

REPUBLIC OF BOTSWANA

NATIONAL DROUGHT PLAN



THE UNCCD DROUGHT INITIATIVE



United Nations
Convention to Combat
Desertification

Prepared
by
Nnyaladzi Batisani (PhD)
2020

Table of Contents

ACCRONYMS	iv
EXECUTIVE SUMMARY	v
1 BACKGROUND.....	1
1.1 Purpose, Goals and Objectives	2
1.1.1 Purpose.....	2
1.1.2 Goal.....	2
1.1.3 Objectives	2
1.2 Principles.....	2
1.3 Plan Development Process	4
2 RELATIONSHIP TO OTHER PLANS AND POLICIES.....	4
2.1 Related National and Sectoral Policies and Regulations.....	4
2.1.1 Vision 2036.....	5
2.1.2 National Forest Policy (2011).....	5
2.1.3 National Meteorological Services Act (2014).....	5
2.1.4 Integrated National Wildland Fire Management Strategy (Final Draft of 2012).....	5
2.1.5 Forest Conservation Botswana Forest Conservation Strategy 2013 – 2020	6
2.1.6 Botswana Wetlands Policy and Strategy (Draft of 2007)	6
2.1.7 National Conservation Strategy (1990).....	6
2.1.8 Wildlife Policy (Draft of 2012).....	6
2.1.9 National Biodiversity Strategy and Action Plan (updated 2014).....	7
2.1.10 Environment Policy and Regulations.....	8
2.1.11 Botswana Climate Change Response Policy Draft 2016	8
2.1.12 Revised National Policy for Rural Development (2002).....	8
2.1.13 Botswana Land Policy (2015).....	9
2.1.14 Community Based Natural Resources Management Policy (2007).....	9
2.1.15 Tourism Policy (1990)	9
2.1.16 National Disaster Risk Reduction Strategy 2013-2018	9
2.1.17 National Development Plan 11 (April 2017 – March 2023).....	10
2.1.18 Waste Management Strategy (1998).....	11
2.1.19 Agricultural Resources Conservation Act of 1974 (CAP 35:06).....	11
2.1.20 Health policy and regulations	11
2.1.21 National Disaster Management Office (NDMO).....	11
2.1.22 Botswana Integrated Water Resources & Water Efficiency Plan	13

2.2	Existing Programmes Addressing Issues of Drought.....	13
2.2.1	Botswana National Action Plan to Combat Desertification, Land Degradation & Drought (NAP) (It is still at the final stage).....	13
2.2.2	National Adaptation Plan of Action (NAPA)	13
2.2.3	NATIONALLY DETERMINED CONTRIBUTION (NDC).....	14
2.3	Importance of National Drought Plan.....	14
3	OVERVIEW OF DROUGHT IN THE COUNTRY	15
3.1	Historical occurrences.....	15
3.2	Understanding drought.....	20
3.2.1	Meteorological drought.....	21
3.2.2	Hydrological drought.....	21
3.2.3	Agricultural drought.....	21
3.2.4	Socio-economic drought	21
3.3	Sectoral Impacts of drought in Botswana.....	22
3.3.1	Impact of Drought on Water Resources.....	22
3.3.2	Impact of Drought on Agriculture	22
3.3.3	Impact of Drought on Biodiversity	23
3.3.4	Impact of Drought on Human Health and Wellbeing	23
3.3.5	Impact of Drought on Tourism	23
3.3.6	Impact of Drought on Industry.....	24
3.3.7	Impact of Drought on Financial Institutions	24
4	ORGANISATION AND ASSIGNMENT OF RESPONSIBILITIES	25
4.1	National Institutional Framework.....	25
4.2	Assignment of responsibilities	25
5	DROUGHT MONITORING, FORECASTING, AND IMPACT ASSESSMENT	28
5.1	Drought indices and Indicators.....	28
5.2	Current Monitoring, Forecasting and data collection.....	33
5.2.1	A Drought Impact Assessment Methodology	34
5.3	Drought severity in all relevant sectors	35
5.3.1	Drought severity and management in water sector	36
5.3.2	Drought severity and management in Livestock sector	38
5.3.3	Drought severity and management in Crop Sector	41
6	DROUGHT RISK AND VULNERABILITY	44
6.1	The drought Risk and Vulnerability Assessment and GIS Mapping	44

6.2	Drought Risk Areas in Various Administrative areas	47
7	DROUGHT COMMUNICATION AND RESPONSE ACTIONS	49
7.1	Drought Communication protocol.....	49
7.2	Drought Declarations conditions, Response to Drought Impacts; and Labour-Intensive Programmes.....	51
7.2.1	Emergency management.....	51
7.2.2	Preparedness	51
7.2.3	Simulation exercises	51
7.2.4	The Botswana Government Drought Response, Resilience and Preparedness proposed Plan 53	
7.2.5	Gender-sensitive indicators to monitor results.....	57
8	DROUGHT MITIGATION AND PREPAREDNESS	59
8.1	National Water Resources Monitoring and Impact Assessment	59
9	CONCLUSIONS AND RECOMMENDATIONS.....	60
9.1	The National Drought Action Plan	61
9.1.1	Priority Implementation Actions.....	61
9.2	Monitoring, Reporting and Verification of The Implementation of The National Drought Plan	71
9.2.1	Implementation of The National Drought Action Plan.....	72
9.3	Future Updates and Revisions	74
10	REFERENCES.....	75

ACCRONYMS

BNAP:	Botswana National Action Plan
NBSAP:	Botswana National Biodiversity Strategy and Action Plan
BVAC:	Botswana Vulnerability Assessment Committee
CBO:	Community Based Organisation
DRR:	Disaster Risk Reduction
EMP:	Emergency Management Plan
FAO:	Food and Agriculture Organization
IDNDR:	International Decade for National Disaster Reduction
MESA:	Meteorological Services is the Monitoring for Environment and Security in Africa
MoA:	Ministry of Agriculture, Development and Food Security
MENT:	Ministry of Environment Natural Resources Conservation and Tourism
MoH&W:	Ministry of Health and Wellness
NAPA:	National Adaptation Plan of Action
NCDP:	National Committee on Disaster Preparedness
NDMO:	National Disaster Management Office
NDRMP:	National Disaster Risk Management Plan
NDP:	National Drought Plan
NEMA:	National Environment Management Act
NMSA.....:	National Meteorological Services Act
SADC:	Southern Africa Development Committee
SNAP:	Strategic National Action Plan
UNCCD:	United Nation Convention to Combat Desertification
UNFCCC:	United Nations Framework Convention on Climate Change
WMO:	World Meteorological Organization

EXECUTIVE SUMMARY

Botswana experiences several natural hazards, of which drought is very common and recurrent. Severe droughts in recent years were from 1981 to 1987 followed by 1990 to 1995. Droughts were also experienced in 1998/99 season, 2002 to 2006 and from 2011 to 2013. The impacts of drought are wide ranging affecting almost all sectors of the economy especially agriculture, water and health. Loss of income either due to loss of crops, livestock or employment causes great stress on people's livelihoods.

Drought adversely affects the already fragile food and agricultural situation and seriously impairs rural economy and socio-cultural structures. About 70% of rural households derive part of their livelihoods from agriculture; and crop production is mainly based on rain-fed farming. Rangeland resources, which cover more than 60% of the country and are the basis for the livestock industry and rural livelihoods, are the most affected by drought albeit to varying degrees. Urban communities are mostly affected by lack of water as water supply becomes limited to support daily activities including rationing of drinking water. The elderly, the destitute, children under the age of five are some of the layers of the population that are severely affected by drought. Malnutrition amongst these groups is usually aggravated during times of drought.

Botswana has an organized drought monitoring system with a strong network of stakeholders and organizations dealing with drought monitoring and mitigation that include National Early Warning Technical Committee, Inter-Ministerial Drought Committee and Rural Development Council. Institutions that monitor drought comprise of Ministry of Agricultural Development and Food Security; Ministry of Health and Wellness; Ministry of Local Government and Rural Development; Ministry of Environment Natural Resources Conservation and Tourism; and Ministry of Land Management, Water, AND Sanitation Services. The indicators used are rainfall, area ploughed and planted to reflect food security at household level; conditions of rangeland, livestock water and wildlife; and malnutrition levels. The above institutions hold early warning monthly meetings to track trends of these indicators.

A Drought and Household Food Security Outlook tour is undertaken annually after the rainy season (April-May). This exercise is conducted to complement early-warning reports compiled on a routine basis by the various Government Departments and Ministries. The assessment verifies and reconciles existing information at the national level with district information and provides a forum to generate discussions with districts on issues of drought and drought management. Therefore, the objectives of this exercise are twofold:

- (i) Ascertain whether it is a drought year. Drought in this context refers to a deficiency in rainfall in terms of its timing, spatial-temporal distribution, and/or overall amounts received and whether they were severe enough to negatively affect plant growth, water supplies, wildlife condition and ultimately human livelihoods and food security in general; and,*
- (ii) Determine the need or otherwise for government intervention, including the modification of form, magnitude, and scope of such interventions, particularly*

considering the identified manifestations of the prevailing situation. Meteorological and Hydrological institutions form part of the Drought Assessment Team and partake in the annual tour. In the past located at the Botswana Meteorological Services was the Monitoring for Environment and Security in Africa (MESA) programme for southern Africa which provides a drought service An Earth observation System which relied on the MESA Drought Monitoring Software and could provide a wide range of drought information products including 10-day drought maps and monthly drought risk maps for use by countries in the region. The SADC Climate Services Centre, also located at Department of Meteorological Services provides operational, regional services for monitoring and predicting extremes in climate condition. The Centre develops and disseminates meteorological, environmental and hydro-meteorological products. The Centre's products contribute to improved disaster risk management in the region and help to ensure Member States are better prepared for weather and climate disasters, conservation, and protection of natural resources.

One of the Drought and Household Food Security Outlook tour team's assignment relates to assessing the current levels of human vulnerability and signs of stress and the possible effects of their interaction with the observed impacts of drought. To address this, the nutritional status of the under-five year old' is reviewed using the information generated by the nutritional surveillance system. The situation regarding destitution and social welfare issues is also reviewed to detect the current and emerging trends in the number and distribution of destitute persons. The extent of wildfires is also reviewed as high fire damages may exacerbate levels of vulnerability if left unchecked.

Botswana Vulnerability Assessment Committee (BVAC) was formed in 2008 as part of the regional effort to respond to the food security crisis that faced SADC countries at the time. Since then, the BVAC has been undertaking annual livelihood vulnerability assessments with the intention to inform decision making for interventions.

Although Government has put in place strategies to mitigate the impacts of drought, there is need to create awareness among the citizenry on the cyclic nature of drought as years of good rainfall are usually followed by those of drought conditions as such people should adopt coping strategies. Research institutions should develop drought forecasting models and enhance early warning systems to minimize negative impacts of drought to vulnerable groups. Consequently, there is need to increase targeted training and development programmes towards areas of scarcity and comparative advantage.

The IPCC reports that climate change is projected to increase the frequency, intensity, and duration of droughts, with impacts on many sectors, in particularly food, water and energy. During UNCCD COP-13 in China, the UNCCD institutions and bodies were requested to implement a drought initiative in the biennium 2018-2019 at national level. A key element of the initiative is to support countries build drought resilience by implementing concrete actions for drought preparedness. The intent is to boost the resilience of people, communities and ecosystems against drought by being prepared and acting early. Thus, the preparation of this document is funded by the UNCCD to meet request of the above, with the main objective of responding to international

initiatives and having in Botswana a National Drought Plan which can respond at any time in the event of drought or extremely low rainfalls.

1 BACKGROUND

Botswana has a semi-arid climate attributed largely to its position at the center of southern Africa plateau, which makes the country naturally prone to droughts. Historical perspective of drought draws back as far as the 1950s, in which Botswana has experienced multiple, multi-year droughts and their return period has shortened while the severity has increased. Impact of drought affects all economic sectors but has dire consequences mostly on water and agricultural sectors and subsequently on communities' livelihoods. The impacts of climate change have exacerbated the frequent recurring of intense drought conditions that negatively affect food security and nutrition, human health and overall national economy over the past few decades. Historical records of drought, coupled with the increasing availability of regional climate and weather forecast capability, means that authorities now have greater capacity to anticipate and prepare for drought. However, in the past communities, stakeholders and government have taken a reactive approach to dealing with drought with minimal planned proactive approach. This reactive approach leads to losses; financially, material and livelihoods. The Government of Botswana thus recognizes the need to develop a drought management plan that will enable the implementation of a more proactive and integrated approach to drought management. In this light, and based on recurring extreme drought conditions, government through the Rural Development Council resolved to develop a Botswana Drought Management Strategy considering the different levels of severity and development of appropriate responsive mechanisms. The strategy is comprehensive enough to address all key issues that are directly or indirectly impacted by drought, covering both the short-, medium- and long-term horizons. This drought management plan builds on that strategy.

Drought is a prolonged dry period in the natural climate cycle that can occur anywhere in the world. The World Meteorological Organization (WMO) highlighted the need for a global drought re-boot as climate change will lead to severe and more frequent dry spells. Since the 1970s, global land area affected by drought has doubled. According to WMO and FAO investing in drought preparedness and resilience is therefore crucial.

Drought is a complex hydro meteorological phenomenon caused by meteorological anomalies that reduce precipitation (Stagge et al., 2015). It is a major climatic hazard and an extreme meteorological event that originates from a deficiency of precipitation leading to water shortage (Sahani et al., 2019). Drought is one of the most devastating but least understood weather phenomenon (Wilhite, 2000). Drought can erupt in a matter of months or gradually creep up on an unsuspecting society over several seasons (Wilhite et al., 2014), it is rarely forecasted with any skill and goes unobserved until its impacts have already occurred. Therefore, drought affects many people worldwide and cause tremendous economic losses, environmental damage and social hardships, hence having significant adverse effect on the socioeconomic, agricultural, and environmental conditions. It is the world's costliest natural disaster causing billions in global damages annually and collectively affects more people than any other natural disaster (Wilhite, 2000). Scientist and researchers foresee that for the coming years, the increase in drought periods is estimated to result in higher incidence of insect's pests, diseases, and soil degradation, compromising food production.

1.1 Purpose, Goals and Objectives

1.1.1 Purpose

Drought planning, preparedness and risk mitigation measures, will help to reduce the impacts and enhance human well-being and security during and after drought event. Preparing for drought and reducing the risk and mitigating the impacts of drought are paramount given the high incidence of land degradation and human poverty in the country. This National Drought Plan for Botswana aims to document the risk of drought and outline a series of approaches and actions that will be taken to prepare for and increase resilience to drought. It will bring together key government agencies and private sector organizations to take a proactive approach to drought management and develop appropriate response actions when drought occurs.

1.1.2 Goal

The goal of this National Drought Plan (NDP) is to move away from crisis management response and mainstream an active and practical integrated drought response focusing on practices that address underlying causes for the vulnerabilities associated with drought impacts. This proactive approach will result in increased resilience systems, adaptation and wellbeing of communities across the country. It will contribute to the attainment of gender equality by including women and men, particularly in rural natural resources dependent communities, in decision-making processes as well as in action implementation, enhanced drought research and knowledge management, integrated early warning systems and monitoring of drought management.

1.1.3 Objectives

The objectives of the drought plan are to:

- Allow for early drought detection through observation and forecasting,
- Improve drought response time by assessing drought vulnerability and risk in order to implement measures to limit the impacts.
- The drought plan should also serve as a critical mitigation action that leads to the formulation and adoption of national drought policies that provide a framework for a proactive, risk-based management for dealing with drought events.

1.2 Principles

Guiding Principles and Values

Botswana's drought management response is guided by seven principles and informed by relevant international best practice, which are consistent with the existing national policy framework, aligned to the:

- United Nations Framework Convention on Climate Change
- Strategic Framework for Drought Management and enhancing Resilience in Africa
- United Nations Convention to Combat Desertification.

The guiding principles have informed the development of the plan to be considered in the implementation of the plan, including the decision-making concerning choice of drought management actions at different levels and across sectors.

- **Proactive and Evidence-based:** Drought risk reduction and drought management responses should be guided by proactive planning that is based on credible scientific information, underpinned by enhanced research capabilities.
- **Equity and Social Inclusion:** Inclusive participation in the development process, striving for gender equality and a balance and fairness for all stakeholders, and across men, women, boys and girls, taking into account the need to address disproportionate vulnerabilities, capabilities, responsibilities and disparities, in a way that promotes social cohesion, upholds justice, and fosters transparency and accountability.
- **Precautionary and Preventive:** Anticipating and minimizing the known risks of drought and offsetting predicted impacts through developmental and risk-averse approaches that reduce the underlying drivers of drought risk.
- **Partnerships and Cooperation:** Strengthening partnerships and collaboration for enhanced drought resilience and management across the sectors and groups to encourage the role of civil society, academia and business as partners in proactive drought management. To enable this, strong leadership and champions are needed.
- **Sustainable Development:** Implementing drought management in a manner that promotes sustainable development, through drought risk reduction and resilience building that balances social, economic and environmental objectives to meet the needs of current and future generations.
- **Informed Participation:** Enabling stakeholder participation in decision-making and enhanced action at all levels, through capacity building, genuine openness to integrating inputs and diverse knowledge sources from all stakeholders, and enhanced communication of drought management, as well as related climate change impacts and responses.
- **Healthy Ecosystems and Sustainable Utilisation of Natural Resources:** Managing drought in a way that promotes sustainable land use management, acknowledges a rights-based approach and availability of and equitable access to water resources.

1.3 Plan Development Process

The steps in the drought plan and preparedness process are:

Step 1: Appoint a National Drought Plan Task Force

Step 2: Define the Goals/Objectives of the Drought Plan

Step 3: Seek Stakeholder Participation

Step 4: Inventory/Situational Analysis

Step 5: Prepare/write the National Drought Plan

Step 6: Identify unmet needs and fill institutional gap

Step 7: Communicate /Educate

Step 8: Evaluate the plan

2 RELATIONSHIP TO OTHER PLANS AND POLICIES

The Botswana National Drought Plan (DMP) is within the all-encompassing national policy frameworks; this is meant to ascertain that all relevant policies and frameworks are consistently addressed. The relationship with other policies will ensure that all sectors of development that cover issues of agriculture, water and drought are addressed. Similarly, it also makes linkages with key sectorial policies such as Draft Drought Management Strategy, Rural Development Policy, Community Development Strategy, Wildlife Management Strategy, Land policies, Disaster risk management strategy, Agricultural policies, Water policies, Social protection policies, and others. The Drought Management Plan is also linked to key international policies to ensure international best practice and benchmarking, as well as coherence with selected international frameworks that Botswana has signed up to. For example, the attainment of Sustainable Development Goals (SDGs).

2.1 Related National and Sectoral Policies and Regulations

Since 1966, Botswana adopted a long-term strategy for accelerated and sustainable development. The country developed transformational agenda that defined its ambitions and goals as a country mostly in line with international sustainable development goals through Vision 2036 to ensure that the country becomes a middle-income nation. Botswana's medium-term strategies have been developed with implementation modalities for Vision 2036. Here, legislation, policies and strategies that are aligned to Vision 2036 and medium strategies that are directly or indirectly related to addressing climate change, land degradation and drought management are discussed.

Sectoral silos have hampered mainstreaming climate change, with the tendency to leave everything to do with environment and climate change to Environment Ministry without necessarily seeing these challenges as being cross-sectoral. Climate change is now being addressed in the broad context of new draft legislation (e.g. National water resources management) and in strategies (e.g.

agriculture and natural resources; forestry). Changes in these would require changes in the National Environment Management Act (NEMA) and its associated regulations to specifically address climate change as part of the long-term, multi-sectoral impacts of an intervention, and to include provisions for enforcement.

2.1.1 Vision 2036

Vision 2036 studied past and current water scarcity situation and predicted that because of recurrent drought spells the situation will worsen. Therefore, the country aims to be water efficient and secure by promoting integrated water resource management strategies through policies and advocacy.

2.1.2 National Forest Policy (2011)

The policy has the overall goal of optimizing the contribution of forest and range resources for the long-term socio-economic development of Botswana (Section 4.1), this is set to be done by ensuring equitable and sustainable flows of benefits to all segments of the population. The policy was revised as a result of the decline in forest and woodland cover, which is due to unsustainable utilisation, unpredictable weather conditions as a result of climate change and frequent wild land fires. Therefore, it promotes land use systems that ensures protection of vulnerable and fragile ecosystems.

2.1.3 National Meteorological Services Act (2014)

The act provides for the national meteorological services to establish, operate, and maintain a national network of meteorological observing stations. The network is designed to cover the various climatic regions of the country. The act also provides for the knowledge management of all meteorological and climatological data including products such as weather and seasonal forecasts nationwide.

2.1.4 Integrated National Wildland Fire Management Strategy (Final Draft of 2012)

The strategy is an integral component of the forest policy and recognizes that there are high levels of wildland fires occurring due to fire fuel load build-up during above average rainfall years. The goal of the strategy is to conserve the country's natural resources, protect lives and property and minimize the negative effect of fire on the environment and on the economy of Botswana. The document outlines an integrated wildland fire strategy with the overall mission of promoting biodiversity and ecosystem integrity through an integrated wildland fire management strategy that provides for controlled use of fire as an ecological process and a land use management tool. Elements of the strategy include fire prevention; rehabilitation and restoration of fire damaged areas; education and awareness and research into wildland fire.

