

STATISTICS BOTSWANA

BOTSWANA ENVIRONMENT STATISTICS: NATURAL DISASTERS DIGEST 2015

BOTSWANA ENVIRONMENT STATISTICS: NATURAL DISASTERS DIGEST 2015

Published by
Statistics Botswana
Private Bag 0024, Gaborone
Tel: 3671300
Email: info@statsbots.org.bw

Copyright Reserved © 2016

Extracts may be published if
Sources are duly acknowledged

PREFACE

Statistics Botswana, through the Environment Statistics Unit (ESU), presents the second edition of the Botswana Environment Statistics: Natural Disasters Digest. The digest provides reliable and current statistics together with a trends analysis on natural disasters, focusing specifically on climate variability, floods, droughts and veldt fires with particular reference to incidences, impacts and responses. The report also presents Botswana Government's policy framework and risk reduction strategies for natural disasters.

Secondary data were used in the production of this digest and were drawn mainly from the National Disaster Management Office, Department of Forestry and Range Resources, Ministry of Local Government and Rural Development as well as the Ministry of Agriculture.

The Framework for Development of Environmental Statistics (FDES) of the United Nations Statistical Division was used in the preparation of this digest. As in the first edition of the Botswana Environment Statistics: Natural Disasters Digest, the statistical information provided in this digest is important for evidence-based decision making with particular reference to natural disasters risk reduction and disaster management.

I wish to acknowledge the National Disaster Management Office, Department of Forestry and Range Resources, Ministry of Local Government and Rural Development and Ministry of Agriculture for their significant contribution by providing the required data and making invaluable comments on the draft report. The continued production of this report is dependent on strong collaboration with our key stakeholders.

For more information and further enquiries, contact the Directorate of Stakeholder Relations at 3671300. All Statistics Botswana outputs/publications are available on the website at www.cso.gov.bw and at the Statistics Botswana Library which is based at the Head-Office in Gaborone.

Thank you.



Anna Majelantle
Statistician General
May, 2016

CONTENTS

Preface	4
EXECUTIVE SUMMARY	8
1.0. INTRODUCTION	10
1.1. Methodology	11
2.0. CLIMATE VARIABILITY SITUATION IN BOTSWANA	13
2.1. Temperature	13
2.1.1. Long Term Average (LTA) temperature Versus Short Term Average (STA) temperature	13
2.2. Rainfall	14
2.2.1. Long Term Average (LTA) rainfall Versus Short Term Average (STA) rainfall	14
2.2.2. Seasonal Rainfall (October – December 2014) and Vegetation Conditions	15
3.0. FLOODS AND STORMS	17
3.1. Incidences, Impacts/Damages and Responses	18
3.1.1. Floods	18
3.1.2. Storms Incidences (Hailstorms, Storm Winds & Thunderstorm)	19
3.1.3. Heavy Rains	21
3.2. Disaster-related Response- Economic, 2009 - 2014	22
4.0. DROUGHT	24
4.1. Drought Occurrences and Impacts/Severity	24
4.1.1. National Crop Yield and Production Estimates	26
4.1.2. Cattle Holding with Drought-Related Livestock Mortality	26
4.1.3. Cereal Requirements and Production	28
4.1.4. Human Water Supply Situation	31
4.2. Response to Drought Impacts	32
4.2.1. Drought Declarations and Labour Intensive Programmes	32
4.2.2. Food Relief Services	34
4.2.3. Drought-Tolerant Livestock (Tswana Breed & MUSI Composite Cattle Breed)	37
5.0. VELDT FIRES	40
5.1. Impacts of Veldt Fires	40
5.1.1. Fire Incidences	40
5.1.2. Fire Affected Area	41
5.1.3. Areas Burnt in Protected Areas	42
5.2. Response to Impacts of Veldt Fires	43
5.2.1. Response Time to Veld Fires	44
6.0. POLICY FRAMEWORK AND DISASTER RISK REDUCTION EFFORTS	45
6.1. Policy Framework	45
6.2. Disaster Risk Reduction Efforts	45
6.3. Climate Smart Agriculture/Conservation Agriculture Programme	48
Reference:	50
ANNEXS	52

LIST OF TABLES

2.1: National Average Maximum and Minimum Temperatures (long vs. short terms)	14
2.2: National Average Rainfall (mm) during Rainy Season (long vs. short terms)	15
3.1.1: Floods Incidences & Impacts by District, 2010 - 2015	18
3.1.2: Storm Incidences, Impacts & Responses by District, 2010 - 2015	19
3.1.3: Heavy Rain Incidences & Impacts by District, 2010 - 2015	21
3.2: Summary of Disasters-related Response (Economic) in Botswana (2009-2014)	23
4.1a: Occurrences of Drought in Botswana (Drought declarations)	24
4.1b: Drought Situation Summary for Districts	26
4.1c: National Crop Yield (planted) in kg/ha	26
4.1d: Cattle Holding with Drought-Related Livestock Mortality by District (2009 - 2013)	27
4.1e: Cereal Requirements in ('000) Tons by Crop from 1998-2013	28
4.1f: Cereal Production in Tons by Crop from 1999-2012	29
4.1g: Imports of Cereals by Crop from 1999-2015	30
4.1h: Percentage Dam levels in 2014/15	31
4.2a: Labour Intensive Public Works Programmes (2009-2014)	33
4.2b: Employment status, Wage and sustenance rates for financial years 2009/10 to 2015/16	33
4.2c: Annual Food Supplies and Deliveries for the Feeding Programmes, 2009 – 2010 All Depots (Summary)	35
4.2c: Annual Food Supplies and Deliveries for the Feeding Programmes, 2011 – 2013 All Depots (Summary) Continued...	36
4.2d: MUSI Cattle population by District and Ranch (2008 - 2015)	38
4.2e: Drought-Adapted/Tolerant Livestock Population ('000) by District (2008 - 2013)	39
5.1a: Number of Fire Incidences by District (1994-2014)	41
5.1b: Fire Affected Area (Hectares) per District 2006-2015	41
5.1c: Percent of Fire Affected Area (Hectares) per District 2006-2015	42
5.1d: Burnt Areas in Protected Areas (2008-2011)	43
5.1e: Percent of Burnt Areas in Protected Areas (2008-2011)	43
5.2a: Response Time to Veld Fires by District (2006)	44
6.1: Status on Disaster Risk Reduction Initiatives as at 2013	47

LIST OF FIGURES

Figure 1.1: The Components of the UNFDES (Component 4 in particular)	12
Figure 2.1: National Average Maximum and Minimum Temperatures (long vs. short terms)	14
Figure 2.2: National Average Rainfall (mm) during Rainy Season (long vs. short terms)	15
Figure 2.3: Rainfall for October to December 2014	15
Figure 2.4: Rainfall for October to December 2014	16
Figure 2.5: Normalised difference vegetation Index (NDVI) anomaly map from September dekad 1, 2014 to March dekad 2, 2015	16
Figure 3.1.1a: Floods Impacts & Assistance Given by District, 2010 - 2015	18
Figure 3.1.1b: 2015 Okavango Delta Flood Update	19
Figure 3.1.2: Storms Impacts & Responses by District, 2010 – 2015	20
Figure 3.1.3a: Heavy Rains Incidences & Impacts by District, 2010 - 2015	22
Figure 3.1.3b: Heavy Rains Incidences & Impacts by District, 2010 - 2015	22
Figure 3.2: Summary of Funds spent on Disaster Relief in Botswana (2009-2014)	23
Figure 4.1a: Drought Severity Map	25
Figure 4.1b: National Crop Yield (planted) in kg/ha	26
Figure 4.1c: Drought-Related Livestock Mortality, Ngamiland 2015	27
Figure 4.1d: Cattle Holding with Drought-Related Livestock Mortality by Region (2009 - 2013)	28
Figure 4.1e: Cereal Requirements in ('000) Tons by Crop from 1998-2013	29
Figure 4.1f: Cereal Production in ('000) Tons by Crop from 1999-2012	29
Figure 4.1g: Imports of Cereals by Selected Crop from 1999-2015	30
Figure 4.1h: Water Supply vs. Demand, 2014/15	32
Figure 4.2a: Labour Intensive Public Works Programmes (2009-2014)	33
Figure 4.2b: Cumulative Employment status by sex for financial years 2009/10 to 2015/16	34
Figure 4.2c: Musi Composite Cattle Breed	37
Figure 4.2d: MUSI Cattle population by District and Ranch (2008 - 2015)	38
Figure 4.2e: National Musi cattle population (2008 - 2015)	38
Figure 4.2f: Drought-Adapted/Tolerant Livestock Population ('000) by Region (2008 - 2013)	40
Figure 5.1a: Fire Affected Area (Hectares) per Selected Districts 2006-2015	42
Figure 5.1b: Percent of Fire Affected Area (Hectares) per Selected Districts 2006-2015	42

EXECUTIVE SUMMARY

The purpose of the Botswana Environment Statistics: Natural Disasters Digest 2015 is to provide reliable statistics and trends analysis on natural disasters, with particular reference to incidences, impacts and responses to floods, droughts and veldt fires. It is guided by the United Nations Framework for the Development of Environment Statistics (UNFDES).

The report is divided into five main sub-sections; i) Climate Variability Situation in Botswana; ii) Floods Impacts and Responses; iii) Drought Impacts and Responses; iv) Veldt Fires Impacts and Responses; and v) Policy Framework and Disaster Risk Reduction Efforts.

With regards to climate variability, the report compares Long Term Average (LTA) temperature for the period 1971-2000 with short term temperature averages for the years 2010 to 2014. Maximum average temperature in the review period fluctuated slightly around the LTA of 29.50C. The year 2012 recorded 29.880C while 2014 recorded slightly lower at 29.250C. Minimum temperature for all the years in the review period exceeded the LTA figure of 12.60C. In 2014 the minimum temperature average was 14.080C. This indicates that temperatures have been generally getting warmer over the recent years.

The national average rainfall experienced a significant decrease from an average of 463.7mm during the period 1970/71 – 2000/01 (LTA's) to a short term average (STA) of 375.5 mm recorded in 2013/14. Generally, rainfall has been on the decline during the recent years (STA) when compared to the long term averages.

With regards to the seasonal rainfall from October to December 2014, the report shows that most Districts received normal to above normal rainfall. However, there are other Districts such as Kgatleng, South East, and Kgalagadi that received below normal rainfall.

During the 2010-2015 period a total of 825 households and 3,361 individuals were affected by floods. As a result, 767 tents and 361 food baskets were given as relief. The impacts of floods were more pronounced in the Tutume Sub-District during the period 2010 – 2015 with 446 households affected and 1,489 individuals displaced in 2013 alone. A total of 981 households were affected by heavy rains during the period 2013 – 2015; 30.89 percent of the households were recorded in the North West District in 2013 and 29.97 percent% were recorded in the Central District during the same year. A total of BWP 41,240,830 was expended by government during the period 2009 – 2014 to provide relief.

The whole country was drought stricken during these periods: 1981-1987; 1991-1999; 2001-2005; 2007-2008; 2011-2013; and 2014. The worst drought in recent years was from 1981 to 1987 followed by 1990 to 1995. The results also indicate that Ghanzi, Kgalagadi, Southern, and South East Districts had the highest drought severity compared to other Districts. The crop yields do not meet the country's food requirements, hence the over dependence on imports and high food prices. A total of BWP 6.01 Billion was used to import cereals (maize, rice, sorghum, millet and wheat) from 1999 to March 2015. As for "Cattle Holding with Drought-Related Livestock Mortality by District and Region, 2009 – 2013" the report reveals that the total number of cattle holdings which experienced livestock mortality (cattle) during the period 2009-2013 followed an upward trend.

It is observed that dam levels during the period 2014/15 were going down with each month. In particular, Gaborone Dam was declared failed when it reached a life-threatening level of 1.7 percent% recorded in June 2015. Botswana is faced with a challenge of below to normal rainfall, hence this decline.

As a response to droughts the Botswana Government introduced Labour Intensive Public Works Programmes and Feeding Programmes. The amount of money expended in the Labour Intensive Public Works Programmes increased between 2009/10 and 2015/16. There has been a decline in the distribution of food commodities at both primary schools and health facilities while remote area dwellers continue to exhibit high levels of malnutrition.

The highest numbers of National Fire incidences were recorded in 2008 (278), 2010 (256), and 2011 (251). The Ngamiland District experienced more fire incidences during the review period followed by Central and Kweneng Districts. The largest total area affected by fire in Botswana was recorded in 2011 (15,439,034 hectares), followed by 12,685,235 hectares in 2010 and 11,846,790 hectares in 2008. In 2011 Ghanzi, Ngamiland and Kgalagadi Districts experienced the largest areas affected by fire. As for the areas burnt in protected areas for the period 2008 to 2011, the Central Kalahari Game Reserve (CKGR) experienced the greatest extent of wild fires.

In an effort to improve disaster preparedness, the Botswana Government established the National Committee on Disaster Preparedness (NCPD) in 1993. In addition, the Government went on to formulate and implement the National Policy on Disaster Management in 1996. In 2013 the Botswana Government implemented the National Disaster Risk Reduction Strategy of 2013 - 2018 after realising that the frequency and magnitude of disasters are on the rise. The National Climate Smart Agriculture (CSA) Program for Botswana for 2015 - 2025 has been developed and is expected to be launched sometime this year (2016) to transform agricultural systems towards more productive, efficient, resilient and sustainable systems in the era of food insecurity and climate change.

1.0. INTRODUCTION

Natural disasters are naturally occurring events or aftermath of natural hazards affecting daily human activities (CSO, 2009), while a natural hazard is a threat to society. The hazard exists because of human activities, which are constantly exposed to natural forces (Dunno, 2011: 7). In an event where there is vulnerability, natural disasters result from natural hazards. Disasters can cause massive damage to environmental assets and human development, while degraded environments, settlement patterns, livelihood choices as well as climate change - exacerbate disaster impacts (UNEP, 2009; Kanwar & Thummarukudy, 2014: 5).

The year 2011 saw the highest economic losses yet due to natural disasters, estimated at US\$370 billion worldwide. This is an increase from 2010, which saw US\$226 billion in economic losses, already three times the total of 2009 (World Bank, 2014: 1). World Disaster Report 2014 on the other hand reveals that 337 disasters related to natural hazards (typified hereafter as "natural disasters") and 192 related to technological hazards ("technological disasters") were reported worldwide in 2013. During the same year floods were the most frequent natural disasters. According to World Disaster Report 2014 the number of deaths caused by natural disasters (22,452) is almost 80 percent below the average for the decade (97,954), much lower than the peak years of 2004 (242,829 deaths), 2008 (235,272 deaths) and 2010 (297,728 deaths).

Africans are confronted with rising incidences of natural disasters, partly due to the effects of climate change, extreme weather events which are on the rise in many parts of the continent (IRFC, 2011). For example, the Sahel region and the Horn of Africa suffer droughts so persistent that crops will not grow and millions of people are deprived of basic food necessities, sometimes amounting to an absolute famine particularly in vulnerable places like Somalia. IRFC (2011) also reports that many other parts of the continent are prone to flooding, for example, heavy rains in Congo and Northern Angola increasingly lead to massive flooding in the areas banking the Zambezi River. This was illustrated by the devastating floods of 2000 and 2001 in Mozambique, which drew the world's attention through television images of a woman giving birth in a tree. Subsequently such floods not only kill people and livestock by drowning, they can also lead to a major upsurge of waterborne diseases such as cholera.

In Botswana, about 418 households and 1,669 individuals were affected by floods in the North West, Kgatleng, and Ngwaketse Districts in 2010 (Statistics Botswana, 2014). The same report reveals that floods affected a total of 329 households and 1,756 individuals in Mahalapye Sub-District alone during the year 2012. CSO (2009) further reports that the whole country was impacted by droughts during the years: 1981–1987; 1991–1999; 2001–2005; 2007–2008, and 2012. Both Bobirwa and Ngamiland Districts experienced the highest drought-related cattle mortality in 2011/12 and 2012/13 compared to the rest of the Districts in Botswana (Statistics Botswana, 2013: 134).

Exacerbating these effects is climate change which causes changing and increasing temperatures, sea level rise, changing rainfall patterns, reduced water availability and increasing frequency, duration and intensity of severe weather events such as cyclones, monsoons, droughts and bushfires (IPCC, 2007; Kanwar and Thummarukudy, 2014).

The impacts of natural disasters on the livelihoods of communities and the natural environment they depend on are prominent and devastating, and they have risen concerns internationally hence their inclusion in 'The 2030 Agenda for Sustainable Development.' The new agenda highlights the need for disaster risk reduction across a number of sectors in line with the understanding that disaster risk reduction is cross-cutting and requires a multi-sectoral approach. Going forward, the on-going development of indicators to monitor the Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction will support coherence and align implementation (<http://www.unisdr.org/>).

It is against this challenging background and the need to support the on-going development of indicators to monitor the SDGs that data collection and documentation of natural disasters statistics is important.

These statistics will inform policies related to disaster risk reduction as well as adaptation and mitigation against the effects of climate change. The purpose of this digest therefore, is to provide and discuss reliable statistics and trends analysis on natural disasters, with particular reference to floods, drought and veldt fires (incidences, impacts and responses) in Botswana.

1.1. METHODOLOGY

The United Nations Framework for the Development of Environment Statistics (UNFDES) guided the production of this digest, particularly "Component 4" of the framework which focuses on "Extreme Events and Disasters" (see Figure 1.1). The FDES is a statistical framework which helps in organizing the collection and compilation of environment statistics (UNFDES, 2013). It is based on a conceptual foundation that takes into account people and their demographic, social and economic activities (the human sub-system) as integral parts of, and interacting with the environment.

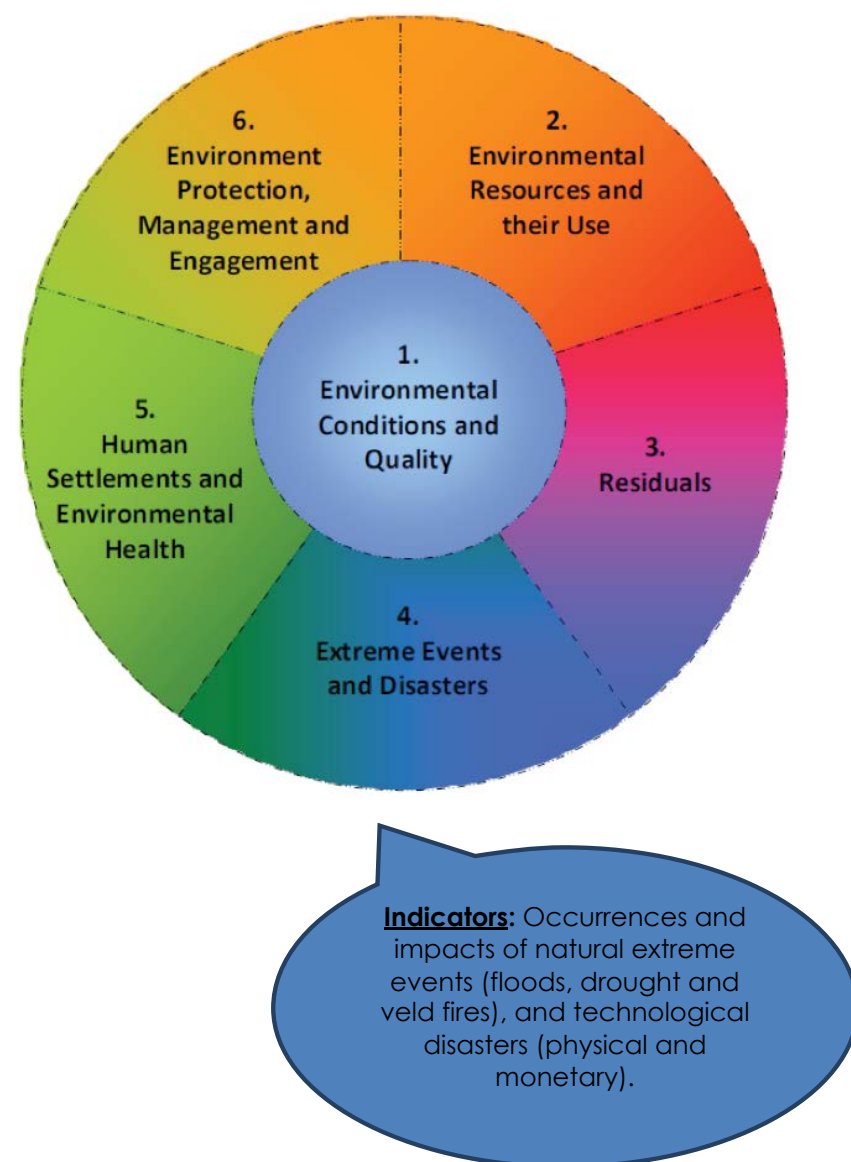
Data for this digest are secondary (administrative records) and were drawn from various departments namely the Department of Forestry and Range Resources (Fire Section), National Disaster Management Office under the Office of the President, Department of Meteorological Services, Rural Development Council, Ministry of Agriculture (Agriculture Statistics Unit), and other relevant literature. Formal data request letters were sent to the afore-mentioned stakeholders/data providers during the first quarter of the year 2015/16. During the same period, follow-ups were made to ensure that at least enough data had been gathered to start the analysis and report writing. Both data analysis and report writing were done during the second and third quarter of the year 2015/16. Data were captured and analysed in Microsoft Excel software. Subsequent to that was the validation of the statistics by data providers as well as the rigorous review of the draft report by both the Statistics Botswana Editor and other Statisticians at different hierarchical levels.

