Contact Unit:
Environment Statistics Unit
Phone: 3671300

BOTSWANA ENVIRONMENT STATISTICS
NATURAL DISASTERS DIGEST 2017

STATISTICS BOTSWANA

Published by

STATISTICS BOTSWANA
Private Bag 0024, Gaborone
Tel: 3671300 **Fax:** 3952201
E-mail: info@statsbots.org.bw
Website: www.statsbots.org.bw

November 2018

BOTSWANA ENVIRONMENT STATISTICS

NATURAL DISASTERS DIGEST 2017

Preface

Statistics Botswana, through the Environment Statistics Unit (ESU), presents the third edition of the Botswana Environment Statistics: Natural Disasters Digest. The digest provides reliable and recent statistics together with trends analysis on natural disasters, focusing on climate v ariability, floods, earthquakes, droughts and veldt fires particularly with reference to incidences, impacts and responses.

Secondary data were used in the production of this digest and were sourced mainly from the National Disaster Management Office, Department of Forestry and Range Resources, Ministry of Local Government and Rural Development, and Ministry of Agricultural Development and Food Security.

The Framework for Development of Environmental Statistics (FDES) of the United Nations Statistics Division was used in the preparation of this 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 Agricultural Development and Food Security for their significant contribution by providing the required data. 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. Statistics Botswana outputs/publications are available on the website at **www.statsbots.org.bw** and at the Statistics Botswana Library which is based at the Head-Office in Gaborone.

Thank you.

Dr. Burton Mguni
Statistician General
November , 2018

Contents

List of Tables

List of Figures

LIST OF ACRONYMS

BPS: Botswana Police Service
BWP: Botswana PULA
CSO: Central Statistics Office
DFRR: Department of Forestry & Range Resources
FDES: Framework for Development of Environment Statistics
IFRC: International Federation of Red Cross
Kg: Kilogram
LTA: Long-Term Average
MENCT: Ministry of Environment, Natural Resources Conservation & Tourism
MITI: Ministry of Investment, Trade & Industry
MNIG: Ministry of Nationality, Immigration & Gender Affairs
NDMO: National Disaster Management Office
STA: Short-Term Average
UNEP: United Nations Environment Programme
UNISDR: United Nations International Strategy for Disaster Reduction

EXECUTIVE SUMMARY

The report is divided into five main sections: i) Climate Variability Situation in Botswana; ii) Floods, Storms and Earthquakes Impacts and Responses; iii) Drought Impacts and Responses; iv) Veldt Fires Impacts and Responses; and v) Policies and practices for Climate-Smart Agriculture (CSA).

Regarding 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 2016. During the review period, the maximum average temperature fluctuated slightly around the LTA of 29.60C. The years 2012 (29.880C), 2013 (30.450C), and 2016 (30.500C) recorded temperatures above LTA of 29.600C. Minimum temperature for all the years in the review period exceeded the LTA figure of 12.600C. This shows that temperatures have been getting warmer over the current years.

The national average rainfall saw a significant decrease from an average of 463.7 mm during the period 1970/71 to 2000/01 (LTA's) to a short term average (STA) of 216.4 mm recorded in 2016/17. This shows that rainfall has been generally on the decline during the recent years (STA) when compared to the long term averages.

During the 2010-2017 period a total of 1,123 households and 4,580 individuals were affected by floods. Consequently, 792 tents and 498 food baskets were dispensed as relief. Generally, the impact of floods were on the decrease during the recent years as compared to the impact recorded in 2013. A total of 1,594 households were affected by heavy rains during the period 2013 – 2017. The highest impact was recorded in the year 2013. The Southern Sub-District had the highest records of earthquake impact with one infrastructure damaged and 200 individuals affected in 2017.

The whole country was declared drought stricken during these periods: 1981-1987; 1991-1999; 2001-2005; 2007-2008; 2011-2013; and 2014-2015. The year 2016 was partially drought stricken, due to below normal rainfall received in some parts of the country. This digest further reports that crop yields do not meet the country's food requirements, hence the over dependence on imports. A total of BWP9.22 Billion was used to import cereals (maize, rice, sorghum, millet and wheat) during the period 1999-2017. With regards to "Drought-Related Livestock Mortality by District and Region, 2015 – 2016" the report reveals that the country experienced the highest cattle mortality, followed by goats.

It is observed that dam levels were on the decline during the 2014 - 2016 period. However, the dam levels experienced a rise during the years 2016 and 2017 due to good rains that were received.

As a response to droughts the Botswana Government expended the sum of BWP 3.18 Billion on Labour Intensive Public Works Programmes. The amount of money expended in the Labour Intensive Public Works Programmes fluctuated during the 2009-2016 period with the highest amount expended in the year 2015/16 (BWP 635.59 Million). There has been a decline in the distribution of food commodities at both primary schools and health facilities, which is attributable to shortages of some food commodities in the market.

The highest numbers of National Fire incidences were recorded in the years 2017 (295), 2010 (256), 2011 (251), and 2014 (249) in that order. The Ngamiland District experienced more fire incidences compared to other districts. All the districts followed a downward trend of area affected by fire between the years 2012 and 2016. However, there was a slight increase from the area affected by fire for all the districts from the years 2016 to 2017.

1.0. INTRODUCTION

Natural hazards are defined as the geophysical events with a potential of causing natural disaster; on the other hand natural disasters are naturally occurring events or consequences of natural hazards affecting daily human activities (CSO, 2009). In an event where there is vulnerability, natural disasters result from natural hazards (Statistics Botswana, 2016). According to Kanwar and Thummarukudy (2014) disasters can cause huge damage to environmental assets and human development, while degraded environments, settlement patterns, livelihood choices, and climate change worsen impacts of disasters.

Africa is faced with increasing 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, heavy seasonal rainfall that started in December 2014 caused flooding in Southern Africa; as of 16 Jan 2015, about 135,000 people had been affected in Malawi, Mozambique, Madagascar and Zimbabwe (OCHA, 16 Jan 2015). Heavy rains experienced in the first quarter of 2015 caused flooding in 15 out of the 28 districts in Malawi, most of which are located in the southern part of the country, and as a result the President declared a state of disaster on 13 January 2015 (IFRC, 2016). During the same period, Zimbabwe experienced widespread flooding across the country, with the worst affected provinces including Manicaland, Mashonaland Central, Mashonaland East, Mashonaland West and Midlands. According to preliminary assessments, approximately 6,000 people (1,200 households) were affected, of which 2,500 people (500 households) were in urgent need of assistance, and the flood-affected population were moved to higher ground, with some seeking refuge in schools (IFRC, 2016).

In Botswana, floods were more pronounced in Tutume Sub-District during the period 2010 to 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 (Statistics Botswana, 2016). In 2014, thunderstorm affected 51 households and displaced 36 individuals in Lobatse. Out of a total of 981 households affected by heavy rains during the period 2013 to 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 (Statistics Botswana, 2016). The Report further highlights that the whole country was impacted by droughts during the years: 1981–1987; 1991–1999; 2001–2005; 2007–2008, 2012, and 2014.

The aforesaid impacts are worsened by climate change, which causes increase in temperatures, sea level rise, changing patterns of rainfall, and increase in frequency, duration and intensity of extreme weather events such as storms, cyclones, and droughts (Kanwar and Thummarukudy, 2014).

The 2030 Agenda for Sustainable Development highlights the need for disaster risk reduction across sectors of the economy, which is informed by the understanding that disaster risk reduction is cross-cutting and requires a multi-sectoral approach. 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 thought-provoking backdrop and the identified need to support the on-going development of SDGs indicators and the implementation of the Sendai Framework for Disaster Risk Reduction that data collection and documentation of natural disasters statistics is important. Therefore, the purpose of this digest is to provide and discuss reliable statistics and trends analysis on natural disasters, focusing on 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, "Component 4" in particular, which focuses on "Extreme Events and Disasters" (see Figure 1.1). 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 (Statistics Botswana, 2016).

Secondary data from the administrative records were used for the production of this digest, and were drawn from various departments namely the Department of Forestry and Range Resources (Fire Section), National Disaster Management Office, Department of Meteorological Services, Rural Development Council, Ministry of Agricultural Development and Food Security (Agriculture Statistics Unit & Food Security Coordination Unit), and other related literature. The cost of collecting administrative data is less than conducting a survey, and the level of response burden is also lessened (UNFDES, 2013).

Formal data request letters were sent to the data providers during the third quarter of the year 2017/18. In the same quarter, data request follow-ups were made to ensure that at least enough data had been gathered to start the analysis and report writing. Data collection continued into the fourth quarter of 2017/18. Both data analysis and report writing were done during the fourth quarter of 2017/18 and first quarter of the year 2018/19. 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.

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 positively correlated to climate and climate change, and their relationship has given rise to climate-related natural disasters (CSO, 2009). The Earth's climate has changed many times in response to a variety of both human and natural causes.

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 immediate 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.

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 rainfall 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.

2.1. Temperature

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

Presented in this sub-section is 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 2016. Botswana temperature fluctuates between extremes in summer and winter; temperatures drop below freezing point in winter and rise above 37°C in some summer months in parts of the country.

In comparing the long term average maximum temperatures for 1971-2000 (LTA's) with the short term average maximum temperatures (years 2010-2016) it is evident from Table 2.1 and Figure 2.1 that the STAs had slight increases from the LTAs figure of 29.50C with 29.880C recorded in 2012, 30.450C in 2013, and 30.500C recorded in 2016. Some years recorded temperature below the LTAs; these are the years 2010, 2011, 2014, and 2015 with 29.25°C, 29.35°C, 29.13°C, and 29.07°C respectively.

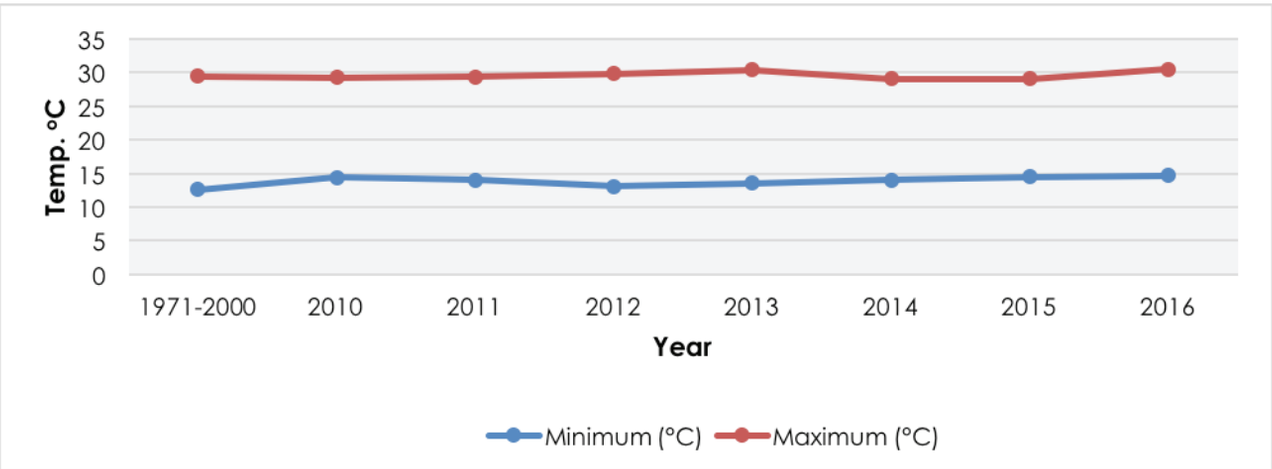
The average minimum temperatures showed an upward trend from the LTA to all the STA temperatures. The following average minimum temperatures increased from the 1971-2000 figure of 12.60°C to: 14.40°C in 2010, 14.07°C in 2011, 14.08°C in 2014, 14.55°C in 2015, and 14.70°C in 2016.

Generally, the results show that temperatures have been slightly getting warmer in recent years compared to the long-term average temperatures. Literature elsewhere supports these results, for example VAM, Food Security Analysis (2015) reports that the overwhelming evidence is that the 2015 El Niño event remained active throughout 2015 and extended into early 2016. Rural Development Council (2017) adds that Botswana continued to be hotter than the average conditions during the year 2016/17, with Ghanzi, Shakawe, Tsabong and Tshane recording extremely hot temperatures of 41.4°C, 41.6°C, 40.7°C, and 41.0°C respectively.

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

Temperature	1971-2000	2010	2011	2012	2013	2014	2015	2016
Maximum (°C)	29.5	29.25	29.35	29.88	30.45	29.13	29.07	30.5
Minimum (°C)	12.6	14.4	14.07	13.13	13.6	14.08	14.55	14.7

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. The long term average rainfall figures are for the thirty-year (30) period stretching 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 2016/17.

Botswana rainfall season 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 250 mm and 550 mm.

It is evident from Table 2.2 that the national average rainfall followed a downward trend during the period to a low of 216mm in 2016/17, a big deviation from the LTA of 463.7mm during the period 1970/71 – 2000/01. The table further shows a declining trend from the year 2009/10 to 2012/13. It can therefore be concluded from these results that rainfall has been on the decline during recent years (STA) when compared to the long term averages (see Figure 2.2).

However, the 2016/17 (October to March) rainfall season received above normal rainfall, with some areas recording in excess of 800mm during this season (Rural Development Council, 2017). This is an exception which resulted from the incursion of tropical depression 'Dineo' into Botswana and its subsequent heavy rains. Rural Development Council (2017) asserts that areas around southern Ngamiland, north-central of Ghanzi district and some parts in the Central District showed vegetation condition that was much above normal (p.11), impying that the vegetation responded well to extreme precipitation that was received.

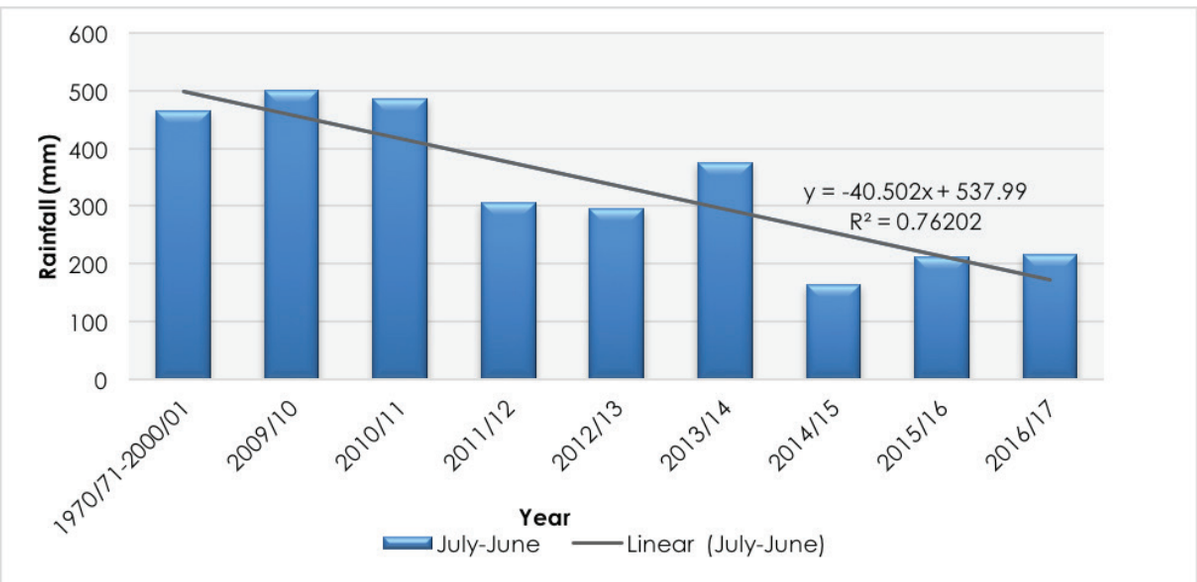
Nonetheless, Botswana is located in the area which is constantly affected by below-average rainfall and this is likely to affect the country in the future. According to FEWS NET (2014) this belt stretches from southern/central Mozambique in the east to Namibia in the west, as well as the western half of South Africa. The countries in this stretch experienced below average precipitation in at least 5 out of 10 El Niño years.