2.1.5 Forest Conservation Botswana Forest Conservation Strategy 2013 – 2020

Forest Conservation Botswana has laid out its strategy for forest conservation in their Forest Conservation Strategy. The strategy aims to address the main threats to forest resources (i.e. elephants, veld fires, human encroachment and climate change (droughts)) as well as management and perception inadequacies (i.e. inadequate forest management, undervaluation of forest research and inadequate research and data). The focus is on forest conservation through improved forest management in selected protected and communal areas. The reduction of threats should result in slowing down the decline of forest areas, and subsequently forest conservation and sustainable use.

2.1.6 Botswana Wetlands Policy and Strategy (Draft of 2007)

The document addresses the nation's plans to conserve wetlands for sustainable ecological and social economic standing. The policy highlights the role of wetlands in preserving biodiversity and ecosystem functioning, while the strategy focuses on environmental management and monitoring, capacity and public awareness. The biggest challenge in the utility of this document in supporting broader landscape management is that it remains a draft after several years, with no immediate indication that it might be implemented. Together, the dry savanna woodlands in the forest reserves and the wet floodplains of the Chobe-Linyanti system provide the combination of dry season and wet season habitat necessary to maintain large herds of herbivores. It is vital that these two ecosystem types are managed together, and that movement corridors and migration routes between them are maintained.

2.1.7 National Conservation Strategy (1990)

The National Conservation Strategy is one of the primary documents underpinning Botswana's commitment to sustainable development. The strategy highlights the commitment to ensuring that present generations consume no more than the annual output of renewable natural resources, and that future generations will have access to capital stocks of natural resources that are similar to those presently available. The strategy clearly defines two sets of goals: those relating primarily to development, and those relating primarily to conservation. The relevance of this foundational strategy comes through its focus on the conservation of ecosystems and the protection of endangered species, among other objectives.

2.1.8 Wildlife Policy (Draft of 2012)

Given that the Forest Policy acknowledges forest resources as a foundation for the wildlife sector, and highlights the importance of forests and woodlands as wildlife habitats to the point of calling for the incorporation of wildlife management into all forest management plans, it is important to ensure that this draft Wildlife Policy is aligned with those intentions with regard to forest areas. For wildlife, the connectivity of habitat and resources that the forest reserves provide is a key aspect to conserve. The draft policy also calls for optimizing the potential of photographic tourism in wildlife areas adjacent to parks, a call that is in keeping with the Forest Strategy.

2.1.9 National Biodiversity Strategy and Action Plan (updated 2014)

The Botswana National Biodiversity Strategy and Action Plan (NBSAP) of 2014 was compiled in compliance with the Convention on Biological Diversity, to which Botswana is a signatory. The vision (Section 2.2) of the strategy is “By 2025, ecosystem, species and genetic diversity is valued, protected, and used sustainably and equitably, through the involvement of all sectors of society and the provision of sufficient resources for its sound management.” The goal of the NBSAP is to contribute to the long-term health of Botswana’s ecosystems and all species as well as to encourage the sustainable and wise use of resources through the provision of a framework of specific activities designed to improve the way biodiversity is perceived, utilized and conserved. The Fifth National Report was completed in 2014 and has been prepared immediately on completion of the revision and update of Botswana’s NBSAP. It builds on the findings arising from that process, and addresses developments and changes recorded since the Fourth National Report, which was submitted in 2009. The updated NBSAP has five goals with a total of 20-time sensitive targets which are based on the Aichi targets. Specific targets that should be brought into the drought plans include the following:

- By 2025, planning processes at all (national, district and urban) levels, and national accounting and reporting systems in Botswana will contain explicit actions to promote biodiversity conservation.
- By 2025, the rate of natural land conversion will be at least halved, and degradation and fragmentation are significantly reduced.
- By 2025, animal and plant resources in Botswana’s wetlands, woodlands and savannas will be sustainably managed using the ecosystem approach, so that the impacts of harvesting remain within safe ecological limits.
- By 2025, wetlands, woodlands and savannas, particularly should be used for range or crops, are managed sustainably, ensuring conservation of biodiversity.
- By 2025, the anthropogenic pressures on wetlands, woodlands and savannas will be minimized, so that the impacts of climate change and other external perturbations on their ecological integrity and functioning can be managed.
- By 2025, ecosystem services are identified and restored or maintained in all Botswana’s eco-regions and contribute to livelihood improvement through strategies that enable equitable access by all vulnerable groups, including women, the poor and local communities.
- By 2025, ecosystem integrity in all Botswana’s eco-regions will be conserved through the adoption of ecosystem-level management approaches built around key ecological processes, so that they contribute to climate change mitigation and to combating desertification.
- By 2025, the indigenous knowledge of Botswana’s various communities, as it relates to the conservation and sustainable use of biodiversity in all the country’s eco-regions, will be documented, assessed and legally protected, and - where relevant - integrated into programmes and projects supporting biodiversity conservation. The forest reserves directly support the goals and targets of the NBSAP particularly in maintaining the long-term health of Botswana’s ecosystems.

2.1.10 Environment Policy and Regulations

Environmental Acts, such as the National Environmental Management Act of 1994 focus on conservation, pollution control, and environmental impact studies, rather than incorporating any aspect related to climate change. In this regard, environmental management policy is based on sound partnership among the farming community, the private and public sectors in the effective implementation of the Botswana Environmental Action Plan.

2.1.11 Botswana Climate Change Response Policy Draft 2016

This policy, although a draft, provides useful insights into climate change responses envisaged. The overall objective (Section 4) is “To mainstream sustainability and climate change into development planning, hence, enhance Botswana’s resilience and capacity to respond to existing and anticipated climate change impacts. The policy also promotes low carbon development pathways and approaches that significantly contribute to socio economic development, environmental protection, poverty eradication and global goal for reduction of Green-house-Gases (GHG) from the atmosphere.” The policy document promotes adaptation through use of best practices in management; forest management in Section 8.1.5, prioritizing research; promoting use of indigenous knowledge to increase forest cover; empowering communities; and promoting alternative livelihoods and climate smart technologies. Including climate change in existing biodiversity and ecosystems policies, adopting climate change guidelines (Section 8.1.8) emphasizes research; promoting ecosystems-based adaptation approaches; avoiding establishment of human settlement near sensitive ecosystems; and promoting natural capital accounting measures. Mitigation actions relevant to forest resources are outlined related to carbon markets (Section 8.2.3) that promotes the use of carbon emission offsets and trading for major economic sectors. Here forest reserves as carbon sinks rather than carbon emitters are important.

2.1.12 Revised National Policy for Rural Development (2002)

The National Policy for Rural Development of 2002 mainly targets the development of rural areas in Botswana. Its objectives include: encouraging rural employment and income generation through identification and exploitation of profitable alternatives to livestock and arable agriculture, encouraging sustainable livelihoods and stimulating a participatory rural development process through the involvement of local communities, strengthening of the DDCs and VDCs, Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and the private sector and rural poverty reduction. The policy (Section 6.1 vii), there is recognition of the vital role the women provide in the rural economy and seeks to strengthen their rights and roles in areas such as CBNRM. Section 6.1 ix) outlines environmental steps relating to natural resource conservation and development. Most forest reserves are adjacent to rural areas and have played a part in stimulating subsistence rural livelihoods through the provision of fuel wood, thatching grass and the harvesting of medicinal plants and fruits. The sustainable use of resources in the forest reserves will go a long way in improving the livelihoods of the villages that are adjacent to forest areas.

2.1.13 Botswana Land Policy (2015)

This policy has been formulated to respond to challenges and the growing demand for land in various parts of the country. It is a guide to all land operations for sustainable human settlement, land utilization and socio-economic development. The policy promotes access, equity, efficiency, land rights security and transparency in land management and administration and is responsive to emerging opportunities and dynamics of planning and development in the country.

2.1.14 Community Based Natural Resources Management Policy (2007)

Community Based Natural Resources Management Policy (2007) is intended to guide and facilitate the strengthening of, and support to, existing and future CBNRM activities. The overall goal of the CBNRM Policy is to create a foundation for conservation-based development, in which the need to protect biodiversity and ecosystems is balanced with the need to improve rural livelihoods and reduce poverty. The policy is needed to safeguard the interests of communities in natural resources management and to attract investment in natural resources-based enterprises. The policy gives communities incentives to engage in conservation activities leading to sustainable development and poverty reduction.

2.1.15 Tourism Policy (1990)

The Tourism Policy of 1990 was prepared after the Government of Botswana recognised that the tourism industry could help diversify the economy and had significant growth potential. The Tourism Policy is designed to ensure that tourist activities are carried out in an ecologically sustainable manner (Section 3.2). As well as designed to provide local communities with direct and indirect benefits from tourism activities. Through those, the policy encourages stakeholder communities to appreciate the value of wildlife and its conservation and the growing opportunities in rural areas for participation in wildlife-based industries, including tourism.

2.1.16 National Disaster Risk Reduction Strategy 2013-2018

In an effort to improve disaster preparedness the Government of Botswana established the National Committee on Disaster Preparedness (NCPD) in 1993 succeeding the United Nations International Decade for National Disaster Reduction of the 1990s. The United Nations General Assembly designated the 1990s as the International Decade for Natural Disaster Reduction- IDNDR (UNGASS, 1989). The objective of the IDNDR was to decrease the loss of life, destruction to property and social and economic disruption due to natural disasters, including but not limited to earthquakes, tsunamis, floods, landslides, volcanic eruptions, droughts, and locust infestations.

The mandate of the NCPD was to; increase coordination and improve effectiveness in the management of disasters; and ensure cost effectiveness in the utilization of resources in the management of disasters. CSO (2009) also reports that multi-sectoral preparedness committees were formed in Districts while other structures also exist within Ministries to take care of sectoral disasters.

The Government went on to formulate the National Policy on Disaster Management in 1996 as the country is vulnerable to multiple disasters and that the disaster management programmes should be consistent with development plans. The objectives of the National Policy on Disaster Management include:

- To establish and maintain optimum systems for dealing with disasters other than drought/famine in Botswana and to integrate these systems into normal ongoing development activities.
- To create a framework facilitating the preparation of plans and legislation for the effective implementation of disaster management in Botswana and its legitimacy.
- To outline the responsibilities of different personnel at different levels in the implementation of the disaster management programme.

2.1.17 National Development Plan 11 (April 2017 – March 2023)

The NDP's main strategies are the six (6) national priority areas of:

- Developing Diversified Sources of Economic Growth.
- Human Capital Development.
- Social Development.
- Sustainable Use of Natural Resources.
- Consolidation of Good Governance and Strengthening of National Security.
- Implementation of an Effective Monitoring and Evaluation System.

The overall goal of implementing these strategies is to address the country's three main development challenges of unemployment, poverty, and income inequality. Based on the national priorities aimed at addressing the development challenges, the overall theme of NDP 11 is: "Inclusive Growth for the Realisation of Sustainable Employment Creation and Poverty Eradication." The NDP strategies directly or indirectly relevant to the forest plans are:

- Developing diversified sources of growth and the use of the private sector as the main vehicle for generating this inclusive growth.
- Cluster development as a means of achieving economic diversification and growth. The clusters include tourism.
- Sustainable management of natural and cultural resources. In this regard sectors such as agriculture, energy, water, manufacturing and tourism will be subjected to sustainability appraisal, planning and implementation.
- Climate change mitigation and adaptation.
- Implementation of the Rural Development Policy to create sustainable jobs and reduce rural urban migration.

The policy also aims to mobilize rural communities to enhance their participation in the development process. To build resilient rural communities to mitigate droughts, illiteracy, ignorance, malnutrition, and disease and to strengthen institutions and structures for rural

development. NDP 11 outlines the main actions (and estimated costs) to be taken by each sector in order to pursue its mandate during the current fiscal period.

2.1.18 Waste Management Strategy (1998)

Waste management is seen as a key approach to protecting the environment and natural resources, particularly of water. The strategy states the need for managing at all stages of the waste cycle, from manufacture through to disposal. This strategy is based on three core principles: Prevention, Polluter Pays, and Co-operation. The objectives are on minimising waste, maximising reuse and recycling, and promoting environmentally sound disposal. One of the key underlying factors behind the development of the strategy was to avoid environmental pollution and protect natural resources from waste materials.

2.1.19 Agricultural Resources Conservation Act of 1974 (CAP 35:06)

The Agricultural Resources Conservation Act (currently under review) makes provision for the conservation and improvement of the agricultural resources of Botswana. The Act defines agriculture resources in Section 2 as soils, water, animal life and fauna (animals, birds, reptiles, fish and insects) and other things to be declared as agriculture resources by regulations. By this definition, the Act covers a wide range of environmental issues, which are relevant to infrastructure provision.

Sections 16 and 18 of the Act explicitly provide for the protection of the physical environment including the protection of slopes, protection of land against erosion, preservation of vegetation, prevention of silting of dams, preservation of the soil and its fertility and the drainage of land (construction, maintenance, or repair of artificial or natural drains, gullies, contour banks).

2.1.20 Health policy and regulations

The National Health Policy (for the period 2011–2021) also identifies climate change as a threat to the well-being of the population (Ministry of Health, 2011). The policy predicts the direct impacts of climate change on health will be an increase in the prevalence of malaria due to increases in temperature and rainfall (in some parts of the country), an increase in the incidence of cholera, and an increase in malnutrition due to reductions in domestic food production and crop yields.

2.1.21 National Disaster Management Office (NDMO)

According to NDMO (2009) the National Disaster Risk Management Plan (NDRMP) which is informed by the disaster risk reduction approach provides a national framework to implement disaster risk reduction and emergency management in Botswana involving all the sectors and institutions at all levels. The NDRMP of 2009 is a major step towards achieving the goal of Sustainable Development through ensuring Disaster Risk Reduction (DRR) implementation in the country.

It provides a framework which guides all sectors and stakeholders in preparing their own DRR and Emergency Management (EM) plans. The plan addresses issues related to natural and man-made hazards and vulnerabilities as per sectoral mandate. The plan was followed by various sectoral and department specific plans. In those plans the actions and commitments for each sector are explained further. Consolidation of all the sector specific plans will result into a Strategic National Action Plan (SNAP) for DRR implementation and Emergency Management Plan (EMP) to deal with disaster related emergencies (NDMO, 2009).

The NDMO (2009) further reports that the specific guiding principles for Botswana NDRMP are:

- a) Building the Resilience: While the occurrence of natural calamities cannot be stopped, national and community resilience can be built to withstand the impact.
- b) Safe and Secure Development Planning: Natural disaster risks are intimately related and connected to the economic development of the society (e.g. technological processes, urbanisation, etc.) hence disaster risks can be managed and reduced through appropriate and precautionary development planning.
- c) Multi hazard approach can enhance the effectiveness of Disaster Risk Management Planning in Botswana. Substantial disaster risk reduction cannot be achieved if actors of this plan only focus on few selected hazards.
- d) Decentralised Approach: Disaster risk management activities such as Disaster Risk Reduction and Emergency Management planning will be premised on a high level of decentralisation based on local initiatives, with the active participation of district and community levels as well as other actors.

In 2013 the Government of Botswana implemented the National Disaster Risk Reduction Strategy of 2013-2018 after realising that the frequency and magnitude of disasters are on the increase. The National Disaster Risk Reduction Strategy contributes towards the decrease of disaster risks and poverty alleviation by achieving the following aims:

- To establish and incorporate the foundational guiding arrangements for disaster risk reduction in the country.
- To increase awareness and knowledge of disaster risk reduction methods and opportunities.
- To inform the legal and institutional basis for efficient disaster risk reduction planning and implementation.
- To contribute towards the inclusion of disaster risk reduction into development policy, programmes and projects.
- To establish a strategic platform for public-private sector co-operation in disaster risk reduction.
- To contribute to community resilience against the threats and effects of disasters.

Botswana National Action Plan to Combat Desertification, Land Degradation & Drought (BNAP)
The BNAP to combat desertification, land degradation & drought in Botswana was developed by

the Ministry of Environment, Natural Resources Conservation and Tourism (MENT), through Department of Forestry and Range Resources underscored the importance of Sustainable Land Management (SLM) and land degradation. It is perceived that the degradation of the land-based resources in Botswana is a compounded economic, environmental, ecological and cultural problem that requires collective actions. In that context, and in a broader sense, the process must be understood as a social problem in which land degradation and desertification are at the center of a triangular relationship between people, poverty, water and food security.

2.1.22 Botswana Integrated Water Resources & Water Efficiency Plan

To improve people's livelihoods and welfare, as well as contribute to sustained economic growth, economic diversification, social justice and poverty eradication through efficient, equitable and sustainable water resources development and management.

2.2 Existing Programmes Addressing Issues of Drought

2.2.1 Botswana National Action Plan to Combat Desertification, Land Degradation & Drought (NAP) (It is still at the final stage)

Botswana National Action Programme (BNAP) to combat desertification, land degradation and drought in Botswana is being developed by the Ministry of Environment, Natural Resources Conservation and Tourism (MENT). It is perceived that the degradation of land-based resources in Botswana is a compounded economic, environmental, ecological and cultural problem that requires collective actions. In that context, and in an even broader sense, the process must be understood as a social problem in which land degradation and desertification are at the center of a triangular relationship between people, poverty and food security.

2.2.2 National Adaptation Plan of Action (NAPA)

This National Adaptation Plan (NAP) Framework was developed to comprehensively address adaptation developed by the Department of Meteorological Services, as a focal Department for Climate Change in collaboration with the International Institute for Sustainable Development (IISD). The Botswana NAP Framework is a strategic document made following the Climate Change Response Policy draft of 2016, that gives guidance on the implementation and highlights potential institutional arrangements based on existing national structures that will enhance the coordination of efforts including the financial and resource mobilization for climate change related problems for adaptation measures such as drought relief programs, water-transfer schemes, and health-responses to disease outbreaks or prevention. Therefore, this NAPA Framework encourages national innovative approaches to mobilizing and accessing climate finance from international sources.

2.2.3 NATIONALLY DETERMINED CONTRIBUTION (NDC)

The Botswana government has stated that it intends to achieve an overall emissions reduction of 15% greenhouse gases (GHGs) emissions reduction target by 2030, taking 2010 as the base year. Its initial emission estimation is 8307 Gg of CO₂ equivalent. It aims to target the emissions reduction nationally through strategies and measures which are relevant for the implementation of the target. This would be achieved if the country has the right resources and proper frameworks.

2.3 Importance of National Drought Plan

The NDP is a measure to reduce the risk and effects of drought in Botswana.

Drought planning, including preparedness and risk mitigation measures, will help to reduce the impacts and enhance human well-being and security during and after drought. Preparing for drought and reducing the risk and mitigating the impacts of drought are paramount given the high incidence of land degradation and human poverty in the country. This National Drought Plan for Botswana aims to document the risk of drought and outline a series of approaches and actions that will be taken to prepare for and increase resilience to drought. This National Drought Plan brings together the key government agencies and private sector organizations to take a proactive approach to drought management and develop appropriate response actions when drought occurs.

3 OVERVIEW OF DROUGHT IN THE COUNTRY

3.1 Historical occurrences

Botswana is a landlocked country lying in the center of Southern Africa between Zambia, Zimbabwe, South Africa and Namibia. Its altitude averages about 1000 m above sea level, but most of the country is flat with gentle undulations and occasional rocky outcrops. The climate is arid and semi-arid, with low rainfall and high rates of evapotranspiration. Mean annual rainfall is 416 mm, ranging from 650 mm in the north to 250 mm in the extreme southwest. Rainfall occurs in the form of localized showers and thunderstorms, resulting in large temporal and spatial variations. Rain generally falls between October and March, but the pattern is highly irregular.

Daytime temperatures in summer can reach 40 °C while winter days are invariably sunny and cool to warm (5-23 °C). Annual open water evaporation varies from about 1900 mm to 2200 mm. Evaporation rates are highest in the summer when 80-95 percent of the rainfall occurs (Nachtergaele, 2002). Most soils in the country are sandy with limited water-holding.

