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SAREP Technical Series – Volume I a

Cubango-Okavango River Basin Climate Change Vulnerability Assessment

December 2013
This publication was produced for review by the United States Agency for International Development.
It was prepared by Chemonics International Inc and the Climate System Analysis Group, University of Cape Town.

SAREP TECHNICAL SERIES – VOLUME IA

CUBANGO-OKAVANGO RIVER BASIN CLIMATE CHANGE VULNERABILITY ASSESSMENT

A PARTICIPATORY ASSESSMENT OF VULNERABILITY OF LIVELIHOOD STRATEGIES AND CAPACITY FOR ADAPTATION TO CLIMATE CHANGE

Contract No. 674-C-00-10-00030-00

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OKACOM

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CONTENTS

ACRONYMS

CBNRM	Community-Based Natural Resources Management
CBO	Community-Based Organization
CORB	Cubango-Okavango River Basin
DWNP	Department of Wildlife and National Parks (Botswana)
EIA	Environmental Impact Assessment
EPSMO	Environmental Protection and Sustainable Management of the Okavango River Basin Project
GIS	Geographic Information System
GRN	Government of the Republic of Namibia
HWC	Human Wildlife Conflict
IDF	Institute for Forest Development (Angola)
IRBM	Okavango Integrated River Basin Management Project
IUCN	International Union for Conservation of Nature
MAT	Ministério da Administração do Território – Ministry of Territorial Administration
MINAMB	Ministry of Environment (Angola)
MINIT	Ministério do Interior – Ministry of Interior
NAP	National Action Plan
NAPA	National Adaptation Plan of Action
NBSAP	National Biodiversity Strategy and Action Plan (Angola)
NDVI	Normalized Differential Vegetation Index
OKACOM	Permanent Okavango River Basin Water Commission
PA	Protected Area
PET	Potential Evapotranspiration
PLUS	Participatory Land Use Strategy
REDD	Reducing Emissions from Deforestation and Forest Degradation
SADC	Southern Africa Development Community
SAP	Strategic Action Plan
SAREP	Southern Africa Regional Environmental Program
SEA	Strategic Environmental Assessment
TDA	Trans-boundary Diagnostic Analysis
USAID	United States Agency for International Development
USFS	United States Forestry Service
WMA	Wildlife Management Area
WSS	Water Supply and Sanitation

EXECUTIVE SUMMARY

This climate change vulnerability assessment report was compiled based primarily on outcomes of a two-day workshop held in Windhoek (Namibia) July 23-24, 2013. The workshop was funded by USAID, and organized by USAID's Southern Africa Regional Environmental Program (SAREP). Workshop participants - practitioners, policymakers, government representatives, and scientists knowledgeable about relevant aspects of the Okavango Basin - explored key challenges of the Basin, identified specific areas vulnerable to climate change, and discussed vulnerabilities of different livelihoods. Finally, participants assessed existing and needed capacity on local, national, and regional levels in the custodian Basin countries of Angola, Namibia, and Botswana.

Timely responses and integrated management of the Okavango River Basin will support sustainable development, buffer existing vulnerabilities of the system, and enhance sustainable livelihoods in all custodial countries of this complex, unique ecosystem. Research shows a consistent signal for future temperature increases, and the Okavango River Basin is likely to experience change, one way or another. While there are somewhat different findings in terms of rainfall and discharge, a shift in the hydro-ecological units, in terms of location and area, will follow in any case.

The direction of change in biophysical impacts remains uncertain and dependent on the direction of change of rainfall and river discharge. Participants were provided with a hydro-climatic overview of the Basin, including historical trends and future projections, as the foundation on which vulnerability of the various components in the Basin were assessed. The climate change projections - the exposure component of vulnerability to climate change - signalled increasing temperatures, yet sent a more complicated message regarding rainfall and river discharge. While rainfall changes might be spatially different, there was a slight indication toward overall drier conditions in the Basin, despite possible increases in rainfall in some areas. This implies that while the conditions in the Okavango River Basin might be drier in the future, there could still be an increase in rainfall and flooding in some areas. Additionally, this may indicate that overall conditions in the Basin could be wetter in the future.

All livelihood strategies assessed (tourism, commercial farming, communal farming, natural resource harvesting), with the exception of mining, were found to be sensitive to the possible socioeconomic impacts of climate change under various scenarios. The identified socioeconomic impacts showed communal farming as the livelihood with the greatest sensitivity to climate change, reflecting the close linkage of communal farming and biophysical elements. While the direction of change and the magnitude of biophysical impacts are difficult to project, the socioeconomic impacts identified were more generic, with possible socioeconomic impacts reflecting the sensitivities of specific livelihood strategies in the Basin. Mining was seen as having the necessary financial means to buffer possible impacts, while the tourism sector is likely to face mostly secondary consequences (eg. loss of habitat, increased poaching) that impact operational costs and the degree to which the sector can attract tourists. But socioeconomic impacts identified reflected how climate change has the potential to push communal farmers across a threshold to very insecure and stressed livelihood conditions.

The adaptive capacity assessment done during the workshop showed some capacity within Basin countries at the national and regional levels. Some relevant Basin policies are in place; however, implementation is sometimes not effective. Capacity at the community level was linked to a variety of factors, including knowledge, diversification, and local support structures. At the local government level, components highlighted included the presence of institutions and existence of local plans, policies, and structures, coupled with well-organized frameworks for disaster response. At the national government level, there was also focus on the existence of frameworks, policies, and programs, with somewhat different aspects being emphasized across the three countries.

While a coordinated Basin-wide response is important, support for further capacity development on the national and local levels is critical to help countries prepare for and respond to more unpredictable weather patterns that may affect natural and socioeconomic systems. A systematic process of sharing lessons learned within the Basin would support an active learning process, strengthening the capacity development process in all three countries. Existing networks should be integrated in such a Basin-wide learning process to integrate existing scientific and local knowledge.

Under three scenarios - reduced rainfall, more extreme weather events, and increased temperatures – coordinated anticipation of, and planning for, change will be crucial in the years to come. The assessment established that coordinated management of the Okavango Basin should be a key priority to ensure a sound and functioning ecosystem that supports sustainable livelihoods and is resilient to climate variability and change. While the system has a considerable degree of resilience, the increased pressures and challenges for the ecosystem, such as expanded development, mining, irrigation schemes, and veterinary fencing, require a coordinated approach. With resilience maintained over time, Okavango River Basin countries will be in a better position to cope with and absorb some level of climate variability and change. In the absence of a legally binding agreement to ensure that development is sustainable within the Basin, it remains a concern that unsustainable development will weaken the existing system. Any response can draw on the extensive capacity existing in all three countries, and should take possible benefit-sharing agreements into consideration.

Given the range of potential changes to which the system is susceptible, the overall recommendation to the SAREP program was to undertake “no regrets” programming to build resilience to climate change in the basin. No regrets programing represents a suite of activities which can be helpful in a variety of potential scenarios and are in and of themselves beneficial activities even in the absence of change to the system.

INTRODUCTION AND BACKGROUND

The USAID-funded Southern Africa Regional Environmental Program (SAREP) is a technical support and capacity building program designed in response to the expressed need to sustainably manage the Cubango-Okavango River Basin resources. The southern African countries in which the Basin is situated - Angola, Namibia and Botswana - experience frequent floods and debilitating droughts, further exacerbated by people living in extreme poverty with limited access to adequate water and sanitation services.

SAREP works closely with these three countries, the Southern Africa Development Community (SADC) and the Permanent Okavango River Basin Water Commission (OKACOM) to implement strategies that integrate biodiversity protection, increase access to water supply and sanitation, focus on global climate change, and improve HIV/AIDS prevention and treatment. For communities surrounding the Okavango River, the program improves access to clean water and reduces contamination, opening the door to better farming techniques and new employment opportunities while ensuring better environmental management.

SAREP has convened the climate change vulnerability assessment workshop discussed below, and solicited this report with the following objectives:

- To support climate change adaptation options in the wider Basin,
- To understand the levels of capacity to adapt, and
- To explore areas of urgent action and capacity development needs at the community, local, and national levels.

Background

This climate change vulnerability assessment report was compiled by Climate Systems Analysis Group (CSAG) and Indigo Development & Change based on outcomes of a two-day workshop held in Windhoek (Namibia) July 23-24, 2013. The workshop was funded by USAID, organized by SAREP, and facilitated by Indigo. Workshop participants included practitioners, policymakers, government representatives, and scientists knowledgeable about relevant aspects of the Okavango Basin. Participants explored key challenges of the Basin, identified specific areas vulnerable to climate change, and discussed vulnerabilities of different livelihoods. In a last step, an assessment was done to compile existing and needed capacity on local, national, and regional levels.

While great care was taken in the development of this report, it is important to point out that it is a compilation of workshop results. Hopefully these insights can inform some of the climate change adaptation discussions in the Okavango Basin. The report does not aim to be a complete vulnerability assessment of the Okavango Basin – it captures, rather, professional judgements of the participants and reflects their perceptions and priorities. We would like to thank the workshop participants for sharing their knowledge and insights in the course of the

workshop and the SAREP team for convening the workshop and for providing excellent logistical support.

Brief Literature Review: Climate Change Impacts in the Okavango River Basin

Climate change is recognized as one of the major drivers and threats to ecological and social wellbeing in the Okavango River Basin. The Okavango River Basin, in which an increasing population is highly dependent on the Basin's natural resources, is located in Southern Africa, a region that is already prone to great climate variability. According to the Transboundary Diagnostic Analysis (OKACOM, 2010), with a lack of climate change awareness among communities and the absence of adequate adaptation strategies, climate change poses a threat to the main livelihood options in the Basin such as agriculture, fishing, and livestock as well as the economic wellbeing of each of the riparian countries, Angola, Namibia, and Botswana.

An earlier study by Wolski (2009), used in the Biodiversity Threat Assessment of the Cubango-Okavango River Basin (Chemonics International, 2012), included climate models that project an increase in temperatures and, though with some spatially differential rainfall changes, there are indications of an overall decrease in the wetness of the Okavango River Basin system due to increases in evapotranspiration. The threat assessment further argues that a drier and hotter scenario will potentially affect maize production and livestock through decreased water and grazing supplies (Chemonics International, 2012). Although flooding in the river Basin is a natural and necessary ecological event, increase in rainfall in parts of the Basin could cause more frequent and severe floods, which will damage infrastructure, affect livelihoods, and endanger lives. With climate change impacting the hydrological system of the river Basin, a domino effect can be expected to affect a range of critical environmental and political factors. Reduction in hydrological flow will threaten biodiversity and increase the concentration of pollutants in the system, whereas an increase in hydrological flow can affect the livelihoods of downstream communities (Wolski, 2009).

Although the literature indicates a wide knowledge base on expected climate change impacts, there is still an emphasized need to address and examine specific future climate change impacts and scenarios (OKACOM, 2010). It is imperative that attention be focused on the vulnerability of the basin system, so as to advise on adaptation implementation plans at national, regional, and local levels.