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

Meteorological Year	Year								
	1970/71-2000/01	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
July-June	463.7	500.7	485.8	306.1	295	375.5	164.9*	211.2	216.4

Data Source: Department of Meteorological Services; SADC Statistical Year Book, 2016.
***Data incomplete**

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



3.0. FLOODS, STORMS AND EARHQUAKES

A flood is defined as an overflow of water onto an area beyond its limits. This overflow can be due 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 caused by seasonal precipitation); ii) Flash floods (caused by seasonal storms); and iii) Coastal floods (overflow of ocean water caused by storms, wind etc.). Both river floods and flash floods are common in Botswana.

Floods pose a serious threat to human beings; they cause loss of lives, damage to personal property, destruction of infrastructure (roads, buildings, dams and bridges) and damage to crop fields and natural vegetation (Statistics Botswana, 2016). Floods are classified as natural hazards. They only become disasters when they destroy human settlements, or when they displace, cause injuries or death.

3.1. Incidences, Impacts/Damages and Responses

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

3.1.1. Floods

Table 3.1.1a depicts that during the period (2013 to 2017) the impacts of floods were more prominent in Tutume Sub-District. In 2013 alone, the floods affected 446 households and displaced a total of 1,489 individuals in Tutume Sub-District. The second district most affected by floods was the Ghanzi District in 2015. A total of 139 households were affected, with 859 individuals . Current floods statistics reveal that a total of 205 households were affected by floods, with 794 individuals affected/ displaced during the year 2017. During the same year, Ghanzi District recorded the highest number of households affected (63) and individuals affected (282). Regarding the assistance given, 36 tents

and 34 food baskets were dispensed to the victims. The topography of Ghanzi District does not have water bodies; therefore this affirms the fact that the floods in this area are mainly flash floods. In the same year (2017), the floods incidences occurred in the following districts: Kgatleng, Kweneng, Ghanzi, North East, Southern, and Ngamiland.

In an effort to relief the victims of the floods, a total of 814 tents and 498 food baskets were given out during the 2013 – 2017 period.

Botswana was hit by tropical depression named 'Dineo' between 18 and 23 February 2017. During this period, some significant flooding caused damages to human assets and infrastructure (Table 3.1.1b). By the end of February a total of 650 households were severely affected by the flooding post-Dineo, with over 500 houses destroyed and infrastructure, telecommunication lines and livelihoods disrupted countrywide (IFRC, 2017). As a form of relief, the International Federation of Red Cross and Red Crescent Societies reported in 2017 that: a total of 300 displaced households were in community halls, schools, and churches; and 500 households with 2,500 beneficiaries needed humanitarian assistance.

Table 3.1.1a: Floods Incidences & Impacts by District, 2010 - 2017

				Impact/Damages		Assistance given	
Incident	Year	District	Villages	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, Eretsha, Beetsha, Gudigwa, Tubu	168	800	235	-
	2013	**Sowa Sub**	Sowa Town	31	84	-	-
		Tutume Sub	Matsitama, Dukwi, Mosetse, Marapong, Zoroga, Tutume, Goshwe, Maposa, Makoba	446	1,489	400	218
	2014	**Tonota**	Serule	5	-	-	-
		Selebi Phikwe	Selebi Phikwe	10	42	-	-
		Francistown	Francistown	25	87	2	7
	2015	**Ghanzi**	D'kar, Kuke, New Xade, Chobokwane, Ghanzi Township, Grootlaagte, Qabo	139	859	52	136
		Kweneng	Thamaga	25	8	10	14
	2016	**Central**	Pilikwe	9	9	6	3
		Ghanzi	D'Kar	35	265	14	14
		Kgatleng	Leshibitse	14	68	12	9
		Kweneng	Molepolole, Mmmanoko	5	45	5	3
	2017	**Kgatleng**	Leshibitse, Mochudi, Bokaa, Pilane	39	98	0	31
		Kweneng	Gabane, Kubung	22	166	1	0
		Ghanzi	West Hanahai, D'kar, East Hanahai,New Xade, Kacqae, Ghanzi Township,Charleshill, Kole, Ncojane	63	282	36	34
		North East	Tatisiding, Siviya, Masingwaneng, Mapoka, Matshelagabedi, Matopi, Matsiloje, Ditladi, Zwenshambe, Nlapkhwane, Senyawe, Letsholathebe, Gulubane, Mambo, Botalaote	44	174	17	12
		Southern	Moshopa, Polokwe	22	34	0	4
		Ngamiland	Khwai, Chanoga, Morutsha	15	40	0	13

Source: *National Disaster Management Office*
(-): Data not available

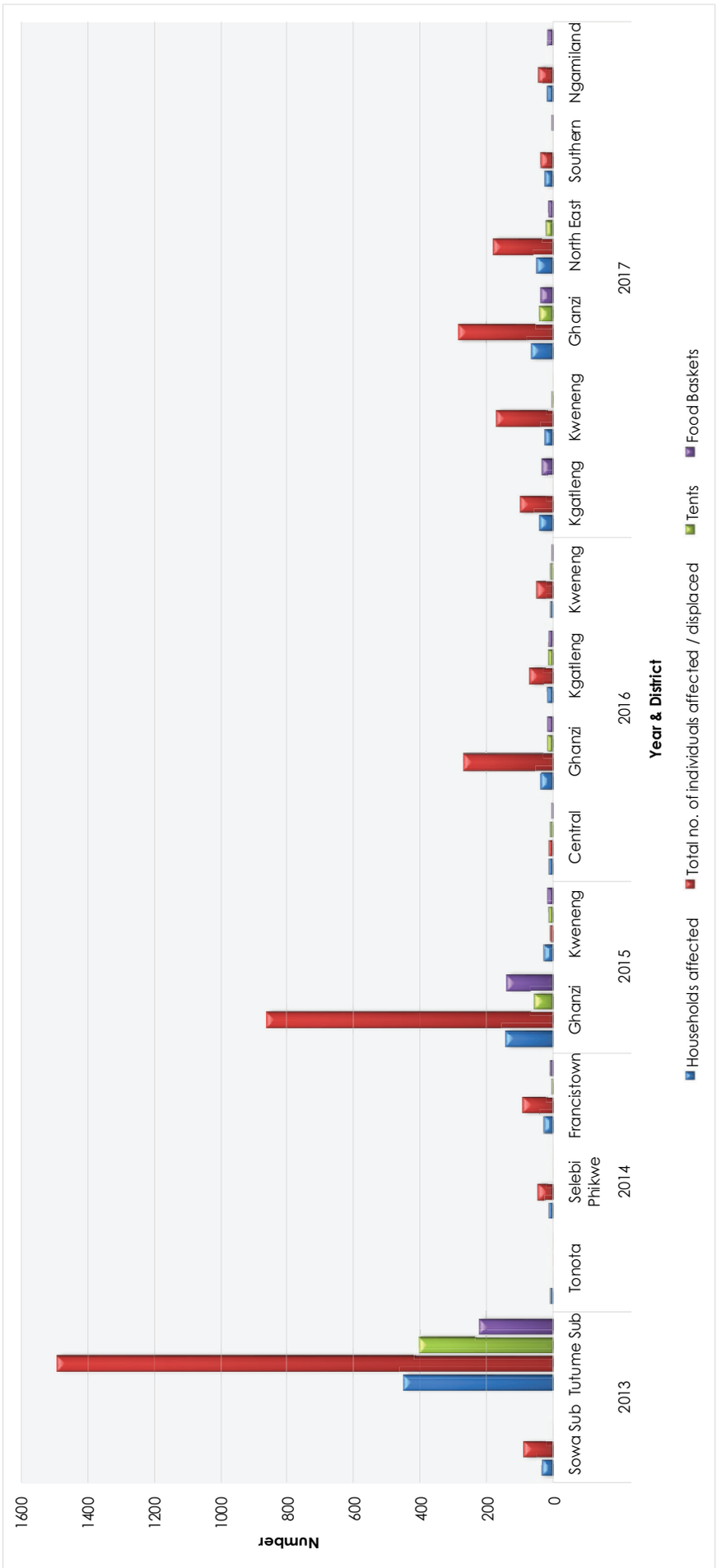


Figure 3.1.1a: Floods Impacts & Assistance Given by District, 2010 - 2017

Table 3.1.1b: Households in Need of Humanitarian Assistance post-Dineo tropical depression (23 February, 2017)

Districts	Villages	Households in Need of Humanitarian Assistance
Chobe	Kavimba	30
	Lesoma	15
	Paragarungu	30
	Kasane	20
	Kachikau	10
	Satau	20
	Kavimba	15
Okavango	Maun	25
	Komana	18
	Shakawe	30
	Nxaraga	30
	Gumare	28
Central	Dukwi	28
	Nata	22
	Gweta	20
	Monnaxai	15
	Tsokotshaa	20
Goodhope	Mabule	30
	Goodhope	15
	Letlhakane	20
Ngamiland	Mohembo	20
	Etsha 6	20
	Etsha 13	19

3.1.2. Storms Incidences (Hailstorm, Thunderstorm & Storm)

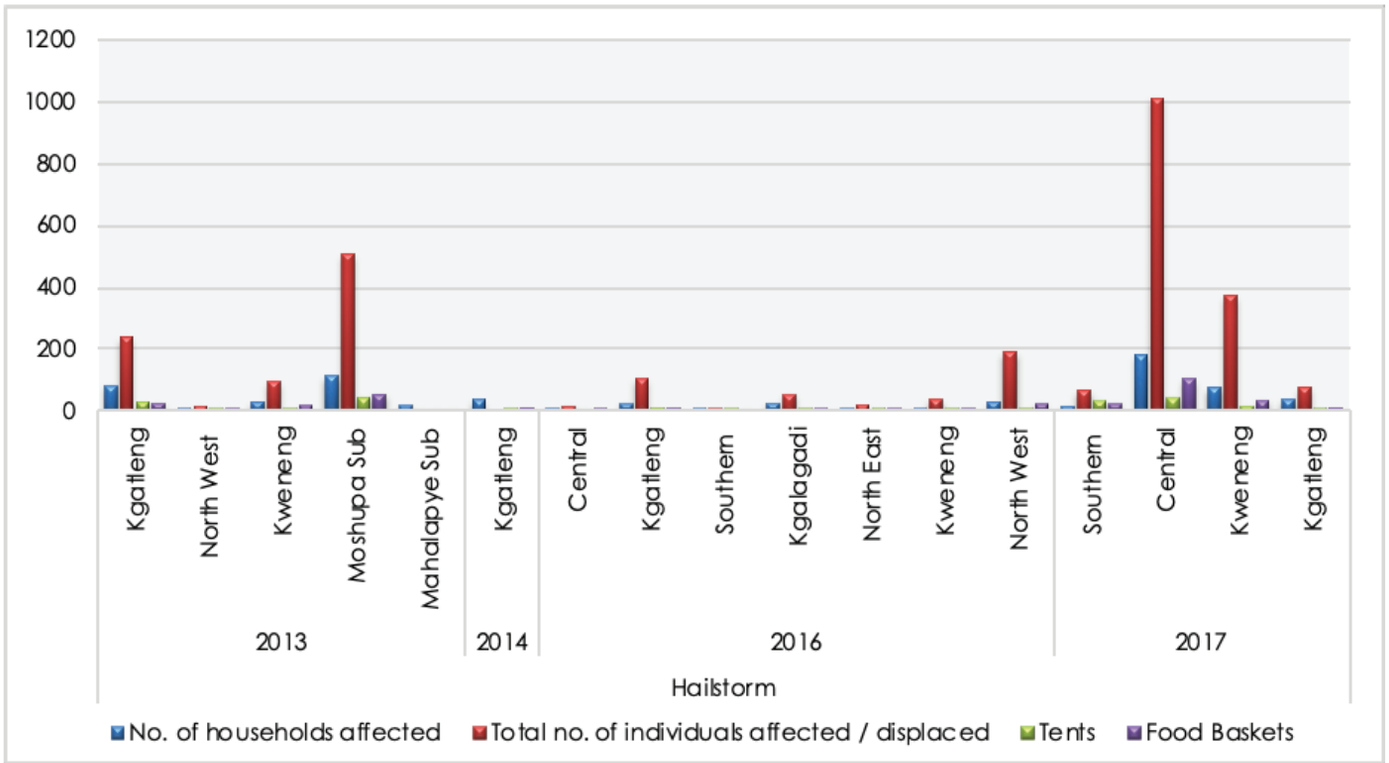
Table 3.1.2 reveals that Central District had the highest record of hail storm impacts with 181 households and 1012 individuals affected in 2017. Moshupa sub-District had the second highest record of hailstorm impact with 506 households and 114 individuals affected. Storm incidences were highest in Central District with 163 households and 65 individuals affected in 2016. Palapye recorded the highest number of individuals at 115 in the year 2013.