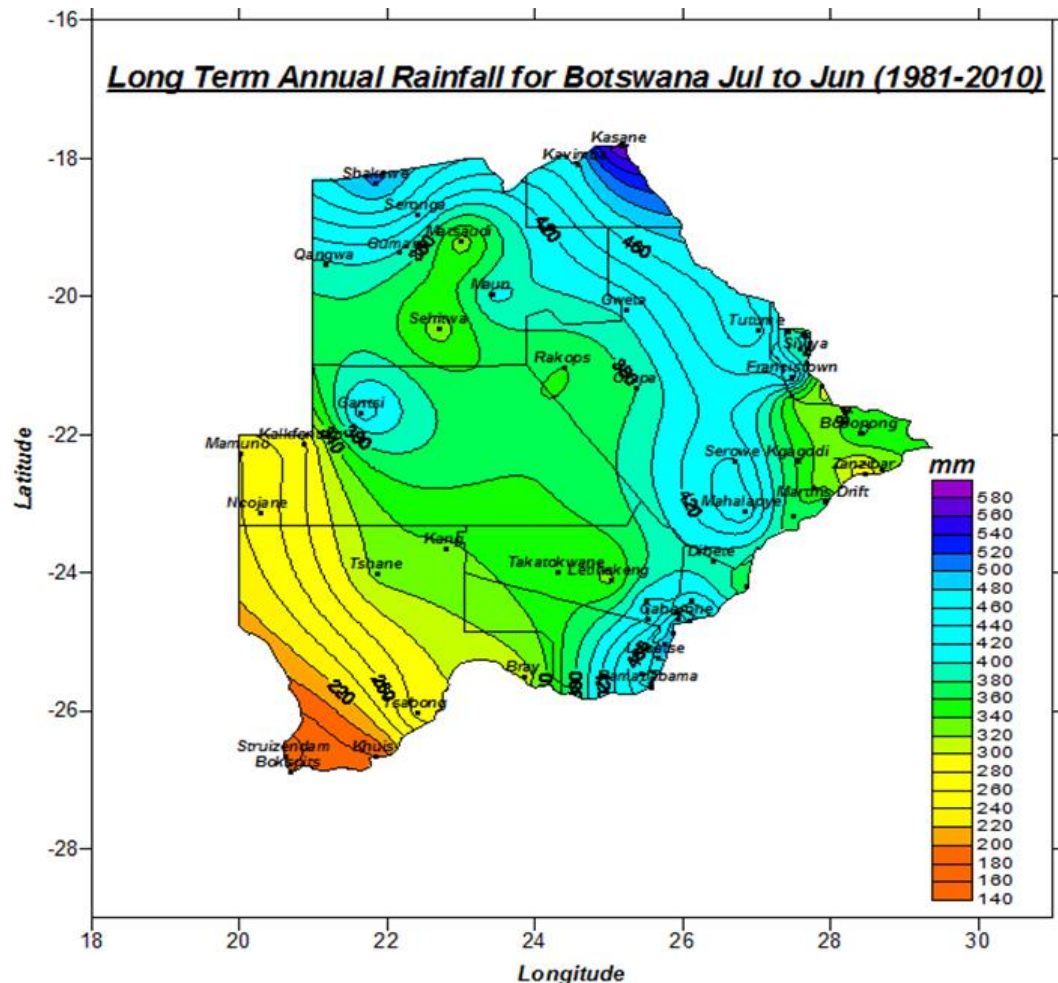


Figure 1: Long term annual rainfall for Botswana

The daytime air temperatures on average during summer months are generally warm to hot due to high insolation, which lead to the extent that the potential evapotranspiration far exceeding precipitation rates.

The mean monthly maximum temperatures in summer months (October to February) for the past 30 years (1981 – 2010) range from 31 °C to 34 °C (Refer Figure 1) and from 22 °C to 29 °C in winter (May – August). The Temperature spatial distribution showed hot temperatures (32.5 °C to 34.5 °C) over the western half and the extreme eastern corner of the country while the bulk of the eastern half of the country experience warm temperatures (Refer Figure 1). The analysis showed the increase in temperature which could be attributed to global warming due to the changing climate resulting in warmer winter mean maximum as shown by the current 30 year period (1981-2010) ranging from 22 °C to 29.5 °C as compared to 19.8 °C to 28.9 °C for the 1971 -2000 period. After the 1981-2010 period, during 2016, temperatures greater than 40 °C were consecutively recorded over most parts of the country resulting in heat waves. Tsabong over south western parts, recorded the highest ever maximum temperature of 44 °C on the 1st November 2016. The month of January 2016 registered temperatures greater than 40 °C over the entire country (Table 1).

Table 1: Extreme Daily Maximum Temperature (°C)

Station name	Month (2016)	Extreme temperature
Maun	January	43.8
Tsabong	January	43.5
Werda	January	43.3
Sir Seretse Khama Airport	January	42.7
Lephepe	January	42.6
Sua Pan	January	42.1
Selebi Phikwe	January	42.0
Jwaneng	January	41.9
Letlhakane	January	41.5
Tshane	January	41.4
Shakawe	January	41.3
Good Hope	January	41.1
Francistown	January	41.0
Pandamatenga	January	40.1

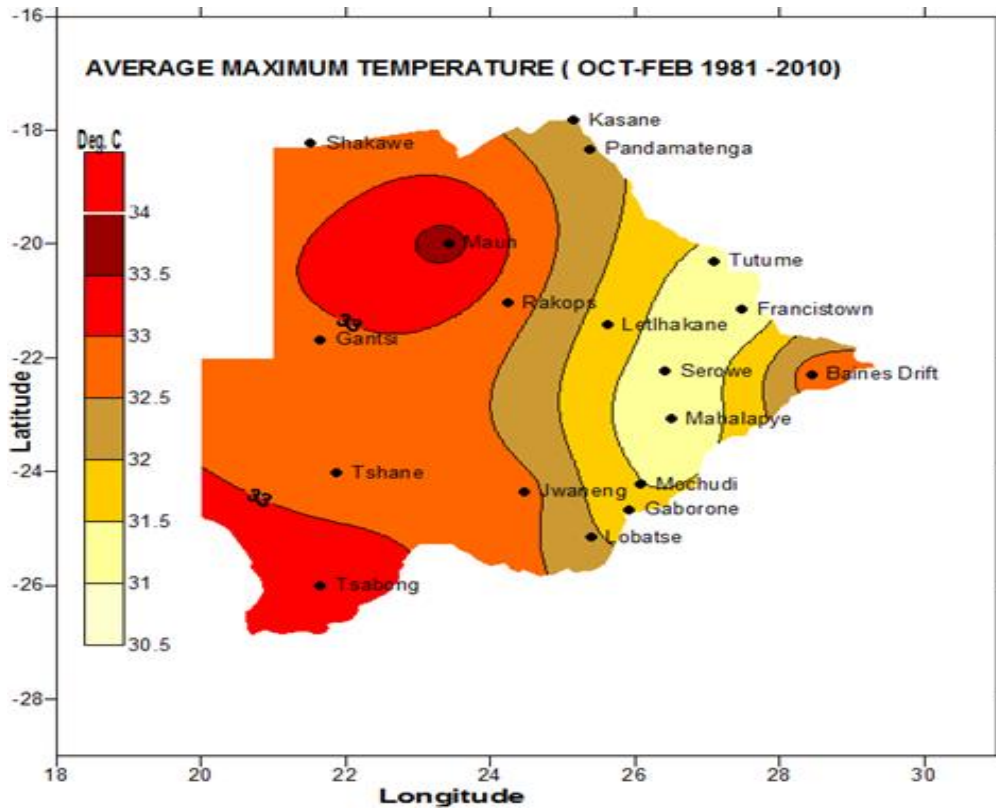


Figure 2: Mean monthly maximum temperature

Minimum temperatures

Mean monthly minimum temperatures for 1981 -2010 range from 16 °C to 20.5 °C in summer and from 2.8 to 10.6°C in winter (Figure 2). Climatologically, the coldest months are June and July and the lowest temperature is normally recorded during July except for a peculiar case where the lowest daily minimum temperature of -15.2°C occurred at Tsoabong in August 1972 and it is the lowest ever recorded and still holds the coldest or lowest temperature for the country. Thus, the south western part of the country is colder than the other parts due to its vicinity to the cold dry air from the Benguela currents induced by the south westerly component. The analysis shows that extreme coldest daily minimum temperatures below freezing point are observed mainly in June and July (Refer Table 2).

Table 2: Winter Daily Extreme Minimum Temperature (°C)

Station	Year	Month	Extreme Minimum
Tsabong	1972	August	-15.2
Sua Pan	2010	June	-8.5
Tshane	1974	July	-8.0
Jwaneng	1996	July	-7.5
Gantsi	2012	July	-7.7
Francistown	1981	June	-6.5
Shakawe	2011	June	-6.1
Mahalapye	1980	August	-6.0
Maun	1962	June	-5.8
S.S.K. A	1996	July	-5.5
Good hope	2014	July	-5.5
Letlhakane	1996	July	-3.8
Kasane	2012	June	-1.0

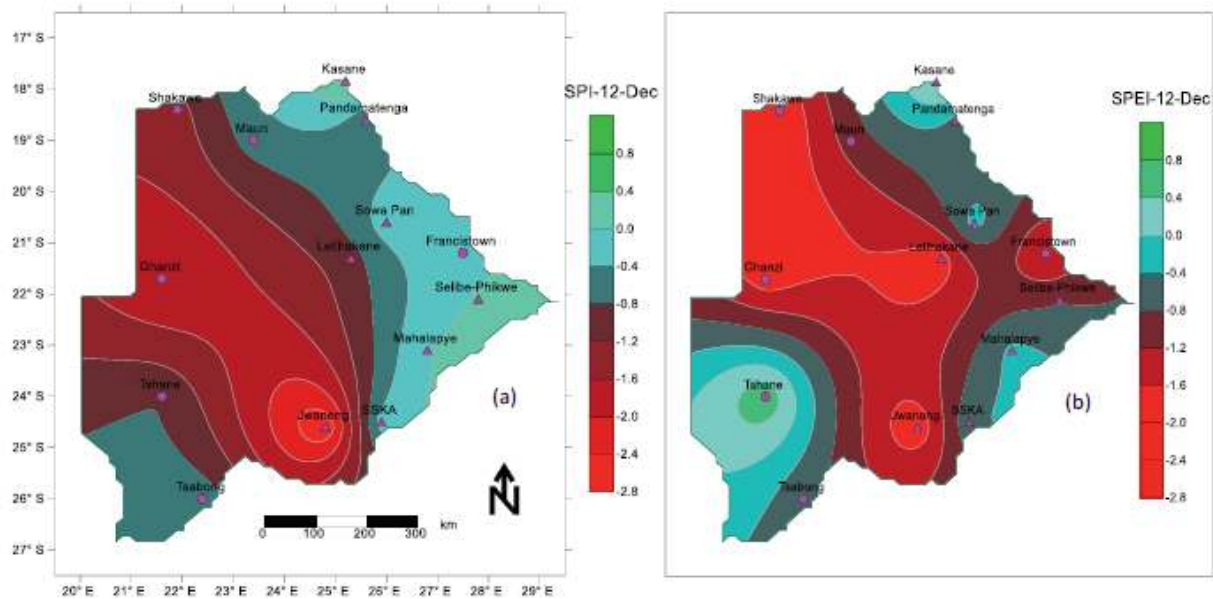


Figure 3: Spatial distribution of drought severity evolutions in Dec-2015 (one of the driest year on record) (a) SPI-evolutions and (b) SPEI evolutions showing vulnerable areas under SPI/SPEI < 0. (Byakatonda et al., 2018).

The history and context of drought management in Botswana

Since the 1950s, Botswana has experienced multiple, multi-year droughts. Records show that drought has occurred in the following years: 1959/60, 1961/62, 1963/64, 1964/65, 1969/70, 1972/73, 1978/79, 1981/82, 1982/83, 1983/84, 1984/85, 1985/86, 1991/92, 1993/94, 1994/95, 1995/96, 1997/98, 1998/99, 2001/02, 2004/5, 2005/06, 2007/08 as well as 2012 (Juana et al, 2014; Mogotsi et al, 2011). These figures indicate that the return period between droughts has shortened, meaning that over time, the frequency of drought has increased.

i. Drought management in the 1950s and 1960s

Just prior to its 1966 independence, Botswana (the then Bechuanaland) was hit by an exceptionally severe drought that necessitated emergency drought relief and the importation of maize and other supplies in growing volumes. The severe drought conditions prevailed throughout the decade, resulting in devastating crop losses, low yields and great mortality among livestock. In April 1966, founding president Sir Seretse Khama told the new parliament that this was “the worst drought in living memory.” An urgent and effective response was needed, and the newly independent Botswanan government established a National Famine Relief Committee and a National Relief Fund to raise funds from the public. Drought relief support measures were delivered by the World Food Programme and the government was also permitted to use the remaining balance of a relief grant, which had been provided by Oxfam in 1964, on public works programmes. The aim of these programmes was to provide resources to poor communities and to build roads and dams. The

Ipelegeng programme was introduced (meaning ‘self-help’ in Setswana), which provided food to poor but able-bodied Botswanans in exchange for their work on community development projects.

ii. Drought management in the 1970s and 1980s

The drought conditions of the previous decade finally abated in 1973, when relatively good rainfall allowed the land to slowly begin recovering. However, in 1978, Botswana once again fell victim to the impacts of drought. The severe drought lasted until 1987/8, causing acute food shortages, particularly in rural areas. Despite its previous experience of drought, the government was once again ill prepared and treated the drought as an emergency. Food had to be imported from neighbouring countries and extensive emergency drought relief aid was provided by international donors. In an effort to ‘solve’ the ongoing drought problem, the government introduced a structured Drought Relief Programme (DRP). The programme, which began in the 1980s, comprised three key aspects: 1) formalisation of the existing *Ipelegeng* programme, also called ‘food for work’; 2) a feeding programme for vulnerable groups and school going children; and 3) a destitute programme for the elderly and abandoned people (Seekings, 2016).

iii. Drought management in the 1990s and 2000s

Following a brief respite from the debilitating drought of the 1980s, Botswana continued to experience recurrent droughts throughout the 1990s and 2000s. In 1991, the DRP was formally institutionalized in the government planning instruments and a budget was allocated for its implementation through the National Development Plan 7 (NDP7) (Seekings, 2016). Although still strongly reliant on donor support, the capacity of Botswanan people to cope with the impacts of drought began to improve. This was largely due to responsible investment of the country’s recently established diamond wealth into infrastructure, education, and other social and economic development efforts. However, the approach to dealing with drought continued to be reactive rather than anticipatory. This type of emergency response tends to be implemented inefficiently due to the urgency of a drought crisis (IPCC, 2014). Significant loss and damage from drought therefore continued to impact the country, with marginal communities being worst affected. Moreover, while the DRP has received much praise, the country’s response to drought was critiqued for creating state dependence and thus undermining the resilience of communities.

3.2 Understanding drought

Drought is characterized into four categories: meteorological, hydrological, agricultural, and socioeconomic. It differs from other natural hazards because its impacts may stretch for a long period of time even after the wet season has commenced making the prediction of its onset and termination difficult. Therefore, timely information on drought onset, its extent, and intensity is crucial for the reduction of drought related losses and subsequently the overall drought vulnerability of a communities and ecosystems.

3.2.1 Meteorological drought

Meteorological drought is defined usually based on the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. Definitions of meteorological drought must be considered as region specific as the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region. This category is a reduction in rainfall supply compared with a specific average condition over some specified period. It is defined as a period during which less than a certain amount, for example 70%, of the normal precipitation is received over any large area for an extended period.

3.2.2 Hydrological drought

Hydrological drought is associated with the effects of periods of precipitation shortfalls on surface or subsurface water supply (i.e., streamflow, reservoir and lake levels, groundwater). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. This category is caused by the impact of a reduction in precipitation on natural and artificial surface and subsurface water resources, some rivers, dams and lakes either dry out or water volumes shrink. It occurs when there is substantial deficit in surface runoff below normal conditions or when there is a depletion of groundwater supplies. For instance, during the 2015/16 elnino, Gaborone dam, the main source of water for Gaborone city dried up (Siderius et al. 2017).

3.2.3 Agricultural drought

WMO specified that agricultural drought should link various characteristics of meteorological (or hydrological) drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, and reduced groundwater or reservoir levels. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. A good definition of agricultural drought should be able to account for the variable susceptibility of crops during different stages of crop development, from emergence to maturity. Deficient topsoil moisture at planting may hinder germination, leading to low plant populations per hectare and a reduction of final yield. However, if topsoil moisture is enough for early growth requirements, deficiencies in subsoil moisture at this early stage may not affect final yield if subsoil moisture is replenished as the growing season progresses or if rainfall meets plant water needs. A reduction in water below the optimal level required by crops, livestock or wildlife during each different growth stage, resulting in impaired growth and reduced yields. Agricultural drought relates to an imbalance in the water content of the soil during the growing season, which although influenced by other variables such as the crop or pasture water requirement, the water-holding capacity and degree of evaporation is also largely dependent upon rainfall amount and both spatial and temporal distribution.

3.2.4 Socio-economic drought

Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. It differs from the

aforementioned types of drought because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather. Because of the natural variability of climate, water supply is ample in some years but unable to meet human and environmental needs in other years. Socioeconomic drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply. The impacts of drought on human activities are both indirect and direct. This impact relates to a meteorological anomaly or extreme event of intensity and/or duration outside the normal range of events considered by enterprises and public regulatory bodies in economic decision-making, thereby affecting production and wider economy. Drought relief is costly when recovery and social support schemes become a necessity, which force government to re-channel financial resources from development projects to, for example, food imports.

3.3 Sectoral Impacts of drought in Botswana

Droughts often inflict significantly greater losses on national economies than other types of disasters. During drought episodes, Gaborone, the capital city of Botswana experiences water usage restrictions, water supply disruption, including decreased water pressure and complete cut-off of supply. As a result of drought impact, unreliable water supply had moved to first position in the challenges that businesses reported; overtaking concerns regarding the availability of skilled labor and domestic demand. Hospitality businesses such as hotels, restaurants and retail outlets struggled to prepare food, laundry and provide customers with flushing toilets. Loss of business assets, reduced productivity, price fluctuations and lay-offs were common due to consequences of the loss of supply (Sahani et al. 2019; Gannon, et al. 2018).

3.3.1 Impact of Drought on Water Resources

With its semi-arid climate, Botswana is naturally water stressed. Groundwater is the main source of potable water supply in most parts of the country. Nevertheless, groundwater recharge is very limited, making the resource finite and non-renewable. Drought causes a decrease in annual dam yields and an increase in average water needs. Increasing demands for consumptive water uses such as domestic, mining, industrial, commercial and agriculture make water a very valuable commodity. The impact of drought on the country's scarce water resources is therefore significant. In addition to a reduced quantity of water for consumption, drought also affects the quality of water resources. A lack of water resources also has implications for sanitation and the health sector.

3.3.2 Impact of Drought on Agriculture

The livelihood activity most at risk from climate change impacts in the semi-arid regions of Africa is agriculture. In Botswana, climate change is likely to cause an increase in the frequency and intensity of drought. As a major share of Botswana's population is highly reliant on arable rain-fed agriculture for its livelihood, impacts will be severe. Changes in the length of growing seasons and in crop production are already being observed and are expected to increase in the future. Most staple cereals such as maize and sorghum yields tend to fluctuate in response to rainfall variability.

Therefore, drought has significant implications for food security in Botswana. Livestock production is also likely to be negatively impacted by drought. The rural economy of the country is largely based on animal production, particularly cattle farming. Increased livestock mortality due to a combination of lack of grazing, heat stress, reduced availability of drinking water, increased distances to water livestock, as well as greater spread of diseases all contribute in this regard. The composition of preferred plant species changes to undesirable plants, and degraded soils reduces pasture productivity. In addition to declines encountered by both arable and pastoral farming, natural resources such as wild fruits and worms that rural communities depend on as alternative food resources are also highly vulnerable to drought.

3.3.3 Impact of Drought on Biodiversity

The Botswana National Biodiversity Strategy and Action Plan (DEA, 2016) identifies climate change and changes to the hydrology and water quality of inflowing rivers as one of the major causes of biodiversity loss in Botswana. With an increasing drying trend and greater number of severe dry spells, shifts in species suitability for specific areas have been observed. A decline in rainfall significantly reduces rangeland productivity leading to less biomass. Thorn and shrub savannahs are predicted to expand in the future, at the expense of grasslands, forests and woodlands. Endemic species, including plants and wildlife, are also at risk of extinction due to recurrent drought. Aquatic and marginal plants struggle to survive when river flows are low, and dried floodplains and low flows lead to a reduction in fish spawning areas and can reduce fish migration.

3.3.4 Impact of Drought on Human Health and Wellbeing

Drought has significant implications for food, water and financial security, particularly for the rural poor who depend directly on natural resources to support their livelihoods. Lack of food and income associated with drought can have far reaching social consequences and may erode relationships with family, neighbors and friends. Hunger and poverty may drive people to adopt risky behaviors such as drug and alcohol abuse, truancy, criminal activities, theft and corruption. Drought also increases the spread of diseases, whilst diminished water quality and access increases sanitation problems. Associated with drought is an increase in morbidity and mortality in children under 5 years of age.

3.3.5 Impact of Drought on Tourism

Botswana's tourism sector primarily depends on the country's renewable natural resource base. The viability of this sector is therefore closely linked to the availability of water. Associated with drought is a decline in nature-based tourism due to ecosystem degradation and shifts in wildlife localization. Water-based tourism activities such as boating in the Okavango Delta are also negatively affected when water levels are low. This situation is particularly worrying for locals who depend on income from transporting tourists around the Okavango swamps in mekoro.

3.3.6 Impact of Drought on Industry

The production, sales, and business operations in a variety of economic sectors are negatively affected by water deficiency. The direct impacts are evidenced predominantly by the reduction in agricultural outputs of crops, livestock, textile, construction, and road infrastructure. A decline in agricultural productivity in the commercial sector has knock-on effects for related agro-processing industries including for meat, dairy and fish processing, hunting, bakery products and beverage processing. Water intensive ventures such as hospitality are also mostly affected.

