

NATURAL DISASTERS DIGEST 2008

Published by

Central Statistics Office
Private Bag 0024, Gaborone
Telephone: 3952200; Fax: 3952201
E-mail: csobots@gov.bw
Website: www.cso.gov.bw

Contact Unit: Environment
Telephone: 3952200 Ext. 1394/1346/1395

Printed by and obtainable from
Department of Printing and Publishing Services,
Private Bag 0081, Gaborone
Telephone: 3953202 Fax: 3959392

August 2009

COPYRIGHT RESERVED

Extracts may be published if
Source is duly acknowledged

Preface

This is the first publication on Natural Disasters that the Central Statistics Office (CSO) has issued. The purpose of the present digest is to provide reliable quantitative information and analysis on natural disasters (causes and consequences/effects on the environment). Natural disasters covered include floods, veldt fires and drought. Also provided in the 2008 Natural Disaster Digest are disasters management structures information which is of great importance for development planning, policy formulation and implementation. Some of the data produced in this digest can be used for monitoring Millennium Development Goals more especially the one on ensuring environmental sustainability. This digest is therefore produced and published with the hope to contribute to the above efforts.

The digest is divided into four sections which has additional individual sub-sections. The first section discusses floods, the second one is on drought, the third on veldt fires, and policy framework and disaster management structures are discussed on the last section.

The production of this digest is a joint effort between the Central Statistics Office (CSO), Department of Forestry and Range Resources, The Office of the President (Natural Disaster Management Committee) and Department of Local Government Development Planning. The Department of Forestry and Range Resources, and Department of Local Government Development Planning provided most of the data published in this digest and wish to acknowledge their significant contributions.



A.N. Majelantle
GOVERNMENT STATISTICIAN

Contents

Content	Page
Preface.....	i
Contents	ii
List of Tables	iii
List of Figures.....	iv
1.0 Introduction.....	1
2.0 Floods.....	3
2.1 Impacts of Floods.....	3
2.2 Response on the Damages caused by Floods.....	7
2.2.1 Village Flood Watch project.....	7
2.2.2 National Disaster Management Office (NDMO).....	7
3.0 Drought	9
3.1 Impacts of drought	13
3.1.1 National Yield & Production Estimates.....	13
3.1.2 Drought related Wildlife Mortality.....	13
3.1.3 Drought related Livestock Mortality	14
3.1.4 Cereal Requirements and Production.....	15
3.2 Response	18
3.2.1 Drought Declarations and Labour Intensive Public Programmes.....	18
3.2.2 Food Relief Services	23
4.0 Veldt Fires.....	25
4.1 Natural Fires.....	25
4.2 Unnatural Fires.....	25
4.3 Impacts of Veldt Fires.....	26
4.3.1 Area Affected and Damage Caused by Fire	26
4.4 Response	32
4.4.1 Fire Suppression Policies.....	32
4.4.2 Status on fire control.....	32
4.4.3 The Southern Africa Fire Network	32
4.4.4 Response Time.....	33
4.4.5 Firebreaks.....	33
5.0 Policy Framework and Disaster Management Structures.....	34
5.1 Policy Framework.....	34
5.2 Disaster Management Structures	35
5.2.1 National Disaster Management Office.....	35
5.2.2 National Committee on Disaster Management	35
5.2.3 National Disaster Management Technical Committee	35
5.2.4 District Disaster Management Committees	35
5.2.5 Village Level.....	35
References:.....	36

List of Tables

Table	Page
Table 2: Damages caused by floods by district.....	4
Table 2: Damages caused by floods by district continued.....	5
Table 3.1: Mean Monthly Rainfall (mm) and Maximum Temperature (degrees Celsius).....	11
Table 3.2 Occurrences of Drought in Botswana.....	12
Table 3.3: Estimated National Crop Yield Forecast in kg/ha.....	12
Table 3.4: Drought Related Wildlife Mortality.....	13
Table 3.5: Livestock Mortality by district (2007)	13
Table 3.6: Cereal Requirements in ('000) Tons by Crop from 1998-2008.....	14
Table 3.7: Cereal Production in ('000) Tons by Crop from 1998-2008	14
Table 3.8: Imports of Cereals by Crop from 1999-2008	15
Table 3.9: NDP 9 Drought declarations	18
Table 3.10: Labour intensive public programmes by district for the 2005/06 Season.....	20
Table 3.11: Labour intensive public works programmes by district (2007/2008)	21
Table 3.12: Annual Food Supplies and Deliveries for the Feeding Programmes, 2005-2007 All Depots.....	23
Table 4.1: Hectares of Area Fire Affected per Land Use.....	26
Table 4.2: Number of Fire Incidences by District 1994-2008.....	28
Table 4.3: Fire Affected Area per District 2006-2008.....	29
Table 4.4: Damage to Property, Human and Animal Casualties: 1991-2001.....	30
Table 4.5: Response Time to Veld Fires by District.....	32

List of Figures

Figure	Page
Figure 1.0: Disasters occur when hazards meet vulnerability.....	1
Figure 2.1: 2008 Okavango flood waters.....	6
Figure 3.1: Seasonal rainfall outlook for January, February and March	9
Figure 3.2: Seasonal rainfall outlook for October, November and December.....	10
Figure 3.3 Imports of Cereals by Crop from 1999-2008	16
Figure 4.1: Area Fire Affected per Land Use and Hectares.....	27
Figure 4.2: Fire Affected (hectares) per district in 2006, 2007 & 2008.....	29
Figure 4.3: Fire Affected Area (hectares) per district in 2006, 2007 & 2008.....	30

NATURAL DISASTERS

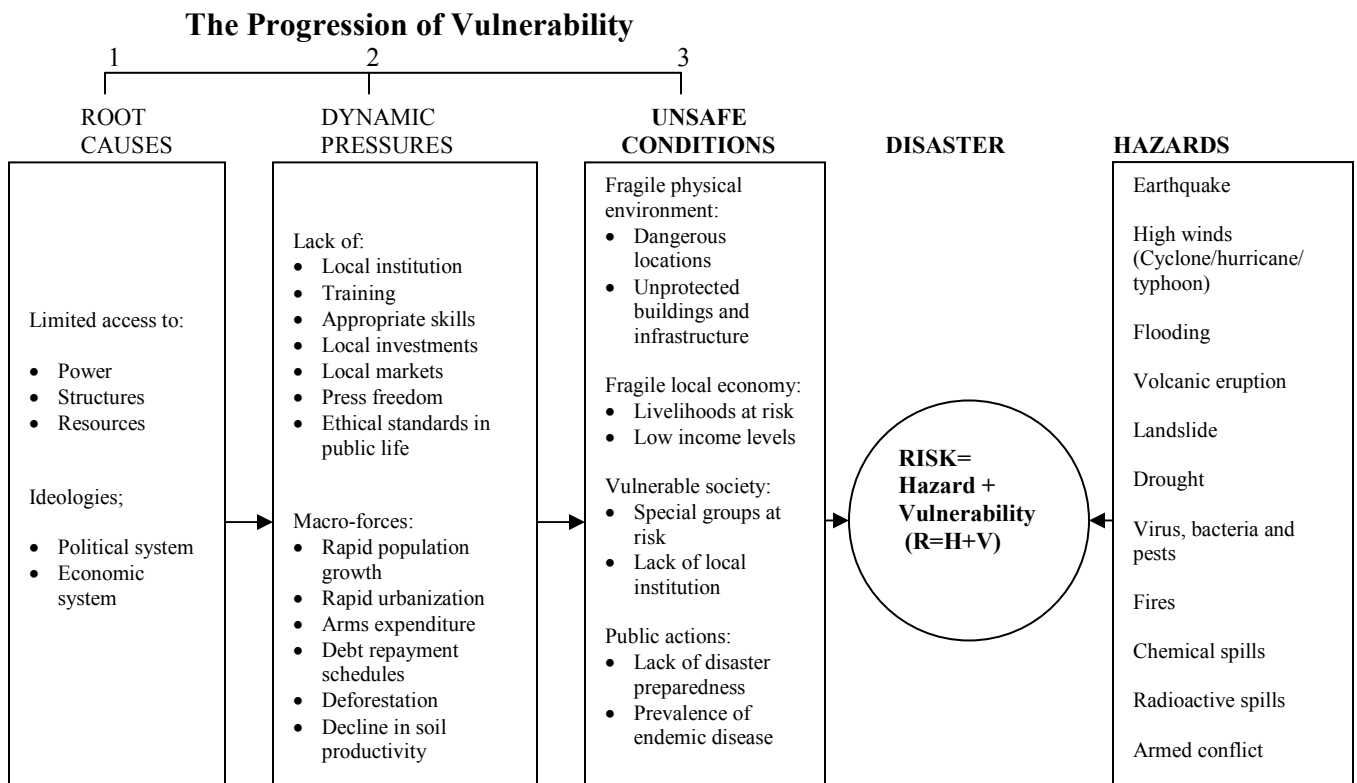
'While some of the worst disasters to befall people are the result of human activity, the most widespread destruction is caused by events that result from natural process way beyond the power of humans to contain or control.'
 (Natural Disasters Readers digest, 1996)

1.0 Introduction

Natural disasters are naturally occurring events or aftermath of natural hazards affecting daily human activities. A natural hazard is the threat or the danger of an event towards human life and the environment. In areas with no vulnerability, natural hazard never result in a natural disaster.

Instances where hazards meet vulnerability disasters do occur (Australian Drought and Climate Change, www.lilith-ezine.com/). Bohle et al. (1994) define vulnerability as 'an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of harmful perturbations.' Figure 1.0 below clearly shows how and when disasters occur.

Figure 1.0: **Disasters occur when hazards meet vulnerability**



Adopted from: *Pressures that result in disasters: the progression of vulnerability* by Blaikie, Cannon, Davis & Wisner, (1994)

Botswana has in the past experienced both natural and human-induced disasters. The natural disasters include mainly droughts, floods, and veldt fires, the reason being that Botswana is a landlocked country and she therefore does not experience other disasters like tsunamis and volcanoes. These three disasters are environmental-related events. It is in light of the afore-mentioned statements that this digest discusses environmental issues with regard to causes and consequences/effects of floods, drought, and veldt fires on the environment (fauna and flora), population and development in Botswana. A Framework for the Development of Environment Statistics is adopted, where the environmental information is grouped into four categories: social and economic activities/natural events, environmental impacts of activities/events, response to environmental impacts, and inventories, stocks and background conditions (United Nations, 1991). Each section of the digest captures each of these information categories.