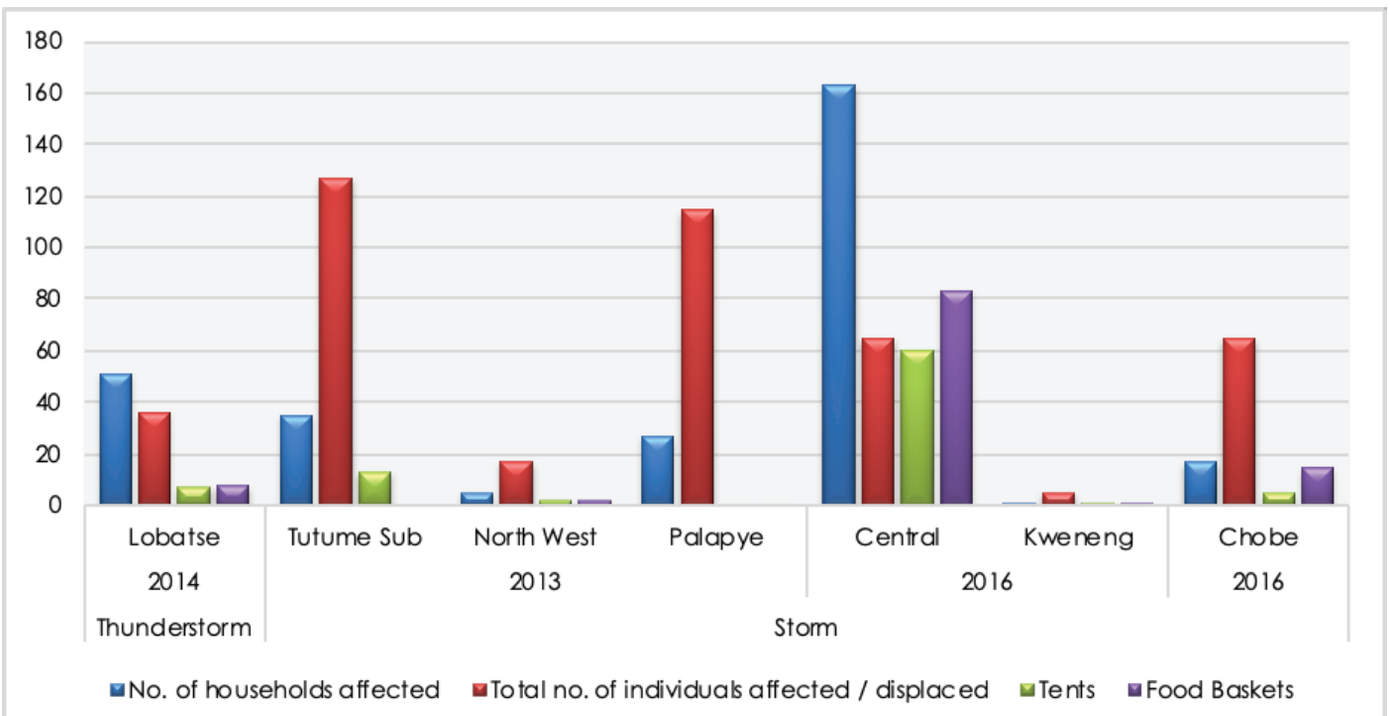
Table 3.1.2: Storm Incidences, Impacts & Responses by District, 2013 - 2017

Incident	Year	District	Villages	Impact/Damages		Assistance given	
				No. of households affected	Total no. of individuals affected / displaced	Tents	Food Baskets
Hailstorm	**2013**	**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
		Mahalapye Sub	Poloka, Setsile	19	-	-	-
	2014	**Kgatleng**		39		7	12
	2016	**Central**	Damochujenaa	5	16	0	3
		Kgatleng	Artesia, Segwagwa, Dikgonnye, Mathubudukwane, Ramonaka, Leshibitse	24	105	12	10
		Southern	Jwaneng	2	5	2	0
		Kgalagadi	Otjiseu, Sunset, Botshabelo, Mogobe	27	55	4	2
		North East	Pole	4	22	2	1
		Kweneng	Mmatseta	8	39	4	4
		North West	Maun	32	192	3	23
	2017	**Southern**	Kgomokasitwa	17	69	33	23
		Central	Molalatau, Serule, Foley, Gojwane, Jamataka	181	1012	42	106
		Kweneng	Boatlaname, Letlhakeng, Sorilatholo, Kumakwane	79	375	17	36
		Kgatleng	Ramokana, Mmathubudukwane	39	80	7	12
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	-	-
	2016	**Central**	Serowe, Mabeleapudi, Matlhako, Kalamare	163	65	60	83
		Kweneng	Molepolole	1	5	1	1
		Chobe	Kazungula	17	65	5	15

Source: *National Disaster Management Office*
(-): Data not available

Figure 3.1.2: Storms Impacts & Responses by District, 2013 – 2017





3.1.3. Heavy Rains

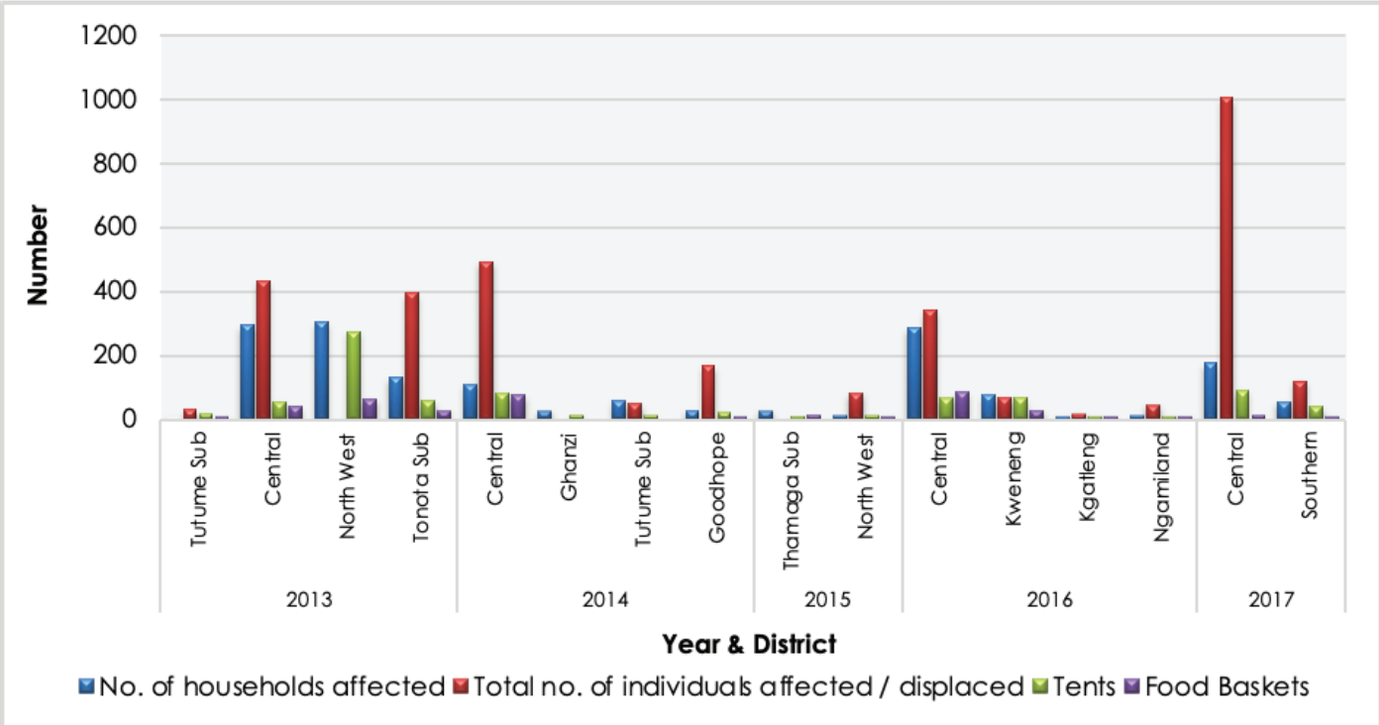
Out of a total of 1,594 households affected by heavy rains during the period 2013 to 2017 the highest number of households affected (303) were recorded in the North West District in 2013, followed by the Central District with 294, 285, and 178 recorded in 2013, 2016, and 2017, respectively. Furthermore, the Central District recorded the highest number of individuals (1,005) affected/displaced as well as the highest number of tents (88) given as relief during the year 2017 alone. The Kgatleng District (Sanyedi, Boseja) had the least number with six (6) households affected by heavy rains in 2016 (Table 3.1.3 and Figure 3.1.3).

Table 3.1.3: Heavy Rain Incidences & Impacts by District, 2013 - 2017

Incident	Year	District	Villages	Impact/Damages		Assistance given	
				No. of households affected	Total no. of individuals affected / displaced	Tents	Food Baskets
Heavy Rains	**2013**	**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, Xhana, Phuduhudu, Maun,	303	-	271	61
		Tonota Sub	Tonota, Shashemooke, Mabesekwa, Mandunyane, Foley, Gojwane, Serule	133	393	57	26
	2014	**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
	2016	**Central**	Radisele, Lerala, Mabuo, Sehunonu, Motshegaletau, Majwanaadipitse, Tshimoyapula, Malatswai	285	341	65	86
		Kweneng	Sojwe, Shadishadi, Loologane, Lephephe,	78	67	67	28
		Kgatleng	Sanyedi, Boseja	6	15	1	2
		Ngamiland	Disaneng, Botshabelo, Matomo, Kgosing, Moeti, Boseja, Samedupe	11	43	4	6
	2017	**Central**	Kodibeleng, Mokgenene, Makwati, Moshana, Lorolwana,ruele,Diabo, Tshweneyagae, Maisane, Lotlhakane East, Gasita,Dipotsana, Mokgenene, Otse, Bonwapitse, Mahalapye, Kalamare, Dovedale, Pilikwe, Mosolotshane, Ramokgonami, Mookane, Tumasera, Tewane	178	1,005	88	13
		Southern	Moshana, Lorolwana, Ruele, Diabo, Tshweneyagae, Maisane, lotlhakane East, Gasita, Dipotsana	55	119	41	1

Source: *National Disaster Management Office*
(-): Data not available

Figure 3.1.3: Heavy Rains Incidences & Impacts by District, 2013 - 2017



3.1.4. Earthquake Incidences

An earthquake is any sudden shaking of the ground caused by the passage of seismic waves through Earth' rocks (Bolt, 2018). Seismic waves are formed when some form of energy stored in Earth's crust is abruptly released, usually when masses of rock straining against one another suddenly fracture and "slip." The seismicity, or seismic activity, of an area is the frequency, type and size of earthquakes experienced over a period of time. Most often Earthquakes occur along geologic faults, narrow zones where rock masses move in relation to one another (Bolt, 2018).The common impacts from earthquakes include structural damage to buildings, damage to bridges, fires, liquefaction, tsunamis, flooding, loss of human life, among others.

The biggest ever earthquake experienced in Botswana took place on the 4th of April, 2017. A strong earthquake struck near the renowned Central Kalahari Game Reserve sending shockwaves across the southern African country. The 6.5 magnitude quake's epicentre was nearly 250 kilometres north-northwest of the capital Gaborone at a depth of 12 kilometres, with tremors felt even in neighbouring South Africa.

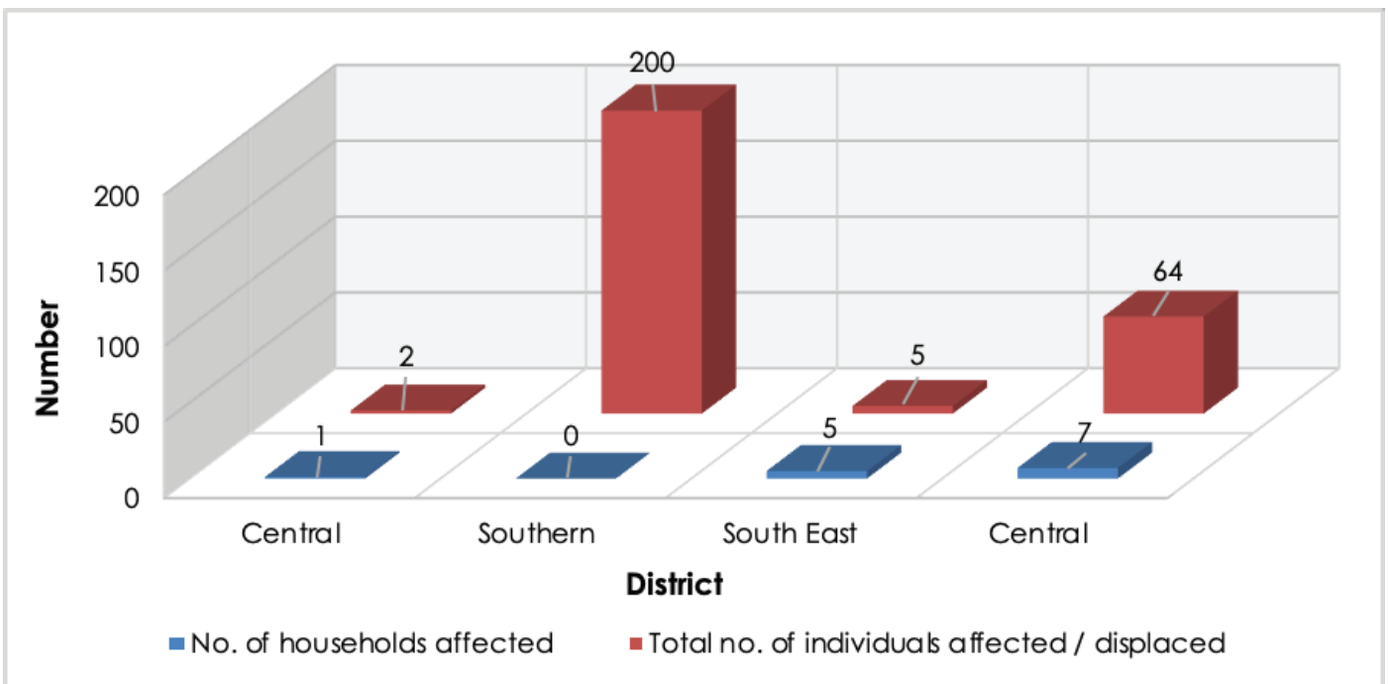
Table 3.1.4 reveals that Southern District had the highest record of earthquake impacts with one infrastructure damaged and 200 individuals affected in 2017. The second highest number of individuals (64) affected by the earthquake was recorded in Central District (Poloka) during the year 2017. Consequently, two tents were given as relief in the Central District.

Table 3.1.4: Earthquakes Incidences, Impacts & Responses by District, 2017

Incident	Year	District	Villages	Impact/Damages			Assistance given	
				No. of households affected	No. of Infrastructure damaged	Total no. of individuals affected / displaced	Tents	Food Baskets
Earthquake	**2017**	**Central**	Mahalapye	1	0	2	0	0
		Southern	Jwaneng	0	1	200	0	0
		South East	Tlokweng	5	0	5	0	0
		Central	Poloka	7	0	64	2	0

Source: *National Disaster Management Office*

Figure 3.1.4: Earthquakes Impacts & Responses by District, 2017



4.0. DROUGHT

This section presents drought occurrences; declarations; and impacts; as well as number of management projects, funds allocated and number of people employed through labour intensive programmes during different drought years between 2009 and 2016 in Botswana.

According to Manthe-Tsuaneng (2014), drought is 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 (p.4). Botswana has been experiencing frequent droughts. This is shown by the decrease in rainfall over the period 2010 to 2016 as compared to the long-term average recorded during the period 1970 to 2000.

4.1. Drought Occurrences and Impacts/Severity

Table 4.1a depicts occurrences of drought or drought declarations in Botswana since the year 1961. The President declares a period of drought, usually in a year when the country has received below average rainfall. There were years when the whole country was declared drought stricken as shown on Table 4.1a).