3.3.7 Impact of Drought on Financial Institutions

Drought has significant implications on financial institutions, particularly for those providing the farming community with some financial assistance. Farmers experience a steep increase in production costs due to drought as low rainfall results in lower water levels and heat waves, which increases the power (electricity) needed to pump irrigation water. In addition, input prices are known to increase sharply during drought events both for crop and livestock farmers. Low yields, both in terms of quality and quantity, have a damaging impact on income earned by the farmers, which can have knock-on effects on loan repayments that push farmers further into debt and expose financial institutions to risk.

4 ORGANISATION AND ASSIGNMENT OF RESPONSIBILITIES

4.1 National Institutional Framework

In order to develop and implement more effective strategies that build resilience in the long-term, government will require assistance from non-state actors; NGOs and other development partners to contribute to drought risk management through investing in the sustainable intensification of livelihoods, assisting with stakeholder engagements and providing support for the implementation of drought management programs. The private sector, on the other hand, may contribute through financial investments and the provision of jobs. **Community participation**, both in decision making and implementation, is important for developing a DMP that is relevant, prominent, feasible and equitable at the local level. This participation may also help create a stronger sense of community ownership among stakeholders, thereby fostering commitment and responsibility when implementing the DMP. Groups such as civil society groups, community-based organizations, traditional and religious leaders, and other local-level, non-state actors can play a key role in championing the agenda of drought risk management on the ground. As well as the Rural Development Council, District Disaster Management Committees, the Village Development Committee and Non-state Actors. The stakeholder participation encourages a participatory process with consultations and feedback mechanisms with a wide range of stakeholders, including women's and academia.

4.2 Assignment of responsibilities

Table 3: National Committees and their responsibilities in Drought Management

National Institutional framework	Responsibilities
Rural Development Council	The Rural Development Council (RDC) was established two years after the government adopted the development of the national drought development strategy in 1972. The council's main mandate is to spearhead works through its many technical sub-committees around the country. The council is chaired by the Vice President of the country and it gives orders to sub-committees to address all issues of drought such as monitoring and assessments. The data gathered through its sub-committee is used to give recommendations to the President for declaration of drought (R.Morgan, 1985).
Inter-Ministerial Drought Committee (IMDC)	To give instructions to the sub-committee to carry out the annual drought assessments (R.Morgan, 1985)
Multi-sectoral Committee for Food Security and Poverty Reduction	Contributes to drought risk management through investing in the sustainable

	intensification of livelihoods, assisting with stakeholder engagements and providing support for the implementation of drought management programs (R.Morgan, 1985)
Early Warning Technical Committee	Receives advices to carry out the annual drought assessments. Once it is completed, the RDC receives the recommendations from the sub-committees and then provides their recommendations to Cabinet and the President for a final decision and a declaration on drought (R.Morgan, 1985)
Botswana Vulnerability Assessment Committee	Works with the early warning technical team to assess the annual drought and give a report with recommendations to the cabinet (R.Morgan, 1985)
District Disaster Management Committees	At the district level the District (City/ Town) Disaster Management Committee (DDMC) were established by the 1966 National Policy on Disaster Management, and further reinforced by the 2005 National Disaster Risk Management Plan (NDRMP). The DDMC is found in each District Administration (DA) and it comprises of representatives from all relevant ministries. The committee, chaired by the District Commissioner (or his representative), is a subcommittee of District Development Committee (DDC). The DDMC plays a pivotal role at the local level when it comes to all disasters, including drought management. They serve as the first point for data collection at the local level (R.Morgan, 1985)
District Climate Change Committees	District Climate Change Committees supports the DDMC in the implementation of sustainable climate change response measures at village and district levels. The committees are responsible for integrating climate change into district development plans and assist in building climate resilient development planning at local levels (Davies et al., 2017).
The Village Development Committee	The Village Development Committees (VDCs) are village level organizational structures that coordinate development issues at the village level. Regarding drought and disaster risk management, the VDCs have the responsibility of coordinating disaster risk management activities at the village level. Their primary role

	<p>is to provide a link with the communities at the village level, to ensure that their voices are heard and incorporated into the disaster risk management plans. Their other role is to support the District Administration, District Disaster Management Committee and the National Disaster Management Office in their efforts to address disaster response and preparedness at a local level (R.Morgan, 1985)</p>
<p>Non-state actors</p>	<p>Non-state actors play a key role in ensuring the effective implementation of the DMS. NGOs such as the Red Cross mostly get involved in disaster management, such as floods and epidemics. There is a role that NGOs and researchers could play in drought management, such as providing scientific information and research, building local capacity and reaching communities that government alone would not reach (Davies et al., 2017).</p>

5 DROUGHT MONITORING, FORECASTING, AND IMPACT ASSESSMENT

5.1 Drought indices and Indicators

Drought indicators are hydrological or biophysical variables or parameters that describe drought conditions such as precipitation, temperature, streamflow, groundwater and reservoir levels, and soil moisture (IDMP, 2016). While indices are described as computed numerical representations of drought severity, used to measure the qualitative state of drought for a given period using climatic inputs like precipitation, temperature, streamflow, groundwater and reservoir levels, and soil moisture. Somehow like the indicators, indices provide quantitative assessment of the severity, location, timing and duration of drought events. Monitoring drought is the easiest of most hazard events because the onsets are usually slow, giving time to observe variations in precipitation, temperature and the status of surface water and groundwater supplies. Drought indicators or indices are often used to help track droughts, and provision options for classifying the severity, location, duration onset and end of such conditions depending on their severity, location, duration and timing. In Botswana the drought indices include SPI (Figure 4). Rainfall trend for October to December for Botswana shows that rainfall for this season is decreasing, whereas for the January to March Season it is constant (Figure 5). Rainfall for the past five (5) years has been above normal during the month of April, which was not initially included in the rainfall months. This could imply that there is a shift in the rainfall patterns, rainfall being mostly decreasing in the first part of the season but increasing the second part of the season.

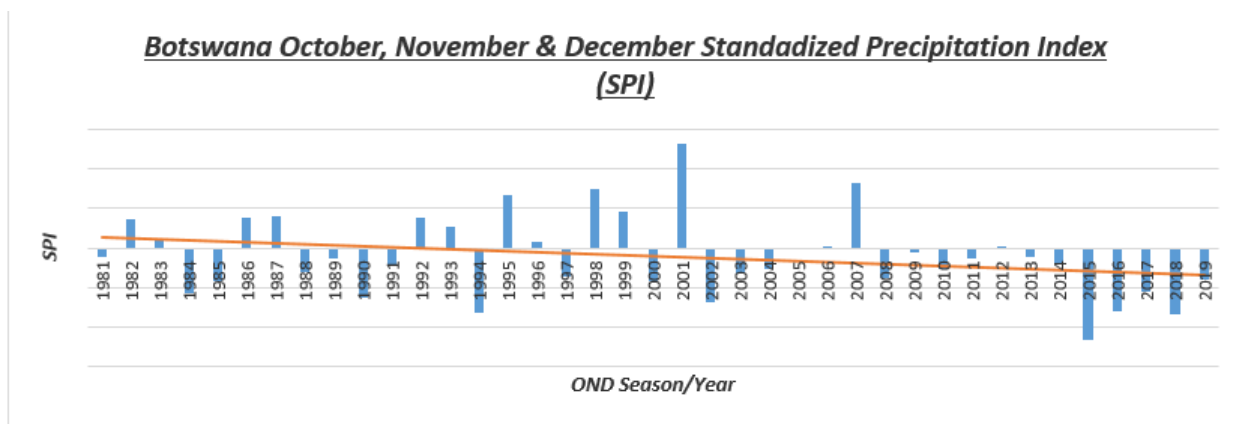


Figure 4: Botswana October, November and December Standardized Precipitation Index

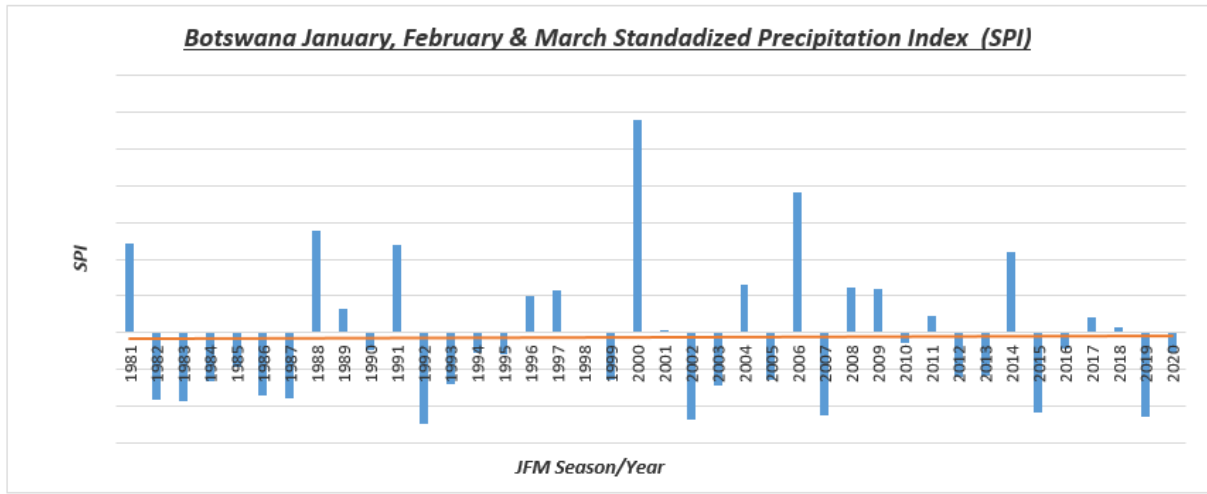


Figure 5: Botswana January, February and March Standardized Precipitation Index

Looking at the entire raining season, October to March, the graph below shows that in general rainfall trend since 1980/81 season has been decreasing slightly. Most of the Meteorological droughts experienced were mild to moderate. For the past 40 years, the 2018/19 was the worst drought experienced, even worse than the 2015/16 drought which had the strongest Elnino of 2.5. 2018/19 was a neutral year in terms of ENSO, but it still had the worst drought, which was severe with an SPI of -1.6. The 1999/2000 severe had extremely wet conditions, which could be related to the invasion of Tropical Cyclone Eline, in February of 2000, resulting in extremely wet conditions in the bulk of Botswana, especially the eastern parts.

The last time Botswana received moderately wet conditions was in the 2013/14 rainfall season when bumper harvest was even produced. Since then, the country has been experiencing moderate to severe droughts for the past Seven (7) seasons.

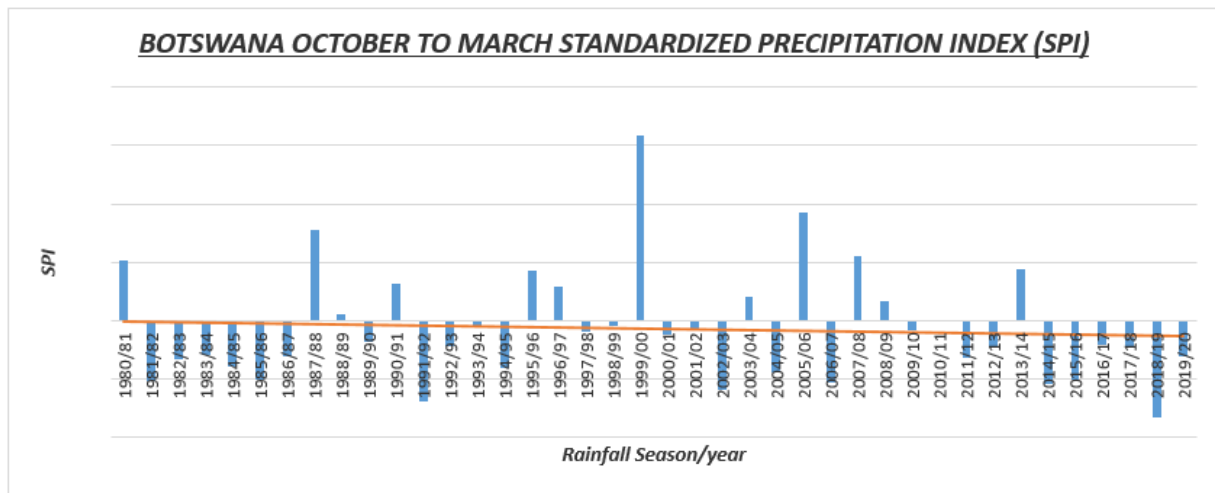


Figure 6: Botswana October to March Standardized Precipitation Index

Table 4: below shows the Standardized Precipitation Index (SPI) of the different years and their seasons showing the extremity of the droughts in Botswana

<u>Year</u>	<u>October to December SPI</u>	<u>January to March SPI</u>	<u>October to March SPI</u>	<u>June to July SPI</u>	<u>Season</u>
1960	1.0	-0.6	0.9	1.4	1960/61
1961	-1.1	0.6	-0.8	-0.6	1961/62
1962	0.5	-0.4	-0.2	0.1	1962/63
1963	1.1	-0.4	-0.7	-0.9	1963/64
1964	-0.2	-1.2	-1.1	-1.0	1964/65
1965	-2.0	-1.1	-0.3	-0.3	1965/66
1966	-0.4	0.5	1.0	1.7	1966/67
1967	-1.3	1.2	-0.6	0.1	1967/68
1968	-0.7	-0.2	0.0	0.0	1968/69
1969	0.2	0.2	-0.9	-0.9	1969/70
1970	-0.1	-1.1	0.0	0.1	1970/71
1971	0.4	0.0	1.5	1.4	1971/72
1972	-1.8	1.5	-1.0	-1.0	1972/73
1973	2.5	-0.4	2.5	2.7	1973/74
1974	0.6	1.7	0.8	1.4	1974/75
1975	0.1	0.6	1.4	1.5	1975/76
1976	0.0	1.5	1.1	1.2	1976/77
1977	0.9	1.2	1.5	1.6	1977/78
1978	-0.6	1.2	-0.5	-0.5	1978/79
1979	0.4	-0.4	0.7	0.5	1979/80
1980	0.1	0.5	1.2	1.1	1980/81
1981	-0.5	1.2	-1.0	-0.9	1981/82
1982	0.3	-0.9	-0.8	-0.7	1982/83
1983	0.0	-1.0	-0.8	-0.9	1983/84
1984	-1.1	-0.8	-0.8	-0.9	1984/85
1985	-1.1	-0.4	-1.1	-0.8	1985/86
1986	0.4	-0.7	-0.8	-0.9	1986/87
1987	1.3	-1.0	1.6	1.8	1987/88
1988	-0.6	1.2	0.3	0.5	1988/89
1989	-0.4	0.5	-0.1	-0.1	1989/90
1990	-1.5	0.0	0.5	0.3	1990/91
1991	-0.3	1.0	-1.4	-1.5	1991/92
1992	0.7	-1.4	-0.3	-0.5	1992/93
1993	0.7	-0.7	0.1	-0.2	1993/94
1994	-1.2	-0.2	-0.7	-0.8	1994/95
1995	1.3	-0.3	0.8	0.8	1995/96
1996	0.2	0.4	0.7	0.7	1996/97

1997	-0.6	0.6	0.0	-0.1	1997/98
1998	1.3	0.2	0.0	-0.2	1998/99
1999	0.9	-0.6	3.0	3.0	1999/00
2000	-0.9	2.8	-0.2	0.1	2000/01
2001	2.8	0.1	-0.1	-0.1	2001/02
2002	-1.1	-1.2	-1.1	-1.3	2002/03
2003	-0.2	-0.8	0.5	0.4	2003/04
2004	-0.6	0.6	-0.7	-0.7	2004/05
2005	0.0	-0.6	1.9	1.7	2005/06
2006	0.0	2.0	-1.0	-1.0	2006/07
2007	1.6	-1.1	1.4	1.2	2007/08
2008	-0.8	0.8	0.3	0.5	2008/09
2009	0.0	0.6	-0.2	0.4	2009/10
2010	-0.8	-0.2	0.0	0.1	2010/11
2011	-0.8	0.3	-0.8	-1.1	2011/12
2012	-0.3	-0.6	-0.8	-0.9	2012/13
2013	-0.5	-0.7	0.9	0.6	2013/14
2014	-0.6	1.1	-1.2	-1.2	2014/15
2015	-2.5	-1.1	-1.2	-1.3	2015/16
2016	-1.6	-0.3	-0.6	-0.8	2016/17
2017	-1.1	0.0	-0.3	-0.6	2017/18
2018	-2.3	0.1	-1.8	-1.7	2018/19
2019	-0.8	-1.0	-0.6		2019/20
2020		-0.3			

Table 5: Botswana SPI

1999/00	690.375	3.163276	Extremely Wet
2005/06	550.7737705	1.845454	
1987/88	519.4327869	1.549598	
2007/08	473.26	1.113732	
1980/81	465.4346154	1.039861	Very Wet
2013/14	449.885	0.893074	
1995/96	445.48	0.851491	
1990/91	423.8208197	0.647031	
1996/97	417.757377	0.589792	

2003/04	398.9310345	0.412074	
2008/09	390.5830508	0.333269	
1988/89	368.035	0.120418	Moderately Wet
2010/11	357.1416667	0.017586	
1998/99	345.3237288	-0.09397	
1993/94	344.257377	-0.10404	
2009/10	338.5651667	-0.15777	
2001/02	338.1833333	-0.16138	
1997/98	335.0457627	-0.191	
2000/01	329.3672131	-0.2446	Normal
1989/90	316.752459	-0.36368	
2016/17	311.132	-0.41674	
2017/18	310.5160345	-0.42256	
1992/93	310.45	-0.42318	
2012/13	308.5351852	-0.44125	
1983/84	293.7322034	-0.58099	
1986/87	290.88	-0.60792	
2019/20	290.7711538	-0.60895	
2011/12	289.5090909	-0.62086	
1982/83	286.5982456	-0.64834	Moderately Dry
1984/85	271.3133333	-0.79262	
1994/95	268.9344828	-0.81508	
2004/05	261.4813559	-0.88544	
1985/86	249.4931034	-0.99861	Severely Dry
2015/16	247.752459	-1.01504	
1981/82	246.7490909	-1.02451	
2006/07	244.2566667	-1.04804	

2014/15	242.1148148	-1.06826
2002/03	230.7603448	-1.17544
1991/92	210.4711864	-1.36697
2018/19	180.7022222	-1.64798

Extremely Dry

Table 6: Drought Indicators used for Meteorological Drought:

Description Drought	Category Drought Type	Drought Index	Classification of drought Index
Moderate	D1	1. Climatic Anomaly (Long term Rainfall Averages of 1981-2010)	-1% to -20% of the average
		2. Standardised Precipitation Index (SPI)	SPI of -1 to -1.49
		3. Rainfall Decile Index (DI %)	20% to 30%
		4. Vegetation Condition Index (VCI %)	50% ≤ 75%
Severe	D2	1. Climatic Anomaly (Long term Rainfall Averages of 1981-2010)	-21% to -30% of the average
		2. Standardized Precipitation Index (SPI)	SPI of -1.50 to -1.99
		3. Rainfall Decile Index (DI %)	10% to 20%
		4. Vegetation Condition Index (VCI %)	36% ≤ 50%
Extreme	D3	1. Climatic Anomaly (Long term Rainfall Averages of 1981-2010)	≤ -31% of the average
		2. Standardised Precipitation Index (SPI)	SPI of ≤ -2
		3. Rainfall Decile Index (DI %)	≤ 10%
		4. Vegetation Condition Index (VCI %)	≤ 36%

5.2 Current Monitoring, Forecasting and data collection

Botswana has a well-developed early warning system for impending drought through the Early Warning Technical Committee. This body makes regular monthly assessments of drought conditions, and reviews nutritional surveillance data gathered. A drought monitoring system is used to inform the decision makers about the possibility of drought risk event well on time before the beginning of the event, so that they can plan for mitigation. Assessment of drought conditions

requires that the team gathers, stores, shares and communicates the available information, which requires a diligent data management for operational system. The Department of Meteorological Services has analytical capacity to play an important role on drought assessment.

5.2.1 A Drought Impact Assessment Methodology

There are many methodologies for drought impact assessment, the country will use the following methodologies to assess drought/low rainfall, hazard analysis, vulnerability analysis and adaptive capacity:

1. The exposure to drought (severity of the drought) at National and Regional Levels
2. Population affected (impact across gender)
3. Sector most severely affected
4. How livelihoods are affected
5. Short-term and long-term food security situation
6. The overall economic performance (GDP impact)

The country will form a multi-sectoral team from sectors, with special attention to those severely impacted by drought with the assistance of United Nations Agencies. The team will be guided by the above methodologies to assess the impact of drought in the country and provide a report to Government for further action. The assessment will be at regular intervals to determine aggregate impacts and use the outputs as risk ranking analysis and classification, and monitoring tool.