The UNFDES supports the use of administrative records. Most of the environmental-related administrative data sources have been usually obtained from government agencies, NGOs, Research Institutions, just to mention a few. According to UNFDES (2013) the main advantage of using administrative data sources is that;

...the cost of collecting such data is usually much less than establishing and conducting a survey. The level of response burden is minimized and complete coverage is assured of units under administration. However, there are usually differences between administrative and statistical terms and definitions; there is the risk of deliberate misreporting; and there may be restriction of access to the data (p.24).

The FDES is an important framework as it is expected to contribute significantly to improved monitoring and measurement of the environmental dimension of Sustainable Development and to the post-2015 development agenda.

FIGURE 1.1: THE COMPONENTS OF THE UNFDES (COMPONENT 4 IN PARTICULAR)



Source: United Nations Statistics Division, 2013

2.0. CLIMATE VARIABILITY SITUATION IN BOTSWANA

Natural disasters are related to climate and climate change, and their relationship has given rise to climate-related natural disasters (CSO, 2009). Climate is referred to as the average weather condition (temperature, wind and rainfall patterns) of the atmosphere experienced over a long period of time. Climate Change on the other hand is defined as the change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (IPCC, 2007). The Earth's climate has changed many times in response to a variety of both human and natural causes.

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level (IPCC, 2007). The Earth has warmed by 0.74°C over the last hundred years. The period 1995-2006 rank among the twelve warmest years in the instrumental record of global surface temperature since 1850 (IPCC, 2007). The same report further reveals that the 100-year linear trend (1906-2005) of 0.74 [0.56 to 0.92]°C is larger than the corresponding trend of 0.6 [0.4 to 0.8]°C (1901-2000) given in the IPCC Third Assessment Report (TAR). Around 0.4°C of this warming has occurred since the 1970s. The IPCC Fourth Assessment Report (AR4) leaves us in no doubt that human activity is the primary driver of the observed changes in climate (Department for Environment, Food and Rural Affairs, 2005).

It is anticipated that Climate change will have serious impacts on the livelihoods of communities and the natural environment they depend on. Some of the climate change consequences will have impact over the longer term, like spread of disease and sea level rise, while some have immediately obvious impacts, such as intense rain and flooding (Anderson & Bausch, 2006). While recognizing the importance of other projected consequences of climate change, this chapter focuses on temperature extremes and precipitation as the main drivers of natural disasters (floods and droughts) in Botswana.

According to Rural Development Council (2015: 4), rainfall and temperatures are the most critical factors that determine the severity of the drought situation in any given area. Low rainfall and extreme temperatures present high chances of drought whereas good rainfalls and normal temperatures show low chance of drought (Rural Development Council, 2015: 4). This chapter therefore, gives an overview of the performance of rainfall and temperatures experienced in Botswana over both long and short periods of time.

Botswana is a semi-arid country with four seasons: i) Summer (November-January) - with maximum rainfall and generally hot; ii) Autumn (February-April) - with less rainfall than in summer and slightly hot; iii) Winter (May-July) - is cold and dry; iv) Spring (August-October) - often dry and hot.

2.1. TEMPERATURE

2.1.1. Long Term Average (LTA) temperature Versus Short Term Average (STA) temperature

This section presents a comparison of Long Term Average (LTA) maximum and minimum temperatures with Short Term Average (STA) temperatures in order to investigate how much the temperatures (maximum and minimum) have changed over time. The long term average temperatures are for the thirty-year (30) period from 1971 to 2000, while the short term averages are for the individual years starting from 2010 to 2014. Botswana's temperature fluctuates between extremes in summer and winter, that is, temperatures drop below freezing point in parts of the country in winter and rise above 37°C in some summer months. In comparing the long term average temperatures for 1971-2000 (LTA's) with short term average temperatures (years 2010-2014) Table 2.1 and Figure 2.1 reveal that:

Generally, the average maximum temperatures fluctuated between the LTA (1971-2000 period) and the single years (STA, 2010-2014) with the slightest increase from the LTA figure (29.5°C) recorded in 2012 (29.88°C) and 2013 (30.45°C). Below the LTA maximum temperatures were recorded in the years 2010, 2011 and 2014 with 29.25°C, 29.35°C, and 29.13°C respectively. The average minimum temperatures followed an upward trend from the LTA to all the STA temperatures. The following average minimum temperatures increased from the 1971-2000 figure (12.60°C) to; 14.40°C in 2010, 14.07°C in 2011 and 14.08°C in 2014. Though there was a slight decrease in the minimum average temperatures for the years 2012 (13.13°C) and 2013 (13.60°C), they are still higher than the LTA.

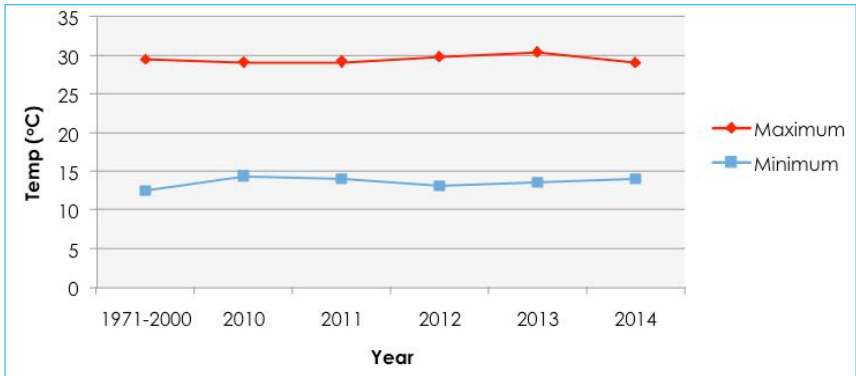
The results generally show that temperatures are slightly getting warmer in recent years compared to the long-term average temperatures. Literature elsewhere (e.g. VAM, Food Security Analysis, 2015) also assert that temperatures are getting warmer. VAM, Food Security Analysis (2015) reports that, although a full blown El Nino event did not develop until early 2015, the performance of the 2014 growing season in many places around the globe (Central America, parts of West Africa and Asia and Southern Africa in particular) was similar to that of a typical El Nino. The VAM, Food Security Analysis publication further reports that the overwhelming evidence is that the current El Nino event is almost certain to remain active throughout 2015 and likely to extend into early 2016.

Table 2.1: National Average Maximum and Minimum Temperatures (long vs. short terms)

Temperature	1971-2000	2010	2011	2012	2013	2014
	Average (°C)	Average (°C)	Average (°C)	Average (°C)	Average (°C)	Average (°C)
Maximum	29.5	29.25	29.35	29.88	30.45	29.13
Minimum	12.6	14.4	14.07	13.13	13.6	14.08

Data Source: Dept. of Meteorological Services; SADC Statistical Year Book, 2014.

Figure 2.1: National Average Maximum and Minimum Temperatures (long vs. short terms)



2.2. RAINFALL

2.2.1. Long Term Average (LTA) rainfall Versus Short Term Average (STA) rainfall

This sub-section presents a comparison of Long Term Average (LTA) rainfall with Short Term Average (STA) rainfall in order to investigate how much precipitation has changed over time. Just like in the case of the temperatures (Sub-section 2.1), the long term average rainfall figures are for the thirty-year (30) period ranging from the years 1970/71 to 2000/01, while the short term average rainfall recorded is for the individual years ranging from 2009/10 to 2014/15.

The rainy season in Botswana starts in October and ends in March, and rainfall varies by locality. As to when exactly (date) it should start raining and the amount expected is not precisely known and therefore makes rainfall unpredictable and unreliable (CSO, 2010). The national average precipitation is between 350 mm and 550 mm.

Table 2.2 shows that the national average rainfall saw a significant decrease from an LTA of 463.7mm during the period 1970/71 – 2000/01 to a short term average (STA) of 375.5mm recorded in 2013/14 (a 19.02% reduction). The table also shows a declining trend from the year 2009/10 to 2012/13. Generally, rainfall has been on the decline during recent years (STA) when compared to the long term averages (see Figure 2.2).

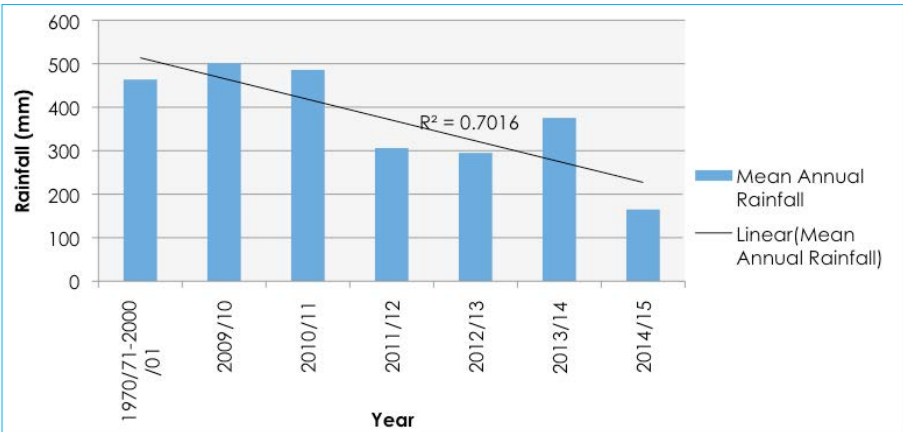
UNDP (2009) further reveals that past rainfall records indicate that there is a decline in the amount of rainfall over Botswana. This is no surprise because Botswana falls in the area which is most frequently affected by below-average rainfall. This is the belt that runs from southern/central Mozambique in the east and stretches westwards to Namibia, as well as the western half of South Africa. The countries in this stretch experienced below average precipitation in at least 5 out of 10 El Niños. On average, reduced rainfall during an El Niño occurred more frequently than this in a few areas including southern Mozambique, northern South Africa, eastern Zimbabwe, northern Namibia, and northern Botswana (FEWS NET, 2014: 2). This has resulted in reduced crop yields in Botswana (refer to subsections 4.1.1 and 4.1.4).

Table 2.2: National Average Rainfall (mm) during Rainy Season (long vs. short terms)

Meteorological Year	Year						
	1970/71-2000/01	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
July-June	463.7	500.7	485.8	306.1	295	375.5	164.9*

Data Source: Dept. of Meteorological Services; SADC Statistical Year Book, 2014.
*Data incomplete

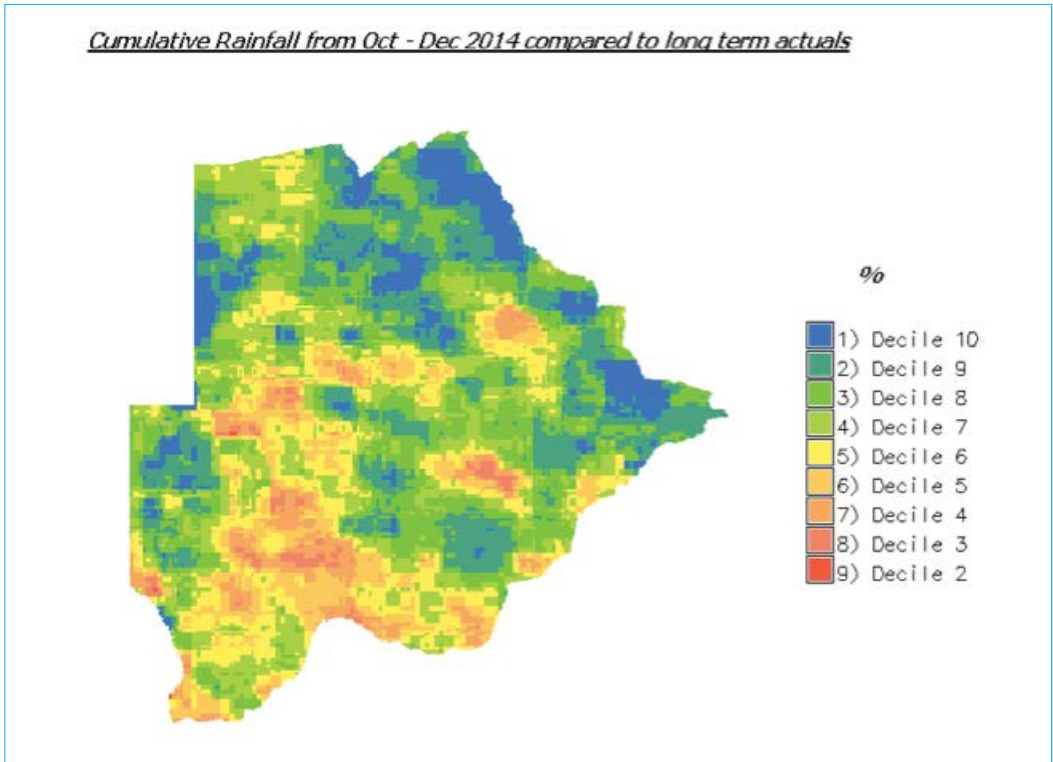
Figure 2.2: National Average Rainfall (mm) during Rainy Season (long vs. short terms)



2.2.2. Seasonal Rainfall (October – December 2014) and Vegetation Conditions

With regards to the seasonal rainfall from October to December 2014, Rural Development Council (2015) reports that most Districts received normal to above normal rainfall (see Figures 2.3 - 2.4). However, there are some Districts (e.g. Kgatleng, South East, and Kgalagadi) which received below normal rainfall. This has a negative impact on the vegetation cover. As a consequence of widespread deficit in rainfall, the most severe vegetation conditions were observed in the southern parts of the country and central areas especially in the following Districts; Kgatleng, South East, Kweneng and Kgalagadi Districts (Rural Development Council, 2015). See Figure 2.5.

Figure 2.3: Rainfall for October to December 2014



Source: Rural Development Council (2015: 5)
Note: A list of all the historic rainfall totals for a particular month are ranked from lowest to highest, and then divided into ten equal parts. These are then compared to the ten rainfall deciles for a specific month to put it into a historical context.

Figure 2.4: Rainfall for October to December 2014

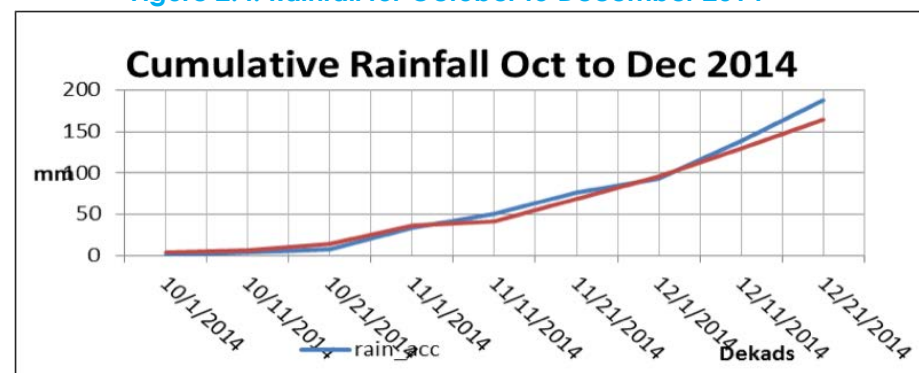
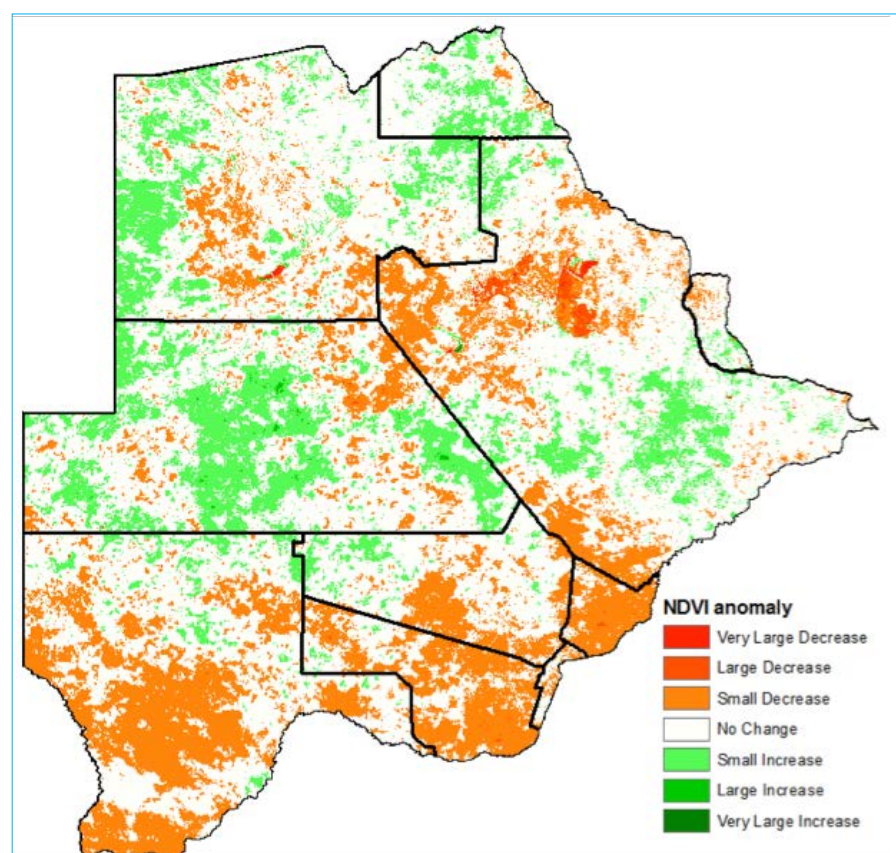


Figure 2.5: Normalised difference vegetation index (NDVI) anomaly map from September dekad 1, 2014 to March dekad 2, 2015



Source: Department of Meteorological Services; Rural Development Council (2015: 8)

3.0. FLOODS AND STORMS

A flood is an overflow of water onto an area beyond its limits. This overflow might be attributable to various factors; an overflow of a river or dam exceeding its total capacity, runoff of surface water normally over a dry area due to heavy rainfall, among others (CSO, 2009). According to UNEP (2004) there are three types of floods: i) River floods (seasonal flooding); ii) Flash floods (caused by seasonal storms); and iii) Coastal floods.