Various programs and projects are underway to support and implement different strategies and plans to support adaptation and/or mitigation to climate change. The Permanent Okavango River Basin Water Commission (OKACOM) was formed by the three riparian countries in order to collectively plan and manage the Basin. The commission works to support implementation of strategies at national, regional, and local levels to increase climate change resilience across the Basin through the development and implementation of a decision-support system to improve resource management, close knowledge gaps, and provide an integrated platform for overall decision making (Chemonics International, 2012; OKACOM, 2011). SAREP is working at the community level in areas such as flood preparedness plans and conservation agricultural practices, and, together with OKACOM, to evaluate the vulnerability of the ecology and economy in terms of climate change (Chemonics International, 2012; OKACOM, 2011).

Although there are various ideas and strategies for Basin-wide management already in place, there is a lack of coordinated transboundary planning and implementation. The governments of the three riparian countries are struggling to manage the Basin effectively across all countries (Chemonics International, 2012). Accordingly, uncoordinated governance and management processes pose a threat to the biodiversity of the Basin (Chemonics International, 2012).

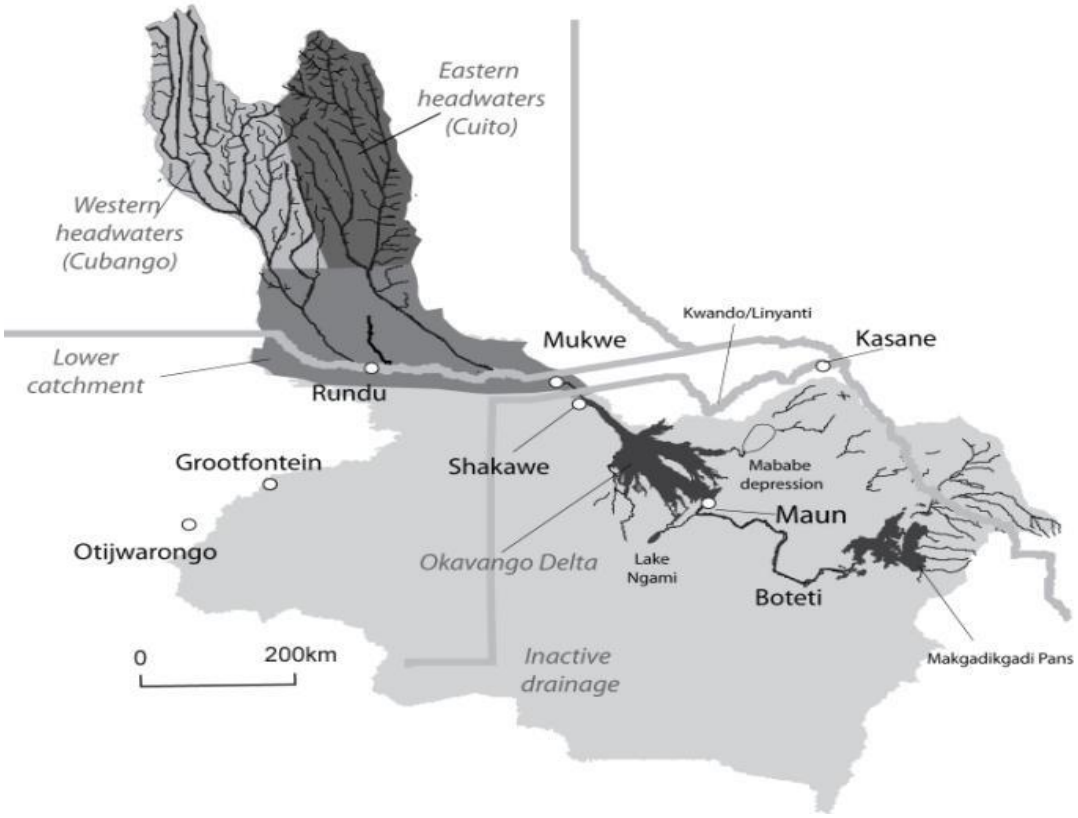

Figure 1: The Okavango Basin and its principal features.

Climate Change Projections for the Okavango River Basin

The report "Anthropogenic climate change and hydro-climatic conditions in the Okavango River Basin," prepared by Piotr Wolski (2013) provided the hydro-climatic information on which the work and discussions at the vulnerability assessment workshop were based. Below is a brief summary of the key messages from the report, and thus the information that framed the work and discussions during the workshop.

According to the report, historical data show inconclusive evidence for an overall, long-term trend in climate or river flows in the Okavango River Basin. Yet there is strong evidence of multi-decadal scale variability in rainfall, air temperatures, and river discharges manifested by the differences in means of 30-year, non-overlapping periods. In terms of rainfall and river discharges, there is a form of oscillatory pattern with high and low (or wet and dry) phases, and some similarity between rainfall and river discharge patterns. Between 2000 and 2009 the system entered a wet phase, and it is likely, but not certain, that this phase will continue in the next decades. Yet, a significant, long-term negative trend has been recorded in the total annual discharges of the Cuito and in the minimum monthly discharges of the Okavango at

Mohembo, which might be caused by the influence of increasing temperatures on evaporation in the catchment. Temperature trends are somewhat spatially inconsistent. However, some station data, such as that from the Maun station, indicate increases in temperatures as a long-term trend (>50 years), as expected from anthropogenic climate change.

In terms of climate change projections, temperatures are showing a consistent increasing trend across models and approaches. The picture for rainfall and river discharge is more inconsistent, with divergence between models and approaches, and more complex due to the feedback between temperature, evaporation, and river discharge. The increasing temperature trend will result in increased evaporation and thus decreased river discharge, which can only be offset if there is a sufficient increase in rainfall in the future. Importantly though, the report found that there are indications that multi-decadal-scale fluctuations are likely in the future, and that their magnitude will probably be similar to that observed in the past.

Depending on the models and the approaches, there are indications of both considerably wetter and considerably drier future conditions. Studies using raw global climate model (GCM) data have shown an increase and a decrease in discharge, the latter in relation to a trend toward overall drier future conditions, driven by change in temperature. Considerably wetter conditions in the Okavango Basin were obtained only in the study where GCM data was statistically downscaled. This result is underpinned by an increase in rainfall in the catchment that more than compensates for the increase in evaporation related to the increase in temperature.

Despite uncertainties surrounding the directions of change, in terms of wetter or drier conditions in the Basin the report can nevertheless provide some important messages in terms of possible impacts. Firstly, impacts on and transformation of hydro-ecological conditions resulting from anthropogenic climate change will be manifested throughout the Okavango Delta, not just in its periphery. This is because the Delta is characterized by a gradient of hydrological conditions (duration and frequency of inundation) extending from the inlet at Mohembo toward the periphery. This gradient underlies ecological functioning of the wetland, and any change of inflows or rainfall and temperatures over the entire wetland will have an impact along the entire gradient.

The impacts will manifest in terms of change of location and area of land of various hydro-ecological units, and thus result in a shift of wetland classes toward the Delta periphery under wetter scenarios, and their retreat toward the Delta core under drier scenarios, with an opposite effect observed for dry-land classes. The range of uncertainty in the magnitude of these impacts (as obtained from a number of GCM projections) is similar in magnitude to the transformation observed between the peak and troughs of the (natural) multi-decadal oscillations in the system. The magnitude of multi-decadal oscillations is not projected to change in the future, but will be most likely be superimposed on the overall drying trend. This drying trend is attributed to increasing temperature and thus increasing evaporation, the effect of which is very significant in the Okavango Delta. This latter point can be interpreted as follows: There will be sequences of wet years and sequences of dry years in the future, similar to those observed in the past. However, progressively, the wet years will be less likely to be as wet as those in the past, and dry years will more likely be drier than those observed in the past.

The consequences of the influence of increasing temperatures on the hydrological processes in the Okavango Delta will be strongly manifested in the conditions in the Delta terminal

rivers, the Boteti and the Kunyere. The analyses project a possible reduction in duration of flow into these rivers, even under the wet, downscaling-derived scenarios. However, put in the context of geomorphological processes taking place in the Okavango Delta, climate change-induced effects can be exacerbated or moderated by shifts in distribution of flows in between the distributaries. Obviously, should such a new shift emerge, a gain of flows in one terminal river will be accompanied by a reduction in flow in another.

Given the consistent signal for future temperature increases, the Okavango River Basin is likely to expect change, one way or another. While there are somewhat different findings in terms of rainfall and discharge, a shift in the hydro-ecological units, in terms of location and area, will follow in either case.

IDENTIFYING THREATS AND VULNERABILITIES IN THE OKAVANGO RIVER BASIN

An important starting point for the vulnerability assessment was the rich picturing process, which worked to provide an overall view of the Okavango River Basin, with its challenges, inter-linkages, and complexities. In the rich picturing process, participants were provided with a large, blank piece of paper and a number of tools such as pens, pencils, and clay, and were asked to create a picture of the Basin and its current vulnerabilities based on their individual experiences.

The Basin stretches across three country boundaries: from its headwaters in Angola; to the lower catchment areas that extend into Namibia; to the inactive drainage areas that engulf areas in Namibia and Botswana; and to the mouth of the Okavango River, the Okavango Delta in Botswana; and the Boteti River that flows southeastward from there. The activities that take place along these multi-functional parts and across the three countries, all play a role in shaping the state of the system. These activities are shaped by national policies and regional and international agreements. The model developed through the rich picturing process, shown in Photo 1, identified the following key areas of concern in the Basin:

- Human-wildlife conflict
- Risk of flooding
- Wild fires
- Livestock fencing restricting movement
- Illegal fencing
- Irrigation agriculture schemes
- Timber concessions
- Poaching of wildlife
- Tourism
- Water use
- Over fishing
- Changes in vegetation
- Declining wildlife
- Livelihoods of small scale farmers

Photo 1: Modeling of vulnerabilities in the Okavango Basin

In the discussions of the rich picture that emerged of the Basin, it became apparent that a range of issues are of concern in the Okavango Basin. It was agreed that one major challenge is the coordination of policies and practices across the Basin. This is especially important for regulating the flow and use of water in the Basin.

The source of the Okavango River is in Angola, in areas with rainfall of over 1,000 millimeters per year, making region a significant source of water for the Basin. Following 30 years of civil war in Angola the country is now developing rapidly, with increases in activities taking place in and around the Okavango headwaters and lower catchment areas. While these are currently areas with low population densities, that is expected to change due to increased population growth, and expansion of small-scale farming activities and large scale development. For example, the new Angolan development plan involves mining developments, which are due to start next year. A specific concern raised with regard to the

developments taking place in Angola relates to the lack of environmental impact assessments (EIAs), and short-term projects that fail to take long-term perspectives into account, especially work conducted by foreign contractors.

While there are a number of policies in place in Angola and large national parks have been declared, law enforcement is a challenge. For the two largest national parks in Angola, for example, all the necessary rules and procedures are in place, but these are not being enforced. There was mention of logging in national park areas, from which large quantities of timber are allegedly transported to South Africa each year. These timber concessions have recently been extended for another five years.

Deforestation was also highlighted to be a challenge on the Namibian side of the boarder in relation to fires. The extent to which these fires are managed or are wild fires was unclear. While there is some emphasis on Community Based Natural Resource Management (CBNRM) in Namibia, the development of so called "green schemes" (modern agricultural irrigation developments) were seen as a concern. The concern relates to water extraction from the Okavango River Basin and to the nutrients from high-intensity agriculture contaminating the river system.