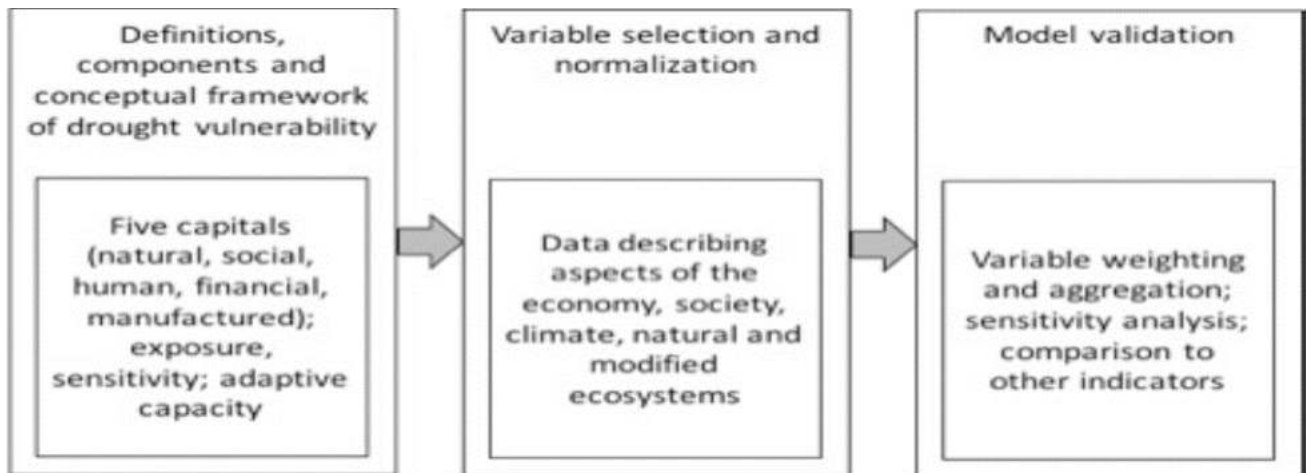


Figure 7: A sample methodological framework for drought vulnerability assessment. Modified from Naumann et al. (2014). (DRAMP Framework: Supporting Technical Guidelines).

5.3 Drought severity in all relevant sectors

Different sectors experience the drought severity differently. While some experience direct severity other would receive it indirectly. The agriculture, livestock, water resources, wildlife, forestry and health are directly impacted by drought severe water scarcity. Around 70% of the country's rural population is dependent on the agriculture sector, therefore, any drought more than half of the country is affected as the overall economy performance would be affected.

While the health and forestry sectors are not directly impacted. The health impacts are mostly results from the impacts on the agriculture such as malnutrition as a result of lack of food, illnesses and deaths, while for the forestry is deforestation, with failure of crops, the forest is last resort for the rural community leading to rapid deforestation

5.3.1 Drought severity and management in water sector

DESCRIPTION OF DROUGHT	CATEGORY OF DROUGHT TYPE	CHARACTERISTICS OF DROUGHT	SOCIO-ECONOMIC IMPACTS	SHORT TERM MITIGATION STRATEGIES	LONG TERM MITIGATION STRATEGIES
MODERATE	D1	<ul style="list-style-type: none"> • A general decrease of surface water availability (50% deficits) • Less than 20 months of supply from dams • 30% decline in Dam levels • Reduced river flows, pockets of water on major river tributaries • Early drying out of water ponds, traditional wells, pans, floodplain areas and reduced wetlands. <p>Groundwater Levels decline by 5m-20m below pump intake</p>	Moderate water deficit	<ul style="list-style-type: none"> • Conjunctive use of both surface and groundwater • Public education and awareness on water use and conservation • Decrease transmission and distribution losses (to >15%) • Monitoring of Water right utilization • Water bowing to vulnerable communities • Rainwater harvesting <p>Destruction of invasive plant species that contribute to water loss</p>	<ul style="list-style-type: none"> • Monitor raw water abstractions • Monitoring release of water from dams as per environmental flows requirement • Rehabilitation of standby boreholes • Negotiate water transfer from transboundary watercourses • Develop National Water Transfers Schemes • Post auditing of wellfields • Development of water resource management strategy • Identification of potential additional water source • Development of Managed Aquifer Recharge strategy • Increase water collection and storage opportunities • Develop communication strategy • Develop early warning systems • Implement Raw water metering and pricing for abstraction

DESCRIPTION OF DROUGHT	CATEGORY OF DROUGHT TYPE	CHARACTERISTICS OF DROUGHT	SOCIO-ECONOMIC IMPACTS	SHORT TERM MITIGATION STRATEGIES	LONG TERM MITIGATION STRATEGIES
SEVERE	D2	<ul style="list-style-type: none"> • A decrease of water availability (less 12 months of supply (dams)) • Water deficit reaches 75%. • 30%-50% decline in level • Reduced perennial river flows • No base flow in major tributaries • Water ponds, traditional wells, pans, wetlands and ponds dry up. • Increases salinity in Groundwater resources • Groundwater levels drop by 20-30m below pump intake 	<ul style="list-style-type: none"> • Severe water deficits 	<ul style="list-style-type: none"> • Connection of standby boreholes • Identification and Drilling of cluster boreholes • Wastewater use • Conjunctive water use • Prohibit raw water abstraction • Curtailment of environmental flow requirement by 35%-50% • Public education and awareness on water use and conservation • Water bowing to vulnerable communities and most affected areas • Improve local transfers • Negotiate acquisition of high yielding boreholes for community supply 	<ul style="list-style-type: none"> • Water rationing • Managed Aquifer Recharge • Increase water collection and storage • Negotiate water transfer from transboundary watercourses • Develop National Water Transfers Schemes • Saline water utilization • Public education and awareness on water use and conservation • Quarterly monitoring of groundwater quality • Water recycling • Real time Groundwater level monitoring • Exploitation of international waters • Metering of high yield privately owned boreholes • Post auditing of wellfield • Eradication of invasive species (e.g. Salvinia, hexanana etc.) • Incentives to invest in water saving technologies • Continuous auditing of wellfields

DESCRIPTION OF DROUGHT	CATEGORY OF DROUGHT TYPE	CHARACTERISTICS OF DROUGHT	SOCIO-ECONOMIC IMPACTS	SHORT TERM MITIGATION STRATEGIES	LONG TERM MITIGATION STRATEGIES
		<ul style="list-style-type: none"> • Drying up of Surface Water Sources • Less 10 months of supply (dams) 	<ul style="list-style-type: none"> • Extreme water deficit • Food insecurity • Hunger and starvation • Thirst 	<ul style="list-style-type: none"> • Implement Raw water metering and pricing for abstraction • Connection of standby boreholes 	<ul style="list-style-type: none"> • Managed Aquifer Recharge • Negotiate water transfer from transboundary watercourses • Develop National Water Transfers Schemes

EXTEREME	D3	<ul style="list-style-type: none"> Major Dams' failure (falls below 5%) Low flows in perennial streams Drying up of shallow boreholes, and sand river aquifers No pocket water in most rivers, dry pans, ponds, traditional wells, floodplain and reduced wetlands. Groundwater levels fall by more than 30m below pump intake. Water deficit is, reaching 80%. 	<ul style="list-style-type: none"> Poor water quality, sanitation and hygiene Severe malnutrition Loss of societal status Increased mortality High enrollment on social protection services 	<ul style="list-style-type: none"> Wastewater use Water recycling Conjunctive water use Decrease transmission and distribution losses (to >22%) Water bowing water to most affected community/areas Implementation and enforcement of water use restrictions Water rationing (3 days) Abstract from private wells for public use Public education and awareness on water use and conservation Drilling and connection of cluster boreholes Saline water utilization Exploitation of international waters <p>Real time groundwater monitoring</p>	<ul style="list-style-type: none"> Development of new water resources (siting and drilling additional borehole) Implementation of drought tariff Education and awareness on water conservation Provide permits to exploit transboundary resources Adjust legal and institutional framework Exploitation of deep-water sources Public education and awareness on water use and conservation Monthly monitoring of groundwater quality Desalination of groundwater resources Incentives to invest in water saving technologies Control of exotic vegetation <p>Continuous auditing of wellfields</p>

5.3.2 Drought severity and management in Livestock sector

drought Category	Description of The Drought Type	Characteristics of Drought	Socio-Economic Impacts	Short Term Mitigation Strategies	Long Term Mitigation Strategies
MODERATE		<ul style="list-style-type: none"> Livestock grazing condition score declining to fair (2). Livestock Body Condition Score (BCS) deteriorating to fair (2) covering more than 25% of the entire country 	<ul style="list-style-type: none"> Slight reduction in livestock productivity Increased livestock sales (>15%) Loss of income 	<ul style="list-style-type: none"> Persuade farmers to reduce stock numbers Cull all unproductive animals Farmers to continue supplementary feeding Intensify monitoring of the drought-stricken hotspots 	<ul style="list-style-type: none"> Incorporate fodder production into livestock production systems Promote appropriate livestock stocking rates Promote drought resistant livestock breeds

	D1	<ul style="list-style-type: none"> Moderate Livestock mortality slightly above 10% due to poor nutrition 		<ul style="list-style-type: none"> Early weaning Inject with vitamins, minerals and deworming Provide winter lick and phosphorus licks	<ul style="list-style-type: none"> Adopt technologies in improved rangeland and livestock management Adopt efficient livestock water management practices (water harvesting) Enforce Natural Resources Conservation Act Introduce livestock insurance schemes Introduce strategic fodder reserves Increase investment in agro-feed manufacturing Research and development on drought tolerant livestock and fodder crops Research and development on climate patterns
--	-----------	---	--	--	---

DROUGHT CATEGORY	DESCRIPTION OF THE DROUGHT TYPE	CHARACTERISTICS OF DROUGHT	SOCIO-ECONOMIC IMPACTS	SHORT TERM MITIGATION STRATEGIES	LONG TERM MITIGATION STRATEGIES
SEVERE DROUGHT	D2	<ul style="list-style-type: none"> Delayed onset of rainfall Livestock Grazing condition very poor (0). Bare ground covering 50% of the entire grazing land. Livestock Body Condition Score (BCS) deteriorating to poor (1) covering 50% of the entire country Increased Livestock mortalities above 25% due to drought 	<ul style="list-style-type: none"> Increased drought related mortalities (>25%) Significant reduction in livestock sales (<8%). Poor livestock productivity Loss of income to famers Increased import bill for livestock products and feeds 	<ul style="list-style-type: none"> Provide winter lick supplementation Inject with vitamins, minerals and deworming Cull all unproductive stock 	<ul style="list-style-type: none"> Incorporate fodder production into livestock production systems Promote appropriate livestock stocking rates Promote drought resistant livestock breeds Adopt technologies in improved rangeland and livestock management Adopt efficient livestock water management practices (water harvesting)

					<ul style="list-style-type: none"> • Enforce Natural Resources Conservation Act • Introduce livestock insurance schemes • Introduce strategic fodder reserves • Increase investment in agro-feed manufacturing • Research and development on drought tolerant livestock and fodder crops <p>Research and development on climate patterns</p>
--	--	--	--	--	---

DROUGHT CATEGORY	DESCRIPTION OF THE DROUGHT TYPE	CHARACTERISTICS OF DROUGHT	SOCIO-ECONOMIC IMPACTS	SHORT TERM MITIGATION STRATEGIES	LONG TERM MITIGATION STRATEGIES
EXTREME DROUGHT	D3	<ul style="list-style-type: none"> • Drying up of Livestock Water sources mainly boreholes • Grazing condition score declining from poor (1) to very poor (0) • Livestock Body Condition Score (BCS) deteriorating to very poor (0) covering more than 70% of the entire country <p>High Livestock mortality (>40%) due to extreme drought</p>	<ul style="list-style-type: none"> • Poor livestock productivity • Low offtake drops to less than 5% • High economic losses to producers • Loss of social status • Destitution • Effect on mental and physical health (non-communicable diseases) • Environmental pollution as a result of decomposing carcasses • Contamination of the underground water sources • High import bill for animal products and livestock feeds 	<ul style="list-style-type: none"> • Drilling of alternative boreholes by government for farmers • Provide winter lick supplementation • Inject with vitamins, minerals and deworming 	<ul style="list-style-type: none"> • Incorporate fodder production into livestock production systems • Promote appropriate livestock stocking rates • Promote drought resistant livestock breeds • Adopt technologies in improved rangeland and livestock management • Adopt efficient livestock water management practices (water harvesting) • Enforce Natural Resources Conservation Act • Introduce livestock insurance schemes • Introduce strategic fodder reserves • Increase investment in agro-feed manufacturing • Research and development on drought tolerant livestock and fodder crops • Research and development on climate patterns

5.3.3 Drought severity and management in Crop Sector

DESCRIPTION	CATEGORY	CHARACTERISTICS	SOCIO ECONOMIC	SHORT TERM MITIGATION STRATEGIES	LONG TERM MITIGATION
MODERATE	D1	<ul style="list-style-type: none"> Poor crop establishment (crop stand of 80%) Late onset of the planting season Intermittent heat waves during growing season Reduced planted areas (<30%)	<ul style="list-style-type: none"> Moderate food supply deficit 	<ul style="list-style-type: none"> Conservation Agriculture Weeding Reduced plant density Use of drought tolerant early maturing Reduced tillage Early warning, information and advice to farmers	<ul style="list-style-type: none"> Adoption of climate smart agriculture farming techniques. Conservation Agriculture Promote drought resilient ecosystems through Research and Development. Provision of crop insurance. Use of early maturing and drought tolerant crop varieties. Improvement of early warning systems
SEVERE	D2	<ul style="list-style-type: none"> Late onset of the planting season Severe intra-seasonal heat waves Reduction in area planted (<40%) Yield reduction of over 50%) 	<ul style="list-style-type: none"> Increase in enrolment of social protection services Rise in food prices due to low produce High food importation bill Reduced household Income 	<ul style="list-style-type: none"> Adopt and adapt Climate Smart Agriculture Monitoring, early warning and information systems 	<ul style="list-style-type: none"> Adopt and adapt Climate Smart Agriculture Promote agricultural insurance schemes Strengthen early warning system [intensifying early information dissemination]. Develop more resilient ecosystems or crop species/types through R & D improvement Develop and review national policies/strategies to cater for drought preparedness.

DROUGHT CATEGORY	CATEGORY	CHARACTERISTICS	SOCIO ECONOMIC	SHORT TERM MITIGATION STRATEGIES	LONG TERM MITIGATION
Extreme		<ul style="list-style-type: none"> Poor crop establishment (crop stand of 80%) Late onset of the planting season Intermittent heat waves during growing season 	<ul style="list-style-type: none"> Moderate food supply deficit Increase in enrolment of social protection services 	<ul style="list-style-type: none"> Conservation Agriculture Weeding Reduced plant density Use of drought tolerant early maturing Reduced tillage 	<ul style="list-style-type: none"> Adoption of climate smart agriculture farming techniques. Conservation Agriculture Promote drought resilient ecosystems through Research and Development. Provision of crop insurance.

	D1	<p>Reduced planted areas (<30%)</p> <ul style="list-style-type: none"> • Late onset of the planting season • Severe intra-seasonal heat waves • Reduction in area planted (<40%) • Yield reduction of over 50%) • Failed seasonal rainfall • Intense intra-seasonal heat waves • Less than 30% of planted area, • Total crop failure • Yield reduction by more than 80 % 	<ul style="list-style-type: none"> • Rise in food prices due to low produce • High food importation bill <p>Reduced household Income</p> <ul style="list-style-type: none"> • Malnutrition for under 5 years' old • General food insecurity especially for the unemployed families • Drastic price increases; 	<p>Early warning, information and advice to farmers</p> <ul style="list-style-type: none"> • Adopt and adapt Climate Smart Agriculture • Monitoring, early warning and information systems • Provision of seeds for the next season • Converting failed crop into animal feeds • Use of early maturing and drought tolerant crop varieties • Intensify vulnerable group feeding schemes (schools, clinics and food basket) and public works 	<ul style="list-style-type: none"> • Use of early maturing and drought tolerant crop varieties. <p>Improvement of early warning systems</p> <ul style="list-style-type: none"> • Adopt and adapt Climate Smart Agriculture • Promote agricultural insurance schemes • Strengthen early warning system [intensifying early information dissemination]. • Develop more resilient ecosystems or crop species/types through R & D improvement <p>Develop and review national policies/strategies to cater for drought preparedness.</p> <ul style="list-style-type: none"> • Development vulnerable group feeding policy • Strengthen Research and Development • Intensify vulnerable group feeding schemes [schools, clinics and food basket] and public works • Improvement of monitoring, early warning and information delivery systems. <p>Develop national adaptation plans to enhance the resilience of arable farming subsector.</p>
--	-----------	---	--	---	---

Alien Invasive Aquatic Plant Species in Botswana: Historical Perspective and Management

Aquatic ecosystems in Botswana have been under threat by the aquatic alien invasive plant species *viz.*, salvinia *Salvinia molesta* Mitchell, water lettuce *Pistia stratiotes* L., and water hyacinth *Eichhornia crassipes* (Mart.) Solms-Laub. While salvinia has been termed the major threat to the Botswana wetlands, water lettuce and water hyacinth are considered to be of minor importance. This review presents the species biology, distribution, historical spread, negative impacts, control achieved right from their discovery in the country by referring to their control and management in the world. Having infested the Kwando-Linyanti-Chobe Rivers in the 1970s, salvinia was initially tried by the use of herbicides, paraquat and glyphosate, between 1972 and 1976. With the discovery of the host specific biological control weevil *Cyrtobagous salviniae* Calder and Sands in 1981, the weevil was introduced by Namibians on Kwando and Chobe Rivers in 1983 and by Botswana in 1986 in the Okavango Delta. While the control was slowly establishing in Kwando-Linyanti-Chobe Rivers, it became apparent that lakes and perennial swamps within and outside Moremi Game Reserve of the Okavango Delta were infested with salvinia from 1992 onwards. With continuous and sustained liberation of the weevil in the Kwando-Linyanti-Chobe Rivers and in the Okavango Delta between 1999 and 2000, salvinia control was achieved by 2003, and since then the weevil constantly keeps the weed at low levels. The success is mainly due to sustainable monitoring through the application of physical and biological control methods. However, salvinia is still threatening the Okavango Delta due to factors such as tourism activities, boat navigation fishing and transportation by wild animals. The first occurrence of water lettuce was recorded on Kwando and Chobe Rivers in 1986. Its biocontrol weevil *Neohydronomous affinis* Hustache was released in the year 1987. The weevil became extinct in Selinda Canal and Zibadianja Lake on Kwando River due to dry and wet events for over 10 years and the weed had been under control biologically on Chobe River. Having surface covered the Selinda and a part of the Zibadianja in high flood and rainfall in 1999/2000 season, research was undertaken to contain water lettuce, which led to its eradication by 2005. Regular physical removal of the water lettuce prior to fruit maturity is an effective method of control or eradicating the weed in seasonal water bodies. The Limpopo Basin (shared by Botswana, South Africa, Zimbabwe and Mozambique) has become vulnerable to water hyacinth infestation. Water hyacinth infested the trans-boundary Limpopo River in 2010 sourced from Hartbeespoort Dam on Crocodile River in South Africa. Botswana and South Africa have been consulting each other to implement integrated control of the weed jointly in the Limpopo River. Water hyacinth could be a continuous threat to the dams and the rivers in the Limpopo basin if its control is not taken seriously.

6 DROUGHT RISK AND VULNERABILITY

6.1 The drought Risk and Vulnerability Assessment and GIS Mapping

Drought risk is an outcome of the likelihood of being exposed to drought hazard. Drought hazard is determined by frequency, duration and severity of droughts. Drought impact on various environments and economy are dependent on the ability to function despite the change in its environment.

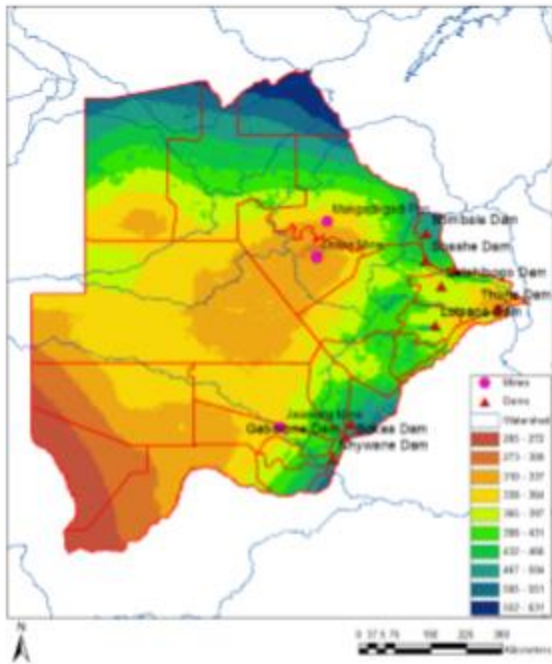
Considering the size of the country, the vulnerability looks at sectoral approach and only hazards connected to rainfall are considered. However, some administrative regions are more vulnerable than others to droughts or insufficient rains due to ecological and socioeconomic (Figure 8).

Drought risk involves both the natural hazard and the human, social, economic and environmental vulnerability of a community or country, and managing risk requires understanding these two components and related factors in space and time. Therefore, proactive drought risk management could save lives and livelihoods. UNCCD emphasis that the principles of risk reduction and prevention adopted as a proactive approach are an urgent need in order to switch from "crisis" management to "risk" management as stated by Brüntrup et al. (2017). This approach improves and increases individual, community, institutional and national capacities to reducing vulnerability to drought impact.