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)
2015-2016	Drought year (Whole Country)
2016-2017	Drought year (Partial)

Source: *Environment Statistics, Central Statistics Office 2000; Rural Development Council*

4.1.1. National Crop Yield and Production Estimates

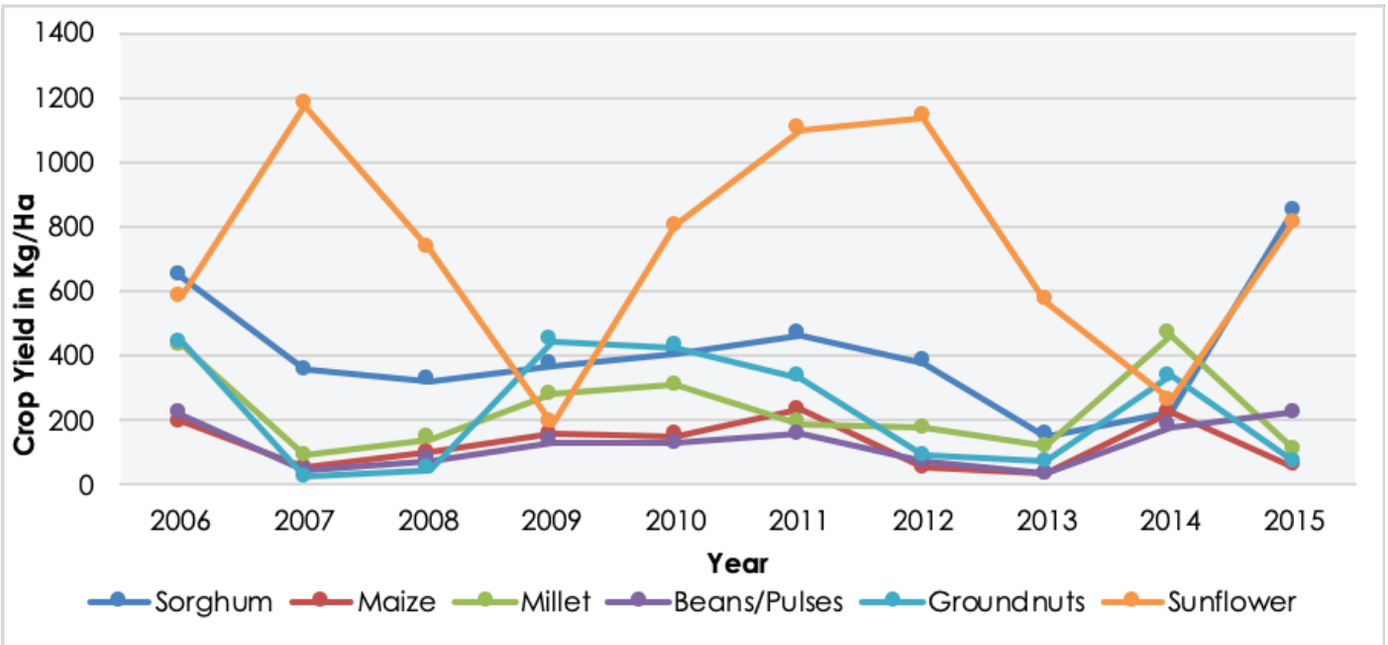
Drought-related moisture deficiencies lead to low crop yields. Moisture deficiencies is mainly driven by high temperatures and low rainfall. On average sunflower had the highest yields during the period 2006 to 2015 compared to all the crops. However, it saw a drastic decline in the years 2008; a 37.8 percent decrease from a 2007 figure of 1,178 Kilogram per hectare to 733 Kilogram per hectare recorded in 2008. It further declined to 191Kilogram per hectare in 2009 (73.9 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 4.1b and Figure 4.1b). These yields do not meet the country's demand/requirements, hence her over dependence on imports (refer to subsection 4.1.4). Low average yields will inevitably result in serious food deficit at household level particularly for the smallholders (Rural Development Council, 2015).

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

Crop	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Sorghum	645	356	323	373	409	464	381	151	226	852
Maize	194	53	101	159	151	233	54	36	226	58
Millet	435	90	144	279	311	189	179	118	466	109
Beans/Pulses	218	43	78	133	128	159	72	35	182	222
Groundnuts	440	25	49	447	429	334	91	71	337	71
Sunflower	585	1,178	733	191	804	1,103	1,140	568	263	810

Source: *Agricultural Statistics Unit, Statistics Botswana*

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



4.1.2. Drought-Related Livestock Mortality

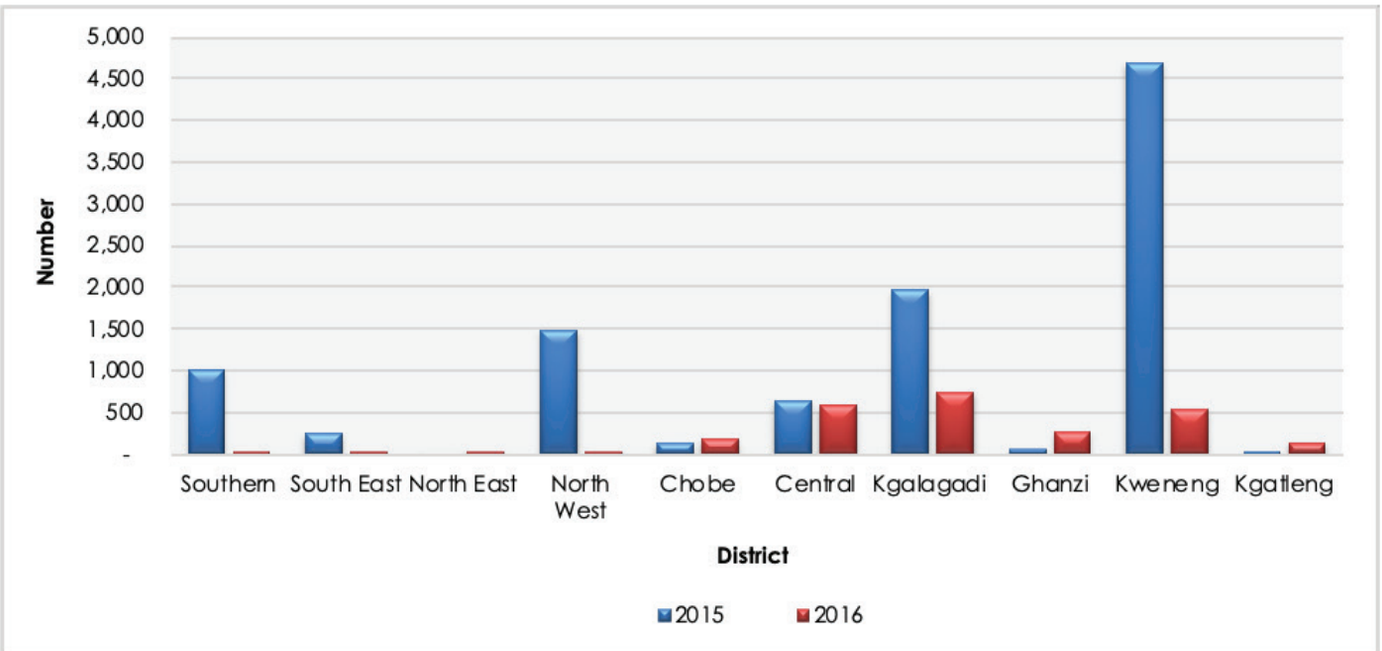
Table 4.1d reveals that cattle experienced the highest mortality during the years 2015 and 2016, followed by goats. The highest number of cattle mortality was recorded in 2015 alone. During the same year, Kweneng saw the highest cattle mortality, followed by Kgalagadi, North West, and Southern with, 4,686, 1,966, 1,485, and 1,007, respectively. On the other hand, goats experienced the highest mortality in the year 2016 (535) in Chobe, followed by 418 recorded in Southern during the year 2015. Kweneng District was affected the most by livestock mortality compared to the other districts.

Table 4.1d: Drought-Related Livestock Mortality by District (2015 - 2016)

	2015					2016				
District	**Cattle**	**Sheep**	**Goats**	**Horses**	**Donkeys**	**Cattle**	**Sheep**	**Goats**	**Horses**	**Donkeys**
Southern	1,007	0	418	3	17	16	0	44	0	7
South East	251	0	0	0	0	1	0	0	0	0
North East	0	0	0	0	0	7	0	0	0	0
North West	1,485	0	213	35	0	17	355	47	67	0
Chobe	139	0	47	1	0	188	85	535	0	0
Central	636	54	0	0	0	593	47	123	0	0
Kgalagadi	1,966	0	1	3	2	732	35	29	4	0
Ghanzi	60	5	2	0	0	273	4	31	462	0
Kweneng	4,686	0	0	0	0	536	36	0	0	0
Kgatleng	15	0	0	0	0	135	15	94	0	0
Total	**10,245**	**59**	**681**	**42**	**19**	**2,498**	**577**	**903**	**533**	**7**

Source: *Agricultural Statistics Unit, Statistics Botswana*

Figure 4.1d: Drought-Related Cattle Mortality by Region (2015 - 2016)



4.1.3. Cereal Requirements and Production

The recurring drought incidences in Botswana has resulted in low agricultural production (cereals in particular), leading to more cereal imports and increased food prices. Table-4.1e depicts that the total cereal requirements fluctuated between the years 1998 and 2007. It then assumed an upward trend during the years 2012, 2013, 2014, 2015, and 2016 with 408 tons, 478 tons, 475 tons, 601 tons, and 646 tons respectively.

In comparing the total cereal requirements with total cereal production it is clear that the production fell short of requirements in the years 1998 to 2016 (see Table 4.1e and Table 4.1f). This situation shows that in Botswana domestic production is way lower than the demand for cereals. This therefore means the country depends on imports to augment the short fall in order to meet its food security obligation. A total of BWP9,224,906,151 (9.22 Billion) was used to import cereals (maize, rice, sorghum, millet and wheat) from 1999 to 2017 (See Table 4.1g).

Table 4.1g further shows that Maize was imported in large quantities during the review period, followed by Wheat, Sorghum, and Rice with 2,270,233 tons, 638,660 tons, 567,953 tons, and 291,074 tons respectively. In general, the quantities of imported cereals and the amount of money expended saw a significant increase during the 1999 to 2017 period. This increase is mainly attributed to the increasing population size.

It is also evident from Table 4.1g that there were more cereal imports during the years 2010 (388,441 tons), 2015 (386,099 tons), 2016 (332,192 tons) and 2009 (328,678 tons) in that order. Most of these were drought-stricken years (e.g. 2009, 2010, and 2015).

Table 4.1e: Cereal Requirements in ('000) Tons by Crop (1998-2016)

Year	Maize	Wheat	Sorghum	Rice
1998	139	76	60	27
1999	142	77	73	31
2000	136	73	76	36
2001	130	75	70	36
2002	120	78	48	36
2003	125	86	65	36
2004	141	83	64	36
2005	140	83	60	36
2006	144	85	57	36
2007	143	87	57	36
2008	135	83	43	36
2009	156	93	45	36
2010	156	95	47	36
2011	161	95	46	36
2012	202	104	67	36
2013	221	125	96	36
2014	220	124	95	36
2015	308	147	110	36
2016	308	155	144	39

Source: *Early Warning Unit, Ministry of Agriculture Development and Food Security*

Figure 4.1e: Cereal Requirements in ('000) Tons by Crop (1998-2016)

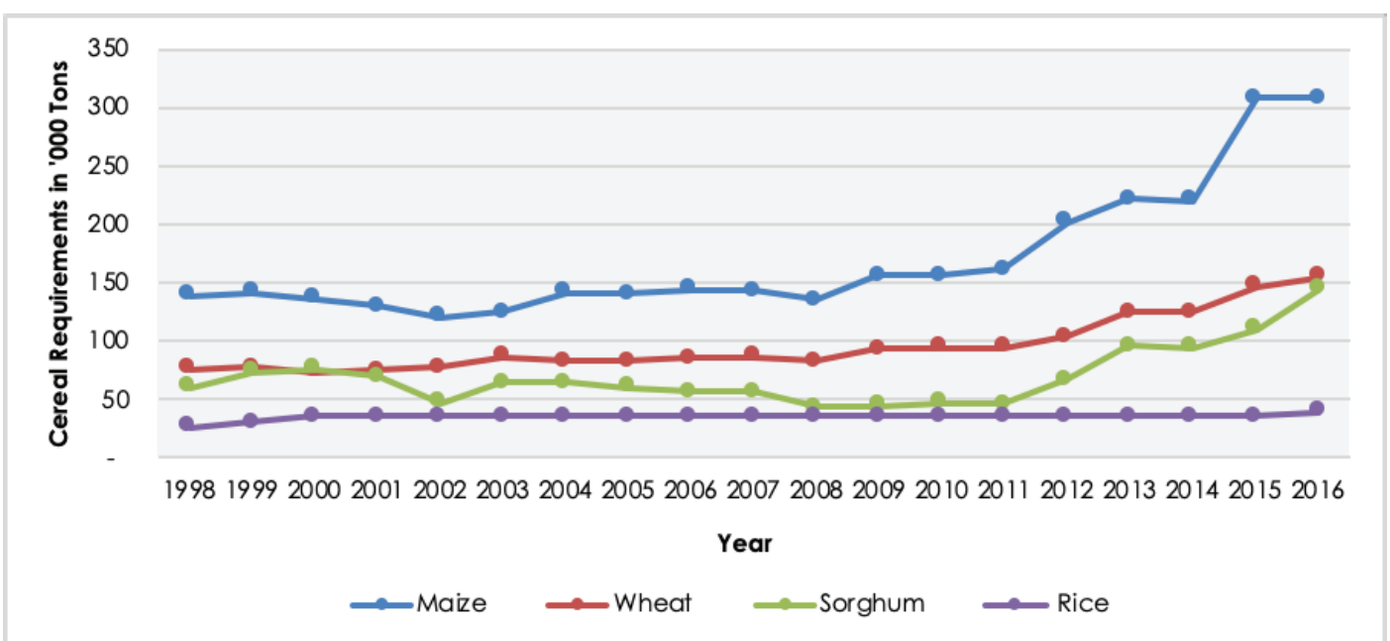


Table 4.1f: Cereal Production in Tons by Crop from 1999-2015

Year	Sorghum	Maize	Millet	Pulses	Sunflower	Groundnuts
1999	6,658	3,796	860	1,348	2,829	217
2000	12,671	21,162	438	4,102	162	546
2001	1,583	4,976	472	1,280	150	8,461
2002	15,805	16,447	54	1,907	2,249	14,995
2003	23,501	1,633	91	460	960	15
2004	6,095	4,291	958	1,093	479	119
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
2013	10,231	3,844	1,391	3,655	2,021	112
2014	14,310	28,550	3,398	6,826	361	552
2015	35,508	3,792	555	7,187	1,388	151

