Namibia. However, the regional statistics mask very large inequalities between different population groups. For example, the average annual income of Khoekhoegowab-speaking households (thus Nama or Damara people) in the region is only N$ 40,211 per household or N$ 8,924 per capita[71]. Combined results are, however, are still skewed by the higher incomes from urban wage-earning households in comparison to rural farming households. Some 5% of households in this region are classified as poor, and 2% as severely poor[67]. If it is considered that 1.4% of households rely on subsistence farming, with 1.5% of households living in traditional houses[66], the relationship between poverty and subsistence farmers in the region is self-evident.

There are 688 farming households in the Daures constituency and 50 in the Walvis Bay Rural constituency[66], while 1,566 households in the Daures constituency and 415 in the Walvis Bay Rural constituency have livestock[72]. There are, however, around 130 Topnaar households along the Lower Kuiseb River, thus 61.5% of Topnaar households do not have enough livestock to consider themselves farmers. In terms of health, the highest incidence of acute respiratory infections is found in Khoekhoegowab-speaking peoples, with more than 25% of treatments and hospitalisations in the Erongo region due to such infections[73]. Rural farming household sizes in the region are *ca*. three per household[68], with an average income of N$ 11,723 per household, with 30.8% of household expenditure on food[69]. Despite the very low household income, which makes these small-scale farmers some of the poorest in Namibia, the relatively small amount of income spent on food items illustrates the effectiveness of keeping livestock in the marginal to extreme desert conditions where they live.

[71] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.
[72] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.
[73] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.

Marginalised indigenous people escape attention and become even more disenfranchised when they live in a region that is perceived to be better off than most others in terms of poverty and potential to earn wages from mining, tourism, transport, construction, marine fisheries and service sectors. They still eke out a living by small-scale farming on the fringes of the economy in ways that are centuries[74] or millennia old[75] while maintaining their extended family networks. There is little evidence of severe rangeland deterioration despite that they cannot migrate with their livestock anymore as in the past (see *Programme Background and Context*, p. 19).

The way in which these farmers keep livestock in drought-prone, very hot environments may serve to understand how livestock production, at least in small-scale herding communities, may be able to cope with rising temperatures in future. At the same time, however, the rangelands on which they keep their animals are under increasing pressure from a growing population and the need to produce excess livestock to acquire modern amenities and provide for their relatives. The activities under Component 2 and Component 3 will collaborate with Topnaar farmers along the Lower Kuiseb River and !Oegan Damara along the Omaruru River in the Okombahe area to understand and learn from them about their livestock production system. In return, through this cooperation the farmers will gain technical skills to evaluate the condition of their communal rangelands and weather influences that they can apply to the decisions they make regarding their livestock. Together the farmers and scientists will develop tools to apply to rangeland management that may strengthen their resilience and allow them to adapt to the climate changes that will occur.

Environmental benefits:
The outcomes from this programme will allow improved landscape management by intensifying cultivation of existing cleared land; reduce livestock impact on marginal habitats; support biodiversity conservation through land conservation measures; encourage traditional measures to coexist and conserve natural resources; and reduce reliance on future irrigation and water extraction as an adaptation measure for national food security.
In the Kavango East communities, most small-scale farmers also rely on natural products as a source of income and food security. Fruit, nuts and berries, mostly harvested in the wild, are an important element of household nutrition[76]. Fish is also harvested from the Okavango River. Other natural products provide opportunities for trade, e.g. the harvesting and selling of thatch grass, timber, and the renowned woodworking crafts of the Kavango communities. Alternative crops from the riverine wetlands and floodplains, or wild and weedy plants in cultivated fields are less known, but still an important source of food, especially in times of scarcity. Some 92.1% and 82% of the houses in the Mashare and Ndiyona constituencies, respectively, are traditional, i.e. built with timber, reed, daub and with thatch roofs[77]. These natural resources reduce farmers' need to spend limited income on more food or expensive construction materials. However, at the same time these resources, albeit renewable, are under increasing pressure from over-harvesting. Predictions of future climate effects on fluvial flow and likely major changes in the

[74] Kinahan, 2001. Pastoral nomads of the Namib Desert: the people history forgot. Windhoek.
[75] Pleurdeau, *et al*. 2012. "Of Sheep and Men": Earliest Direct Evidence of Caprine Domestication in Southern Africa at Leopard Cave (Erongo, Namibia). PLoS One. 2012: e40340.
[76] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.
[77] NSA, 2013. Namibia 2011 Population and Housing Census. Regional Tables. Windhoek.

composition of the Kavango woodlands suggest that these pressures will increase[78], which in turn may negatively affect the tourism sector that is the major source of wage employment.

Namibia has already reached or exceeded its capacity for sustainable water extraction over most of the country. The agricultural sector uses *ca*. 75% of all water, with commercial crop irrigation consuming 50% of the national demand of around 160 Mm^3 per year[74]. The envisaged Green Scheme agricultural initiative, of which 81% (22,000 ha) of the proposed projects will be along the Okavango River will require an additional 80% water (*ca*. 290 Mm^3). This initiative may drastically reduce poverty in the target area. Yet, a predicted 10–20% reduction in rainfall over the upper catchments of the rivers originating north of Namibia is expected to lead to a reduction in runoff and drainage of about 25% in the northern perennial rivers, including the Okavango River. This reduction in river discharge combined with increased evaporation and evapotranspiration of 5–15% from the likely rise in temperature (5% for every 1°C), draws into doubt the sustainability of the envisaged irrigation projects. Even if those irrigation projects do not take place, a reduction of flow would lead to a reduction in wetlands and diminished ecosystem services (flood attenuation, water retention, water purification) and rural livelihoods (harvesting plants, animals, tourism income)[74].

Component 1 and Component 3 will assist communities to better prepare for such future changes. The activities in Component 1 will allow a better understanding of informal harvests on which small-scale farmers rely, while also developing information through active collaboration with farmers on which of their traditional landraces is best suited for particular conditions. Activities under Component 3 will allow improved availability and transmission of information on likely weather conditions and synoptic systems, including those that may affect river discharge and dryland forest regeneration and growth.

At the other end of the scale, the small-scale livestock producers in the Lower Kuiseb River and Okombahe area are already living in a marginal and fragile environment. Both the Topnaar and !Oegan Damara also harvest natural resources to supplement their diets and produce a cash income. The Topnaar harvest !nara melons (*Acanthosicyos horridus*) that grow in the dunes for own consumption or to sell. As the Topnaar live in a national park, harvesting of other natural resources is constrained. Park managers, however, are concerned as there is very little information on how the Topnaar may impact the environment. Preliminary observations suggest that their impact is negligible, but accurate information will be generated through Component 2 of this programme.

The !Oegan Damara farmers are not as constrained in terms of access to natural resources. However, in the Okombahe area along the Omaruru River there is much greater pressure due to the higher number of rural households with livestock than along the Kuiseb. The activities under Component 2 will likewise develop information in collaboration with the farmers about the current condition of the rangelands. It will also develop protocols that can be used to inform the National Rangeland Management Policy and Strategy on how appropriate management procedures may be implemented on communal rangelands elsewhere in Namibia as that component of the policy is currently vague. As in Component

[78] Schneider, *et al*., 2015. Climate Change Vulnerability and Adaptation Assessment. Windhoek.

1, activities under Component 3 will allow a better understanding of the close relationship of weather conditions and rangeland regeneration or degeneration.

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

The programme activities were designed to cascade into each other as information and skills mature over the life of the programme. The different components of the programme were also designed to be mutually supportive and contribute to enhanced capacity for community-level adaptation planning in Namibia by developing information and case studies for application elsewhere. It is theoretically feasible to quantify effectiveness in monetary terms if clear conditions for uptake of benefits can be measured and the number of immediate beneficiaries can be predicted. This was not feasible for most activities. The cost-effectiveness of programme activities was therefore evaluated based on elements contributing to sustainability, or benefits, and alternative scenarios, i.e. the likelihood and potential cost, whether these would be applicable to or taking place in the target area, and how these would affect overall programme execution or the target community.

The sustainability of any programme may be evaluated on whether (i) the activities are truly participatory and inclusive; (ii) it builds on current initiatives or programmes, or may set conditions for future initiatives; (iii) it provides a legacy that would continue beyond the life of the activity; (iv) it integrates local knowledge; (v) it is methodologically and technically robust, i.e. replicable and scalable; and (vi) it addresses identified weaknesses and requirements.

A pertinent question would be if the different components are (i) truly interlinked; (ii) if the programme will be substantially weakened by leaving out one of the components; or (iii) if the programme will be more cost effective by excluding a component. In responding to (i) any one of the components may be executed as stand-alone. However, without the contribution by the other components, it would have substantial limitations and have limited replicability over large parts of Namibia. In terms of (ii), improved weather forecasting and agrometeorology is essential for climate adaptation in Namibia. It may be argued that excluding either small-scale livestock production or crop cultivation would result in a more focused programme, which were indeed considered, but as traditional systems in both types of production systems have been neglected, and livestock is the only source of income over most of Namibia, and an integral component of farming by crop cultivators in northern Namibia, both components were retained. Crop cultivation is the major contributor to food security of small-scale farmers and rural communities in Namibia, thus it simply cannot be ignored in terms of replicability. There the question was framed as "*If this programme does not do it, will another initiative take up the challenge?*" The answer was "*No*". Regarding (iii) making more resources available to the other components by excluding a component would surely make execution simpler and potentially include more direct beneficiaries, but the programme as a whole will not become more cost-effective, and may at the same time lose the opportunity to integrate essential services and products that would more effectively support decision-making within a much broader range of potential beneficiaries.

Other realities pertain to the cost-effectiveness of any adaptation programme at the local level. Namibia has a large land surface with a low population density and a small pool of specialists, which escalates the cost of any local adaptation measures due to distances, a dearth of constituency-level expertise, and divergent commitments of national specialists. The programme areas have been selected to partly compensate for such cost effects. Increases in the scale of implementation may increase the number of direct beneficiaries, but that has to be balanced against suitable logistic arrangements, the availability of definite information or the time required to develop such data, the potential of subsequent uptake from locally demonstrated proof, the willingness of national agencies to promote effective measures, the potential risks to already vulnerable and poverty-stricken recipients, and the potential funding that would be available.

A related reality is that Namibia is a multicultural society where people with different traditional livelihood practices often live in the same areas. Effective adaptation requires an understanding of how such cultural differences may affect uptake and implementation of specific adaptation measures, which requires specific expertise and information. This complication is further compounded by environmental variables, topography and temporal expression of three different weather systems that create uncertainties about the local effect of and response to weather, which requires explanation by applying different skill sets and types of expert analysis. Generalisations on the effect of climate change and suitable adaptation measures are therefore misleading and inappropriate.

Evaluation of the programme's cost effectiveness in Table 8 was based on the considerations outlined above.

Table 8: Cost effectiveness and sustainability evaluation of programme activities.

Action	Cost USD	Alternatives	Sustainability and Benefits
Collate information on traditional coping strategies in Kavango East region	42,400	• Rely on known information sources [*low reliability*] • Trust another initiative will collate information [*unlikely*] • Outsource the activity to a consultant [*costly, parallel activities not feasible*]	• Livelihood and culture-specific information is available for future adaptation activities in the region; partly applicable to neighbouring regions • Template for other regions
Document on-farm genetic crop diversity system in the target area	50,000	• Use available NPGRC accession and pilot study data [*poor coverage*] • Trust another initiative will collate information [*possible, unlikely during programme life*] • Outsource the activity [*costly, poor control over data collection*]	• Baseline from detailed data allow tracking of adaptation measures, e.g. spread of improved cultivars, uptake of alternative production systems, changes in income
Promote community seed banks for PGRFA conservation	21,500	• Rely on another initiative, e.g. from community or NPGRC [*possible but unlikely*] • Do not execute [*Incremental loss of local landraces*]	• Community empowerment • Template for other regions • Template for other SADC countries through the SADC Plant Genetic Resources

Action	Cost USD	Alternatives	Sustainability and Benefits
			Centre (SPGRC) network • Implementing an identified element in national PGRFA and biodiversity strategic plans • Continued availability of Kavango East landraces
Strengthen seed exchange systems	18,000	• Rely on another initiative and market forces [*possible but unlikely*] • Do not execute [*Limited availability of landraces*] • Outsource the activity [*costly, ownership vague*]	• Community empowerment • Landraces available to small-scale farmers in other regions • Potential for income generation and value addition
On-farm trials and yield assessments by farmers on traditional varieties	30,000	• Outsource the activity or carry out on research stations [*costly, effect of local variables and cultural practices unclear*] • Rely on another initiative, e.g. within DAPEES [*unlikely*] • Do not execute [*Limited data on the effect of local variables and cultural practices*]	• Skills transfer to farmers • Data to inform crop modelling of traditional agriculture • Improved data to inform algorithms used for national food security and agricultural production assessments
Develop local capacity for crop genetic analysis and mapping	56,000	• Rely on another national initiative, e.g. NCRST [*likely, but not in target area*] • Do not execute [*Appropriate skills development unlikely*] • Outsource the activity [*costly, information ownership vague, local skills development unlikely*]	• Expert analysis allow informed valuation and decision-making on PGRFA priority areas • An identified critical skill in national technological expertise can be applied to local situations
Contribute germplasm and passport data to national collection	6,000	• Rely on NPGRC to carry out independently [*likely but not in programme timeframe*] • Rely on NPGRC for co-funding [*possible but unlikely as collaboration already has cost implications, e.g. training, processing for accessioning, archiving, collection maintenance*] • Do not execute [*poor collaboration on national issues*]	• Skills training and transfer • Improved awareness of PGRFA • Support to NPGRC as a national institution • Improved representation and long-term availability of Kavango East landraces • Archived data and germplasm support TK rights of communities
Providing top-up bursaries for capacity building in: • Anthropological cultural analysis	50,000	• Rely on other initiatives, e.g. NCRST, universities[*likely, but not in required disciplines or target area*] • Rely on available expertise	• Focus on critical skills gaps in national technological expertise • Greater availability of professional support with

Action	Cost USD	Alternatives	Sustainability and Benefits
• Quantification of Livelihood diversification • Crop yield analysis • Agricultural statistics (biometry) • Crop modelling • Crop genetic marker studies • Agrometeorology • Livestock performance testing • Rangeland analysis Fodder and food nutritional quality		and skills [*Poor programme execution, poor data analysis, follow-on studies unlikely, continue inadequate specialist support to communities*] • Do not execute [*poor professional skills development, short courses only*]	rare analytical skills in Namibia • More Namibian adaptation studies and projects by early career professionals • Capacity and skills transfer to Namibian tertiary training institutions • Greater availability of professional support to implement national strategies and action plans
Document the livestock herding practices in marginal desert regions of Namibia	24,000	• Rely on known information sources [*variable reliability*] • Trust another initiative will collate information [*likely for Topnaar*] • Outsource the activity to a consultant [*costly, parallel activities not feasible*]	• Improved livelihood and culture-specific information on small-scale livestock production; partly applicable to neighbouring regions
Evaluate livestock behaviour in relation to local temperature and grazing	59,600	• Outsource the activity [*costly, effect of local variables, livestock management practices and breeds remain unclear*] • Rely on another initiative, e.g. DAPEES or DARD [*unlikely*] • Do not execute [*Limited data on the effect of local variables on agricultural export production not feasible*]	• Clarification of livestock responses to increased temperatures • Highly relevant information for Namibia's most important commercial agriculture producers • Data to inform habitat suitability models to evaluate the effects of climate change on livestock production • Improved data to inform algorithms used for evaluating rangeland and livestock by remote sensing
Determine availability and nutritional qualities of fodder on rangelands	55,150	• Outsource the activity [*costly, local skills remain limited*] • Rely on another initiative, e.g. DAPEES or DARD [*unlikely*] • Do not execute [*Limited data on nutritional quality*]	• Essential skills development and training • Improved data to inform algorithms used for evaluating rangeland from remote sensing • Performance data on livestock to inform decision-making matrices for risk management or livestock production models

Action	Cost USD	Alternatives	Sustainability and Benefits
Promote registered associations for farmers in target area	23,000	• Rely on another initiative, e.g. FSP or DAPEES or Division Cooperatives in MAWF [*possible but unlikely*] • Do not execute [*Poor negotiating power and communication structures perpetuated*]	• Community empowerment • Improved communication platform for farmer consultation • Forum for information exchange on shared resources and rangeland management
Prepare two constituency risk management and adaptation plans through informed participation	40,000	• Rely on another initiative [*possible but unlikely*] • Do not execute [*climate unpreparedness with associated poor risk management continues*]	• Community empowerment • Consultative risk management • Improved climate change preparedness • Template for application elsewhere in Namibia
Test a downscaled forecast system for livestock production	12,000	• Rely on another initiative, e.g. from NMS [*possible but unlikely*] • Do not execute [*continued poor knowledge of livestock producer needs*]	• More effective distribution of weather forecasts • Support for on-farm decision-making, risk management and extended family support
Develop Namibian capacity in weather forecasting to support agriculture	140,000	• Rely on current incremental capacity building, e.g. from NMS and MAWF [*likely but slow, high levels of expertise within next decade unlikely*] • Establish local university courses [*costly, local expertise inadequate to support, sustainability in terms of skills employment questionable*]	• Namibian capacity to monitor and analyse weather patterns essential to effective climate change adaptation • Greater availability of professional support with rare (for Namibia) analytical skills • Increased evaluation of climate variability and synoptic weather analysis by early career professionals • Capacity and skills transfer to Namibian tertiary training institutions • Increase of professional support to implement national strategies and action plans
Develop Namibian capacity for climate modelling	68,200	• Rely on another initiative, e.g. NMS, universities, WMO etc. [*possible but unlikely*] • Do not execute [*continued inability to downscale regional products*] • Outsource the activity [*costly, sustainability unlikely, local capacity not developed*]	• Addressing critical skills gap in national technological expertise • Capacity building and advanced skills transfer to Namibian institutions • Developing capacity for downscaling NWP to produce weather forecasts

Action	Cost USD	Alternatives	Sustainability and Benefits
			for critical local sectors • Rapid improvement of information on likely climate change impacts
Improve weather forecast dissemination in local languages	15,000	• Provide internet access to global and regional services [*unsustainable, access at farms and remote areas problematical, understanding of forecasts remain poor*] • Rely on another initiative, e.g. from community or NMS [*possible but unlikely*] • Do not execute [*Understanding and use of weather forecasts remain low*]	• Weather information available in local vernacular • Better understanding and potential use of forecast information • More effective distribution of weather forecasts • Support on-farm decision-making, risk management and extended family support systems
Test effective weather forecast dissemination	5,000	• Rely on another initiative [*probable but unlikely for target areas*] • Do not execute [*Access and use of weather information remain unclear*]	• Improved weather forecast communications to communities at risk • Consultation mechanism to inform the development of improved forecast information • Pilot study for potential nationwide application
Develop a community weather monitoring network in Kavango East (low rainfall woodland area)	12,500	• Rely on another initiative, e.g. NMS or DAPEES [*possible but unlikely*] • Do not execute [*Community ability to monitor and act on weather remains low*]	• Community empowerment • Skills transfer • On-farm tools to exploit crop production opportunities or apply crop risk management procedures • Improved climate change awareness and weather monitoring • Improved data to inform weather forecasting and food security models
Develop community weather monitoring networks in two desert areas of Erongo region	12,500	• Rely on another initiative, e.g. NMS or DAPEES [*possible but unlikely*] • Do not execute [*Low community input and action for effective adaptation*]	• Community empowerment • Skills transfer • Improved climate change awareness and weather monitoring • On-farm support to apply rangeland decision-making matrix • Improved data to inform weather forecasting models
Inform agricultural extension services	7,000	• Do not execute [*Full uptake from reporting and knowledge*	• Detailed understanding of procedures and outcomes at

Action	Cost USD	Alternatives	Sustainability and Benefits
about results from agrometeorological forecasting trials		*management unlikely*] • Rely on NMS and DARD to transmit full information [*likely but little credit to AF programme*]	all levels • Assimilation of programme outcomes and likely long-term continuation

D. Describe how the 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 programmes of action, or other relevant instruments, where they exist.

This programme is strongly aligned to national and sub-national policies, plans and priorities for sustainable development, and specifically from the perspective of climate change, as detailed in Table 9. However, no specific national, regional or sectoral policies or plans prioritise development or climate change adaptation in the target areas.

Table 9: Programme complementarity with existing national/subnational development strategies.

Instrument and Description	Programme relevance
Constitution of the Republic of Namibia (1990) *Fundamental law according to which Namibia is acknowledged to be governed*	***Article 95 (l).*** Maintain ecosystems, essential ecological processes and biological diversity of Namibia, and utilise our living natural resources in a sustainable manner for the benefit of all Namibians, both present and future.
Vision 2030 (2004) *Framework outlining Namibia's development programmes and strategies to achieve its national objectives; aims to transform Namibia into a healthy and food-secure nation, where people enjoy high standards of living, a good quality of life and have access to quality education, health and other vital services*	Founded on six pillars, including; ***Agriculture***: sustainability in the land and agriculture sectors and diversified livelihoods are important in production systems; ***Education***: places great emphasis on skills development; ***Science & Technology***: recognises the need to adopt a science and technology-led development strategy.
National Development Plan 4 (2012/13–2016/17) *4th five-year implementation tool for V2030, with three high-level goals: high and sustained economic growth; employment creation; and increased income equality*	Agriculture identified as one of four economic priority areas; Climate change ("weather misfortunes") identified as a challenge to be addressed by investigating drought-tolerant crops and livestock; Education and skills identified as one of five basic enablers, but R&D underdeveloped.
2nd National Biodiversity Strategy and Action Plan (2013–2022) *Framework for maintaining and enhancing biodiversity and ecosystem services, through five Strategic Goals and 17 Targets, aligned with the CBD Strategic Plan and Aichi targets*	***Strategic Goal B: Reduce direct pressures on biodiversity and promote sustainable use of biological resources.*** Target 9: By 2016, ecosystems most vulnerable to climate change and their anthropogenic pressures are identified, and by 2018, appropriate adaptation measures are developed and implemented in priority areas. ***Strategic Goal C: Improve the status of biodiversity and safeguarding ecosystems, species and genetic diversity.***

Instrument and Description	Programme relevance
	Target 12. By 2020, genetic diversity of cultivated plants and farmed animals is maintained and enhanced ***Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building***. Target 15. By 2020, traditional knowledge and the innovations and practices of indigenous and local communities relevant to the conservation and sustainable use of biodiversity are recognised, respected and promoted Target 16. By 2022, knowledge, science base and technologies relating to biodiversity and ecosystem management are improved and made relevant to political decision-makers.
National Policy on Climate Change for Namibia (2011) *Legal framework to manage national climate-change responses in a timely, effective and appropriate manner*	Objective 1. To develop and implement appropriate adaptation strategies and actions that will lower vulnerability of Namibians and various sectors to the impacts of climate change. Objective 4. To enhance capacities and synergies at local, regional and national levels and at individual, institutional and systemic levels to ensure successful implementation of climate change response activities. Recognises the complexity of climate change and need for multi-sectoral responses, through strategies devised for food security and sustainable resource base (4.2); agriculture (4.3); education, training, capacity building and institutional strengthening (4.10); research and information needs (4.11); public awareness, participation and access to information (4.12); technology development and transfer (4.16); gender issues and child welfare (4.18); and vulnerable groups (4.19)
National Climate Change Strategy and Action Plan (2013–2020) *Operationalises the Climate Change Policy through providing guiding principles and priority action areas through a multi-sectoral approach*	Regional profiles on climate change impacts and projections. ***Within the Adaptation Agenda, the following Strategic Aims are relevant****:* *Under Theme A1: Food Security and Sustainable Resource Base:* SA2: Development of climate resilient cropping systems SA3: Identify climate resilient livestock practices SA5: Test sustainable land management practices SA6: Improve Early Warning Systems and Climate Risk Management (CRM) Systems SA12: Conservation of biological resources and maintenance of resilient ecosystems ***Within the Cross-cutting Issues Agenda:*** *Under Theme C1: Capacity building, training, and institution strengthening:* SA1: CRM capacity development *Under Theme C2: Research and information needs:* SA1: Improved functional climate monitoring system SA2: Monitor ecosystem and biodiversity changes related to climate change SA3: Coordinate research for knowledge production on climate change SA4: Document TK and coping mechanisms. *Under Theme C3: Public awareness, participation and access to information:* SA1: Develop and disseminate public awareness materials SA2: Promote public participation in addressing climate change *Under Theme C4: Disaster Reduction and Risk Management:* SA1: Strengthen forecasting and EWS SA2: Improve disaster preparedness and response mechanism *Under Theme C9: Gender issues and Child Welfare* SA1: Empower communities with participation of men and women SA2: Ensure climate change response mechanisms are gender