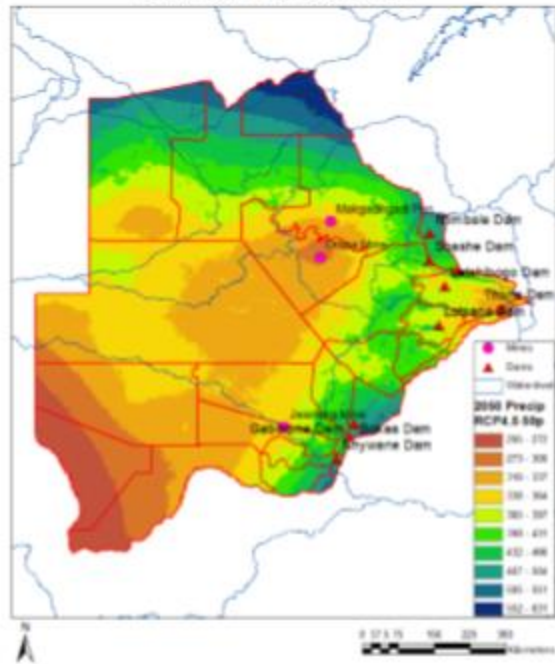
Based on RCP (regional climate projections) modelling (4.5 and 8.5 – see figure 7 and 8) by CIAT1 (2015), climate change will affect agricultural yields directly through changes in temperature and precipitation. This is projected to result in a decrease in suitable area for growing finger millet, dry beans and maize. In contrast, sorghum is projected to greatly increase in its area suitable to production. Increased aridity is expected to lead to an increased grazing stress and deteriorating vegetation, resulting in a reduction of livestock productivity throughout the country. Parts of western Botswana may experience complete losses of grazing areas.

The Adaptation at Scale in Semi-Arid Regions2 (ASSAR - 2018) studies have indicated similar climate change impacts over Southern Africa (Botswana, Namibia and South Africa) that reduced conditions will ensue, more heat waves for temperature increases of 1.5 to 4oC.

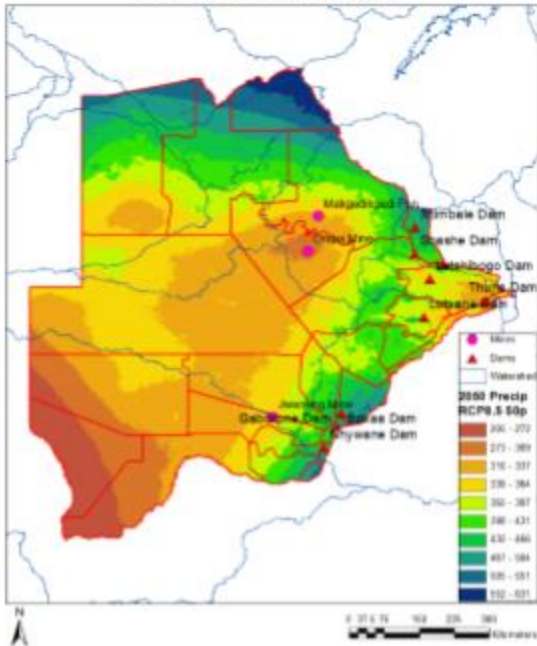
Botswana Historical Average Annual Precipitation (mm)



Botswana 2050 RCP4.5 Annual Precipitation (mm)
GCM/RCM Ensemble Median



Botswana 2050 RCP8.5 Annual Precipitation (mm)
GCM/RCM Ensemble Median



Botswana 2050 RCP8.5 Annual Precipitation (mm)
GCM/RCM Ensemble 25 Percentile

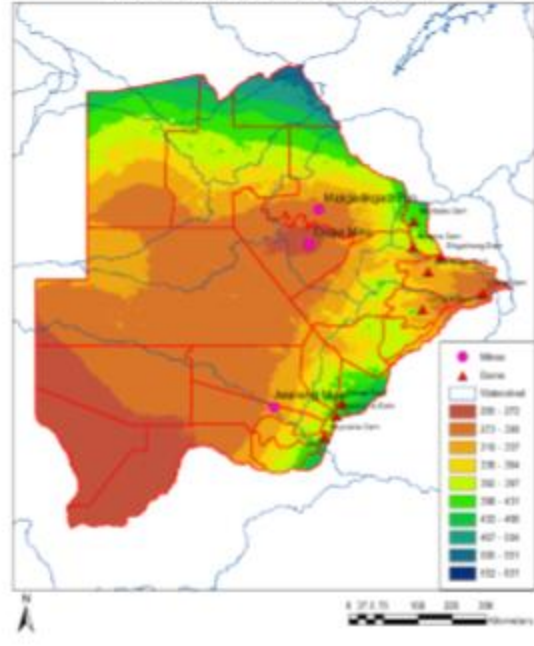


Figure 8: Projected precipitation by 2050 based on RCP4.5 and 8.5

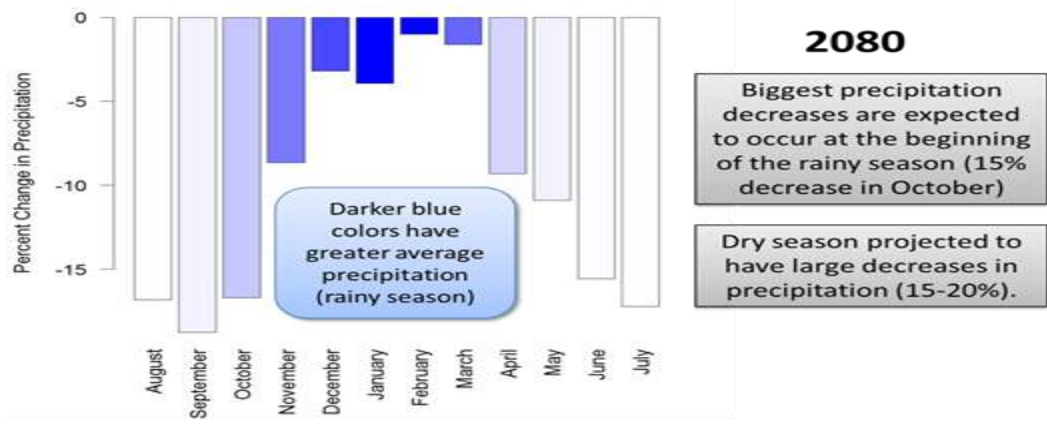


Figure 9: Percent change in precipitation in 2080 under the higher RCP 8.5 greenhouse gas emissions scenario based on an ensemble of 19 climate models from the IPCC Fifth Assessment Report. The darker bars represent months with greater average precipitation (from Climate Wizard, CIAT, 2015).

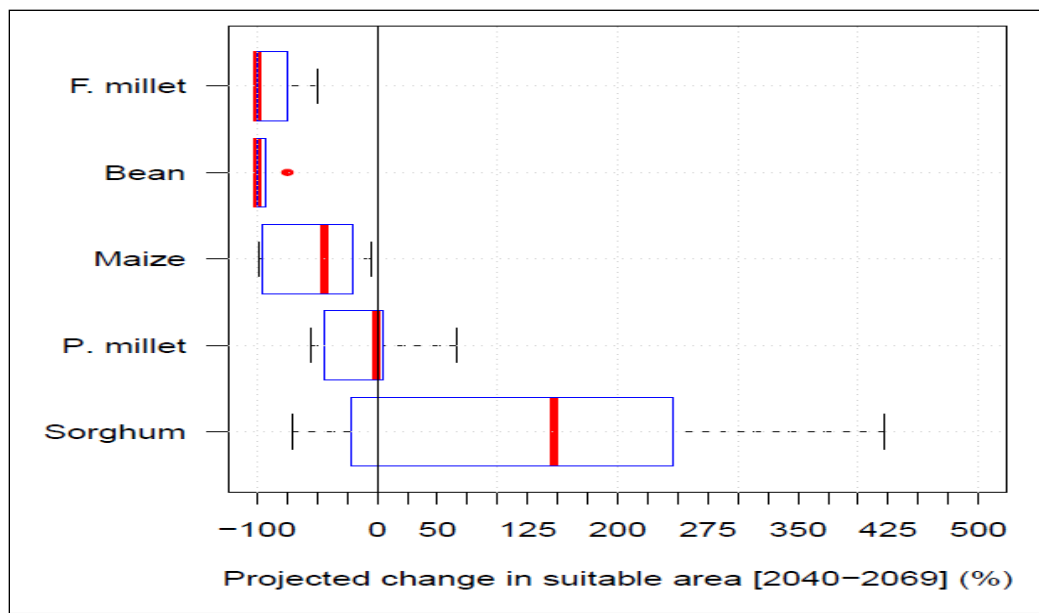


Figure 10: Percent change in suitable area for major crops in Botswana due to climate change (Analysis provided by J. Vargas, CIAT (2015)). The red line represents the average projected change and the blue box and dashed lines represent uncertainty associated with the crop modelling.

6.2 Drought Risk Areas in Various Administrative areas

Due to geophysical conditions, climatic extremes, and high degrees of exposure and vulnerability, Botswana is a highly disaster-prone country, drought being one of the major hazards affecting the country. According to the vulnerability assessment undertaken in 2015, Botswana was affected by drought due to late, unevenly distributed and erratic rainfall during the rainy season, with an overall deficit fluctuating between 25% and 50% - high risk areas (Figure 10). Particularly most affected areas were some areas in Ngamiland, Ghanzi and Kgalagadi districts, which have precipitation shortfall of more than 50%. Variations in vegetation cover and distribution are noticeable in the eastern and western part of Botswana (Figure 11).

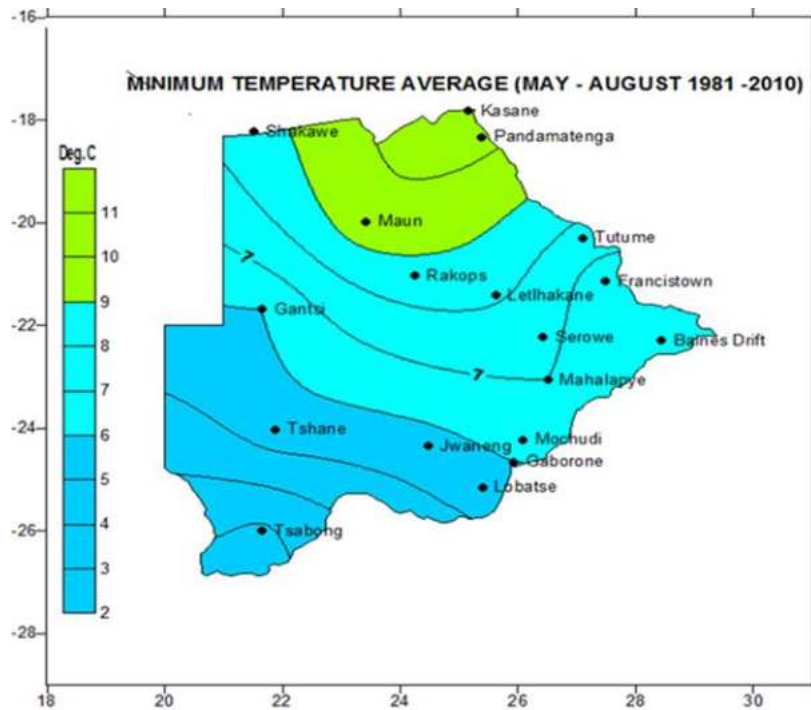


Figure 11: Vulnerability of key sectors to drought hazard

Hot/very high-risk areas: 6 -2 - precipitation shortfall of more than 50%

High risk areas: 9 - 7- Precipitation deficit fluctuating between 25% and 50%

Medium risk areas: 10-rainfall shortfall of 10% and 25%

Low risk areas: 11-short fall more than 5% and excess of 10%

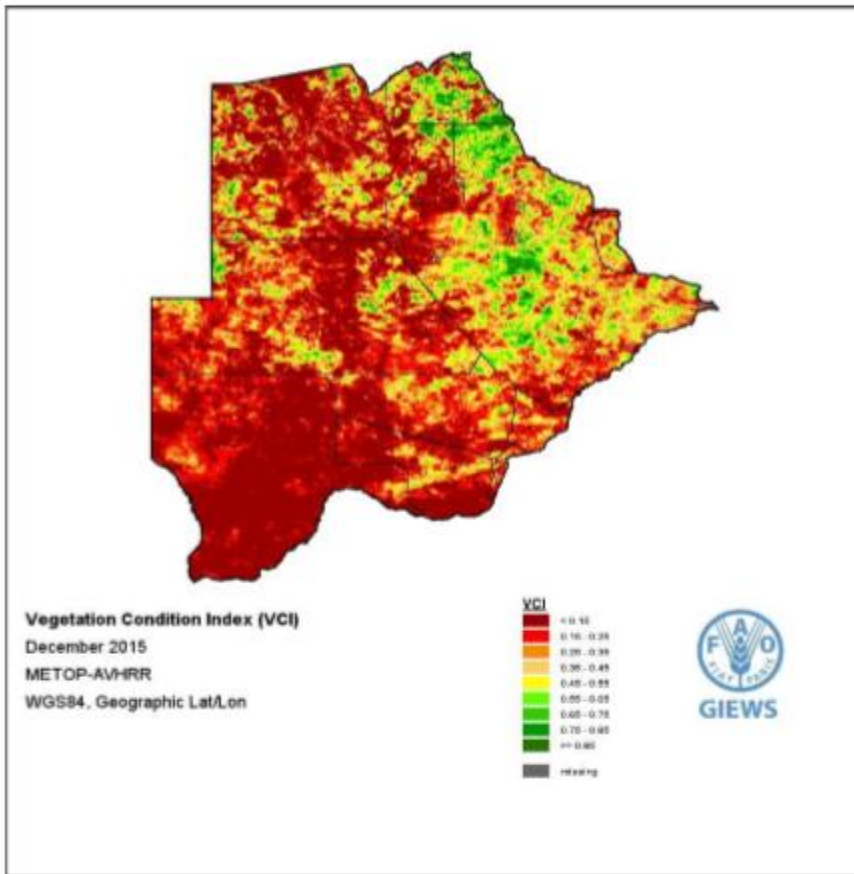


Figure 3: Vegetation condition index showing drought severity across Botswana (December 2015) (Source FAO)

7 DROUGHT COMMUNICATION AND RESPONSE ACTIONS

7.1 Drought Communication protocol

Communication of information is essential for efficient and effective action, development of poverty eradication and socio-economic aspects. In lieu of effective drought incidence response, the Government of Botswana must be dedicated to enlightening the timely availability of appropriate information to the whole nation on drought at all stages (planning, preparedness, occurrence, response and monitoring). In order to mitigate the effects of drought, it is vital that the whole nation is aware of risks that they are exposed to. Therefore, Drought Communication Strategy has to allow all sectors to clarify their specific and thematic messages that should be communicated to different target audiences e.g. sectors such as water, agriculture and health.

The importance of communication plan within a drought management plan is to provide timely information in advance or during the early onset of drought to prompt action within a drought risk management plan as a means of reducing potential impacts. A diligent, integrated approach is vital for monitoring such a slow-onset hazard. Effective drought monitoring and early warning systems require timely, reliable and effective communication of drought risk.

The main aim of an early warning system is to identify when to act to mitigate social, environmental and economic impacts and reduce the chance of losing human lives and livelihoods. Currently, government declares drought with recommendation from Botswana Vulnerability Assessment Committee (BVAC). BVAC conducts the annual Drought and Household Food Security Assessment and Analysis every year with the objectives of assessing the season's rainfall and determine the impact of rainfall amounts on major socio-economic activities. Other objectives are to verify whether the distribution of rainfall had or was likely to severely affect crop and pasture growth, water supplies, livestock and wildlife conditions and ultimately human livelihoods and food security in general.

Figure13 shows a system that collects and share early warning information on a range of droughts events, it describes the basics of an effective Early Warning System and explains what creates and motivates successful implementation of the system. It is a system of information transmission, where data is received and shared.

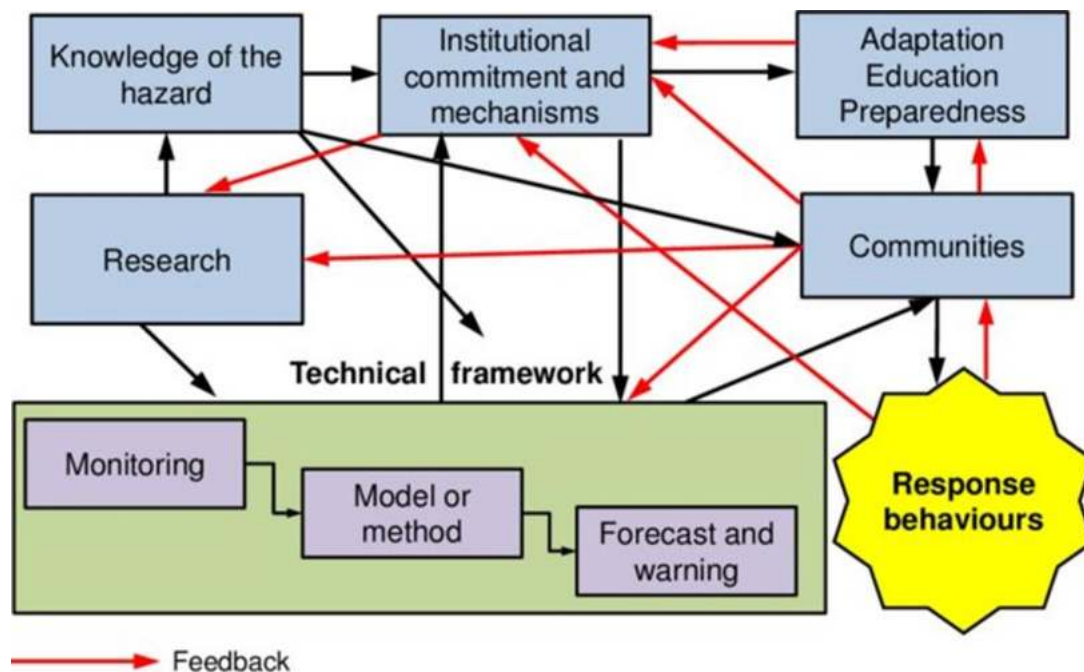


Figure 13. Drought communication channels (Lumbroso, 2016)

Drought early warning system

Drought assessment and monitoring are meant to track, assess and deliver relevant information concerning climatic, hydrologic and water supply conditions and trends. The current drought management monitoring forecasting and impact assessment are reactive (after drought effect and then assess damage or drought state), rather than proactive. Therefore, the proposed proactive approach is going to adopt early warning systems that are much more than forecasts, linking risk information and communication system that actively engages communities involved in preparedness. Risk assessment provides information for setting priorities and developing actions and mitigate drought impacts. Drought risk assessment extends vulnerability assessment by including information about drought hazard independent of sectors and communities potentially impacted by drought. Drought risk can be calculated as:

$$\text{Drought risk} = \text{Vulnerability (V)} \times \text{Hazard (H)}$$

Important to apply the standard definition of Risk = Vulnerability X Hazard X Exposure. A risk assessment that excludes an estimate of vulnerability is not very useful to support decisions and policy. The DRAMP Technical Guidelines, pages 17-24 have much information and guidance on how to do a risk assessment, including a list of indicators and data sources for the vulnerability assessment (DRAMP Framework 2018).

7.2 Drought Declarations conditions, Response to Drought Impacts; and Labour-Intensive Programmes

Drought declarations are made by the President of the Republic of Botswana following recommendations to Cabinet by the Drought Assessment Inter-Ministerial Team. A drought is declared when there is rainfall failure, late commencement of ploughing and planting season, deteriorating of grazing for livestock, and little or no in-flow of water into dams, among others. The President may then recommend:

- Drought Relief Labour Intensive Public Works Programme;
- Adjustment of the wage rates for the Drought Relief Labour Based Public Works Programme;
- Supplementary Feeding should be provided to all children under-five years attending Child Welfare Clinics.
- Provision of subsidies to the agricultural sector.

Drought relief programs funding is drawn from the on-going development projects already in the normal development planning process (CSO, 2009), hence the need to provide for drought funding under the proactive approach. Drought response has always been dependent on government. Therefore, the need for transformation with a modified focus on individual initiative and the private sector (Jacques, 1995). More restructuring, changes of attitudes, and new methods of organization are required to empower people and enable them to take the future into their own hands, with the support of a government which understands issues and facilitates the process.

7.2.1 Emergency management

Drought emergency management activities include preparedness, response, alert, emergency support functions, and relief, rehabilitation, and reconstruction.

7.2.2 Preparedness

Preparedness is aimed at addressing the functions and activities that may be required to deal with a likely or an imminent hazard which can result in a disaster.

7.2.3 Simulation exercises

This plan will allow for various simulation exercises to be conducted by various sectors for various drought scenarios.

The main objectives of simulation exercises are:

- Testing the effectiveness of drought response and contingency plans as well as the level of capacity of all the responsible actors.
- Awareness generation and sensitization of people.
- Learning from the simulation exercise and improving on drought response.

The decisive goal of the Communication Strategy is to improve awareness and understanding on the management of droughts especially on water issues and initiatives in Botswana for effective contribution to poverty eradication and climate change adaptation (Table 7).