Natural disasters are related to climate change and their relationship has given rise to climate-related natural disasters. According to the Department of Environment, Food and Rural Affairs 2005 Report climate refers to the average weather experienced over a long period. This includes temperature, wind and rainfall patterns. The climate of the Earth is not static, and has changed many times in response to a variety of natural causes. The Earth has warmed by 0.74°C over the last hundred years. Around 0.4°C of this warming has occurred since the 1970s. The recent Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) 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).

Climate change is predicted to have a range of serious consequences, some of which 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) As already mentioned this digest focuses on this second category: 'extreme weather events' responsible for natural disasters. They include:

- High levels of precipitation, and associated flooding
- Lack of precipitation, and associated drought, and
- Veldt fires which are not climatic.

Data for this digest are secondary and were drawn from various departments namely the Department of Forestry and Range Resources (Fire Section), National Disaster Management Committee under the Office of the President, Department of Meteorological Services, Drought & Household Food Security Outlook, and other relevant literature. Most of the literature was obtained through desktop research. The use of secondary data, therefore limits the digest to variables collected at different sources.

2.0 Floods

Damages caused by floods and responses are presented in this section. A flood is a great flow of water beyond its normal confines. The overflowing of water might take place in a place that is normally dry or within a body of water such as a lake or river, exceeding its total capacity. According to the Natural Disaster Readers Digest (1996), flooded areas of land usually start off as very dry land. Floods are caused by heavy rains that pour too much water into rivers and other waterways making these natural channels unable to carry all the water. Rising water flows over or breaks the banks to the waterways causing the surrounding land to be flooded. It is also stated in the Natural Disaster Readers Digest (1996) that, the type of land that is prone to flooding is broad and flat usually situated on the banks of a river or main waterway. Rivers that flood are regarded in three different stages. They are:-

***‘ONE:** - Water comes off the mountains, eroding the beds and banks of the river as it flows.*

***TWO:** - This type of river travels through a broad valley which slows the current of the river down. If the current is slow it will transport less material down the river.*

***THREE:** - Flood-plain stage. Little if not any erosion takes place most of the material that is carried in the current is suspended and deposited to form a flood plain.’*

Floods are destructive by nature, there is usually physical damage ranging from bridges, buildings, roads and other properties. Human and animal casualties are common due to drowning. The unhygienic conditions caused by floods influences the spread of water borne diseases and scarcity of clean drinking water. Damages to crop fields by floods can lead to shortage of food hence an increase in food prices. This will affect the poor for they would not be able to afford high-priced food, leading to extreme poverty in some areas.

In Botswana, known reliable records on floods date as far back as 1995 when heavy rains fell over most parts of the country, resulting in floods covering parts of Kweneng and Central districts. The floods caused damage to property, infrastructure, life (human and animal), and vegetation, and was mainly a result of continuous, unidirectional rains (Environmental Statistics, 2000). Floods in Botswana occur during the rainfall season; October, November, December, January, February and March.

2.1 Impacts of Floods

The 1999/2000 floods were the worst in the country. They affected twenty-three administrative districts/cities/town/villages, thus amounting to almost the entire country. These floods caused loss of life and extensive damage to infrastructure, public and private assets, environment and disrupted normal family life. Thirteen lives were lost, over seventeen thousand structures were damaged leading to displacement of thousands of people, and crops were damaged as well as infrastructure comprising major roads,

bridges and railway lines. Livestock was also not spared. (Botswana Country Report, 2004)

Table 2: Damages caused by floods by district

Year	District	Location	Damages
1995	Central	Palapye	153 people affected, rail bridge damaged, huts/houses destroyed
2000	Gaborone	Ext: 1, 7, 8, 9, 12, 15, 16, 18, 37. Phase 2, Old Naledi, Prisons & Block 5	Not Known
2001	Gaborone	Residential areas in Taung, Segoditshane, Phase 4, Old Naledi, Village, Kgale View, Phase 1 & 2, Universal Estate, Ext. 2, Bontleng, White City, & G West	P5 million worth of private and public property was damaged.
2003	Central	Sowa	Independent Electoral Commission (IEC) tents affected at Nata West, Gweta west, Zoroga, Nata East and Tshwane
	South East	Ramotswa	52 chickens/fowls were killed.
2004	Central	Tutume	120 households affected at Nata, Gweta, Malelejwe, Semowana, and Manxotae. Classrooms at Gasebalwe were submerged, post office, standpipes and inner roads
	Ngamiland	Shakawe, Nxamasere, Mohembo West, Xakao	992 households, water treatment plants at Sepopa and Mohembo East, waiting room at the pantoon area, Mohembo/Seronga road all affected.
	Central	Letloreneng	973 people affected, 199 huts destroyed, Letloreneng the most hard hit, Machaneng/Sherwood Road managed, water reticulation pipes at Machaneng destroyed
	North East Chobe	Francistown Chobe Enclave	125 families affected Kachikau, Satau, Parakarungu road inaccessible. Borehole supplying Kachikau flooded.

Source: Office of the President (National Disaster Management Office)

Table 2: Damages caused by floods by district continued

Year	District	Location	Damages
2005	Ghanzi	Ghanzi	437 people were affected
2006	Gaborone	Taung	8 households affected
		Central	16 household structures affected
		Shoshong	15 households affected
	North East	Mosolotshane	
		Botalaote, Toteng, Mambo, Tshesebe, and Tati Siding Villages	32 households were assisted for food rations
South East	Ramotswa	2 sewage pump stations affected	

Source: Office of the President (National Disaster Management Office)

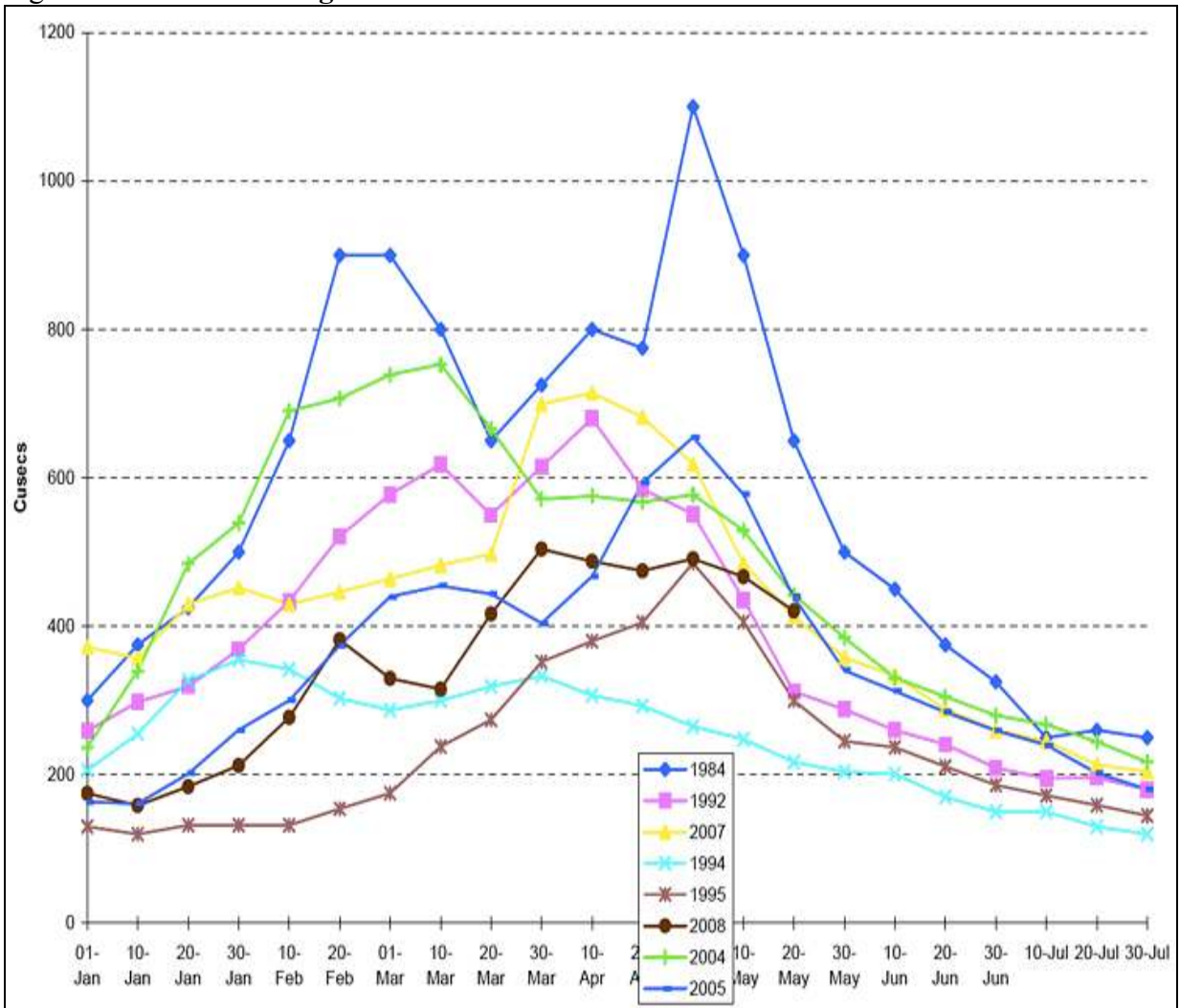
Table 2 shows that the Central District experienced more floods than any other district in the country. Among the seven (7) incidences of floods in the country from 1995-2006, the Central District experienced four (4) incidences followed by Gaborone with three (3) then North East and South East Districts with 2 incidences of floods each. In Gaborone an estimated amount of P5 million worth of private and public property was damaged in 2001. The supply of clean water to the public was affected by floods for example; Borehole supplying Kachikau flooded in 2004, water reticulation pipes at Machaneng destroyed in 2004, and water treatment plants at Sepopa and Mohembo East were affected by floods in 2004. There was only one case where two (2) sewage pump stations were affected by floods in Ramotswa in 2006.

Figure 2.1 shows the levels of the 2008 Okavango flood waters. According to Okavango Delta Flood Update 2008, rainfall in Angola, Zambia, Botswana and Zimbabwe has been very high during the 2008 season and that meant two things:

- 1) The catchments of the Okavango, Kwando and Zambezi Rivers received a large quantity of rain and as a result, all these rivers were swollen. Their waters took some time to reach most safari camps, which are generally in the mid-to-lower reaches of the rivers. However, the early flow levels allowed predictions of how the safari camps and viewing conditions are likely to be affected later in the year. At that stage the Okavango flood did not appear to be a big one; however, it was still early to make conclusions.
- 2) The rainfall in northern Botswana in 2008 has been so high that the level of flooding usually experienced in winter months (May-July) was being achieved. This had widespread impacts on airstrips such as Kings Pool and Selinda and also on game drives in areas such as Vumbura, where the roads were already deep in water, although passable. Towards the end of March and beginning of April, when the Okavango flood reached the Delta, it combined with the rain water already lying in the area and created a very heavy flood.