Instrument and Description	Programme relevance
	sensitive
2nd National Communication to the UNCCC (2011) *Follow up document to the Initial National Communication of 2011*	Identified Land Use, Land use Change and Forest (LULUC) sector as key for adaptation activities; Factors determining vulnerability Impact on farming households Livestock management systems Developing climate resilient production systems: Use of improved crop and non-traditional crop varieties; Improved Early Warning Systems; Crop modelling capacity Development of climate resilient crops: Crop germplasm conservation, evaluation and breeding Improve disaster preparedness and vulnerability mapping Capacity building and Institutional strengthening
Climate Change Vulnerability and Adaptation Assessment (2015) Contribution to the 3rd National communication to the UNFCCC	Provides overview of current state of agricultural sector; drivers of sensitivity; state of adaptive capacity; and an assessment of sectoral vulnerability. Particular vulnerabilities of certain groups of the Namibian population, including women, children and the elderly, and indigenous people are highlighted. Assesses current adaptation and adaptation priorities in the sector, e.g. climate smart agriculture approaches, like growing drought-tolerant crops; introducing fodder flow systems.
National Policy on Community Based Natural Resource Management (2013) *Framework for wise and sustainable use of natural resources on State land outside Protected Areas, as well as the promotion of integrated land and natural resource management*	Recognises rights and development needs of local communities; Recognises need to promote biodiversity conservation and empowers present and future generations to manage and benefit from natural resources, in an integrated manner. These rights include rights to access, use, control and benefit. Promotes planning and decision-making that consider the most appropriate land uses based on land capability, optimum economic return, environmental and human needs, through integration and strengthening of community institutions and structures.
Ministry of Environment and Tourism Strategic Plan 2012/13–2016/17 *Medium-term framework to guide organisational operations and strategic interventions of MET, aligned with V2030 and NDP4*	Climate Change identified as a threat affecting implementation of MET operations. Under programme "Implement climate change mitigation and adaptation measures", community based adaptation actions will be piloted and implemented
National Agricultural Policy (1995) *Framework to increase and sustain agricultural productivity, real farm incomes and national food security within the context of a fragile ecosystem*	Promotes consultative and participatory approaches to problem-solving in the sector Emphasis on support to communal farmers; Improved technology for farmers generated through research; Develop agricultural education and training opportunities to enhance human capital in the sector; Vulnerability addressed through long-term preparedness planning
[Draft] Namibia Agricultural Policy (2011) *Revised framework to promote contribution of agriculture to economic development in Namibia*	Contribute to improving rangeland resources; increase crop and livestock production and productivity particularly in communal areas; ensure a pool of qualified professional and technical agriculturalists; capacitate farmers with knowledge and skills; develop appropriate research agenda responsive to farmers' needs; improve access to agricultural information, while recognising that climate change will impact on production potentia
National Rangeland Management Policy and Strategy (2012) *Framework and guidelines to manage rangelands in a sustainable manner, reduce vulnerability of rangeland users,*	Advocates for: Managing rangeland for effective utilisation; Monitoring the resource base; Identify and share best practices; Ensure functional support services; Integrated local land-use planning;

Instrument and Description	Programme relevance
and contribute to livelihood improvement	Adjusting livestock to available fodder sources; Improving rangeland research capacity
National Drought Policy and Strategy (1997) *Framework and measures to support farmers by reducing vulnerability to drought in the longer term through sustainable resource use*	Given that drought may be one of the manifestations of climate change in Namibia, some strategies are relevant, i.e. strategies to promote drought mitigating technologies and practices; on-farm risk minimisation; sustainable rangeland management; agricultural research, extension and training; improved information gathering, analysis and dissemination
Disaster Risk Management Act (Act #10 of 2012) *Legal Framework that establishes institutions and supports an integrated approach to disaster risk management in Namibia*	Provides for mitigation, reducing risk/severity and prevention of natural disasters that may be a direct or indirect consequence of climate change; Advocates for Early Warning Systems and related research and capacity development
Research, Science and Technology Act (Act #23 of 2004) *Legal framework to promote effective application of scientific and technological skills to produce goods and services for national development*	In particular, this programme contributes to two objectives: It will promote common ground in research, scientific and technological thinking across several disciplines; and It will encourage and promote innovative and independent thinking and the optimum development of intellectual capacity of Namibia's human resources
National Programme on Research, Science, Technology and Innovation (2014/2015–2016/17) *In accordance with Section 18 of the RST Act, programme provides direction on developing, adopting and utilising research, science and technology to improve livelihoods and socio-economic status of Namibia's people*	***Priorities and strategic research areas defined, including:*** Priority 2: Building research capacities and technical skills Priority 3. Promoting cooperation in research and innovation activities Priority 4. Disseminating scientific and technological knowledge ***Strategic research areas within Agriculture:*** (h) Promote rangeland management (k) Develop technologies that promote resilience and adaptability to the environment and communities to the changing climate; (l) Promote the conservation and protection of indigenous animal and plant genetic resources ***Strategic research areas within Indigenous Knowledge Systems:*** (f) Promote research in IKS and documentation, as well as the use of social knowledge and traditions ***Strategic research areas within Social sciences and humanities:*** (g) leveraging emerging technologies to benefit Namibians (k) Climate change and adaptation
Indigenous Peoples and Climate Change in Africa (2013) *Report on case studies of Namibia's Topnaar and Hai||om Communities, including impacts, vulnerability and adaptation strategies*	***Recommendations include:*** 1) Use local knowledge for adapting to climate change 2) Develop strategy for adaptation and capacity-building 3) Establish associations to empower communities

In addition, the following instruments and plans have elements that has bearing on this programme, but those same elements are encompassed and deconstructed in more detail in more recent plans: Regional Planning and Development Policy (1997); National Poverty Reduction Action programme; Amendment to the 1975 Nature Conservation Ordinance (1996); National Land Policy (1998); Communal Land Reform Act (2002); etc.

E. Describe how the 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.

Namibia places high priority on environmental protection for sustainable development, recognising that environmental management is both an enabler and driver of economic development. As a result, various legal instruments, particularly as these relate to the environment (as indicated in *Section II.D*, p. 57), have been promulgated, and their associated operational standards offer effective guidelines for programme implementation.

The national technical standards most relevant to the programme are those relating to environmental impact assessments, i.e. Environmental Management Act #7 of 2007. This Act serves as an overall governing instrument to promote coordinated and integrated management of the environment; to give statutory effect to the compilation of environmental assessments; and to enable obligations under international environmental conventions. The processes (standards) required to identify and mitigate potential environmental impacts of any development intervention are clear. However, there are no adverse environmental effects anticipated as a result of the implementation of this programme; and it would not be necessary to conduct EIAs for any of the components.

In undertaking on-farm cropping trials in the Kavango East region, only land already cleared for agricultural purposes will be utilised. No on-farm trials will be carried out on recently established farms (within the past five years) or on farms with large cleared areas that practice mechanised agronomy. On-station trial will be undertaken on designated lands under management of the Ministry of Agriculture, Water and Forestry. No infrastructure development is planned for this programme, thus building standards, for example, are not relevant.

Protected areas in Namibia, including the Lower Kuiseb farms of the ≠Aonin Nama or Topnaar in the Namib-Naukluft Park, are proclaimed under the Nature Conservation Ordinance of 1975. In addition to providing a framework for establishing state protected areas, this Ordinance regulates natural resource uses both within and outside conservation areas. Research/collecting permits will be obtained from the MET if reference or voucher material is required for indigenous species, though currently no such collection is envisaged. The requirement for research permits has been waivered for non-invasive research in the Gobabeb research concession area along the Kuiseb River. Understanding and monitoring the traditional livestock production system of the local Topnaar community in this area is of particular interest to the NNP managers, Kuiseb Basin Management Committee, TTA and other interested and affected stakeholders. Initial review of research applications and subsequent progress reporting to the MET will ensure compliance to terms and conditions of permits, as well as that the implementation of activities is relevant, responsive and responsible.

The Ordinance was amended in 1996 (Act #5 of 1996) to provide for the utilisation of wildlife in communal areas through the establishment of conservancies and community forests (Forest Act #12 of 2001). Rights and obligations regarding sustainable use and management of natural resources in these areas are transferred to communities, also

allowing them to benefit from their involvement. As a consequence, Namibia is recognised as a world leader in the development of the Community Based Natural Resource Management approach to conservation, and the subsequent CBNRM policy (2013) suggests appropriate success measures for possible uptake by the programme. For example, the policy recognises the increasing threat of climate change, and advocates for tactics that draw on community strengths to monitor effects, discuss adaptation options and to transfer new skills and technologies.

Research interventions will comply with verifiable technical standards and protocols, specific to the relevant discipline. Methodologies will be assessed by the SF, in consultation with university faculty associated with each of the qualifying training opportunities. Scientific standards are developed from hands-on, field and lab-based experience held by the programme facilitators and key stakeholders. For example, collecting and accessioning of PGRFA and associated passport data will be prescribed by the protocols of the National Plant Generic Resources Centre, developed over 25 years of operations, and in line with internationally accepted practices.

Ethical standards are critically important when conducting research with communities, and implementation of such research will adhere strictly to a code of conduct that subscribes to Free Prior-Informed Consent. In the case of livestock research (Component 2) and in the absence of specific rules designed to ensure the humane care of animals used for scientific purposes, the US National Institutes of Health and Australian code of practice will apply, if relevant.

The Traditional Authorities Act #25 of 2000 recognises Traditional Authorities (TAs) as legal entities to promote peace and welfare amongst the community members and to ensure the observance of the customary law of that community by its members. TAs must be fully involved in the planning of land use and development for their areas, including sustainable resource management - it is their duty under the law to ensure this. Thus the programme will be collaborating closely with TAs to guarantee that implementation is sensitive to customary practice and in line with acceptable standards regarding community engagement.

An important deliverable from this programme will be qualifying and enhanced training that could be deployed within the public and private sectors. Professional skills development will comply with the regulations and National Qualifications Framework that were established by the National Qualifications Authority (NQA) in terms of the Namibia Qualifications Authority Act (Act #29 of 1996) and the university associated with qualifying training. Specific requirements for various categories within the Public Service of Namibia are established by the Public Service Commission in terms of the Public Service Act (Act #13 of 1995) and the Recruitment Policy Framework of the Public Service, as well as the various training policies, technical requirements and evaluation procedures of line ministries. *Ad hoc*, informal and short training courses for practical skills development and field assistants will be developed by project facilitators in terms of the quality and kind of data that would be required.

The programme thus complies fully with the ESP of the AF.

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

Following a thorough review of ongoing climate change initiatives in Namibia, it is clear that this programme does not duplicate, overlap with or compromise other initiatives. This programme, in fact, will complement or further expand current or past projects. Some of the most relevant current interventions to which this programme will be aligned include:

- *Scaling up community resilience to climate variability and climate change in Northern Namibia, with a special focus on women and children (SCORE)*
  Funder: GEF/PIMS 4711
  Location: Northern Namibia
  Implementers: MET; MAWF; regional partners
  Dates: 2015–2020
  Status: Programme staff recruited; inception workshop planned for 29 July 2015.

This project aims to strengthen the adaptive capacity to climate change and reduce the vulnerability of 4000 households (80% of which are female-headed) and children in 75 schools, to droughts and floods in Northern Namibia. Three project outcomes are as follows: i) smallholder adaptive capacity for climate resilient agricultural production practices strengthened; ii) reduced vulnerability to droughts and floods through the restoration of wells and enhancement of floodwater pools for food security; and iii) climate change mainstreamed into national agricultural strategy/sector policy. With a strong focus on resilience, and an approach of participatory decision-making, there is some scope for collaboration between this project and the programme. The focus area for SCORE is north-central, with some interventions planned for Kavango East. However, it is unlikely that the same beneficiaries will be targeted, the interventions are complementary rather than duplication, and platforms to inform and advise exist. Activities envisaged include agricultural capacity development with more conservation tillage, leafy vegetable and fruit production, and integrated pest management; improved financial services; and improved market access. The EE may serve on the steering committee for this project.

- *Adaptation of agriculture to climate change in Northern Namibia*
  Funder: giz/Namibia
  Location: Northern Namibia
  Implementers: MAWF; giz/Namibia
  Dates: 2015–2019

The objective of the project is to promote the application of climate adapted farming practices and targets smallholder farmers and communities most vulnerable to climate change. This project is designed to complement the SCORE project. Indicative outputs are climate adapted methods are practiced; delivery of services for climate adapted methods is secured; know-how and experiences on climate adapted farming practices is capitalized on; and the capacity of the MAWF to tackle climate change issues is increased. Cross learning opportunities with this initiative and others that may emerge over the implementation period will be facilitated through training during field schools, advisory and mentorship programmes as well as through the Stakeholder Forum.

- *Biodiversity management and climate change programme*

Funder: giz/Namibia
Location: Northern Namibia
Implementers: giz/Namibia; MET
Dates: Until 2016
Status: Ongoing, integrated with MET operations

This project aims to consolidate the successes of the community-based natural resources management approach and align it with nature conservation policies. The project works with a number of communal conservancies and community forests in the Kavango East and Ohangwena regions. It promotes the commercial use of biodiversity-based products (biotrade), the ecosystem-based adaptation to climate change, and improved governance to sustain these development processes. There is no overlap with this programme's objectives, which address agricultural issues, although more direct linkages may be sought during programme implementation. Some immediate areas of interest for this programme would be to assess target areas and existing networks for agricultural interventions.

- *Developing a National Strategic Action Plan (SAP) for Plant Genetic Resource for Food and Agriculture, in the context of climate change*
  Funder: Benefit-Sharing Fund of the International Treaty for PGRFA
  Location: Nationwide
  Implementers: Gobabeb; UNDP, MET; NPGRC
  Dates: 2014–2015

This main deliverable from this one-year project will be a short- to medium-term strategy and implementation mechanism to conserve PGRFA in Namibia, particularly within the context of climate change. The plan will be underpinned by relevant, targeted studies that provide baseline results and lessons learnt, which in turn will be translated into relevant actions in the SAP. Preliminary findings in the Kavango East have been the main source and inspiration for Component 1 activities in the programme. Target areas were identified through participatory actions in 2014 and 2015, and beneficiaries were identified. These communities are thus already informed and welcome follow-up interventions regarding accessing traditional crop landraces, and timely and accurate forecasting information.

- *Developing and testing a rangeland production early warning system with livestock farmers in Namibia*
  Funder: EU
  Location: National
  Implementers: Agra ProVison
  Dates: 2015–2020
  Status: Launched in 2015

The overall objective is to enhance the ability of all livestock farmers in Namibia to make management decisions based on timely and relevant data regarding the state and productivity of their rangelands in order to reduce their vulnerability to drought and the adverse impact of climate change. The rangeland monitoring system to be developed will be based on RS/GIS technology. There is definite scope for collaboration with this initiative particularly regarding assessments of rangeland conditions and shared mechanisms for interacting with farming communities. Local-level guidelines for assessing rangeland condition could be developed in close collaboration with this project. The geographical spread of this project, however, is broad, and intends to develop a tool for nation-wide application. This programme intends to focus on specific groups of small-scale livestock

farmers. This programme may furthermore contribute field observation data to validate and support RS/GIS analysis, while Component 3 contributes a meteorological forecasting mechanism not yet envisaged.

- *Comprehensive Conservation Agriculture Programme (CCAP) for Namibia*
  Funder: MAWF/GRN
  Location: National – all cropping regions
  Implementers: MAWF
  Dates: 2015–ongoing
  Status: Developed in 2014

This programme, developed for implementation as part of the operational plan of DAPEES, seeks to holistically address important aspects of conservation agriculture (CA) in order to promote uptake of and profit for small-scale farmers. The overall objective of the programme is to counter and reverse land degradation and adapt to climate change through CA adaptation as a basis for sustainable crop production and improved food security at national and farm level. The programme aims to (i) increase awareness and knowledge on CA among stakeholders; (ii) increase knowledge and skill among farmers and extension staff; iii) conduct farmer focused research to develop appropriate technologies and packages for the farming systems; (iv) establish institutional arrangements for harmonised and coordinated implementation of the CA programme; (v) ensure farmer sustained access to CA equipment, inputs, markets and services; and (vi) develop standards, monitoring and evaluation. The programme aims to provide assistance to communal farmers, in particular, in the form of subsidies. Small-scale farmers in Kavango East would fall within the beneficiary regions, and could potentially participate in this programme. There is little overlap with this programme, but strong potential for linkages, e.g. farmer-focused research; developing standards and an M&E framework to determine uptake and continuation; and incorporating elements of PGRFA in conservation tillage.

- *Strengthening the capacity of farmers to manage climate-related risks in Northern Namibia*
  Funder: EU
  Location: National
  Implementers: FAO; Namibia National Farmers Union (NNFU); MAWF
  Dates: 2015–2020
  Status: Launched in 2015

This project aims to contribute to the vulnerability of small-scale farmers in the northern regions of Namibia to the potential negative impacts of climate change through the promotion of climate smart CA and complementary Good Agricultural Practices as an adaptation strategy. It will support on-going MAWF interventions to increase agricultural productivity and production of small-scale farmer, especially women farmers and youth. Efforts will be made to establish linkages with this initiative as there are obvious parallels in envisaged outcomes and potential synergies to be explored as explained for CCAP. There is, however, no direct duplication or conflict between activities.

Various other climate change adaptation and agriculture related initiatives are on-going currently in Namibia, particularly in the crop-producing Northern Communal Areas (NCAs) and, to a slightly lesser extent, the Kavango regions and Zambezi region. Most of these initiatives work closely with local communities to strengthen capacity to deal with climate

change and reduce food insecurity in various ways. The most pertinent efforts include a conservation tillage project implemented by the Namibia Agronomic Board (NAB) and the Agro-Marketing and Trade Agency (AMTA), a parastatal under MAWF, which is assisting farmers to market their fresh produce through business hubs. An AMTA centre in Rundu in the Kavango West region may be a useful linkage for this programme to assist beneficiary farmers with marketing of their produce. Several international bodies such as the International Federation of Red Cross and Red Crescent Societies (IFRC) support the Namibian Red Cross, and others, and conduct assessments as well as provide support focused on food security, nutrition, water and sanitation, health and hygiene promotion in the northern regions. These are all complementary interventions that address baseline resilience needs.

Since ratifying the UNFCCC, Namibia has made significant strides in developing national climate change policies and strategies with a strong focus on adaptation measures, particularly awareness and mitigation initiatives. The deliverables of various interventions over several years underpinned the development of these policy frameworks and their operational mechanisms.

The outcomes of some of these initiatives have furthermore served as a precursor and prompt for elements within this programme by emphasising priority areas that need to be addressed. Parts of the programme will build on previous efforts, applying lessons learnt and exploring critical questions arising from previous initiatives. There have been no similar activities as envisaged by this programme.

Some linkages to earlier projects include:

- *Africa Adaptation Project in Namibia (AAP NAM): Building the foundation for a national approach to Climate Change Adaptation in Namibia*
  Funder**:** JICA
  Location: National
  Implementers: MET; UNDP
  Dates: 2010–2013

This initiative was a focused effort to develop a national approach to addressing climate change. It aimed to build an effective leadership and institutional framework in Namibia for improved coordination and integration of climate change programmes into development policy. This initiative delivered (i) National Climate Risk Management Capacity Assessments and Capacity Development Plan; (ii) Dynamic Systems Modelling and Threshold 21 (T21) to undertake cross-sectoral analyses of climate change impacts; (iii) Information packages and targeted awareness-raising and training to decision-makers and practitioners on climate change adaptation; (iv) Regional climate change adaptation information toolkits (including for the Kavango and Erongo regions); and (v) outreach programmes for youth action. Deliverables directly informed the development of the NCCSAP, and can thus be regarded as the project's most significant legacy.

Previous interventions in the agricultural sector that have relevance focused on land access and management, livestock support and indigenous natural products through the Agriculture Project of the Millennium Challenge Account (MCA). This project was primarily focused on achieving a sustainable increase in economic performance of the agriculture sector in the Northern Communal Areas (NCAs) of Namibia. The activities of the Agriculture

Project strengthened the land tenure system in the NCAs; improved rangeland management practices; strengthened animal health services; improved livestock marketing efficiency, and; strengthened the supply chains and marketing of indigenous natural plant products throughout Namibia. The approach was to synchronise support efforts that contribute to poverty alleviation and towards improved livelihoods of beneficiaries. The MCA compact terminated at the end of 2014, but useful lessons can be learnt, for example, regarding mobilising communities to form Plant Product Producers associations; and engaging communities in rangeland monitoring activities.

Other related projects include: (i) SPA (Strategic Priority on Adaptation) *Adapting to Climate Change through the Improvement of Traditional Crops and Livestock Farming* (CCA), which developed and piloted a range of coping mechanisms for reducing the vulnerability of farmers and pastoralists to climate change including variability by introducing improved crop cultivars and livestock breeds; (ii) *Adjusting Community Agricultural Practices to Reduce Climate Change Risk in Omusati region (OIKE), which was a* community-based project supported by the Global Environmental Facility Small Grants Programme (GEF SGP) through UNDP to strengthen resilience of communities to the adverse impacts of climate change by providing practical tools for adaptation and to increase community awareness regarding risks.

A more thorough scoping on previous climate change adaptation interventions will continue during programme implementation. Despite significant investment in Namibia to understand potential impacts and provide suitable coping mechanisms at local level, there has been no systematic compilation of projects and their outputs, deficiencies and strengths to inform follow-on programmes. It is thus problematic to assess uptake and exploit opportunities created by these projects. The review also highlighted that the overwhelming majority of interventions have focused on the densely populated NCAs where returns on funding investment in terms of beneficiaries are more favourable. Almost no attention has been afforded vulnerable communities in the central and southern regions, e.g. small-scale farmers in the Erongo region. Inventory, characterisation and evaluation of local crop cultivars that could be key to agricultural adaptation strategies in Namibia, and elsewhere in the southern African region, have not been comprehensively undertaken. Marrying tried and tested traditional knowledge with scientific rigour has been a rare approach, with either top-down or local-level interventions most common. This programme will seek a different approach, but will work in close collaboration other relevant initiatives.

In addition to those climate change adaptation interventions by various stakeholders mentioned above, the programme proponents also have extensive experience dealing with climate change issues, and in particular, the impacts and risks of climate change on the agricultural and environmental sectors, and the socioeconomic implications. The climate change credentials of the EE and sub-EE can be summarised as follows:

Gobabeb has a long history and extensive experience in environmental monitoring, and a similar long history in meteorological monitoring and international collaboration in climate science. It is currently implementing an assessment of how climate change may affect the incidence of fog and fog-adapted species along the Namibian coast through the SASSCAL FogNet and WeatherNet initiatives, as well as the FogLife project. This centre has been observing the close relationship of Topnaar people with their environment for over 20

years. Through its Executive Director, Gobabeb has vast experience of plant science and agricultural development in Namibia, including climate change impact evaluations and adaptation initiatives. Gobabeb has furthermore recently implemented a BSF project on PGRFA in northern Namibia and is developing a national strategy for conservation of PGRFA in response to climate change. Gobabeb expertise, knowledge of practical implementation measures, and experience in stakeholder feedback from small-scale farmers are therefore a fundamental contribution to this programme.

The LAC has a similar long history of engagement with communities regarding land, environmental and development issues in Namibia. It has worked extensively with communities, especially marginalised and poverty stricken people. The LAC will bring essential skills in participatory evaluations, community mobilisation and establishment of viable community organisations to the programme. For example, the LAC has recently completed a study on the vulnerability of indigenous peoples and traditional knowledge to the impacts of climate change, which included the Topnaar. Programme implementation will thus be enhanced by LAC expertise, knowledge of community expectations for climate change adaptation and ability to establish viable community networks to manage resources.

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

The programme prioritises skills development and transfer as integral to the execution of all activities as explained under *Part I. Programme Components*. The programme is therefore rich in learning and knowledge management elements (Table 10).

Table 10: Explicit Learning and Knowledge Management activities and verifiable indicators.