7.2.4 The Botswana Government Drought Response, Resilience and Preparedness proposed Plan

As highlighted earlier, Botswana has been applying the reactive approach to respond to drought events also referred to as a crisis management response and this has led to very expensive measures (Rossi, 2000). Government has concluded that it cannot afford this type of approach to drought management. Thus the decision to adopt a proactive strategic approach. The implementation of drought mitigation measures continues during and after the event. Rossi highlighted that precautionary procedures taken in preparation for the drought events reduce the potential vulnerability of the system to the drought.

A drought early warning system identifies climate and water supply trends to detect the probability of occurrence and the likely severity of drought. This information can provide decision makers with timely and reliable access to information on which mitigation measures can be based. Therefore, the plan will try to understand lead causes of vulnerability per location, as an essential component of drought management to reduce risk for the country (Wilhite, 2006). Proactively managing drought risks in an informed and effective way using past drought experiences as well as research and innovation is important to reduce damages and mitigate long-term impacts on development.

The plan will be used to give an outlook on potential ways forward that comprehensively characterize drought events and risk assessment and a systematic analysis to deal with the impacts. The Drought Management Plan will be mainstreamed into National Development Plans.

Drought risk knowledge: Establish a systematic, standardized process to collect, assess and share data, maps and trends on drought and vulnerabilities

- Organizational arrangements established
- Drought characterized
- Community vulnerability assessment
- Risks assessment
- Information stored and accessible

This will improve the adequacy of understanding drought problems especially of natural and non-natural features of water shortages.

Drought monitoring and warning service: Establish an effective drought monitoring and warning service with a sound scientific and technological basis.

- Institutional mechanisms established
- Monitoring Systems Developed
- Forecasting and Warning Systems established
- Improve the struggles in forecasting drought characteristics (duration, severity) and time and space variability over a region;
- Sourcing appropriate network for monitoring hydrometeorological variables and water resources conditions;

Dissemination and Communication: Develop communication and dissemination systems to ensure people and communities are warned of impending drought events and facilitate national coordination and information exchange.

- Organizational and decision-making processes institutionalized
- Effective communication systems and equipment installed
- Warning messages recognized and understood

Governance and Institutional Arrangements: Develop institutional, legislative and policy frameworks that support the implementation and maintenance of effective early warning systems.

- Early Warning Secured as a long term national and local priority
- Legal and Policy Frameworks to support early warnings established
- Institutional capacities assessed and enhanced
- Financial resources secured

Monitoring and evaluation: advocate for meteorological and hydrological data networks that are often inadequate in terms of density of stations for all major climate and water supply parameters. This has been observed to affect data quality, as a result of missing data or an inadequate length of record.

Botswana's national drought plan will also include an inventory of natural, biological, human, government and financial resources for drought response identifying all constraints that may impede the planning and implementation process and specify vulnerable population groups and sectors that are likely to be affected first and the most at each drought category.

Governance and Institutional Arrangements: Develop institutional, legislative and policy frameworks that support the implementation and maintenance of effective early warning systems.

Early Warning Secured as a long term national and local priority

Legal and Policy Frameworks to support early warnings established

Institutional capacities assessed and enhanced

Financial resources secured

Drought risk knowledge: Establish a systematic, standardized process to collect, assess and share data, maps and trends on drought and vulnerabilities

Organizational Arrangements Established

Drought characterized

Community vulnerability assessment

Risks assessment

Information stored and accessible

Drought monitoring and warning service: Establish an effective drought monitoring and warning service with a sound scientific and technological basis.

Forecasting and Warning Systems established

Monitoring Systems Developed

Institutional mechanisms established

Dissemination and Communication: Develop communication and dissemination systems to ensure people and communities are warned of impending drought events and facilitate national coordination and information exchange.

Organizational and decision-making processes institutionalised

Effective Communication systems and equipment installed

Warning messages recognized and understood

Figure 14: Summarizes a list of the main procedures and actions that the government through community and organizations will use when implementing and evaluating early warning systems plan.

The measures and actions used in the drought risk management are to reduce the impacts of drought based on their vulnerabilities of the involved sector, therefore, understanding the mitigation plans and steps is important. Natural resource management – water resource development linked to rangeland productivity; improved sustainable natural resource management and utilization.

Integrated Water Resources Management (IWRM), such as mitigating upstream-downstream user conflicts and coordinating between water users, communities and sectors. Enhancing irrigation schemes through efficient irrigation systems is also important.

Diversifying rural livelihoods through social protection, cash-transfer programs or improving access to markets and rural services: Access to markets could help create alternative non-farm employment that could reduce the impacts of droughts. Other mitigation measures include.

- Crop and animal insurance
- Shifting to early maturing and drought tolerant crop and animal species.
- Managing livestock production within the landscape,
- Livestock services – animal health – routine vaccination, quality assurance; livestock marketing.

Gender mainstreaming -This is a cross-cutting issue in drought risk reduction as drought affect men and women differently. There is an urgent need to adopt gender-responsive approaches in drought preparedness policy making and programming to enable the crucial role of women as actors in drought-risk management initiatives:

- Mainstreaming indigenous drought coping strategies,
- Community-based Early Warning Systems and community-based preparedness and response (contingency plans, funds and services) and methodologies.
- Improved access to financial services - better documentation and improved links with policy makers. Promote drought resilient ecosystems through Research and Development. Use Adopt and adapt Climate Smart Agriculture techniques including Conservation Agriculture. Establish emergency and stabilization fund facility.

Table 7: stakeholders and communication modes

Objective	Stakeholders	Lead agency	Modes of communication
Advocacy, public awareness and education about the status of water and food supply throughout the production season	NDMO, MENT, MoA, MLWSS, MoHW, Research Institution, NGOs Schools and other educational institutions Local Government International Organizations, Regional institutions, National Government Businesses and their associations, Focal Points (UNCCD, UNFCCC, CBD, CITES, UN Ramsar Site etc.)	RDC	Targeted meetings, documentations/films, press release, special interest meetings with resource users, kgotla meetings, radio, TV, road shows, meetings with community representatives, drama, pamphlet, workshops, Internet, fact sheets, briefs, research publications, reports, seminars Media tours/visits, website, Internet/email, media events and relations, Media briefings, coverage in magazines, Newsletters, scientific articles, e-Newsletters, IUCN Knowledge Network, brochures, meetings. electronic messaging boards
Raising awareness about health issues	NDMO, MENT, MoA, MLWSS, MoHW, Research Institution, NGOs Schools and other educational institutions Local Government International Organizations, Regional institutions, National Government, Businesses and their associations	RDC	
Increasing knowledge on the drought level alert system and potential implications	NDMO, MENT, MoA, MLWSS, MoHW, Research Institution, NGOs Schools and other educational institutions Local Government International Organizations, Regional institutions, National Government, Businesses and their associations	RDC	
Identifying mechanisms for effective communication regarding drought status	NDMO, MENT, MoA, MLWSS, MoHW, Research Institution, NGOs Schools and other educational institutions Local Government International Organizations, Regional institutions, National Government Businesses and their associations,	RDC	

7.2.5 Gender-sensitive indicators to monitor results

The declaration, response and coping plan is inclusive of all stakeholders (gender equality) and addresses all related gender issues. The response plan includes gender equality indicators, which are measures of performance that require the collection and analysis of sex disaggregated information on who participates in and benefits from development activities.

Gender equality results refers to results achieved for women and girls compared with those achieved for men, and results that contribute to changing relations between women and men and norms around gender roles (gender relations).

Therefore, gender equality indicators would measure the following:

- The differences in participation, benefits, outcomes, and drought impacts for women, men, boys, and girls;
- changes in gender relations (positive or negative)—that is, changes toward equality, or changes toward inequality between men and women, and between girls and boys; and
- how these changes impact on the achievement of drought plan objectives, particularly on all sectors, poverty reduction, and drought mitigation measures.

Table 8: Reduced vulnerability of low-income women to drought impacts, and strengthened capacity to manage these changes

Gender Equality Indicators
Number of community-based adaptation activities that strengthen women’s access to water resources for sustainable food production and everyday life activities
Number and percentage of low-income women and men with increased resilience to deal with drought disasters, have increased knowledge
Time saved in collecting and carrying water, due to environmentally sustainable and climate change adaptation activities to address the drought disaster.
Evidence that sex-disaggregated information on women’s and men’s access to and use of waterways, and their links and challenges are documented and applied to program planning and implementation
Evidence that national drought policies, frameworks, strategies, and plans require the equal participation and involvement of poor women and men in developing and managing local adaptation and mitigation plans in disaster preparedness and response
Evidence that policies, strategies, and plans are based on gender analysis of the different impacts of drought on low income women and men, and include gender equality objectives for each sector adaptation and mitigation
Number and percentage of women and men whose livelihood is restored following a drought disaster
Evidence that disaster risk management and response strategies include gender equality objectives and are based on gender analysis of women’s and men’s different risks, resilience, and capacity to respond
Number of days of paid work by women and men during relief, recovery, and reconstruction phases
Number and percentage of women and men who receive credit or cash grants to reestablish their livelihoods (or establish new livelihoods)
Number and percentage of women and men in local drought disaster preparedness and management committees, and risk assessment and planning teams
Women’s and men’s satisfaction with the water and sanitation investment including accessibility, quality, reliability, affordability, and maintenance of water supply; conflicts between domestic and other uses for water; credit packages; appropriateness of sanitation facilities; and type of technology used

8 DROUGHT MITIGATION AND PREPAREDNESS

With increasing vulnerability to drought is remarked globally, particularly in the Sub-Saharan Region and with concern on climate change also increasing, a greater attention has been directed to reducing risks associated with drought occurrences through the introduction of policies and plans to improve operational capabilities of climate and water supply/resources monitoring, building institutional capacities and laying mitigation measures that are aimed at reducing the impacts of drought.

Some of the issues on the current status of the country on drought preparedness include the following:

- The low institution capacities and resources of the existing Government bodies (Ministry of Agriculture and the National Disaster Management Office) to deal with drought issues.
- Often drought/crop failures responses are coordinated through both Governmental and Non-Governmental organizations.
- The inventions in terms of reliefs/aids are directed toward human relief and recovery.
- There is little or no post-drought/crop failures evaluation of responses undertaken.
- No existence of a formal drought/crop failure contingency plan.
- The current early warnings can serve drought and famine but need to be instituted in a national drought policy (which does not exist) and a drought plan.
- Climate change vulnerability and risk assessments of sectors often carried out in every four years as part of the National Communication under the United Nation Framework Convention on Climate Change (UNFCCC).
- Drought/crop failure mitigation actions mainly focus on economic and crop diversification and poverty reduction measures, increasingly viewed as part of the development process with drought policy lacking.

As expected, a detailed organizational structure with institutional capacity and resources should be in place to coordinate all actions of government at various levels, as well as those of donors and nongovernmental organizations (NGOs).

8.1 National Water Resources Monitoring and Impact Assessment

Public health policies require portable water to meet certain legislative requirements that ensures no health risks are posed to the public. Development of monitoring programs for water quality for human consumption is based on different risk scenarios for each locality; however, some actions must be guaranteed during drought situations such as the following:

- To develop a collaborative action plan elaborating all activities and strategies to minimize risks to health of human and animals especially in vulnerable locations
- Monitoring and evaluation of different methods of water supply, particularly of alternative solutions used for emergency supplies, such as wells, ponds, fountains and water trucks, and, policies for temporary control until improvements are in relation to sanitary conditions

- Develop and provide controls for sanitary issues recommended by health regulations to carry out the inspection of vehicles responsible for water supply, such as water trucks;
- Provision of capacity building on health education actions in collaboration with health professionals and water truck supply personnel's, particularly in relation to advising people about the proper handling and storage of water, the cleaning and disinfecting of water tanks, the treatment of water intended for human consumption in homes (filtration and the addition of two drops of 2.5% sodium hypochlorite to each liter of water or, in case of the unavailability of hypochlorite, filtration followed by boiling)
- Determine priority sources of water to supply water trucks, prioritizing the capture of water in water treatment plants using conventional forms of treatment and, where not possible, prioritize obtaining water from underground or surface water sources. Perform minimum levels of water treatment through filtration and disinfecting before distribution to the population.
- Request that those responsible for water systems, or alternative collective solution to provide water supplies, systematically monitor the concentration of cyanobacteria in the catchment points of surface water and improve the operational control of water treatment plants, including more frequent washing of fast filters to avoid the accumulation of algae and cyanobacteria in the filter bed, which can cause the release of cyanotoxins into the treated water;
- Maintain links with emergency units (hospital and emergency care) to warn of the possible increase in the number of cases of waterborne diseases, especially acute cases of diarrhea, and a potential increase in the number of cases of psychosocial and behavioral disorders

9 CONCLUSIONS AND RECOMMENDATIONS

The strategies and activities proposed in this National Drought Management Plan are intended to sustainably address the historical and projected challenges Botswana will face and enhance resilience of the economy and citizens under increase droughts due to the projected climate change. The design and implementation of this National Drought Management Plan set the framework for future strategies and actions to alleviate the adverse effects of climate change induced droughts, to raise awareness within the local population about the challenges ahead and to establish Government's commitment to work in partnership with the wider community and development partners to achieve a more sustainable future for the country and her citizens. As global greenhouse gas emissions are continuing unabated, climate change impacts including more frequent and intense drought, are likely to intensify an already precarious situation into the future. If no action is taken to reduce or minimize expected drought impacts, the costs to society and the economy will be immense. Botswana National Drought Management Plan identifies the sectors that are most vulnerable to climate change induced drought impacts and proposes interventions to mitigate and respond to these impacts, while promoting climate change-resilient production systems. Activities identified in the National Drought Plan require substantial additional and adequate financial resources for their implementation, and funding is therefore required from both domestic and

international sources. Partnerships must be forged, and all stakeholders should mainstream climate and drought management and responsive activities in their programmes and projects. New and additional resources are needed to support Botswana's research, development as well as strengthen academic institutions that are competent enough to identify and predict drought incidence, time-wise persistence, and termination.

Recommendations are:

- To make a commitment to reduce the gender gap between women and men by detailing actions to empower women and meet the different priorities of women and men in responding to drought.
- Promote gender differentiated sustainable land management best practices.
- Integrate and enhance scientific and indigenous drought monitoring and early warning systems.
- Translate the National Drought Plan into Botswana languages.
- The National Drought Plan, once agreed, should be continuously updated at specified intervals after evaluation and revision. Information should be sought from the government, NGO's and the public sector with participation of all stakeholders.
- Increase access to drought tolerant crops
- Develop guidelines for project staff, government and non-government partners for use in the design, implementation, monitoring and evaluation of drought disaster risk reduction activities.
- Encouraging farmers to use treated wastewater for irrigation, which will reduce the pressure on groundwater
- Institutionalize multi-sectoral and integrated water resource management approaches that promote rational utilization and conservation based on community needs and priorities and the protection of the ecosystem.
- Capturing rainwater by harvesting and building micro and macro-dams for storing water.
- Explore water efficiency and management of water demand, particularly in dry areas like the Kgalagadi districts
- Build capacity and strengthen local expertise on the concepts of Integrated Water Resources Management
- Review existing policies and regulations to identify gaps
- Sensitize policy makers about drought laws and the need for enforcement
- Integrate drought response actions into budget systems
- Drought Early warning system should consider health of the people particularly of the most vulnerable

9.1 The National Drought Action Plan

9.1.1 Priority Implementation Actions

A variety of strategies and actions must be pursued to improve the resilience of the country's economy especially the sectors (agriculture, water resources, fisheries, forestry and wildlife) that are climate and rainfall dependent. In Botswana these investments must be made as part of a

comprehensive plan that includes, for the water resources sector, expanded water conservation, water recycling, storm water capture and reuse, local and regional water storage, groundwater management and other strategies to ensure water supply reliability and ecosystem health. For the forestry and protected areas (National Parks and Forest Reserves), tree growing using indigenous trees which are climate and climate change resilient would work under harsh conditions including droughts. Based on stakeholder consultations and literature review, the following key actions are relevant to the development and implementation of Botswana National Drought Management Plan as indicated in Table 9 below.

Table 9: BOTSWANA NATIONAL DROUGHT PLAN

National Priority Setting and Cross-cutting projects and actions to implement National Drought Plan and Resilience under Changing Climate in Botswana is estimated at a total cost of US\$ 31,100,000

Strategic objective	Objective	Activities	Output	Lead agency	Partners/ stakeholders	Time frame	Estimated cost (USD)
1. Governance and institutional arrangement	Improve sectoral coordination and institutional arrangement	<p>a) Establish Drought Management Office</p> <p>b) Establish Drought Management National Task Team</p> <p>c) Provide the valuable insight and perspectives necessary for a more robust and comprehensive drought management plan.</p> <p>d) Participate in the development and review of the Drought Management Plan</p> <p>e) Guide and facilitate the means to collect and review data on drought assessment</p> <p>f) Develop a representative and applicable drought definition, water use priorities, and operating principles;</p>	<p>A functional DM Office established.</p> <p>A functional National Task Team established</p> <p>Comprehensive drought management plan provided</p> <p>Drought management plan reviewed</p> <p>Data on drought assessment facilitated and reviewed</p> <p>Country specific drought definition, water use priorities and operating principles developed</p>	RDC	NDMO MENT MoA MLWSS MoHW	2020 - 2021	500 000

2.	Develop institutional, legislative and policy frameworks that support the implementation and maintenance of effective early warning systems.	<ul style="list-style-type: none"> a) Secure Early Warning as a long term national and local priority b) Establish Legal and Policy Frameworks to support early warnings c) Assess and enhance Institutional capacities d) Outsource Financial resources 	<p>Early Warning Secured</p> <p>Legal and Policy Frameworks to support early warnings established</p> <p>Institutional capacities assessed and enhanced</p> <p>Financial resources outsourced</p>	RDC	NDMO MENT MoA MLWSS MoHW		350,000
3. Drought risk knowledge	Establish a systematic, standardized process to collect, assess and share data, maps and trends on drought and vulnerabilities	<ul style="list-style-type: none"> a) Characterize drought risk assessment. b) Undertake desk top study on historical droughts profile and information c) Identify challenges of the implementation of the previous drought events and management plans; d) Compile lessons learned from management of past droughts; 	<p>Drought characterized.</p> <p>Historical desk top study undertaken.</p> <p>Challenges of the Implementation drought management plans identified.</p>	RDC	NDMO MENT MoA MLWSS MoHW	2020 - 2021	900,000
	Community vulnerability assessment of the economy (water, agriculture, livestock, forests, wildlife protection, ecosystems, commercial industries, trade etc.)	<ul style="list-style-type: none"> a). Conduct vulnerability assessment at all levels b) Identify future vulnerabilities and impacts across subnational and national jurisdiction and across relevant sectors. c). Assess and identify historical and potential future drought impacts 	<p>Vulnerability assessment conducted</p> <p>Future vulnerabilities and impacts identified</p> <p>Historical and potential future drought impacts assessed</p>	RDC	NDMO MENT MoA MLWSS MoHW	2020 - 2021	750,000

		<p>d) Determine the potential drought mitigation measures that address the potential future drought impacts</p> <p>e) Develop drought stages, trigger points, and response targets that are based on the identified climate change related drought scenarios</p> <p>e) Develop national and Districts Drought Management Plan based on the impacts, and response measures and strategies</p> <p>f) Develop and implement medium- and longer-term drought mitigation and response strategies at the national and District levels.</p>	<p>Potential drought mitigation measures determined</p> <p>Drought stages, trigger points and response targets identified</p> <p>Districts drought management plans developed</p> <p>Drought mitigation and response strategies at the national and Districts level developed</p>				
Drought monitoring and warning service	Establish an effective drought monitoring and warning service with a sound scientific and technological basis.	<p>a) Establish Forecasting and Warning Systems</p> <p>b) Develop a National Drought Monitoring Systems</p> <p>c) Establish Institutional mechanisms</p>	<p>Forecasting and Warning Systems established</p> <p>Monitoring Systems Developed</p> <p>Institutional mechanisms established</p>	RDC	NDMO MENT MoA MLWSS MoHW	2020 - 2022	500,000
Dissemination and Communication	Develop communication and dissemination systems to ensure people and communities are warned of impending drought events and facilitate	<p>a) Install effective communication systems and equipment</p> <p>b) Computerize all climatic and sectoral observations and communication system:</p>	<p>Effective Communication systems and equipment installed</p> <p>Warning messages recognized and understood</p> <p>All climatic and sectorial observations and</p>	RDC	NDMO MENT MoA MLWSS MoHW		750,000

	national coordination and information exchange.	<p>c) Establish real time information dissemination to central and sectoral databases for the climate and other environment observations;</p> <p>d) Equip (computers and software) climate and sectoral databases facilities required to manage data receipt, storage, access, visualization, climate service creation and dissemination;</p> <p>e) Provide reliable and stable internet services to all the operators of climate and environmental data bases;</p>	<p>communication system computerized</p> <p>Real time information dissemination databases established</p> <p>Sectoral database facilities equipped</p> <p>Reliable and stable internet provided</p>						
Water sector									
Water Resource Management	Creation of new surface and groundwater storage and improved distribution systems at the community and District Administrative levels to help address the nation's projected stresses in the surface and groundwater resources under changing climate related drought conditions	<p>a) Implement water conservation measures, awareness campaigns</p> <p>b) Develop national water conservation strategy</p> <p>c) Assess water resources and scarcity</p> <p>d) Develop programs to protect urban poor from price increases</p> <p>e) Increase data availability/access and documentation</p>	<p>Water conservation measures and awareness campaigns implemented</p> <p>National water conservation strategy developed</p> <p>Water resources and scarcity assessed</p> <p>Programs to protect urban poor from prices increases developed</p> <p>Data availability/access and documentation increased</p> <p>Water resources for rural areas diversified and increased</p>	MLWSS	NDMO MENT MoA MoHW RDC	2020 - 2021	-	1,500,000	