In summary, the heavy rains experienced in the summer of 2008 in the Okavango Delta and Linyanti areas were already creating conditions very similar to the annual winter flood. This scenario, combined with the influx of water into the Delta from the end of March/early April, was expected to result in a substantial flood. (Okavango Delta Flood Update, 2008)

Figure 2.1: 2008 Okavango flood waters



(Measured in cubic metres per second at Mohembo, on the Okavango River just as it enters Botswana)

Source: Okavango Delta Flood Update, 2008

2.2 Response on the Damages caused by Floods

2.2.1 Village Flood Watch project

The Village Flood Watch project, which was completed in 2002, was designed to help establish an early-warning system for potential flooding events by adding or upgrading six gauging stations to near real-time capabilities and providing training on hydrologic runoff modeling. In early 2000 many parts of the Southern African Region experienced devastating floods. According to U.S. Geological Survey 2007, rainfall accumulations in Botswana during February 2000, for example, were reported to have been greater than 1000 millimeters (more than 39 inches) in one storm event, more than twice the annual average rainfall. Many lives were lost, tens of thousands of people were displaced from homes, and over 1 billion Pula (about \$285,000,000) of damage was reported. Following these events, multiple agencies initiated a variety of disaster relief programs. Among others, United States Agency for International Development (USAID) asked the U.S. Geological Survey (USGS) to design and implement a Village Flood Watch Project (U.S. Geological Survey, 2007). The project focused only on the Limpopo River Basin. The project specific objectives were to:

1. Build three new and upgrade three key hydrological monitoring stations, all with near real-time capability.
2. Provide two new all-weather meteorological stations.
3. Document critical floods that occurred in 1995 and 2000 by indirectly computing peak discharges using open-channel hydraulic methods.
4. Provide local scientists with the training needed to develop hydrological runoff modeling capabilities.
5. Provide hydrologists and meteorologists within the Departments of Water Affairs and Meteorological Services with training and equipment for the successful operation, maintenance, and troubleshooting of the electronic hydrological and meteorological equipment used in their hydrological and meteorological networks.

2.2.2 National Disaster Management Office (NDMO)

In 1998, the National Disaster Management Office (NDMO), a unit under the Development Division in the Office of the President, was established. NDMO has three divisions which are: Information, Education and Awareness, Operations Control, and Coordination and Logistics. The NDMO coordinates its activities through the National Committee on Disaster Management, the National Disaster Management Technical Committee and District Disaster Management Committee (Hlabaangani & Mnjama, 2008). The goals of NDMO are:

- (i) To protect life and the environment and prevent loss of property from all types of hazards (both natural and human-made) through a risk prevention management approach.
- (ii) To strengthen inter-agency coordination and create an effective joint disaster management capacity with stakeholders.

(iii) To determine types of disasters, frequencies of their recurrences, and their impact magnitude.

The NDMO is responsible for formulating national disaster management systems and coordinating disaster management activities through:

- (i) Establishing and maintaining a comprehensive Disaster Management Information System.
- (ii) Proving early warning on approaching disaster and predictions of its possible effects on the country, population and people's livelihoods.
- (iii) Formulating Standard Operating Procedures for emergency response and management.
- (iv) Holding in readiness a series of preparedness or contingency plans, (for specific hazards such as floods, veldt fires etc.) for implementation when the circumstances and requirements are known.
- (v) Maintaining strategic reserves of essential commodities and equipment at the national and district levels with which to mount immediate disaster relief, while further national and international assistance is being mobilized.
- (vi) Maintaining up-to-date inventory of all available resources.
- (vii) Formulating and implementing, in partnership with training and academic institutions, programmes in disaster management education, training and public awareness, including training assessment, for all levels of government, community and non-governmental organizations, as part of capacity building and disaster preparedness.

Note: Section four of this digest discusses disaster management further.

3.0 Drought

This section of the digest discusses the occurrences; impact; declaration of drought; number of management projects; funds allocated; number of employed during different drought years in Botswana.

A drought is a protracted period of time when an area experiences moisture deficiency. Consistent below average rainfalls influences drought. Furthermore, high evaporation rate and infiltration capacity are known to be some of the determinants of droughts.

Moisture content is determined by amount of precipitation, infiltration capacity of the soil, run-off and evaporation rate. In Botswana most soils are dry and sandy as they have a high infiltration capacity. Run-off is a common occurrence when rain fall in short spells of high intensity. Annual average evaporation rate of free water is 2 000 mm, very high for a country with low precipitation. (CSO, Environmental Statistics 2000)

Drought should be well thought-out relative to some long-term average condition of balance between precipitation and evapotranspiration. Due to lack of recent data on evaporation rates of free water, average rainfall and temperature data was used in the discussion as factors influencing recurrent droughts in Botswana. It is usually easier to compare the amount of rainfall received and the rate of evaporation of free water in a particular given area.

The ENSO (El Nino-Southern-Oscillation) weather phenomenon is the most dominant perturbation responsible for interannual climate variability over Eastern and Southern Africa. The typical rainfall anomaly associated with ENSO over Eastern and Southern Africa is a dipole rainfall pattern. During ¹La Nina phase, drought conditions prevailed in East Africa and enhanced rainfall in Southern Africa. The situation is reversed during an ²El Nino event, with drought conditions over Southern Africa and enhanced rainfall over East Africa (Department of Forestry & Range Resources, 2008). Climate change in Botswana is influenced by the ENSO weather phenomenon.

According to the data from Department of Metrological Services, Botswana should have normal amount of rainfall received as shown in Figure 3.1 & 3.2. The two figures are showing detailed region-by-region rainfall outlooks. Using Seasonal Rainfall Outlook for October, November and December (first phase of the rainfall season) for the three regions (Regions 1-3) and mean monthly rainfall (2005-08) it is clearly evident that the rainfalls received in Region 3 (Ghanzi, Tsabong and Tshane) were way below normal over the past four years; 2005-2008 (See Table 3.1 and Figure 3.1). Normal rainfall should range between 90 mm-130 mm in the same region. For example, Tsabong received mean monthly rainfall of 12.8 mm for October, 22.8 mm in November and 32.3 mm in December. Below normal rainfall were also received in region 1 and 2 for October, November and December rainfall season. For January, February and March season (second phase of the rainfall season) the Regions 1 and 3 received below normal monthly rainfall too. Above normal rainfall was only received in Shakawe in the month of January

¹ La Nina= Cold phase of ENSO

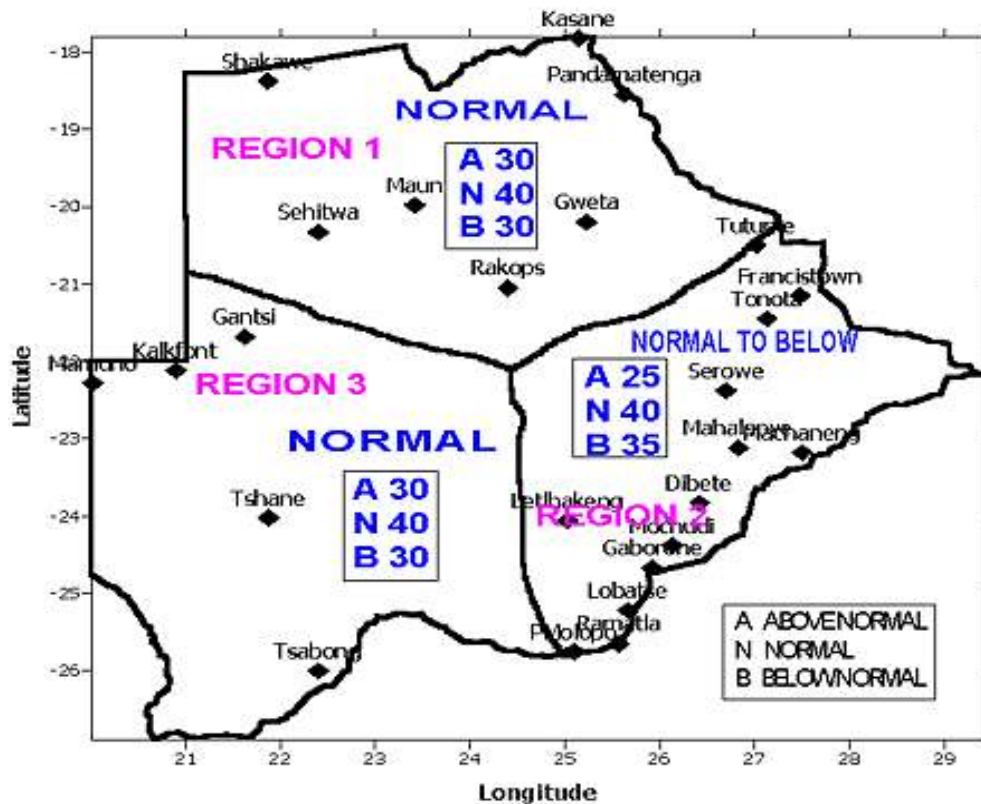
² El Nino= Warm phase of ENSO

amounting to a mean monthly rainfall of 197.3 mm (See Table 3.2). However, the rest of the findings clearly show that a problem of moisture deficiency has been contributing to the recurrence of drought in Botswana.

Due to the country's location the seasonal ranges of temperature are high. The highest mean monthly temperatures range between 32^oC and 35^oC (The Botswana National Atlas). Table 3.1 shows that more than half of the mean monthly maximum temperature recorded were more than 32^oC in the months of October-January. The extreme mean monthly maximum temperatures were recorded in Tsabong (35^oC) in January, Shakawe (35.7^oC) and Maun (35.3^oC) both in the month of October over the six years period (2005-2008). The assumption here is that if the temperature is high so is the evaporation rate of free water that is; high evaporation rate is influenced by an increase in temperature.