- **River Floods (seasonal flooding):** River floods are usually caused by seasonal precipitation over large catchment areas, by melting of snow that has accumulated over winter or sometimes by a combination of these (UNEP, 2004: 2). River floods are common in the north western part of Botswana where wetlands are found.
- **Flash Floods (floods caused by tropical storms):** The heavy rain that accompanies tropical storms is one of the most common causes of flooding and usually the rains are too much for the streams and rivers to handle, causing water to overflow and produce floods (UNEP, 2004: 2). Flash floods are also common in Botswana. For Botswana, most of the flash floods are caused by heavy rains, storm rains, hailstorms, and thunderstorms.
- **Coastal Floods:** Storms, wind and other events can sometimes cause ocean water to overflow, leading to onshore flooding. For example, Tsunamis, exceptionally large ocean waves triggered by volcanic events, landslides, earthquakes, or explosions also cause coastal flooding (UNEP, 2004: 2). By virtue of being a landlocked country, Botswana does not experience any coastal floods.

Floods are a threat to human beings in many different ways including loss of lives and personal property, among others. Their effects on the environment can also include damage to infrastructure (roads, buildings, dams and bridges) and damage to vegetation (crop fields and natural vegetation). CSO (2009) also states that floods are destructive in nature and have far reaching effects on people, human and animal lives due to drowning, displacing people, and health issues such as the spread of water borne diseases. Floods are naturally occurring hazards and they become disasters when they have destructive effects on human settlements (<http://www.unep.org/>).

According to SADC (2000), severe flooding due to a tropical depression and Cyclone Eline ravaged large parts of the four southern African states; including Botswana during the month of February, 1999/2000. Large areas of potentially productive agricultural land flooded, together with livestock and farming implements leaving the food security prospects at both national and regional level uncertain (SADC, 2000).

3.1. Incidences, Impacts/Damages and Responses

This sub-section presents flood and storm occurrences by location and year, as well as number of households and individuals affected, and assistance given.

3.1.1. Floods

Table 3.1.1 shows that the impacts of floods were more pronounced in Tutume Sub-District during the period 2010 – 2015 compared to other districts. The floods affected 446 households and displaced a total of 1,489 individuals in Tutume Sub-District in 2013 alone. As a result, 400 tents and 218 food baskets were dispatched to the victims as relief. The floods incidences in the Tutume Sub-District occurred in the following towns and villages: Sowa Town, Matsitama, Dukwi, Mosetse, Marapong, Zoroga, Tutume, Goshwe, Maposa, and Makoba. According to the NDMO, these are flash floods. The second most floods affected District is the Ngamiland District in 2010. A total of 168 households were affected, with 800 individuals displaced.

As an effort to relief the victims of the floods, a total of 235 tents were given. A handful of villages were affected by these floods, including; Ikoga, Nxamasere, Etsha 13, Mohembo East, Kauxhwi, Jao Flats, Eresha, Beetsha, Gudigwa, and Tubu. These villages are located along the Okavango given, 130 tents and 136 food baskets were dispensed to the victims. The topography of Ghanzi District does not have wetlands nor water bodies; therefore this asserts the fact that the floods in this area are mainly flash floods. The Ghanzi District's land surface mainly comprises of gently undulating sandveld which lies between

Table 3.1.1: Floods Incidences & Impacts by District, 2010 - 2015

Incident	Year	District	Villages	Impact/Damages		Assistance given	
				No. of households affected	Total no. of individuals affected / displaced	Tents	Food baskets
Floods	2010	Ngamiland	Ikoga, Nxamasere, Etsha 13, Mohembo east, Kauxhwi, Jao Flats, Eresha, Beetsha, Gudigwa, Tubu	168	800	235	-
		Sowa Sub	Sowa Town	31	84	-	-
	2013	Tutume Sub	Matsitama, Dukwi, Mosetse, Marapong, Zoroga, Tutume, Goshwe, Maposa, Makoba	446	1,489	400	218
		Tonota	Serule	5	-	-	-
	2014	Selebi Phikwe	Selebi Phikwe	10	42	-	-
		Francistown	Francistown	25	87	2	7
	2015	Ghanzi	D'Kar, Kuke, New Xade, Chobokwane, Ghanzi, Grootlagte, Qabo	140	859	130	136

Source: National Disaster Management Office

Figure 3.1.1a: Floods Impacts & assistance given by District, 2010 - 2015

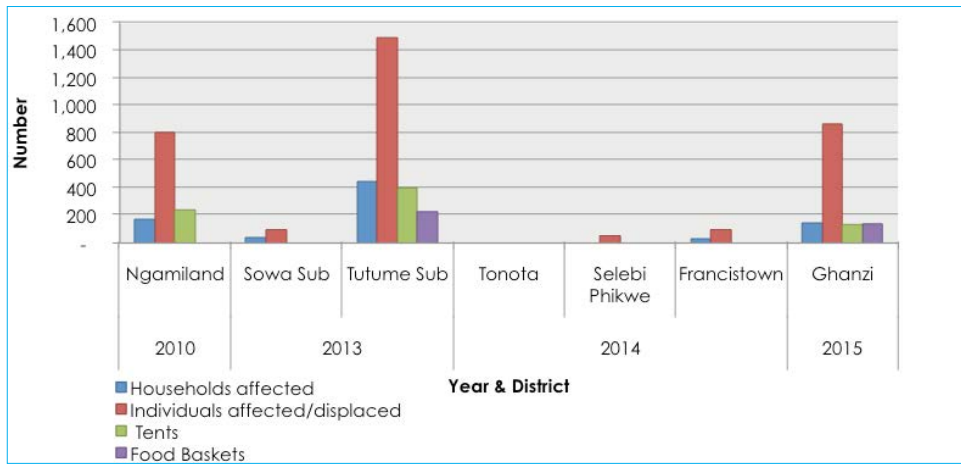
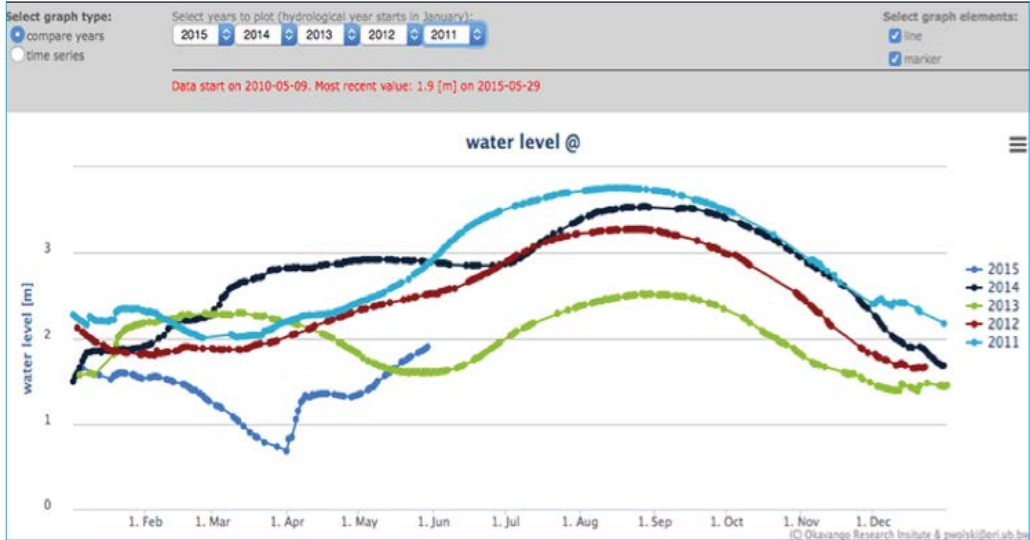


Figure 3.1.1b: 2015 Okavango Delta Flood Update



Source: 2015 Okavango Delta Flood Update (www.letakasafaris.com/2015-okavango-flood-update/)

3.1.2. Storms Incidences (Hailstorms, Storm Winds & Thunderstorm)

Literature elsewhere (e.g. UNEP, 2004) states that heavy rain that accompanies tropical storms is one of the common causes of flooding which is referred to as Flash floods. Therefore, it is important to document and report on the types of storms, their incidences and impacts so that it is clear which communities or districts are at risk of experiencing the events. Furthermore, tropical storms-related statistics provide enough information to justify causes of floods within a given region though in-depth research is needed.

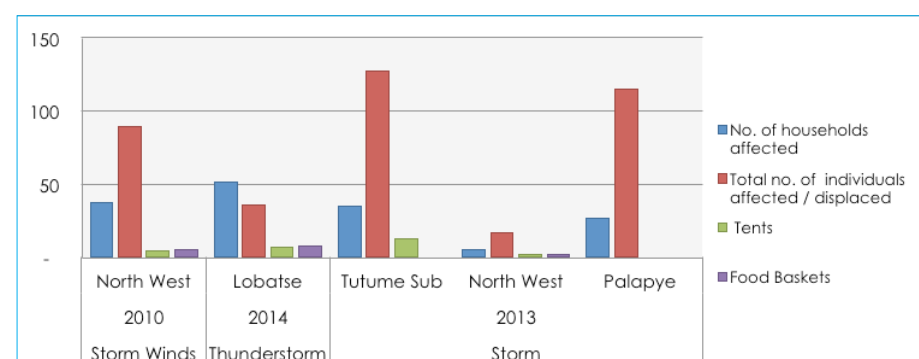
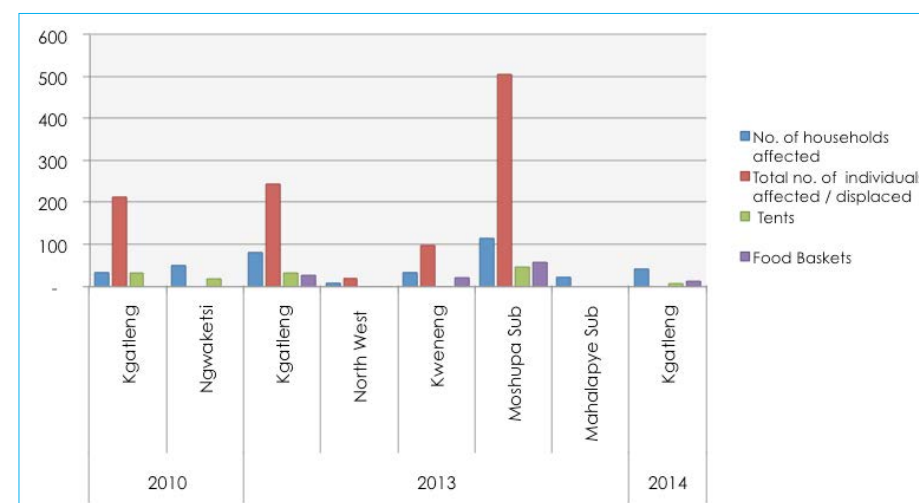
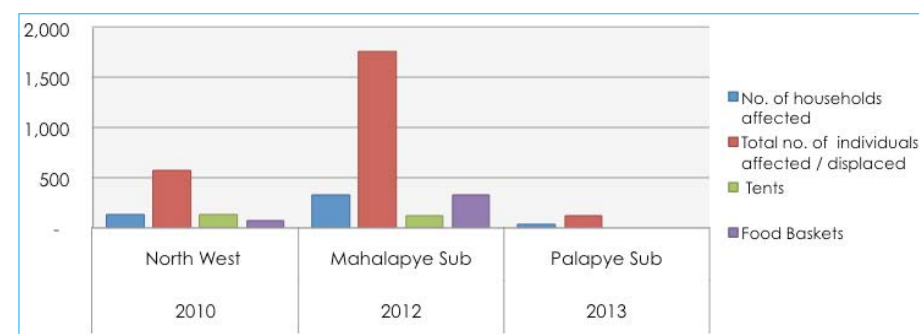
Table 3.1.2 reveals that Mahalapye Sub-District had the highest records of storm impacts (from storm rains) with 329 households and 1,756 individuals affected in 2012. The second highest number of individuals (132) and households (568) affected by storm incidences (from storm rain) was recorded in North West District (Maun) during the year 2010. Consequently, a total of 132 tents and 69 food baskets were given as relief. In 2014 alone, the most occurring storm incidence was the thunderstorm which affected 51 households and displaced 36 individuals in Lobatse.

Table 3.1.2: Storm Incidences, Impacts & Responses by District, 2010 -

Incident	Year	District	Villages	Impact/Damages		Assistance given	
				No. of households affected	Total no. of individuals affected / displaced	Tents	Food Baskets
Storm Rains	2010	North West	Maun	132	568	132	69
	2012	Mahalapye Sub	Mahalapye	329	1,756	119	322
	2013	Palapye Sub	Maunatlala, Seolwane, Mogapi, Matolwane, Mogapinyana, Malaka	27	115	-	-
Hailstorm	2010	Ngwaketsi	Nthantlhe, Lekgolobotlo	49	-	18	-
		Kgatleng	Morwa, Bokaa, Oodi, Rasesa, Malotwana, Mochudi	81	242	32	27
		North West	Maun	5	17	2	2
		Kweneng	Salajwe	32	96	3	19
		Moshupa Sub	Kgomokasitwa	114	506	46	56
	2013	Mahalapye Sub	Poloka, Setsile	19	-	-	-
	2014	Kgatleng		39		7	12
Hailstorm & Heavy Rains	2010	Kgatleng	Ramotlabaki, Malolwane, Kgomodiatshaba	32	212	32	-
Storm Winds	2010	North West	Maun	37	89	4	5
Thunderstorm	2014	Lobatse	Lobatse	51	36	7	8
Storm	2013	Tutume Sub	Tutume	35	127	13	
		North West	Maun	5	17	2	2
		Palapye	Maunatlala, Seolwane, Mogapi, Matolwane, Malaka, Mogapinyana	27	115	-	-

Source: National Disaster Management Office

Figure 3.1.2: Storms Impacts & Responses by District, 2010 – 2015



3.1.3. Heavy Rains

Heavy rains have an influence on the occurrences of both river floods (seasonal flooding) and floods caused by tropical storms (flash floods). Seasonal precipitation over large catchment area causes river floods. The heavy rains that are accompanied by tropical storms which are too much for streams and rivers to handle causes flash floods (UNEP, 2004).

Out of a total of 981 households affected by heavy rains during the period 2013 – 2015; 303 (30.89 percent) were recorded in the North West District in 2013 and 294 (29.97 percent) were recorded in the Central District during the same year. Although the Central District constitutes only about 10.81 percent of the total households affected by heavy rains in 2014, it recorded the highest number of individuals (491) affected/displaced as well as the highest number of tents (81) and food baskets (75) given as relief. Trailing behind all the Districts affected by heavy rains is the North West District (Bodibeng Village) which recorded 11 households affected by heavy rains in 2015 (Table 3.1.3 & Figure 3.1.3a).

As rainfall becomes heavier, streams and rivers can overflow leading to floods. SADC (2014) reports that heavy rains were received in the period 11th February 2014 to 10th March 2014 in some parts of the region, including northern South Africa, Botswana, central and northern Mozambique, western and northern Zambia, northern Malawi, and southern Tanzania. The rainfall was significantly above average, especially in Botswana and South Africa and the rains resulted in widespread floods in South Africa, Mozambique, Zambia, and Namibia. (See Figure 3.1.3b)

Table 3.1.3: Heavy Rain Incidences & Impacts by District, 2010

Incident	Year	District	Villages	Impact/Damages		Assistance given	
				No. of households affected	Total no. of individuals affected / displaced	Tents	Food Basket
Heavy Rains	2013	Bobonong	Lepokole, Mathathane, Molalata, Mmadinare, Tsetsebjwe	-	-	-	-
		Tutume Sub	Tutume	-	32	18	5
		Central	Maunatlala, Topisi, Moreomabele, Tamasane, Mogapi, Lesenepole, Mosweu, Mokokwana, Seolwane, Lerala, Majwaneng, Ratholo, Goo Tau, Goo Sekgweng, Mathakola, Mokungwane, Lecheng	294	433	54	42
		North West	Tsau, Nxaraga, Semboyo, Shorobe, Toteng, Makalamabedi, Makankung, Sehithwa, Chanoga, Xhama, Phuduhudu, Maun,	303	-	271	61
		Tonota Sub	Tonota, Shashemooke, Mabesekwa, Mandunyane, Foley, Gojwane, Serule	133	393	57	26
		Central	Serowe, Dimajwe, Mmashoro, Tshimoyapula, Mabeleapodi	106	491	81	75
	2014	Ghanzi	Tshootsha, Charleshill	24	-	12	-
		Tutume Sub	Tutume	57	49	11	-
		Goodhope	Sekhutlane, Leporung, Mmakgori	28	169	23	8
	2015	Thamaga Sub	Thamaga	25	-	10	14
		North West	Bodibeng	11	80	11	9

Note: Bobonong was affected by heavy rains though no data was documented.