		<p>f) Diversify and increase water resources for rural areas</p> <p>h) Adopt indigenous methods of water use</p> <p>i) Implement integrated water resources management strategies</p>	<p>Indigenous methods of water use adopted</p> <p>Integrated water resources management strategies implemented</p>				
Agricultural sector							
		<p>a) Intensify national irrigation network use of desalination water, soil-water-crop management strategies, rainwater harvesting, and treated wastewater to address increasing water scarcity.</p> <p>b) Implement conservation systems: adoption of zero tillage to improve soil structure and increase soil water infiltration. Climate smart agriculture</p> <p>c) Diversify crops to lessen risks and increase productivity.</p> <p>d) Improve crop varieties toward varieties tolerant to disease, heat and drought, and toward early-maturing varieties.</p> <p>e) Provide seeds and fertilizer to help increase productivity (through the government's Integrated Support Programme for Arable Agriculture</p>	<p>National irrigation network use desalination. Soil-water-crop management strategies, rainwater harvesting, and treated wastewater to address increasing water scarcity intensified</p> <p>Conservation systems implemented</p> <p>Crops to lessen risks and increase productivity diversified</p> <p>Crop varieties improved</p> <p>Seeds and fertilizers provided</p>	MoA	NDMO MENT MoA MLWSS RDC	2020 - 2023	15,000,000

		<p>Development agricultural support scheme)</p> <p>f) Use greenhouses/nets to improve growing conditions</p> <p>h) Improve early-warning systems for better coordination and emergency and response planning</p> <p>I) Improve access to farm inputs and credit, and improve agricultural extension services</p> <p>j) Construct dams, well, and irrigation schemes and livestock</p>	<p>Greenhouses/nets used</p> <p>Early-warning systems improved</p> <p>Access to farm inputs improved</p> <p>Dams, wells and irrigation schemes constructed</p>				
Livestock sector							
		<p>a) Supplementary feeding animals during drought</p> <p>b) Vaccinate against opportunistic diseases that result from drought</p> <p>c) Move cattle to better pastures</p> <p>d) Focus on livestock breeds that are more drought- and disease-tolerant</p> <p>e) Fence off grazing areas for individuals or syndicates</p> <p>f) Match livestock breeds to the local environment</p>	<p>Animals during drought fed</p> <p>Opportunistic diseases vaccinated</p> <p>Cattle moved</p> <p>Livestock breeds that are more tolerant focused</p> <p>Off grazing areas fenced</p> <p>Livestock matched</p>	MoA	NDMO MENT MoA MLWSS RDC	2020 - 2022	10,000,000

		g) Diversify farm produce h) Use fallback grazing areas I) Use mixed small-stock and large-stock herds of various breeds	Farm produce diversified Fall-back grazing areas used Mixed small and large stock used				
Health sector							
Health Services		a) Implement malaria control programmes b) Control diarrheal diseases and integrate management of childhood infections c) Provide social safety nets for the health sector d) Intensify public awareness on health issues during drought	Malaria control programme implemented Diarrheal diseases controlled Social safety nets provided Public health awareness intensified	MoHW	NDMO MENT MoA MLWSS RDC	2020 - 2023	850,000

9.2 Monitoring, Reporting and Verification of The Implementation of The National Drought Plan

Monitoring, evaluation, reporting and verification will be critical activities of the implementation of this Botswana National Drought Management Plan. These activities are expected to ensure that implementation actions of the Plan are effective and put more emphasis on integration of climate change risks and responses into development frameworks. These activities should be able to influence and effectively contribute to the achievement of sectoral, national and regional development objectives and goals as well as complement national efforts and on-going and planned initiatives by other bi-lateral and multilateral development partners.

The overarching objectives of the Monitoring and Evaluation (M&E) System will be to track the transition of Botswana to a low carbon and climate resilient economy. This will include:

1. Provision of a clear picture of the various drought mitigation and response measures.
2. Provision of an assessment of the effectiveness of these mitigation and response measures.
3. Applying a consistent approach to these assessments to allow for greater comparability.
4. Increasing co-ordination of climate change response measures.
5. Demonstrating impact of response measures to Government and development partners.
6. Increasing transparency on financial flows relating to climate and climate change related drought responses; and
7. Increasing awareness of historical, observed and projected droughts and their impacts.

A development of an integrated framework for measuring, monitoring, evaluating, verifying and reporting results of response actions and the synergies between them is recommended. Internal feedback from monitoring and evaluation is important as it would ensure effective implementation of the Botswana National Drought Management Plan. The framework for assessing the effectiveness of investment in the drought management is critical for the continued mobilization of financial and technological support. National, bilateral and multilateral financial partners and other providers of finance use the results of MRV systems to validate the effectiveness of funds provided. Therefore, an ideal MRV framework for Botswana should:

1. Be based on the existing institutions and knowledge.
2. Be informed by planned disaster management governance structures.
3. Provide guidance on the implementation of drought response actions, whether in the form of policies, projects, programmes or investment ventures.
4. Help Botswana fulfil her international reporting obligations on drought assessment.
5. Demonstrate Botswana's drought financing readiness; and
6. Provide a strong platform for attracting international climate finance flows from multilateral and bilateral development partners.

For effective and efficient monitoring, reporting and verification, criteria with quantitative and qualitative indicators disaggregated according to gender and covering various sectors and levels of the national economy need to be developed and utilized in the monitoring process. Particular attention should be paid to coverage of the activity whether it be at the grassroots level community, sub-national and/or national; agriculture, water resources, ecosystem, etc.; local level, middle-level and high-level decisions-makers and national policymakers. The monitoring and evaluation criteria must also include the assessment of the impacts of the activity on the community and at the national levels such as change in knowledge and awareness on drought management, improvement in the livelihoods and influence on decision and policy making at the local and national levels.

Indicators to be developed for the MRV system should include for example institutional adaptive capacity indicators that provide measures of the effectiveness of national initiatives to build institutional capacity to address the challenges of drought hazards at the county level such as the number of Ministries, Civil Society Organizations, Youth and Women Groups, Media Agents, etc., that have received training for staff operating at district/county and national levels on the cost and benefits of the effective drought management. The indicators should also include vulnerability indicators that may be a mixture of process-based and outcome-based indicators and should measure the effectiveness of local and national level initiatives to reduce vulnerability to drought risks at the national level. Such indicators include number of people (disaggregated according to gender) permanently displaced by droughts and the number of households that need support such as pipe-borne water and food aid.

9.2.1 Implementation of The National Drought Action Plan

The implementation of Botswana National Drought Action Plan is dependent on the existing and implementation of the Drought Policy and the National Climate Change Policy (draft), development and enactment of a climate change legal framework and a well-established institutional structure with well-defined roles and responsibilities of institutions and individuals.

Drought Implementation Framework and Future Revision of the Plan

The cross-cutting and overarching role of policy, legislative and institutional reform enable Botswana to climate change response, the following priority actions are envisaged for the implementation of Botswana National Drought Plan. Many of the mitigation measures are geared towards the improvement of sustainable availability of water supplies under climate and climate change drought management systems and framework. The activities indicated in the Plan and aligned to the national priorities such as Vision 2036 and National Development Plan 11 of Botswana.

Partnerships and an Integrated Approach

A collective approach with research institutions, local and central Governments, communities, private sector, resources users and other partners is an essential and sustainable means of implementing the Botswana National Drought and Management Plan. The scale of climate change related droughts impacts far exceeds the ability of any one country, agency, or organization to

effectively respond as a single entity. Existing sustainable partnerships, which have evolved over time, are an ideal platform to support combined efforts towards mutual goals for drought response. Additionally, new partnerships specific to climate change related droughts should be forged to provide the enabling environments for closer working relations on a range of science and drought response and mitigation tools for decision making.

Financing and resourcing the Botswana National Drought and Management Plan

The planned activities for climate and disaster management can be financed from various sources from both domestically and internationally. Finance is critical to addressing hazards, including droughts, because large-scale investments are required to significantly reduce impacts, notably in key sectors such as water resources, agriculture, fisheries, forestry and parks and wildlife. In accordance with the principles of Multilateral Environment Agreements (CBD, UNCCD and UNFCCC), developed countries are to provide financial resources to assist developing countries in implementing the objectives of the Agreements. It is important for all governments and stakeholders to understand and assess the financial needs developing countries have so that such countries can undertake activities to address climate change hazards including droughts.

9.3 Future Updates and Revisions

Drought is expected to worsen, becoming more severe under projected climate change. Hence, it is critically essential that national and sub-national systems and institutions relevant for future drought management should be revised and updated to become more resilient and to promote resilient economies. The following will be relevant for the revision and updating of the national and sub-national systems.

- National institutions, parastatals, and private organization should have action plans in place, including scenarios founded on the historic occurrences of droughts, an inventory of existing resources, and they should be able to identify what resources are required for a timely response to droughts under future climate and climate change situations.
- It is necessary to strengthen the performance capacity of the structures under the natural resources and social sectors (e.g., Health) in order to develop timely responses to reduce the risk of drought across national and sub-national systems.
- To reduce the impacts of droughts on the national economy, it is essential to develop actions to strengthen the ability of emergency services to deal with emergencies associated with drought in order to ensure the provision of services and the reduction of ensuing risks.
- Studies and research must be conducted to produce guidance documents to support the participation of drought prone sectors and communities in emergencies for the management of information, for the evaluation of lessons that are learned, and to improve the work process both continuously and permanently.
- The use of Indigenous knowledge must also be considered will developing drought management plans
- Develop and strengthen the understanding of the behavior of droughts and associated disasters and to have prior knowledge of their geophysical, environmental, social, economic, and political characteristics, as well as the health profile of the population in the affected areas.

10 REFERENCES

- Babugura, A.A, 2008. Vulnerability of Children and Youth in Drought Disasters: A Case Study of Botswana. *Children, Youth and Environments*, Vol. 18, No. 1, Children and Disasters, 126-157
- Batisani N (2011) The spatio-temporal-severity dynamics of drought in Botswana. *Journal of Environmental Protection*, 2, 803-816 doi:10.4236/jep.2011.26092 Published Online August
- Batisani N (2012) Climate variability, yield instability and global recession: the multi-stressor to food security in Botswana. *Clim Dev* 4:129–140
- Botswana Government, Drought Management Strategy 2020
- Botswana Government and United Nations (2010) Botswana Millennium Development Goals Status Report.
- Botswana Government. Revised Botswana Biodiversity Strategy and Action Plan, 2007.
- Botswana Government. Accelerated Remote Area Development Policy – 1987
- Botswana Government. Community Based Natural Resources Management Policy – 2004
- Botswana Government. Community Based Strategy for Rural Development – 1997
- Botswana Government. Eco-tourism Strategy – 2001
- Botswana Government. Environmental Impact Assessment Act – 2005
- Botswana Government. Game Ranching Policy – 2002
- Botswana Government. National Agricultural Development Policy (NADP) – 1991
- Botswana Government. National agroforestry strategy and action plan-2020
- Botswana Government. National Forestry Policy – 2000
- Botswana Government. National Land Policy – (Reviewed 2003)
- Botswana Government. National Policy for Rural Development – 2002
- Botswana Government. National Policy on Land Tenure – 1985
- Botswana Government National Meteorological Services Act--2014
- Botswana Government. National Policy on Natural Resources Conservation and Development – 1990
- Botswana Government. National Policy on the Use and Management of Natural resources (Agricultural Resources Conservation) –1999
- Botswana Government. National Policy on Tribal Grazing Land (TGLP) – 1975
- Botswana Government. National Settlement Policy – 1998
- Botswana Government. National Strategy for Poverty Reduction – 2003
- Botswana Government. National Tourism Policy – 1990
- Botswana Government. National Water Policy – 2005
- Botswana Government. National Wetlands Policy – 2000
- Botswana Government. Waste Management Act – 1998
- Botswana Government. Wildlife Conservation Policy – 1986
- Botswana, S., 2017. Botswana Environment Statistics. *Water Clim. Dig.*
- Byakatonda J. 2020. Investigating relationship between drought severity in Botswana and ENSO. *Natural Hazards*,100:255–278
- Davies, J., Spear, D. and Omari, K., 2017. Background paper on Botswana's draft drought management strategy Siderius, C., Gannon, K.E., Ndiyoi, M., Opere, A., Batisani, N., Olago, D., Pardoe, J., &Conway, D. (2017). Hydrological Response and Complex Impact Pathways of the

- 2015/2016 ElNiño in Eastern and Southern Africa, *Earth's Future*,5.
<https://doi.org/10.1002/2017EF000680>
- Davies, J., Spear, D., Omari, K., 2017. Background paper on Botswana's draft drought management strategy.
- Ding, Y., Hayes, M.J., Widhalm, M., 2011. Measuring economic impacts of drought: a review and discussion. *Disaster Prev. Manag. Int. J.* 20, 434–446.
<https://doi.org/10.1108/09653561111161752>
- Ding, Y., Hayes, M.J., Widhalm, M., 2011. Measuring economic impacts of drought: a review and discussion. *Disaster Prev. Manag. Int. J.* 20, 434–446.
<https://doi.org/10.1108/09653561111161752>
- Ding, Y., Hayes, M.J., Widhalm, M., 2011. Measuring economic impacts of drought: a review and discussion. *Disaster Prev. Manag. Int. J.* 20, 434–446.
<https://doi.org/10.1108/09653561111161752>
- Donald A. Wilhite, M.V.K. Sivakumar and Deborah A. Wood (Eds.). 2000. Early Warning Systems for Drought Preparedness and Drought Management. Proceedings of an Expert Group Meeting held in Lisbon, Portugal, 5-7 September 2000. Geneva, Switzerland: World meteorological Organization.
- Drought Management Plan for Botswana 2020
- Foguesatto, C.R., Artuzo, F.D., Talamini, E., Machado, J.A.D., 2020. Understanding the divergences between farmer's perception and meteorological records regarding climate change: a review. *Environ. Dev. Sustain.* 22, 1–16. <https://doi.org/10.1007/s10668-018-0193-0>
- Foguesatto, C.R., Artuzo, F.D., Talamini, E., Machado, J.A.D., 2020. Understanding the divergences between farmer's perception and meteorological records regarding climate change: a review. *Environ. Dev. Sustain.* 22, 1–16. <https://doi.org/10.1007/s10668-018-0193-0>
- Gannon, K., Conway, D., Pardoe, J., Ndiyoi, M., Batisani, N., Odada, E., Siderius, C. (2018). Business experience of floods and drought-related water and electricity supply disruption in three cities in sub-Saharan Africa during the 2015/2016 El Niño. *Global Sustainability*, 1, E14. doi:10.1017/sus.2018.14
- Hazelton, D.G., Pearson, I., Kariuki, A.W., 1994. Development of drought response policy options for the cost-effective provision of water supply to rural communities subject to recurring droughts. Report to the Water Research Commission by the Development Services and Technology Programme Division of Water Technology CSIR WRC Report No 506/1/94
- Holm, J.D., Morgan, R.G., 1985. Coping with Drought in Botswana: an African Success. *J. Mod. Afr. Stud.* 23, 463–482. <https://doi.org/10.1017/S0022278X00057189>
- Holm, J.D., Morgan, R.G., 1985. Coping with Drought in Botswana: an African Success. *J. Mod. Afr. Stud.* 23, 463–482. <https://doi.org/10.1017/S0022278X00057189>
- Integrated Drought Management Programme (IDMP), Svoboda, M., Fuchs, B., 2016. Handbook of Drought Indicators and Indices. Drought Mitig. Cent. Fac. Publ.
- Jacques, G. 1995. Drought in Botswana: Intervention as Fact and Paradigm. Pula: Botswana Journal of African Studies Vol. 9 No.1
- Jacques, G., 1995. Drought in Botswana: intervention as fact and paradigm.
- Juana, J. 2014. Socioeconomic Impact of Drought in Botswana. *International Journal of Environment and Sustainable Development* 11(1):43-60

Lumbroso, D., 2016. Building the concept and plan for the Uganda National Early Warning System (NEWS). Final report.

Morgan, R., 1985. The development and applications of a drought early warning system in Botswana. *Disasters*, Volume 9 (1), pg. 44-50

Nachtergaele, F., 1999. From the soil map of the world to the digital global soil and terrain database: 1960-2002. *Handb. Soil Sci.* CRC Press Boca Raton H5-17.

Phaup, M. & Kirschner, C., 2010, 'Budgeting for disasters: Focusing on good times', *OECD Journal on Budgeting* 1, 1–22. <https://doi.org/10.1787/budget-10-5kmh>

Rossi, G., 2000. Drought Mitigation Measures: A Comprehensive Framework, in Vogt, J.V., Somma, F. (Eds.), *Drought and Drought Mitigation in Europe*, *Advances in Natural and Technological Hazards Research*. Springer Netherlands, Dordrecht, pp. 233–246. https://doi.org/10.1007/978-94-015-9472-1_18

Rossi, G., 2000. Drought Mitigation Measures: A Comprehensive Framework, in Vogt, J.V., Somma, F. (Eds.), *Drought and Drought Mitigation in Europe*, *Advances in Natural and Technological Hazards Research*. Springer Netherlands, Dordrecht, pp. 233–246. https://doi.org/10.1007/978-94-015-9472-1_18

S. Pulwarty, R., Sivakumar, M.V.K., 2014. Information systems in a changing climate: Early warnings and drought risk management. *Weather Clim. Extreme.*, High Level Meeting on National Drought Policy 3, 14–21. <https://doi.org/10.1016/j.wace.2014.03.005>

S. Pulwarty, R., Sivakumar, M.V.K., 2014. Information systems in a changing climate: Early warnings and drought risk management. *Weather Clim. Extreme.*, High Level Meeting on National Drought Policy 3, 14–21. <https://doi.org/10.1016/j.wace.2014.03.005>

S. Pulwarty, R., Sivakumar, M.V.K., 2014. Information systems in a changing climate: Early warnings and drought risk management. *Weather Clim. Extreme.*, High Level Meeting on National Drought Policy 3, 14–21. <https://doi.org/10.1016/j.wace.2014.03.005>

Siegle J., 1990. Botswana's approach to drought: how disaster relief can be developmental. A Plan B paper submitted to Michigan State University in partial fulfilment of the requirements for the Degree of Master of Science, Department of Agricultural Economics.

Simmons, C., Lyons, S., 1992. Rhetoric and Reality: The management of Botswana's 1982-88 drought relief programme. *J. Int. Dev.* 4, 607–631.

Stone, R.C., 2014. Constructing a framework for national drought policy: The way forward – The way Australia developed and implemented the national drought policy. *Weather Clim. Extreme.*, High Level Meeting on National Drought Policy 3, 117–125. <https://doi.org/10.1016/j.wace.2014.02.001>

Stone, R.C., 2014. Constructing a framework for national drought policy: The way forward – The way Australia developed and implemented the national drought policy. *Weather Clim. Extreme.*, High Level Meeting on National Drought Policy 3, 117–125. <https://doi.org/10.1016/j.wace.2014.02.001>

Stone, R.C., 2014. Constructing a framework for national drought policy: The way forward – The way Australia developed and implemented the national drought policy. *Weather Climate. Extreme.*, High Level Meeting on National Drought Policy 3, 117–125. <https://doi.org/10.1016/j.wace.2014.02.001>

UN General Assembly, transforming our world: the 2030 Agenda for Sustainable Development, 21 October 2015, A/RES/70/1, available at: <https://www.refworld.org/docid/57b6e3e44.html> [accessed 3 May 2020]

United Nations Convention on Biological Diversity – 1992

United Nations Convention on Combating Desertification (UNCCD) – 1992

United Nations Convention on Wetlands of International Importance – 1971

United Nations Framework Convention on Climate Change – 1992

Valentine, T.R., 1993. Drought, Transfer Entitlements, and Income Distribution: The Botswana Experience World Development, Vol. 21, No. I. pp. 109-126

Wilhite, D.A., 2000. Chapter 1 Drought as a Natural Hazard: Concepts and Definitions 22.

Wilhite, D.A., 2006. Drought monitoring and early warning: Concepts, progress and future challenges. World Meteorology. Organ. WMO 1006.

Wilhite, D.A., 2006. Drought monitoring and early warning: Concepts, progress and future challenges. World Meteorology. Organ. WMO 1006.

Wilhite, D.A., Sivakumar, M.V.K., Pulwarty, R., 2014. Managing drought risk in a changing climate: The role of national drought policy. Weather Climate. Extreme., High Level Meeting on National Drought Policy 3, 4–13. <https://doi.org/10.1016/j.wace.2014.01.002>

World Meteorological Organization (WMO); Global Water Partnership (GWP) - WMO, 2016 (WMO-No. 1173)