Figure 3.1:

RAINFALL OUTLOOK FOR October + November + December (OND)



Key: Rainfall outlook for each region during October, November, and December:

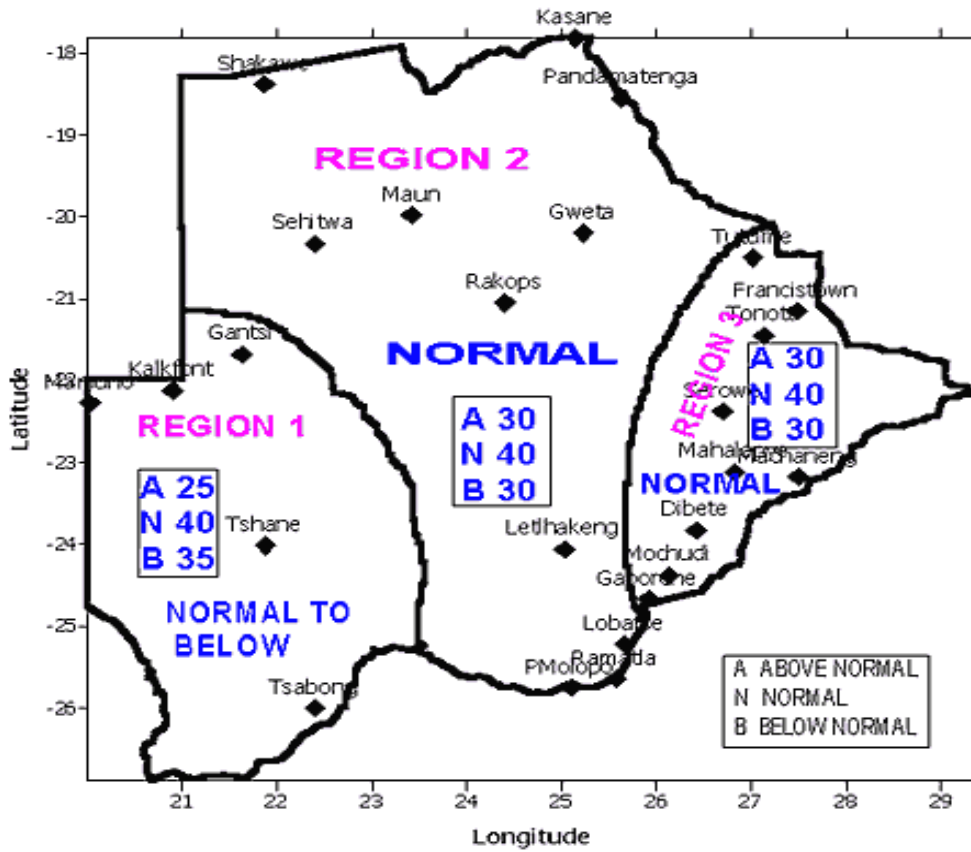
REGION 1: Normal rainfall over this region for October, November and December ranges from values 120 mm in the northern parts of the Central District to 230 mm in the northern parts of the Chobe District.

REGION 2: Normal rainfall over this region for October, November and December ranges from 130 mm in the western parts of the Central District to 180 mm in the Northeast, Southern and Southeast Districts.

REGION 3: Normal rainfall over this region ranges between 90 mm in the southern parts of the Kgalagadi District to 130 mm in the Gantsi and western Kweneng Districts. (Source: Department of Metrological Services)

Figure 3.2:

RAINFALL OUTLOOK FOR January + February + March (JFM)



(Source: Department of Metrological Services)

Key: Rainfall for each region during January, February and March:

REGION 1: Normal rainfall ranges from 170 mm in the southern parts of Kgalagadi District to 230 mm in the extreme Northern parts of the Gantsi District.

REGION 2: Normal rainfall over this region for January, February and March ranges between 180 mm in the western parts of the Kweneng District and 330 mm in the northern parts of the country.

REGION 3: Normal rainfall is expected over this region for January, February and March. The normal values ranges from 210 mm in the western parts of the Central District to 240 mm in the Northeast District.

Table 3.1: Mean Monthly Rainfall (mm) and Maximum Temperature (degrees Celsius)

		Ghanzi	Shakawe	Maun	Francistown	Mahalapye	Tshane	Gaborone	Tsabong
January	Rainfall	128.4	197.3	123.9	103.8	112.8	127.5	142.6	41.0
	Temperature	32.5	31.3	32.3	31.2	31.5	33.3	32.0	35.0
February	Rainfall	93.1	119.3	104.8	30.9	56.2	46.7	82.1	58.5
	Temperature	32.2	31.2	32.8	31.7	31.9	33.0	31.9	34.0
March	Rainfall	101.6	112.9	65.8	57.8	57.6	70.4	73.5	39.5
	Temperature	30.7	30.6	32.1	29.6	29.7	31.0	29.8	31.4
April	Rainfall	28.3	8.0	7.5	14.3	29.1	20.0	30.0	32.6
	Temperature	28.9	30.2	31.2	28.5	28.1	28.3	27.6	28.3
May	Rainfall	6.9	4.7	6.3	0.6	8.5	10.1	8.3	18.2
	Temperature	26.3	28.4	29.0	26.6	25.9	25.6	25.1	25.3
June	Rainfall	0.1	0.0	0.0	0.3	0.0	0.2	7.5	0.9
	Temperature	24.6	26.0	26.5	24.1	23.5	23.2	22.5	22.7
July	Rainfall	0.0	0.0	0.0	0.0	1.3	0.0	1.0	0.0
	Temperature	24.4	25.0	25.5	23.9	23.0	23.1	23.5	23.5
August	Rainfall	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
	Temperature	27.6	29.9	29.6	27.7	26.7	26.2	25.9	25.1
September	Rainfall	0.2	13.6	0.0	2.1	15.1	0.0	5.8	2.7
	Temperature	31.8	33.5	33.4	31.0	29.8	30.2	29.9	28.9
October	Rainfall	21.5	18.1	10.7	12.6	17.3	9.0	5.8	12.8
	Temperature	33.6	35.7	35.3	32.5	31.7	32.2	31.7	31.9
November	Rainfall	56.6	101.5	63.2	88.8	83.5	39.2	57.8	22.8
	Temperature	33.8	34.2	34.9	32.5	32.2	33.0	31.9	33.7
December	Rainfall	68.5	99.9	66.4	115.8	117.0	34.4	70.9	32.3
	Temperature	33.4	31.6	32.7	31.6	31.0	33.5	32.0	34.9

Note:

Monthly rainfall over 4 years (2005-08)

Monthly temperature over 6 years (2003-08)

Source: Department of Meteorological Services

3.1 Impacts of drought

The occurrences of drought and impact areas are shown in Table 3.2 below.

Table 3.2 Occurrences of Drought in Botswana

Year	Impact area
1961-1965	North East, Central
1968-1971	-
1979-1980	Bobirwa
1981-1987	Whole country
1991-1999	Whole country
2001-2005	Whole country
2007-2008	Whole country

Source: Environment Statistics 2000; Rural Development Office

3.1.1 National Yield & Production Estimates

Occurrences of drought lead to low crop yields because of moisture deficiencies. High temperatures and low rainfall are the main contributing factor to low crop yields and these are drought features. The estimated national crop yields during 2007/08 ³DAT1 were higher than the 2006/07 estimates but generally lower than those of 2005/06 for all the crops (Drought & Household Food Security Outlook, 2008), (See Table 3.3). Table 3.3 clearly shows how drought struck 2006/07 crop season was, compared to 2005/06 and 2007/08 crop seasons.

Table 3.3: Estimated National Crop Yield Forecast in kg/ha

	2005/06	2006/07	2007/08
Sorghum	225	185	206
Maize	221	124	245
Millet	-	-	146
Pulses	231	170	215
Others	-	-	287

Source: Drought & Household Food Security Outlook (2008)

3.1.2 Drought related Wildlife Mortality

Just like many other animals wildlife is hit by the impact of drought. Shortage of water is the main problem faced by wildlife and it has contributed to wildlife mortality. According to 'Drought and Household Food Security Outlook (2008)' there was a total of seventy (70) drought related wildlife mortalities reported in Kgalagadi South district in 2007 (See Table 3.4). The outlook further notes that most of the elands died due to

³ DAT= Drought Assessment Tour

exhaustion and thirst along the Botswana and South Africa boundary after their migration was stopped by the boarder fence and there was no water points nearby.

Table 3.4: Drought Related Wildlife Mortality

Species	No. of animals
Eland	56
Wildebeest	5
Hartebeest	8
Ostrich	1
Total	70

Source: Drought & Household Food Security Outlook (2008)

3.1.3 Drought related Livestock Mortality

Cattle, goats, sheep, horses and donkeys were also affected by the 2006/07 drought year. Drought and Household Food Security Outlook (2008) state that though the just ended drought appeared severe, the death toll for livestock (as a result of drought) was less than 1 percent (0.07 percent). Refer to Table 3.5 below. Most cattle deaths were experienced in Molepolole district followed by Kgalagadi North and Maun with 45.2 percent, 18.8 percent and 10.1 percent respectively. Across all the selected livestock, high mortality rates were prevalent in Molepolole district compared to all districts.

Table 3.5: Livestock Mortality by district (2007)

District	2007									
	Cattle		Goats		Sheep		Horses		Donkeys	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Kgalagadi North	278	18.8	98	27.5	0	0.0	8	27.6	10	6.3
Kgalagadi South	17	1.0	29	8.1	0	0.0	0	0.0	0	0.0
Kgatlang	87	5.9	0	0.0	0	0.0	0	0.0	0	0.0
Letlhakeng	96	6.5	48	13.5	25	32.5	4	13.8	8	5.1
Maun	150	10.1	0	0.0	0	0.0	16	55.2	14	8.9
Molepolole	670	45.2	151	42.3	50	64.9	0	0.0	115	72.8
Nata	81	5.5	0	0.0	0	0.0	0	0.0	0	0.0
Serowe	12	0.8	0	0.0	0	0.0	0	0.0	9	5.7
Southern (Kanye)	21	1.4	0	0.0	0	0.0	0	0.0	0	0.0
Southern (Lobatse)	48	3.2	31	8.7	2	2.6	0	0.0	1	0.6
Southern (Jwaneng)	16	1.1	0	0.0	0	0.0	1	3.5	1	0.6
Tutume	8	0.5	0	0.0	0	0.0	0	0.0	0	0.0
Total	1482	100	357	100	77	100	29	100	158	100

Source: Drought & Household Food Security Outlook (2008)

3.1.4 Cereal Requirements and Production

The occurrence of drought result in a low production of cereals, hence an increase in cereal requirements leading to more cereal imports and increased food prices. Table 3.6 shows cereal requirements in metric tons from 1998-2008. Total cereal requirements were high during the year 2000, followed by 2001, then 1998 and 2007 with 321,345 tons, 311,000 tons, 302,154 tons and 286,283 tons respectively. All these stated years were declared as drought years. Comparing total cereal requirements with total cereal production, it is evident from Table 3.7 that productions were less than requirements in all the presented years. This clearly presents the problem situation Botswana has been facing during the drought years (between 1998 and 2008). There has been indeed food crisis in Botswana. This situation has led to an increased cereal imports. The country is spending a lot of money importing food (cereals) from outside the country. A total of P 1,156,587,130 was used to import cereals (maize, rice, sorghum, millet and wheat) from 1999 to 2008 (See Table 3.8). Figure 3.3 shows that there were more cereal imports during the year 2004/05 more especially maize and rice, and according to the Rural Development Office the year 2004/05 was a non-drought year and a drought recovery year too. More food had to be imported to cater for high requirements because of the just ended drought.