Source: National Disaster Management Office

Figure 3.1.3a: Heavy Rains Incidences & Impacts by District, 2010 - 2015

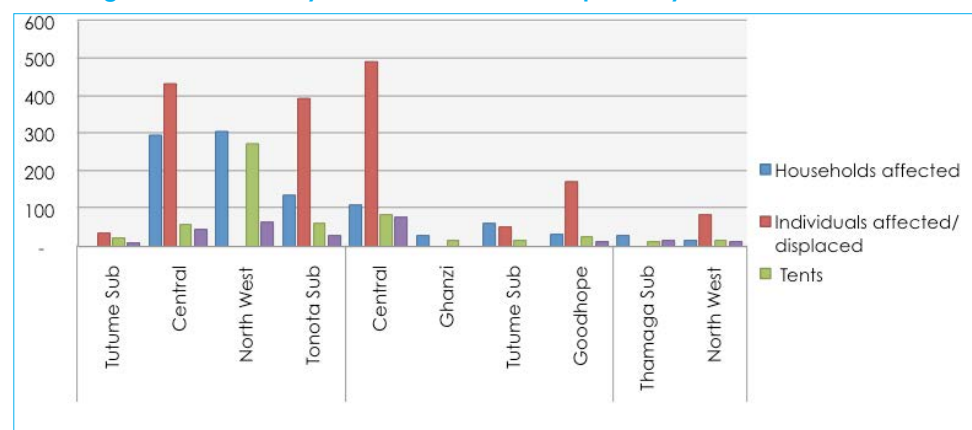
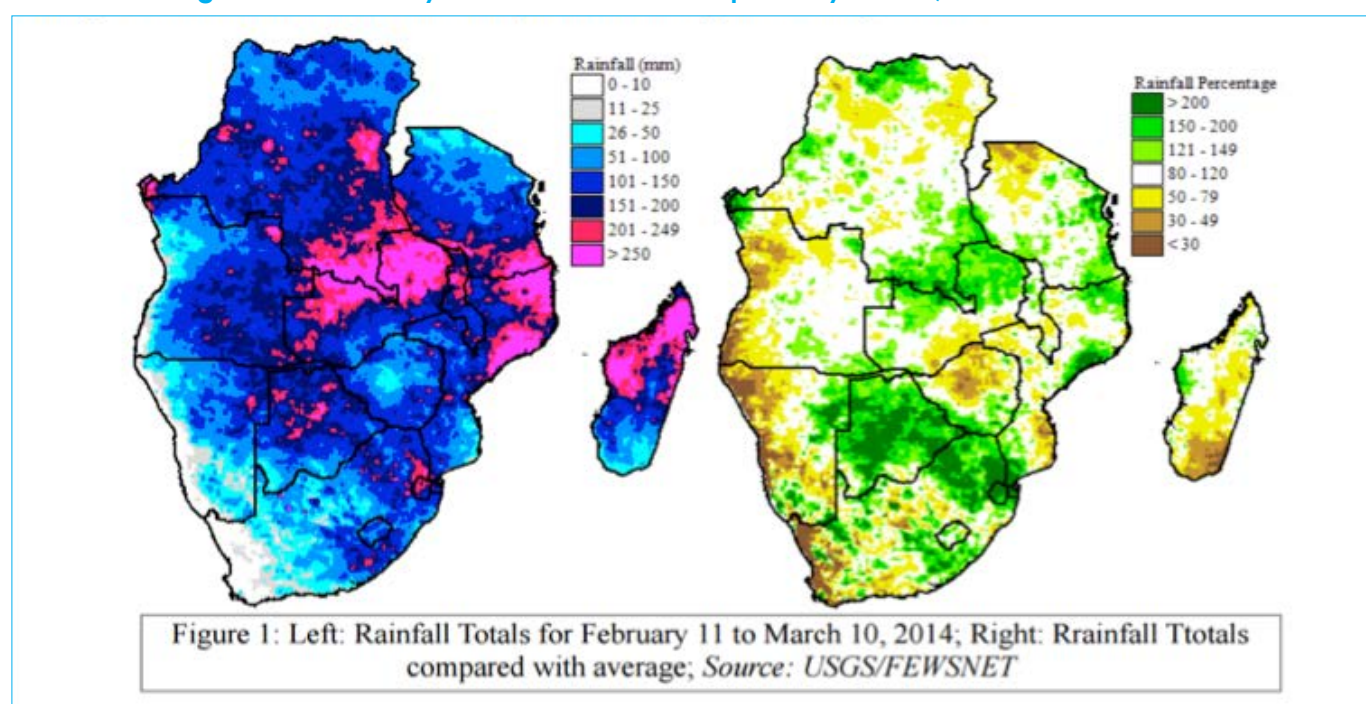


Figure 3.1.3b: Heavy Rains Incidences & Impacts by District, 2010 - 2015



Source: Southern African Development Community, 2014 (http://www.sadc.int/files/5313/9584/9071/SADC_Disaster_Risk_Reduction_Update)

3.2. Disaster-related Response- Economic, 2009 - 2014

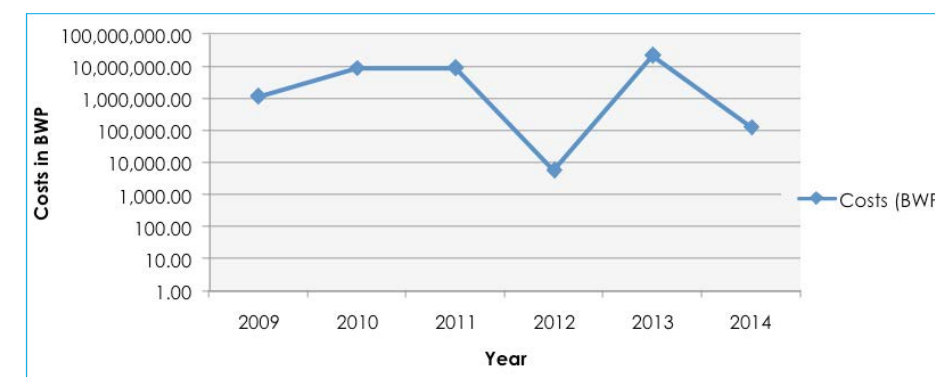
The National Disaster Management Office (NDMO) of The Office of the President which is responsible for formulating national disaster management systems and coordinating disaster management activities, responded to 2010-2015 flood incidences. Table 3.2 provides a summary of disasters-related response (economic) in Botswana for the 5-year period stretching from 2009 to 2014. The table reveals that a total of 5,469 families affected by different hazard types (floods, storms, heavy rains) were assisted during the period under review. The type of assistance given includes food relief, tents, relocation, payments, rehabilitation of bridges, roads and culverts, construction of houses, and water and electricity connections. The assistance provided as relief to the victims of the hazard types mentioned above were valued (refer to Table 3.2). A total of BWP41,240,830 was expended during the period under review to provide relief. The highest assistance in monetary terms was expended in Central, Ngamiland and North East Districts in 2013. The cost of relief was at BWP21,645,000 (52.48 percent of total expenditure) and it was used for the construction of 481 houses (2-roomed). In 2010 houses were constructed to help victims of Okavango floods and winter rainfall in Ngamiland District. This assistance cost BWP8,500,000 (20.61 percent of the total expenditure). Generally, the annual trend of the expenditure emanating from the disasters relief increased during the review period with the exception of those recorded in the years 2012 and 2014.

Table 3.2: Summary of Disasters-related Response (Economic) in Botswana (2009-2014)

Year	Hazard type	No. of Households	Assistance type	Costs (BWP)
2009	Floods in Okavango Delta and Chobe	900	Food Relief, Tents, Relocated,	700,000.00
	Heavy winter Rainfall throughout the country	686	Food Relief, Tents,	260,000.00
	Storm in Mahalapye	329	Food Relief, tents etc.	200,000.00
2010	Construction of houses to help victims for Okavango floods and Winter rainfall	425	One roomed house construction	8,500,000.00
	Okavango floods	163	Food Relief, Tents,	54,000.00
	Floods / Heavy rains in Moshupa Districts	46	Food Relief and Tents	20,700.00
	Storm in Maun	132	Food relief and Tents	100,000.00
	Floods in Serowe Admin Authority	37	Food relief and Tents	0
	Kgalagadi District Fire incident	5	Exgratia payment	250,000.00
	Storms at Ramotlabaki at surroundings	32	Tents	0
	Storms at Ntthantlthe - Lekgoloboto	49	Tents	0
	Heavy rains and storms at Natale	60	Food relief and Tents	18,000.00
	Storms at Lerela	14	Food Relief, Tents	0
2011	Okavango flood Rehabilitation	-	Rehabilitation of bridges, roads, water, treatment plants	6,290,000.00
	Chobe floods Rehabilitation	-	Rehabilitation of bridges, roads, culverts	2,500,000.00
	Bridge collapse at Sitatunga - floods	-	Boat hiring to help people cross the river	30,000.00
	Storms in Makwati, Sefhare, Chadibe,	124	Food relief and Tents	16,000.00
	Storms in Palapye, Mokgware, Mogapinyana	12	Food relief and Tents	5,064.00
	Re-imbursement of 50victims of Loolagane floods	50	Floods of 1994	160,896.00
2012	Storms at Makaleng - Masunga	71	Food Relief, Tents	5,850.00
	Various Villages with heavy Storms	320	Food Relief and Tents	0
2013	Various Villages with heavy Rains throughout	1,473	Relief food from RF, From HE, Tents,	360,000.00
	Construction of 481 houses (2-roomed) in Central, Ngamiland and North East	481	Construction of 2roomed houses	21,645,000.00
2014	Floods in the Northern part of the country	50	Search and rescue boats, tents, food relief	9,000.00
	Re-imbursement of Etsha 13 relocated residents following 2009 floods	10	Water and Electricity Connection	116,320.00
Total		5,469		41,240,830.00

Source: National Disaster Management Office
Dashes (-) mean no household was given relief

Figure 3.2: Summary of Funds spent on Disaster Relief in Botswana (2009-2014)



4.0. DROUGHT

Presented in this section are: drought occurrences; declarations of droughts impacts; number of management projects, funds allocated and number of people employed through labour intensive programmes during different drought years (2009 – 2014) in Botswana.

A prolonged period of time when an area experiences moisture deficiency is referred to as drought. Drought can also be defined as 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 (Manthe-Tsuaneng, 2014: 4). Rainfall trends in Botswana show that the amount of precipitation received over the long term compared to the short term period has been on the decline (refer to Subsection 2.2). Temperatures have become warmer in the country. Therefore, this implies that the country has been experiencing recurring droughts. Subsection 4.1 discusses this further.

4.1. Drought Occurrences and Impacts/Severity

The impacts of drought are devastating to both humans and the environment they live in. The National Drought Mitigation Center (2015) adds that different drought impacts are often grouped as “economic,” “environmental,” and “social” impacts. The economic impacts include: money losses due to crop failure; more money spent on feeding the livestock; more money needed to buy more food; and water companies may charge more money on additional water supply. The environmental impacts are: wildlife and livestock mortality and migration; lack of water for animals; low water levels; and wind and water erosion of soils. The social impacts include: depression about economic losses due to drought; health problems related to low water flows and poor water quality; loss of human life; reduced incomes; and rural-urban migration.

Table 4.1a presents occurrences of drought or drought declarations in Botswana. The President declares a period of drought which is mostly a year when the country is receiving below average rainfall. Enough information is needed to assess the country's drought status in order to make recommendations. This information is collected and compiled by the National Early Warning Technical Committee. The Committee improves drought-monitoring activities, maintains the country in a state of readiness to confront drought and facilitates the response to drought situations. The whole country was drought stricken during these periods: 1981-1987; 1991-1999; 2001-2005; 2007-2008; 2011-2013; and 2014 (Table 4.1a). The worst drought in recent years was from 1981 to 1987 followed by 1990 to 1995 (Manthe-Tsuaneng, 2014: 2).

Table 4.1a: Occurrences of Drought in Botswana (Drought declarations)

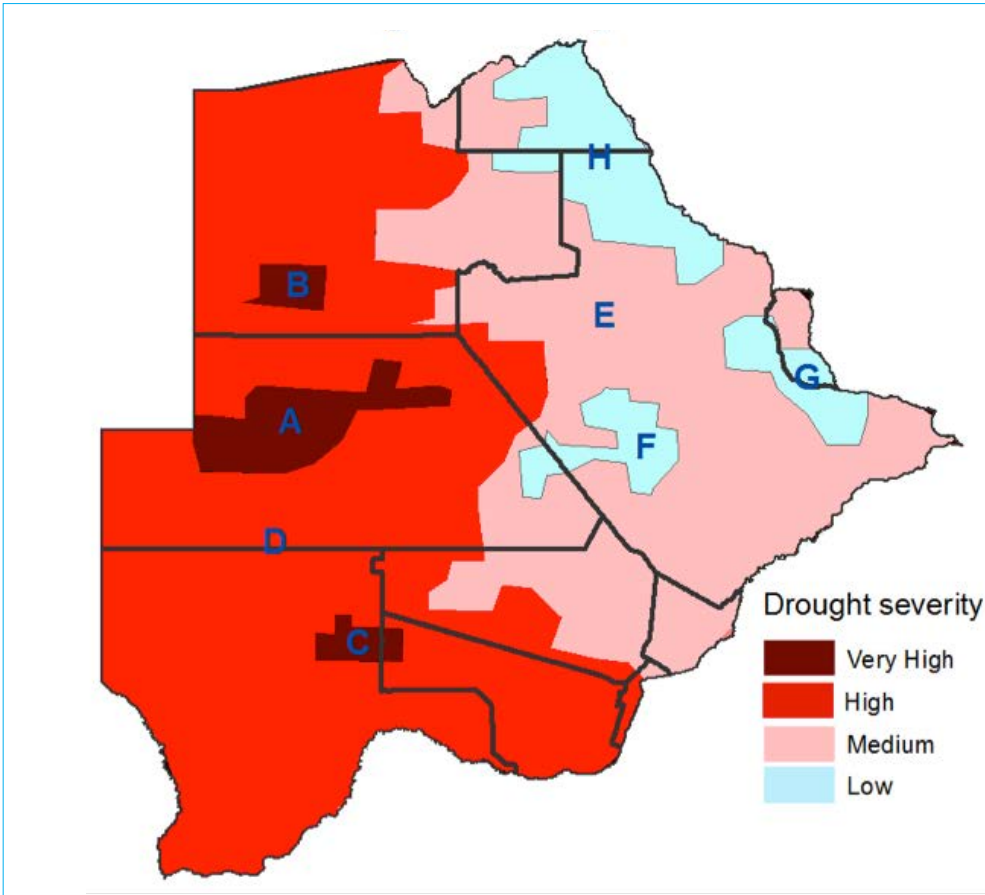
Year	Impact Area
1961-1965	Drought year (North East, Central)
1968-1971	Non-drought years
1979-1980	Drought year (Bobirwa)
1981-1987	Drought years (Whole Country)
1991-1999	Drought years (Whole Country)
2001-2005	Drought years (Whole Country)
2007-2008	Drought year (Whole Country)
2008-2009	Non-drought year
2009-2010	Whole Country
2010-2011	Whole Country
2011-2012	Whole Country
2012-2013	Drought year (Whole Country)
2013-2014	Non-drought year
2014-2015	Drought year (Whole Country)

Source: Environment Statistics 2000; Rural Development Council

The drought severity for the 2014/15 season is depicted in Figure 4.1a. The figure shows that the worst affected area of the country is the Western half. The very high risk areas had a rainfall deficit of more than 50 percent. The low drought severity was evident in the greater part of Chobe District, and some parts of Central District into North East and Central Kalahari Game Reserve. These low risk areas had a rainfall deficit of greater than 5 percent and a surplus of less than 10 percent.

Table 4.1a shows drought situation summary for districts for the year 2014/15. The table reveals that Ghanzi, Kgalagadi, Southern, and South East Districts had the highest drought severity compared to the rest of the districts.

Figure 4.1a: Drought Severity Map



Source: Department of Meteorological Services (DMS), 2015

Worst Areas : Drought hot spots includes Regions A, B, C
High risk areas: D
Medium risk: E
Low risk Areas: Region H, F, G
Where:
Very high risk areas are places with rainfall deficit of more than 50 percent;
High risk areas are places with deficit between 25 percent and 50 percent;
Medium risk areas places with deficit between 10 percent and 25 percent
Low risk areas are places with rainfall deficit of greater than 5 percent and a surplus of less than 10 percent.

Table 4.1b: Drought Situation Summary for Districts

District:	Drought Severity
Ngamiland	High to Medium
Chobe	Low to Medium
Central	Medium
North East	Low to medium
Ghanzi	High
Kgalagadi	High
Kweneng	Medium to high
Southern	High
South East	High
Kgatleng	Medium

Source: Department of Meteorological Services (DMS), 2015

4.1.1. National Crop Yield and Production Estimates

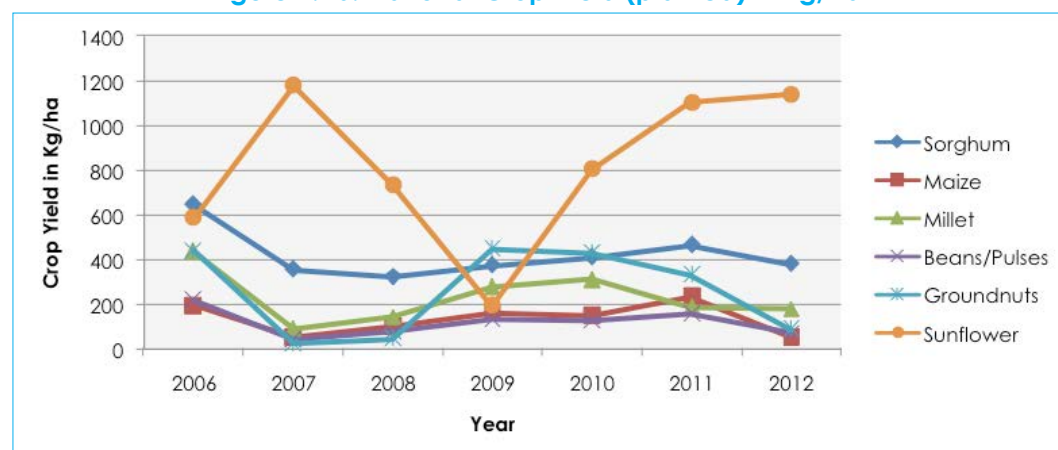
On average sunflower had the highest yields during the period 2006 – 2012 compared to all the crops. However, it saw a drastic decline in the years 2008; 37.78 percent decrease from a 2007 figure of 1,178 Kg/ha to 733 Kg/ha recorded in 2008. It further declined to 191Kg/ha in 2009 (a 73.94 percent decline from the 2008 figure). Generally, the yields for other crops were on the increase though they experienced a significant decline in 2007 (Table 4.1c and Figure 4.1b). Nonetheless, these yields do not meet the country's demand/requirements, hence her over dependency on imports (refer to subsection 4.1.4). The low average yields will inevitably result in serious food deficit at household level particularly for the smallholders (Rural Development Council, 2015).

Table 4.1c: National Crop Yield (planted) in kg/ha

Crop	2005*	2006	2007	2008	2009	2010	2011	2012
Sorghum	82	645	356	323	373	409	464	381
Maize	160	194	53	101	159	151	233	54
Millet	-	435	90	144	279	311	189	179
Beans/Pulses	394	218	43	78	133	128	159	72
Groundnuts	-	440	25	49	447	429	334	91
Sunflower	110	585	1,178	733	191	804	1,103	1,140

Source: Agricultural Statistics Unit
*2005 data is commercial sector ONLY

Figure 4.1b: National Crop Yield (planted) in kg/ha



4.1.2. Cattle Holding with Drought-Related Livestock Mortality

Due to lack of data on the number of livestock dying because of drought, a proxy indicator was used instead: "Cattle Holding with Drought-Related Livestock Mortality by District and Region, 2009 – 2013." Table 4.1d reveals that the total number of cattle holdings which experienced livestock mortality (cattle) during the period 2009-2013 followed an upward trend. The number of holdings increased significantly from 4 holdings in 2009 to 125 holdings in 2013. The Southern Region is affected the most compared to the other regions.

Figure 4.1c: Drought-Related Livestock Mortality, Ngamiland 2015



Source: Picture shot by Dintwa, K.F. (08.12.2015) in the Ngamiland West District

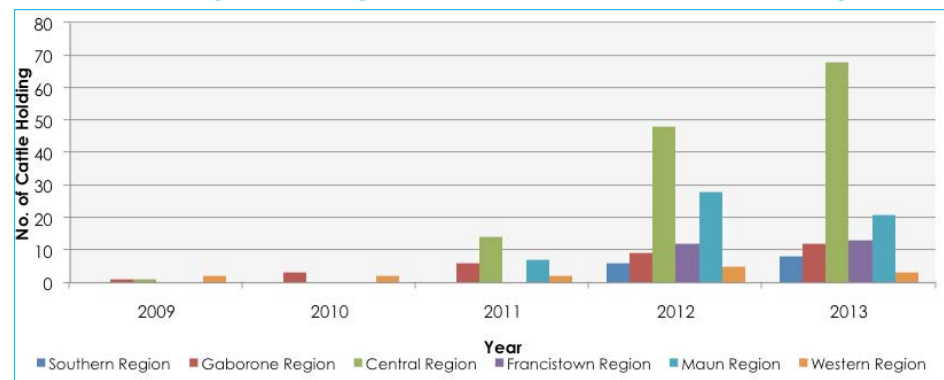
Table 4.1d: Cattle Holding with Drought-Related Livestock Mortality by District (2009 - 2013)

AGRICULTURAL DISTRICTS	2009	2010	2011	2012	2013
	Cattle	Cattle	Cattle	Cattle	Cattle
Ngwaketse South	-	-	-	-	2
Ngwaketse Central	-	-	-	4	5
Ngwaketse West	-	-	-	2	1
SOUTHERN REGION	-	-	-	6	8
Bamalete/Tlokweneng	1	3	-	-	3
Kweneng South	-	-	-	5	1
Kweneng North	-	-	-	1	5
Kgatleng	-	-	6	3	3
GABORONE REGION	1	3	6	9	12
Mahalapye East	1	-	6	9	4
Mahalapye West	-	-	1	11	8
Palapye	-	-	1	-	9
Serowe	-	-	2	4	2
Bobonong	-	-	3	13	22
Letlhakane	-	-	1	3	11
Selebi-Phikwe	-	-	-	8	12
CENTRAL REGION	1	-	14	48	68
Tati	-	-	-	1	-
Tutume	-	-	-	10	9
Tonota	-	-	-	1	4
FRANCISTOWN REGION	-	-	-	12	13
NGAMILAND EAST	-	-	7	28	21
Maun Region	-	-	7	28	21
Ghanzi	1	2	2	2	2
Hukuntsi	-	-	-	2	1
Tsabong	1	-	-	1	-
WESTERN REGION	2	2	2	5	3
TOTAL	4	5	29	108	125

Source: Agricultural Statistics Unit

Note: (-) means that no holding experienced drought-related mortality.
These data are unweighted cases of cattle holdings.