Significant tourism-related activity takes place in the downstream section of the Okavango River Basin in Botswana. There are also a relatively large number of settlements, mostly on the outskirts of the Okavango Delta, with some also situated in the Delta. A growing concern here is the number of farming, prospecting, and mining concessions awarded in the area. An important step toward coordination of the Basin among the three countries was initiated by the signing of a basin-wide treaty. The treaty centers around the regulation of a shared water resource, the Okavango River Basin, but the workshop participants highlighted that the treaty is not legally binding. A coordinated approach to water management within the Basin was considered to be crucial, but is currently not implemented.

The need for more extensive, cross-sector cooperation among the three countries emerged through discussion of key issues facing the Basin. These issues, discussed below, impact all three countries, although to varying degrees.

Development of large scale, mechanized irrigation schemes ("green schemes"). Green schemes aim to implement mechanized agricultural irrigation. Often the water requirements go beyond recommended sustainable off-take. Furthermore, fertilizers used in these large-scale, mechanized agricultural activities may contaminate rivers and have the potential to change the nutrient levels in the ground water. When these higher nutrient levels start to interact with the natural systems, natural functions will be impacted. Government distribution of alien seedlings is also a concern, as it brings alien plants into the Basin system.

Human-wildlife conflict (HWC). This is a significant issue in all three countries. People living in the Basin are not significantly benefitting from wildlife resources, and often perceive wildlife as a threat to their livelihoods. This causes discontent among people living in the Basin, and reduces the local incentive to protect wildlife. Accordingly, poaching is a problem throughout the Basin.

Veterinary fences limiting connectivity. To control the spread of livestock diseases and in response to European Union beef import regulations, so-called veterinary fences have been set up mainly across Botswana but partly also in Namibia. The placement of fences was not

well planned, and they have largely been done on ecological contours where there would naturally be significant animal movement. The fences prevent the natural migration of wildlife, particularly in relation to animals' need to move according to seasons and water availability. Animal movement is considered key during droughts, both for livestock and game. With the fences, however, natural adaptive wildlife systems are limited, and the constriction of movements has a secondary effect on the ecosystems. For example, woodlands in some areas are not being browsed, and, due to the increased fuel load, cause larger fires.

Expansion of human settlements destroying natural habitats and connectivity. Human settlement expansion and infrastructure development, population increases, and expansion of planned and unplanned settlements are putting pressure on natural habitats, and further eroding the connectivity of different areas within the Basin.

Vulnerable communities. The communities in the Okavango River Basin largely depend on natural resource extraction, and are thus very vulnerable to ecological changes. Furthermore, land-use plans that largely focus on agricultural mechanization, not small-scale farming and CBNRM, are expected to further marginalize already vulnerable communities in the Basin. There is already a trajectory of change, with veld products, timber, and fish being lost, and communities being left with charcoal as their key source of income. As economic activity develops and road infrastructure expands in the Basin, HIV and AIDS rates rise, subsequently increasing the stress experienced by communities.

VULNERABILITIES OF KEY LIVELIHOODS

Participants conducted a qualitative assessment of sectoral vulnerabilities, focusing on the potential biophysical and socioeconomic impacts of different climate scenarios, for key livelihoods in the Basin. Based on their experience and areas of expertise, workshop participants broke into five groups: tourism, commercial farming, communal farming, natural resource harvesting, and mining. Each group was asked to look at sectoral impacts in terms of specific climate futures, choosing the climate scenarios that they considered the most important based on the findings of Piotr Wolski's study (2013).

Tourism Sector

The group analyzed the tourism sector in relation to four possible climate change scenarios.

Table 1: Climate change impacts identified for the tourism sector

System	Climate change scenario	Biophysical impact	Socioeconomic impact
Tourism sector	Hotter	• Increase in fires • Increase in pests • More disease vectors • Species dying/moving	• Operational costs leading to economic loss/reduced income • More health issues (malaria) • Increase in HWC • Higher energy/ water demand
Tourism sector	More extremes (floods/ droughts)	• Alterations/ loss of habitat • Wildlife disruption •	• Infrastructure damage • Increased operational costs • Increased poaching
Tourism sector	Drier	• Decrease in wetland habitat • More seasonal wildlife migration • Higher wildlife concentrations	• Less favorable farming leading to more poaching and HWC (bad for tourism) • Reduced tourism opportunities and services (negative GDP)
Tourism sector	Wetter	• More permanent flood plains • Changes to habitat • Wildlife disruption • Disease vectors and pest loads	• Increase in HWC • Activities less diversified

For each of the four climate change scenarios key biophysical impacts identified include habitat loss/change and wildlife disruptions (loss and migration). Warmer and/or wetter conditions would also mean an increase in pests and disease vectors and fires. While some changing climatic conditions will have direct socioeconomic impacts, such as increases in temperatures requiring increased air-conditioning and water usage and thus higher operational costs, most are secondary impacts triggered by the biophysical impacts. This includes health issues, where an increase in disease vectors such as malaria will impact both staff and tourists. It also includes the increase in HWC resulting from habitat changes. For example, more permanent floodplains would force wildlife toward the periphery of the Delta and concentrate them onto dry islands within the system, forcing them to move closer to human settlements and tourism establishments. Changing climatic conditions and increases in HWC may also make farming activities less viable, leading to increased poaching. The resulting loss of wildlife, as well as the negative connotations for marketing, will in turn make it harder to attract tourists.

With either of the potential climate change scenarios, the tourism sector is therefore likely to face some direct and secondary consequences. These consequences will impact operational costs and the degree to which the sector can attract tourists.

Commercial Farming Sector

The group looking at the commercial farming sector analyzed irrigation farming in relation to a temperature increase of 3 degrees Celsius, and livestock farming in relation to an overall reduction in rainfall.

Table 2: Climate change impacts identified for the commercial farming sector

System	Climate change scenario	Biophysical impact	Socioeconomic impact
Irrigation farming	+3 degrees C	• Increase in potential evapotranspiration (PET) • Change in crop varieties • Change in crops • Increase in pests/disease • Shift in growing season • Change in crop rotations • Decrease in soil fertility and structure • Increase in salinity • Change in invasive species • Decrease in groundwater level	• Decrease in yield • Increase in input prices • Increase in product prices • Change in labor dynamics • Decreased (stressed) livelihood conditions • Increase in imports • Increase in inflation • Increase in support for irrigation farming
Livestock farming	Reduced rainfall	• Decrease in forage production • Increased runoff due to changing vegetation • Increase in invasive species • Increased likelihood of over grazing • Change in herd/species composition	• Increase in feedlots • Decreasing livestock prices • Increasing inputs required • Financing difficulties • Increased requirements for relief budgets • Fluctuations in exports

For irrigation farming, it was found that an increase in temperatures could impact the biophysical frame conditions that shape the type of crops that are farmed and the farming strategies that are used. For example, higher degrees of decomposition due to increasing temperatures could lead to decreased fertility of the soil and, together with potential changes in soil salinity and structure; farmers might need to re-think their farming activities. Further threats caused by increases in pests, disease, and alien invasive species would put pressure on crops and threaten yields. Increases in PET could lead to increased irrigation demand, and as a consequence lower groundwater levels. This would in turn require a shift to crops with greater heat tolerance and lower water requirements, or potentially threaten the overall viability of farming activities. The changing temperatures, water availability, and crop types may further require changes in the growing season and crop rotation practices. In terms of the socioeconomic impacts, changes in labor dynamics due to increasing heat stress could increase operational input costs, while a decrease in overall yields may lead to a decrease in local food production and a subsequent increase in a country's imports. With irrigation farming potentially being seen in political circles as more stable than rain-fed farming in a warmer future, governments may desire to put further support into irrigation.

For livestock farming, it was found that reduced rainfall could lead to increased run-off due to changing vegetation, reduced forage production, increases in invasive species, greater

likelihood of overgrazing, and a subsequent need to change the type of animals farmed. In turn, this could lead to socioeconomic impacts such as lower livestock prices teamed with higher input costs, making livestock farming less viable, and making it more difficult to attract financing. Reduced rainfall might also lead to a more mechanized farming approach, and thus an increase in feedlots. The challenges might also require an increase in government support and could lead to fluctuations in beef exports.

Changing climatic conditions such as increasing temperatures and reduced rainfall are thus expected to have direct impacts on the viability of various commercial farming activities, and may require commercial farmers to re-think their current practices.

Communal Farming Sector

The group analyzing the communal farming sector considered three climate change scenarios: less rain, more frequent droughts, and increasing temperatures. Additionally, they explored two hydrological scenarios: more frequent floods and a decrease in overall water flow.

Table 3: Climate change impacts identified for the communal farming sector

System	Climate change scenario	Biophysical impact	Socioeconomic impact
Communal farming	Less rain	• Decrease in soil moisture • Change in herd/species composition • Different weeds • Decrease in woody species • Increase in grasses • Changes in fire dynamics (group not sure how)? • Increase in grazers • Decrease in fish stocks (partly due to impact of increased fishing) • Increase in HWC	• Conditions no longer good for growing rice • Increase in sorghum production • Decrease in maize production • Decrease in general production • Increase in poverty • Decrease in economic diversity • Increased government aid and reliance on aid • Decrease in cultivation (due to risk avoidance in relation to, for example, HWC increase) • Increased fishing
Communal farming	More frequent droughts	• Decrease in soil moisture • Change in species composition • Different weeds • Decrease in woody species • Increase in grasses • Changes in fire dynamics (group not sure how)? • Increase in grazers • Decrease in fish (partly due to impact of increased fishing) • Increase in HWC • Livestock and wildlife die-off • Pest outbreaks	• Conditions no longer good for growing rice • Increase in sorghum production • Decrease in maize production • Decrease in general production • Increase in poverty • Decrease in economic diversity • Increased government aid and reliance on aid • Decrease in cultivation (due to risk avoidance in relation to, for example, HWC increase) • Increased fishing • Famine • Increase in urban migration • Increase in crime, unemployment, and HIV/AIDS
Communal farming	Increasing temperatures	• Increase in PET • Change in species composition • Increase in fires • Decrease in water	• Decrease in crop production • Decrease in food security • Decrease in people's motivation • Decrease in livestock numbers

		availability	
Communal farming	More frequent floods	• Increase in floodplain area • Increase in wetland area • Tree die-offs • Increase in soil fertility • Decrease in grassland areas • Increase in fish stocks • Increase in soil moisture	• Increase in Molapo agriculture [1] • Increase in livestock • Decrease in veterinary fences • Decrease in livestock markets • Shocks – access decreases and increases and loss of infrastructure
Communal farming	Decrease in overall water flows	• Increase in wetland loss • Decrease in water availability • Increase in grasslands in the short term, then succeeded by woody savannah • Decrease in fish • Decrease in soil fertilities • Decrease in flood plains • Decrease in wildlife • Increase in HWC	• Decrease in Molapo agriculture • Decrease in livestock (except perhaps goats) • Decrease in natural resources • Decrease in economic diversity • Increase in land use conflict • Increase in HWC

A number of negative impacts were identified for each of the climate change scenarios. For biophysical impacts, many aspects related to changes in species composition, for example, overall decreases in fish, wildlife, livestock, and woody species, and increases in grasses and numbers of grazers. Yet this would vary somewhat with the different scenarios with, for example, increased fish stocks being projected for the more frequent flooding scenario. In terms of fires, the group was not certain about how the less rain scenario or the more frequent drought scenario would impact fire dynamics, but they predicted that increasing temperatures would lead to an increase in fires. Soil moisture was also predicted to change, yet the direction of change depended on the scenario: with increased soil moisture under a more frequent flooding scenario and a decrease under a less rain scenario. The group thus highlighted how the direction of change for the various biophysical impacts could differ depending on whether the future becomes wetter or drier.