Activity	Objective	Indicator
Learning Elements		
1.1.1 *Collate information on traditional climate variability coping strategies in the Kavango East Region*	Learn from and document traditional farmers' experience	Summary report on traditional coping strategies
1.1.2 *Document on-farm genetic crop diversity system in the Mashare and Ndiyona constituencies*	Compile intensive constituency documentation of on-farm PGRFA	Database of on-farm PGRFA in Mashare and Ndiyona constituencies at NPGRC
1.2.1 *On-farm trials by farmers on yields and performance of traditional varieties under different conditions*	Evaluate crop performance through participatory on-farm trials	Database on yields from traditional varieties and associated biophysical data at DARD
1.2.2 *Develop local capacity for genetic mapping of Namibian maize landraces*	Train a Namibian to do crop-related genetic marker studies	PhD thesis on maize phylogeography in Namibia and associated academic publications
1.2.4. *Develop knowledge on traditional agrobiodiversity systems by providing top-up bursaries for advanced study*	Support qualifying training at Masters level for six Namibians in rare analytic disciplines relevant to agriculture	Six Masters degrees with at least six academic papers and six popular papers on traditional agriculture in Namibia

Activity	Objective	Indicator
2.1.1 *Document the livestock herding practices of ≠Aonin Nama in the Lower Kuiseb and !Oegan Damara in the Okombahe area*	Learn from and document traditional farmers' experience	Summary report on traditional coping strategies
2.1.2 *Track livestock activity with seasonal assessments of livestock condition in grazing areas*	Understand livestock behavioural adaptation to temperature and grazing for communal rangeland management	Database on livestock behaviour and associated biophysical data at DARD
2.1.3 *Determine the seasonal availability and nutritional qualities of available feed in grazing areas*	Determine livestock productivity from small-scale farming for communal rangeland management	Database on performance testing of local fodder sources and seasonal rangeland assessments at DARD
2.1.6 *Test a livestock production forecasting information system in the Lower Kuiseb area*	Test meteorological livestock production models	Comparative information on model performance and limitations (academic publication)
3.1.1 *Develop Namibian human resources for agrometeorological monitoring and forecasting*	Support six Namibians to receive primary degrees in meteorology, one at Masters degree level in Numerical Weather Prediction (NWP)	Six Namibians complete SAWS-UP bridging course and Honours degree in meteorology, with one Masters degree in NWP
3.1.2 *Develop Namibian agrometeorological modelling capacity based on real-time weather monitoring*	Employ three SADC students at PhD level or two post-doctoral interns in downscaling and refining NWP, analysing and explain climate variability and synoptic weather conditions in Namibia, and agrometeorological modelling	Working downscaled NWP model for Kavango East Region; working crop production model for northern Namibia; at least four academic and four popular publications on Namibian weather and climate variability
3.1.3; 3.2.2.; 3.2.3. *Establish weather forecasting information dissemination and monitoring systems through participatory processes*	Train and equip farmer parameteorologist networks in Kavango East and Erongo regions	Weather diaries and submission of weather data by participating farmers
Knowledge Management Components		
1.1.3 *Develop suitable partnerships to maintain community seed banks for on-farm PGRFA*	Establish community seedbanks for on-farm PGRFA	Operational community seedbanks and seed exchange mechanism
1.2.3 *Contribute germplasm and passport data to NPGRC*	Conserve broader representation of Kavango East landraces in NPGRC	Change in NPGRC collection holdings and database on accessions from the Kavango East region
1.2.4. *Develop knowledge on traditional agrobiodiversity systems by providing*	Recognise annually the best academic paper and	Four annual award announcements (2017-

Activity	Objective	Indicator
top-up bursaries for advanced study	best popular communication on climate adaptation	2020) with associated publicity on climate change adaptation
2.1.5 *Prepare Walvis Bay Rural and Daures constituency risk management / adaptation plans*	Apply vulnerability assessments and seasonal monitoring for community planning	Two constituency risk management and adaptation plans for the Walvis Bay Rural and Daures constituencies
3.1.3; 3.2.1. *Establish weather forecasting information dissemination systems through participatory processes*	Distribute and explain weather forecasts in local vernaculars	Working GSM weather forecast dissemination system
3.2.4 *Mainstream agrometeorological early warning and forecasting systems into agricultural extension services*	Attend MAWF directorate meetings during 2020 to report on programme outcomes	Agrometeorological forecasting included in MAWF annual plans after 2020 and in Strategic Plan for 2022/23 to 2027/2028

A recurrent issue at all local institutions is the reluctance of Namibian scientists to publish their research, both to inform their peers internationally as well as to inform the Namibian public about what they do and advances that are being made. The programme includes specific incentives to encourage participating scientists, recipients of study grants, and interns to disseminate information widely. Due to the reticence of Namibians to write, recipients of study grants will be contractually obliged to produce information products for popular consumption and for their peers, while facilitators and collaborating scientists will also be encouraged to contribute to wider appreciation of adaptation measures. Contractual obligations would require grantees and interns to blog at least once every two weeks about what they have learned on an appropriate website, to post at least one communique every two weeks on programme Facebook pages, and to produce at least two popular articles every year. They will also be required to deposit electronic copies of published academic papers and dissertations with the PMU and/or relevant national institutions.

A specific incentive is annual awards for the best academic paper and best popular science communication, recognising that academic contributions are valued by project managers and climate adaptation scientists worldwide, while popular contributions reach national policy makers, stakeholders and immediate beneficiaries. These publications will also contribute to the compilation of future National Communications to the UNFCCC. The PMU will coordinate that activity by soliciting nominations, while also keeping track of relevant articles in locally available newspapers and magazines. The awards will be made by the SF in consultation with the NCRST. Only peer-reviewed articles in scientific journals will qualify for academic awards, while popular communications may include any type of mass-media platform. In addition, the PMU will prepare relevant press releases at least twice a year, while also maintaining a list of local journalists and media to invite to public events.

As in all programmes, progress reporting and feedback is integral to tracking execution of an activity and not simply a closure routine. The programme objective is specifically designed to identify and include appropriate elements of traditional small-scale farming into adaptation measures and to generously develop information and data that would cascade into and inform other activities. The programme cannot be executed without learning from

the farmers themselves and consulting them about potential adaptive changes that may be introduced, which requires keeping a record of the consultative process and feedback to farmers on the outcomes of the participatory learning. Knowledge management is therefore an integral part of the outputs from every activity. The information developed from activities is not only intended to keep beneficiaries and stakeholders informed, but also since information from one activity will contribute to delivering well-informed products from other activities through non-hierarchical and mutually supporting feedback loops.

The information products themselves are the measurable indicators of the programme. A major challenge to effective adaptation is sound information on which to base decisions, which may require consulting the original sources. Information is developed from applying specific analytical procedures according to current discipline-specific procedures on raw data, which is messy and variable in nature. Alternative interpretations or improved analytic procedures may require re-analysis. Access to particular sets of data on which past interpretations of future climate change in Namibia was based is often not readily available.

The PMU, in consultation with facilitators, will therefore ensure sound data management, i.e. archiving of raw data, with accompanying metadata – the process according to which the data was gathered. Facilitators would be responsible for developing the format and kind of data collection, as well as skills training for enumerators and field assistants. They will also verify the accuracy of recording data through unannounced field visits and spot checks of data, while the feedback mechanisms to the primary sources of data – the farmers themselves – provide an additional means of data verification.

At completion of the programme, data archives will be deposited at appropriate national institutions, i.e. complete sets of programme archives (data, accompanying reports, minutes of meetings, etc.) will be deposited in the Gobabeb archives, the LAC and the National Archive of Namibia. Subsets of those archives will be deposited at relevant national institutions, e.g. cultural information at the National Museum of Namibia, Component 1 archives (crops) at DARD-MAWF and NPGRC, Component 2 archives (livestock) at DARD-MAWF and MET, and Component 3 (weather forecasting) at NMS and DARD-MAWF.

The implementation arrangements expect facilitators to regularly report on progress on a quarterly basis, while compiling a synthesis report at completion of the activity. However, an integral component of many activities would be to engage Namibian students as interns and field assistants to work alongside participating farmers. One aspect of such arrangements is the learning element by transferring practical skills and improving communication. Selected participants, identified by the facilitators, will therefore be engaged to assist in preparing reports and analysing data. It is expected that up to ten interns will learn how to write reports under the supervision of facilitators.

Interns and field assistants will be required to undergo short training courses coordinated by facilitators before they are deployed to the field to document information, i.e. on-farm PGRFA, crop production methods and yield assessments, recording field conditions, livestock condition assessments, rangeland monitoring, weather data, etc. Participating farmers will undergo similar training courses. All such training will also include an induction element that will include a climate change awareness aspect, with particular emphasis on disseminating available information, and a knowledge management aspect. The knowledge

management component will encourage all participants to contribute information to journalists, climate change awareness blogging sites (e.g. using WordPress on the Gobabeb website) and contributing short essays and accounts of their experiences, or even video productions, to specific programme websites that will be hosted as part of the Gobabeb, LAC and Traditional Authority (TA) websites. Those contributions will be eligible for an annual reward for popular communication on climate change adaptation issues.

Establishing a specific programme website is not sustainable beyond the life of the programme, therefore the PMU and facilitators will assist the relevant TAs (Shambyu, Gciriku, !Oegan, Topnaar) to establish their own websites and Facebook pages on which components of the programme will be represented. The PMU will contract website developers through competitive bids to establish such websites, while the facilitators, in consultation with TAs, will identify specific community members that may be trained to maintain the websites. Designated staff employed at the offices of the respective TAs will receive some assistance during the lifetime of the programme to maintain their websites, but a special effort will be made to involve tourism operations or other development agencies in those regions to provide a greater degree of support. Providing in-depth assistance to develop and maintain communication outlets for TAs would detract from the primary purpose of the programme, but promoting such an initiative would be appropriate.

The primary beneficiaries of the programme, the farmers themselves, will be closely engaged with the programme during its duration. It is not feasible to engage all farmers in all the activities, thus Farmers' Focus Groups (FFGs) will be established to engage in specific activities such as on-farm trials to determine yields of traditional crops, livestock performance under field conditions and establishing parameteorologist networks. However, regular feedback to the community at large, arranged to coincide with other events so not to interfere with regular schedules, will engage all farmers. Farmers generally visit each other freely, during which time they will be informed about progress at demonstration plots by participating farmers that will be enhanced further by engaging agricultural extension workers and resource persons from other development initiatives. This will ultimately promote an informal exchange of information on best practices and the benefits of the programme. In addition, a focus on distributing essential information by using local languages, e.g. weather forecasts, information posters, and explanatory documents, and by involving local resource persons such as students and teachers, will ensure that accurate information is understood and assimilated.

Particular information products will be produced by the end of the programme to ensure that the knowledge that was generated is available both within beneficiary communities as well as a wider audience. Specific products will include posters on local landraces for schools and community centres in the Kavango East region; a more durable booklet on seed and local landraces with detailed information on agronomic traits in English/Rukwangali; posters on how to evaluate livestock condition and pasture availability; a booklet on fodder plants in the Erongo region and their attributes in English/Khoekhoegowab/Otjiherero; a pamphlet in English/Rukwangali/Khoekhoegowab to understand weather forecast uncertainties; a small handbook for parameteorological networks; and a poster on cloud formation and how it relates to synoptic conditions. These products will be prepared through the programme, with their actual printing and distribution facilitated through collaborating government agencies. The programme will also have compiled and distributed a small-scale farmers'

decision-making matrix that combines traditional observations with scientifically informed observations for improved risk management for crop production in northern Namibia and livestock production along the desert margin. The programme will also have compiled a Risk Management and Climate Adaptation Strategy for implementation by the Topnaar and !Oegan Traditional Authorities.

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

Due to the multifaceted nature of the programme, various consultations including participatory meetings, one-on-one interviews, telephonic conversations, and workshops informed concept formulation and programme preparation and development. Throughout this process two considerations were uppermost – how will the programme build on or address issues that constrains effective adaptation to climate-induced stressors, and will potential actions be of particular benefit to vulnerable groups. By focusing on small-scale farmers, the programme implicitly acknowledges that women are a primary beneficiary as they carry out the bulk of the work in Namibian communal farming areas, while more than 40% of all small-scale farming households are *de facto* women-led, and even more when it is taken into account that male heads of households in small-scale farmers are often absent to seek work elsewhere or traditionally only carry out certain types of labour.

i) Concept formulation

The programme concept emerged during a baseline survey on PGRFA that Gobabeb carried out in the Mashare constituency, 09–17 August 2014. The survey itself was conducted after consultation with the Shambyu Traditional Authority and in close collaboration with the Directorates of Agricultural Production and Engineering and Extension Services (DAPEES) and Agricultural Research and Development (DARD) of the Ministry of Agriculture, Water and Forestry (MAWF). The Traditional Authority and regional DAPEES offices in Rundu and the Mashare Agricultural Development Institute (MADI) were introduced to the objectives of the research and the anticipated outcomes. House-to-house surveys were conducted to better understand (i) the knowledge of local crop farmers regarding climate risks and impacts; (ii) locally existing coping strategies; and (iii) the diversity of and on-farm conservation approaches for plant genetic resources for food and agriculture (PGRFA) at household level. Interviews were facilitated by using a semi-structured questionnaire and conducted in vernacular languages (Rumanyo/Rugciriku and Rukwangali) with 28 households (9 female-headed) from six wards (Mupapama, Mabushe, Shavivare, Yuru, Tara-tara and Dove). The wards were selected based on their perceived vulnerability to climate risks such as floods and drought. The first three wards were close to the Okavango River, the other three further south into the interior.

The similarities in the concerns and constraints that those small-scale crop farmers expressed in terms of climate-related risks were strikingly similar to those of Topnaar farmers in the Walvis Bay Rural constituency. Participatory studies carried out during 2013 and 2014 along the Lower Kuiseb to evaluate the environmental impact of small-scale

livestock herders and their awareness and management of risk indicated a wealth of experience, but little access to, knowledge or acceptance of science-based production skills. Both communities had a similar desire for early warning information on likely seasonal climate conditions and information that may improve production; were skeptical and reluctant to adopt new approaches that may de-stable already precarious and finely balanced traditional production systems; but were desirous to find out and learn proven ways to increase production.

Those field observations were followed by a desktop review of climate-related risks for the potential programme sites, including a review of related previous and ongoing projects. The outcomes were discussed and refined at various consultation meetings with specialists in government agencies; local and foreign universities; advocates and project officers involved with a range of rural development projects; traditional leaders; and various community members.

ii) Programme development consultation

A community meeting with the Topnaar was conducted at Utuseb, 17 April 2015, to consult rural residents of the Lower Kuiseb. The meeting was conducted in Khoekhoegowab, and 34 persons participated (6 male; 28 female, see attendance list Appendix B3, p. 130). The meeting informed and gauged interest for this initiative among community members. Livelihood diversification options are limited for these marginalised people, and there has been limited investment in understanding and enhancing their production systems. A pressing concern, however, is whether their successful coping strategies will continue to suffice with an increasing number of livestock confined to a desert environment, coupled with the negative impacts of a changing climate. There was a clear signal from community members that interventions as proposed in this programme are opportune although long overdue.

An attempt was made for formal key stakeholder consultation and participatory planning at the National Botanical Research Institute in Windhoek on 11 May 2015 (50% female; see attendance list Appendix B5, p. 133). This meeting was convened to inform key partners about the outcome of an AF concept review process by the NIE and to plan for drafting a full proposal within a very limited time period. Those that were not able to attend reaffirmed their interest to participate and assist with inputs in taking the process forward. During that meeting frank discussion on issues such as (i) Is this truly an adaptation project and not "business-as-usual" development project? (ii) Can we demonstrate that the programme will primarily address climate change and/or climate variability? (iii) Does the programme offer suitable and adequate adaptation measures? (iv) Is the programme cost effective? (v) What is the likelihood of future uptake and continuance by government agencies or other national institutions? (vi) Are there overlaps with past or current adaptation or development projects (or government programmes)? and (vii) Are there specific social, economic and environmental benefits to be explained?

Other organisations with projects in the intended areas, or invited by the NIE to prepare AF proposals, were also invited to participate to share information and establish potential linkages and synergies. The outcome of this meeting was a clear roadmap for developing the proposal, with roles designated and understood, and a commitment from all partners to

support both the design and execution of the programme. Subsequent to that meeting all collaborators provided input via e-mail correspondence.

Follow up consultation with farmers from the Mashare and Ndiyona constituencies for specific inputs was carried out on 13 May 2015 (50% female; see Appendix B2, p. 129). This consultation was crucial for the refinement of the tangible outputs and activities that specifically address agrometeorological needs, in particular the availability of short-term and seasonal weather forecasting in an understandable format. While Kavango East is one of the poorest and most vulnerable regions in the country, it has received very limited focused attention regarding climate change interventions. As elsewhere in many rural areas, weather information at the grassroots level is non-existent. The results from this consultation confirmed that farmers' seasonal calendar is strongly driven by women, who also lead various other activities at household level throughout the year. During the meeting, conducted in Rumanyo, farmers provided specific input for programme design, including aligning the timing of activities with their seasonal calendar.

Livestock farmers from the Okombahe area of the Daures constituency provided specific inputs into the preliminary programme design during a meeting facilitated by mentors associated with the Farmers Support Project on 20 June 2015 (33% female; see Appendix B4, p. 131). The meeting was conducted in the Khoekhoegowab vernacular and assessed the need for an early warning and rangeland monitoring system for farmers in the Okombahe area. This consultation paralleled the Lower Kuiseb consultation. The Okombahe farmers cited examples of how their livestock management system is compromised by episodic climate events (flooding of the Omaruru River), which may be better managed if information was advanced through a timely mechanism. Weather information is currently only accessible at the Agricultural Development Centres (ADCs), while farmers judge the condition of their rangeland based on experience.

iii) Stakeholder inputs

Namibia Meteorology Services (NMS). The objective of the NMS is to promote the application of meteorology to a broad range of sectors of the national economy, including agriculture. It also records and preserves Namibia's national climate data. Collaboration with this national competent authority is fundamental for implementation of Component 3 of the programme. Staff at the NMS would also be potential beneficiaries of the capacity development activities that support qualifying graduate and post-graduate training in meteorology. Programme developers briefed the Executive Officer and senior staff of the NMS about the intended activities. The collaborative framework was discussed for effective integration with ongoing and future initiatives in terms of the broader international meteorological observation network. The NMS pledged their support and endorsed the proposed activities of this programme pending high-level executive oversight in the Ministry of Works and Transport.

Ministry of Agriculture, Water and Forestry (MAWF). The mandate of MAWF is to promote, develop, manage and utilise agricultural, water and forest resources in Namibia. As a key implementing partner as well as a major beneficiary of this programme, ownership of the intervention by MAWF is cardinal to both its execution and sustainability. Professional staff within the Division of Livestock Research – Subdivision Pasture Science (DARD); National Botanical Research Institute (DARD), Division of Agricultural Training (DARD); Division

Agronomy and Horticulture (DARD); Namibia Early Warning and Food Information Unit (Directorate of Planning); Division of Forest Research (Directorate of Forestry - DoF); and Sustainable Management of Namibia's Forested Lands (NAFOLA) Project (DoF) were consulted from an early stage and throughout the process (see Appendices A5–A7, p. 124–126). Short briefing meetings were conducted with MAWF management, including the Acting Permanent Secretary; the Director: DAPEES; and the Director: DARD.

National Plant Genetic Resources Centre (NPGRC). Established in 1990 as part of a SADC network, the NPGRC is a section in the National Botanical Research Institute (NBRI), within MAWF. It functions as a repository for the national seed collection, and promotes the conservation and use of Namibia's Plant Genetic Resources for Food and Agriculture. With a particular interest in on-farm conservation as a complementary conservation strategy, the goal and objectives, as well as activities, of this programme are aligned with the operational plans of this centre. Staff of the NPGRC will provide technical support to activities within Component 1.

National Commission on Research Science and Technology (NCRST). Charged with the responsibility to promote and develop research, science and technology in Namibia, the NCRST was consulted regarding the programme's capacity development elements. In particular, the Manager and Senior Researcher within the Section Biotechnology provided useful background information for the proposal development. The Chief Executive Officer has furthermore provided written endorsement (see Appendix A8, p. 127), and urged for collaboration regarding execution of especially the capacity development elements of the proposed programme.

Farmers Support Project (FSP). This project enhances competencies of farmers and supports them to improve their practices through a mentoring approach. Given these objectives, the FSP could provide the necessary linkages for programme implementation at community and individual farmer levels. Future collaboration allows for information-sharing and synergies on various agricultural support programmes, projects and other interventions in the Erongo region, specifically related to livestock production and rangeland management.

International FogLife Research Consortium, Gobabeb. This international scientific consortium investigates the interaction between fog and desert biota, with a particular focus on clarifying the potential future effects of climate change on the fog-driven Namib Desert ecosystem. It constitutes a network of specialist scientists from Namibia, South Africa, USA, UK, Australia, Switzerland and Germany that are renowned experts in meteorology, climate modelling, palaeo-environmental reconstruction, geomorphology, ecophysiology, molecular applications in biology, microbiology, plant ecology and taxonomy, entomology, mammology and environmental restoration. Of particular relevance is the range of instrumentation to measure weather and climate parameters to inform and improve Global Circulation Models (GCMs) and comprehensive downscaling at 8 km^2 resolution for Namibia and eventually at a 1 km^2 resolution for the central Namib Desert. The meteorological and climate modelling components are particularly relevant to this programme, though useful discussions with local and international experts helped to crystallise specific information to achieve programme objectives (45% female; see Appendix B6, p. 132).

Key collaborators provided continuous review of programme elements during its development, particularly for programme design and implementation arrangements. The NIE manager also provided important guidance during the drafting process. Consultative interaction has been through email correspondence, telephone and contact meetings. The level of engagement of partners has been high. Table 11 presents a summary of the consultation process.

***Table 11*:** Synopsis of the consultation process.

Stakeholder and institutions consulted	Description of consultation	Date, Location and Gender
Mashare constituency crop farmers	House-to-house pilot survey to better understand (i) the knowledge of local crop farmers regarding climate risks and impacts; (ii) locally existing coping strategies; and (iii) status of on-farm plant genetic resources at household level (see list of farmers consulted in Appendix B1, p. 128).	August 2014 Six farming wards; three riverine (Mupapama, Mabushe, Shavivare) and three inland (Yuru, Tara-tara and Dove) 33% female-headed households
Walvis Bay rural constituency (Topnaar of Lower Kuiseb)	General discussion on the concept, discussion around livestock management in arid environments and group discussions on coping strategies and skills transfer/ capacity development opportunities (see list of farmers consulted in Appendix B3, p. 130)	April 2015 Community Centre, Utuseb 80% female
Stakeholder planning meeting (Windhoek)	Recap on content of concept document, report on inception meeting, agreement on the timeframe, roles and responsibilities for compiling the full proposal, debate key questions underpinning proposal development (see list of participants in Appendix B5, p. 133)	May 2015 National Botanical Research Institute, Windhoek 50% female
Mashare and Ndiyona constituency farmers and Agricultural Extension Officers, including traditional authority council members	Demand articulation of weather forecasting information needs in relation to on-farm conservation of traditional crop varieties, means of communication on weather data (see list of farmers consulted in Appendix B2, p. 129).	May 2015 Agricultural Development Institute, Mashare 50% female
Kavango Regional Council	Briefing of concept and involvement of the TAs, selection of beneficiaries etc. (see endorsement letter in Appendix A2, p. 121)	May 2015 Okavango Regional Council, Rundu

Farmers Support Project	Meeting with the FSP mentors for the Erongo region regarding collaboration, exchange of ideas on livestock management practices etc.	June 2015 Gobabeb Research and Training Centre
Daures constituency farmers (Okombahe)	Background on the concept, discussions on the need for early warning systems, in which format/media and information relevant to promoting linkages between the Lower Kuiseb and Okombahe livestock management systems (see list of farmers consulted in Appendix B4, p. 131).	June 2015 Okombahe 33% female
Various: NCRST, NMS, NAFOLA, MAWF/DARD, NBRI, DoF, SASSCAL, UNDP, FAO	Institutional support solicited through meetings; linkages with execution of activities pertaining to organisational mandates (see letters of endorsement in Appendix A4–A8, p. 123–127).	January – June 2015 Various locations in Windhoek

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

This programme has three integrated components that address specific needs of small-scale traditional farmers in Namibia that were identified and refined through consultation (see *Section II.H*, p. 73). Although agriculture and climate change adaptation has been the focus for many funding sources from various international partners and from within government (see *Section II.F*, p. 63), interventions that attempts to mobilise and strengthen traditional agricultural knowledge and provide information on agrometeorology has not been attempted before. The programme shall deliver specific support to improve the resilience of some of the poorest and most vulnerable communities in Namibia (see *Section II.B*, p. 43) in alignment with national development and adaptation objectives (see *Section II.D*, p. 57). The outcomes from this programme are likely to inform current agricultural and climate change actions at the national level, while make a significant impact at the local level, thus uptake and continuation of the contributions made by this programme to the national capacity for adaptation is very likely (see *Section II.J*, p. 82). The programme emphasises knowledge management; skills development to allow communities to implement and develop risk management and adaptation strategies at the local level; capacity building and technical proficiency in rare but essential skills in national institutions; and developing a knowledge management and information system that ensures that the experiences, participatory mechanisms and lessons learnt through implementation will be carried forward (see *Section II.J*, p. 82). Each of the components addresses a specific aspect relevant to small-scale subsistence agriculture in Namibia where targeted knowledge-based scientific intervention may contribute to improving resilience and livelihoods, but where the skills and knowledge of the farmers themselves are as an important element in the adaptive equation (see *Section II.A*, p. 24). The programme activities themselves are at a modest scale and will be implemented as an independent programme without additional funding from other sources at a total cost of USD 989,140 (see *Section III.G*, p. 110). Active participation by government

agencies and other partners are most likely, but the programme did not factor in nor relies on such additional resources that may become available for its execution. It is also likely that once implemented, the programme may act as a catalyst to attract additional funding to expand its activities and achieve greater impact. However, even if such a scenario materialises, the programme management mechanisms that will be established (see *Section III.A*, p. 94) will ensure that the programme remains true to its objective and identity.