Figure 4.1d: Cattle Holding with Drought-Related Livestock Mortality by Region (2009 - 2013)



4.1.3. Cereal Requirements and Production

Due to the recurring drought incidences in Botswana, agricultural production (cereals in particular) has been low. This situation has worsened the already existing problem of food insecurity, hence an increase in cereal requirements leading to more cereal imports and increased food prices. Table-4.1e shows that the total cereal requirements fluctuated between the years 1998 and 2007. It then adopted an upward trend during the years 2009, 2010, 2011, 2012, and 2013 with 330 tons, 334 tons, 338 tons, 408 tons, and 420 tons respectively. The afore-mentioned years were officially declared as drought years.

A comparative analysis of the total cereal requirements with total cereal production reveals that production fell short of requirements in all the presented years (1998 – 2013) (see Table 4.1e and Table 4.1f). This situation depicts a clear picture of the problem situation (food insecurity) Botswana has at hand. A total of BWP6,006,437,187 (6.01 Billion) was used to import cereals (maize, rice, sorghum, millet and wheat) from 1999 to March 2015 (See Table 4.1g).

The table also shows that Maize was imported in large quantities during the review period, followed by Sorghum, Wheat, and Rice with 1,710,507,653 Kg, 535,054,098 Kg, 360,257,038 Kg, and 207,450,609 Kg respectively. Generally, the quantities of cereals imported and the amount of money expended saw a significant increase during the 1999 to March 2015 period. On the other hand, there has been an increase in population size of Botswana, hence an increase in the number of people to feed. According to Statistics Botswana (2014: 10) the population of Botswana experienced an intercensal increase of 26.7 percent between 1991(1,326,796) and 2001(1,680,863) and another increase of 20.5 percent between 2001(1,680,863) and 2011 (2,235,995).

It is also evident from Table 4.1g that there were more cereal imports during the years 2010 (388,440,822 Kg), 2009 (328,678,273 Kg), and 2012 (304,459,440 Kg) in that order. According to the Rural Development Council, these were drought-stricken years.

Table 4.1e: Cereal Requirements in ('000) Tons by Crop from 1998-2013

Year	Maize	Wheat	Sorghum	Rice	Total
1998	139	76	60	27	302
1999	142	77	73	31	323
2000	136	73	76	36	321
2001	130	75	70	36	311
2002	120	78	48	36	282
2003	125	86	65	36	312
2004	141	83	64	36	324
2005	140	83	60	36	319
2006	144	85	57	36	322
2007	143	87	57	36	323
2008	135	83	43	36	297
2009	156	93	45	36	330
2010	156	95	47	36	334
2011	161	95	46	36	338
2012	202	104	67	36	408
2013	207	107	69	37	420

Source: Ministry of Agriculture (Early Warning Unit)

Figure 4.1e: Cereal Requirements in ('000) Tons by Crop from 1998-2013

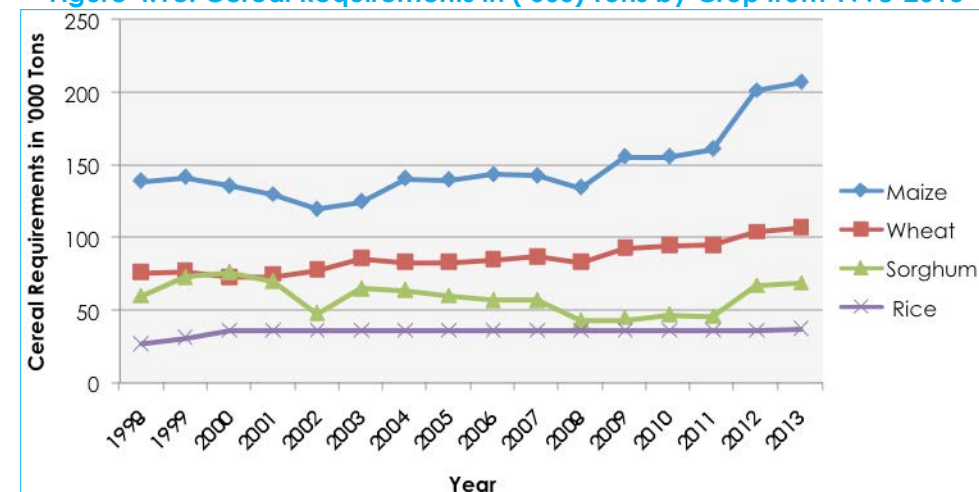


Table 4.1f: Cereal Production in Tons by Crop from 1999-2012

Year	Sorghum	Maize	Millet	Pulses	Sunflower	Groundnuts
1999	6,658	3,796	860	1,348	2,829	217
2000	12,671	19,962	439	4,102	163	546
2001	1,583	4,976	472	1,280	150	147
2002	15,805	16,447	54	1,907	2,250	137
2003	23,501	1,633	91	460	960	15
2004	11,756	7,536	2,697	2,177	487	270
2005	807	153	-	313	436	-
2006	41,493	15,156	3,188	4,920	1,768	560
2007	11,774	2,158	532	805	2,558	76
2008	23,632	8,969	1,636	2,305	8,140	161
2009	29,379	19,247	2,757	4,317	1,765	1,538
2010	31,326	16,575	3,368	3,617	3,843	1,828
2011	32,591	35,322	2,511	4,700	15,837	833
2012	25,021	7,677	1,959	2,285	6,000	200

Source: Agricultural Statistics Unit

**2005 Figures are commercial sector ONLY

Figure 4.1f: Cereal Production in Tons by Crop from 1999-2012

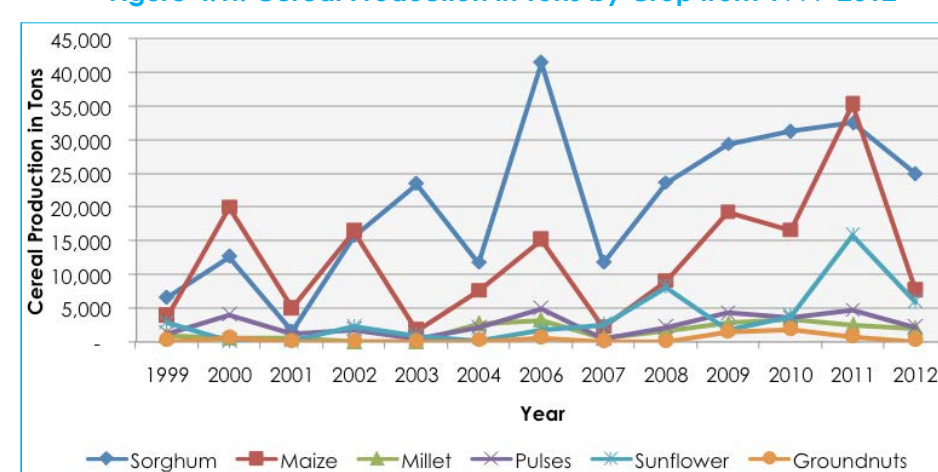
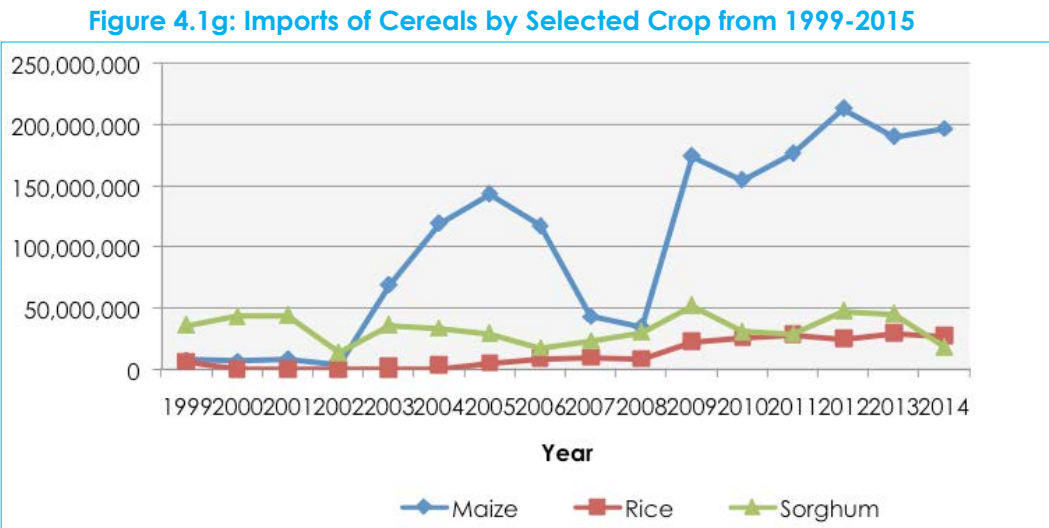


Table 4.1g: Imports of Cereals by Crop from 1999-2015

YEAR	Maize		Rice		Sorghum		Millet		Wheat	
	(Kg)	Pula	(Kg)	Pula	(Kg)	Pula	(Kg)	Pula	(Kg)	Pula
1999	7,889,262	5,389,745	6,148,277	31,182,624	36,269,929	29,644,189	36,509	16,827	74,585	266,712
2000	6,760,159	5,651,911	306,467	1,303,989	43,398,646	71,964,487	74,803	54,688	143,016	87,577
2001	8,442,918	5,579,717	441,362	2,679,436	44,138,991	36,512,271	67,525	115,434	54,034	34,242
2002	3,704,845	5,125,832	230,300	3,035,710	13,847,169	19,990,714	22	1,899	417,134	678,097
2003	69,122,739	93,168,419	1,992,027	4,298,475	36,236,495	46,373,515	45,785	124,937	2,202,308	3,213,857
2004	119,297,957	104,400,863	3,271,911	9,296,048	33,221,624	38,140,820	330	4,152	172,226	311,486
2005	143,616,024	103,718,537	4,888,984	15,602,397	29,528,543	23,952,330	4,025	14,001	6,300	21,439
2006	117,607,567	137,352,631	8,571,181	25,026,942	17,368,714	24,130,901	1,924	6,570	34,000	105,226
2007	43,420,439	90,885,027	9,573,789	30,396,814	23,092,793	46,271,132	68,292	354,785	52	376
2008	34,543,266	47,071,886	8,266,417	44,992,563	30,450,721	48,027,015	500	3,427	1,016	4,458
2009	174,839,479	263,580,941	22,426,200	189,015,943	51,906,565	76,876,549	2	258	79,506,027	213,172,264
2010	155,351,356	231,682,898	25,420,486	190,096,355	30,705,853	47,175,331	328	2,226	176,962,799	181,567,409
2011	177,077,432	315,037,143	28,198,072	209,816,125	28,663,859	57,527,117	423	2,032	57,570,684	146,502,416
2012	213,230,856	429,286,583	24,774,194	178,732,627	47,739,200	379,852,285	423	176,035	18,714,767	42,198,059
2013	190,369,264	413,877,517	29,189,131	219,435,931	45,326,362	132,465,692	153,423	520,118	15,772,058	49,832,975
2014	196,992,806	428,625,206	27,263,500	200,829,895	18,124,620	66,209,659	5,360	147,955	6,536,690	22,705,813
Jan_2015	18,070,333	33,775,506	2,247,537	17,521,066	1,633,458	4,270,578	363	7,094	1,376,000	2,806,427
Feb	14,594,912	27,675,823	1,339,965	10,911,395	1,412,480	3,567,966	442	12,659	63,487	131,049
Mar	15,576,039	32,453,967	2,900,809	23,395,950	1,988,076	4,885,420	36	634	649,855	1,483,166

Source: Statistics Botswana (International Merchandise Trade Statistics)



4.1.4. Human Water Supply Situation

Botswana gets 56 percent of its water source from boreholes and the rest (44 percent) from dams (Rural Development Council, 2015: 44). The same report indicates that currently the production and monitoring of boreholes indicate a decline in water levels. This is attributable to low and unreliable rainfall coupled with high rates of potential evapotranspiration. The flat topographic nature of Botswana results in low rates of surface run off and groundwater recharge.

It is evident from Table 4.1h that dam levels declined during the 2014/15 period. As previously mentioned, the country is faced with a challenge of high evaporation rates due to semi-arid weather conditions and below to normal rainfall, hence this decline. Gaborone Dam has been declared failed reaching critical levels at 1.7 percent in June 2015. Bokaa Dam has also declined whilst Nnywane has shown a slight improvement in water levels though it does not contribute much to the water supply of the area (Rural Development Council, 2015).

Currently there are 80 villages and settlements with water deficits inclusive of the following major villages: Kanye, Moshupa, Bobonong, Goodhope, Lentsweletau, Thamaga, Maun, Tlokwen, Ramotswa and Mogoditshane. The water supply versus demand map (Figure 4.1h) depicts that some of the districts in Botswana experienced a water supply deficit of more than 30 percent due to:

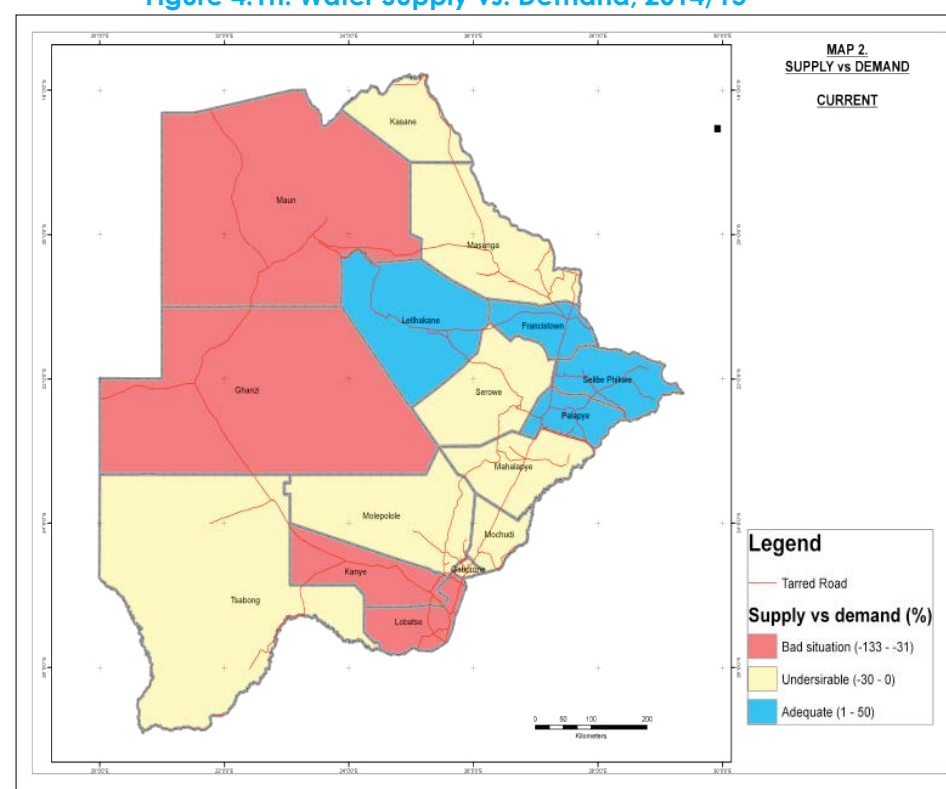
- i) Inappropriate and undeveloped water supply infrastructure, for example, Palapye and Maun,
- ii) Dilapidated water supply infrastructure, for example, Molepolole, Kanye scheme infrastructures, and
- iii) Watering of livestock by farmers (Rural Development Council, 2015: 50).

Table 4.1h: Percentage Dam Levels in 2014/15

Year	Month	Dam									
		Gaborone	Nnywane	Bokaa	Letsibogo	Shashe	Nlimbale	Thune	Lotsane	Dikgatlhong	Molatedi
2014	17 th February	13.2	74.7	38.5	100.9	98.3	100	41.6	99.1	101	20.2
	14 th March	16	-	57	103.7	103.4	102	55.5	108.3	106.5	26
	14 th April	15.1	73	56.2	97.7	97.3	98.4	55.7	96.4	98.9	35.3
	16 th May	13.7	67.6	50.2	93.6	94.3	97.5	58.7	94.2	98.3	34.6
	15 th July	11.3	54.6	41.8	86.6	87.9	94.1	58.7	84.5	95.6	31
	29 th August	9.8	54.1	36.3	77.5	83.4	90.5	52	82.9	95.4	28.4
	23 rd September	8.5	51.1	30.5	78.7	80.6	88.7	51.2	80.7	92.3	26.8
	8 th October	7.5	47	27.3	75.9	78.9	87.3	49.9	77.5	91.2	24.7
	14 th November	6.1	40.2	22	72.3	75.1	84.1	48.1	75.2	88.2	21.7
	15 th December	5.2	92.1	19.7	70.7	71.5	84.1	48.1	71.7	87.1	20.8
	*January	4.7	93.2	20.5	69.9	83.7	89.6	47.7	73.4	88	18
	17 th February	4.2	94.2	21.2	69	95.8	95	47.2	75	88.8	15.2
2015	9 th March	3.4	88.4	18.4	65.2	93.9	92	46.8	72.2	87.4	15.2
	15 th April	2.7	85.6	15.5	58.3	92.6	97.9	45.5	70	85.6	13.4
	15 th June	1.7	73.3	8.2	53.1	95.1	93.9	43.1	64.8	82.5	11.5

Dash (-) = no data
*January data interpolated using average of two nearest neighbours
Source: Water Utilities Corporation publications

Figure 4.1h: Water Supply vs. Demand, 2014/15



4.2. Response to Drought Impacts

4.2.1. Drought Declarations 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 are: very little rains, 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 then recommends: 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 50 percent price subsidy on seed for a maximum of 5 hectares per farmer in the communal sub-sector. Drought relief programs are drawn from the on-going development projects which have been in the normal development planning process (CSO, 2009).

Table 4.2a presents Labour Intensive Public Works Programmes for the period 2009/10 to July 2015/16. The primary focus is on the amount of money expended during the review period. It is evident from the table that the amount of money budgeted for the Labour Intensive Programmes followed an upward trend: there is a two-fold increase from BWP260,000,000 budgeted in 2009/10 to BWP635,590,000 budgeted in 2015/16. Out of the total money budgeted (BWP3,200,560,000) for during the review period, about 54.83 percent (BWP1,754,939,159.47) was used for labour; 11.41 percent (BWP365,038,904.15) was used for material; running expenses accounted for about 7.03 percent (BWP224,995,849.91); and about 7.61 percent (BWP243,515,051.85) was used for sustenance.

A total of BWP2,144,242,051.31 was expended in the Labour Intensive Public Works Programmes, about 33.00 percent short of the amount budgeted (BWP3,200,560,000) for. Table 4.2a also reveals that, of the 20,665 planned projects only 10,334 were completed during the review period. This is not impressive in terms of service delivery. A total of 2,889,766 employment opportunities were created by the Labour Intensive Programmes. The sex differentials of the total cumulative employment are such that females (2,113,095) were employed in large numbers as compared to their male counterparts (776,131) during the review period (Table 4.2b). Cumulative employment is the actual employment which increases by successive addition, while targeted employment is the selective employment which is often based on set criteria.