In terms of socioeconomic impacts, those highlighted are largely around decreased livestock numbers, specific crops or overall crop yields, with secondary effects such as decreased food security, increased poverty and famine, and increased reliance on government aid. The group further predicted aspects such as increased urban migration, HWC, crime, unemployment, and HIV/AIDS rates. This thus highlights that for communal farming, climate change, both in terms of wetter and drier scenarios, has the potential to push communities into very undesirable conditions.

Natural Resource Harvesting

The group analyzing natural resource harvesting considered a number of key natural resources, and then looked at three scenarios: increased temperatures, drought, and variations in hydrological flows.

1 Floodplain agriculture

Table 4: Climate change impacts identified for the natural resource harvesting sector

System	Climate change scenario	Biophysical impacts	Socioeconomic impacts
Natural resource harvesting, with focus on wild game, fish, Devil's Claw, reeds, thatching grass, timber, Murulu/Mongongo/South plum, fire wood/charcoal	Increase in temperature	• Decrease in soil moisture • Increase in PET • Increase in soil salinity • Increase in seasonal shift •	• Increased production of Devil's Claw • Decline in grass and fruit off-take • Decline in reeds • Decline in grass quality and sales • Decline in wetland habitat = decrease in fish • Decrease in forest recruitment[2] • Decrease in local GDP • Decreased (stressed) livelihood conditions • Decrease in employment
	Drought	• Increase in occurrence of soil erosion • Increase in seasonal shift • Decrease in germination rates • Decrease in insect pollination • Decrease in soil run-off • Increase in fire rates • Changes to the habitat	• Decrease and increase in production of Devil's Claw • Decreased thatching grass production • Decreased fruit, nut production • Decrease in forest regeneration • Decline in wildlife numbers • Increase in wildlife movement • Increase in disease transmission • Increase in HWC
	Increase and decrease in hydro-flow	• Loss of habitat • Shifts in habitats	• Decrease in reed production – which will lead to decline in ecosystem services such as water purification • Decrease in fish stocks • Decrease in wildlife numbers

Biophysical impacts that were identified in relation to natural resource harvesting were largely centered on changes in soil qualities, seasonal shifts, and habitat shifts. In relation to the drought scenario, concerns around decreased insect pollination and germination rates, and increasing fire rates were also raised. In terms of socioeconomic impacts, the group largely focused on the impact on the production and availability of various natural resources. The impacts were largely found to be negative, with the exception of Devil's Claw (Harpagophytum procumbens). These impacts were further linked to decreases in employment, GDP, and general livelihood conditions, thus indicating how a changing climate and the impacts on natural resources may lead to the degradation of people's livelihoods.

Mining Sector

An analysis of the mining sector was included as the workshop participants identified the sector as one of the important livelihood activities in the Basin. Yet as the group focusing on the mining sector started looking at the impacts of different climate change scenarios they came to the conclusion that mining is resilient and able to deal with an adverse amount of impacts due to its large profit margin. They therefore decided to focus on the impacts caused by mining activities.

[2] Refers to the process of adding new individuals to a population or subpopulation.

Table 5: Possible mining sector impacts on the Okavango River Basin

System	Climate change Scenario	Biophysical	Socioeconomic
Mining		• Ecosystem fragmentation • Loss of biodiversity (increase of pests and invasive species) • Pollution (air, surface water, groundwater, noise, dust, light) • Increase in water usage • Increased pressure on natural resources • Increased waste generations (spoil heaps, etc.)	• Increase in jobs (improved livelihoods) • Infrastructure development (Road/rail/bridge/schools, etc.) (+/-) • Corruption (wars/conflict) • Increase in HIV/AIDS, sexually transmitted diseases • Increase in traffic (+/-) • Increase in poaching • Increased crime (behavioral change) • Increased migration (+/-) • Involuntary resettlement • Tourism (+/-) • Corporate social responsibility • Economic up-lift (+) • Increased energy demands • Mining takes precedence over all other land uses

The group found that mining has only negative biophysical impacts. In terms of the socioeconomic aspects, a number of the impacts were seen as both negative and positive (indicated by +/- in above table). These include infrastructure development and increased traffic in the Basin, which on the one hand could improve livelihood conditions and attract more economic activity. Yet on the other hand, it could introduce more negative secondary impacts, such as rising HIV/AIDS rates and increased crime and poaching as more people would be moving through Basin areas. Positive and negative impacts on tourism were also identified. While more people working in the Basin, both local and international, could attract more tourists, in terms of the families of those involved in different aspects of mining, the industry's presence means that a pristine tourism area is transformed into a mining area with pollution and waste. Other negative socioeconomic effects identified included increased energy demands, corruption, involuntary resettlements, and mining taking precedence over all other land uses. Corporate social responsibility was highlighted as a factor that tends to be used as a negotiation factor in arguing for the positive impacts of industrial development. But it was noted that corporate responsibility is often forgotten after the mining concession has been granted.

While the focus on the mining sector became decoupled from climate change impacts, the sector has a healthy profit margin and thus the resources to deal with impacts, and it is important to view the impacts of mining on the Basin with a climate change lens. If mining contributes to degraded ecosystems in the river Basin, and has a number of negative socioeconomic impacts as suggested above, mining may cause ecosystems, people, and livelihoods to be less resilient in response or adaptation to projected changes in the climate.

Discussion of Overall Impacts

As outlined above, changes in key climate variables, including temperature and rainfall, are likely to have a range of impacts on ecosystems and social and economic spheres in the Okavango River Basin. The direction of change of the biophysical impacts and the extent of impact is somewhat difficult to predict, partly due to the uncertainty relating to the

magnitude, and sometimes direction, of change for each climate variable. But it is clear that the livelihoods of the Basin are, to different degrees, sensitive to climatic change. Based on the group activities of workshop participants, the communal farming sector seems to be the most sensitive to climatic change. This can be linked to the fact that for communal farmers, livelihood options are limited and are directly linked to changes in ecosystems. The socioeconomic impacts identified, including decreased economic diversity, increased government aid, and increased poverty, reflect how the workshop participants see communal farmers as being very sensitive to impacts, with the potential to be pushed across a threshold to very insecure, stressed livelihood conditions.

For commercial farming activities, a number of impacts were also identified. Yet the socioeconomic impacts identified were not as severe, and generally more economic rather than threatening to livelihoods. This thus reflects the perception that commercial farmers are, while still vulnerable to impacts, less sensitive to change.

For natural resource harvesting, the focus was largely on changes in natural resource availability, mainly in terms of a decline. While the group did not expand on the magnitude of impacts on livelihoods, beyond highlighting possible decreases in employment and decreases in or stresses on livelihood conditions, the strong emphasis on the negative impacts on natural resources indicates that the sector is very sensitive to climatic change.

The analysis of the tourism sector also reflected sensitivity to climatic change, mainly in relation to increasing operational costs and the ability to attract tourists. It further highlighted how tourism is interlinked with other livelihood activities in the Basin. Thus the tourism sector can be seen as highly complex, in that it is sensitive to a number of primary and secondary impacts.

COMMUNITY, LOCAL, AND NATIONAL LEVEL ADAPTIVE CAPACITY

To provide an overview of existing adaptive capacity for the three countries, workshop participants divided into country groups and worked to identify country-specific adaptive capacity. The groups looked at existing and needed adaptive capacity, focusing at three levels: community, local government, and national government. The groups were asked to look at adaptive capacity in relation to specific climate scenarios, highlighting the most important aspects using red dots (depicted as ✹ in the tables below).
The following section provides detailed overviews of country-specific capacities and an overall analysis of adaptive capacity across the three countries.

Angola

Table 5: Existing adaptive capacity and adaptive capacity needs for Angola with a general focus rather than on specific climate scenario

	Existing Adaptive Capacity	**Adaptive Capacity Needs**
Community Level	• Local knowledge (agriculture) • Local leaders have knowledge, decision making capacity, and influence • Information is available but limited	• Training and capacity development ✹✹ • Increased knowledge and information ✹ • Increased financial resources and projects
Local Government Level	• Limited knowledge and information • Institutions but with limited capacity and human resources • Improving governance and leadership structures • Provincial development plans	• Improved institutional capacity (planning, policy development and implementation, governance, partnerships) ✹✹✹✹✹ • Training and capacity development ✹✹✹ • Adaptive technology ✹ • Increased human and financial resources • Increased knowledge and information generation and dissemination
National Level	• The Ministry of Environment (MINAMB) (research institutions and projects, the NAPA and climate change strategy, the climate change unit and the NAPs) • Ministry of Energy/ Water, Basin Plans for Cubango, NAPs and Strategic Action Program (SAP) and TDA (OKACOM) • The National Institute of Meteorology and Geophysics (INAMET) (weather stations, modeling and early warning systems) • MAT (local governance empowerment) • MINIT (strategy on extreme events, civil protection authority, early warning) • Political will and decision making • Increased knowledge on Okavango and climate change	• Integrate climate change into all government programs ✹✹✹ • (Focus on results ✹✹✹✹✹) • Improve cross-sector coordination ✹✹✹ • Turn policies into actions (implementation) ✹✹✹ • Stimulate innovation • Improved fund allocation to policies/ strategies/ projects

Community Level

Considering existing adaptive capacity, the Angola group found local knowledge on adaptive practices to deal with seasonal events and drought at the community level. It was further highlighted that knowledge from local leaders is important as this is passed on from generation to generation, making it important to bring traditional leaders on board, especially in the context of adaptation projects. General information was seen as available but limited. Accordingly, increased knowledge and information was identified as one of the adaptive capacity needs, together with increased financial resources and projects, though training and capacity development was identified as the key adaptive capacity need at community level. Importantly, the group noted that they would have been better informed had they been able to consult communities, and that they were feeling a bit uncomfortable compiling the information above without adequate community representation and consultation.

Local Government Level

Moving up to the local government level, information was also seen as existing but very limited. For example, it was said that while many research reports have been written, these are mainly in English and/or are just not available. The governor, for example, might be in possession of a copy of a report, without sharing it with local government officials. Hence there are barriers to access and use of existing information. It was also noted that governance and leadership structures are in place, and that there are relevant institutions, but that these have limited capacity and human resources. The provincial development plans were also highlighted as aspects of the existing adaptive capacity, as there are at least plans that the provinces are working from. It was mentioned that while some of these provincial development plans are good, they do not include clear guidelines on adaptive capacity. The key adaptive capacity need identified was the need to improve overall institutional capacity, in relation to planning, policy development, and implementation. Creation of good partnerships and collaboration between institutions, rather than organizations competing for funding or power, was also seen as critical. The second most important adaptive capacity need identified was general training and capacity development, followed by adaptive technology. The need to increase knowledge and information generation and dissemination was also identified, as well as the need to increase human and financial resources.