2001 and 2014 is traditional sector only
2005 is commercial sector ONLY

Figure 4.1f: Cereal Production in ('000) Tons by Crop from 1999-2015

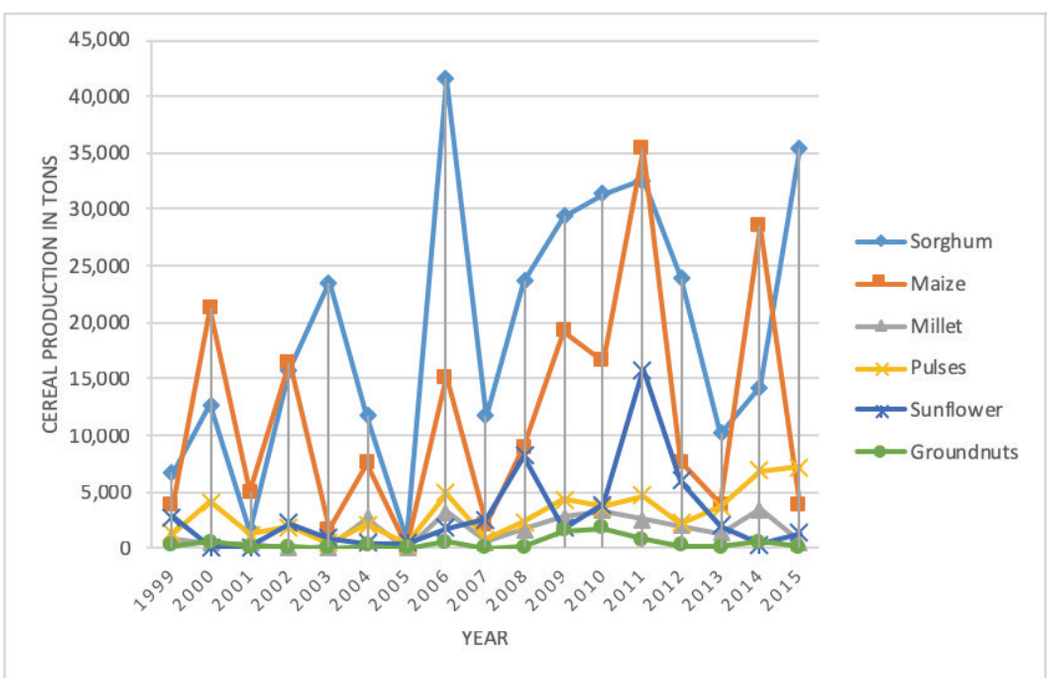
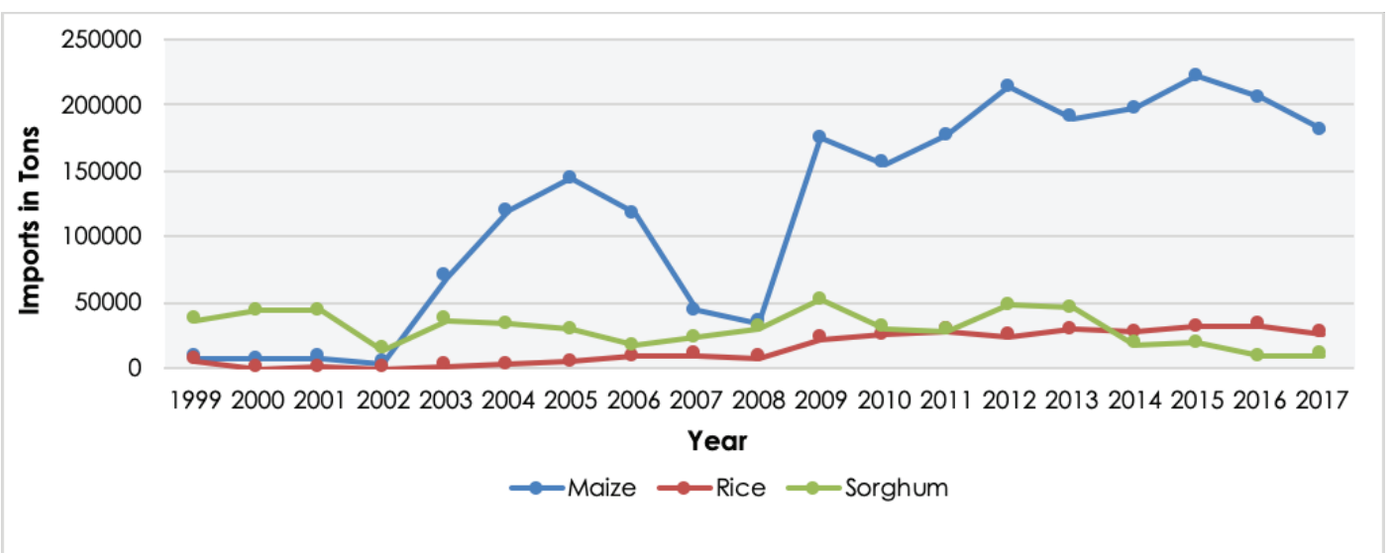


Table 4.1g: Imports of Cereals by Crop from 1999-2017

	Maize		Rice		Sorghum		Millet		Wheat	
Year	(Tons)	Pula	(Tons)	Pula	(Tons)	Pula	(Tons)	Pula	(Tons)	Pula
1999	7,889	5,389,745	6,148	31,182,624	36,270	29,644,189	37	16,827	75	266,712
2000	6,760	5,651,911	306	1,303,989	43,399	71,964,487	75	54,688	143	87,577
2001	8,443	5,579,717	441	2,679,436	44,139	36,512,271	68	115,434	54	34,242
2002	3,705	5,125,832	230	3,035,710	13,847	19,990,714	0	1,899	417	678,097
2003	69,123	93,168,419	1,992	4,298,475	36,236	46,373,515	46	124,937	2,202	3,213,857
2004	119,298	104,400,863	3,272	9,296,048	33,222	38,140,820	0	4,152	172	311,486
2005	143,616	103,718,537	4,889	15,602,397	29,529	23,952,330	4	14,001	6	21,439
2006	117,608	137,352,631	8,571	25,026,942	17,369	24,130,901	2	6,570	34	105,226
2007	43,420	90,885,027	9,574	30,396,814	23,093	46,271,132	68	354,785	0	376
2008	34,543	47,071,886	8,266	44,992,563	30,451	48,027,015	1	3,427	1	4,458
2009	174,839	263,580,941	22,426	189,015,943	51,907	76,876,549	0	258	79,506	213,172,264
2010	155,351	231,682,898	25,420	190,096,355	30,706	47,175,331	0	2,226	176,963	181,567,409
2011	177,077	315,037,143	28,198	209,816,125	28,664	57,527,117	0	2,032	57,571	146,502,416
2012	213,231	429,286,583	24,774	178,732,627	47,739	379,852,285	0	176,035	18,715	42,198,059
2013	190,369	413,877,517	29,189	219,435,931	45,326	132,465,692	153	520,118	15,772	49,832,975
2014	196,993	428,625,206	27,264	200,829,895	18,125	66,209,659	5	147,955	6,537	22,705,813
2015	221,771	536,641,900	31,469	238,970,598	18,939	68,403,927	231	2,682,944.00	113,690	399,311,266
2016	205,093	639,747,667	32,106	257,890,783	8,983	46,872,876	91	2,535,250.00	85,920	267,900,278
2017	181,104	389,795,574	26,537	235,368,979	10,011	46,713,767	90	1,884,305.90	80,883	246,647,550
TOTAL	**2,270,233**	**4,246,619,997**	**291,074**	**2,087,972,234**	**567,953**	**1,307,104,577**	**871**	**8,647,844**	**638,660**	**1,574,561,500**

Note: *Zeros (0) means the figures were not significant at 3 decimal places*
Source: *International Merchandise Trade Statistics, Statistics Botswana*

Figure 4.1g: Imports of Cereals by Selected Crop from 1999-2017



4.1.4. Human Water Supply Situation

Botswana gets 56 percent of its water from boreholes and the rest (44 percent) from dams (Rural Development Council, 2015: 44). Recurrent droughts coupled with uneven and erratic rainfall, high evaporation rates, little to no borehole recharge as well as relatively high water losses (19% to 41%) has made the provision of water to Batswana a very difficult task (Rural Development Council, 2017). It should be noted that the rainfall seasons for the years 2010/11 to 2014/15 before the 2015/16 rainfall season received below normal rainfall resulting in declining dam water and borehole water levels.

It is evident from Table 4.1h that dam levels saw a declining trend during the 2014 to 2016 period. This is attributable to the fact that the country experienced high evaporation rates due to semi-arid weather conditions and below to normal rainfall, hence this decline. However, the dam levels experienced a rise during the years 2016 and 2017 due to good rains that were received. According to Rural Development Council (2017) the recent tropical cyclone 'Dineo', brought lots of rain that resulted in significant inflows into the dams: most notable is the performance of Gaborone and Thune dams which has not been satisfactorily in the past (p.36). Gaborone Dam which was declared failed reaching critical levels at 1.7 percent in June 2015, increased to 91.6 percent in June 2017.

An assessment of water supply in all Management Centres in Botswana shows that during the year 2016/17, eight Management Centres (Kanye, Maun, Selebi Phikwe, Mochudi, Mahalapye, Palapye, Molepolole, and Tsabong) had supply that did not meet demand, hence deficit (Rural Development Council, 2017). While the other eight Management Centres had supply in excess of their demand (Serowe, Masunga, Letlhakane, Lobatse, Kasane, Gaborone, Francistown, and Ghanzi). The majority of districts during the year 2015/16 had supply deficit indicating drought conditions were on-going.

Table 4.1h: Percentage Dam Levels in 2014 - 2017

Year	Month	Dam									
		Gaborone (141.4 MCM)	Nnywane (2.3 MCM)	Bokaa (18.5 MCM)	Letsibogo (100.0 MCM)	Shashe (85.0 MCM)	Ntimbale (26.5 MCM)	Thune (90.0 MCM)	Lotsane (42.5 MCM)	Dikgatlhong (400.0 MCM)	Molatedi (201.0 MCM)
2014	17th February	13.2	74.7	38.5	100.9	98.3	100	41.6	99.1	101	20.2
	14th March	16	-	57	103.7	103.4	102	55.5	108.3	106.5	26
	14th April	15.1	73	56.2	97.7	97.3	98.4	55.7	96.4	98.9	35.3
	16th May	13.7	67.6	50.2	93.6	94.3	97.5	58.7	94.2	98.3	34.6
	15th July	11.3	54.6	41.8	86.6	87.9	94.1	58.7	84.5	95.6	31
	29th August	9.8	54.1	36.3	77.5	83.4	90.5	52	82.9	95.4	28.4
	23rd September	8.5	51.1	30.5	78.7	80.6	88.7	51.2	80.7	92.3	26.8
	8th October	7.5	47	27.3	75.9	78.9	87.3	49.9	77.5	91.2	24.7
	14th November	6.1	40.2	22	72.3	75.1	84.1	48.1	75.2	88.2	21.7
	15th December	5.2	92.1	19.7	70.7	71.5	84.1	48.1	71.7	87.1	20.8
2015	*Jan 15th	4.7	93.2	20.5	69.9	83.7	89.6	47.7	73.4	88	18
	Feb 17th	4.2	94.2	21.2	69	95.8	95	47.2	75	88.8	15.2
	Mar 9th	3.4	88.4	18.4	65.2	93.9	92	46.8	72.2	87.4	15.2
	Apr 15th	2.7	85.6	15.5	58.3	92.6	97.9	45.5	70	85.6	13.4
	May 15th	2.2	79.5	11.9	55.7	93.9	95.9	44.3	67.4	84.1	12.5
	Jun 15th	1.7	73.3	8.2	53.1	95.1	93.9	43.1	64.8	82.5	11.5
	Jul 17th	1.6	66.7	2.4	49.2	91.5	89.8	41.5	61.3	80.9	10.2
	Aug 26th	1.5	60.5	2	46.3	87.9	89.3	43	59.9	79.4	8.9
	Sep 22nd	1.4	56.2	2	43.8	85.1	86.3	39.1	58.3	78.3	8.4
	Oct 6th	1.4	53.4	2	43.3	83.2	85.3	39.1	57.4	77.6	7.6
	Nov 13th	1.1	46.2	2	38.3	79.6	83.6	37.6	51.7	74.5	5.2
	Dec 14th	1.3	65.3	45.8	36.4	76.5	81	0	0	72.5	5
2016	Jan 18th	1.7	100	51.7	35.6	83.8	82.7	36.5	46.5	70.4	7.3
	Feb 15th	1.7	93.3	49.4	36.5	80.7	91	37	44.4	70	7
	Mar 17th	9	102.6	73.5	68.7	100.8	101.6	37.3	98	88	8.9
	Apr 20th	18.8	94.6	99	75.9	98.1	97.8	39.9	96.9	97.9	39.3
	May 19th	18.6	88.2	91.5	72.9	95.4	95.4	37	93.2	95.9	36
	Jun 6th	17.2	80.1	88.5	71.1	93.7	93.8	37	91	94.5	35
	Jul 21st	16.1	77.3	82.5	67.9	89.4	90.6	36.2	87.8	92.1	33.7
	Aug 8th	15.5	74.1	80	66	87.2	88	-	-	91	-
	Sep 12th	14.4	68	75.7	63.3	83.6	88.5	-	-	-	29.7
	Oct 10th	13.2	61.5	71.4	60.6	80.5	87	-	-	-	-
	Nov 18th	13.7	54	71.8	57.3	77.8	79.8	29.9	91.5	84.2	24.7
	Dec 8th	14.6	74.5	99.8	56.3	76.3	78.7	29.9	92.6	83.2	24.9
2017	Jan 16th	22.2	100	100	67.9	100.8	100.9	47.2	100.9	101.8	30.4
	Feb 13th	35.8	100	100.8	100	100	103.6	72.4	100.9	104	37.6
	Mar 15th	99.6	99.7	100	100	100.4	100.2	87.4	100.8	101.8	65.9
	Apr 12th	97	91.9	95.8	97.2	97.7	99	85.4	96.4	99.3	64.4
	May 15th	94.7	91.9	90.8	95	94.3	92.7	80.9	94.2	96.9	61.9
	Jun 15th	91.6	91.9	85.1	92.4	91.1	95.5	80.5	89.1	95.1	59
	Jul 19th	89.6	91.2	80.5	89.6	87.2	91.8	78.4	88.8	93.2	57.2
	Aug 15th	87.7	89.4	75.4	88	84.5	90.6	76	86.1	91.8	54.9
	Sep 15th	85.7	86.5	70	85.4	81.5	85.1	74.8	82.9	89.7	52.5
	Oct 16th	83.7	79	64.9	83.8	79.3	82.9	72.9	81.3	88.2	49.7
	Nov 15th	80.7	73.9	58.4	80.8	76.8	80.2	72.1	77.5	86.1	46.4
	Dec 11th	79.4	72.3	55.8	85.1	74.8	80	67.8	74.8	84.9	44.1

Dash (-) = no data
**January data interpolated using average of two nearest neighbours for the year 2015.*
Source: *Water Utilities Corporation publication*

4.2. Response to Drought Impacts

4.2.1. Drought Declarations and Labour Intensive Programmes

The commonly instituted interventions during drought years include: expanded Drought Relief Labour Based Public Works Programme; Supplementary Feeding to be provided to all children under-five years attending Child Welfare Clinics; and Provision of free seed subsidy for a maximum of five (5) hectares per farmer in the communal sub-sector and 50 percent price subsidy on additional hectarage above the 5 hectares. The Drought relief projects are usually drawn from the on-going development projects which have been in the normal development planning process.