The programme objective is to improve the preparedness and adaptive capacity of small-scale farmers in Namibia by addressing their specific information needs and strengthening appreciation for and use of traditional mechanisms to ameliorate climate variation in agricultural systems.

The programme will specifically seek to enhance the resilience of four rural farming communities, classified as poor to severely poor, in two regions that are already subject to considerable climate variability and are highly vulnerable to climate-induced risks. The four constituencies are strategically targeted because of their variable climatic conditions and the likely future intensification due to global climate change, but equally for the lessons can be shared between the two paired communities in each region and the relevance of those outcomes elsewhere in Namibia.

The programme will collaborate with competencies and logistical skills within the mandated government institutions, especially MAWF and NMS-MWT, but also with NGOs such as LAC, FSP, DRFN and NNF on the ground to implement programme activities. The programme emphasises participatory involvement with and skills transfer to beneficiary traditional farmers and rural communities, including their traditional socio-political structures, to increase resilience and adaptive capacity for coping with climate uncertainty in communal areas of the Kavango and Erongo regions. It will contribute towards developing cutting-edge scientific information and associated technical competencies that are currently rare in Namibia. During implementation, it will develop linkages with other programmes and projects that may take its outputs on board and extend it to other areas, while also working closely with various regional offices, regional governments, international and national organisations, and civil society organisations to extend its impact and ensure continuance.

Component 1: Promote preparedness and adaptive capacity of small scale crop farmers

Baseline

Specific baseline for all outcomes and outputs are very limited in the target areas (see *Section III.E*, p. 105) despite a range of climate change adaptation activities that have been undertaken, especially in the north central regions (see *Section II.F*, p. 63). However, few of those have specifically targeted the same communities where this component, will intervene, whereas others, e.g. the CCA project (p. 68) had unforeseen consequences by eroding on-farm PGRFA. Direct linkages with ongoing initiatives that are dealing with climate change and agriculture in the northern parts of the country will be sought during the implementation, e.g. MAWF Early Warning Systems that deal with crop and livestock production forecasting and the NMS and the MAWF Dryland Crop Production programme.

Although relevant policies and SAPs such as the seed policy, climate change policy and NCCSAP, and NBSAP are in place they do not have the information on which to act. Information on the suitability of various traditional varieties under different climate

scenarios do not allow effective use of farmers' capacity to secure better yields for improved food security or to advise farmers about specific, cost-effective means to improve yields. Most adaptation interventions advocate changing the farming systems, which is a high-risk venture in already marginal production systems. There is currently no early warning system on agrometeorology in either of the target areas. The farmers make use of traditional knowledge to make weather forecasts and plan for seasons. In addition, specific competencies to support small-scale farmers are rare in Namibia as the focus has been to support economically and nationally important intensive crop production initiatives.

With-programme scenario (adaptation alternative)

Component 1 will conduct on-farm trials to promote the retention of crop varieties and landrace specific interventions to reduce vulnerabilities and strengthened adaptive responses in the 35 wards of the Shambyu and Gciriku small-scale crop farmers. Participation by the farmers themselves in these trials will transfer skills to evaluate crop performance and monitor outputs. Access to landraces maintained in community seed banks will allow farmers to access seed when required and on-farm PGRFA conservation. Well-trained people with specific skills and knowledge of small-scale farming systems will continue to refine information and provide support services to farmers. Testing and operationalising an agrometeorological early warning system in an understandable format, e.g. cellular phone alerts in vernacular languages, will allow farmers to react and schedule activities, or to take early precautionary measures, to climate uncertainties. Information on the performance of traditional crops will be disseminated by extension personnel that will improve potential returns on additional financing mechanisms for small-scale farmers that are in the pipeline.

Component 2: Promote climate-smart herding practices

Baseline

As in Component 1, the specific baseline situation that informs the outcome and output of this activity is virtually non-existent. Anthropological researchers working with small-scale livestock farmers in the marginal desert areas of western Namibia has consistently shown that knowledge on the rangeland management practices of these farmers is deficient, typically based on ill-informed 'drive-through' observations that are data deficient. Surprisingly, as little is known about livestock behavioural adaptation under increased thermal stress and the future effect of increased temperatures on livestock production. Most predictive information is based on wildlife research and experimentation under controlled conditions. Not surprisingly, the National Policy on Rangeland Management (MAWF) has detailed provisions for freehold rangelands, but advocates only principles for communal rangelands. There are currently no early warning systems or any monitoring tools to evaluate risks and make decision regarding their livestock - the farmers rely on their experience and advice from extension personnel to make decisions on livestock management. Flooding in the two relevant ephemeral rivers (Kuiseb and Omaruru Rivers) is a key indicator on the availability of forage for livestock, but the effect of floods on forage production and the nutritional quality of forage have not yet been investigated. At the local level, the Farmers Support Project (FSP) is an initiative to mentor and provide technical training to livestock and crop farmers throughout Namibia.

Activities of this component will be coordinated with FSP and DAPEES-MAWF officials responsible for implementing rangeland management activities, and the traditional

authorities that are responsible for communal rangeland management in the two areas. It will seek synergies with the EU-funded project on developing and testing a rangeland production early warning system that is being implemented through Agra ProVision.

With-programme scenario (adaptation alternative)

Component 2 will develop specific information to understand how climate change may affect livestock production in terms of livestock behavior under thermal and environmental stress. This will be explained in terms of the attributes of local herding and livestock management practices of small-scale farmers to understand and model how climate change will affect livestock production in future. Evaluating the condition of rangelands, food availability and nutrient quality is part of that process. Active participation by small-scale farmers will contribute information. More importantly, participating farmers will learn and advise on how to effectively monitor communal rangelands, which are essential skills for practical rangeland management and risk assessment in unpredictable environments. Skills transfer to 40 small-scale livestock farmers in the two target areas will allow the introduction of rangeland monitoring and risk assessment decision matrices. Those tools will inform community risk management and adaptation plans for the two areas, locally tailored and communally developed to meet their needs. The methodologies developed in collaboration with the farmers will also be used to distil best practices, refine methods and communicate the outcomes to a wider audience. During this process, an agro-meteorological early warning system will also be tested to determine the most valuable information for small-scale farmers to make livestock production systems more robust.

Component 3: Access to short term seasonal weather forecasting

Baseline

Currently the NMS distributes national daily forecasts, seasonal climate outlooks, and urgent severe weather advisories that are based on downscaled models for the SADC region by the regional meteorological centre. The NMS also maintains a national network of weather observation stations countrywide and provides weather updates for international air and ship traffic. Climate change analysis and forecasting does not play a significant role in the institutional portfolio yet. Other baseline investments are through the SASSCAL Weathernet stations, which are well represented in the Kavango East and central Namib in the Erongo region. Although an Early Warning Unit does exist in the MAWF, which includes agrometeorology, its functions are limited to providing seasonal crop and livestock outlooks in collaboration with other stakeholders such as the Directorate of Disaster Risk Management in the Office of the Prime Minister and the Namibian Red Cross.

With-programme scenario (adaptation alternative)

Component 3 is specifically designed to introduce area specific short-term and seasonal forecasts by downscaling the regional forecasts through Numerical Weather Prediction models and Ensemble Prediction Systems. Accurate and timeous early warning appropriate for crop farmers, e.g. the likelihood of rain in order to schedule plowing, planting, fertiliser applications, pest management, harvesting etc. have been repeatedly identified as an urgent and potentially most effective intervention to improve the livelihoods and risk management of subsistence farmers in an unpredictable and variable climate environment. With the likelihood of shorter seasons and more extreme variation and extreme weather events from climate change, downscaled short-term forecasting relevant to specific areas is a necessity for adaptation. Introducing downscaled weather prediction is, however, reliant

on well-trained and technically proficient meteorologists that can gain experience and greater accuracy over time. The NMS already has the technological resources, but not the technical expertise and manpower capacity to develop downscaled NWP/EWP forecasting. This component will focus on developing such resources by training Namibians for long-term sustainability and recruiting already trained expertise on short-term contract to develop and test such models. At the same time, particularly communal farmers need to be trained to understand the uncertainties inherent to all forecasting systems, while forecast information needs to be verified on the ground to improve the accuracy of the forecasts. The SASSCAL and NMS weather observation networks have great potential, but should be augmented. Mobilising and equipping farmer networks have the advantage of rapidly implementing such networks, while also equipping farmers with skills to monitor weather for on-farm risk management. Lastly, an efficient mechanism for disseminating forecast information has to be introduced, and forecasts have to be disseminated in vernacular languages for ease of use. Cellular phone penetration in rural areas of the Kavango East are even greater than radio (67% vs 61%)[79], while farmers are often too busy to listen to radio broadcasts. Component 3 will address all the above elements, while also initiating a process to develop a similar early warning system for small-scale stock farmers that will be tested in the Erongo region. Two downscaled NWP models for the Kavango East and Erongo regions will be tested, with farmers' networks on agrometeorology in those regions providing a feedback loop between users and providers of the weather data to improve accuracy and effectiveness in communication.

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

Extensive consultation with communities, traditional authorities, relevant government agencies and various development initiatives and civil society organisations was carried out at the preliminary stages of developing the programme to ensure that the envisaged interventions and activities would be both appropriate and continue beyond the life of the programme. Such consultation continued throughout the design phase, often leading to modifications in the envisaged execution of the programme.

During this process it became clear at an early stage that the national capacity to support programmes of this nature is limited, and that diverging demands are made on the few specialists who could support such a programme. In some cases, e.g. meteorological modelling, technical knowledge and proficiency are simply not available. The urgent need for appropriate interventions to support traditional farming systems was clear, but without simultaneous capacity development to empower support systems, the sustainability of the programme beyond the implementation period was questionable.

It is possible to carry out the programme without a capacity building element by contracting consultants, but then the onus of continuing the outputs would have rested with the beneficiaries themselves. Traditional communities do not have the technical infrastructure, financial resources, managerial and institutional structures, or other instruments to apply the outcomes of the programme over the medium term. National institutions do have all

[79] NSA, 2012. Namibia Household Income and Expenditure Survey (NHIES) 2009/2010. Windhoek.

these systems already in place, but do not have the trained human resources to continue the specific outcomes this programme envisaged. Considered compromises were therefore regarding the degree to which the programme would directly benefit the small-scale farmers and traditional authorities with whom it will work, as well as the degree to which it may assist national institutions with capacity development. The former has short-term benefits, the latter long-term. The envisaged sustainability of the programme is elaborated in Table 12.

Table 12: Envisaged continuation of outputs and likely agents and their roles.

Concrete Output	Continuation	Agency and Responsibility
1.1 Validated information on PGRFA improve food security and is incorporated into agricultural extension	Farmers use a suite of traditional varieties to achieve better yields Extension officials use programme information to advise on which landraces yield best results Agricultural researchers develop additional improved varieties Traditional Authorities and farmers groups manage seed availability and TK	DAPEES-MAWF develop information advice on landraces and cultivation treatments Shambyu and Gciriku Traditional Authorities support seed banks and manage seed production and distribution Development agencies support farmers to acquire implements and fertilisers DARD-MAWF continue research and development of new improved varieties for specific conditions
1.1.1 Description of traditional Kavango agrobiodiversity and climate coping strategies	Information is used to plan and monitor participatory development initiatives and interventions	Core information document Regional Government distribute Traditional Authorities evaluate cultural impacts Cultural and Environmental agencies provide oversight and monitor cultural change
1.1.2 Current distribution, characteristics and production system of traditional landraces are mapped and documented in detail	Similar agrobiodiversity mapping is carried out in other regions Detailed mapping allows for development of agronomical information support system Detailed mapping provides M&E framework for uptake of farmer support and adaptation interventions Repeat surveys allow monitoring of on-farm PGRFA conservation	DARD-MAWF expand activity to other regions DAPEES-MAWF develop constituency-level advisories Traditional Authorities maintain database to track changes in core M&E areas FFGs provide framework for participatory farmer involvement Development agencies use data for M&E of intervention success
1.1.3 Community seed banks ensure PGRFA availability	At least three seed banks in two districts receive and distribute traditional landraces Participatory management of seed	FFGs/Wards manage seed bank operations Traditional Authorities provide oversight Cultural and Environmental

Concrete Output	Continuation	Agency and Responsibility
	banks ensure access and sustainable use NPGRC provide quality control	agencies assist further development of networks NPGRC- DARD-MAWF specialist support DAPEES-MAWF promote more PGRFA seed banks
1.1.4 Communally managed PGRFA Seed Exchange is established	Inventory of landraces and seed quantities in seed banks maintained by TAs On-line inventory of landraces maintained on TA and RG websites with access and request protocols Template for a national PGRFA exchange	Traditional Authorities maintain inventory and TK Regional Government facilitate FFGs/Wards provide seeds through transparent protocols Development agencies advise on TK issues DAPEES-MAWF promote national exchange
1.2 More effective intervention from national agricultural support services	Accurate information informs agricultural research and extension interventions Extension officials use programme information to advise on which landraces yield best results under specific conditions Agricultural researchers develop additional improved varieties Traditional authorities and farmers groups manage seed availability and TK	DARD-MAWF use downscaled crop modelling to issue more effective early warning advisories Regional government offices provide more timeous support to rural communities Development agencies plan and monitor the outcomes of interventions more effectively National technical capacity support development initiatives more effectively
1.2.1 Actual/potential yields of Kavango cereal landraces are documented	Validated information on production characteristics of landraces inform crop yield modelling for climate change scenarios Further production trials to test various treatments and suitability under different conditions Farmers use a suite of traditional varieties to achieve better yields Development initiatives carry out participatory on-farm trials to test suitability of various cultivation approaches Improved food security	DARD-MAWF expand activity to other regions DARD-MAWF apply data for crop yield modelling and annual early warning on food security DAPEES-MAWF develop information advice on landraces and cultivation treatments Traditional Authorities advise farmers on outcomes from trials FFGs advise neighbours on achieving better yields Development agencies test landraces for other adaptation interventions, e.g. conservation agriculture, soil water conservation, on-farm fertility treatments

Concrete Output	Continuation	Agency and Responsibility
	interventions	
1.2.2 Improved national capacity to analyse and monitor genetic attributes of agrobiodiversity	Namibian maize landraces are genetically compared to global maize diversity Genetic marker studies on other Namibian cereal landraces are initiated Namibian specialist advises on bioprospecting issues particularly regarding the Access and Benefit-Sharing Bill (and the Nagoya Protocol of the CBD) Accelerated capacity development on genetic attributes of local biodiversity	National specialist continue to develop genetic tracer study on indigenous landraces ABS Advisor to the Environmental Commissioner consults specialist on policies and TK identification University students receive specialist training and supervision to carry out advanced genetic marker studies Traditional Authorities can rely on national authority to resolve TK rights
1.2.3 Improved regional representation of PGRFA in NPGRC available for research and development	Comprehensive participatory germplasm collecting in agrobiodiversity core areas are accelerated Greater utilisation of NPGRC as national resource NPGRC archive allows tracking of agrobiodiversity changes	NPGRC continue initiative to improve comprehensive regional representation DARD-MAWF draw on NPGRC inventory to improve attribute characterisation of landraces University students draw on NPGRC inventory to carry out advanced genetic marker studies
1.2.4 Improved national capacity in rare skills and technical ability for agricultural development and support	Six Namibians with rare technical skills are recruited by national institutions with specific needs Technically proficiency and skills improve through further study or practical experience Accelerated transfer of rare skills through student project supervision and training	DARD-MAWF recruit technically proficient Namibians with rare skills National universities access specialist supervisors to broaden the range of studies carried out by students National institutions have greater access to specialist professional capacity Traditional communities receive improved technical advice and services
2.1 Communal Integrated Land Management inform livestock production and risk management	Farmers regularly evaluate livestock performance and rangeland condition for risk management decisions Extension officials use programme information to develop protocols for communal rangeland assessment	DAPEES-MAWF develop specific protocols to implement communal rangeland management in terms of the National Rangeland Management Policy and Strategy Topnaar and !Oegan Traditional Authorities implement rangeland management and

Concrete Output	Continuation	Agency and Responsibility
	Agricultural researchers develop improved models and carry out additional research to determine the likely effects of climate change Commercial farmer associations adapt the protocols developed for communal risk management assessment for application to freehold livestock production Traditional Authorities and farmers groups apply communal rangeland management procedures to cope with climate variability and prepare community members for climate change impacts	adaptation planning procedures Development agencies support farmer association structures to improve risk management and livestock production Environmental agencies support TAs to continue rangeland monitoring and transfer skills to other communal areas DARD-MAWF continue refinement of livestock modelling to determine the long-term effects of climate change on national livestock production Gobabeb continues livestock production monitoring in the lower Kuiseb area Farmers apply informed risk management decision-making tools
2.1.1 Traditional Nama and Damara livestock production practices are described	Information is used to plan and monitor participatory development initiatives and interventions	Core information document Regional Government distribute Traditional Authorities evaluate potential changes that can be promoted Cultural and Environmental agencies compare information to other communities with livestock and prepare descriptions of differences
2.1.2 Validated information on livestock behaviour in desert environments	Methodology is increasingly applied to monitor and evaluate livestock and wildlife behaviour under different environmental conditions Rapid capacity development of technically proficient specialists to evaluate livestock and wildlife responses to future climate change scenarios Improved scenario development to inform national climate change adaptation strategies Improved ability to monitor climate change impacts on livestock subsector contribution to GDP	DARD-MAWF apply data to develop and improve livestock production models and early warning systems DARD-MAWF evaluate livestock behaviour on agricultural research farms DAPEES-MAWF develop advisories for farmers on livestock behaviour Farmers adapt management intervention practices to incorporate natural behaviour patterns Environmental agencies apply methodology to evaluate wildlife behaviour in Namibia National universities apply information to train students in behavioural and physiological

Concrete Output	Continuation	Agency and Responsibility
		adaptation to heat stress
2.1.3 Validated information on seasonal changes in the quality and condition of desert rangelands	Methodology is increasingly applied to monitor and evaluate rangeland condition and likely animal production under different environmental conditions Rapid capacity development of technically proficient rangeland monitoring advisors Rapid skills transfer to small-scale livestock farmers in other regions Improved application of rangeland monitoring to inform livestock production and risk management procedures Improved ability to monitor rangeland conditions nationwide	DAPEES-MAWF expand activity to other regions DARD-MAWF apply data for early warning and economic forecasts on livestock production in communal areas DAPEES-MAWF develop information advice on communal rangeland monitoring and livestock production DRSPM-MET apply methodology to assess rangeland condition in national parks Traditional Authorities advise farmers on outcomes from monitoring FFGs advise neighbours on practical livestock production assessment Development agencies support continuation of monitoring by FFGs and expand methodology to other areas Environmental agencies promote similar monitoring in conservancies and other communal areas National universities incorporate appropriate methodology in livestock and rangeland management courses
2.1.4 Possible establishment of a Topnaar and !Oegan Farmers Association	Improved income generation due to more negotiating power Improved production from increased transfer of skills and resources to farmers by development agencies Greater collaboration between farmers	DAPEES-MAWF apply model to promote communal farmers associations elsewhere Farmers improve negotiating and marketing skills Development agencies support skills development and provide more resources and intervention support to farmers
2.1.5 Vulnerability Assessment and Risk Management and Climate Change Adaptation plan for Lower Kuiseb and Okombahe areas	Participatory implementation of climate-smart communal activities Participatory identification of resources and skills required for climate-smart action Improved ability to attract and	Traditional Authorities implement communal monitoring and risk assessment Rural Topnaar have greater resilience to adverse climate conditions Development agencies support specific adaptation and

Concrete Output	Continuation	Agency and Responsibility
	distribute critical resources	vulnerability interventions Environmental agencies support climate-smart initiatives
2.1.6 Preliminary testing of a livestock production model for Namibia	Appropriate livestock production model is selected for further testing Data gathering for model improvement	DARD-MAWF continue model development and testing Gobabeb supply data for model development and verification
3.1 Trained professional carry out downscaling through Numerical Weather Prediction models and provide short-term weather forecasting	Rapid dissemination of short-term weather forecasts Farmers receive short-term weather forecasts and early warning advisories directly Improved accuracy of weather forecasts Improved crop production and weather-related disaster planning Expansion of weather monitoring station network	NMS develop additional NWP downscaling capacity NMS distribute forecast information directly to users NMS and SASSCAL expand Namibian weather monitoring network Farmers use forecasts for production scheduling National universities include weather monitoring in their curricula Environmental agencies expand national weather monitoring network
3.1.1 Improved capacity for weather monitoring and forecasting is in place	Six new professional meteorologists are employed Namibian meteorologists investigate and describe local synoptic phenomena Namibian meteorologists evaluate climate variability patterns Namibian meteorologists monitor and describe observed changes in climate	NMS has capacity to carry out advanced climate analysis NMS and SASSCAL expand Namibian weather monitoring network National universities include weather monitoring in their curricula in collaboration with NMS Environmental agencies expand national weather monitoring network Climate Change Unit-MET receives up to date information on observed changes and climate variability
3.1.2 Downscaled NWP for short-term forecasts is tested and in place	Downscaled NWP models produce area-specific forecasts at various timescales NWP models are tuned by technically proficient specialists using tested protocols Three SADC professional	NMS carry out downscaled NWP modelling for specific areas National agencies receive area specific forecast information Regional offices receive forecast information of direct relevance to their areas Disaster relief and development agencies receive improved area-

Concrete Output	Continuation	Agency and Responsibility
	meteorologists/climatologists specialising on Namibian climate support further skills development	specific weather updates WMO and International agencies provide more support for capacity building to the NMS
3.1.3 Tested dissemination system for short-term weather forecasts and early warning is in place	Effective dissemination of weather information directly to users Improved risk management planning and exploitation of opportunities Improved income generation and resilience	NMS disseminate weather forecasts and warnings directly to users Farmers use forecasts for production scheduling Environmental agencies and students use forecasts to monitor biotic responses to weather Remote communities adopt resilient responses to weather warnings
3.2 Downscaled NWP provide area-specific agrometeorological forecasts and early warning	Continued development and improvement in model accuracy Expansion of areas for which specific information are provided Additional languages are added to improve appreciation of weather updates Improved production and weather-related risk management	NMS produce short-term NWP forecasts for important agricultural production areas NMS disseminate forecasts and warnings directly to users DARD-MAWF adopt NWP models and appoint specialist personnel in consultation with NMS Farmers use forecasts for production scheduling Regional offices establish protocols to react to weather warnings
3.2.1 Agrometeorological forecasts are disseminated in local languages through GSM cell phone network	Forecasts disseminated directly to users in local languages Improved production and activity scheduling based on weather forecasts Improved resilience and risk management to inclement weather	NMS continue to disseminate forecasts and warnings directly to users in local languages Users register with NMS to receive direct weather updates in their own language Farmers use forecasts for production scheduling SASSCAL and other development agencies assist NMS to maintain weather dissemination system
3.2.2 Crop farmers in Kavango East region receive forecasts and provide feedback on accuracy	Farmers continue to monitor weather on their farms for intervention scheduling Feedback mechanism scheduled to end at programme termination	DAPEES-MAWF establish more verification networks to provide feedback on forecast accuracy and crop intervention elsewhere Development agencies may decide to continue activity
3.2.3 Livestock farmers in	Farmers continue to monitor	DAPEES-MAWF establish more

Concrete Output	Continuation	Agency and Responsibility
Erongo region receive early warning and provide feedback on accuracy	weather on their farms for risk management Feedback mechanism scheduled to end at programme termination	verification networks to provide feedback on forecast accuracy and rangeland monitoring elsewhere Development agencies may decide to continue activity Gobabeb will assume responsibility for Lower Kuiseb monitoring network
3.2.4 Ministry of Agriculture officials briefed on agrometeorological forecast testing and protocols	MAWF expand capacity of Agrometeorological Unit MAWF promote wide area networks and communication protocols for weather monitoring and feedback	DARD-MAWF adopt NWP models and appoint specialist personnel for critical crop area forecasts DARD-MAWF expand weather monitoring station network in collaboration with NMS DAPEES-MAWF establish verification networks to provide feedback on forecast accuracy NMS distribute forecast information and develop additional NWP downscaling capacity

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

During the programme development, careful consideration was given to potential environmental and social impacts. Components of the programme will work on established small-holder farms in their respective target areas. The particular activities are geared towards appreciating and improving interactions between man and nature through optimisation of current practices. None of the activities, apart from consultations to track decision-making, will be carried out at any recently established farms, while none of the activities are reliant on particular environmental conditions. The programme therefore carries negligible environmental risk.