Table 4.2a: Labour Intensive Public Works Programmes (2009-2014)

Year	Budget	Labour	Material	Running Expenses	Subsistence	Total Expenditure	Planned	Completed
*2015/16	635,590,000	410,507,768.00	79,136,400.00	39,405,272.00		635,590,000.00	3,098	14
*2014/15	580,590,000	163,897,317.15	31,834,324.09	15,225,409.60	40,356,668.90	251,313,719.74	3,676	392
2013/14	580,590,000	337,953,989.86	80,632,611.57	34,543,396.53	66,354,476.00	519,484,473.96	3,607	1,546
2012/13	530,590,000	264,122,361.00	57,253,568.13	34,188,832.08	30,263,346.95	385,828,108.16	3,058	2,614
2011/12	330,000,000	254,974,500.26	21,414,999.36	24,401,451.70	-	300,790,951.32	2,335	1,296
2010/11	283,200,000	205,022,327.20	37,672,440.00	34,076,011.00	-	276,770,778.20	2,277	2,241
2009/10	260,000,000	118,460,896.00	57,094,561.00	43,155,477.00	-	218,710,934.00	2,614	2,231
TOTAL	3,200,560,000	1,754,939,159.47	365,038,904.15	224,995,849.91	243,515,051.85	2,588,488,965.38	20,665	10,334

Note: 2014/15 Expenditure figures are as at July 2015

Source: Rural Development Council

Figure 4.2a: Labour Intensive Public Works Programmes (2009-2014)



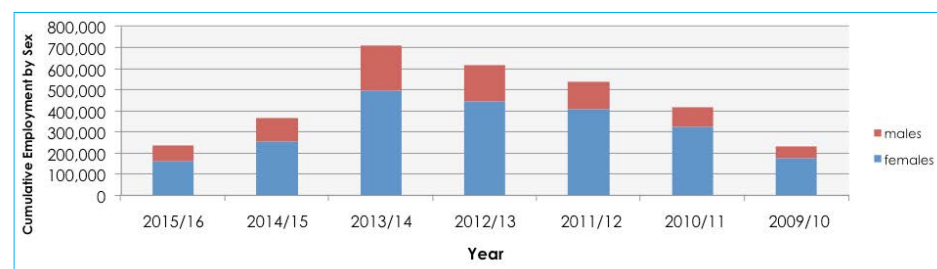
Table 4.2b: Employment status, Wage and sustenance rates for financial years 2009/10 to 2015/16

Year	Cumulative Employment			Targeted Employment		Wages per Month		Sustenance (per person per day)
	Females	Males	Total	Cumulative	Monthly	Labourers	Supervisor	
2015/16	165,428	74,291	239,719	256,764	64,191	540	620	8
2014/15	255,511	110,596	366,107	394,542	65,757	510	590	7
2013/14	498,578	214,628	713,206	727,801	61,670	480	560	5
2012/13	445,214	174,937	620,151	662,000	55,000	400	534	3
2011/12	410,998	127,756	538,754	600,000	50,000	400	534	-
2010/11	326,620	91,756	418,376	480,000	40,000	360	528	-
2009/10	176,174	56,458	232,632	480,000	40,000	360	480	-
Totals	2,113,095	776,131	2,889,766	3,344,343	312,427			

Note: 2015/16 Employment figures are as at August 2015

Source: Rural Development Council

Figure 4.2b: Cumulative Employment status by sex for financial years 2009/10 to 2015/16



4.2.2. Food Relief Services

The food relief services are provided by the Food Relief Services Department of the Ministry of Local Government and Rural Development. The Department ensures the implementation of the Food Relief Services Programme as well as managing and supplying food commodities to the feeding centres countrywide.

Table 4.2c provides a summary of annual food supplies and deliveries for the feeding programmes during the period 2008/9 – 2013/14. The distribution of food commodities under the Primary School Feeding Programme fluctuated during the review period, with the lowest quantities supplied in 2012/13 (56 percent), 2013/14 (60 percent), and 2008/09 (70 percent) in that order. This is due to shortages of some food commodities in the market and failure of suppliers to honour contracts (Drought & Household Food Security Outlook, 2008; CSO, 2009: 33).

In summary, Rural Development Council (2015: 113) reports that there has been a decline in the distribution of food commodities at both primary schools and health facilities. With regards to the nutrition status of children aged 0 – 59 months, the Rural Development Council (2015) reports that the situation is improving across the districts although still higher than the 3 percent national target for total malnutrition. This is attributable to the fact that the Remote Area Development Programmes (RADS) continue to exhibit high levels of malnutrition.

Table 4.2c: Annual Food Supplies and Deliveries for the Feeding Programmes, 2009 – 2010 All Depots (Summary)

Year	Commodity	Primary Schools		Health Facilities		Beneficiaries			
		Quantity Required (mt)	Quantity supplied (mt)	Quantity Required (mt)	Quantity supplied (mt)	Targeted		Actual Beneficiaries fed	
						Primary Schools	Health Facilities	Primary Schools	Health Facilities
2008/09	Sorghum grain 50kg	2729.74	2534.38	N/A	N/A	251075	N/A	251075	N/A
	Sorghum meal 25kg	60.12	53.7	N/A	N/A	20849	N/A	20849	N/A
	Beans 50kg	2878.78	2206.36	2579.99	1466.08	271924	116530	271924	66218
	Samp 25kg	2211.37	1392.33	N/A	N/A	271924	N/A	271924	N/A
	Stewed steak 3.1kg	1066.17	827.81	N/A	N/A	271924	N/A	271924	N/A
	Veg oil 750ml	534.99	259.11	2070.41	612.97	271924	234139	271924	69320
	UHT Milk 340ml	3578.11	1873.66	N/A	N/A	271924	N/A	271924	N/A
	M/meal 5.5kg	N/A	N/A	7608.33	4380.14	N/A	116530	N/A	67087
	Tsabana 2.5kg	N/A	N/A	8484.11	6368.22	N/A	117608	N/A	88278
Total		12010.3	8358.53 (70%)	19216.13	12015.62 (63%)				
2009/10	Sorghum grain 50kg	2606.01	2138.98	N/A	N/A	250636	N/A	250636	N/A
	Sorghum meal 25kg	96.08	87.08	N/A	N/A	10877	N/A	10877	N/A
	Beans 50kg	3239.95	2726.58	2565.65	1927.9	261513	116216	261513	87328
	Samp 25kg	2187.22	1813.74	N/A	N/A	261513	N/A	261513	N/A
	Stewed steak 3.1kg	1032.12	974.6	N/A	N/A	261513	N/A	261513	N/A
	Veg oil 750ml	485.04	176.25	2066.36	511.49	261513	230985	261513	57176
	UHT Milk 340ml	3510.38	3088.46	N/A	N/A	261513	N/A	261513	N/A
	M/meal 5.5kg	N/A	N/A	7774.65	4137.92	N/A	116216	N/A	61854
	Tsabana 2.5kg	N/A	N/A	9037.82	7195.64	N/A	114769	N/A	91376
Total		13156.8	11005.69 (84%)	21444.48	13772.95 (64%)				
2010/11	Sorghum grain 50kg	2 793	2 416.3	N/A	N/A	265 974	N/A	265 974	N/A
	Sorghum meal 25kg	337.28	323.27	N/A	N/A	44 970	N/A	44 970	N/A
	Beans 50kg	3 576	2 439.7	2 372.3	1 804.9	310 944	121 357	310 944	83 532
	Samp 25kg	2 394.27	1 512.46	N/A	N/A	310 944	N/A	310 944	N/A
	Stewed steak 3.1kg	1 150.49	1 150.49	N/A	N/A	310 944	N/A	310 944	N/A
	Veg oil 750ml	536.38	436.3	1 959.19	1 019.31	310 944	234 885	310 944	107 920
	UHT Milk 340ml	23 406.39	1 616.85	N/A	N/A	310 944	N/A	310 944	N/A
	Tsabotihe 2.5kg	N/A	N/A	8 163.4	4 679.4	N/A	123 688	N/A	72 458
	Tsabana 2.5kg	N/A	N/A	8 814.3	7 465.8	N/A	117 524	N/A	100 913
Total		13 643.10	9 940.21 (73%)	22 022.28	15 209.54 (69%)				

Source: Rural Development Council Secretariat

Table 4.2c: Annual Food Supplies and Deliveries for the Feeding Programmes, 2011 – 2013 All Depots
(Summary) Continued...

Year	Commodity	Primary Schools		Health Facilities		Beneficiaries			
						Targeted		Actual Beneficiaries fed	
		Quantity Required (mt)	Quantity supplied (mt)	Quantity Required (mt)	Quantity supplied (mt)	Primary Schools	Health Facilities	Primary Schools	Health Facilities
2011/12	Sorghum grain 50 kg	2645.37	2478.14	N/A	N/A	259571	N/A	259571	N/A
	Sorghum Meal 25 kg	93.23	5.58	N/A	N/A	8605	N/A	8605	N/A
	Beans 50 kg	3265.59	2959.89	2895.45	2236.19	268176	717714	268176	554298
	Samp 25 kg	2315.14	1114.95	N/A	N/A	268176	N/A	268176	N/A
	stewed steak 3.1 kg	1052.04	923.59	N/A	N/A	268176	N/A	268176	N/A
	veg oil 750 ml	565.91	245.99	2392.13	291.28	268176	832687	268176	193809
	UHT milk 340 ml	3587.45	2572.82	N/A	N/A	268176	N/A	268176	N/A
	Malutu 5.5 kg	N/A	N/A	7542.76	1662.03	N/A	717714	N/A	158146
	Tsabana 2.5 kg	N/A	N/A	8691.46	2696.04	N/A	114973	N/A	35663
Total		13524.73	10300.96	21521.8	6885.54		832687	268176	193809
	% Supply	76%		40%					
2012/13	Sorghum grain 50 kg	2433.48	1289.8	N/A	N/A	239359	N/A	268761	N/A
	Sorghum Meal 25 kg	167.57	76.35	N/A	N/A	28817	N/A	28817	N/A
	Beans 50 kg	2996.52	1007.58	2122.19	427.58	268176	166415	268176	69588
	Samp 25 kg	2093.9	1523.16	N/A	N/A	268176	N/A	268176	N/A
	stewed steak 3.1 kg	1009.5	943.23	N/A	N/A	268176	N/A	268176	N/A
	veg oil 750 ml	588.22	479.93	1875.63	1504.72	268176	382874	268176	261551
	UHT milk 340 ml	3366.6	1850.09	N/A		268176	N/A	268176	N/A
	Malutu 5.5 kg	N/A	N/A	7119.56	5222.78	N/A	175701	N/A	106364
	Tsabana 2.5 kg	N/A	N/A	8766.87	6525.87	N/A	207173	N/A	155187
Total		12655.79	7170.14	19884.25	13680.95	268176	382874		261551
	% Supply	56%		68.80%					
2013/14	Sorghum grain 50 kg	3051.54	2616.75	N/A	N/A	259674	N/A	259674	N/A
	Sorghum Meal 25 kg	135.18	56.64	N/A	N/A	15409	N/A	15409	N/A
	Beans 50 kg	3758.4	2573.12	2894.5	1713.7	259674	117492	259674	73978
	Samp 25 kg	2652.24	380.49	N/A	N/A	259674	N/A	259674	N/A
	stewed steak 3.1 kg	1214.49	1128.93	N/A	N/A	259674	N/A	259674	N/A
	veg oil 750 ml	655.72	66.56	2235.77	128.56	259674	247 359	259674	190 313
	UHT milk 340 ml	4085.85	2509.05	N/A	N/A	259674		259674	N/A
	Malutu 5.5 kg	N/A	N/A	8484.84	6550.11	N/A	117492	N/A	92239
	Tsabana 2.5 kg	N/A	N/A	10576.46	7801.18	N/A	129867	N/A	98074
Total		15553.42	9331.54	24191.57	16193.55	259674	247 359	259 674	190 313

Source: Rural Development Council Secretariat

4.2.3. Drought-Tolerant Livestock (Tswana Breed & MUSI Composite Cattle Breed)

The indigenous breeds for cattle and goats (Tswana) have high adaptive capacity to harsh environment (Republic of Botswana, 2015.b). It is for this reason that Tswana cattle have been selected to develop a composite cattle breed known as Musi. Musi has been developed to improve animal productivity and adaptability to harsh climatic conditions. It is composed of Tswana (28 percent), Tuli (4.4 percent), Brahman (22.6 percent), Simmental (26.3 percent) and Bonsmara (18.4 percent) (Republic of Botswana, 2015.a). Adaptability traits inherited from Tswana and Tuli make it (Musi) tolerant to climate variability and change in the region and has good growth ability inherited from exotic breeds.

Therefore, an increase in the domestication of drought-tolerant livestock makes communities less vulnerable to impacts of climate change, specifically those caused by recurring droughts.

On average, Morale Ranch in Mahalapye Agricultural District had the highest population of Musi cattle during the period 2008 – 2015 (Table 4.2d and Figure 4.2d). On the other hand, the annual differentials are such that Matlolakgang Ranch in Kweneng (128 cattle) recorded the highest number of Musi cattle in the year 2015 alone. The least number of cattle were recorded at Sebele Ranch in the Gaborone Region. The national total population of Musi cattle fluctuated between the years 2008 and 2015 with the highest total population (381) recorded in 2015 (Figure 4.2e). There was a 34.63 percent increase in the national total population of Musi cattle from 283 recorded in 2008 to 381 in 2015. (Refer to Table 4.2d, Figures 4.2d and 4.2e)

Figure 4.2c: Musi Composite Cattle Breed



Source: Republic of Botswana, 2015.b: 13

Table 4.2d: MUSI Cattle population by District and Ranch (2008 - 2015)

	2008	2009	2010	2011	2012	2013	2014	2015
Kweneng (Matlolakgang Ranch)	51	55	63	90	84	88	86	128
Mahalapye (Morale Ranch)	53	53	103	121	108	126	109	102
Ghanzi (Xanagas Ranch)	49	48	59	83	91	102	91	86
Barolong (Morapedi Ranch)	114	132	144	48	63	56	65	61
Maun Region (Tsetseku ranch)	16	16	20	7	6	6	5	4
Francistown Region (Impala Ranch)	-	-	33	-	-	-	-	-
Gaborone Region (Sebele Ranch)	-	-	-	-	15	2	-	-
TOTAL	283	304	422	349	352	378	356	381

Source: Agriculture Statistics Unit

Figure 4.2d: MUSI Cattle population by District and Ranch (2008 - 2015)

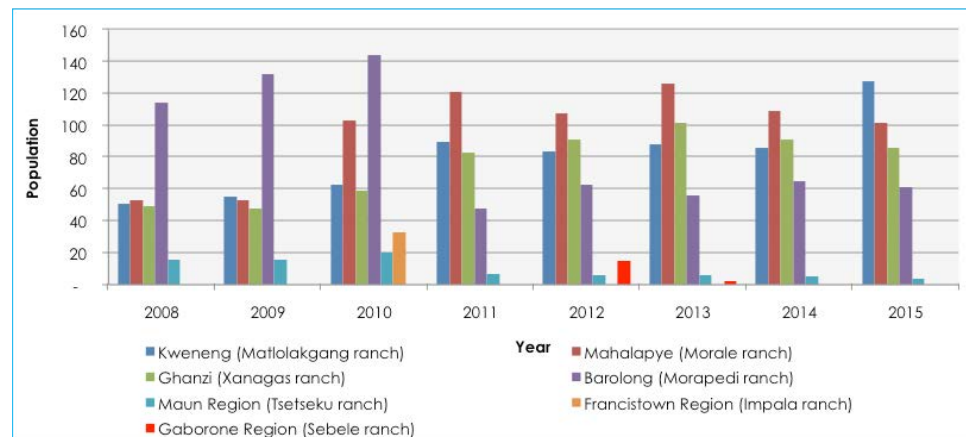


Figure 4.2e: National Musi cattle population (2008 - 2015)

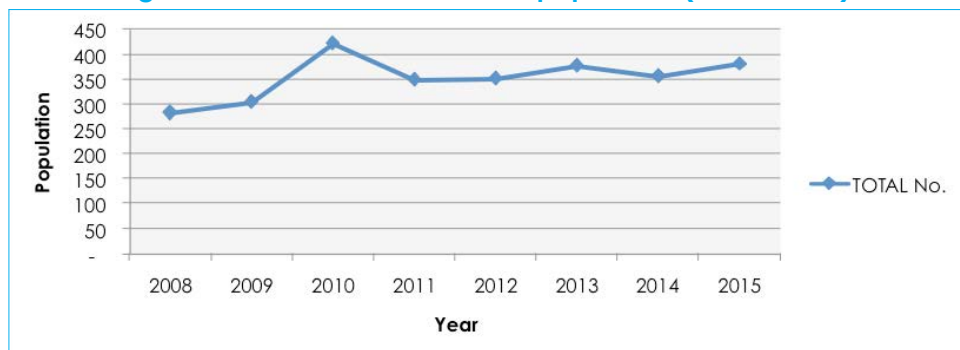


Table 4.2e presents drought-adapted/tolerant livestock population ('000) by district for the period 2008 – 2013. Generally, the population of Tswana Cattle followed an upward trend from 2008 - 2010 then saw a downward trend from 2010 - 2013. The highest total number of Tswana Cattle was recorded in 2010 (1,110,634) followed by 1,108,992 which was recorded in 2009. The region with the highest population of Tswana Cattle during the review period is the Central Region which is made up of: Mahalapye East, Mahalapye West, Palapye, Serowe, Bobonong, Letlhakane, and Selebi Phikwe.

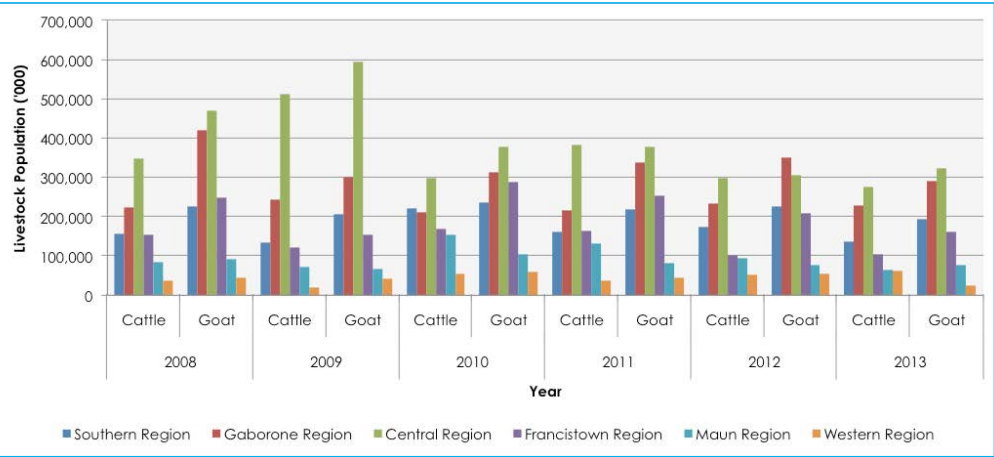
Table 4.2e also shows that the population of Tswana goats fluctuated during the review period with the highest count recorded in 2008 (1,503,326) and the lowest in 2013 (1,074,279). The Central Region had the highest population of Tswana Goats throughout the period 2008 – 2013 (See Table 4.2e and Figure 4.2f). In summary, the population of both Tswana cattle and goats (drought-adapted) are slightly reducing in numbers. This is not a good sign more especially in the phase of the devastating impacts of climate change which worsens the already existing problem of food insecurity.