National Government Level

At the national government level, the group highlighted various key ministries and institutions, including the Ministry of Environment (MINAMB), the Ministry of Energy and Water, the National Institute of Meteorology and Geophysics (INAMET), MAT and MINIT, and their involvement in the development of a number of policies, strategies, and projects, and research and information gathering and sharing. The group also identified the presence of political will, including from local governments and ministries, and the fact that the Minister of Environment has decision making power. Knowledge on the Okavango and on climate change, and awareness of climate change and processes on the national level were further seen as important for existing adaptive capacities at the national level.

The integration of climate change into all government programs and a focus on seeing results in these programs were identified as the most important adaptive capacity needs, thus highlighting a need for mainstreaming beyond the ministries mentioned above. The group also mentioned the gap between central and provincial government plans, and the need to integrate climate change issues at the local planning level. As noted above, Angola has a

number of policies in place, though an important adaptive capacity need relates to implementation ability. Improving coordination across different sectors was another important adaptive capacity need, followed by better fund allocation to policies, strategies, and projects, and the need to stimulate innovation.

Namibia

Table 6: Existing adaptive capacity and adaptive capacity needs for Namibia focused on a drier climate scenario

	Existing Adaptive Capacity	Adaptive Capacity Needs
Community Level (Food security No. 1 priority)	• There are drought resistant crops (sorghum, millet, may be useful for Angola to change from maize to mahargh), but yields are low. ✹✹ • Most households have a variety of animals – goats, cattle etc. • People have different income streams (remittances, others). • There are capable people at community level willing to work. Increase their responsibilities, represents untapped potential. • Land tenure is improving through land registration.	• Youth have lost knowledge (on cropping and indigenous traditional knowledge), due to HIV or rural > town migration. ✹✹✹ • Conservation agriculture✹ • Drier conditions will lead to less grazing available to livestock, putting more pressure on grasslands.✹ (What happens if people need to give up cropping altogether – lead to more livestock?) • Need more cooperative management of river/ fish (fish sanctuary). ✹
Local Government Level	• MET and other ministries have established innovative model policy for CBNRM (wildlife as livelihood option). • OKACOM in place, NAP finalized.	• Need to improve conservancy governance - especially financial governance (need more skills) and creative ways of benefiting from wildlife – game farming.✹✹✹✹✹✹ • Higher dependency on groundwater (need more groundwater monitoring) – will require deeper boreholes. ✹ • Concerns: Green schemes, salination of soils, low quality produce, losing seed varieties. • It will cost more financially and environmentally to maintain green schemes. • Need to implement NAP.
National Level	• The Government of the Republic of Namibia (GRN) is creating incentives for communal farmers to de-stock. • GRN responsible for policies and programs to buffer communities. • Enforces regulations to reduce abstraction of water from rivers.	• Need to carry out economic cost/ benefit analyses to honestly assess viability of green schemes. ✹✹ • Improve grazing management.✹ • Need to declare more forest resources.✹ • Need more data on why trees are disappearing.

Community Level

The Namibia group found that an important component of existing adaptive capacity of community households is linked to diversification: different income streams, including remittances, and having a variety of livestock, such as goats and cattle. The use of drought resistant crops, such as sorghum and millet, was also highlighted as an important component, together with people at the community level being capable and willing to work. In this latter point the group further highlighted that there is untapped potential among people at the community level, reflecting how adaptive capacity goes beyond finances and physical capital, and that attitude and human capital are also important.

In terms of adaptive capacity needs, the key point that was highlighted by the group related to the loss of local knowledge, and how, due to HIV/AIDS and migration to the cities, youth have lost traditional knowledge relating to plants, cropping, and other activities. With knowledge around traditional practices being lost, and the influence of modern, mechanized farming practices, the group emphasized the need to focus on developing capacities to practice conservation agriculture. The group also foresees that in a drier future there will be more pressure on grasslands as grazing availability goes down. They questioned whether drier conditions mean that communities will need to give up cropping altogether and, as a consequence, will need to depend on growing livestock numbers. This thus highlights how people, as they potentially lose their ability to depend on a variety of income streams, will need to develop capacities for dealing with shifting livelihoods and the new pressures that arise from this situation. Lastly, the group identified the need to develop capacity for more cooperative management of rivers to ensure sustainable and fair sharing of river resources.

Local Government Level

The presence of OKACOM and the finalization of the National Adaptation Plan (NAP) were seen as important aspects for adaptive capacity at the local government level. The group also emphasized how the Ministry of Environment and Tourism (MET) has established an innovative model policy for CBNRNM, supporting wildlife as a livelihood option. The green schemes, governmental irrigation projects aimed at developing the Namibian agriculture sector while creating profit for historically disadvantaged people, were highlighted as part of current adaptive capacity. Yet there was also concern in relation to these schemes, due to possible negative impacts on soils and seed varieties. Accordingly, it was highlighted that the cost-benefits of the green schemes are low, financially and environmentally.

The key adaptive capacity need identified by the group was the need to improve conservancy and community governance through skills development, with special focus on financial management, to improve wildlife benefits. To support adaptation to drought, the need for deeper boreholes and, related to that, more groundwater monitoring was identified. Lastly, the group identified the need to develop the capacity to implement the NAP at the local government level.

National Government Level

In terms of adaptive capacity at the national government level the group highlighted national incentives for de-stocking and policies and programs aimed at buffering communities, as well as regulations related to the abstraction of water from rivers. Participants also mentioned that institutions are not necessarily at capacity to enforce regulations and that there needs to be more focus on understanding and managing forests. The group also highlighted needs for improved grazing management and for an honest assessment of the green schemes.

A Wetter Future Scenario

The Namibia group also had a brief look at a wetter future scenario. In relation to this possible future, the group highlighted that there would be limited opportunities for communities, who will lose land due to flooding and will thus require exploration of alternative livelihoods. The potential increase in rice farming was also emphasized.

Botswana

Table 7: Existing adaptive capacity and adaptive capacity needs for Botswana focused on a more frequent flood climate scenario

	Existing Adaptive Capacities	Adaptive Capacity Needs
Community Level	• People are used to periodic floods, people are used to seasonal shifts – e.g. periodic floods and shifts in farms, fishing areas. • CBNRM and Participatory Land Use Strategy (PLUS) Activities • The presence of trusts/ CBOs	• Need to increase diversification of livelihoods – tourism, crops, etc. ✹✹✹✹✹ • Need to decrease poverty.✹✹✹✹ • Need to increase mobility and markets for livestock.✹✹✹ • Need official recognition of Malapo user rights with government assistance etc. and regulation.✹
Local Government Level	• There is a well-organized flood response. • Land use plans exist.	• Need to increase planning links to resolution enforcement.✹ • Need to increase capacity of technological support. • Need to increase capacity to deal with invasive pests and invasive species.
National Level	• There is a well-organized flood response. • There is an adaptable tourism development policy.	• Policy for HWC/corridors needs to be integrated across sectors (and must be sustainable). ✹✹✹✹ • Need to decrease livestock subsidies.✹✹ • Need to deal with disease transmission.✹✹

Community Level – Frequent Flood Scenario

The Botswana group highlighted that involvement in CBNRM and PLUS activities is important for the current adaptive capacity at the community level, thus reflecting emphasis on the importance of creating sustainable local livelihoods. The capacity to deal with current climate variability, in terms of periodic flooding, was also mentioned, thus highlighting the importance of local traditional knowledge. Community initiatives and financial mechanisms, in terms of trusts and community based organizations (CBOs), were also identified as key components of existing adaptive capacity.

Increased diversification of livelihoods, through tourism, crops, and so on was identified as the most important adaptive capacity need. For example, the group mentioned how fishing as a livelihood strategy is less resilient in periods of increased climate variability, and that in considering the possibility of less frequent flooding in the future new possible livelihoods should be explored. The second most important aspect highlighted was the need to decrease poverty, reflecting how poor communities, while they might hold important local traditional knowledge, lack the financial resources they might require to adapt effectively. Some adaptive capacity needs identified at the community level are linked to government regulations, highlighting the role of enabling frameworks for grassroots-level adaptive capacity. This situation relates to the identified need for official recognition of users' rights and regulations to ensure sustainable and fair management of those rights. Further, it also relates to the need for increased mobility and markets for livestock, per the current restrictions caused by livestock fences and EU export regulations noted above.

Local Government Level – Frequent Flood Scenario

At the local government level a well-organized flood response and the existence of land use plans were identified as existing adaptive capacity aspects. Yet the group emphasized that local governments lack the capacity to implement land use plans, and that further capacity in terms of technical skills are required in that regard. It was also noted that there needs to be an increased link between the enforcement of regulations and planning.

National Government Level – Frequent Flood Scenario

At the national level the group also highlighted flood response as an important existing adaptive capacity, together with the existence of an adaptable tourism development policy. In terms of adaptive capacity needs at the national level, the group identified the need for a sustainability-focused, cross-sectoral policy for HWC and wildlife corridors. The group further thought that the livestock sector needs attention because current livestock subsidies are problematic and create conflicting incentives. Additionally, there is a need to look at how to better deal with disease transmission.

Table 8: Existing adaptive capacity and adaptive capacity needs for Botswana focused on a drought climate scenario

	Existing Adaptive Capacities	Adaptive Capacity Needs
Community Level	• People are used to periodic floods. • People are used to seasonal shifts.	• Need to diversify livelihoods.✹✹✹✹✹ • Need rain water harvesting/ storage.✹✹✹✹ • Should move toward less reliance on drought relief.✹✹ • Need to increase access to better beef markets. • Need better management of stocking rates.✹✹ • Need to improve agriculture based CBNRM support.✹ • Need better mobility for cattle.
Local Government	• Well organized drought relief. • Artificial water points for wildlife.	• Need a change in dual grazing policy (national) - (conservation agriculture).✹✹ • Need to improve rangeland management. • Need to implement land use plans. • Need to improve pest and invasive species control.
National Level	• 17 % of land is protected area, hence good ecosystem connectivity. • There is a Strategic Environmental Assessment (SEA) for the Delta.	• Need to implement the SEA.✹✹✹✹ • Need to support community tourism development. ✹✹✹✹ • Need to reverse ban on hunting.✹✹✹ • Need to improve fire management.✹✹✹ • Need to improve support for CBNRM.✹ • Need to improve agricultural – arable policy – research and development in drought resistant plants. • Need to implement elephant management strategy. • Need to support use of natural indigenous products.

Community Level – Drought Scenario

As in Angola and Namibia, Botswana communities' ability to deal with current climate variability, this time with regards to seasonal shifts, was highlighted as a component of existing adaptive capacity. Under a more frequent flooding scenario, diversified livelihoods was identified as the key adaptive capacity need. This was followed by the need for water harvesting and storage to deal with drier future conditions and the need to decrease reliance on drought relief. The group also identified that drier future conditions might make grazing more scarce, thus requiring management of stocking rates and more mobility for cattle. Yet in opening mobility for cattle, access to better beef markets might also be required, as the EU markets have strong restrictions in relation to cattle mobility. Lastly, the group identified the need for improved support for agriculture-based CBNRM, thus the reflecting a parallel need to develop local, sustainable livelihoods.

Local Government Level – Drought Scenario

At the local government level the group highlighted that there is some adaptive capacity for dealing with drought, both in terms of a well-organized drought relief program and artificial water points for wildlife. In terms of adaptive capacity needs, the group emphasized changes in national dual grazing policy to enable local governments to implement more conservation-based regulations that make grazing more sustainable. Improved pest and invasive species control and improved rangeland management were additional points that highlighted the need for improved frameworks for local government implementation. Lastly, the identified need for land use plan implementation reflects how, even when frameworks are in place, there is not always enough capacity to implement.