Particular consideration was given to social impacts and risks. The programme will collaborate with some of the poorest people in Namibia, all of them hard-working farmers. This programme cannot collaborate with all households, nor can it address the complex set of environmental, societal and historical imbalances that contributed to the present situation. Potential imbalances that may be induced through programme activities had to be weighed against the imperative to ensure envisaged outcomes. The programme cannot expect people to carry out work and take risks on its behalf, thus participants will be appropriately compensated. Compensation is both desirable and a potential stressor. This programme will apply minimum wage guidelines as advised in the Namibian Labour Act (Labour Act #11 of 2007; Labour Amendment Act #2 of 2012). Other means of encouraging and compensating participation will also not be random distribution of largesse, but will be

carefully designed to support rather than unravel cultural cohesion. Student participants and other activity facilitators will be informed of appropriate culture-sensitive protocols to interact with participants during induction training.

The potential imbalances that may be posed by working closely with a representative group of farmers were addressed by including activities in each component that will first carry out detailed consultations in the communities and not to simply select specific sites for convenience, practicality and scientific project design. Practical issues and robust design will still apply, but final site selection and participants will only be carried out after extensive consultation with the beneficiaries themselves. In that process, historical and cultural prejudices will be identified and addressed diplomatically in order to ensure representative participation, particularly by women farmers. The programme is particularly aware of the 'big man' concept, thus participatory consultation will take care not to allow individuals, even from traditional authority structures, to impose their own perceptions on behalf of all beneficiaries. Feedback to farmers, both by facilitators and participating farmers from the communities itself, will allow the community to be kept informed and raise potential issues and grievances at an early stage.

The facilitators are also well aware that marginalised communities are often imposed upon by well-intentioned initiatives that wish to engage them, but on time-frames decided unilaterally. That is increasingly leading to 'workshop fatigue'. This programme's activity schedules will be coordinated with other initiatives in order to cause minimal interruption, while on-farm consultation and participation will take into account cultural calendars.

Uptake of the information that will be generated and disseminated through programme activities, as well as applying the adaptation measures that are envisaged, largely depend on how the beneficiaries perceive the programme and its results. Active engagement of farmers in the process will allow skills transfer to beneficiary communities, while also allowing participating specialists to understand how best to adapt available knowledge for effective consumption. However, uptake of information also requires buy-in and taking over the responsibility for continuing activities at closure. Both cultural structures, i.e. communal decision-making processes as represented by traditional authorities, and societal support structures, e.g. public service (government) agencies and various development agencies, are important for continuation and ensuring uptake. The programme will work closely with traditional authorities during implementation to develop products that they perceive appropriate and useful, while it is already liaising with other development initiatives and government agencies to include participation and ensure the outcomes will also meet their standards and objectives (see Appendix A1–A8: Support letters). The final design was screened against the stipulated principles of the AF ESP. The results of the screening are presented in Table 13.

The programme is considered to be in **Category C**, i.e. with no anticipated adverse environmental or social impacts. *Part III. Implementation arrangements* contains specific information in this regard, particularly *Sections III.C* and *III.D*. *Section II.B* elaborates how the programme will provide environmental and social benefits and how it will avoid or mitigate negative impacts in accordance with the AF ESP. It is clearly understood from these guidelines that the onus for mitigating or managing impacts and risks lies with the NIE. Even though no environmental or social risks have been identified, management or mitigation of

such risks, should they arise, will be dealt with promptly in consultation with the NIE. Early alerts regarding potential impacts are anticipated to be tracked through the regular reporting procedures. Formats for quarterly reporting will prompt and make provision for reporting on potential environmental and social impacts and concerns observed during execution of activities or raised by participants.

During programme implementation, activities will be closely monitored by the facilitators as to whether there is adverse impact on biodiversity or ecosystem support areas. Facilitators will have a specific responsibility to monitor for early signs of any negative impacts on local communities, especially the most vulnerable segments of those societies. Elements of environmental and social impact and risk assessment will be included in all training interventions to raise awareness at local level. Furthermore, all programme stakeholders will have recourse to voice grievances. Community beneficiaries, in particularly, will be informed of the programme grievance procedures through the facilitators. The NIE will be able to intervene and resolve concerns that fail to be adequately addressed.

Table 13: Potential environmental and social impacts.

Checklist of environmental and social principles	**No further assessment required for compliance**	**Potential impacts and risks – further assessment and management required for compliance**
Compliance with the Law	☑ All programme activities compliant with Namibian and international laws	-
Access and Equity	☑ Skills transfer, training and other programme benefits will be accessible to all potential beneficiaries through transparent, equitable processes	-
Marginalised and Vulnerable Groups	☑ Programme specifically targets but also capacitates vulnerable, marginalised communities. Within these communities, efforts will be made to fully include women, the elderly, people living with disabilities and people living with HIV/AIDS	-
Human Rights	☑ Programme will respect and promote human rights. Sub-EE (LAC) involvement will ensure that activity protocols recognise, *inter alia*, equality, freedom of expression and association, education and access to information; e.g. Free, Prior-Informed Consent	-
Gender Equity and Women's Empowerment	☑ Programme will ensure full and equal participation of both men and women, particular in target areas where female-headed households predominate	-
Core Labour Rights	☑ Programme will comply with Labour Act #11 of 2007; Labour Amendment Act #2 of 2012	-
Indigenous Peoples	☑ Beneficiaries are all indigenous peoples. Programme will respect their rights and	-

	responsibilities set forth in the United Nations Declaration on the Rights of Indigenous Peoples	
Involuntary Resettlement	☑ Irrelevant - no involuntary resettlement will occur as a result of programme activities	-
Protection of Natural Habitats	☑ Programme activities in Component 2 will promote holistic rangeland management and sustainable resource use. Other activities will have no negative effects on natural habitats. Field trials will be executed on land previously cleared for agriculture	-
Conservation of Biological Diversity	☑ Programme promotes protection of agro-ecosystems, including rangelands, as well as genetic diversity of local landraces. Activities aligned with specific strategic goals and targets of NBSAP 2	-
Climate Change	☑ Programme anticipates to build resilience to climate change, and will not contribute to increased greenhouse gas emissions or other drivers of climate change	-
Pollution Prevention and Resource Efficiency	☑ Programme will not produce excessive waste, or release pollutants, and will be aspire to be energy efficient, where appropriate. Procured goods and services that purport to be environmentally friendly will be preferred	-
Public Health	☑ No negative impacts on public health are expected. Nutritional status of vulnerable communities may improve with reintroduction of adapted crop cultivars	-
Physical and Cultural Heritage	☑ No programme activities will be implemented in important cultural sites identified by the communities; or compromise cultural practices in the target areas. Cultural information will be deposited at the National Museum of Namibia	-
Land Conservation	☑ Rangelands and riparian woodland resources in Erongo will be quantified to provide baselines for management of forage resources	-
Soil Conservation	☑ Programme will promote soil conservation through traditional conservation agricultural techniques in the Kavango East. Programme will not promote fertiliser or pesticide usage that may lead to adverse environmental effects. Currently, agrochemical application in the target areas is low	-
Water Conservation	☑ Programme will support integrated water management through improved forecasting. The programme will furthermore improve dryland cropping and not promote irrigation agriculture	-

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for programme implementation.

The programme will be implemented on farms at the ward level within identified constituencies in the Kavango East region (Mashare and Ndiyona constituencies); and Erongo region (Walvis Bay Rural and Daures constituencies).

Implementation will involve stakeholders from government, tertiary training institutions, traditional authorities, local communities, agroindustry/business, civil society, and projects. The programme management arrangements have been designed to be inclusive with close collaboration between project partners and all key stakeholders (Figure 11), as well as to align closely with other relevant initiatives, both currently ongoing and as new initiatives may develop during the five year implementation period.

The mechanism to maintain this close collaboration and to share information regarding project implementation will be through various fora. Programme management structures will be created to oversee implementation and monitor progress. However, attempts will be made to capitalise on existing, established fora as conduits for information-sharing, as opposed to creating additional superfluous communications structures.

i) Programme Management

The **Programme Management Unit (PMU)**, established at Gobabeb, will facilitate information sharing, progress reporting and programme review. In addition, the PMU will be the central point for technical guidance and ensuring efficient programme implementation on a day-to-day basis. A **Programme Coordinator (PC)** will be employed (Full Terms of Reference (ToR) attached as Appendix D1, p. 137). Support will be provided to this position by existing in-house, administrative competencies at the Executing Entity (EE) on a part-time basis, e.g. **Financial Support**. The PMU will liaise closely with the National Implementing Entity (NIE) particularly as regarding Monitoring and Evaluation (M&E), as well as the tracking and management and/or mitigation of risks. The PMU will furthermore interact closely with and maintain effective working relationships with all partners.

The proposed ToR for the PC will include the following key elements, *inter alia*:

- Provide strategic leadership to programme implementation
- Manage all programme activities
- Ensure compliance with all NIE/Adaptation Fund (AF) requirements
- Develop effective networks with current and emerging partners
- Communicate programme outcomes to all beneficiaries
- Develop and maintain electronic and paper records of activities

The PC will be recruited through a competitive process that adheres to the EE human resource policy and employed in accordance with the Namibian Labour Law (Labour Act #11 of 2007; Labour Amendment Act #2 of 2012). Arrangements will be made that the PC, once

recruited, will spend some time at the NIE for induction and orientation as to NIE/AF procedures.

ii) Executing Entity

The designated **Executing Entity (EE)** is Gobabeb Research and Training Centre. Gobabeb will thus assume overall responsibility for programme implementation over the five year period and will be accountable for both programme and financial management. The Executive Director of Gobabeb will function as the overall Programme Leader and will provide strategic leadership and overall guidance to the PMU.

Gobabeb is a non-profit organisation, registered as a trust (T53/98), which operates under a joint venture agreement between the Ministry of Environment and Tourism (MET) and the Desert Research Foundation of Namibia (DRFN). As the NIE, DRFN is responsible for ensuring the proper management of funds received for the programme, and for the delivery of results against those funds (see v. below). The EE will thus function effectively under DRFN's supervision and report to DRFN. As the National Competent Authority for climate change in Namibia, the Department of Environmental Affairs (DEA) within MET is responsible for coordination and providing overall oversight and advice regarding climate change issues in Namibia. Given this long established tripartite relationship since 1998, Gobabeb is preconditioned for effective engagement regarding programme implementation with these two key advisory bodies. The Gobabeb Trust Management Committee may serve as an additional *de facto* forum for reporting and consultation regarding programme implementation.

Gobabeb is a formal member of the National Climate Change Committee (NCCC), which will provide an additional and multisectoral touchpoint for advice regarding programme implementation. In the same way, the National Plant Genetic Resources Committee (NPGRCom), a long-standing body that coordinates national effort in PGRFA, can provide strategic guidance to Component 1 of the programme.

With a long history and a global reputation for excellence in science and education, particularly in arid-zone ecology and desertification, and with a burgeoning programme on atmospheric sciences and climatology, Gobabeb is well-placed to design and lead implementation of technical programme activities. A broad portfolio of training offerings that target different levels of beneficiaries (i.e. primary, secondary and tertiary), has resulted in strong ties with training institutions in Namibia and in the SADC region, which will facilitate the identification and placement of students to take advantage of the envisaged capacity development opportunities provided by this programme.

Gobabeb furthermore has strengthened its partnership with the Topnaar Traditional Authority in developing and executing projects focused on community development amongst rural Topnaar neighbours. In a similar vein, the Gobabeb associate responsible for implementing Component 2 activities has extensive working experience and local credibility in the Daures constituency. The sub-EE, the Legal Assistance Centre (LAC), is well-established as a competent humanitarian NGO that provides socio-economic support at grass-roots level, particularly as regards rights of minority groups, and has an existing and pronounced presence in the Kavango East region.

Gobabeb has established its own comprehensive in-house financial management support structures. Financial expertise is available to implement all aspects of programme and financial management. Gobabeb has consistently received a clean audit at the annual financial reviews (Appendix C1, p. 136).

Gobabeb will sign the grant agreement with the NIE and will be accountable for the disbursement of funds and the achievement of the programme aims and outcomes according to the programme workplan. In effect, Gobabeb in the EE role, will, *inter alia*:

- Co-ordinate all programme activities
- Disburse and account for expenditure
- Recruit consultants and student associates (including develop ToR, advertise, screen, employ)
- Monitor and evaluate all activities
- Report on progress, delivery and impacts
- Monitor compliance with AF ESP
- Serve as contact point for the progamme.

Progress will be monitored routinely on a quarterly basis through reports that are submitted to and collated by the PMU, and submitted to the NIE. These will align with the agreed annual workplan and will include qualitative, quantitative and financial information, as well as projections for the next quarter. The PMU will develop a quarterly reporting template that will be used internally and also by programme partners.

iii) Support Structures

Programme implementation will require close collaboration with partners and key facilitators, who will be charged with managing specific activities within the three programme components. In particular, the LAC will be a **Sub-executing Entity**, and lead organisation for Component 1. The LAC's main objective is to protect the human rights of all Namibians. It is the only organisation of its kind in Namibia. It has a Head Office in Windhoek and two regional offices. Its work is supervised by the Legal Assistance Trust, whose trustees include legal practitioners, other professionals and community leaders. It works in five broad areas: (i) Litigation; (ii) Information and Advice; (iii) Education and Training; (iv) Research; and (v) Law Reform and Advocacy.

A **Stakeholder Forum (SF)**, draft ToR attached as Appendix D3 (p. 141), will be established from amongst key stakeholders/partners as an advisory body to the programme. The SF will provide some technical oversight; support programme governance; and ensure integration and coordination between partners and other initiatives. The composition of this body will be determined based on competencies and equitable representation. The SF would define training modalities, select student grant recipients and monitor academic progress and output. This body will meet at least twice a year. The ToR will be finalised by the EE after the project launch. The PMU will provide secretariat services to this body.

A **Facilitator** (ToR attached as Appendix D2, p. 139) will be identified to lead activities for each of the three programme components. These facilitators will be experts within the

respective disciplines for implementation of activities, and will interact closely with one another as well as the PC. The facilitators would be required to participate in meetings of the SF. An additional and fundamental role of the facilitators will be to ensure that there is equitable representation of women and other vulnerable groups within the targeted beneficiaries at local level.

Farmers' Focus Groups (FFG) will be created within the target communities to ensure local-level ownership, as well as to guarantee farmer involvement in experimentation, data generation and information-sharing, and appropriate skills transfer. Membership of the FFG will be determined by the respective communities themselves at programme roll-out with input from the respective facilitators for equitable representation.

In order to ensure continued and harmonious participation, all programme stakeholders, particularly community beneficiaries, will be informed of the grievance procedures. Issues of concern will be communicated through the facilitators to the PMU. Traditional channels will be the conduits for this communication, i.e. the Directorate of Agricultural Production and Extension and Engineering Services (DAPEES) under the Ministry of Agriculture, Water and Forestry (MAWF), as well as the Farmers Support Project (FSP), as appropriate. At the inception meetings, and initial programme engagement with communities, all stakeholders will be informed of these procedures. Recourse will be available through the NIE should concerns that are repeatedly reported not be adequately addressed.

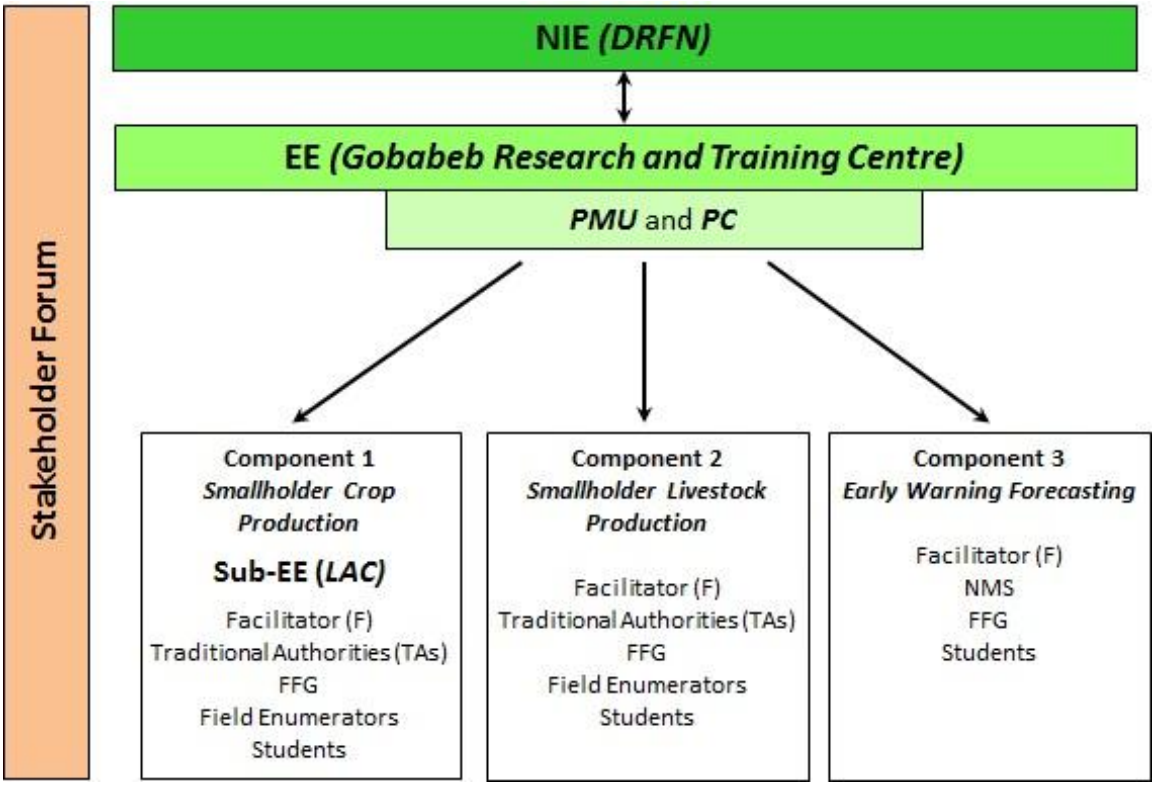


Figure 11: Programme management structure.

iv) Programme accounting and procurement processes

The EE will be responsible for financial management of the programme. Procurement of goods and services will comply with the Procurements and Purchasing Policy of Gobabeb. All tender documents and recommended award of tenders will be submitted to the NIE for approval in order to ensure that internationally accepted procurement principles and practices are applied. The LAC will operate within the framework of its own financial management system, and will maintain sound accounting procedures that will be reviewed and endorsed by the EE.

A separate programme account will be opened in Namibian dollars with the First National Bank, a financial institution that has been providing banking services to Gobabeb for many years. The programme will be included in the annual organisational audits of the EE. Gobabeb has a clean financial record for the past three years and complies with all financial instruments as is required by national legislation.

During the design phase of the project, a meeting was held on 23 June 2015 between the NIE Manager and the Executive Director of Gobabeb. The purpose of this meeting was to clarify and develop a common understanding as to *modus operandus* for programme implementation. Discussions included, *inter alia*: i) roles and responsibilities of NIE; ii) programme oversight; iii) reporting requirements; iv) midterm and terminal review arrangements; iv) audits; v) financial management systems including procurement of goods and services and disbursement arrangements.

Disbursement of funds from the AF will be effected annually according to an annual disbursement schedule with time-bound milestones (see *Section III.H*, p. 114). The first tranche received will fund the recruitment of core staff, as well as inception activities; thereafter disbursements will be pegged to achievement of milestones. The financial flow from the AF is to the NIE, which will then allocate funds to the EE/PMU. An MoU to determine the flow between EE and LAC will be developed.

v) National Implementing Entity (NIE)

The Desert Research Foundation of Namibia (DRFN) is accredited as the NIE for Namibia, and is contracted by the AF to execute an oversight role for project/programme implementation in Namibia. The NIE bears full responsibility for overall programme management, monitoring and evaluation, including financial monitoring, and reporting responsibilities associated with the programme. The grievance mechanism that was required for accreditation with the AF will apply. Some specific roles and responsibilities of the NIE include, *inter alia*:

- Advise and oversee programme implementation
- Liaise with and report to AF
- Establish protocols for annual progress reporting
- Facilitate formal scheduled programme evaluations
- Ensure compliance with the ESP of the AF, and other essential operational frameworks
- Advise and arbitrate on grievance claims, should these arise

- Disburse funds and monitor expenditure

A longstanding association exists between the EE and the NIE and it is anticipated that this foundation of trust will continue with the AF-funded programme implementation. The EE, through the PMU, will inform the NIE on programme performance through submission of quarterly reports. The EE and NIE will meet to discuss these reports within one week after the reporting period. The two entities will endeavour to maintain effective communication flow and will undertake *ad hoc* consultations as a routine operational procedure.

The NIE will provide periodic monitoring services through site visits according to a predetermined schedule.

B. Describe the measures for financial and project risk management.

DRFN will have an overarching role as the NIE in overseeing and ensuring financial and programme risk management. These risks, and associated mitigation/management measures, will be assessed on an ongoing basis. The following risks, their potential impacts, and proposed responses in mitigation/management are as follows (Table 14):

Table 14: Measures for financial and programme risk management.

Risk	Level	Management/Mitigation
FINANCIAL		
Ineffective Financial Management Systems	Low	Financial Management Systems streamlined and compatible. Experienced and skilled staff involved. Part-time contract of Financial Support staff reviewed and adjusted regarding number of days, functions and deliverables. NIE and auditors to provide timely advice and ensure efficient use of funds
Delays in disbursement	Low	PMU and NIE will closely liaise regarding disbursement of funds. Enhanced effort to achieve designated milestones as a trigger for disbursement. Procurement plan will be agreed and adhered to. Key support staff will be appointed immediately after funding is availed
Exchange rate fluctuations	Medium	Close monitoring of fluctuations, accommodating these in budget reallocations, communication between all programme partners, guidance provided from the NIE in this regard
Local inflation rates	Medium	Close monitoring of inflation rates and price escalations , accommodating these in budget reallocations, communication between all programme partners, guidance provided from the NIE in this regard
PROGRAMME		
Failure to achieve milestones and provide deliverables on time	Low	Close engagement between NIE and EE. Quarterly reports and consultations would flag issues of concern in advance, which could then be addressed in a timely manner
Inability to source appropriate students	Low	Close engagement with universities to identify appropriate students; timely advertisements, efficient review processes
Inadequate community involvement/workshop “fatigue”	Low	Effective information-sharing mechanisms established within six months of programme inception; increased engagement with DAPEES/MAWF and the FSP, and with the regional and local political structures

Unavailability of suitable technology	Low	Detailed review of applicability and replicability of off-the shelf or bespoke technologies carried out
Failure to create ownership of programme at community level	Low	Establishment of FFGs, training of DAPEES/FSP partners, information in vernacular, using community members as para-meteorologists, high priority of skills transfer arrangements
Ineffectual grievance and conflict resolution	Low	PMU and coordinators will inform beneficiaries of procedures at programme inception and will closely monitor potential social and environmental risks for early reporting and resolution. SF will provide guidance, while the NIE is responsible for overall oversight and arbitration in accordance with its approved grievance procedures.
INSTITUTION		
Inadequate government involvement	Low	SF meeting to include relevant competent authorities, i.e. MAWF, MET, NCRST, NMS
Duplication/Inadequate coordination with climate change projects	Low	Regular participation at NCCC meetings will ensure relevance and compatibility with other initiatives
Inability of partners to deliver	Low	ToR for all key programme partners will be discussed and agreed at inception. All partners selected based on good track-records for delivery and in-house competency
Staff turn-over	Medium	Institutional rather than individual commitments for key partnership roles have been pledged. This provides some surety that activities will not be compromised due to inevitable staff turn-over. Contractual arrangements will be made for students benefiting through study grants, and consultants will be engaged through service agreements preferably fixed cost contracts). Remuneration for PC will be competitive and in line with industry standards

C. Describe the measures for environmental and social risk management, in line with the Environmental and Social Policy of the Adaptation Fund.