Table 4.2e: Drought-Adapted/Tolerant Livestock Population ('000) by District (2008 - 2013)

Agricultural District	2008		2009		2010		2011		2012		2013	
	TSWANA Cattle	TSWANA Goat	TSWANA Cattle	TSWANA Goat	TSWANA Cattle	TSWANA Goat	TSWANA Cattle	TSWANA Goat	TSWANA Cattle	TSWANA Goat	TSWANA Cattle	TSWANA Goat
Barolong	21,959	27,681	17,044	17,465	35,611	52,303	15,953	29,001	31,554	39,037	15,884	25,256
Ngwaketse South	25,637	26,958	13,127	25,210	17,474	16,392	22,675	28,857	17,068	24,691	15,969	23,534
Ngwaketse North	32,435	70,156	31,291	81,209	41,469	72,194	41,930	44,441	52,396	79,943	41,630	74,023
Ngwaketse Central	58,027	70,367	33,874	46,794	75,342	63,946	49,615	72,485	42,726	49,544	35,790	43,263
Ngwaketse West	19,978	31,106	39,738	34,980	50,743	31,211	32,463	43,758	29,866	32,652	27,575	27,384
Southern Region	158,036	226,268	135,074	205,658	220,639	236,046	162,636	218,542	173,610	225,867	136,848	193,460
Bamalete /Tlokeng	16,120	67,405	11,597	23,289	17,163	47,013	16,516	39,224	18,981	46,657	36,959	37,394
Kweneng South	101,763	184,724	150,054	136,139	75,351	105,336	87,165	117,900	64,643	96,862	68,144	105,618
Kweneng North	34,206	70,763	21,861	42,305	20,129	52,332	28,654	68,061	43,376	83,204	29,277	46,864
Kweneng West	29,788	48,337	18,877	44,634	41,662	50,398	37,927	46,616	28,701	58,501	25,239	33,544
Kgatleng	43,682	48,853	42,236	55,637	57,781	58,715	47,238	66,207	78,482	66,236	68,473	69,196
Gaborone Region	225,559	420,082	244,625	302,004	212,086	313,794	217,500	338,008	234,183	351,460	228,092	292,616
Mahalapye East	23,088	33,126	26,099	51,463	33,331	44,645	31,925	38,839	19,135	37,990	31,255	38,611
Mahalapye West	69,521	76,005	100,023	77,832	92,890	86,838	92,458	79,167	59,475	56,065	78,144	72,436
Palapye	55,429	110,357	80,689	91,765	58,214	112,567	68,567	84,919	76,840	78,794	55,673	78,490
Serowe	47,265	57,555	102,972	92,939	32,307	27,042	47,327	34,363	33,014	33,271	42,284	40,556
Bobonong	68,262	90,168	49,331	95,958	13,686	35,435	21,097	37,720	16,609	25,577	7,935	27,942
Letlhakane	60,968	62,573	113,212	102,530	41,723	41,268	87,785	69,867	71,102	49,361	49,862	49,939
Selebi-Phikwe	24,911	40,309	40,107	82,200	27,617	30,736	35,485	34,946	23,165	26,112	12,471	14,753
Central Region	349,444	470,093	512,433	594,687	299,768	378,531	384,644	379,821	299,340	307,170	277,624	322,727
Tati	35,452	64,717	30,637	53,939	27,447	52,149	23,660	54,089	12,240	37,065	8,142	34,396
Tutume	84,842	137,576	62,868	57,135	99,196	163,340	103,417	139,332	64,585	123,113	74,471	88,812
Tonota	35,326	47,963	29,530	43,875	42,582	72,738	36,298	61,247	24,626	49,225	22,519	39,487
Francistown Region	155,620	250,256	123,035	154,949	169,225	288,227	163,375	254,668	101,451	209,403	105,132	162,695
Ngamiland West	18,812	13,260	26,192	21,766	38,723	35,488	37,318	18,616	14,945	24,590	9,536	11,504
Ngamiland East	63,031	77,246	42,097	46,014	109,683	66,362	92,318	60,690	76,303	52,434	52,578	65,086
Chobe	2,301	695	4,424	310	6,147	2,125	2,228	2,188	2,914	622	3,476	1,325
Maun Region	84,144	91,201	72,713	68,090	154,553	103,975	131,864	81,494	94,162	77,646	65,590	77,915
Ghanzi	23,272	13,899	10,793	34,904	21,975	18,237	16,590	17,176	9,044	13,245	48,397	14,446
Hukuntsi	10,162	15,396	5,075	4,759	8,040	11,868	8,040	11,868	23,168	15,019	14,210	8,891
Tsabong	5,294	16,131	5,244	3,764	24,348	29,674	12,721	16,426	20,087	26,650	385	1,529
Western Region	38,728	45,426	21,112	43,427	54,363	59,779	37,351	45,470	52,299	54,914	62,992	24,866
TOTAL	1,011,531	1,503,326	1,108,992	1,368,815	1,110,634	1,380,352	1,097,370	1,318,003	955,045	1,226,460	876,278	1,074,279

Source: Agriculture Statistics Unit

Figure 4.2f: Drought-Adapted/Tolerant Livestock Population ('000) by Region (2008 - 2013)



5.0. VELDT FIRES

This section provides information on fire incidences and impacts by district and protected area for the years 1994 to 2014 and part of 2015. Veldt Fire is the uncontrolled burning of open grazing areas and they usually occur during winter season (CSO, 2009). Fires occur in two-fold: either natural or unnatural. Natural fires are caused by ignition from lightning which mostly occur during the rainy seasons, while unnatural fires are caused by ignition occurring as a result of human intervention. Unnatural fires are common during the dry season and often prolonged by late rains (HIU Consultants, 2008).

In Botswana, man causes the vast majority of wild-land fires (unnatural fires). According to the Department of Forestry and Range Resources (DFRR) the unnatural fires may be incidental and occur through the use of fire as a tool, such as agriculture management, honey collection, grazing and harvesting management or accidental occurring through mismanagement of cooking fires, cigarettes smoking, among others. Depending on the season and weather conditions these human induced fires often burn vast areas and are difficult to control due to their remoteness, inaccessibility and their high fire intensity (http://www.mewt.gov.bw/DFRR/article.php?id_mnu=318).

5.1. Impacts of Veldt Fires

Since the impacts of veldt fires can be devastating to both humans and the environment they depend on, it is important to collect and document such information for fire management and monitoring purposes. Fires contribute to the destruction of fauna and flora, loss of human and animal lives and there are economic implications; cost incurred in fighting the fire, provision of aid, and loss of economically active population (CSO, 2009: 37). It is better to prevent unwanted fires than to sustain unacceptable loss to natural resources as a result of fire (DFRR).

5.1.1. Fire Incidences

Table 5.1a shows the total number of veldt fire incidences in each district between 1994 and 2014 though the data for the year 2013 are missing. The table reveals that the highest numbers of National Fire incidences were recorded in 2008 (278), 2010 (256), and 2011 (251) in that order. The Ngamiland District experienced more fire incidences during the review period with a total of 470 compared to all the districts. The second highest was the Central District with a total of 465 fire incidences followed by Kweneng District (437). The least number of fire incidences during the review period were recorded in the South East (130), North East (173), and Kgatleng (186) in their ascending order.

Table 5.1a: Number of Fire Incidences by District (1994-2014)

District	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014
Ngamiland	69	9	55	-	-	50	17	24	18	17	-	2	12	18	41	9	11	15	-	103
Central	7	5	96	31	-	15	8	44	11	12	2	9	12	14	82	19	26	18	6	48
Chobe	25	18	22	43	-	15	5	9	3	12	-	-	4	5	10	17	28	42	3	46
Southern	5	2	17	11	-	30	20	49	7	9	19	13	5	3	11	25	18	28	2	14
Ghanzi	9	5	8	39	-	13	44	24	12	5	5	6	14	22	39	3	9	8	9	12
Kweneng	10	-	8	18	-	13	41	40	46	14	8	13	11	7	47	34	55	48	13	11
Kgalagadi	19	3	12	34	8	22	27	20	10	1	5	-	5	13	24	5	52	35	10	11
North East	-	-	4	25	3	4	18	7	52	6	12	8	11	2	3	6	1	8	-	3
Kgatleng	-	-	12	-	-	2	4	3	18	3	7	7	3	-	16	11	53	45	1	1
South East	-	2	11	3	-	1	21	9	45	6	1	3	6	-	5	0	3	4	10	0
Total	144	44	245	204	11	165	205	229	222	85	59	61	83	84	278	129	256	251	54	249

Source: Department of Forestry & Range Resources
Note: No data for the year 2013

5.1.2. Fire Affected Area

Table 5.1b and Figure 5.1a show the total area (hectares) affected by veldt fires by district in the period 2006 to 2014 and some part of 2015. It is evident from the table that all the districts experienced a fluctuating trend of area affected by fire during the review period. The largest total area affected by fire in Botswana was recorded in 2011 (15,439,034 hectares), 12,685,235 hectares in 2010 and 11,846,790 hectares in 2008, in that order.

Districts which were affected by fire the most in terms of area burnt in 2011 were Ghanzi, Ngamiland and Kgalagadi with 5, 228, 034 hectares, 3, 712, 408 hectares and 3, 466, 251 hectares respectively. Ngamiland and Ghanzi Districts were also the most affected in 2014.

Table 5.1c shows the percent of fire affected area by district for the years 2006 to 2015. Proportionately, Ngamiland District, Ghanzi District and Chobe District show more hectarage of burnt areas. The table further shows that the North East and South East Districts had the lowest proportionate burnt area. This is attributable to the fact that these districts have the lowest land area compared to all the districts, among other factors. (Table 5.1c and Figure 5.1b)

Table 5.1b: Fire Affected Area (Hectares) per District 2006-2015

District	District size	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015**
Ngamiland	11,134,421	1,929,956	854,680	2,565,514	842,762	2,408,697	3,712,408	5,120,500	984,900	1,180,793	125,202
Ghanzi	11,472,587	1,428,153	1,109,580	5,241,479	238,065	5,291,407	5,228,384	1,951,300	532,600	1,118,966	16,714
Central	14,637,419	803,070	56,820	1,460,431	179,136	2,757,523	1,150,172	1,345,400	49,400	281,256	5,353
Chobe	2,101,920	771,400	309,390	683,599	446,677	534,789	812,350	649,600	15,800	427,815	1,264
Kgalagadi	10,491,604	665,520	738,995	397,478	357,151	901,540	3,466,251	1,290,000	217,600	358,947	415
North East	514,619	32,955	1,070	1,910	3,301	494.00	14,846	16,700	0	57	124
Southern	2,723,320	2,090	58,620	87,933	45,953	884,225	378,296	506,800	37,600	16,006	94
Kweneng	3,696,345	3,280	0	1,287,104	9,336	683,658	514,127	437,700	219,100	18,462	35
South East	85,800	5,350	0	9,888	0	1,503	2,804	4,500	200	0	17
Kgatleng	761,943	3,280	0	111,452	2,571	122,939	159,396	5,000	18,700	535	0
Grand Total	57,619,978	5,645,054	3,129,155	11,846,790	2,124,952	12,685,235	15,439,034	11,327,500	2,075,900	3,402,837	149,218

Source: Department of Forestry & Range Resources
Note (**): Statistics up to May 2015

Figure 5.1a: Fire Affected Area (Hectares) per Selected Districts 2006-2015

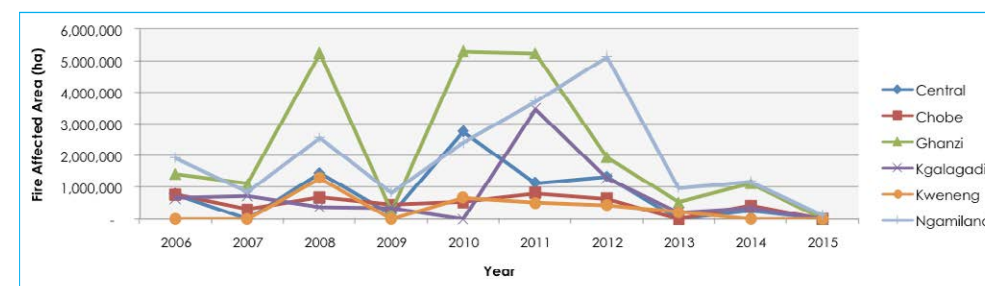
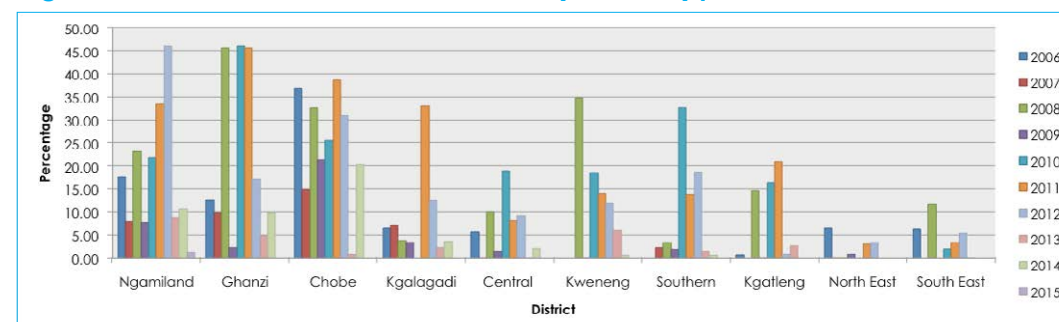


Table 5.1c: Percent of Fire Affected Area (Hectares) per District 2006-2015

District	District size	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Ngamiland	11,134,421	17.33	7.68	23.04	7.57	21.63	33.34	45.99	8.85	10.60	1.12
Ghanzi	11,472,587	12.45	9.67	45.69	2.08	46.12	45.57	17.01	4.64	9.75	0.15
Chobe	2,101,920	36.70	14.72	32.52	21.25	25.44	38.65	30.91	0.75	20.35	0.06
Central	14,637,419	5.49	0.39	9.98	1.22	18.84	7.86	9.19	0.34	1.92	0.04
North East	514,619	6.40	0.21	0.37	0.64	0.10	2.88	3.25	-	0.01	0.02
South East	85,800	6.24	-	11.52	-	1.75	3.27	5.24	0.23	-	0.02
Southern	2,723,320	0.08	2.15	3.23	1.69	32.47	13.89	18.61	1.38	0.59	0.00
Kweneng	3,696,345	0.09	-	34.82	0.25	18.50	13.91	11.84	5.93	0.50	0.00
Kgalagadi	10,491,604	6.34	7.04	3.79	3.40	-	33.04	12.30	2.07	3.42	0.00
Kgatleng	761,943	0.43	0	14.63	0.34	16.13	20.92	0.66	2.45	0.07	-
Grand Total	57,619,978	9.80	5.43	20.56	3.69	22.02	26.79	19.66	3.60	5.91	0.26

Derived from Table 5.1b

Figure 5.1b: Percent of Fire Affected Area (Hectares) per Selected Districts 2006-2015



5.1.3. Areas Burnt in Protected Areas

Table 5.1d shows the areas burnt in protected areas for the period 2008 to 2011. The Central Kalahari Game Reserve (CKGR) experienced the greatest extent of wild fires during the period under review. The CKGR has the largest land area compared to the other protected areas. The Kgalagadi Trans-Frontier Park (KTP) also shows one of the largest areal expanses of burning, particularly for the years 2009 (257,241 hectares) and 2011 (435,282 hectares).

Proportionately, Kasane Forest Reserve Extension, Kazuma Forest Reserve and Kutse Game Reserve show more hectareage of burnt areas with 97 percent experienced in Kutse Game Reserve in 2010 and about 92 percent experienced in Kazuma Forest Reserve in 2010 (Table 5.1e). These fires burnt nearly the reserves' whole area.

Table 5.1d: Burnt Areas in Protected Areas (2008-2011)

PROTECTED AREAS	Size (ha)	2008	2009	2010	2011
CKGR Game Reserve	5,226,136	3,352,491	78,991	3,330,236	2,702,829
Transfrontier National Park	2,620,712	0	257,241	39,459	435,282
Chobe National Park	1,062,447	180,185	4,774	208,757	274,791
Kutse Game Reserve	255,137	71,948	6,054	248,483	157,916
Sibuyu Forest Reserve	119,433	81,525	15,136	0	98,303
Kasane Forest Reserve Extension	67,175	59,583	n/a	54,747	48,466
Nxai Pan National Park	249,093	53,491	1,866	127,744	36,636
Maikaelele Forest Reserve	53,220	15,447	n/a	40,826	30,313
Kazuma Forest Reserve	19,536	17,980	n/a	13,380	8,944
Makgadikgadi Pans National Park	505,901	4,723	14,616	308,531	6,802
Chobe Forest Reserve	143,197	42,686	n/a	15,692	0
Nata Bird Sanctuary	24,943	401	n/a	24	0
Moremi Game Reserve	489,614	794	n/a	0	0

Source: Department of Forestry & Range Resources
Note: n/a means data not available

Table 5.1e: Percent of Burnt Areas in Protected Areas (2008-2011)

PROTECTED AREAS	Size (ha)	2008	2009	2010	2011
Sibuyu Forest Reserve	119,433	68.26	12.67	0.00	82.31
Kasane Forest Reserve Extension	67,175	88.70	n/a	81.50	72.15
Kutse Game Reserve	255,137	28.20	2.37	97.39	61.89
Maikaelele Forest Reserve	53,220	29.02	n/a	76.71	56.96
Central Kalahari Game Reserve	5,226,136	64.15	1.51	63.72	51.72
Kazuma Forest Reserve	19,536	92.04	n/a	68.49	45.78
Chobe National Park	1,062,447	16.96	0.45	19.65	25.86
Transfrontier National Park	2,620,712	0.00	9.82	1.51	16.61
Nxai Pan National Park	249,093	21.47	0.75	51.28	14.71
Makgadikgadi Pans National Park	505,901	0.93	2.89	60.99	1.34
Chobe Forest Reserve	143,197	29.81	n/a	10.96	0.00
Nata Bird Sanctuary	24,943	1.61	n/a	0.10	0.00
Moremi Game Reserve	489,614	0.16	n/a	0.00	0.00

Derived from Table 5.1d
Note: n/a means data not available

5.2. Response to Impacts of Veldt Fires

Fire like any other natural extreme event needs management in order to reduce its impact on the environment (e.g. fauna and flora). The DFRR reports that fire management is a technical, socio-cultural and political challenge that requires an effective network of willing partners and appropriate fire management functions and processes to effectively find the right balance between developing and conserving natural resources and managing unwanted fires. Many local communities use their indigenous knowledge to manage and prevent fires, hence the need to tap into those resources.

At present, the Department of Forestry and Range Resources (DFRR) in collaboration with Environmental Support Programme (ESP)/Global Environment Facility (GEF) is in the process of developing proposals for the development of community fire management plans in respect of two Trusts (Khama Rhino Sanctuary and Mababe Zokotsama Community Development Trust). The objective of the design of Community Based Fire Management plans aim at: (i) creating sensitivity, awareness and knowledge about fire, its usage, benefits and danger; (ii) enabling the communities to manage fire for their own benefits (prescribed burning) and minimize the negative impacts of fire (including provision of basic fire suppression training); and (iii) enabling communities to develop, regulate and enforce village fire regulations and suppress unwanted fires through village fire crews.

The other fire management approach (strategy) used in Botswana rely upon legislation and threat of punishment through law enforcement to prevent fires. It focuses on maintaining firebreaks and reactive suppression of uncontrolled wild land fires when they occur. According to DFRR this fire management strategy is intensive and costly requiring considerable resources and capabilities to implement.

With the saying that 'if you cannot measure it, you cannot manage it' it is important to collect and document statistics on fire management in order to inform policies and programmes that are aimed at reducing the extent of fire outbreaks as well as their impacts on the environment.

The intention of the subsequent subsection of this digest was to report on response time to veldt fires and the area change under firebreaks as well as their maintenance but data was not available. Data that is available on response time to veld fires dates as far back as 2006 (refer to sub-section 5.2.1).

5.2.1. Response Time to Veld Fires

On average the DFRR responded to wild land fires within 17 hours; due to slow resources mobilization (See Table 5.2a). The resources included but not limited to; human, transportation, and water for fire extinguishing. The target time of two (2) hours set by the DFRR is proving to be unrealistic and unachievable due to the aforementioned challenges.