National Government Level – Drought Scenario

From a national perspective, the group found that there are some good regulations in place, more specifically the relatively large percentage of declared protected areas that ensure good ecosystem connectivity. A Strategic Environmental Assessment (SEA) has been conducted for the delta part of the Basin. Yet it was also highlighted that the SEA and the elephant management strategy still need to be implemented. Other important adaptive capacity needs identified include supporting community tourism development, reconsidering hunting regulations - either by removing the current ban to allow economic activities or to actually implement the ban - and improving support for CBNRM. The needs identified thus reflect emphasis on the need for national government to create enabling conditions for local level livelihoods. The need for improved fire management was also noted, reflecting the need to develop capacity to deal with increased fire frequency under a drier future scenario.

ANALYSIS OF ADAPTIVE CAPACITY ACROSS THE THREE COUNTRIES

Taking a collective look at adaptive capacity across the Basin, as outlined in the table below, a variety of local knowledge, diversified income streams, willingness to work and the presence and capacity of local leaders, CBOs and trusts, are key components of existing capacity in the Basin at the community level. Capacity at the community level was linked to a variety of factors, including knowledge, diversification, and local support structures. Moving one level up, to the local government level, components highlighted included the presence of institutions and existence of local plans, policies, and structures, coupled with well-organized responses to disasters, thus demonstrating that some of the necessary frameworks are in place to respond and implement.

For the national government level, there was also focus on the existence of frameworks, policies, and programs, yet with somewhat different aspects being emphasized across the three countries. In Angola, a number of ministries and associated institutions, plans, and policies were highlighted, together with the existence of political will. In Namibia, national incentives for creating sustainable livelihoods and buffering at the community level and enforcement of water abstraction regulations were highlighted. Lastly, in Botswana, the presence of good disaster response and protected areas were key components.

Table 9: Existing adaptive capacity across the three countries

	Existing Adaptive Capacity Across the Three Countries		
	Angola	**Namibia**	**Botswana**
Community level	• Local knowledge (agriculture) • Local leaders have knowledge and decision making capacity and influence • Information is available but limited	• There are drought resistant crops (sorghum, millet, and may be useful for Angola to change from maize to mahargh), but yields are low. ✹✹ • People have different income streams (such as remittances) • Most households have a variety of animals – goats, cattle, etc. • There are capable people at community level willing to work - Increase their responsibilities, to use this untapped potential • Land tenure is improving through land registration	• People are used to periodic floods, people are used to seasonal shifts – e.g. periodic floods and shifts in farms, fishing areas • CBNRM and PLUS activities • The presence of trusts/ CBO's
Local Government level	• Limited knowledge and information • Institutions, but with limited capacity and human resources	• MET and other ministries have established innovative model policy for CBNRM (wildlife as livelihood option)	• There is a well - organized flood response • There is a well - organized drought

	• Improving governance and leadership structures • Provincial development plans	• OKACOM in place, NAP finalized	relief • Land use plans exist • There are artificial water points for wildlife
National Government level	• The Ministry of Environment (MINAMB) (research institutions and projects, the NAPA and climate change strategy, the climate change unit and the NAPs) • Ministry of Energy/ Water, Basin Plans for Cubango, NAPs and Strategic Action Program (SAP) and TDA (OKACOM) • The National Institute of Meteorology and Geophysics (INAMET) (weather stations, modeling and early warning systems) • MAT (local governance empowerment) • MINIT (strategy on extreme events, civil protection authority, early warning) • Political will and decision making • Increased knowledge on Okavango and climate change	• GRN creating incentives for communal farmers to de-stock. • National GRN responsible for establishing policies and programs to buffer communities. • Enforce regulations to reduce abstraction of water from rivers.	• There is a well-organized flood response • There is an adaptable tourism development policy • 17 % of land is Protected Area, hence good ecosystem connectivity • There is a strategic Environmental Assessment (SEA) for the Delta

In terms of adaptive capacity needs at the community level, general capacity development, more specific capacity needs such as capacity to diversify livelihoods, better management of stocking rates, expansion of cooperative management, and the need to practice conservation agriculture were identified. This reflects the need to provide more training, knowledge, and information to people at the community level. Some aspects highlighted also related to enabling factors. These include financial resources for projects and targeted sectors, such as CBNRM, and the need for new/changed regulations, for example those to improve the mobility of livestock.

At the local government level, the key needs identified were linked to institutional capacity. Governance capacity, both human and financial, technological capacity, and the capacity to implement are all interlinked aspects that relate to overall capacity of local government institutions.

At the national level, capacity to coordinate and change/improve/integrate policy was emphasized, thus highlighting the cross-sectoral nature of climate change and the Basin, and the need for policies to be developed accordingly. The identified need for institutional capacity, in terms of capacity to implement policies and plans, reflects how implementation is seen as a challenge that runs from the national through to the local level. In the context of Botswana, the need for support for CBNRM was also highlighted again, as it was at the community level, showing that while the push for such support might come from the community level decisions need to be made at the national level.

Table 10: Adaptive capacity needed across the three countries

	Adaptive Capacity Needs		
	Angola	**Namibia**	**Botswana**
Community level	• Training and capacity development✸✸ • Increase knowledge and information ✸ • Increase financial resources and projects	• Youth have lost knowledge (on cropping and indigenous traditional knowledge), due to HIV or rural>town migration. ✸✸✸ • Food security is the number one priority✸✸ • Conservation agriculture✸✸ • Drier conditions will lead to less grazing availability to livestock, more pressure on grasslands✸ • Need more cooperative management of river/ fish (fish sanctuaries) ✸ • What happens if people need to give up cropping altogether? Will lead to more livestock?	• Need to increase diversification of livelihoods – tourism, crops, etc., ✸✸✸✸✸✸✸✸✸✸ • Need to decrease poverty✸✸✸✸ • Need rain water harvesting/ storage✸✸✸✸ • Need increased mobility and markets for livestock✸✸✸ • Need better management of stocking rates✸✸ • Should move toward less reliance on drought relief✸✸ • Need official recognition of Malapo use rights with government assistance etc. and regulation✸ • Need to improve agriculture- based CBNRM support✸
Local Government level	• Improve institutional capacity (planning, policy development and implementation, governance, partnerships) ✸✸✸✸✸ • Training/capacity development✸✸✸ • Adaptive technology✸ • Increase human and financial resources • Increase knowledge and information production, dissemination	• Need to improve conservancy governance - especially financial governance (need more skills) and creative ways of benefiting from wildlife, Game farming✸✸✸✸✸✸ • Higher dependency on ground water (need more groundwater monitoring). Will require deeper boreholes✸ • Concerns: Green schemes, salination of soils, low quality produce, loosing seed varieties • It will cost more financially and environmentally to maintain green schemes. • Need to implement NAP	• Need a change in dual national grazing policy (conservation agriculture) ✸✸ • Need to increase planning links to resolution enforcement✸ • Need to increase capacity of technological support • Need to improve rangeland management • Need to implement land use plans • Need to improve pest and invasive species control
National Government level	• Integrate climate change into all government programs ✸✸✸ (focus on results ✸✸✸✸✸) • Improve cross-sectoral coordination ✸✸✸ • Turn policies into actions ✸✸✸ (implementation) • Stimulate innovation • Improved fund allocation to	• Need to carry out economic cost/benefit analyses to honestly assess viability of green schemes. ✸✸ • Improve grazing management✸ • Need to declare more forest resources✸ • Need more data on why trees are disappearing	• Policy for HWC/corridors needs to be integrated across sectors (and must be sustainable) ✸✸✸✸ • Need to support community tourism development✸✸✸✸ • Need to implement the SEA✸✸✸✸ • Need to reverse ban on hunting✸✸✸ • Need to improve fire management✸✸✸ • Need to decrease livestock subsidies✸✸ • Need to deal with disease transmission✸✸

	policies/ strategies/ projects		• Need to improve support for CBNRM/ use of natural indigenous products✹ • Need to implement elephant management strategy • Need to improve agricultural/arable policy and research and development in drought resistant plants

Namibia, Botswana, and Angola, have structures, institutions, and policies in place but need to improve the capacity of government institutions at their local and national levels to coordinate and improve policy and adopt a cross-sectoral view that integrates aspects of climate change into plan implementation and policies. At the community level, there is local knowledge and structures, but a need remains for information and training that link livelihoods and existing knowledge to empower communities to pursue sustainable, economically viable livelihoods.

CAPACITY OF BASIN-WIDE MANAGEMENT

Capacity Existing in the Basin

Broad brainstorming on the capacity existing in the Basin resulted in an overview of a number of key structures, actors, initiatives, plans, assessments, and assets found in the Basin.

Table 11: Management capacity existing across the basin

Structures, actors, initiatives, plans, and assessments	Descriptions
Basin Management Committees	All three countries have Basin management committees, yet the capacities of these committees vary. If the committees work together trans boundary management of the river Basin could be improved.
Eco-Tourism Industry	There is an established, well-resourced eco-tourism industry in the Okavango River Basin which, by being aimed at top class tourism, is generally not affected by increasing flight prices. The sector has the potential to withstand both drier and wetter conditions, and to provide continuous livelihood opportunities. The tourism industry also has the potential to be the collection point for benefit sharing in the Basin, and it has the management capacity to set up a Payment for Ecosystem Services (PES) scheme. At the same time, it should be noted that the top class tourism industry exists alongside people living in extreme poverty.
Joint Permanent Commission for Cooperation (JPCC)	The JPCC is a high level ministerial collaboration, across all sectors. It initially only included Namibia and Botswana, but now also includes Angola. Trans-boundary fisheries management was initiated through JPCC.
Kavango-Zambezi Transfrontier Conservation Area (KAZA)	KAZA provides a platform for NGOs and consultancies, but lacks the potential for change to trickle down to the community level.
National Adaptation Plans (NAPs)	Botswana, Namibia, and Angola all have NAPs.
Okavango Research Institute (ORI)	The ORI was highlighted as an important hub for Basin-generated knowledge. It houses three data information systems through the Future of the Okavango Project: OBIS (The Okavango Basin

	Information System); ODIS (The Okavango Delta Information System); ORI (Okavango River Information, a monitoring data website).
The Permanent Okavango River Basin Water Commission (OKACOM)	OKACOM was established in 1994, providing a platform for basin-wide management and sharing of information.
Strategic Action Plan (SAP)	All the NAPs feed into an overall, trans-boundary plan, the SAP, which has been endorsed by the ministries in Botswana and Namibia, and is due to also be endorsed in Angola.
Southern African Development Community (SADC)	With SADC comes political willingness, trans-boundary cooperation and protocols. It is a forum/mechanism for regional economic growth that attracts resources, and all three countries are members.
Strategic Environmental Assessment	For the Delta part of the Okavango River Basin (Botswana)
Trans Frontier Conservation Area (TFCA)	No details provided here

While a number of actors and mechanisms exist in the Basin, as illustrated in the table above, there seems to be a lack of knowledge sharing and coordination between the various initiatives. Accordingly, workshop participants noted that lateral, rather than sectoral or national, thinking will be important for the Basin going forward. Participants further noted that while some lateral thinking exists in the Basin at the moment, through for example OKACOM and JPCC, there is not enough. Rather than creating new initiatives there is a need for building on what is already there, coordinating ongoing mechanisms and actors and facilitating a more holistic, rather than sectoral and compartmentalized, approaches to Basin management.