Namibia acknowledges the fundamental link between environmental protection and sustainable development. The Namibian Constitution explicitly states that ecosystems, essential ecological processes and biological diversity of Namibia must be maintained and utilised in a sustainable manner for the benefit of all Namibians, both present and future. As an environmental organisation in existence for more than 50 years, Gobabeb has an acute awareness of environmental issues in Namibia, and subscribes to the provisions within the environmental legal and policy framework, e.g. Environmental Management Act (Act #7 of 2007).

The EE has a long history of association with traditional communities, particularly the ≠Aonin Nama or Topnaar (Letter of support from TTA attached as Appendix A1), and is the process of formulating an MoU that spells out terms of engagement with this particular community. The LAC is recognised as a champion for marginalised, disadvantaged minorities in Namibia. Indigenous people will be the direct beneficiaries of this programme, and thus there has been widespread consultation with relevant Regional Authorities (Letter of support from the Office of the Kavango Regional Council attached as Appendix A2), Traditional Authorities as well as community members during the programme design (see *Section II.H*, p. 73). The programme subscribes to the 2007 UN Declaration on the Rights of

Indigenous Peoples, and particularly with regard to Free, Prior, Informed Consent (FPIC). Programme activities shall be implemented in close consultation with affected communities.

Gobabeb has carefully considered and is fully aware of its responsibilities with regards to the provisions of the Environmental and Social Policy (ESP) of the Adaptation Fund. After careful consideration and evaluation of the programme against the principles in the AF ESP, this programme is categorised as a **Category C**, i.e. no anticipated adverse environmental or social impacts (see *Section II.K*, p. 90).

In summary, the evaluation of potential environmental and social risks in terms of the AF ESP is as follows:

- ***Compliance with the Law***: All programme activities are compliant with Namibian and international laws.
- ***Access and Equity***: All programme activities are inclusive and will provide fair and equitable benefits to all. No activities will exacerbate existing inequities.
- ***Marginalised and Vulnerable Groups***: All programme activities capacitates marginalised and vulnerable groups without imposing any prejudice.
- ***Human Rights***: As required by Namibian law, all programme activities will respect and promote human rights in compliance with the Universal Declaration of Human Rights.
- ***Gender Equity and Women's Empowerment***: The programme will ensure full and equal participation of men and women in all activities.
- ***Core Labour rights***: All programme activities will meet core ILO labour standards as enshrined in Namibian law.
- ***Indigenous Peoples***: All programme activities target indigenous peoples and are consistent with the rights and responsibilities as set forth in the UN Declaration on the Rights of Indigenous Peoples and national policy.
- ***Involuntary Resettlement***: No involuntary resettlement will occur.
- ***Protection of Natural habitats***: No programme activities will require conversion or degradation of natural habitats or resource areas used by traditional communities.
- ***Conservation of Biological Diversity***: All programme activities will avoid reduction or loss of biological diversity, while some activities are designed to support its conservation and use.
- ***Climate Change***: No programme activities will contribute to drivers of climate change or greenhouse gas emissions.
- ***Pollution Prevention and Resource Efficiency***: No programme activities will lead to the production of waste, release of pollutants (including fertilisers and pesticides), or increase in the use of natural resources, while some activities are designed to optimise the use of resources, e.g. rangelands.
- ***Public Health***: No programme activities will lead to negative impacts on public health.
- ***Physical and Cultural Heritage***: All programme activities will be sensitive to traditional cultural norms and practices, with specific reference to both tangible and intangible cultural heritage of programme participants and beneficiaries.
- ***Lands and Soil Conservation***: All programme activities will avoid degradation of lands, while some activities are designed to maintain ecosystem services and improve sustainable management of communal lands. In particular, no programme activity will advocate for an increase in the use of scarce water resources. Those

programme activities dealing with cropping will promote the conservation of soils and appropriate means of increasing soil fertility.

As no potential environmental or social impacts or risks have been identified, it is not feasible to develop management plans to be in compliance with the ESP.

Should any such risks arise during the course of implementation, these will be considered by the PMU and appropriately addressed by the EE, in consultation with the SF and especially the NIE, which is charged with the overall responsibility in this regard. In the event that unforeseen risks recur, an environmental and/or social risk management plan will be developed. Programme funds, upon agreement by the SF and in consultation with the NIE, may be redirected to risk management activities. In such cases, it will need to be clearly demonstrated and motivated that these additional costs can be provided from within the programme budget, and a request for approval will be submitted to the NIE. Punitive measures (e.g. withholding funds) will be taken against partners that fail to employ actions to address overt risks or repeated negative scenarios, particularly if some support to improve response capacity has been provided by the PMU.

Any grievances that cannot be resolved amicably will be arbitrated by the NIE in accordance with its grievance procedures as approved by the AF. The programme will not circumvent such established procedures.

Studies to be undertaken in the Walvis Bay Rural constituency (within the Namib-Naukluft Park) will fall under the permission awarded to Gobabeb as part of its research concession. Germplasm collecting with be undertaken under the ambit of the annual collecting permit of the National Botanical Research Institute (NBRI). Material accessioned from the National Plant Genetic Resources Centre (NPGRC) for on-station/on-farm trials will be under the terms and conditions of the Standard Material Transfer Agreement of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), or the access agreement of the NPGRC, depending on whether the material requested is on Annex 1 of the ITPGRFA.

D. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

The EE has existing M&E arrangements that will be employed in forecasting, reporting, monitoring and evaluation activities associated with this programme. The M&E template of the EE was used as a basis for the Results Framework for the programme (see *Section III.E*, p. 105).

An inception workshop will launch implementation of the programme. This event will bring together all key partners with definitive roles, as well as other stakeholders. At this workshop the programme outline and activities will be presented and verification of baselines that underpin the M&E plan will need to be undertaken. This will ensure full understanding and ownership of the programme by all partners. The ToR of the SF will be confirmed and a meeting schedule created. At this time, the NIE will need to provide clear guidelines as procedures that will apply to implementation of programme activities. It is

advised that the NIE develops a manual in this regard. An inception workshop report will serve as a record of decisions.

Once the PC has been recruited, the SF will meet. At the first meeting, a number of key issues need to be discussed and modalities adopted. For example, the annual plan of operation and budget will be discussed and agreed. A detailed overview of the roles and responsibilities of all key partners will be clarified and agreed, as relevant. The formats and scheduling for reporting (including financial) will be shared and agreed. Minutes of all SF meetings will be documented by the PMU and made available to relevant partners within one month after every meeting.

Target community beneficiaries were involved in the preparatory planning processes that underpin this programme (see *Section II.H*, p. 73). At programme launch, these communities will be further consulted regarding the final activity design and implementation schedule, the proposed implementation strategies, and will be advised as to recourse in the event of grievances or risk-related incidences. This will take place during a series of community consultative meetings, endorsed by the traditional authorities and facilitated by the DAPEES and FSP. Continuous community engagement is planned, but formal feedback to beneficiary communities must occur at least once a year. These actions will be overseen by the respective facilitators, and effected through the FFG established within target communities.

Recruitment, progress and academic quality control of Student Grant Recipients will be partially executed by the PMU and the SF, but academic quality control processes within the tertiary training institutions will also apply. Research articles in peer-reviewed journals will serve as a key performance indicator for the qualifying training activities; as well as theses to be submitted upon completion of studies.

Overall programme progress will be monitored through quarterly reports submitted to the NIE by the PMU, with contributions collated from all partners. A template for routine reporting will be developed by the PMU in close consultation with the NIE and with due consideration given to the requirements of the AF. The EE, supported by NIE, will monitor that the required competencies are available in the PMU, and additional skills developed or sourced, if required, and within budgetary frameworks.

Quarterly reporting will include a component on forecasting for the next quarter. These forecasts will underpin the disbursement of funds for projected activities, and should also include due consideration to risks. Once scrutinised by the PMU, these requests will be submitted to the NIE for approval. The EE and NIE will meet to discuss these reports within one week after the reporting period.

Annual reporting templates will be developed by the NIE and disseminated by the PMU. The PMU will be responsible to collate and submit annual programme implementation/progress reports to the NIE, in order to track progress according to programme objectives and outcomes. This annual report will also include: i) lessons learnt; ii) a breakdown of direct beneficiaries in terms of gender and minority group membership; iii) knowledge management; iv) skills transfer accounting; and v) a financial/expenditure report.

The NIE will provide periodic monitoring services through site visits according to a predetermined schedule.

Account audits will be undertaken annually as part of the financial management procedures of both the EE and the NIE. The Financial Year of the EE extends from March to February, while that of the NIE extends from January to December. Final audits will be undertaken at programme completion.

An independent mid-term review of the programme will be conducted by external consultants to evaluate progress on implementation since inception, giving particular attention to achievement of programme outcomes. The scheduling of this process will be agreed by all programme partners and endorsed at the SF. The ToR for this review will be developed by the NIE, who will also provide the funding for the review. The PMU will facilitate the execution of the review. Recommendations will be provided to improve performance, as appropriate, as well as suggestions as to how any changes would be accommodated in the workplan would be a key deliverable of this process.

An independent terminal evaluation, financed by the NIE, will be conducted by external consultants upon completion of the programme according to specific ToR developed by the NIE in consultation with the AF. The focus of this action will be to assess overall programme achievements and the impacts and sustainability of key results. Follow-up actions will be suggested that contribute to sustainability. Some specific considerations could be: i) the overall contribution to capacity development; ii) degree of uptake of results; and iii) an impact assessment.

A terminal report will be prepared by the PMU according to a template provided by the NIE. This will be: i) a comprehensive stock-taking of achievements; ii) analysis of shortcomings, if relevant; iii) lessons learnt; iv) best practice guidelines; v) suggested future actions; and vi) sustainability recommendations.

Table 15. M&E activities, responsibilities, budget and timeframe.

M&E activity	M&E Executor/s	Budget	Timeframe
Inception Workshop and report	PC, NIE	3,000	Within 3 months of programme start up
Community inception meetings	PC, NIE	12,000 (Activity 1.1.1 & 2.1.1)	Within 3 months of programme start up
Verification of baselines	PC/PMU, NIE	1,250	Year 1
SF meetings	PC/PMU, NIE	7,500	Biannually
Community meetings	PMU, Facilitators, Partner Initiatives	41,000 (Activity 1.1.3 & 2.1.4)	Biannually
Annual progress reports	PC/PMU, NIE	0 (EE operating costs)	Annually
Routine progress reports	PC/PMU	0 (EE operating costs)	Quarterly
Mid-term review	PC, NIE, External consultants	0 (NIE contribution)	At mid-term
Terminal evaluation	PC, NIE, External consultants	0 (NIE contribution)	Upon completion
Programme Terminal report	PC, NIE	0 (EE operating costs)	Upon completion
Audit	PC, NIE, Local audit firm	5,000	Annually, and upon completion
Visits to sites	NIE	0 (NIE contribution)	Annually

Continuous routine monitoring	PC, NIE, SF	0 (EE operating costs)	Ongoing
Documentation and archiving	PC/PMU, NIE, SF	0 (EE and SF operating costs)	Ongoing
Scientific peer-reviewed publication	PMU, Student associates	0 (included in grants)	Ongoing
Public information products	PMU, Student associates, SF	50,500 (Knowledge Management)	Ongoing

E. Include a results framework for the project, including milestones, targets and indicators.

***Table 16*:** Results Framework for the Programme based on M&E Plan template of EE.

RESULT STATEMENT (GOAL, OUTCOMES & OUTPUTS)	INDICATORS	BASELINE	TARGETS(S)	MEANS OF VERIFICATION			
				DATA SOURCE & METHODOLOGY	FREQUENCY OF COLLECTING	FREQUENCY OF REPORTING	RESPONSIBILITY
GOAL: Improve resilience to climate variability in vulnerable rural communities in Namibia	Number of small-scale farmers provided with risk management decision-making information	0 women and 0 men	6,021 women and 4,831 men in 1871 households (804 women-headed)	2011 National Census; National Household Income and Expenditure Surveys Gender-sensitive Participatory Rural Assessments in target areas	During programme implementation	Terminal report	Facilitators Student enumerators
OUTCOME 1: Improved food security and income generation from promoting validated traditional varieties, based on agrometeorological forecasts	Agrometeorological early warning system (EWS) benefiting small-scale farmers, particularly women-headed households	0 constituency EWS	2 constituency EWS tested and operational	Dissemination protocol with recipient contact information	During programme implementation	Annual reports Terminal report	EE/ PMU Facilitators
OUTPUT 1.1: On-farm retention of crop varieties to reduce vulnerabilities and strengthen adaptive responses	Number of Wards with comprehensive crop landrace inventories Number of functional community seed banks	0 Wards inventoried 1 national and 0 community seed banks	35 Wards inventoried 6 community seed banks	Household surveys Seed bank inventories. Participatory operational plans for seed banks	During Y2-Y3 of programme implementation During Y3-Y5 of programme implementation; Annually, after harvest	Quarterly Reports Annual Reports Terminal Report	TAs Facilitators FFGs NPGRC/MAWF Students

RESULT STATEMENT (GOAL, OUTCOMES & OUTPUTS)	INDICATORS	BASELINE	TARGETS(S)	MEANS OF VERIFICATION			
				DATA SOURCE & METHODOLOGY	FREQUENCY OF COLLECTING	FREQUENCY OF REPORTING	RESPONSIBILITY
OUTPUT 1.2: Improved information on the agronomic potential of traditional crop varieties and their attributes for climate adaptation	Number of small-scale farmers testing local varieties for specific climate conditions	0 women and 0 men	40 women and 40 men	On-farm and on-station trials	During Y2-Y4 of programme implementation	Quarterly reports Annual reports Terminal report	TAs FFG Facilitators DARD/DAPEES/FSP Students
	Information products on landraces and climate distributed in local languages	0 information products	3 printed information products in 3 languages	Products accessioned into National Library and Archives (legal depositories)	During Y3 & Y5 of programme implementation	Annual reports Terminal report	EE/PMU NPGRC/MAWF
	Number of advanced qualifications specialising on traditional landraces	1 woman	4 women and 3 men with at least Masters degrees	Minutes of SF scholarship evaluations Theses deposited at relevant institutions	During Y3-Y5 of programme implementation	Grantee progress reports Annual reports Terminal reports	SF EE/PMU
OUTCOME 2: Improved rangeland management and livestock production by indigenous herding communities in marginal desert ecosystems	Small-scale livestock farmers in two target areas trained in rangeland monitoring and risk assessment tool	0 tools and 0 trained livestock farmers in target areas	1 tool in 3 languages and 40 trained livestock farmers in 2 constituencies	Training record	During programme implementation	Terminal report	Facilitators DAPEES/FSP Students
OUTPUT 2.1: Greater efficiency in livestock and rangeland monitoring to	Knowledge of indigenous livestock behaviour under thermal stress	0 scientific information for Namibia	3 peer-reviewed science publications for quality assurance	Publically accessible through internet	During Y1-Y3 of programme implementation	Annual reports Terminal report	Facilitators Students

RESULT STATEMENT (GOAL, OUTCOMES & OUTPUTS)	INDICATORS	BASELINE	TARGETS(S)	MEANS OF VERIFICATION			
				DATA SOURCE & METHODOLOGY	FREQUENCY OF COLLECTING	FREQUENCY OF REPORTING	RESPONSIBILITY
improve resilience by indigenous herders in marginal desert areas	Quarterly communal rangeland assessments Risk Management and Adaptation Plans for two communal livestock producing areas	0 scheduled assessment 0 plans	20 women and 20 men on two communal rangelands 2 plans for 332 households (129 woman headed)	Assessment reports Plans available at TAs, CC Unit MET	Quarterly during Y3-Y5 of programme implementation Y5 of programme implementation	Quarterly reports Terminal report	TAs FFGs Facilitators Students TAs FFG Facilitators EE/PMU
OUTCOME 3: Established Namibian capacity to interpret and model climate patterns for agrometeorological forecasting with tested protocols for communicating forecast information to small-scale farming communities	Locally produced weather forecasts from downscaled NWP models distributed in local languages to small-scale farmers	1 regional model for SADC seasonal and daily forecasts; 0 downscaled NWP for Namibia	2 downscaled NWP models for Kavango East and Erongo Regions inform 3,259 farming households (1,354 woman headed)	Operational NWP downscaling at NMS	During programme implementation	Annual reports Terminal report	EE/PMU NMS DARD/MAWF SASSCAL Namibia
OUTPUT 3.1: Improved seasonal and short-term agro-meteorological forecasting provided by local specialists on Namibian agricultural production areas	Trained Namibian meteorologists do forecasting through NWP and EPS Cellular phone distribution of weather forecasts	2 women and 6 men with primary degrees; 0 advanced degree 0 forecasts via cellular phone	5 women and 9 men with primary degrees; 1 person at Masters level Forecasts in 5 languages via cellular phone	Minutes of SF scholarship evaluations Theses deposited at relevant institutions Register of subscribers	During Y1-Y5 of programme implementation During Y5 of programme implementation	Grantee progress reports Annual reports Terminal reports Terminal report	SF EE/PMU EE/PMU NMS DARD/MAWF

RESULT STATEMENT (GOAL, OUTCOMES & OUTPUTS)	INDICATORS	BASELINE	TARGETS(S)	MEANS OF VERIFICATION			
				DATA SOURCE & METHODOLOGY	FREQUENCY OF COLLECTING	FREQUENCY OF REPORTING	RESPONSIBILITY
			(short-term, seasonal, early warning bulletins)	SMS text message archive			
OUTPUT 3.2: Local communication and dissemination networks empower agriculture extension officials and small-scale farming communities to respond timeously to seasonal forecasts	Regional and constituency forecasts distributed to farmers	National forecasts disseminated via radio, newspaper, TV	6,311households (2,622 women-headed) in 4 constituencies	Extension protocols	During Y4 & Y5 of programme implementation	Terminal report	Facilitators FFGs DAPEES/FSP Students
	Farmer networks advise meteorologists on forecast accuracy	0 farmer networks report meteorology	2 operational networks involving 40 women and 40 men	Weather network databases	During Y4 & Y5 of programme implementation	Annual report Terminal report	Facilitators FFGs DAPEES/FSP

F. Demonstrate how the project aligns with the Results Framework of the Adaptation Fund.

***Table 17*:** Programme alignment with the Results Framework of the Adaptation Fund

Programme Objective(s)	Programme Objective Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
Improve resilience to climate variability in vulnerable rural communities in Namibia	Number of small-scale farmers provided with risk management decision-making information	**Outcome 4**: Increased adaptive capacity within relevant development and natural resource sectors (agriculture)	**4.1.** Development sector's (agricultural) services responsive to evolving needs from changing and variable climate	**989,140**
Programme Outcome(s)	**Programme Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)**
Outcome 1: Improved food security and income generation from promoting validated traditional crop varieties, based on advance warning on appropriate time frames	Agro-meteorological early warning system (EWS) benefiting small-scale farmers, particularly women-headed households	**Output 6:** Targeted individual and community livelihood strategies strengthened in relation to climate change impacts, including variability	**6.1.1.** Number and type of adaptation assets (physical as well as knowledge) created in support of individual- or community-livelihood strategies	**312,700**
Outcome 2: Improved rangeland management and livestock production by indigenous herding communities in marginal desert ecosystems	Small-scale livestock farmers in two target areas trained in rangeland monitoring and risk assessment tool	**Output 3:** Targeted population groups participating in adaptation and risk reduction processes at local level	**3.1.1.** Number and type of risk reduction actions or strategies introduced at local level	**237,750**
Outcome 3: Established Namibian capacity to interpret and model climate patterns for agrometeorological forecasting with tested protocols for communicating forecast information to small-scale farming communities	Locally produced weather forecasts from downscaled NWP models distributed in local languages to small-scale farmers	**Output 2.2:** Targeted population groups covered by adequate risk reduction systems	**2.1.2.** Capacity of staff to respond to, and mitigate impacts of, climate-related events	**275,200**

G. Include a detailed budget with budget notes, a budget on the Implementing Entity management fee use, and an explanation and a breakdown of the execution costs.

***Table 18*:** Detailed programme budget, with budget notes

Programme components, outputs and activities	Budget (USD)	Budget Notes
Component 1: Promote preparedness and adaptive capacity of small scale crop farmers to climate change and variability through on-farm conservation of traditional crop varieties by integrating scientific and local knowledge.	**312,700**	
Coordination and technical support	38,800	LAC Facilitator including operating costs
Output 1.1: On-farm retention of crop varieties to reduce vulnerabilities and strengthen adaptive responses		
Activity 1.1.1: Collate information from farmers, agricultural extension and scientists on traditional agro-biodiversity coping strategies to climate variability in the Kavango East Region	42,400	Inception meetings x 2 (6,000); Local enumerator training and mobilisation (28,400); Knowledge management (8,000)
Activity 1.1.2. Document current on-farm genetic crop diversity system in the Mashare and Ndiyona constituencies	50,000	FFG support x 6 (9,000); Local enumerator training and mobilisation (23,000); Statistical and RS/GIS analysis (8,000); Knowledge management (10,000)
Activity 1.1.3. Develop suitable partnerships to maintain community seed banks of indigenous crops to enhance effectiveness for on-farm plant genetic conservation	21,500	Community seed bank meetings x 10 (20,000); Knowledge management (1,500)
Activity 1.1.4. Strengthen seed exchange systems to enable a proactive response to agro-meteorological climate information	18,000	Farmer exchange visits (18,000)
Output 1.2: Improved information on the agronomic potential of traditional crop varieties and their attributes for climate adaptation		
Activity 1.2.1. On-farm trials by participating farmers on yields and effectiveness of traditional varieties under different conditions for future testing at agricultural development centres (ADCs)	30,000	On-farm trials on 30 farms and on-station verification trials x 2 (30,000)
Activity 1.2.2. Develop local capacity to analyse crop genetic resources through genetic mapping of local maize landraces in north-central Namibia	56,000	PhD study grant, including field sampling (56,000)
Activity 1.2.3. Contribute to germplasm and passport data collecting to fill gaps in national collection	6,000	Germplasm collecting and accessioning (6,000)
Activity 1.2.4. Develop knowledge on traditional agrobiodiversity systems by providing top-up bursaries for advanced study	50,000	Masters studies x 6 (50,000)

Programme components, outputs and activities	Budget (USD)	Budget Notes
Component 2: Promote climate-smart herding practices for indigenous herding communities in desert farming areas	**237,750**	
Coordination and technical support	24,000	Livestock Facilitator including operating costs
Output 2.1: Greater efficiency in livestock and rangeland monitoring to improve resilience by indigenous herders in marginal desert areas		
Activity 2.1.1. Document the livestock herding practices in the Lower Kuiseb (Walvis Bay Rural Constituency) and Okombahe (Daures Constituency) areas	24,000	Inception meetings 2x (6,000); Intern training and mobilisation (10,000); Knowledge management (8,000)
Activity 2.1.2. Track livestock activity with seasonal assessments of livestock condition in grazing areas	59,600	Tracking equipment (20,000); FFG support x 4 (8,000); seasonal field assessment (15,000); RS/GIS analysis (2,600); Isotope analysis/specialist services (9,000); Knowledge management (5,000)
Activity 2.1.3. Determine the seasonal availability and nutritional qualities of available feed in grazing areas	55,150	Performance testing equipment for FFGs (8,150); Participatory seasonal field assessments (19,000); Forage production and performance trials (14,000); Specialist services (9,000); Knowledge management (5,000)
Activity 2.1.4. Promote farmers' associations for small-scale livestock farmers, e.g. Lower Kuiseb and Okombahe Farmer's Associations	23,000	Consultative community meetings x 20 (21,000); Knowledge management (2,000)
Activity 2.1.5. Prepare Walvis Bay Rural and Daures constituency risk management / adaptation plans based on vulnerability assessments and seasonal livestock and grazing condition monitoring	40,000	Vulnerability assessments x 2 (10,000); Participatory risk assessment and adaptation planning x 2 (25,000); Knowledge management (5,000)
Activity 2.1.6. Test a livestock production forecasting information system in the Lower Kuiseb area	12,000	Model testing at Gobabeb (12,000)
Component 3: Access to short-term and seasonal weather forecasting improves the resilience of small scale farmers to cope with climate variability	**275,200**	
Coordination and technical support	**15,000**	Climate Facilitator including operating costs
Output 3.1: Improved short-term and seasonal agro-meteorological forecasting provided by local specialists on Namibian agricultural production areas		
Activity 3.1.1. Develop Namibian human resources for agro-meteorological monitoring and forecasting	140,000	SAWS-UP bridging course and Honours in Meteorology x 6 (115,000); Masters in Meteorology x 1 (25,000)
Activity 3.1.2. Develop Namibian	68,20	Computer equipment and software

Programme components, outputs and activities	Budget (USD)	Budget Notes
agrometeorological modelling capacity based on real-time weather monitoring	0	(13,000); PhD x 3 or Post-doc x2 (55,200)
Activity 3.1.3. Establish forecasting information dissemination systems appropriate for use by small-scale farmers through participatory processes	15,000	FFG support x 6 (11,000); Knowledge management (4,000)
Output 3.2: Local communication and dissemination networks empower agriculture extension officials and small-scale farming communities to respond timeously to seasonal forecasts		
Activity 3.2.1. Test a constituency-based agrometeorological forecasting system in the Kavango East Region	5,000	Translation services (3,000); Participatory testing (2,000)
Activity 3.2.2. Develop a constituency-based feedback system on crop production and weather monitoring in the Mashare and Ndiyona constituencies	12,500	Equipment (1,500); Network training (8,000); Knowledge management (3,000)
Activity 3.2.3. Develop a constituency-based rangeland and weather monitoring feedback system in the Daures and Walvis Bay Rural constituencies	12,500	Equipment (1,500); Network training (8,000); Knowledge management (3,000)
Activity 3.2.4. Mainstream agrometeorological early warning and forecasting systems into agricultural extension services	7,000	Participation in MAWF meetings x 2 (7,000)
Programme Activities Cost (A)	**825,650**	
Programme Execution Cost (9.5%) (B)	**86,000**	
	46,750	Programme Coordinator (Part-time)
	15,000	Financial Support (Part-time)
	13,000	Operating costs: Inception workshop (3,000); SF meetings (7,500); communications (2,500)
	0	Office facilities (EE responsibility)
	0	Transport (Activity operating costs)
	1,250	Verification of baselines
	5,000	Materials and supplies for PMU
	5,000	Annual and terminal audits
Total Programme cost (A + B)	**911,650**	
Programme Management Fee (8.5%) (C)	**77,490**	
Amount of Financing Requested (A + B + C)	**989,140**	

Implementing Entity Budget

The NIE has submitted a budget for programme management activities associated with this programme, as indicated in Table 19.