Presented in Table 4.2a(i) are the Labour Intensive Public Works Programme for the period 2009/10 to July 2016/17. The main focus is on the amount of money expended during the period under review. The table shows that the amount of money budgeted for the Labour Intensive Programme followed an upward trend from the years 2009/10 to 2015/16, then dropped from BWP635,590,000 in 2015/16 to BWP612,964,318 in 2016/17. Out of the total money budgeted (BWP3,813,524,318.00) for during the review period, about 57 percent (BWP2,179,832,485.45) was used for labour; about 10 percent (BWP383,060,330.69) was used for material; running expenses accounted for about 7 percent (BWP257,760,217.61); and about 9 percent (BWP360,785,237.46) was used for sustenance.

A total of BWP3,181,438,271.21 was expended in the Labour Intensive Public Works Programmes, about 17 percent less than the amount (BWP3,813,524,318.00) budgeted for. Table 4.2a(i) also reveals that, of the 23,196 planned projects only 13,022 were completed during the review period. A total of 3,892,447 employment opportunities were created by the Labour Intensive Programmes. The sex differentials of the total cumulative employment are such that females (2,807,094) were employed in large numbers compared to their male counterparts (1,085,353) during the review period (Table 4.2a(ii)).

The Ipelegeng programme provides relief to vulnerable members of the community who are affected the most by economic hardships, also carry out development projects prioritized under normal development process (RDC, 2017). This programme also complements other Ministries on their various initiatives: Crime Prevention and Special Constables; Wildlife Volunteers, Immigration Volunteers, among others (Table 4.2b). The programme engages skilled, semi-skilled, and unskilled labourers to undertake projects. Table 4.2b illustrates a summary of beneficiaries engaged per sector for the years 2014/15 to 2016/17. During the year 2016/17, a cummulative total of 763,502 beneficiaries were engaged, constituting 535,346 female and 228,156 male.

Table 4.2a(i): Labour Intensive Public Works Programmes (2009-2016)

Year	Expenditure						Projects	
	Budget	Labour	Material	Running Expenses	Sustenance	Total Expenditure	Planned	Completed
2016/17	612,964,318	424,893,325.98	18,021,426.54	32,764,367.70	117,270,185.61	592,949,305.83	2,531	2,688
*2015/16	635,590,000	410,507,768.00	79,136,400.00	39,405,272.00	106,540,560.00	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	**3,813,524,318**	**2,179,832,485**	**383,060,331**	**257,760,218**	**360,785,237**	**3,181,438,271**	**23,196**	**13,022**

Note: 2014/15 Expenditure figures are as at July 2015
(-): Data not available
Source: *Rural Development Council*

Figure 4.2a: Labour Intensive Public Works Programmes (2009-2016)

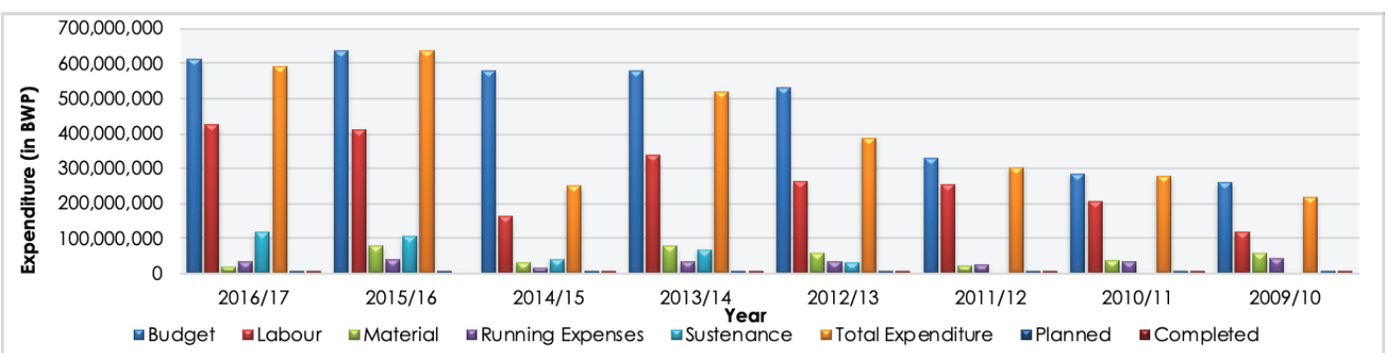


Table 4.2a (ii): Employment status, Wage and sustenance rates for financial years 2009/10 to 2016/17

Year	Cumulative Employment			Targeted Employment	
	Females	Males	Total	Cumulative	Monthly
2016/17	528,571	234,931	763,502	769,667	64,191
2015/16	165,428	74,291	239,719	256,764	64,191
2014/15	255,511	110,596	366,107	394,542	65,757
2013/14	498,578	214,628	713,206	727,801	61,670
2012/13	445,214	174,937	620,151	662,000	55,000
2011/12	410,998	127,756	538,754	600,000	50,000
2010/11	326,620	91,756	418,376	480,000	40,000
2009/10	176,174	56,458	232,632	480,000	40,000
Totals	**2,807,094**	**1,085,353**	**3,892,447**	**4,370,774**	**440,809**

Note: 2015/16 Employment figures are as at August 2015
Source: *Rural Development Council*

Figure 4.2a(ii): Cumulative Employment status by sex for financial years 2009/10 to 2015/16

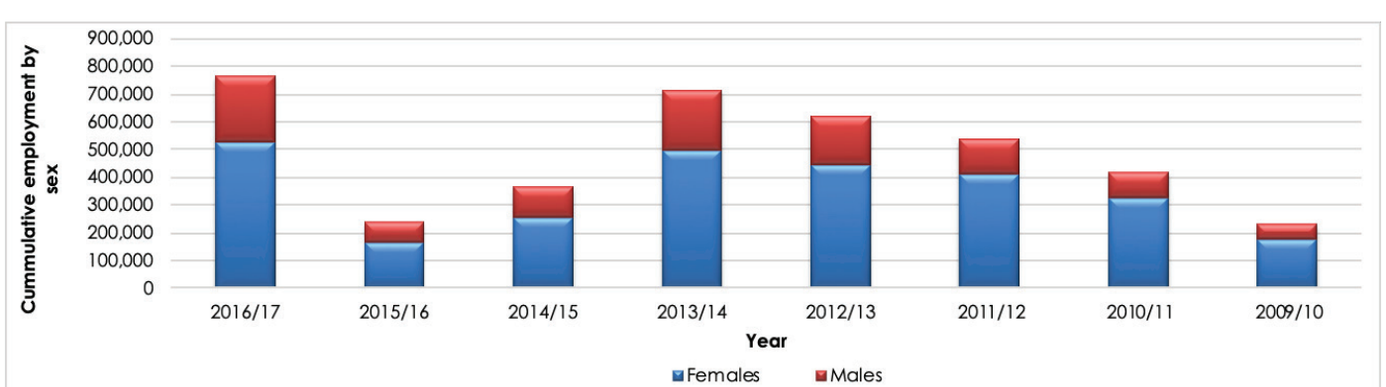


Table 4.2b: Engagement trends per sector for the financial years 2014/15 - 2016/17

	2014/15		2015/16		2016/17	
Sector/District	**Target**	**Actual**	**Target**	**Actual**	**Target**	**Actual**
Districts	641,004	612,359	691,104	658,458	691,104	681,538
BPS- CPV	78,000	73,280	57,500	66,704	60,000	67,130
BPS- Special Constable	8,400	6,055	8,400	7,208	8,400	6,341
MENCT- Monuments	888	834	888	838	888	784
MENCT- Wildlife Volunteers	18,000	10,041	11,000	8,455	8,400	7,253
MITI- Special Support Programme	24,962	22,554	N/A	N/A	N/A	N/A
MNIG- Immigration Volunteers	N/A	N/A	625	120	1,500	456
Totals	**771,254**	**725,123**	**769,517**	**741,783**	**770,292**	**763,502**

Source: Rural Development Council (2016)

4.2.2. Food Relief Services

Table 4.2c presents a summary of annual food supplies and deliveries for the feeding programmes during the years 2011/12 to 2015/16. It is evident from the table that the distribution of food commodities under the Primary School Feeding Programme fluctuated during the review period, with the lowest quantities supplied in 2012/13 and 2013/14 (56 percent for each). On the other hand, the lowest quantities supplied under the Health Facility Programme was recorded in 2011/12 (40 percent), 2014/15 (48 percent), and 2013/14 (64 percent), in that order. This is attributable to shortages of some food commodities in the market and failure of suppliers to honour contracts (Rural Development Council, 2008).

According to Rural Development Council (2016), the total annual malnutrition rate in all the health districts assessed during the year 2015/16 remained the same at 3.8 percent for 2013 and 2014, and increased to 3.9 percent in 2015. While the total malnutrition rate for year 2011 stood at 4.1 percent, the highest recorded between the years 2011 and 2015. The highest quantity of food supplied to the health facilities at 69 percent saw the lowest total malnutrition rate of 3.8 percent (Table 4.2c(i) and Table 4.2c(ii).

Table 4.2c(i): Annual Food Supplies and Deliveries for the Feeding Programmes, 2011/12 – 2015/16 All Depots (Summary)

		Primary Schools		Health Facilities		Beneficiaries			
						Targeted		Actual Beneficiaries fed	
Year	Commodity	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**	**268176**	**832687**	**268176**	**193809**
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**	**268176**	**261551**
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**	**247359**	**1573453**	**454604**
2014/15									
	Sorghum grain 50 kg	2282.27	2171.55	N/A	N/A	273383	N/A	273383	N/A
	Sorghum Meal 25 kg	695.89	302.01	N/A	N/A	273383	N/A	273357	N/A
	Beans 50 kg	3479.06	2177.86	2758.02	1240.07	273383	162383	273383	68903
	Samp 25 kg	2171.55	1234.58	N/A	N/A	273383	N/A	273387	N/A
	stewed steak 3.1 kg	1058.48	854.04	N/A	N/A	273383	N/A	273387	N/A
	veg oil 750 ml	795.98	608.28	2253.76	1392.93	273383	N/A	273387	N/A
	UHT milk 340 ml	3559.27	536.73	N/A	N/A	273383	N/A	273375	N/A
	Malutu 5.5 kg	N/A	N/A	8292.56	5384.77	N/A	162584	N/A	86882
	Tsabana 2.5 kg	N/A	N/A	10106.9	7014.11	N/A	190742	N/A	920742
Total		**14042.5**	**7885.05**	**23411.24**	**15038.88**	**1913681**	**862314**	**862314**	**12254.79**

Table 4.2c(i) continued: Annual Food Supplies and Deliveries for the Feeding Programmes, 2011/12 – 2015/16
All Depots (Summary)

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
2014/15									
	Sorghum grain 50 kg	2684.77	2094.45	N/A	N/A	276380	N/A	276380	N/A
	Sorghum Meal 25 kg	359.57	236.57	N/A	N/A	276380	N/A	276380	N/A
	Beans 50 kg	3743.71	1788.45	12412.8	5177.66	276380	129424	276380	52740
	Samp 25 kg	2435.48	1515.4	N/A	N/A	276380	N/A	276380	N/A
	stewed steak 3.1 kg	1201.68	699.96	N/A	N/A	276380	N/A	276380	N/A
	veg oil 750 ml	591.09	389.78	10537.89	5530.82	276380	264078	276380	147119
	UHT milk 340 ml	3996.74	891.55	N/A	N/A	276380	N/A	276380	N/A
	Malutu 5.5 kg	N/A	N/A	9337.44	4117.15	N/A	129165	N/A	57567
	Tsabana 2.5 kg	N/A	N/A	10537.89	5530.82	N/A	134300	N/A	69443
Total		**15013.04**	**7616.16**	**42826.02**	**20356.45**				

Source: *Rural Development Council Secretariat*
N/A: item Not Applicable

Table 4.2c (ii): National Rates of Malnutrition (%) 2011 - 2015

Year	2011	2012	2013	2014	2015
National Average (%)	4.1	4	3.8	3.8	3.9

Source: *Rural Development Council Secretariat*

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

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 Musi tolerant to climate variability and change in the region and has good growth ability inherited from exotic breeds.

Therefore, an increase in the rearing of drought-tolerant livestock makes communities less vulnerable to impacts of climate change.

Figure 4.2c: Musi Composite Cattle Breed

Source: *Republic of Botswana, 2015.b: 13*

On average, Morale Ranch in Mahalapye Agricultural District (975) had the highest population of Musi cattle during the period 2008 to 2017, followed by Kweneng (Matlolakgang ranch) and Barolong (Morapedi ranch) with 908 and 838, respectively (Table 4.2d and Figure 4.2d). The annual differentials are such that Matlolakgang Ranch in Kweneng (135 cattle) recorded the highest number of Musi cattle in the year 2017. The national total population of Musi cattle fluctuated between the years 2008 and 2014, and saw a 25 percent increase from the year 2014 (356) to 2017 (445) (Table 4.2d and Figure 4.2e).