Capacity Needed in the Basin

To identify the capacity needed for Basin-wide management, workshop participants individually wrote their thoughts on cards, then shared and grouped these on the wall. These resulted in the clusters outlined below.

Knowledge, Information, and Training. The need for various aspects of knowledge, information, and training in the Basin created the biggest cluster of points.

- Increased training programs on adaptive measures for local communities
- Strengthen community adaptation through availability of information
- Information: data sharing, protocols, and mechanisms
- Mainstream information on the impacts of climate change on the livelihoods of Okavango (data and economic information)
- Improve networking and partnerships among Okavango Basin stakeholders
- Create a database for the Basin (centered on the entire Basin)
- Improved data sharing
- Improved data collection networks
- Institutions and entitlement: Dissemination of information and an increased awareness of climate change threats and use of information to influence decision making
- Knowledge and information: Strategic Environmental Assessment for Basin
- Knowledge and information: Notification mechanism supported by Basin SEA
- Knowledge and information: Notification protocol on proposed activities
- Climate change analysis capacity in OKACOM

- Develop strategies and tools (information sheets, etc.) to increase awareness and knowledge of ministries of agriculture about real costs of fences, green schemes etc.
- Information and knowledge forum that involves youth clubs
- Information packaged for consumption by different levels of stakeholders
- Improved science-policy communication
- Provide decision makers with user friendly information (posters, etc.) on the costs/benefits of different land use strategies.
- Assessment of existing capacities and needs

As highlighted through discussions, there is a need for good information about the environment and climate, linked with dissemination mechanisms, to build capacity for climate change adaptation. To some extent this is about generating new information and knowledge, yet it is also about making existing information and knowledge more widely known and accessible to a variety of actors. For example, during discussions it was clear that many participants were unaware of the various ORI databases that are available online.
Economic Incentives and Sharing of Resources. Economic components also came out strongly in the workshop exercise. This related to a variety of factors, as illustrated below, yet the request for focus on Payment for Ecosystem Services (PES) was most prominent.

- Economic Benefit Sharing model
- Asset based-PES sustainable funding mechanism
- Asset-based Basin-wide PES scheme
- PES scheme to support flexible livelihoods
- Basin-wide investment strategies on tourism
- Private sector engagement
- Resource accounting
- Strengthening the economic basis of proposals
- Remove subsidies (livestock sector)
- Funding
- Increase incentives for wildlife based economy (CBNRM)
- Reduce barriers to wildlife-based economy (such as policy gap in Angola hunting ban) and promote incentives (payment for corridor services)
- Assets: Hydrology-meteorology and other monitoring stations in Angola portion of Basin

The key message here is the need for a Basin-wide approach to ensure that the benefits of the Basin are shared, potentially through a PES scheme. For example, most of the water in the Basin originates in Angola, yet Angola does not receive any direct benefits from not extracting the water and allowing it to flow into Namibia and Botswana. Some form of benefit-sharing model could provide an equitable approach that ensures that all three countries benefit from the Basin, while at the same time ensuring its sustainability. Participants also highlighted the need for the benefit-sharing model to make business sense, and to be backed up with a proper cost/benefit analysis. These requests for benefit sharing, PES schemes, and for a Basin-wide investment strategy illustrate a call for a more holistic, equitable, and coordinated approach across the Basin.

Coordination and Integration. The need for coordination and integration was highlighted in relation to specific policies and initiatives.

- Integrate agricultural/conservation planning and policies
- Inclusive sectoral co-ordination
- Policy integration, i.e. agriculture/land use
- Flexible decision making: Integrated sectoral policy development
- Sectoral planning integration
- Bring agriculture and energy sectors into OKACOM
- OKACOM more fully representative of other sectors
- Implementation of integrated water resource management
- Donor coordination

As illustrated in the bullet points above, participants highlighted the need for cross-sectoral integration. Through discussions it was suggested that ideally national policies across the different Basin states should also be aligned, and that a mechanism could be put in place to assess and explore how they can work together across the Basin.
As was highlighted in discussions, OKACOM is driven by a focus on water. Although OKACOM currently focuses on all resources in the Basin that are driven by water, there was a request for OKACOM to expand its focus beyond water.

General Needs. A variety of needs that could not easily be clustered were also highlighted:

- Science-policy loop
- Innovative advanced warning systems such as cell phones for flood and fire warnings
- Increased spatial and temporal scale of meteorology/policy directives/ actions
- Incorporate adaptive management systems
- Focus on ecosystem connectivity, wildlife mobility , alternative livelihoods/CBNRM
- Address the ‘’bottlenecks’’ e.g. KAZA- TFCA-wildlife movement
- Capacity needs for Basin-wide management in the context of climate change

Key capacity needs include better information, improved information sharing and coordination, benefit sharing, and cross-sectoral integration and coordination, all of which potentially require adherence to a shared, holistic vision, where all countries are equal, benefitting partners. Yet, as came out in workshop discussions, it is important to be realistic and to note that countries are likely to prioritize national interests, especially in the face of crisis. There is thus a need to strategize toward a shared vision which is realistic and which considers national differences.

DISCUSSION AND RECOMMENDATIONS

This report has outlined and analyzed the views and perceptions of stakeholders participating at the Okavango Vulnerability Assessment Workshop in Windhoek. The report provides a picture of the possible impacts of climate change on key livelihoods in the Okavango River Basin, the capacity that exists, and the capacity needed to respond to climate change challenges.

As a starting point to the assessment, participants were provided with a hydro-climatic overview of the Basin, including historical trends and future projections. This provided the foundation on which vulnerability of the various components in the Basin were assessed. The climate change projections, which can be seen as the exposure component of vulnerability to climate change, **provided a clear message of increasing temperatures, yet a more complicated message when it comes to rainfall and river discharge.** While rainfall changes might be spatially different, there was a slight indication toward overall drier conditions in the Basin, despite possible increases in rainfall in some areas. This implies that while the conditions in the Okavango River Basin might be drier in the future, there could still be an increase in rainfall and flooding in some areas. It also implies a possibility that the conditions in the Basin might be overall wetter in the future. **This uncertainty is reflected in this report, with the direction of change of biophysical impacts depending on the direction of change of rainfall and river discharge.** For example, floodplain areas might increase or decrease, as might soil moisture.

While the direction of change and the magnitude of biophysical impacts are difficult to project, the socioeconomic impacts identified are more generic. The outline of possible socioeconomic impacts reflects the sensitivities of the various livelihood strategies in the Basin. **All livelihood strategies assessed (tourism, commercial farming, communal farming, natural resource harvesting), with the exception of mining, were found to be sensitive to the possible impacts of climate change.** Mining was seen as having the necessary financial means to buffer possible impacts. The socioeconomic impacts that were identified **showed communal farming as the livelihood with the greatest sensitivity to climate change**. This reflects the close linkage of the livelihoods of communal farmers and biophysical elements. The socioeconomic impacts identified reflected how climate change has the potential to push the farmers across a threshold to very insecure and stressed livelihood conditions.

The possible consequences of three likely climate scenarios have been summarized in the diagrams below, detailing some possible changes that are expected under a scenario expecting more extreme weather events, an increased average temperature scenario, and a reduced rainfall scenario.

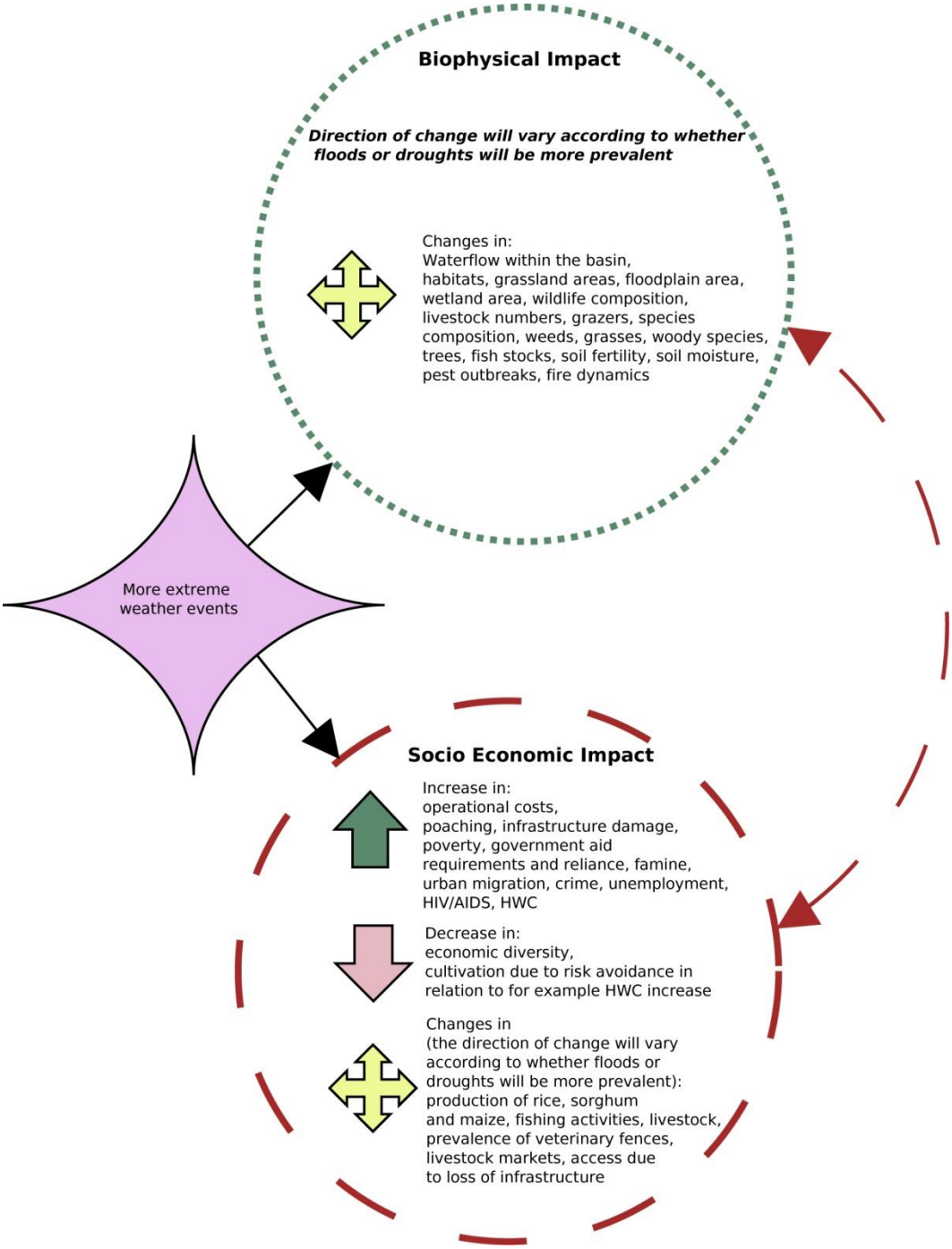

Figure 1: Expected impact in the Okavango Basin under a more extreme weather events scenario

If more extreme weather events are expected, it is clear that this poses a special challenge. As the socioeconomic impacts of this scenario cannot be determined clearly, it is crucial that an approach to mediate the impacts has to be highly flexible and responsive.