Table 3.6: Cereal Requirements in ('000) Tons by Crop from 1998-2008

Year	Maize	Wheat	Sorghum	Rice	Total
1998	138,746	75,750	60,258	27,400	302,154
1999	141,831	77,064	72,626	31,000	322,521
2000	136,360	72,590	76,395	36,000	321,345
2001	130,000	75,000	70,000	36,000	311,000
2002	120,000	78,000	48,000	36,000	282,000
2003	124,680	85,715	64,736	36,000	275,131
2004	141,438	82,646	63,717	36,000	287,801
2005	139,588	82,472	60,176	36,000	282,236
2006	143,532	84,510	56,601	36,000	284,643
2007	143,042	86,640	56,601	36,000	286,283
2008	134,550	82,493	43,122	36,000	260,165

Source: Ministry of Agriculture (Early Warning Unit)

Table 3.7: Cereal Production in ('000) Tons by Crop from 1998-2008

Year	Sorghum	Maize	Millet	Pulses	Sunflower	Groundnuts	Total
1999	6,658	3,796	860	1,348	2,829	217	17,707
2000	12,671	21,162	438	4,102	162	546	41,081
2001	1,583	4,976	472	1,280	150	8,461	18,923
2002	15,805	16,447	54	1,907	2,249	14,995	53,459
2003	23,501	1,633	91	460	960	15	28,663
2004	6,095	4,291	958	1,093	479	119	15,039

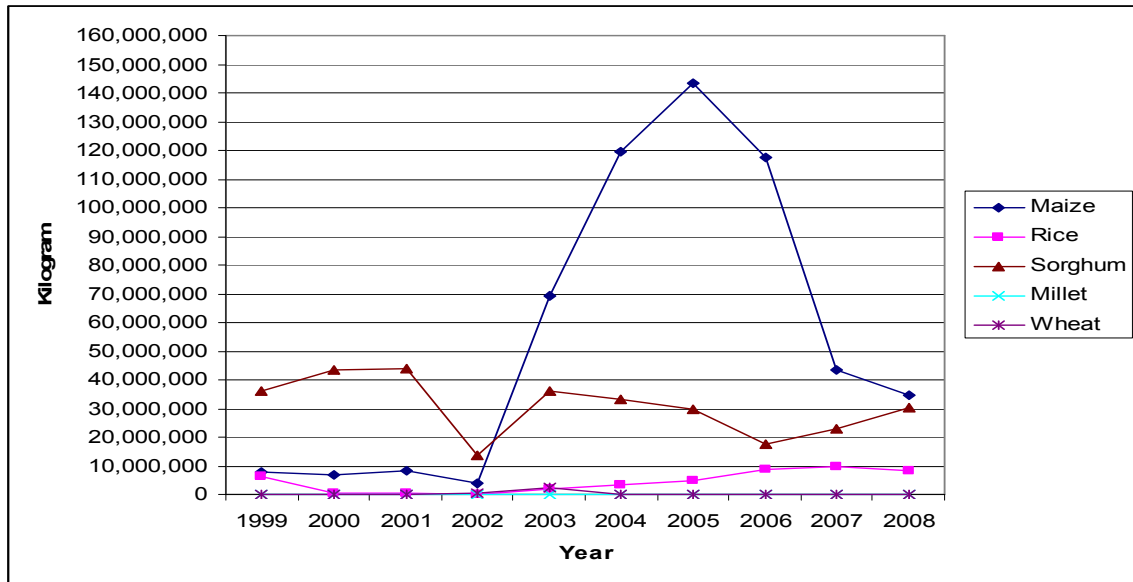
Source: Central Statistics Office (Agriculture Statistics Unit)

Table 3.8: Imports of Cereals by Crop from 1999-2008

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
Total	554,405,176	598,344,568	43,690,715	167,814,998	307,553,625	385,007,374	299,715	696,720	3,104,671	4,723,470

Source: Central Statistics Office (External Trade Statistics Unit)

Figure 3.3: Imports of Cereals by Crop from 1999-2008



Source: Derived from Table 3.8

3.2 Response

3.2.1 Drought Declarations and Labour Intensive Public Programmes

The President declares a period of drought which is mostly a year when the country is receiving below average rainfall.

According to the World Health Vol. 9, 1998, the Early Warning System came into being in 1984 with the establishment of an Early Warning Technical Committee, which reports to the Inter-ministerial Drought Committee. The aims of the National Early Warning Technical Committee are to assess the country's drought status and make recommendations, improve drought-monitoring activities, maintain the country in a state of readiness to confront drought and facilitate the response to drought situations. This Committee monitors:

- the incidence and severity of drought conditions on human and livestock populations;
- the effects of such conditions on human and livestock populations;
- the supply situation and outlook for basic foodstuffs for the vulnerable groups.

Drought relief programs are drawn from the ongoing development projects which have been in the normal development planning process. The recent drought declaration was by His Excellency the former President of Botswana Mr. F.G. Mogae, and the drought relief measures effected from 1st June 2007 to 30th April 2008. After realizing that during the 2006/2007 rainy season very little rains were received, ploughing and planting season commenced late, grazing for livestock was likely to deteriorate, and little or no in-flow of water into dams was experienced, the former President of Botswana recommended the implementation of the following measures:

- i. *Drought Relief Labour Intensive Public Works Programme at district level;*
- ii. *The wage rates for the Drought Relief Labour Based Public Works Programme be increased from P10.00 to P15.00 for labourers and P16.00 to P20.00 for supervisors per six hour working day.*
- iii. *Supplementary Feeding should be provided to all children under-five years attending Child Welfare Clinics.*
- iv. *Supplementary Feeding be provided to children aged from 5 to 6 years.*
- v. *A second meal be provided for the Remote Area Dwellers' children who attend school.*
- vi. *Provision of 50% price subsidy on seed for a maximum of 5 hectares per farmer in the communal sub-sector.*

- vii. *Provision of 25% price subsidy on selected livestock supplements, namely; Drought Pellets, Winter Lick, Di-calcium phosphate, Coarse Salt/Rock Salt and Molasses.*
- viii. *Timely maintenance of fire breaks and formation of standby fire fighting teams comprising people engaged in the Labour Intensive Public Works.'*
(FARNRPAN, 2007)

Table 3.9: NDP 9 Drought declarations

Year	Amount Approved	Number of Projects	Employment Level
2002/03	72,000,000	1,375	128,127
2003/04	170,500,000	1,366	95,752
2005/06	172,524,159	9,30	104,020
2006/07	295,648,953	1,385	117,799
2007/08	267,749,928	1,404	125,386
TOTAL	978,423,040	6,460	571,084

Source: Ministry of Local Government, Department of Local Government development Planning, Early Warning Technical Committee.

Table 3.9 shows the amount of money approved, number of projects and total employment created during the National Development Plan 9 drought declarations. A total of P978, 423,040 was used in 6,460 projects from 2002 to 2008 to reduce the effects of drought on the affected population and 571,084 were employed. It is evident from Table 3.9 that the amount of money used for the drought relief projects were on the increase each drought year as well as the number of people employed. This is a clear sign that the government wants to counter the effects of drought on people who depend on agricultural production for their living. The reason why the number of projects and people employed are on the increase might be because of the high unemployment rate as indicated in the 2005/06 Labour Force Survey estimates of 17.5 percent. Another factor could be the high percentage (30.6 percent) of Batswana living below poverty datum line (Poverty Datum Line for Botswana, 2003).

The number of labour intensive public works programmes, the amount of money used and the number of people employed during the drought period of 2005/06 by district are shown in Table 3.10. During 2005/06 season a total of P172, 524,159 was used to curb the effects of drought in all administration districts in the country. A total of 104,020 people were employed during the same season and 930 projects were completed to improve the socio-economic status of different localities across the country, hence reducing the impact of drought.

Table 3.11 shows the number of drought relief projects that were completed, number of employees and the amount of money used during the drought year 2007/08 in all the administration districts in Botswana. During the drought period 2007/08, a total amount of P267, 749,928 was used to develop 1,404 drought relief projects in which 125, 386

people were employed. Some of the drought projects are as follows: dam de-silting, maintenance and erection of drift fences, toilets, guard rooms, de-silting and lining of storm water drainage, de-bushing, etc. The district with the highest number of projects was the Central (334) followed by Kweneng (256) then Southern (247), North West (173), Kgalagadi (108), Ghanzi (102), South East (71), North East (46), Kgatleng (39), and lastly Chobe (34). The size of the district in terms of population and sub-districts influenced the differences in the number of projects, funds allocated and the number of people employed. Districts with large areas and large population sizes had the highest number of projects. This is the case also with Table 3.3 during the drought period 2005/06.

Table 3.10: Labour intensive public programmes by district for the 2005/06 season

District	Sub District	No. of Projects	Funds allocated (Pula)	No. of people employed
Central	Bobirwa	27	6,800,000	3,572
	Boteti	41	7,377,228	3,081
	Mahalapye	41	10,000,000	6,814
	Serowe/Palapye	60	10,000,000	7,040
	Tutume	76	15,105,786	5,717
	SUB TOTAL	245	49,283,014	26,224
Ghanzi	Charleshill	18	5,715,000	1,404
	Ghanzi	28	7,000,000	2,570
	SUB TOTAL	46	12,715,000	3,974
Kgalagadi	Hukuntsi	25	7,000,000	2,641
	Kgalagadi South	42	10,500,000	6,205
	SUB TOTAL	67	17,500,000	8,846
Kgatleng	Kgatleng	30	8,040,000	4,676
	SUB TOTAL	30	8,040,000	4,676
Kweneng	Kweneng	81	10,000,000	5,500
	Letlhakeng	63	7,192,000	5,840
	SUB TOTAL	144	17,192,000	11,340
North East	North East	56	10,820,000	9,370
	SUB TOTAL	56	10,820,000	9,370
North West	Chobe	22	5,476,670	3,007
	Okavango	30	9,550,000	5,309
	Ngamiland	103	12,915,158	17,111
	SUB TOTAL	155	27,974,145	25,427
South East	South East	29	7,000,000	4,265
	SUB TOTAL	29	7,000,000	4,265
Southern	Goodhope	68	7,000,000	3,259
	Kanye/Moshupa	64	10,000,000	4,794
	Mabutsane	26	5,000,000	1,845
	SUB TOTAL	158	22,000,000	9,898
Grand Total		930	172,524,159	104,020

Source: Department of Local Government Development Planning (2007)

Table 3.11: Labour intensive public works programmes by district (2007/2008)