Table 4.2d: MUSI Cattle population by District and Ranch (2008 - 2017)

Agricultural District	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Kweneng (Matlolakgang ranch)	51	55	63	90	84	88	86	128	128	135
Mahalapye (Morale ranch)	53	53	103	121	108	126	109	102	94	106
Ghanzi (Xanagas ranch)	49	48	59	83	91	102	91	86	97	101
Barolong (Morapedi ranch)	114	132	144	48	63	56	65	61	75	80
Serowe region (Makhi ranch)	-	-	-	-	-	-	-	-	23	23
Maun Region (Tsetseku ranch)	16	16	20	7	6	6	5	4	4	-
Francistown Region (Impala ranch)	-	-	33	-	-	-	-	-	-	-
Gaborone Region (Sebele ranch)	-	-	-	-	15	2	-	-	-	-
TOTAL	**283**	**304**	**422**	**349**	**352**	**378**	**356**	**381**	**421**	**445**

Dash (-) means no data
Source: *Agriculture Statistics Unit, Statistics Botswana*

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

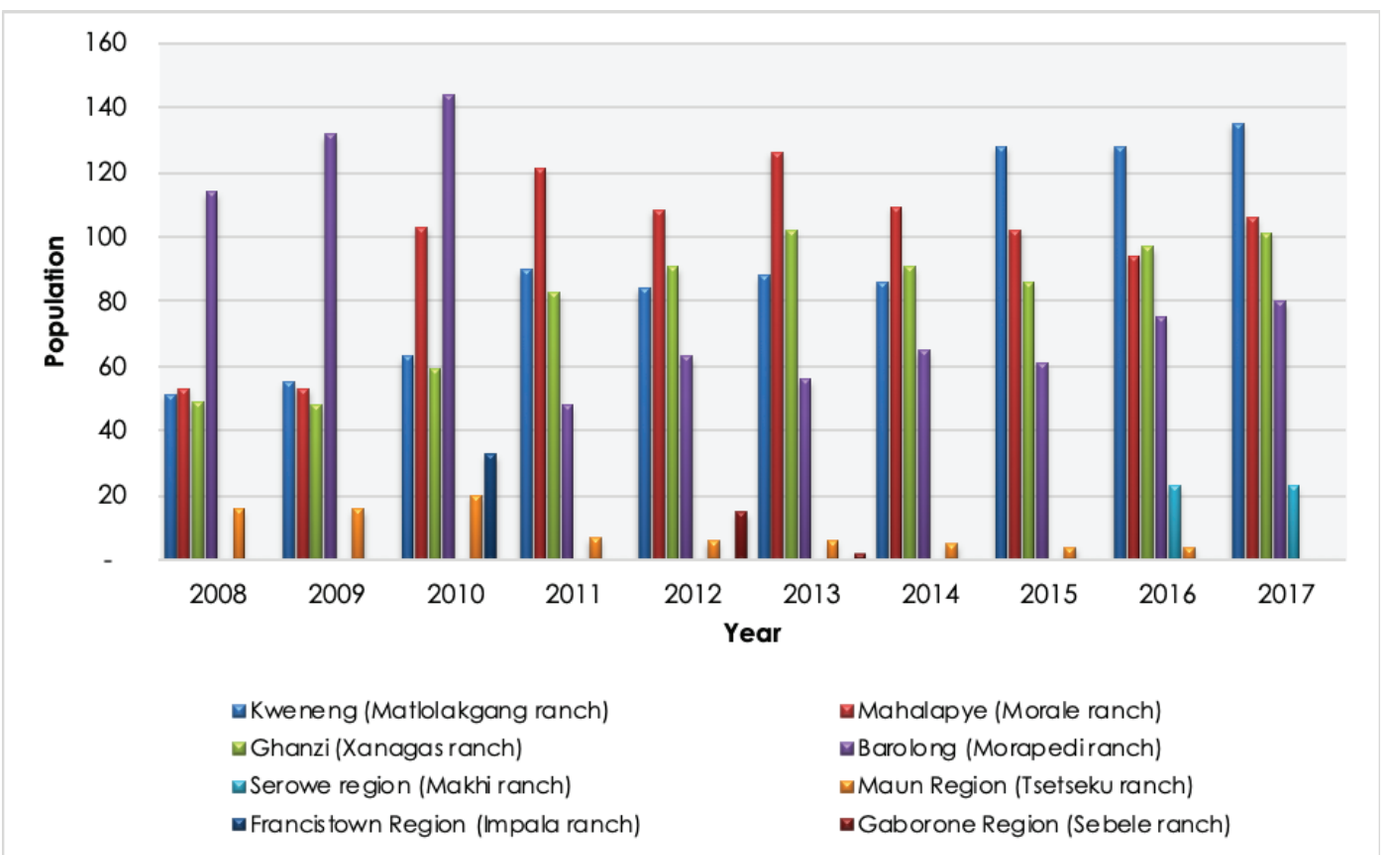


Figure 4.2e: National Musi cattle population (2008 - 2015)

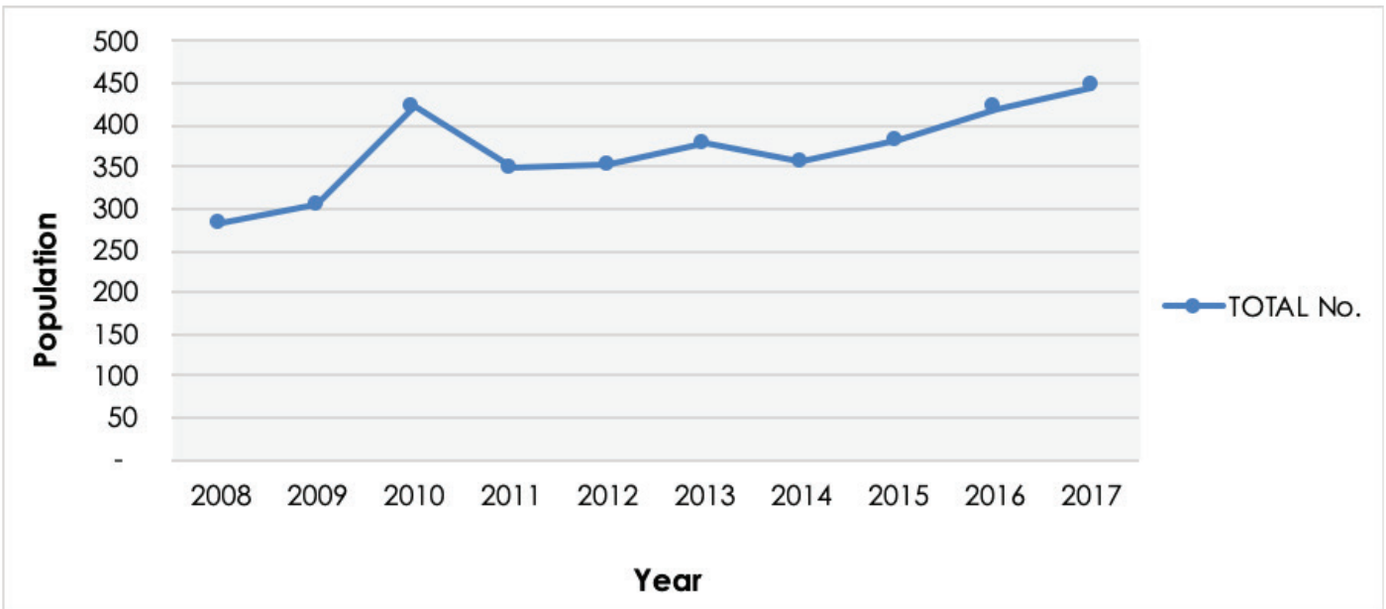


Table 4.2e presents drought-adapted/tolerant livestock population ('000) by district for the period 2008 to 2014. The table shows that the population of Tswana Cattle followed an upward trend from 2008 to 2010 then experienced a downward trend from 2010 to 2014. The highest total number of Tswana Cattle was recorded in 2010 (1,110,634) while the lowest was recorded in 2014 (705,607). The region with the highest population of Tswana Cattle during the review period is the Central Region which is the largest district.

With regards to the population of Tswana goats, Table 4.2e 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 recorded the highest population of Tswana Goats throughout the period 2008 to 2013 (Table 4.2e and Figure 4.2f).

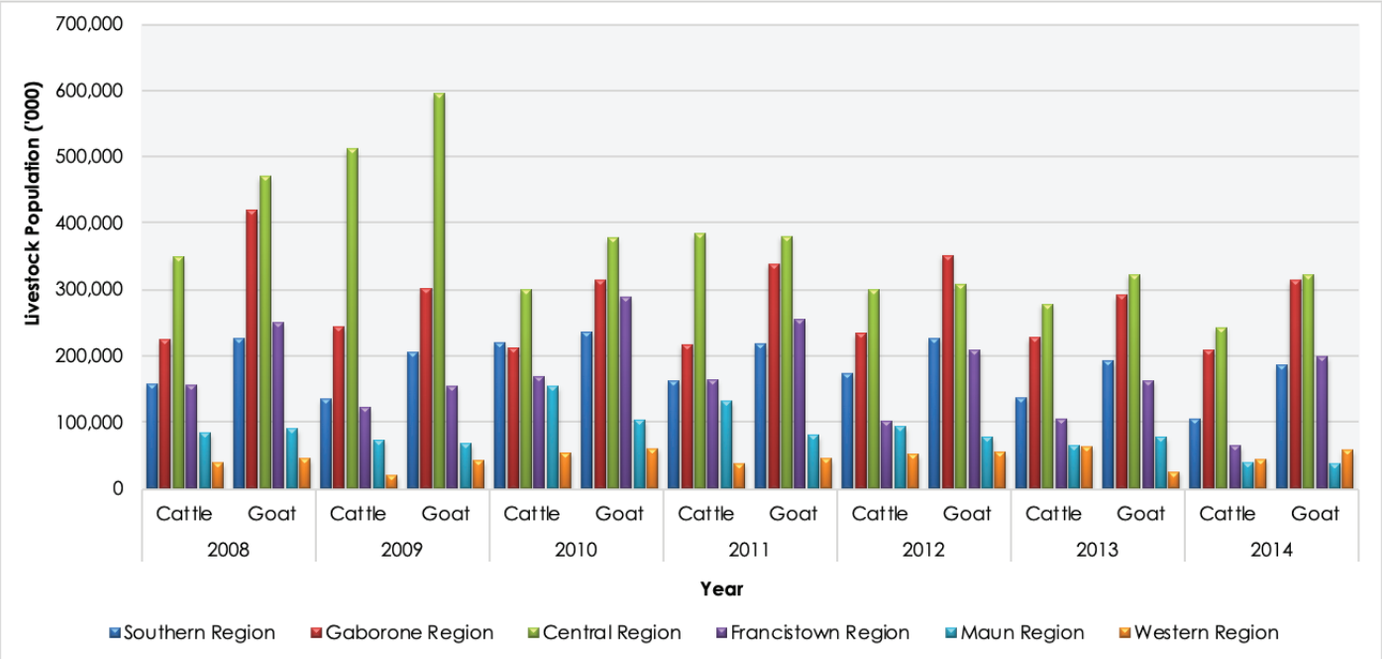
In summary, the population of both Tswana cattle and goats, which are adapted to drought, are experiencing a slight decrease in numbers. This increases the vulnerability to drought of the population dependent on agriculture for their livelihoods. The reduction in the population of drought-tolerant livestock can also worsen the already existing problem of high imports to meet the country's food security obligation.

Table 4.2e: Drought-Adapted/Tolerant Livestock Population ('000) by District (2008 - 2014)

Agricultural District	2008		2009		2010		2011		2012		2013		2014	
	TSWANA Cattle	TSWANA Goat	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	3,124	11,214
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	10,216	10,187
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	36,407	89,464
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	19,950	37,483
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	36,054	37,736
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	105,751	186,084
BaMalete/Tlokweng	16,120	67,405	11,597	23,289	17,163	47,013	16,516	39,224	18,981	46,657	36,959	37,394	22,512	61,888
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	47,921	105,014
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	26,560	46,145
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	37,287	35,735
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	74,376	64,946
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	208,656	313,728
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	26,407	35,154
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	75,385	78,633
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	52,471	88,705
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	31,422	30,818
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	10,274	29,055
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	32,295	32,051
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	14,306	28,391
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	242,560	322,807
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	12,029	44,992
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	42,858	92,484
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	10,318	61,201
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	65,205	198,677
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	15,018	5,341
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	22,220	31,168
Chobe	2,301	695	4,424	310	6,147	2,125	2,228	2,188	2,914	622	3,476	1,325	2,402	1631
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	39,640	38,140
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	24,645	25,052
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	7,824	12,502
Tsabong	5,294	16,131	5,244	3,764	24,348	29,674	12,721	16,426	20,087	26,650	385	1,529	11,326	20,763
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	43,795	58,317
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**	**705,607**	**1,117,753**

Source: *Agriculture Statistics Un it, Statistics Botswana*

Figure 4.2f: Drought-Adapted/Tolerant Livestock Population ('000) by Region (2008 - 2014)



4.2.4. New crop varieties

Several crop varieties with different physiological characteristics have been released over the years, of which farmers can tap into in their endeavour to adapt and mitigate against the harsh climatic conditions faced in Botswana. The Department of Agricultural Research has been developing crop technologies that are best suited to the existing agro-ecological conditions in Botswana. They come in the form of crop varieties that exhibit different characteristics and quality attributes therefore giving farmers an opportunity to choose varieties that are best suited to the prevailing conditions. SADC (2015) notes that, in-built into the crop varieties could be drought tolerance, pest (witchweed) resistance and high yield. There is continued breeding and selection for earliness, drought tolerance, hybrid combination and yield. SADC (2015) further notes that, currently there are sorghum lines in early stages of development with regards to early maturity, and at the same time, conversion of released sorghum lines to male sterility for potential hybrid combination is being done. The old varieties that are no longer in production (65D, 8D, and Marupantse) are maintained and conserved for future use in the breeding program as they may possess some favorable genes that may prove essential in the future.

5.0. VELDT FIRES

This section provides information on fire incidences and impacts by district for the years 2010 to 2011, and 2014 to 2016 as well as part of 2017. Veldt Fires are the uncontrolled burning of open grazing areas and they usually occur during winter season (CSO, 2009). Veldt fires occur in two ways; they can occur naturally or unnaturally. Natural fires are caused by ignition from lightning which usually occur during the rainy seasons, while unnatural fires are caused by ignition from human intervention. Unnatural fires are common during the dry season and often prolonged by late rains (HIU Consultants, 2008). In Botswana, man causes the majority of wild-land fires (unnatural fires).

5.1. Impacts of Veldt Fires

Since the impacts of veldt fires can be devastating to both humans and the environment on which they base their livelihood; it is important to collect, document and publish such information for fire management and monitoring purposes. Fires have the potential of destroying both the fauna and flora.

5.1.1. Fire Incidences

Table 5.1a shows the total number of veldt fire incidences in each district between 2010 and 2017. It is evident from the table that the highest numbers of national fire incidences were recorded in 2017 (295), 2010 (256), 2011 (251), and 2014 (249) in that order. The Ngamiland District experienced more fire incidences during the review period followed by Central and then Chobe. The least number of fire incidences during the review period were recorded in the South East, North East, and Kgatleng in an ascending order.

Table 5.1a: Number of Fire Incidences by District (2010 - 2017)

District	2010	2011	2014	2015	2016	2017
Ngamiland	18	28	103	124	90	109
Central	55	48	48	41	27	79
Kgalagadi	26	18	11	7	5	34
Ghanzi	28	42	12	18	8	23
Chobe	11	15	46	34	22	21
Kweneng	52	35	11	8	4	11
Southern	53	45	14	7	2	9
North East	1	8	3	4	1	7
Kgatleng	9	8	1	1	0	2
South East	3	4	0	7	0	0
Total	**256**	**251**	**249**	**247**	**159**	**295**

Source: *Department of Forestry & Range Resources*
No data for the years 2012 & 2013.

5.1.2. Fire Affected Area

Table 5.1b and Figure 5.1a depict the total area (hectares) affected by veldt fires by district in the period 2012 to 2017. It is evident from the table that almost all the districts followed a downward trend of area affected by fire between the years 2012 and 2016. There was a slight increase from the area affected by fire for all the districts from the years 2016 to 2017. The largest total area affected by fire in Botswana was recorded in 2012 (11,315,800 hectares), 8,618,179 hectares in 2013 and 3,402,837 hectares in 2014, in that order. Districts which were affected by fire the most in terms of area burnt in 2012 were Ngamiland, Ghanzi and Central with 5, 120, 500 hectares, 1, 951, 300 hectares and 1, 345, 400 hectares respectively. Ngamiland District was the most affected during the review period.