Table 19**:** Implementing Entity budget.

Fee Category	Cost category	Total (USD)
Management Fees	Programme management, finance administration and office administration	46,494
Operating Expenditure	Travel, daily subsistence allowances and workshops associated with programme oversight and governance	15,500
Office Services and Supplies	Utilities, telecommunications and office supplies	4,652
Auditing and consulting	External auditing, programme evaluation and technical support	10,844
Total		**77,490**

H. Include a disbursement schedule with time-bound milestones.

***Table 20*:** Disbursement schedule with time-bound milestones

	Upon signature of agreement	End Year 1	End Year 2	End Year 3	End Year 4	Total (USD)
Scheduled Date	Nov 2015	Feb 2017	Feb 2018	Feb 2019	Feb 2020	
Programme Funds	160,800	192,400	215,100	205,900	137,450	911,650
NIE Fee	14,110	14,109	16,279	14,109	18,883	77,490

Milestones	Expected Completion
Start of programme (Inception workshop)	January 2016
Mid-term evaluation	April 2019
Programme closure	June 2021
Terminal evaluation	April 2021

***Table 21*:** Programme Implementation Schedule

	Y1				Y2				Y3				Y4				Y5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Component 1																				
Output 1.1: On-farm retention of crop varieties to reduce vulnerabilities and strengthen adaptive responses																				
Activity 1.1.1: Collate information from farmers, agricultural extension and scientists on traditional agro-biodiversity coping strategies to climate variability in the Kavango East Region																				
Activity 1.1.2. Document current on-farm genetic crop diversity system in the Mashare and Ndiyona constituencies																				
Activity 1.1.3. Develop suitable partnerships to maintain community seed banks of indigenous crops to enhance effectiveness for on-farm plant genetic conservation																				
Activity 1.1.4. Strengthen seed exchange systems to enable a proactive response to agro-meteorological climate information																				
Output 1.2: Improved information on the agronomic potential of traditional crop varieties and their attributes for climate adaptation																				
Activity 1.2.1. On-farm trials by participating farmers on yields and effectiveness of traditional varieties under different conditions for future testing at agricultural development centres (ADCs)																				
Activity 1.2.2. Develop local capacity to analyse crop genetic resources through genetic mapping of local maize landraces in north-central Namibia																				
Activity 1.2.3. Contribute to germplasm and passport data collecting to fill gaps in national collection																				

	Y1				Y2				Y3				Y4				Y5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 1.2.4. Develop knowledge on traditional agrobiodiversity systems by providing top-up bursaries for advanced study																				
Component 2																				
Output 2.1: Greater efficiency in livestock and rangeland monitoring to improve resilience by indigenous herders in marginal desert areas																				
Activity 2.1.1. Document the livestock herding practices in the Lower Kuiseb (Walvis Bay Rural Constituency) and Okombahe (Daures Constituency) areas																				
Activity 2.1.2. Track livestock activity with seasonal assessments of livestock condition in grazing areas																				
Activity 2.1.3. Determine the seasonal availability and nutritional qualities of available feed in grazing areas																				
Activity 2.1.4. Promote farmers' associations for small-scale livestock farmers, e.g. Lower Kuiseb and Okombahe Farmer's Associations																				
Activity 2.1.5. Prepare Walvis Bay Rural and Daures constituency risk management / adaptation plans based on vulnerability assessments and seasonal livestock and grazing condition monitoring																				
Activity 2.1.6. Test a livestock production forecasting information system in the Lower Kuiseb area																				

Component 3																				
Output 3.1: Improved short-term and seasonal agro-meteorological forecasting provided by local specialists on Namibian agricultural production areas																				
Activity 3.1.1. Develop Namibian human resources for agro-meteorological monitoring and forecasting																				
Activity 3.1.2. Develop Namibian agrometeorological modelling capacity based on real-time weather monitoring																				
Activity 3.1.3. Establish forecasting information dissemination systems appropriate for small-scale farmers through participatory processes																				
Output 3.2: Local communication and dissemination networks empower agriculture extension officials and small-scale farming communities to respond timeously to seasonal forecasts																				
Activity 3.2.1. Test a constituency-based agrometeorological forecasting system in the Kavango East region																				
Activity 3.2.2. Develop a constituency-based feedback system on crop production and weather monitoring in the Mashare and Ndiyona constituencies																				
Activity 3.2.3. Develop a constituency-based rangeland and weather monitoring feedback system in the Daures and Walvis Bay Rural constituencies																				
Activity 3.2.4. Mainstream agrometeorological early warning and forecasting systems into agricultural extension services																				
Programme Management																				
PMU established and operational																				
Inception workshop and meetings																				
Mid-term review																				
Terminal review																				

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

A. Record of endorsement on behalf of the government[1]

Mr. Teofilus Nghitila, *Environmental Commissioner,* *Ministry of Environment and Tourism,* *Namibia*	**Date:** *21 July 2015* ***Signature:***

MINISTRY OF ENVIRONMENT AND TOURISM
P/Bag 13306
Windhoek, Namibia
2015 -07- 24
Office of the
Environmental Commissioner

B. Implementing Entity certification

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 4, National Policy on Climate Change for Namibia 2011 and National Climate Change Strategy and Action Plan 2013-2014 and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme 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/programme.	
S Aldrich Implementing Entity Coordinator	
Date: 23 July 2015	Tel.: +264811220671 E-mail: schreuderaldrich@hotmail.com
Project Contact Person: Dr M Schneider	
Tel. :+264812460379, or +26461377500 E-mail: martin.schneider@drfn.org.na	

Project title: Strengthening traditional approaches for coping with climate variability by small-scale farmers

Executing entity: Gobabeb Research and Training Centre (GRTC)

[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.

ADAPTATION FUND

Letter of Endorsement by Government

Ministry of Environment and Tourism

21 July 2015

To: 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 "Strengthening traditional approaches for coping with climate variability by small-scale farmers"

In my capacity as Designated Authority for the Adaptation Fund in Namibia, I confirm that the above national project 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 the Namibia.

Accordingly, I am pleased to endorse the above project 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 Gobabeb Research and Training Centre.

Sincerely,

MINISTRY OF ENVIRONMENT AND TOURISM
P/Bag 13306
Windhoek, Namibia
2015 -07- 24
Office of the
Environmental Commissioner

Teofilus Nghitila
Environmental Commissioner

APPENDICES

Table of Contents

APPENDIX A1

TOPNAAR TRADITIONAL AUTHORITY
CHIEF SETH KOOITJIE
P. O. BOX 2041
WALVISBAY
NAMIBIA
TEL/FAX: 064-207103
CELL: 0812775899
Protocol 1980/7/27 **Email:** seth.kooitjie@gmail.com **Reg: No T297/03**

Enquiries: Hon. Chief Seth M. Kooitjie **28th January 2015**

TO: **Desert Research Foundation of Namibia**
7 Rossini Street
P.O Box 20232
Windhoek
Namibia

Dear Sir/ Madam,

SUBJECT: GRANT APPLICATION: ADAPTATION FUND - DECLARATION OF ASSOCIATION

We hereby declare that the Topnaar Traditional Authority, represented by Chief Seth Kooitjie, is interested to participate in the adaptation project entitled:

Strengthening Traditional Approaches for coping with Climate Variability by Small-Scale Farmers in Namibia

In this context, we agree to collaborate with the designated Executing Entity, Gobabeb Research and Training Centre, to develop a project proposal to the Adaptation Fund based on the objectives and envisaged activities explained in the concept note in order to clarify our role in executing the envisaged project in the Erongo Region.

Yours Truly,

Hon. Chief Seth M. Kooitjie

APPENDIX A2

KAVANGO REGIONAL COUNCIL

Tel. No. 066-266000/266006
Fax. No. 066-255378
e-mail: kmherculano@krc.gov.na
Enquiries: Mr. Herculano Mwenyo

Private Bag 2124
RUNDU
NAMIBIA
28 May 2015

Desert Research Foundation of Namibia
7 Rossini Street
P.O Box 20232
WINDHOEK
Namibia

Dear Sir/Madam

SUPPORT FOR GRANT APPLICATION FOR ADAPTATION FUND: DECLARATION OF ASSOCIATION

We hereby declare that Kavango Regional Council, represented by Mr. S.H.Kantema as the Chief Regional Officer, have been informed of and are interested to collaborate in the proposed programme, **Strengthening *Traditional Approaches for coping with Climate Variability by Small-Scale Farmers in Namibia***.

We confirm that we were involved in the formulation of the proposal and are therefore familiar with the contents. It is anticipated that this initiative will impact significantly on the livelihoods of small-scale farmers in the Kavango East region by providing information and support tools to counter impacts of a changing and variable climate.

It has been agreed that our Executing Entity will be Gobabeb Research and Training Centre, who are authorised to represent all programme beneficiaries during engagement with the National Implementing Entity and other involved authorities.

Yours sincerely

.....

MR. A.T. MAKONGWA
ACTING CHIEF REGIONAL OFFICER

KAVANGO REGIONAL COUNCIL
CHIEF REGIONAL OFFICER
2015 -05- 28
P/BAG 2124, RUNDU

APPENDIX A3

P O Box 604
4 Marien Ngouabi Street
Windhoek
Namibia

Tel: Int +264 61 223356
Fax: Int +264 61 234953
E-mail: info@lac.org.na
Web: http://www.lac.org.na

LEGAL ASSISTANCE CENTRE

Recipient of the UNICEF Maurice Pate Human Rights Award – 1997
JP Karuaihe Human Rights Award – 2008 and 2010

21 January 2015

Desert Research Foundation of Namibia
P. O. Box 20232
Windhoek

Dear Sir/Madam

ENDORSEMENT: ***Agrobiodiversity Concept Note for Climate Change Adaptation***

We confirm the provisional interest of the Legal Assistance Centre (LAC) to participate in the adaptation project entitled "***Strengthening Traditional Approaches for coping with Climate Variability by Small-Scale Farmers in Namibia***". In this context we agree to collaborate with the Gobabeb Research and Training Centre to develop a project proposal to the Adaptation Fund based on the objectives and envisaged activities explained in the concept note in order to clarify our role in executing the envisaged project in the Erongo and Kavango East Regions.

The LAC, through its Land, Environment and Development Project, has a long history of engaging in research, lobbying, law reform, extending advice, mediation and litigation services relating to land, environmental and development issues for farmers and rural communities. For example, in 2012 and 2013, the LAC worked closely with the Topnaar community living in the Namib Naukluft and the Gobabeb Research and Training Centre on a World Bank funded study focusing **on *the Impacts of Climate Change on Indigenous Peoples and Traditional Knowledge***. In 2014, the LAC teamed up as a country partner with the Institute for Poverty, Land and Agrarian Studies (PLAAS) to conduct a study on the ***Commercialisation of Land and Land Grabbing*** in Southern and Eastern Africa. For the Namibian part of this study, we focused on the Kavango East and Zambezi Regions.

Based on the above experiences, we are of the opinion that the LAC is in a good position to add value to the Gobabeb Research and Training Centre's proposed study.

Yours sincerely,

Willem Odendaal
Project Coordinator,
Land, Environment and Development Project
Legal Assistance Centr

APPENDIX A4

NAMIBIA
SASSCAL
Southern African
Science Service Centre for
Climate Change and
Adaptive Land Management

Registration number of Company: 21/2013/0964

Telephone: +264 61 224868
Web: www.sasscal.org
P.O. Box 86755

Sinclair Office Park
Sinclair Str.6, Windhoek

22th January 2015

Dr Gillian Maggs-Kölling
Executive Director
Gobabeb Research and Training Centre
Namib Naukluft Park
P.O. Box 953
Walvis Bay
Namibia

RE: Letter of endorsement for Adaptation Fund concept

Dear Dr Maggs- Kölling

SASSCAL would definitely like to explore with your consortium how we can be of assistance in making data from the SASSCAL WeatherNet available to your project, should you be invited to prepare a full funding proposal. We see this as an opportunity to provide a service to rural farmers, which can eventually be rolled out to the southern African region. This kind of service provision is one of our main SASSCAL mandates.

I wish you success with your concept proposal and look forward to a fruitful cooperation of our organizations.

Yours sincerely

Peter Erb
National Director

APPENDIX A5

REPUBLIC OF NAMIBIA
MINISTRY OF AGRICULTURE, WATER AND FORESTRY

NATIONAL BOTANICAL RESEARCH INSTITUTE

Private Bag 13184
Windhoek
Namibia
Tel: +264 61 202 2021
e-mail: essies@nbri.org.na

27 January 2015

Desert Research Foundation of Namibia
P. O. Box 20232
Windhoek

Dear Sir/Madam

ENDORSEMENT: ***Agrobiodiversity Concept Note for Climate Change Adaptation***

We confirm the provisional (interest/commitment) of the National Botanical Research Institute (NBRI), in particular the National Plant Genetic Resources Centre (NPGRC) to participate in the adaptation project entitled ***"Strengthening Traditional Approaches for coping with Climate Variability by Small-Scale Farmers in Namibia"***. In this context we agree to collaborate with the Gobabeb Research and Training Centre to develop a project proposal to the Adaptation Fund based on the objectives and envisaged activities explained in the concept note in order to clarify our role in executing the envisaged project in the Erongo and Kavango East Regions.

Participation in the adaptation project is of particular relevance to the NPGRC in that the NPGRC has conducted on-farm surveys in the Omuasti, Oshana and Zambezi regions to document on-farm traditional knowledge/practices. Lessons learnt from these surveys could serve as a valuable resource in streamlining procedures and questionnaires to be used by the project. Results from the proposed documentation activities will contribute as well as add value to data housed at the NBRI. In addition, the sharing of information as well as genetic material can assist in developing strategies to cope with climate change. Subsequently, the project serves to provide a platform where research and traditional knowledge/practices can complement each other in the efforts to solve food security issues.

Furthermore, the NPGRC will be a direct beneficiary of the component 1 deliverables as well as an active partner in the planned activities of the proposed project.

In addition, the proposed collaboration on the adaptation project will strengthen the existing partnership between the NBRI and the Gobabeb Research and Training Centre as these two institutions are currently collaborating on the Benefit Sharing Fund (BSF) project. Thus far the NBRI has been involved in providing training to students and sharing experience on lessons learnt relating to traditional agrobiodiversity coping strategies.

In anticipation of your favourable feedback to the adaptation project ***"Strengthening Traditional Approaches for coping with Climate Variability by Small-Scale Farmers in Namibia"***.

Yours sincerely,

Esmerialda Strauss
Acting Head: NBRI

APPENDIX A6

REPUBLIC OF NAMIBIA

Ministry of Agriculture, Water and Forestry

Tel: (061) 208-7002/28
Fax: (061) 208-7082

Directorate of Agricultural Research and Development
Private Bag 13184, Windhoek

Enquires: *Ms J. F. N. Andowa*

Desert Research Foundation of Namibia
7 Rossini Street
P.O Box 20232
Windhoek
Namibia

29 January 2015

Dear Sir or Madam

Climate Change Adaptation Fund - Declaration of Association

The Directorate of Agricultural Research and Development (DARD), within the Ministry of Agriculture, Water and Forestry, hereby declares that we have been consulted and are interested to participate in the climate change adaptation project entitled, ***Strengthening Traditional Approaches for coping with Climate Variability by Small-Scale Farmers in Namibia.***

Recognising that all three project components described in the concept note will make a significant contribution to climate change adaptation strategies within the agricultural sector, we agree to collaborate with the designated Executing Entity, Gobabeb Research and Training Centre in developing a project proposal to the Adaptation Fund based on the objectives and proposed activities presented in the concept. The role of DARD in this initiative will be further clarified at this stage, but we anticipate close collaboration with Gobabeb and other consortium partners in executing this envisaged project.

In particular, the component on agrometeorology will address a critical need identified within the sector and the provision of timely, relevant weather information to small-scale farmers would have far-reaching impacts. Developing new knowledge and building research capacity are functions that fall directly within the mandate of this directorate and we appreciate that the collaboation with Gobabeb will be mutually beneficial while serving a national priority to support the agricultural sector in coping with and developing resilience to climate change.

Yours sincerely

Johanna Andowa
Acting Director

MINISTRY OF AGRICULTURE AND FORESTRY
THE DEPUTY DIRECTOR
29 JAN 2014
P/BAG 13184 WINDHOEK
DIVISION RESEARCH - WINDHOEK
REPUBLIC OF NAMIBIA

APPENDIX A7

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND FORESTRY

DIRECTORATE OF FORESTRY

Telephone: (061) 2087327
Fax: (061) 2087802
E-Mail: hailwaj@mawf.gov.na
Enquiries: J. S. Hailwa
Our Ref: F 23/11

Government Office Park
Luther Street
P/Bag 13184
Windhoek
Namibia
28 January 2015

Desert Research Foundation of Namibia
P. O. Box 20232
Windhoek

Dear Sir/Madam

ENDORSEMENT: ***Agrobiodiversity Concept Note for Climate Change Adaptation***

We hereby would like to confirm the provisional interest and commitment of the Ministry of Agriculture, Water and Forestry, Directorate of Forestry to participate in the adaptation project entitled "***Strengthening Traditional Approaches for coping with Climate Variability by Small-Scale Farmers in Namibia***". In this context we agree to collaborate with the Gobabeb Research and Training Centre to develop a project proposal to the Adaptation Fund based on the objectives and envisaged activities explained in the concept note in order to clarify our role in executing the envisaged project in the Erongo and Kavango East Regions.

Gobabeb Research and Training Centre and our Ministry has a standing collaborating relationship in implementing projects such as the Benefit-Sharing fund project they have been working closely with the National Botanical Research Institute within our Ministry in this regard, in particular the National Plant Genetic Resources Centre in the documenting of on-farm conservation strategies in the northern cropping regions and other support to the NPGRC, including equipment. Our Ministry will benefit from this new project in that it will assist us in the execution of appropriate needs-driven service provision to small-scale farmers, and contribute to capacity development and research output within the sector. The sustainability of the *Faidherbia* riverine forest along the !Khuiseb River is of particular interest to the Directorate of Forestry in the conservation of riverine forests especially along ephemeral rivers in Namibia.

We look forward in working together on this project.

Yours sincerely

J. S. Hailwa
DIRECTOR: FORESTRY

MINISTRY OF AGRICULTURE, WATER AND FORESTRY
DIRECTORATE OF FORESTRY
2015 -01- 2 8
P/BAG 13184, WINDHOEK
REPUBLIC OF NAMIBIA

APPENDIX A8

NCRST
National Commission on Research Science & Technology

Head Office
Hamutenya Wanehepo Ndadi Str
Olympia, Windhoek, Namibia
Tel: +264 61 431 7000

Innovation Hub
Cnr Louis Raymond & Grant Webster Str
Olympia, Windhoek, Namibia
Tel: +264 61 431 7099

Email: info@ncrst.na
Web: www.ncrst.na

Dr Gillian Maggs-Kölling
Executive Director
Gobabeb Research and Training Centre
Namib Naukluft Park
P.O. Box 953
Walvis Bay
Namibia

11 June 2015

Dear Dr. Maggs-Kölling,

RE: PROPOSAL DEVELOPMENT FOR THE ADAPTATION FUND FOR CLIMATE CHANGE

Your letter dated 2 June 2015 bears reference. The National Commission on Research, Science and Technology (NCRST) is pleased to form partnership with the Gobabeb Research and Training Centre, in the development of the proposal and execution of the project titled "Strengthening Traditional Approaches for Coping with Climate Variability by Small-Scale Farmers in Namibia".

Selected staff members of the NCRST will actively participate on this project as part of capacity building effort in research and development.

The NCRST therefore supports this novel initiative.