District	Sub District	No. of Projects	Funds allocated (Pula)	No. of people employed
Central	Bobirwa	30	8,530,000	3,763
	Boteti	32	8,800,00	3,760
	Mahalapye	75	22,760,000	4,388
	Serowe/Palapye	91	24,211,690	6,584
	Tonota	39	9,780,000	2,936
	Tutume	67	13,756,000	3,901
	SUB TOTAL	334	74,317,690	25,332
Ghanzi	Charleshill	45	8,200,000	2,254
	Ghanzi	57	10,760,000	3,030
	SUB TOTAL	102	18,960,000	5,284
Kgalagadi	Hukuntsi	33	8,800,000	1,827
	Kgalagadi South	75	12,700,000	5,640
	SUB TOTAL	102	21,800,000	7,467
Kgatleng	Kgatleng	39	11,000,000	2,032
	SUB TOTAL	39	11,000,000	2,032
Kweneng	Kweneng	200	22,260,000	12,777
	Letlhakeng	56	8,660,000	5,110
	SUB TOTAL	256	30,920,000	17,887
North East	North East	46	16,580,238	6,834
	SUB TOTAL	46	16,580,238	6,834
Chobe	Chobe	34	8,260,000	5,140
	SUB TOTAL	34	8,260,000	5,140
North West	Okavango	67	13,860,000	8,525
	Ngamiland	106	19,460,000	17,940
	SUB TOTAL	173	33,320,000	26,465
South East	South East	71	7,072,000	4,622
	SUB TOTAL	71	7,072,000	4,622
Southern	Goodhope	89	14,260,000	7,528
	Kanye/Moshupa	127	22,760,000	14,717
	Mabutsane	31	8,500,000	2,078
	SUB TOTAL	247	45,520,000	24,323
Grand Total		1404	267,749,928	125,386

Source: Department of Local Government Development Planning (2008)

3.2.2 Food Relief Services

Food Relief Services Department manages the supplementary feeding programme by performing the following tasks:

- Ensuring implementation of the programme,
- Managing and supplying food commodities to the feeding centres around the country.

According to Drought and Household Food Security Outlook for the year 2008, ‘the programme covered primary school feeding with an enrolment of 260,507 and vulnerable group feeding (at health facilities) with 230,301 beneficiaries.’

The distribution of food commodities under the Primary School Feeding Programme for the year 2007 has shown a decrease of 1 percent from 67 percent in 2006 to 66 percent in 2007. This is because of shortages of some food commodities in the market and failure of suppliers to honour contracts. Although there were shortages of food commodities the Vulnerable Group Feeding Programme registered an increase of 15.6 percent from 54.4 percent in 2006 to 70 percent in 2007 (See Table 3.12). In spite of this improvement the programme still experiences non availability of food commodities such as dried skimmed milk, sugar beans and vegetable oil. The Vulnerable Group Feeding Programme (VGFP) covers distribution of food commodities to the under five children (<5 years), pregnant mothers, lactating mothers, TB outpatients and 5-6 years out of school children. (Drought and Household Food Security Outlook, 2008)

Table 3.12: Annual Food Supplies and Deliveries for the Feeding Programmes, 2005-2007 All Depots

YEAR	Commodity	Primary Schools		Health Facilities	
		Quantity Required (mt)	Quantity Supplied (mt)	Quantity Required (mt)	Quantity Supplied (mt)
2005	Sorghum grain 50 kg	3695.9	3564.6	N/A	N/A
	Beans 50 kg	3397.7	2539.9	3297.3	2337.5
	Samp 50 kg	2318.8	1211.8	N/A	N/A
	Stewed steak 3.1kg	1486.1	1186.1	N/A	N/A
	Veg oil 750 ml	1815.3	941.8	2459.2	1444.6
	UHT Milk 340ml	4770.3	-	N/A	N/A
	M/meal 5.5 kg	N/A	N/A	8885.5	6200.2
	Tsabana 2.5 kg	N/A	N/A	9093.7	7615.9
	DSM	N/A	N/A	N/A	NIL
Total		17484.1	9444.20 (54%)	23717.7	17598.2 (74%)
2006	Sorghum grain 50kg	2721.5	2478.8	N/A	N/A
	Beans 50kg	3075.2	2344.5	2500.5	1525.3
	Samp 25kg	1022.6	866.3	N/A	N/A
	Stewed steak 3.1kg	3456.4	1795	N/A	N/A
	Veg oil 750ml	572.4	109.3	1838.3	739.6
	UHT Milk 340ml	2166.3	1112.2	N/A	N/A
	M/meal 5.5 kg	N/A	N/A	7510.8	4398.2
	Tsabana 2.5 kg	N/A	N/A	7258.1	3735
Total		13014.4	8706 (67%)	19107.7	10398.1 (54.4%)
2007	Sorghum grain 50kg	2844.15	2825.75	N/A	N/A
	Sorghum meal 25kg	99.28	76.37	N/A	N/A
	Beans 50kg	3242.77	1343.99	2416.36	958.26
	Samp 25kg	2178.52	698.44	N/A	N/A
	Stewed steak 3.1kg	1068.53	1011.59	N/A	N/A
	Veg oil 750ml	543.49	152.4	1989.07	288.68
	UHT Milk 340ml	3720.9	2865.25	N/A	N/A
	M/meal 5.5 kg	N/A	N/A	7653.77	6311.78
Tsabana 2.5 kg	N/A	N/A	8502.25	6928.88	
Total		13697.64	8973.79 (66%)	20561.45	14488.60 (70%)

Source: Drought & Household Food Security Outlook (2008)

4.0 Veldt Fires

This section of the digest provides summary information on fire events and a comparison to the previous years from 1991 up to 2008. Veldt Fire is the uncontrolled burning of the open grazing areas of a country. Most of the fire incidences in Botswana occur during winter season.

Fires are a natural phenomenon if started by lightning. However, human beings account for 95 percent of forest and veldt (savannah) fires. On average, fires burn millions of hectares of forest and grassland per year worldwide. In 2002, 350 million hectares of land was burnt worldwide, while in 2003, in Europe alone, 700 000 hectares were burnt (FAO; Seen Environmental Learning Information Sheet No. 8).

There are two types of fire and they are divided according to the nature at which they occur; natural and unnatural. At times it is difficult to identify the cause of fire and hence their characteristics are used to differentiate the two. Therefore an appreciation of the difference in the characteristics of an unnatural fire originating from human activities compared to a natural fire is necessary in order to understand this section of the digest.

4.1 Natural Fires

These are typified by:

- The primary source of ignition which is lightning;
- Due to the source of ignition, occurrence is most frequent during the rainy seasons;
- High moisture content of the vegetation and accompanying rain contains fire to smaller “patches” although this has become more widespread in recent seasons;
- Indigenous vegetation is fire adapted and dependant on fire for biodiversity; and
- A lower fire intensity and spread occurs in normal circumstances.

(HIU Consultants, 2008)

4.2 Unnatural Fires

These are typified by:

- The primary source of ignition is usually human intervention;
- Due to the source of ignition frequency is usually higher than natural fires;
- Mostly occurring in the dry season (often protracted by late rains);
- High fire load due to the low moisture content of the veld;
- Radical fire spread through invasive alien plants, often with high resin or oil content; and
- A high intensity (hot fire) which has a strong sterilizing effect on the soil.

(HIU Consultants, 2008)

Furthermore, HIU Consultants noted that unnatural fires can be split into unwanted, unmanaged wildfires and managed prescribed fires, which can be good, provided these are performed by experienced burners in carefully controlled conditions.

According to the Department of Forestry & Range Resources (2008), lack of available information concerning the number, place, size, and location, influence of weather, fuel characteristics and cause of fire contributes strongly to an incomplete understanding of fire and its causes. Provided in the following section are the impacts of veldt fires but their causes were unknown.

4.3 Impacts of Veldt Fires

As stated earlier most of the veldt fires are human induced, through carelessness or by accident. 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.

4.3.1 Area Affected and Damage Caused by Fire

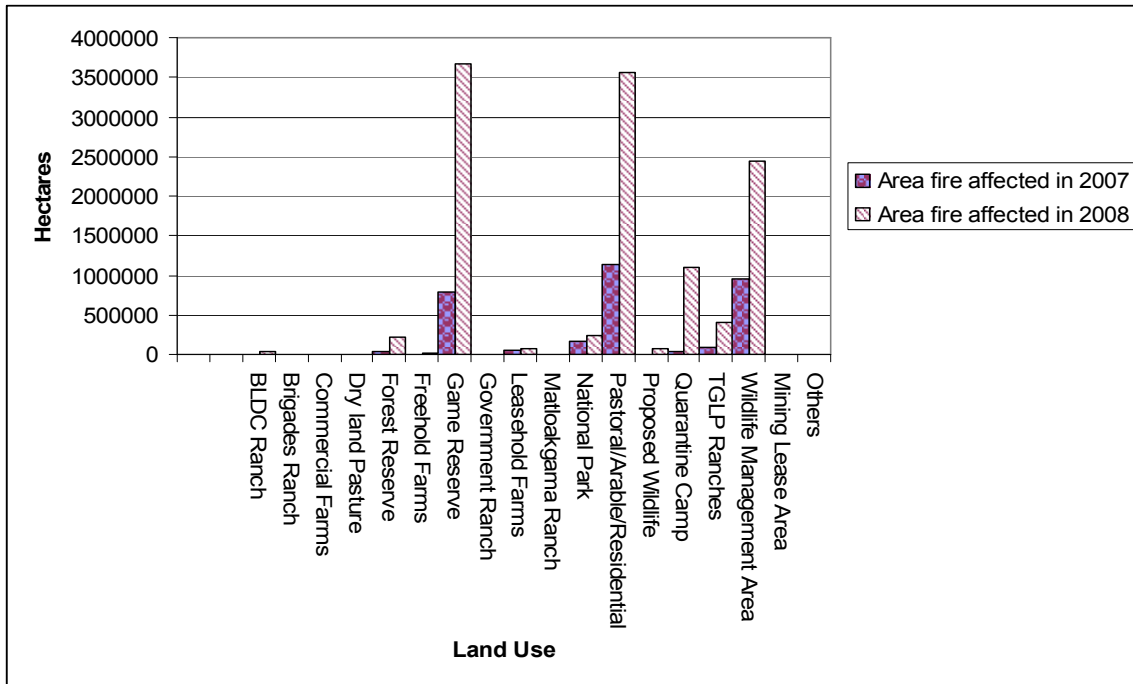
Hectares of area fire affected per land use are shown in Table 4.1 and Figure 4.1. The table shows that in 2007 the area most affected by fire was Pastoral/communal/residential areas constituting about 34.6 percent of the total area fire affected, followed by Wildlife Management with 29 percent, Game Reserves (24 percent), and National Parks (5 percent). For the year 2008, incidents of fire at Pastoral/Communal/Residential areas came second with 3, 560, 720 hectares burnt after Game Reserves (3, 661, 930 hectares), Quarantine camp (1, 101, 551 hectares), and TGLP (395, 620 hectares). There is evidence from this analysis that human beings might have burnt the veldt given the vast area burnt under Pastoral/Communal/Residential which constitutes a high percentage (34.6) of area fire affected. This assumption is backed-up by the land use type (Pastoral/Arable/Residential) which corresponds with high percentages of area fire affected.