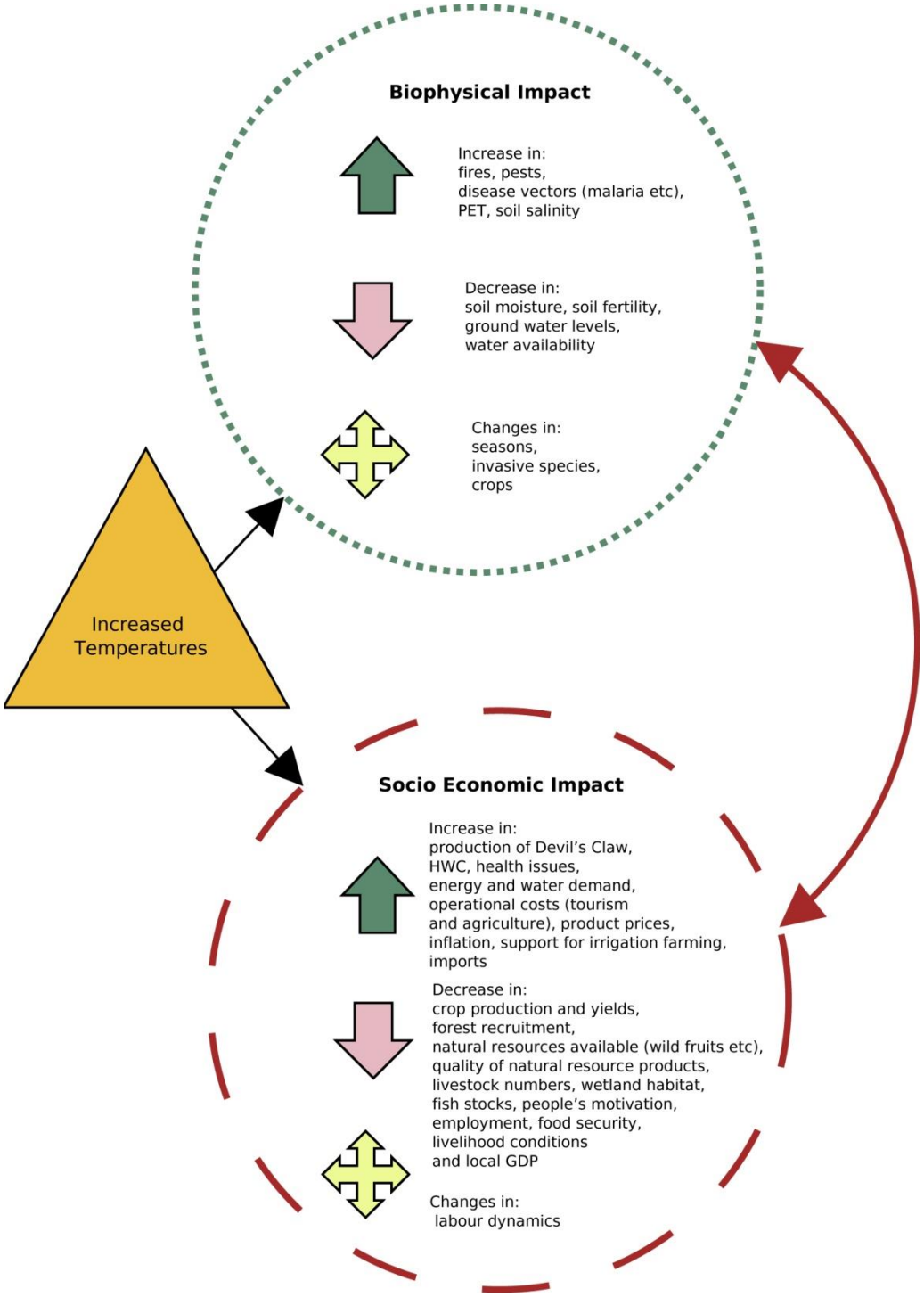

Figure 2: Expected impact in the Okavango Basin under an increased temperature scenario

This scenario has already been observed and thus urgent coordinated action should be taken to anticipate further biophysical change and to put in place measures that will ideally prevent any negative socioeconomic impacts.

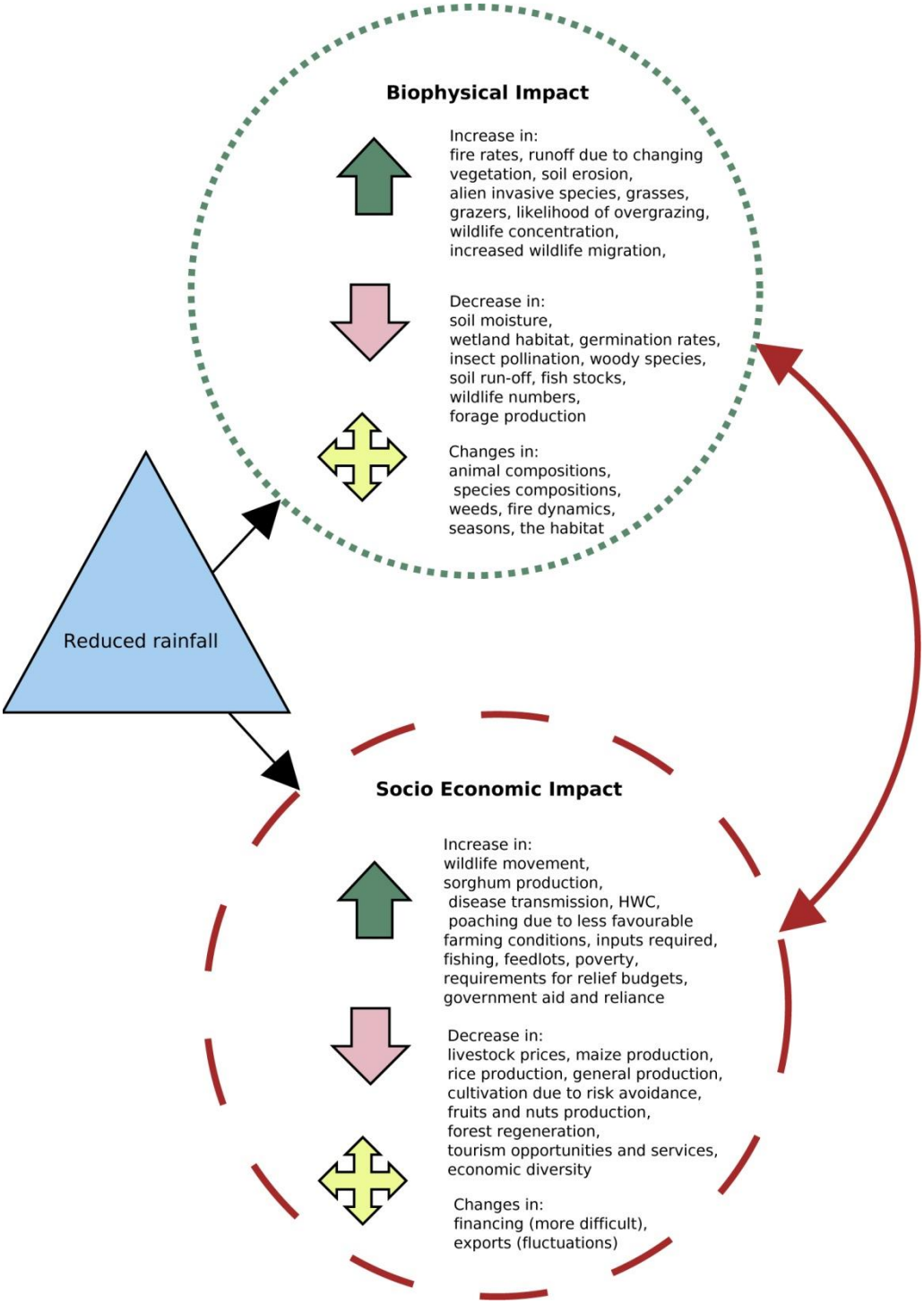

Figure 3: Expected impact in the Okavango Basin under a reduced rainfall scenario

A reduced rainfall scenario will also have far reaching biophysical and socioeconomic impact. It is crucial to further explore in more detail how this scenario would affect different areas in the Basin, and what measures could be put in place to increase the resilience of vulnerable groups.

All three scenarios clearly show that anticipating and planning for change is going to be crucial in the years to come. The capacity assessment done during the workshop showed that some capacity is present within the Basin at the national and regional levels. Some relevant

policies are also in place; however, implementation is sometimes not effective. The greatest challenge remains the coordination between the three countries toward an integrated management that safeguards ecological systems while promoting sustainable and resilient livelihoods within the larger Basin.

In summary, the assessment established that sustainable management of the Okavango Basin should be a key priority to ensure a sound and functioning ecosystem that supports sustainable livelihoods and is resilient to climate variability and change. There are already heavy pressures on natural resources, and some developments in the Basin give rise to concern that current practices might affect the ecosystem as a whole and will undermine livelihood strategies in the future in all three countries. In the absence of a legally binding agreement to ensure that development is sustainable within the Basin, it remains a concern that unsustainable development will weaken the existing system. Considering the climate change projections for the Basin, it is clear that additional stress might be put on the system due to climate variability and change.

While the system has a considerable degree of resilience, the increased pressures and challenges for the ecosystem, such as increased development, mining, irrigation schemes, and veterinary fencing, require a coordinated approach. With resilience maintained over time, the Okavango River Basin will be in a better position to cope with and absorb some level of climate variability and change. As it is clear that increased temperatures will have an effect on the Okavango River Basin, there is an urgent need for a legally binding coordinated response by the governments of Namibia, Botswana, and Angola. The response can draw on the extensive capacity existing in all three countries, and should take possible benefit sharing agreements into consideration. This could support a resilient Okavango River Basin and sustainable livelihoods in all three countries.

While a coordinated Basin-wide response is important, it is also crucial to support further capacity development on the national and local levels to prepare for and respond to more unpredictable weather patterns that may affect natural and socioeconomic systems. To facilitate this process, a systematic process of sharing lessons learned within the Basin might support an active learning process, strengthening the capacity development process in all three countries. Existing networks should be integrated in such a Basin-wide learning process to integrate existing scientific and local knowledge.

The Okavango River Basin is a complex and somewhat resilient system. Timely responses and a focus on integrated management of the Basin that supports sustainable development will buffer existing vulnerabilities of the system and enhance sustainable livelihoods in all countries that are custodians of this unique ecosystem.

ANNEX A

Reference List

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ANNEX B

Participant List for Vulnerability Assessment Workshop 23-24 July 2013

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2	Anna Matrose-Goreses	Polytechnic of Namibia (Previously national Project coordinator of SASSCAL)
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9	Charity N Angula	Southern Africa Regional Environmental Program (SAREP)
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16	Jacky U Tjivikua	Namibia Nature Foundation (NNF)
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25	Peter Tarr	Southern African Institute of Environmental Assessment
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27	Vera De Lauwer	Polytechnic of Namibia
28	Vladimir Russo	Holísticos – Environmental Consultancy Company