Table 5.2a: Response Time to Veld Fires by District (2006)

Fire Name	Place/District	Date reported	First Attack	Time
2006				
CKGR	Gantsi	10/8/2006	11/8/2006	24hrs
Chobokwane	Charleshill	11/12/2006	12/12/2006	24hrs
Sepako	Central Tutume	4/9/2006	4/9/2006	04hrs
Parakarungu	Chobe	27/07/2006	28/07/2006	24hrs
Savuti	Chobe	22/09/2006	24/09/2006	-
Mamuno/Kalkfontein	Gantsi	8/9/2006	8/9/2006	11hrs

Source: Department of Forestry & Range Resources

6.0. POLICY FRAMEWORK AND DISASTER RISK REDUCTION EFFORTS

This section presents policy framework and disaster risk reduction efforts in Botswana. Several attempts have been made in order to abate the impacts and risks associated with natural disasters; some of the efforts include disaster preparedness committees, disaster management structures with policies and programmes, among others.

6.1. Policy Framework

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 in view of the fact that 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:

- a) 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.
- b) To create a framework facilitating the preparation of plans and legislation for the effective implementation of disaster management in Botswana and its legitimacy.
- c) To outline the responsibilities of different personnel at different levels in the implementation of the disaster management programme.
- d) To establish a set of working definitions for the disaster management programme in Botswana.
- e) To ensure that the disaster management policy is consistent with policies from other sectors and the objectives of the National Development Plan.

6.2. Disaster Risk Reduction Efforts

Disaster Risk Reduction should not be implemented in an isolated manner and it should take cognisance of international agreements and guidelines (Republic of Botswana, 2013). The United Nations International Strategy for Disaster Reduction (UNISDR) Hyogo Framework for Action of 2005-2015 highlighted the following relevant strategic action points, against which disaster risk management activities should be measured:

- a) Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.
- b) Identify, assess and monitor disaster risks and enhance early warning.
- c) Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
- d) Reduce the underlying risk factors.
- e) Strengthen disaster preparedness for effective response at all levels.

The International Strategy for Disaster Reduction reflects a major shift from the traditional emphasis on disaster response to disaster reduction, and in effect seeks to promote a “culture of prevention” (www.unisdr.org/who-we-are/international-strategy-for-disaster-reduction)

In 2009 the Government took a step towards a paradigm shift from the usual approach of ‘disaster management’ to ‘disaster risk reduction.’

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.

Table 6.1 indicates to what extent measurable disaster risk reduction activities and principles have been implemented as at 2013. Only the item on “Articles and news on disaster risk management are regularly published in the media” has been fully achieved, and the majority of the items/actions have not been achieved.

Table 6.1: Status on Disaster Risk Reduction Initiatives as at 2013

Item/Action/Outcome	National Status
1. The implementation of risk reduction or other initiatives are based on the disaster risk assessment results	1
2. Case studies, initiatives and lessons learned in risk reduction have been documented and disseminated	2
3. Risk reduction-related projects and initiatives have been included in development plans	1
4. Disaster risk reduction programmes, projects and initiatives have been implemented	2
5. Progressive application of disaster risk reduction techniques and measures are reported in annual reports and submitted to the National Disaster Management Office.	2
6. Effective and appropriate early warning strategies have been developed and implemented and the information communicated to stakeholders to enable appropriate responses	2
7. Disaster risk reduction is the focus of all disaster risk management awareness programmes	2
8. Awareness of disaster risk management is promoted at schools and in communities known to be at risk	2
9. Awareness of disaster risk management is widespread, and risk-avoidance behaviour is integrated into the day-to-day activities of all stakeholders	1
10. Articles and news on disaster risk management are regularly published in the media	3
11. Disaster risk reduction is included as a standard agenda item for consideration at meetings of all governmental role players and stakeholders	1
12. Disaster risk reduction is included as a standard agenda item for consideration at meetings of all non-governmental role players and stakeholders	1
13. Budgets in all spheres of government include the costs of routine disaster risk reduction measures and activities	1
14. Feasibility studies for capital projects include information drawn from disaster risk assessments and appropriate risk reduction measures	1
15. Capital budgets clearly reflect the costs of disaster risk reduction	1
16. There is a clear correlation between disaster risk reduction and effective law, bylaw and policy enforcement	1
17. Vulnerability have decreased in the last five years as a result of risk reduction initiatives	2

Note: 1= Not yet achieved; 2= Started-in process/Partially achieved; 3= Fully achieved
Source: Republic of Botswana (2013)

6.3. Climate Smart Agriculture/Conservation Agriculture Programme

Food insecurity and climate change remains the biggest challenges in developing countries. As a result, agriculture in developing countries should undergo significant transformation in order to meet the escalating challenge of food insecurity (FAO, 2010). With an increase in both food consumption trends and population growth, it is expected that a 60 percent increase in global agricultural production will be required by 2050 (FAO 2012; Kaczan et al. 2013). This challenge is most severe in Sub-Saharan Africa (Kaczan et al. 2013), where there is an expectation that the population would increase from the neighbourhood of one billion in 2010 to between 1.9 and 2.4 billion people in 2050 (UNDESA, 2012). To make sure there are adequate food supplies it will require faster growth in agricultural production as compared to that experienced over the past decade (World Bank, 2013).

Botswana just like most of the sub Saharan African countries has the majority of her population dependent on agriculture. About 50 percent of its population is based in rural areas and dependent on rain-fed agriculture for their livelihoods (Republic of Botswana, 2015). The country is characterised as an arid climate, with about 6 percent of the total land area suitable for agriculture. Due to the water scarcity and unfertile soils, livestock dominates Botswana's agriculture, and the subsector accounts for over 80 percent of the country's agriculture Gross Domestic Product (GDP) (Republic of Botswana, 2015). It is against this background that the country is prone to the current and projected negative impacts of climate change and variability (e.g. recurring droughts, long seasons of dry spells, declining rainfall and increased temperatures).

Consequently, there is a need to simultaneously improve agricultural productivity and reduce yield variability over time under adverse climatic conditions (Kaczan et al., 2013). According to Kaczan et al. (2013) a proposed means to achieve this, is increased adoption of a 'climate-smart agriculture' (CSA) approach (FAO, 2010). CSA, which is defined by its intended outcomes, rather than specific farming practices, is composed of three main pillars:

- sustainably increasing agricultural productivity and incomes;
- adapting and building resilience to climate change and reducing and/or
- removing greenhouse gases emissions relative to conventional practices (FAO, 2013; Kaczan et al., 2013: 3).

There are increasing regional and international calls for Climate Smart Agriculture (CSA) as part of the quest to transform Africa's agricultural systems towards more productive, efficient, resilient and sustainable systems in the face of changing global food systems and climate change (Republic of Botswana, 2015).

It is against this backdrop that the national CSA Program for Botswana for 2015-2025 has been developed and expected to be launched sometime this year (2016). It is jointly implemented by Ministry of Agriculture and Ministry of Environment, Wildlife and Tourism.

Agricultural growth is crucial for stimulation of Botswana's economic growth. Total dependence on rain-fed agriculture and poor soils increases vulnerability of farming systems and predisposes rural households to food insecurity and poverty thus eroding their productive assets and weakening their coping strategies and resilience (Republic of Botswana, 2015).

Republic of Botswana (2015: vi) further reports that to address this challenge, the Government of Botswana identifies six strategic priorities as sources of Botswana's agricultural development and growth in a changing climate. The six strategic priorities are:

a) Improved Productivity and Incomes – A pro-growth, pro-poor development agenda that supports agricultural sustainability and includes better targeting to climate change impacts will improve resilience and climate change adaptation. Because climate change has a negative impact on agricultural production, achieving any given food and nutrition security target will require greater investments in agricultural productivity.

b) Building Resilience and Associated Mitigation Co-Benefits - CSA will help reduce vulnerability of Botswana's agriculture sector by increasing productivity, enhancing adaptation and resilience of the farming systems and reducing emissions intensity in the context of achieving sustainable development and poverty eradication.

c) Value Chain Integration - This approach is holistic in that it considers input supply, production, agricultural services, marketing, and business support services as necessary building blocks. Under the approach, both public and private sectors are seen as critical actors in the value chain.

d) Research for Development and Innovations – Although Botswana has a fairly developed agricultural research system; use of modern science and climate smart technologies in agricultural production is still limited. The role of research will be reoriented to support innovations that facilitate the transition to climate-smart agriculture by smallholder farmers. A major thrust will be use of climate-smart agricultural practices, promoting improved land management and sustainable crop-livestock and fisheries intensification, in order to bolster farmers' adaptive capacity and support the national vision of achieving food security.

e) Improving and Sustaining Agricultural Advisory Services - Agro-advisory services that include climate applications for agriculture will help farmers to make informed decisions in the face of risks and uncertainties, in addition to the integrated management of present and emerging pests and disease challenges. Climate applications include seasonal weather forecasts, monitoring and early warning products for drought, floods and pests and disease surveillance.

f) Improved Institutional Coordination - Improved institutional coordination is crucial for the achievement of horizontal and vertical integration required for effective discharge of the CSA Programme. The achievement of horizontal integration requires a framework that provides high-level guidance while vertical integration is instrumental in determining the roles of various sector institutions and devolved Governments in performing CSA mandates. The proposed coordination framework will improve Inter-Ministerial and District level coordination; enhance partnerships with private sector and civil society organizations; and strengthen coordination with development partners.

Reference:

Anderson, J., & Bausch, C., (2006). **Climate Change and Natural Disasters: Scientific evidence of a possible relation between recent natural disasters and climate change** (IP/A/ENVI/FWC/2005-35) Briefing Note. European Parliament, Policy Department Economic and Scientific Policy. Pgs. 1-30 (http://www.ecologic.eu/sites/files/project/2013/Brief_CC_and_natural_disasters_scientific_evidence_of_relation_Jan_2006_EP_version.pdf) Accessed 25.09.2015.

Central Statistics Office(2009). **Natural Disaster Digest 2008** . Gaborone: Central Statistics Office.

Department of Environment, Food & Rural Affairs, United Kingdom, Climate Change & Energy, 2005 (<http://www.defra.gov.uk/environment/statistics/globalatmos/index.htm>) Accessed 21.10.2015.

Department of Forestry and Range Resources (DFRR). **Fire Management**. (http://www.mewt.gov.bw/DFRR/article.php?id_mnu=318) Accessed 05/11/2015

Dunno, H.C., (2011). **Measuring Social Vulnerability to Natural Hazards: An Examination of the United States Virgin Islands**, Ph.D. Thesis, Directed by Dr. Rick Bunch. 207 pp.

FAO (2012). **'The State of Food insecurity in the World (SOFI)'** , Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

HIU Consultants, (2008). **Wildfires, A Natural Phenomenon?** FSP NO 5072

International Federation of Red Cross & Red Crescent Societies, (2011). Disasters in Africa: **The case for legal preparedness**. Geneva, Switzerland. (<https://www.ifrc.org/PageFiles/92463/IDRL-Africa-Report-2011.pdf>) Accessed 24.09.2015.

International Panel on Climate Change- IPCC (2007). **IPCC Fourth Assessment Report: Climate Change 2007** (https://www.ipcc.ch/publications_and_data/ar4/syr/en/mains1.html) Accessed 25.09.2015.

Kaczan, D., Arslan, A., & Lipper, L., (2013). **Climate-Smart Agriculture? A Review of current practice of agroforestry and conservation agriculture in Malawi and Zambia**. ESA Working Paper No. 13-07, Agricultural Development Economics Division of Food and Agricultural Organization of the United Nations. Pg. 1-62.

Kanwar, S.S., & Thummarukudy, M., (2014). **Disaster Risk Reduction is an Integral Objective of Environment Related Policies and Plans, Including for Land Use, Natural Resource Management and Adaptation to Climate Change**. Prepared for the 2015 Global Assessment Report on Disaster Risk Reduction, Disaster Risk Reduction United Nations Environment Programme, Geneva.

Manthe-Tsuaneng, M., (2014). **Drought Conditions and Management Strategies in Botswana**. Ministry of Environment, Wildlife and Tourism- Natural Resources. (http://www.ais.unwater.org/ais/pluginfile.php/601/mod_page/content/27/BotswanaFinal.pdf) Accessed 28.10.2015.

Republic of Botswana (1996). National Policy on Disaster Management. Office of the President, National Disaster Management Office, No. CAB. 27/96.

Republic of Botswana (2013). **Natural Disaster Risk Reduction Strategy 2013-2018, Beyond Vulnerability- Towards resilience**. In collaboration with United Nations Development Programme and National Disaster Management Office. (<http://www.undp.org/content/dam/botswana/docs/Gov>). Accessed on the 04/01/2016.

Republic of Botswana (2015.a). **Botswana Baseline Report on Climate Change Adaptation & Mitigation** submitted by Ministry of Environment, Wildlife and Tourism and Ministry of Agriculture to Southern African Development Community (SADC).

Republic Of Botswana (2015.b). **Botswana Climate Smart Agriculture Programme 2015 – 2015**. Jointly implemented by Ministry of Agriculture and Ministry of Environment, Wildlife and Tourism.

Secretary-General Ban Ki-moon (2013). Secretary-General's message on **World Day to Combat Desertification and Drought**. United nations, New York, 17 June 2013. (<http://www.un.org/sg/sTaTeMenTs/index.asp?nid=6911>). Accessed 07/01/2016.

Secretary-General Ban Ki-moon (2015). **World Threatened by Dangerous and Unacceptable Levels of Risk from Disasters**. United nations, New York, 4 March 2015. (<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=26788&ArticleID=34790&I=en>). Accessed 21/10/2015.

Southern African Development Community(2000). **Special Report on Floods in Southern Africa_Regional Food Security Programme-Growing Season- 1999/2000** - Issue 2. Gaborone. (<http://reliefweb.int/report/botswana/special-report-floods-southern-africa>) Accessed 21/10/2015.

UNDESA (2012). **'World Population Prospects: The 2010 Revision'** , United Nations Department of Economic and Social Affairs (DESA), Population Division. (<http://data.un.org>). Accessed 05/01/2016.

United Nations Environment Program (2009). **Environment and Disaster Risk: Emerging Perspectives**. Prepared on behalf of the UNISDR Working Group on Environment and Disaster, Nairobi, Kenya.

United Nations Environment Program (2004). **APELL and Floods A community-based approach for disaster reduction**. (<http://www.unep.org/resourceefficiency/Portals/24147/scp/sp/publications/brochures/pdf/APELL-Floods.pdf>) Accessed 22/10/2015.

UNISDR. **Disaster Risk Reduction in the Post-2015 Development Agenda 'Transforming Our World: The 2030 Agenda for Sustainable Development'** (http://www.unisdr.org/files/45417_disasteriskreductionpost2015develo.pdf) Accessed 24.09.2015.

United Nations Office for Disaster Risk Reduction. **United Nations International Strategy for Disaster Reduction** (UNISDR). (<https://www.unisdr.org/who-we-are/international-strategy-for-disaster-reduction>). Accessed 05/01/2016.

United Nations General Assembly Session (UNGASS) 44 Resolution 236. A/RES/44/236 22 December 1989. Accessed 05.01.2016.

United Nations Resident Coordinator. (2013). **Botswana: Floods** - Office of the Resident Coordinator Situation Report No. 1.

VAM, Food Security Analysis **(2015) El Niño: Implications and Scenarios for 2015**.

World Bank (2013). 'Fact Sheet: **The World Bank and Agriculture in Africa**', (<http://go.worldbank.org/GUJ8RVMRLO>). Accessed 05/01/2016.

World Bank (2014). **Natural Disasters in the Middle East and North Africa; A Regional Overview**. Urban, Social Development, and Disaster Risk Management Unit: Sustainable Development Department Middle East and North Africa. In partnership with UNDP, UNISDR, & GFDRR. Pgs. 1-52.

World Disaster Report (2014). **Focus on Culture and Risk**. (<https://www.ifrc.org/en/publications-and-reports/world-disasters-report/>) Accessed 24/09/2015.

REGIONAL FOOD SECURITY PROGRAM - **GROWING SEASON STATUS - 1999/2000** - Issue 2 - February 2000

ANNEXES

Table 3: National Floods Incidences & Impacts (2010 – 2015)

Incident	Year	District	Villages	Impact/Damages		Assistance given	
				No. of households affected	Total no. of individuals affected / displaced	Tents	Food Baskets
Floods	2010	Ngamiland	Ikoga, Nxamasere, Etsha 13, Mohembo east, Kauxhwi, Jao Flats, Ereisha, Beetsha, Gudigwa, Tubu	168	800	235	-
		Sowa Sub	Sowa Town	31	84	-	-
	2013	Tutume Sub	Matsitama, Dukwi, Mosetse, Marapong, Zoroga, Tutume, Goshwe, Maposa, Makoba	446	1,489	400	218
		Tonota	Serule	5	-	-	-
	2014	Selebi Phikwe	Selebi Phikwe	10	42	-	-
		Francistown	Francistown	25	87	2	7
Storm Rains	2015	Ghanzi	D'Kar, Kuke, New Xade, Chobokwane, Ghanzi, Grootlagte, Qabo	140	859	130	136
	2010	North West	Maun	132	568	132	69
	2012	Mahalapye Sub	Mahalapye	329	1,756	119	322
Hailstorm	2013	Palapye Sub	Maunatlala, Seolwane, Mogapi, Matolwane, Mogapinyana, Malaka	27	115	-	-
		Ngwaketsi	Ntlhantlhe, Lekgolobotlo	49	-	18	-
		Kgatleng	Morwa, Bokaa, Oodi, Rasesa, Malotwana, Mochudi	81	242	32	27
	2014	North West	Maun	5	17	2	2
		Kweneng	Salajwe	32	96	3	19
		Moshupa Sub	Kgomokasitwa	114	506	46	56
Hailstorm & Heavy Rains	2010	Mahalapye Sub	Poloka, Setsile	19	-	-	-
		Kgatleng		39	-	7	12
Storm Winds	2010	Kgatleng	Ramotlabaki, Malolwane, Kgomodiatshaba	32	212	32	-
Thunderstorm	2010	North West	Maun	37	89	4	5
Storm	2014	Lobatse	Lobatse	51	36	7	8
		Tutume Sub	Tutume	35	127	13	-
		North West	Maun	5	17	2	2
Heavy Rains	2013	Palapye	Maunatlala, Seolwane, Mogapi, Matolwane, Malaka, Mogapinyana	27	115	-	-
		Bobonong	Lepokole, Mathathane, Molalatau, Mmadinare, Tsetsebjwe	-	-	-	-
		Tutume Sub	Tutume	-	32	18	5
		Central	Maunatlala, Topisi, Moreomabele, Tamasane, Mogapi, Lesenepole, Mosweu, Mokokwana, Seolwane, Lerala, Majwaneng, Ratholo, Goo Tau, Goo Sekgweng, Mathakola, Mokungwane, Lecheng	294	433	54	42
		North West	Tsau, Nxaraga, Semboyo, Shorobe, Toteng, Makalamabedi, Makankung, Sehithwa, Chanoga, Xhama, Phuduhudu, Maun,	303	-	271	61
	2014	Tonota Sub	Tonota, Shashemooke, Mabesekwa, Mandunyane, Foley, Gojwane, Serule	133	393	57	26
		Central	Serowe, Dimajwe, Mmashoro, Tshimoyapula, Mabeleapodi	106	491	81	75
		Ghanzi	Tshootsha, Charleshill	24	-	12	-
		Tutume Sub	Tutume	57	49	11	-
		Goodhope	Sekhutlane, Leporung, Mmakgori	28	169	23	8
	2015	Thamaga Sub	Thamaga	25	-	10	14
		North West	Bodibeng	11	80	11	9

Source: National Disaster Management Office