Yours sincerely

NATIONAL COMMISSION
OFFICE OF CEO
2015 -06- 11
NCRST
Research, Science & Technology

Eino Mvula
Chief Executive Officer

APPENDIX B1

List of surveyed households in Mashare constituency, 11-15 August 2014							
Date	**Location (Region)**	**Location (Constituency)**	**Location (Village)**	**First Name**	**Surname**	**Age**	**Sex**
11-Aug-14	Kavango	Mashare	Mupapama	Moses	Shimongwa	29	M
11-Aug-14	Kavango	Mashare	Mupapama	Kantema M.	Gende	90	M
11-Aug-14	Kavango	Mashare	Mupapama	Frans Kaluwa	Ndars	62	M
11-Aug-14	Kavango	Mashare	Mupapama	Peter MaRungu	Shimongwa	70	M
12-Aug-14	Kavango	Mashare	Mupapama	Albetina	Mulini	30	F
12-Aug-14	Kavango	Mashare	Mabushe	Nikome	Shikuro	69	M
12-Aug-14	Kavango	Mashare	Mabushe	Josephen	Shirungu	46	F
12-Aug-14	Kavango	Mashare	Mabushe	Josephen	Kaharu	64	F
12-Aug-14	Kavango	Mashare	Mabushe	Mesitilde	Shikusho	56	F
12-Aug-14	Kavango	Mashare	Mabushe	Elisabeth	Mushova	64	F
13-Aug-14	Kavango	Mashare	Shavivare	Mbangu Marthin	Mpengo	84	M
13-Aug-14	Kavango	Mashare	Shavivare	Annarosa	Mbangu	41	F
13-Aug-14	Kavango	Mashare	Shavivare	Tewo Kawana	Mukuwe	36	M
13-Aug-14	Kavango	Mashare	Shavivare	Johannes K.	Mandandi	26	M
13-Aug-14	Kavango	Mashare	Shavivare	Hedwig	Kamwanga	63	F
14-Aug-14	Kavango	Mashare	Yuru	Ndumba	Muranda	64	M
14-Aug-14	Kavango	Mashare	Yuru	Imelda	Mbamba	42	F
14-Aug-14	Kavango	Mashare	Yuru	Gotfried	Kampungu	44	M
14-Aug-14	Kavango	Mashare	Yuru	Matias	Shivambo	60	M
14-Aug-14	Kavango	Mashare	Yuru	Andrias	Hayingura	29	M
14-Aug-14	Kavango	Mashare	Dove	Muhera	Samate	86	M
14-Aug-14	Kavango	Mashare	Dove	Agustinus	Sipete	64	M
14-Aug-14	Kavango	Mashare	Dove	Tendro	Livamba	62	M
15-Aug-14	Kavango	Mashare	Tara Tara	Manfried Shikanga	Mutjida	79	M
15-Aug-14	Kavango	Mashare	Tara Tara	Gerefasiusi	Mahupe	68	M
15-Aug-14	Kavango	Mashare	Tara Tara	Christoph K	Kalihonda	26	M
15-Aug-14	Kavango	Mashare	Tara Tara	Patricky	Mundinda	68	M
15-Aug-14	Kavango	Mashare	Tara Tara	Cristine Nayita	Frai	30	F

APPENDIX B2

Participants Registry Mashare 13.05.2015

Edina	Fani	Mukunda	(Ngodi) Number Cellphone
Anna	Viti	Juru	
Imelda	Mbamba	Juru	0813307140
Poulus	Ndumba	Juru	0813771236
~~Kampungu~~ Gottfried	Kampungu	Juru	0815532916
Mathias	Siwambo	Juru	
Andreas	Kavandi	Juru	
Andreas	Kudumo	Juru	
Markus	Limungu	Juru	
Poulus	Shintango	Juru	
Anna	Kampungu	mupapama	0816160995
Joseph	Kandyangu	Mupapama	0815890201
Tomas	Kambongi	mupapama	0816908679
Auresia	shampapi	mupapama	
mestilde	Shikusho	mabushe	
Rauresia	Ndara	mabushe	
Josephine	Shirungu	Mabushe	0814516903
Albertina	Muhini	Mupapama	
ELISabeth	Mushova	Mabushe	
SHARARA	Sophia	MUPAPAMA	0816789346
NAPENDA	JOHN	MUPAPAMA	0812470075
KUTENDA	MACHEAL	MUPAPAMA	
Sebastian	Kahili	mupapama	0818431743 5
KLEMENS	HATUTALE	Runbu	066-255666
~~Shimon~~ Shimongwa	moses N	Mupapama	0813646134
Shimongwa	Peter	Mupapama	
Gende	Mikael	Mupapama	

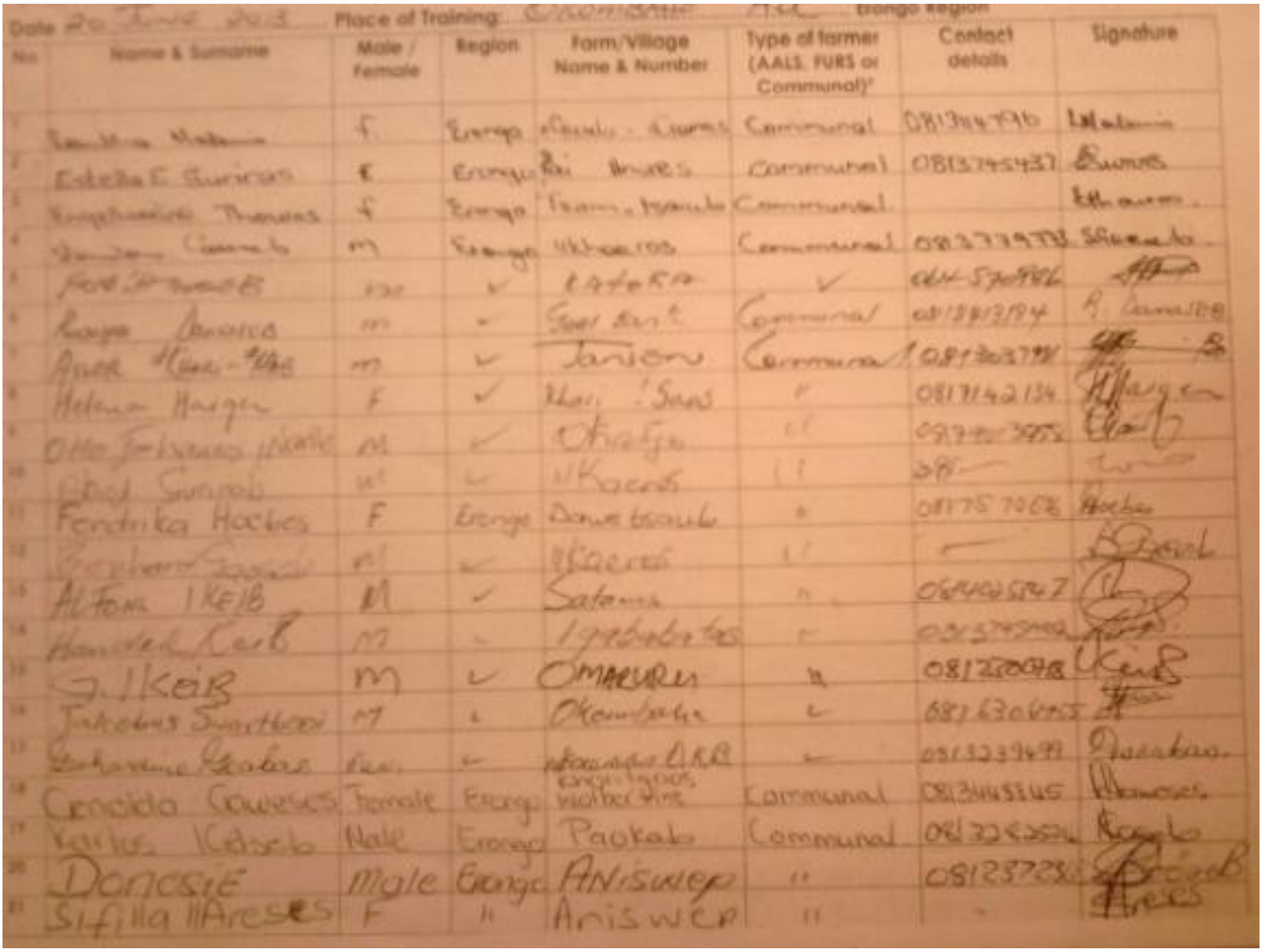
APPENDIX B3

COMMUNITY MEMBERS INTERESTED IN THE PROJECT

Participant Registry - 17 April 2015

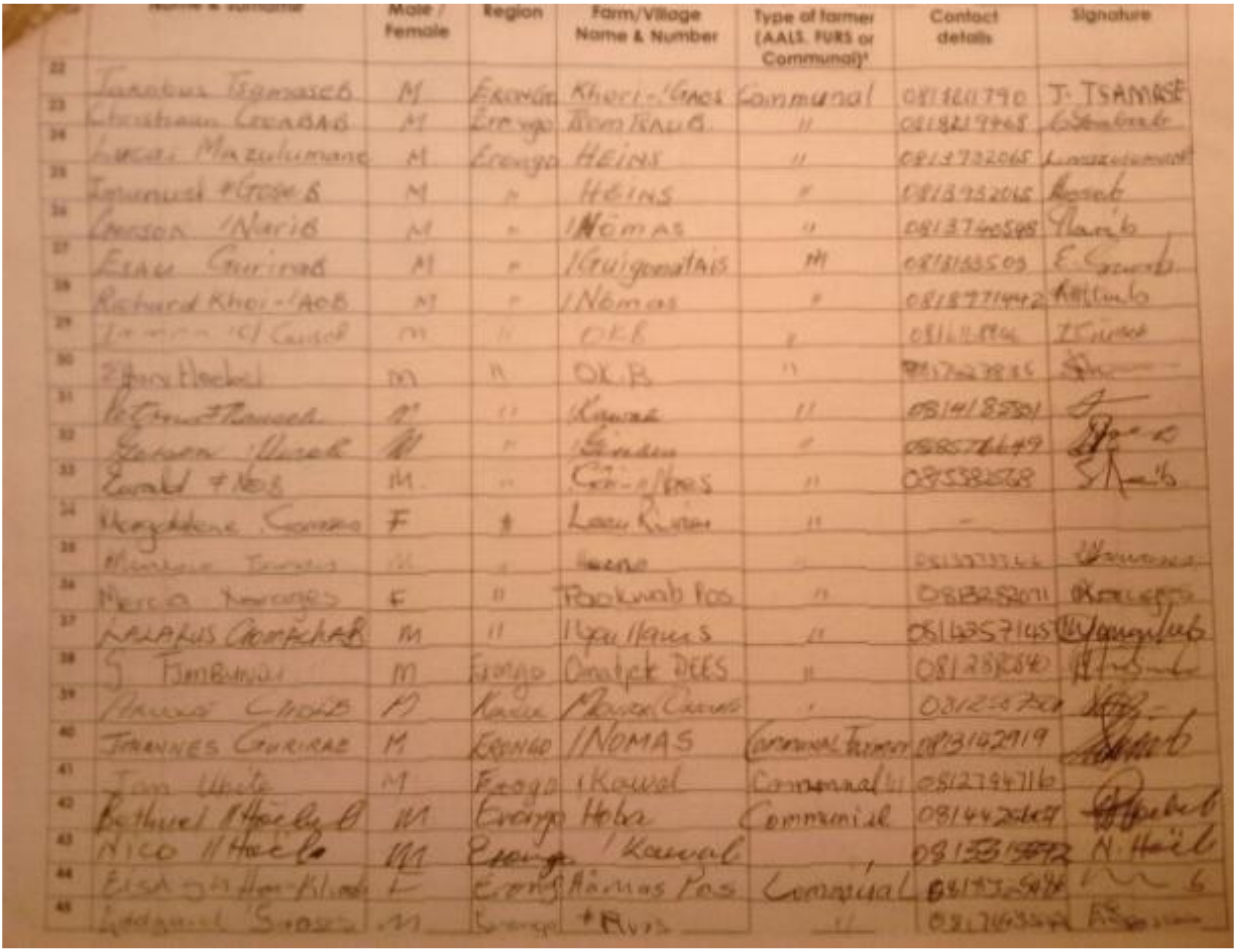
Luise Kooitjie	0816506014	Christle Kooitjie	0818878502
Christina Anamas	0812424432	Julene Animas	0815665741
Anna Bees		Chantel Melani	0817406337
Belinda Beukes	0813053892	Priscilla Bam	0818702749
Irene Gowases		Ingrid /Goagoses	
Elfriede Beukes	0813985785	Waehoudia Goramus	0812032068
Elly Cloete	0812112440	Ingrid Afrikaner	0816197231
Martha /khurisas	0814884301	Judy Afrikaner	0816465375
Jusnelda Skeyer	0817999813	Dennis Kasper	0813928158
Priscilla Vries	0812229772	Edward Swartbooi	0812352250
Petrina Swartbooi	0813486789	Delene Engelbrecht	0813298490
Kelly Engelbrecht	0814511007	Hendrik /Khurisab	0818444214
Delene Engelbrecht	0813298490	Meweline Engelbrecht	0813298501
Dennis Kasper	0813928158	Antonia Otta	0813532354
Bernadine Engelbrecht	0814007494	Albertus Kooitjie	0817888911
Ednicia Engelbrecht	0816488933	Kelly Engelbrecht	0814511007
Meweline Engelbrecht	0813298501	Sonia Goramus	0812032068
Antonia Otta	0813532354	Erold B Anamab	0813275981
Francina Cloete	0812391063	Malton Gonteb	0817379912
Lena Kasper	0817405726	Veronica Haoses	0815602312

APPENDIX B4



Date 20 June 2013 Place of Training: [illegible] Erongo Region

No	Name & Surname	Male / Female	Region	Farm/Village Name & Number	Type of farmer (AALS, FURS or Communal)*	Contact details	Signature
1	[illegible]	f	Erongo	[illegible]	Communal	0813944796	[illegible]
2	Estella E Surirses	f	Erongo	[illegible]	Communal	0813745437	[illegible]
3	[illegible] Thomas	f	Erongo	[illegible]	Communal		[illegible]
4	[illegible]	m	Erongo	[illegible]	Communal	[illegible]	[illegible]
5	[illegible]	m	✓	[illegible]	✓	[illegible]	[illegible]
6	[illegible]	m	✓	[illegible]	Communal	[illegible]	R. [illegible]
7	[illegible]	m	✓	Janson	Communal	[illegible]	[illegible]
8	Helena Haigen	F	✓	[illegible] !Saas	″	0817142134	[illegible]
9	Otto [illegible]	M	✓	Okatjo	″	[illegible]	[illegible]
10	[illegible]	M	✓	//Kaeros	″	[illegible]	[illegible]
11	Fendrika Hoebes	F	Erongo	[illegible]	″	[illegible]	[illegible]
12	[illegible]	M	✓	//Kaeros	″	—	[illegible]
13	Alfons IKEIB	M	✓	Sateme	″	[illegible]	[illegible]
14	[illegible]	M	″	[illegible]	″	[illegible]	[illegible]
15	G. IKEIB	M	✓	OMARURU	″	[illegible]	[illegible]
16	Jakobus [illegible]	M	″	Okombahe	″	[illegible]	[illegible]
17	[illegible]	F	″	[illegible]	—	[illegible]	[illegible]
18	Cenelda Gowases	Female	Erongo	[illegible]	Communal	[illegible]	[illegible]
19	[illegible]	Male	Erongo	Paukab	Communal	[illegible]	[illegible]
20	Donasie	Male	Erongo	ANISWEP	″	[illegible]	[illegible]
21	Sifilla //Areses	F	″	Aniswep	″	—	[illegible]



	Name & surname	Male / Female	Region	Farm/Village Name & Number	Type of farmer (AALS, FURS or Communal)*	Contact details	Signature
22	Jakobus Tsamaseb	M	Erongo	Khori-!Gaos	Communal	0811821790	J. TSAMASE
23	Christiaan Coraseb	M	Erongo	Tom Raub	"	0818219468	[illegible]
24	Lucas Mazulumane	M	Erongo	HEINS	"	0813732065	L Mazulumane
25	Immanuel ǂGoseb	M	"	HEINS	"	0813932015	[illegible]
26	Carson !Narib	M	"	!Nomas	"	0813740598	!Narib
27	Esau Gurirab	M	"	!Guigamatais	"	0818188509	E. Gurirab
28	Richard Khoi-!Aob	M	"	!Nomas	"	0818771442	[illegible]
29	[illegible]	M	"	OKB	"	[illegible]	[illegible]
30	Efraim Hoebeb	M	"	OKB	"	[illegible]	[illegible]
31	[illegible]	M	"	!Kawab	"	0814185581	[illegible]
32	Gerson [illegible]	M	"	[illegible]	"	[illegible]	[illegible]
33	Ewald ǂNeb	M	"	[illegible]	"	0855382568	[illegible]
34	Magdalene [illegible]	F	"	[illegible]	"	-	
35	[illegible]	M	"	[illegible]	"	[illegible]	[illegible]
36	Mercia [illegible]	F	"	Paokuab Pos	"	0818252071	[illegible]
37	Lazarus [illegible]	M	"	[illegible]	"	0816357145	[illegible]
38	S Tjimbundu	M	Erongo	Omatjek DEES	"	[illegible]	[illegible]
39	[illegible]	M	[illegible]	[illegible]	"	[illegible]	[illegible]
40	JOHANNES GURIRAB	M	ERONGO	!NOMAS	Communal Farmer	0813142919	[illegible]
41	Tom [illegible]	M	Erongo	!Kawab	Communal	0812794716	[illegible]
42	Bethuel [illegible]	M	Erongo	Hoba	Communal	[illegible]	[illegible]
43	Nico //Hoeb	M	Erongo	!Kawab	"	[illegible]	N. Hoeb
44	Elsa [illegible]	F	Erongo	!Nomas Pos	Communal	[illegible]	[illegible]
45	[illegible]	M	Erongo	ǂRuis	"	[illegible]	[illegible]

GOBABEB
RESEARCH & TRAINING CENTRE

Attendance – 11 May 2015, NBRI

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APPENDIX B6

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16–18 June 2015

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APPENDIX C1

STIER VENTE ASSOCIATES
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TO WHOM IT MAY CONCERN

AUDITORS' CERTIFICATE OF GOOD STANDING

We confirm that we are the duly appointed and authorized auditors of the Gobabeb Trust, Gobabeb Research and Training Centre.

We have been the appointed auditors since the first reporting period of the Trust which was 31 December 2000. We further confirm that we provided an unqualified audit report on the financial statements for the last 3 years (29 February 2012, 28 February 2013 and 28 February 2014).

We are in the process of finalizing the annual financial statements of the Trust for the year ended 28 February 2015 and do not foresee a qualified audit opinion at this stage.

Should you have any queries, please do not hesitate to contact the undersigned.

Yours faithfully

J LOURENS
PARTNER

WINDHOEK
11 June 2015

APPENDIX D1

TERMS OF REFERENCE

PROGRAMME COORDINATOR

1. Background

The Programme Coordinator (PC) is part-time position. The incumbent will be selected through an open, competitive process. S/he will be responsible for the overall coordination of the programme. The position will be based at Gobabeb Research and Training Centre. The PC will report to the Executive Director of Gobabeb (the Executing Entity) regarding all substantive and administrative issues pertaining to the programme. From a strategic point of view, the PC will report on a periodic basis (biannually) to the Stakeholder Forum (SF), which functions as a steering committee. The PC will furthermore maintain regular communication with the NIE. The PC will work closely with the financial support officer and all other administrative and technical staff at Gobabeb, as well as the Facilitators of the various programme components. The terms and conditions as stipulated in the Gobabeb Conditions of Service manual apply to this position.

2. Duties and Responsibilities

- Ensure the timely and effective implementation of all components of the programme;
- Supervise and coordinate the programme outputs, as per the programme document;
- Mobilise all programme inputs, in collaboration with the Financial Support, in accordance with AF procedures;
- Supervise and coordinate the work of all Facilitators, partners, consultants, students and interns;
- Prepare and revise annual programme work and financial plans, as required by the SF and/or NIE;
- Liaise with all stakeholders, both current and emerging, for effective coordination of all programme activities;
- Manage the recruitment and support processes for student beneficiaries;
- Oversee and ensure timely submission of the Inception report, Quarterly reports

(including financial reports and forecasting), Annual progress reports, Terminal report, and other reports as may be required by the SF, EE or NIE;

- Disseminate such reports, and other documentation relevant to the programme, and respond to queries from concerned stakeholders and beneficiaries;
- Report progress of programme to the SF, and ensure the uptake of SF advice;
- Provide secretariat services to the SF;
- Ensure that the programme adheres to the requirements of the AF, through regular consultation with the NIE; and
- Develop and maintain electronic and paper records of activities.

3. Qualifications

- A university degree (Masters degree preferred) in Agriculture, Natural Resource Management, or Environmental Sciences;
- At least three years' experience working within the relevant discipline;
- At least three years' of project/programme management experience;
- Working experience with Offices/Ministries/Agencies, national institutions and/or NGOs would be an advantage;
- Ability to effectively coordinate a large, multi-stakeholder initiative;
- Ability to administer budgets and develop workplans;
- Strong drafting and reporting skills;
- Strong computer skills, in particular, mastery of all applications of the MS Office package and internet search;
- Strong knowledge about Namibia's political and socio-economic context, in particular at local level; and
- Excellent writing/communication skills in English.

APPENDIX D2

TERMS OF REFERENCE

FACILITATOR

1. Background

The Facilitator is engaged on a part-time basis to provide specific services, and will be selected based on a high level of relevant expertise and skills, and a respected professional reputation within specific, required academic discipline, e.g. socio-economics; rangeland management, or meteorology. The Facilitator will be responsible for the regional co-ordination of a specific programme component, including the implementation of all activities in the target areas. In particular, the Facilitator will provide training, technical oversight, results analysis and guide programme implementation as required by the relevant component. The Facilitator will report to the PC and PMU for all coordination and implementation; while the SF will support this position as regards technical oversight and advice. S/he will perform a liaison role between the PMU and the local communities and governance structures, but particularly serving as a conduit for information flow to the beneficiaries, as well as maintaining close collaboration with other relevant partners and stakeholders operating within the target areas.

2. Duties and Responsibilities

- Supervise and coordinate the implementation of programme component activities in the target areas;
- Support and coordinate the work of FFGs and target local communities/beneficiaries;
- Assist with developing and carrying out training content and modules for enumerators, participating farmers and other field personnel;
- Assist with and advise on the analyses of results, in particular formats appropriate for academically rigorous reporting to inform peers as well as informative and understandable communications to schools and communities;
- Liaise with other facilitators, partners, stakeholders, community representatives, and regional and traditional authorities for effective coordination of all activities;
- Oversee and ensure timely implementation of programme component activities and prepare reports detailing progress and forecasting to be submitted to the PC on a quarterly basis;

- Report general programme progress to the PMU and SF, as well as to the beneficiaries in the target area;
- Serve on the SF, which shall meet on a biannual basis;
- Oversee the exchange and sharing of experiences and lessons learned with relevant community-based integrated agricultural and development projects at all levels and within all appropriate fora; and
- Participate in recruitment of students; assist with research project design and implementation, including the dissemination of results through peer-reviewed research papers.

3. Qualifications

- A post-graduate degree (preferably a PhD degree) in a specialist discipline as identified by the programme, e.g. Rangeland science; Anthropology; Meteorology;
- At least five years' working experience within the desired discipline;
- At least five years' project/programme management experience;
- Strong interpersonal skills and ability to mobilise participation at local level;
- Strong drafting and reporting skills; and
- Ability to lead tertiary level students to undertake research projects, and transfer knowledge/skills effectively.

APPENDIX D3

[DRAFT]

TERMS OF REFERENCE

STAKEHOLDERS FORUM

1. Background

A programme entitled "*Strengthening traditional approaches for coping with climate variability for small-scale farmers*", funded by the Adaptation Fund, is a multisectoral initiative to investigate, evaluate and advocate for best-practice solutions to assist small-scale farmers in Namibia in coping with climate variability and global change. The target areas for implementation will be selected sites in the Kavango East and Erongo regions.

Gobabeb Research and Training Centre is the Executing Entity, while the Legal Assistance Centre is a sub-Executing Entity for Component 1 of the programme. As the initiative will cut across several geographical areas; climatic zones; demographics; agricultural livelihoods; technical disciplines; and will involve a diverse range of partners and stakeholders, it is deemed appropriate to establish a structure that can serve the programme in an advisory capacity, and provide governance support to oversee its overall implementation. This body, the **Stakeholder Forum (SF)**, would also provide a mechanism to share information between active programme partners, and collectively promote the programme amongst a broader current and emerging stakeholder group.

2. Objective of the Stakeholder Forum

The objective of the SF is to provide advice and support to the implementation of the AF programme.

3. Purpose and tasks of the Stakeholder Forum

The main purpose of the SF is to give advice to the PMU in terms of protocol, strategy, operations and scientific approach within the framework of existing and possible future programme activities. Advice will be given in the spirit of co-operation to support the PC in the execution of his/her duties.

The specific tasks of the SF are to:

i. provide interactive, technical guidance, regarding *inter alia* the implementation of the various activities under the programme components, based on relevant information provided to the SF by the PC;
ii. monitor and evaluate programme performance, and give inputs into the development of annual workplans and budgets;
iii. define training modalities, select student grant recipients and monitor academic progress and output;

iv. participate in review processes, as may be required;
v. carry out specific and agreed tasks and report back to the SF, as may be required from time-to-time;
vi. promote the programme and its activities, and advocate for complementarity and relevant technical partnerships with other initiatives.

4. Authority

The SF will assume an advisory and supportive role rather than a decision-making role on matters concerning the operations of the programme.

The SF shall operate in accordance with the terms of reference agreed upon at inception of the programme.

The SF may constitute subcommittees to undertake clearly defined tasks, as may be required, e.g. selection of student beneficiaries.

5. Meetings

The SF should meet at least on a biannual basis, according to a predetermined schedule. The EE, through the PMU, may request *ad hoc* meetings as necessary.

The selection of meeting times and venues are at the discretion of the SF, but consideration of the locations of SF members and their respective work schedules will be considered.

A quorum for meetings is a minimum of three members (excluding representation from the EE, sub-EE, PMU and facilitators). Inputs from members may be solicited and provided through electronic media channels and are considered valid for decision-making.

A notice of each meeting confirming the date, time, venue and agenda shall be forwarded to SF members at least one week in advance.

The SF meetings will be chaired by the Executive Director of the Executing Entity, or his/her designate. The PMU will act as Secretariat.

6. Membership

Membership will include representatives from the Executing Entity, the sub-Executing Entity, the National Implementing Entity; the PMU; Facilitators; and key partner organisations; i.e. MAWF; NBRI; NMS; MET; NCRST; SASSCAL; FSP.

The composition of this body will be determined based on competencies and equitable representation.

Experts, as identified by the PMU, may be co-opted to attend meetings from time-to-time.

The term of membership is the duration of the programme.

APPENDIX E
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