Presented in Table 5.1c are the percent of fire affected area by district for the years 2012 to 2017. Proportionately, Ngamiland District, Ghanzi District and Chobe District show more hectarage of burnt areas compared to the rest of the districts. The lowest proportionate burnt area was observed in the South East, North East, and Kgatleng. (Table 5.1c and Figure 5.1b)

Table 5.1b: Fire Affected Area (Hectares) per District 2012-2017

District	2012	2013	2014	**2015	2016	2017	District Size (Hectares)
Ghanzi	1,951,300	2,676,749	1,118,966	122,500	15,232	851,715	11,472,587
Ngamiland	5,120,500	3,862,011	1,180,793	473,396	225,380	712,056	11,134,421
Kgalagadi	1,290,000	482,742	358,947	11,649	6,562	342,441	10,491,604
Chobe	649,600	546,135	427,815	55,349	67,446	190,327	2,101,920
Central	1,345,400	430,677	281,256	473,060	20,126	102,154	14,637,419
Southern	506,800	37,600	16,006	643	116	4,560	2,723,320
Kweneng	437,700	532,819	18,462	27,853	4,342	3,654	3,696,345
North East	5,000	1,633	57	404	24	1,646	514,619
Kgatleng	5,000	47,613	535	15	-	154	761,943
South East	4,500	200	-	3,493	8	28	5,800
Grand Total	**11,315,800**	**8,618,179**	**3,402,837**	**1,168,362**	**339,236**	**2,060,383**	**57,539,978**

Note (-): No data
(**): *Statistics upto May 2015 for all districts*
Source: *Department of Forestry & Range Resources*

Figure 5.1a: Fire Affected Area (Hectares) per Selected Districts 2012-2017

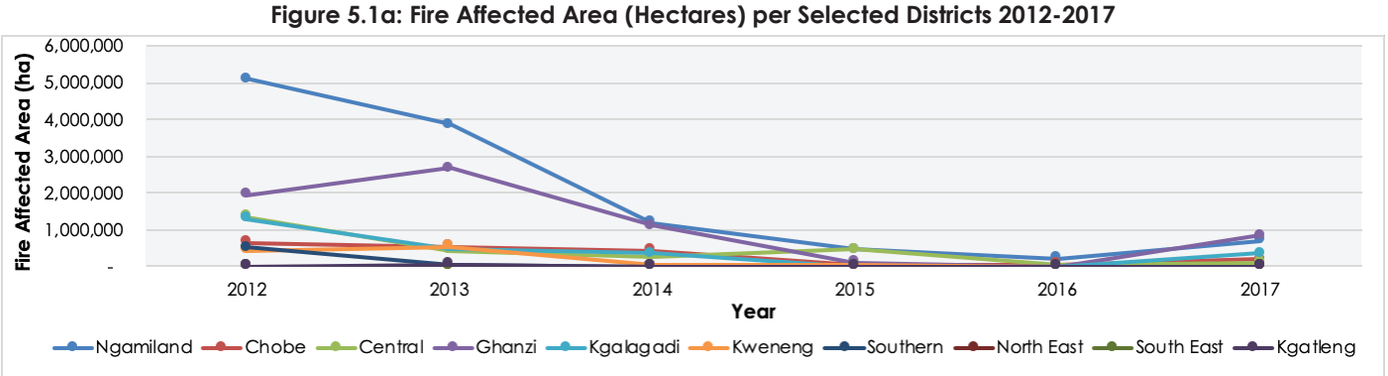
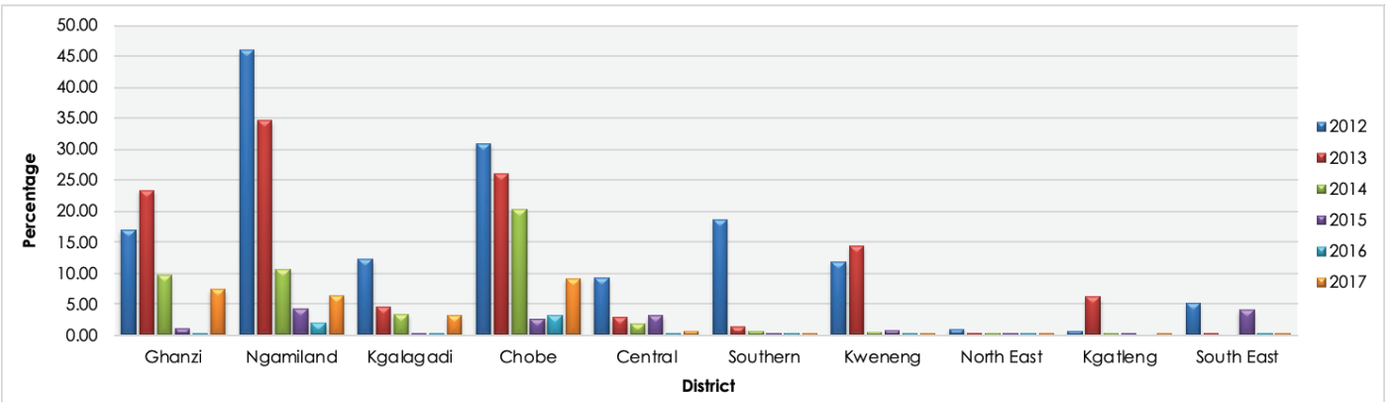


Table 5.1c: Percent of Area Affected by Fire (Hectares) per District 2012-2017

District	District size	2012	2013	2014	2015	2016	2017
Ghanzi	11,472,587	17.01	23.33	9.75	1.07	0.13	7.42
Ngamiland	11,134,421	45.99	34.69	10.6	4.25	2.02	6.4
Kgalagadi	10,491,604	12.3	4.6	3.42	0.11	0.06	3.26
Chobe	2,101,920	30.91	25.98	20.35	2.63	3.21	9.05
Central	14,637,419	9.19	2.94	1.92	3.23	0.14	0.7
Southern	2,723,320	18.61	1.38	0.59	0.02	0	0.17
Kweneng	3,696,345	11.84	14.41	0.5	0.75	0.12	0.1
North East	514,619	0.97	0.32	0.01	0.08	0	0.32
Kgatleng	761,943	0.66	6.25	0.07	0	-	0.02
South East	85,800	5.24	0.23	-	4.07	0.01	0.03
Grand Total	**57,619,978**	**17.01**	**23.33**	**9.75**	**1.07**	**0.13**	**7.42**

Derived from Table 5.1b
Note (-): No data

Figure 5.1b: Percent of Fire Affected Area (Hectares) per Selected Districts 2012-2017



5.2. Response to Impacts of Veldt Fires

There is need to manage the extent of damage caused by veldt fires in order to reduce the magnitude of the future impacts. In Botswana it is done through community fire management plans which helps to supress unwanted fires. The other fire management approach (strategy) used is 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.

5.2.1. Firebreaks Construction and Maintenance

During the year 2016/17 a total of 4,040.5 kilometres of firebreaks were maintained out of the planned 9,229.5 kilometres of firebreaks. The maintenance costed BWP 15.7 Million. About 57 percent of the total expenditure was expended in the Central District alone (Table 5.2)

Table 5.2: Firebreaks Construction and Maintenance for 2016/17

District	No. of Firebreaks	Construction/Maintenance (Km)		Expenditure (BWP) in 2016/17
		Planned	Actual	
Central	9	2,134.00	2,134.00	9,000,840.65
Chobe	13	1,315.50	1,315.50	5,001,531.00
Ngamiland	6	1,167.00	373	1,118,584.82
Kweneng	8	1,078.00	218	582,748.75
Southern	10	836	-	-
Kgalagadi	9	970	-	-
Ghanzi	8	1,338.00	-	-
Kgatleng	8	391	-	-
Total	**71**	**9,229.50**	**4,040.50**	**15,703,705.22**

Source: *Department of Forestry and Range Resources, 2016; Rural Development Council, 2016*
Note (-): No data

6.0. POLICIES AND PRACTICES FOR CLIMATE-SMART AGRICULTURE (CSA)

In 2016 Botswana launched the national CSA Program for the period 2015 to 2025. Botswana heeded the increasing regional and international calls for Climate Smart Agriculture (CSA) as part of the quest to transform agricultural systems towards more productive, efficient, resilient and sustainable systems in the face of changing global food systems and climate change. Both the Ministry of Agricultural Development and Food Security and the Ministry of Environment, Natural Resources Conservation and Tourism Development jointly implemented the program. A total of six strategic priorities were identified as sources of Botswana's agricultural development and growth in a changing climate. These are;

(a) Improved productivity and incomes;
(b)Building resilience and associated mitigation co-benefits;
(c) Value chain integration;
(d) Research for Development and innovations;
(e) Improving and sustaining advisory services, and;
(f) Improved institutional coordination.

As a way of evaluating the aforesaid program across sub-Saharan Africa, Botswana included, the Food Agriculture and Natural Resources Policy Analysis Network (FANRPAN) commissioned a study in 2017 on Policies and Practices for Cliamte-Smart Agriculture in Sub-Saharan Africa. The results from this assessment highlight a set of areas for action in terms of both policy and practice, and identify key barriers to the successful integration of climatesmart practices at the regional and national levels.

The key findings of the assessment revealed that the eastern and southern African countries have policies on agriculture and climate, and do recognize the impacts of the latter on the former" (FANRPAN, 2017: 10). Botswana is in the process of finalising its Climate Change Policy, while other African countries (e.g. Madagascar, Malawi, Uganda, and Zambia) have already developed theirs. The FANRPAN reports that such policies often lack adequate instruments to achieve the goals that have been set. Furthermore, the policies are fragmented across sectors presenting a clear need for greater policy coherence to help create synergies and subsequently avoid both duplication of efforts and conflicts.

Botswana, just like most of the African countries have examples of both traditional and research-based agricultural practices that can be reckoned to be climate-smart. The challenge is, they are not mainstreamed and still receive limited support. Such practices include both agroecological techniques (e.g. mulching,
intercropping, agroforestry, mixed farming) and agricultural biotechnology, such as high-yield and/or drought-tolerant crop varieties and livestock breeds (FANRPAN, 2017: 10).

Other challenges presented by the FANRPAN assessment included but not limited to, inadequate material such as human resource capacity, insufficient smallholder participation in governance, and gender inbalances which exacerbates the already existing challenge of lack of women empowerment. The other hindering factor that affects not only Botswana but the rest of the sub-Sahara african countries is that of lack of funds, which is often coupled with limited access to technology to upscale CSA practices. Other practices based on biotechnology and machinery for conservation agriculture remain expensive and are dependent on foreign actors. FANRPAN, (2017) recommends that, there is need for South-South and North-South cooperation that promotes the endogenous technological development of Africa. There is also a need for smallholder farmers, women and the youth, in particular, to actively participate in policy formulation and implementation, and decision making processes.

Lastly, the FANRPAN identified four key areas of action in order to promote CSA:

(i) Increased investment in material and human resources,
(ii)The design of coherent, integrated policies,
(iii)A focus on evidence-based, context-specific plans, that include the promotion of strategies to

ensure equitable participation in governance,
(iv) Capitalising on innovation as a pathway to promote CSA.

With regards to Climate-smart agriculture policy, Botswana has formulated and implemented the following, some of which were already in existence:
- CSA Framework Programme,
- National Master Plan for Arable Agriculture and Dairy Development,
- Integrated Support Programme for Arable Agriculture Development, and
- Livestock Management and Infrastructure Development programme.

The incentives for adoption of the above mentioned policies and programmes as alluded to by FANRPAN (2017) include:

(i) Capacity development and technology support;
(ii) Tax exemption for agricultural products and farming inputs;
(iii) Young Farmers Fund issues loans at lower interest rates and longer repayment periods to

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.pd) Accessed 25.09.2015.

Bolt, B.A., (2018). ***Earthquake, Geology.*** (https://www.britannica.com/science/earthquake-geology) Accessed on 11/05/2018.

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

FANRPAN (2017). ***Policies and Practices for Climate-Smart Agriculture in Sub-Saharan Africa.*** Synthesis Report. (https://www.fanrpan.org/sites/default/files/publications/CSA)

FEWS NET (2014). Seasonal Monitor, Southern Africa. (www.fews.net/southern-africa/special-report/july-2014) Accessed: 25/05/2018.

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

International Federation of Red Cross & Red Crescent Societies, (2016). ***Resilience: saving lives today, investing for tomorrow.*** (http://media.ifrc.org/ifrc/publications/world-disasters-report-2016/) Accessed 23.05.2018.

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.

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.

Mmegionline (2017). ‚Biggest ever' Botswana earthquake. (http://www.mmegi.bw/index.php?aid=67929&dir=2017%2Fapril%2F04) Accessed on 11th May 2018.

UN Office for the Coordination of Humanitarian Affairs (2015). Southern Africa: Floods and Cyclones Update (as of 16 Jan 2015). (https://reliefweb.int/map/malawi/southern-africa-floods-and-cyclones-update-16-jan-2015) Accessed 22/05/2018.

UNISDR (2015). Global Assessment Report on Disaster Risk Reduction: ***Making Development: The Future of Disaster Risk Management.*** Geneva, Switzerland: UNISDR.

ReliefWeb (2015). ***Southern Africa: Floods- Jan 2015.*** (https://reliefweb.int/disaster/fl-2015-000006-mwi) Accessed on 07th May 2018.

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).

Rural Development Council (2017). ***Drought and Household Food Security Outlook 2016/17.*** Ministry of Local Government and Rural Development.

Rural Development Council (2016). ***Drought and Household Food Security Outlook 2015/16.*** Ministry of Local Government and Rural Development.

Rural Development Council (2015). ***Drought and Household Food Security Outlook 2014/15.*** Ministry of Local Government and Rural Development.

Statistics Botswana (2016). ***Botswana Environment Statistics: Natural Disasters Digest 2015.*** Statistics Botswana.

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.

UN Office for the Coordination of Humanitarian Affairs (2015): ***Southern Africa: Floods and Cyclones Update*** (as of 16 Jan 2015) (https://www.unocha.org/) Accessed 07th May 2018.

UN Office for the Coordination of Humanitarian Affairs (2015): ***Zimbabwe: Floods Emergency Plan of Action (EPoA) DREF Operation n° MDRZW010*** (as of 13 Jan 2015) (https://www.unocha.org/) Accessed 07th May 2018.

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_disasterriskreductionpost2015develo.pdf) Accessed 24.09.2015.

BOTSWANA ENVIRONMENT STATISTICS

NATURAL DISASTERS DIGEST 2017

BOTSWANA ENVIRONMENT STATISTICS

NATURAL DISASTERS DIGEST 2017