Table 4.1: Hectares of Area Fire Affected per Land Use

LANDUSE	Area fire affected in 2007	% of Area Fire Affected	Area fire affected in 2008	% of Area Fire Affected
BLDC Ranch	7,680	0.233	31,671	0.267
Brigades Ranch	0	0	3,988	0.034
Commercial Farms	2,385	0.072	2,339	0.020
Dry land Pasture Research Station	0	0	520	0.004
Forest Reserve	42,100	1.278	217,548	1.836
Freehold Farms	8,004	0.243	23,300	0.197
Game Reserve	789,128	23.955	3,661,930	30.911
Government Ranch	0	0	2,782	0.023
Leasehold Farms	48,566	1.474	82,020	0.692
Matloakgama Ranch	0	0	654	0.006
National Park	172,116	5.225	243,164	2.053
Pastoral/Arable/Residential	1,139,955	34.604	3,560,720	30.056
Proposed Wildlife Management Area	0	0	69,288	0.585
Quarantine Camp	31,205	0.947	1,101,551	9.298
TGLP Ranches	94,639	2.873	395,620	3.340
Wildlife Management Area	958,494	29.096	2,449,268	20.675
Mining Lease Area	0	0	157	0.001
Others	0	0	270	0.002
Total	3,294,272	100	11,846,790	100

Source: Department of Forestry & Range Resources, 2009

Figure 4.1: Area Fire Affected per Land Use and Hectares



Source: Derived from Table 4.1

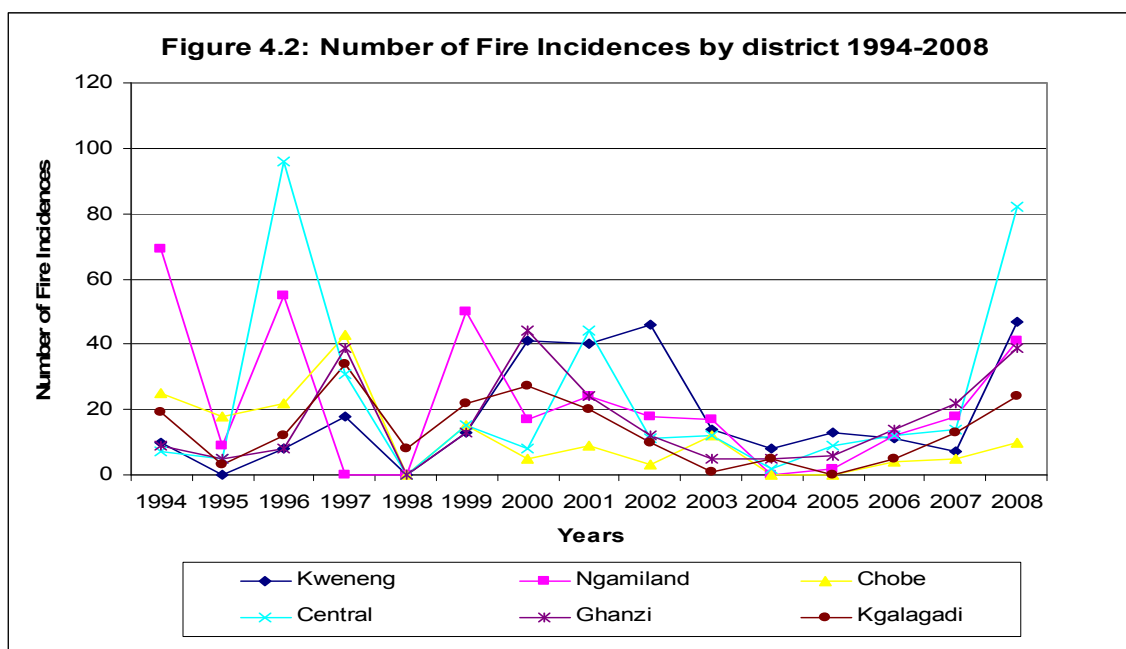
Table 4.2 shows the total number of veldt fire incidences in each district between 1994 and 2008. The Central District experienced the highest fire incidences with 96 fire incidences in 1996 constituting 39.2 percent of the total fire incidences for all the Districts and 82 fire incidences in 2008 constituting 29.5 percent of the total fire incidences for all the Districts. The North East, South East and Kgatleng Districts experienced the least number of fire incidences compared to the rest of the districts in the country. Looking at the trend at which fire incidences took place in Kweneng, Central, Ngamiland, Ghanzi, Chobe, and Kgalagadi districts it is evident that fires were more frequent in the years 1996-1997 and dropped in 1998 in the mentioned districts. From 1999-2002 fire incidences went high again and fell in 2003-2004. They lastly went high in 2008. (See Figure 4.2)

Table 4.2: Number of Fire Incidences by District 1994-2008

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

Note: - refers to zero

Source: Department of Forestry and Range Resources



Source: Derived from Table 4.2

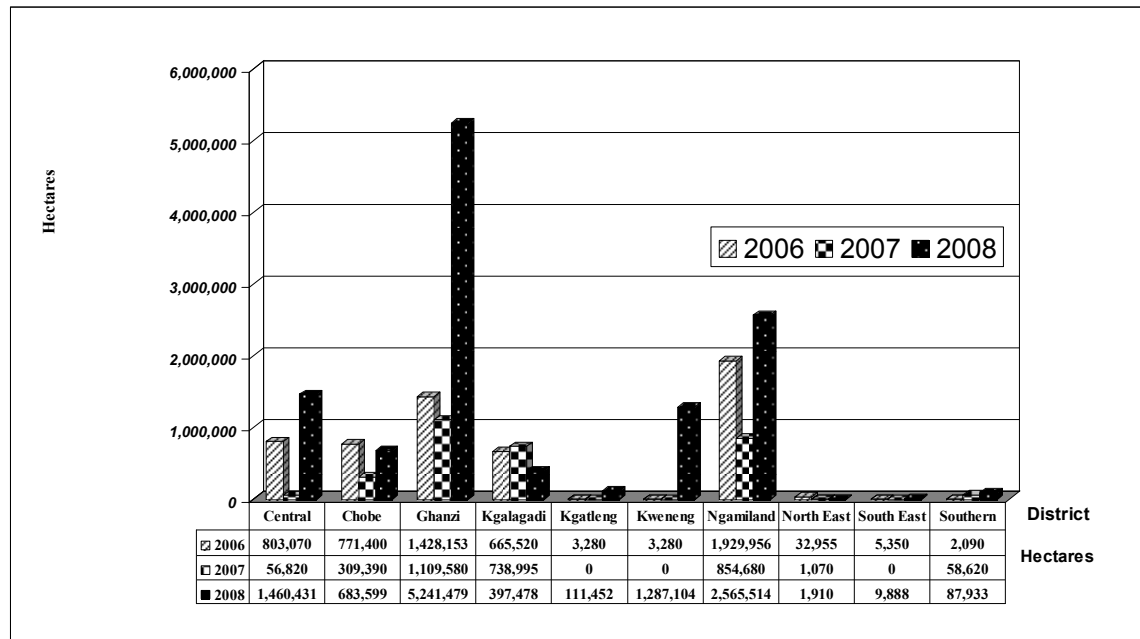
Table 4.3 and Figure 4.3 show the total area (hectares) affected by veldt fires between the period 2006 to 2008. More than half of the districts experienced a declining trend of area affected by fire from 2006 to 2007 and increased in 2008. The total area affected by fire in 2006 was 5,645,054 hectares. However in 2007 the total area gutted by fire reduced to 3,129,155 hectares and increased in 2008 to 11,846,790 hectares. In 2008 the three top districts which were affected by fire the most in terms of area fire affected were Ghanzi, Ngamiland and Central with 5, 241, 479 hectares, 2, 565, 514 hectares and 1, 460, 431 hectares respectively.

Table 4.3: Fire Affected Area (Hectares) per District 2006-2008

District	2006	2007	2008	District size
Central	803,070	56,820	1,460,431.379	14,637,419
Chobe	771,400	309,390	683,599.421	2,101,920
Ghanzi	1,428,153	1,109,580	5,241,479.23	11,472,587
Kgalagadi	665,520	738,995	397,477.996	10,491,604
Kgatleng	3,280	0	111,451.984	761,943
Kweneng	3,280	0	1,287,104.173	3,696,345
Ngamiland	1,929,956	854,680	2,565,513.604	11,134,421
North East	32,955	1,070	1,910.351	514,619
South East	5,350	0	9,887.993	85,800
Southern	2,090	58,620	87,933.404	2,723,320
Grand Total	5,645,054	3,129,155	11,846,789.54	57,619,978

Source: Department of Forestry and Range Resources

Figure 4.3: Fire Affected Area (hectares) per district in 2006, 2007 & 2008



Source: derived from Table 4.

Table 4.4: Damage to Property, Human and Animal Casualties: 1991-2001

Districts	Human and Animal Casualties, and damage to Property										
	People	Cattle	Goats	Sheep	Horses	Donkeys	Wildlife	Ranches	Fields	Houses	Vehicles
Kweneng	1	50	48	-	-	-	-	-	-	-	-
Ngamiland	1	3	144	7	4	3	6	85	9	4	-
Chobe	-	-	-	-	-	-	1	-	-	19	-
Central	4	46	259	-	-	36	113	10	59	23	2
Ghanzi	1	-	48	-	2	-	-	30	6	-	1
Kgalagadi	-	8	1	-	4	4	-	6	3	3	-
Southern	-	14	-	-	20	13	-	-	12	-	-
North East	-	-	-	-	-	-	-	-	1	14	-
South East	-	-	-	-	-	-	-	-	-	-	-
Kgatleng	-	-	-	-	-	-	-	-	-	-	-
Totals	7	121	500	7	12	56	120	131	90	63	3

Source: Department of Forestry and Range Resources

Veldt fires can endanger both life and property, and are therefore a concern for the entire nation. There was loss of life due to devastating veldt fires between 1991 and 2001 in Botswana. A total of 7 people were killed. Central District recorded the highest number of deaths (4), Kweneng, Ngamiland, and Ghanzi recorded 1 person each. Livestock casualties were also high more specially in the Central District, where 259 goats, 46 cattle and 36 donkeys were killed.

4.4 Response

4.4.1 Fire Suppression Policies

Uncontrolled fires pose a huge risk in the supply of natural resources for those who depend on them and this situation is further exacerbated by the effects of climate change. Most of the Southern African countries have established legislations prohibiting burning of the veld due to the increased fire incidences and dangers to human life. Dube (2005) adds that it is an offence punishable by law to cause wildfires in Botswana, and those who wish to use fires for localized land use management such as clearing fields have to apply for a permit. Dube further noted that under such restrictions, fire is totally prohibited in land use systems where large scale burning was once used, exception on private farms. The fire suppression approach, which dates back to the colonial period, does not consider the role of fire in the ecology of the savannas.

The many incidents of fire show that attempts to control burning through laws designed to prevent uncontrolled use of fire have failed (Frost, 1999; Dube, 2005). Others have noted that one of the consequences of fire suppression policies is an increased risk of fierce fires due to accumulation of fuel loads. This is evident in protected areas with limited land use pressure such as Game Reserves and National Parks (Perkins *et al.*, 2002; Dube, 2005)

4.4.2 Status on fire control

The role of local communities in fire control has weakened and fire has grown to be a major threat, central governments' fire control systems are resource-constrained and fragmented. Currently, neither fire weather-forecasting nor the condition of fuel loads are priorities in the early warning systems of Southern Africa (<http://www.sadc-fanr.org.zw/>) Where fire risk assessment is made, it is usually either limited to specific areas or not consistent with up-to-date information on fire risk, and it is rarely communicated to the communities affected. There are also inconsistencies in methods of reporting fires, and most countries have no system of archiving fire data. (Dube, 2005)

4.4.3 The Southern Africa Fire Network

SAFNet was constituted under the Global Observation of Forestry Cover (GOFC) Fire Project. GOFC is part of the Global Terrestrial Observing System (GTOS). The network is currently coordinated under the Botswana Global Change Committee (BGCC) in the Department of Environmental Science at the University of Botswana. SAFNet provides, for the first time, a framework for trans-boundary exchange on fire issues. The objectives of SAFNet are as follows:

- To build capacity to collect, archive and distribute regional fire related databases and associated information.
- To develop capability to monitor, using remote sensing, fire and its effects.
- To increase information on fire issues through research and raise the public's and policy makers' awareness on issues of fire and the value of geo-spatial information in its control.

- To seek resources to facilitate the applications of remote sensing products for fire control among local communities. (<http://www.safnet.net/>)

4.4.4 Response Time

The response time was defined as the time between the receipt of the reports of fire outbreaks and the time the resources were mobilized. The Department of Forestry and Range Resources' targeted time was stated as 12.5 hrs. The target time of 2 hours was found to be unrealistic and unachievable, that is the Department of Forestry and Range Resources never met the target in the sampled cases. On average the department responded to wild land fires within 17 hours; because of the slow mobilization process. (See Table 4.5) Acquiring human resources was very slow because the Department of Forestry and Range Resources did not have officers specifically employed in the fire section. (Performance Audit Report No.8, 2008)

Table 4.5: Response Time to Veld Fires by District

Fire Name	Place/District	Date reported	First Attack	Time
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

Average response time 17 hours

Source: Performance Audit Report No.8 of 2008

4.4.5 Firebreaks

The Department of Forestry and Range Resources constructed firebreaks across the country in its endeavor to fight the outbreak of veld fires. The firebreaks were constructed in a continuous width of 20 meters. According to the Performance Audit Report No.8 of 2008, internal boundaries in the forest reserves were measured at 6 meters widths. The Department of Forestry and Range Resources was responsible for maintaining networks of firebreaks across the country till 2007 when private contractors started to be engaged. Inspection of firebreaks is done on timely manner.

5.0 Policy Framework and Disaster Management Structures

Botswana just like other countries in Southern Africa- Mozambique, South Africa, has put in place disaster preparedness committees as well as disaster management structures with programmes and policies in order to prepare herself for disasters. This section therefore presents issues of policy framework and disaster management structures in Botswana.

5.1 Policy Framework

According to Botswana Country Report (2004), the Government of Botswana established a National Committee on Disaster Preparedness (NCPD) in 1993 following the United Nations International Decade for National Disaster Reduction. Its mandate was:

- (i) to increase coordination and improve effectiveness in the management of disasters.
- (ii) To ensure cost effectiveness in the utilization of resources in the management of disasters.

In addition, multi-sectoral preparedness committees were formed in Districts. Some structures also exist within Ministries to deal with sectoral disasters. For example, the Department of Animal Health and Production in the Ministry of Agriculture has sectoral responsibility for animal diseases.

In 1996 the Government formulated the national Policy on Disaster Management in recognition that:

- (i) Botswana was vulnerable to other disasters other than drought.
- (ii) A cost effective disaster management programme should as far as possible use existing resources and capacity.
- (iii) The disaster management programme should be consistent with development objectives of Government.
- (iv) The programme should deal with disaster management comprehensively by giving equal focus to all disaster management elements (prevention/mitigation, preparedness, response recovery) and ensuring that such activities are implemented within local and national development context.

The objectives of the Policy are to:

- (i) Establish and maintain systems for dealing with all actual or potential disasters that may occur in Botswana.
- (ii) Integrate these systems into normal development activities at local and national levels.
- (iii) Create a framework that facilitates preparation of plans and legislation for effective implementation and legitimacy of disaster management programme.
- (iv) Outline disaster management responsibilities.
- (v) Establish a set of working definitions.
- (vi) Ensure consistency of the Policy with objectives of the National Development Plans.

5.2 Disaster Management Structures

The following structures are couched in the country's initiatives in its endeavor in dealing with issues related to disaster management elements (prevention/mitigation, preparedness, response and recovery), that is according to Botswana Country Report (2004):

5.2.1 National Disaster Management Office

The overall responsibility for disaster management rests with the Office of the President. In 1998, the National Disaster Management Office (NDMO), responsible for overall coordination of disaster management in the country was established. Its major responsibility is to ensure a high state of disaster preparedness and capacity to deal with any eventually. It also has to facilitate integration of disaster management into sectoral policies.

5.2.2 National Committee on Disaster Management

This is an inter-ministerial Committee of Deputy Permanent Secretaries from Ministries and representatives of Botswana Police Service, Botswana Defense Force, Botswana Red Cross Society, United Nations and Non Governmental Organizations. The committee is a policy formulation body responsible for developing a disaster management strategy for the country.

5.2.3 National Disaster Management Technical Committee

The NDMTC is a multi-sectoral technical advisory body composed of professionals from all stakeholders represented in the NCDM. The Committee advises the NDMO and NCDM on all disaster management issues.

5.2.4 District Disaster Management Committees

The DDMCs are formed by each city/town and district to oversee the implementation of disaster management in districts. They comprise all Government Departments and organizations operating in the District. The primary responsibility of the DDMCs is to protect life, property and environment in their respective areas of jurisdiction.

5.2.5 Village Level

The overall responsibility rests with traditional leaders and organized groups identified by each DDMC.

References:

- Anderson, J. & Bausch, C. (2006) *Climate Change: Scientific evidence of a possible relation between recent natural disasters and climate change* (IP/A/ENVI/FWC/2005-35). European Parliament
- Australian Drought and Climate Change, /www.lilith-ezine.com/ accessed on 02/02/2009
- Bohle, H.G., Downing, T.E. & Watts, M.J. (1994) *Climate change and social vulnerability: Toward a sociology and geography of food security*. *Global Environmental Change*, 4(1): 37-48.
- Botswana Country Report submitted to the African Regional Consultations on Disaster Reduction Workshop, June 2-3, 2004 Midrand, South Africa
- Department of Environment, Food & Rural Affairs, United Kingdom, *Climate Change & Energy*, 2005
(<http://www.defra.gov.uk/environment/statistics/globalatmos/index.htm>; accessed on 12/03/2009)
- Dube, O.P. (2005). *A Collaborative Effort Towards Developing Capacity for Operational Fire Monitoring and Management Systems in Southern Africa*. AIACC Working Paper No.11, June 2005.
- Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), (2007). *Statement on drought declaration, Botswana, 2007*, by Mr. F.G. Mogae.
- Frost, P.G.H. (1999). *Fire in Southern African Woodlands: origins, impacts, effects, and control*. In: Proceedings of an FAO Meeting on Public policies affecting forest fires, FAO Forestry Paper 138, 181-205.
- Government of Botswana, Central Statistics Office, 2000; *Environment Statistics*, 2000. Printing and Publishing Services.
- Government of Botswana, Department of Metrological services, 2008.
- Government of Botswana, Central statistics Office, 2003, *Poverty Datum Line for Botswana 2003*
- Government of Botswana, Central Statistics Office, *2005 Annual Agricultural Survey Report*
- HIU Consultants, (2008). *Wildfires, A Natural Phenomenon?* FSP NO 5072

Hlabaangani, K. & Mnjama, N. (2008) *Disaster Preparedness in information centres in Gaborone, Botswana*. African Journal of Library, Archives and Information Science

Ministry of Finance and Development Planning, Division of Rural Development

Ministry of Development Planning, Division of Economic and Financial Policy, *Drought and Household Food Security Outlook for the year 2008; Findings & Recommendations from the first Drought Assessment Tour 2008: 14th January-2nd February 2008*

Ministry of Local Government, Department of Local Government development Planning, Early Warning Technical Committee.

Ministry of Local Government, Department of Local Government Development Planning, Early Warning Technical Committee, March 2007 report

Ministry of Local Government, Department of Local Government Development Planning, early Warning Technical Committee, March 2008 report

Okavango Delta Flood Update, May 20, 2008, Eyes on Africa (www.eyesonafrica.net/updates/flood-update.html), accessed 25/03/2008

Perkins, J.S., Stuart-Hill, G. & Kgabung, B. (2002). *The impact of cattle-keeping on the wildlife, vegetation, and veld products*. In: Sporton, D. and Thomas, D.S.G. (eds). "Sustainable livelihoods in the Kalahari environments. A contribution to global debates". Oxford University Press, Oxford, 67-90.

SADC Regional remote Sensing Unit, Harare, Zimbabwe (<http://www.sadc-fanr.org.zw/>)

Seen Environmental Learning Information Sheet No. 8. Natural Resource management; *Veld Fires*

Southern African Fire Network, (<http://www.safnet.net/>)

The Botswana National Atlas, <http://www.atlas.gov.bw/html> , accessed on 20/0/2009.

The Food and Agriculture Organization, www.fao.org/forestry

The Report of the Auditor General on the Management of Wild Land Fires by the Department Of Forestry and Range Resources, Performance Audit Report No. 8 Of 2008

U.S. Geological Survey, 2007: *Project: Botswana-Village Flood Watch* led by D. Phil Turnispeed.