

**Draft Copy**

## **Hazard Mapping for Namibia**

Submitted to Directorate of Emergency Management in the Office of the Prime Minister and United Nations Development Programme (UNDP)

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## Acknowledgement

A special thank you is given to the Namibian Office of the Prime Minister – the Directorate of Emergency Management, the SADC RVAA Programme, and the Regional Hunger Vulnerability Programme (RHVP) for making this work possible. Also appreciation is given to United Nations Development Programme (UNDP) in Namibia and the Department for International Development (DFID) for their financial support. Thanks should also be extended to all institutions and individuals which provided information for this hazard mapping work. This work has also been made possible with the earlier work on livelihood zoning which was done in November 2008 by the Namibian Vulnerability Assessment Committee with support from the Regional Hunger Vulnerability Project under the SADC RVAA Programme.

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**List of abbreviations**

DEM	Directorate of Emergency Management
NAP	National Action Plan
FMD	Foot and Mouth Disease
RHVP	Regional Hunger Vulnerability Programme
UNDP	United Nations Development Programme
RVAA	Regional Vulnerability Assessment and Analysis
SADC	Southern Africa Development Community
GIS	Geographical Information Systems

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## Executive Summary

The Government of the Republic of Namibia, through the Directorate of Emergency Management (DEM), in the Office of the Prime Minister is implementing the National Action Plan (NAP) for Disaster Risk Management and has prioritized the development of national hazard maps. The hazard maps are intended to assist in the understanding of the information about hazards in Namibia. A particular emphasis has been placed on the nature of risks faced by people living under the threat of natural hazards and their vulnerability to disasters.

The **main objective of the study** is to develop national hazard maps that will show flood-prone areas, local rainfall patterns, flood level records, drought prone areas and areas prone to food insecurity, areas at risk of veld and forest fires, records of human and animal diseases outbreaks, climate related hazards and other human induced hazards. The specific objectives of the study include the following: analyzing existing maps; analyzing existing vital statistics; conducting microzoning and identification of areas subject to natural hazards; developing maps with Geographical Information System (GIS) that show drought prone areas, area affected by disease outbreaks, areas prone to veld and forest fire hazards; and linking the maps with population figures, land use and livelihood zones.

The study involved literature review, data collection on hazards and relevant information pertaining to hazard mapping and analysis, and interviews with key stakeholders. The study also integrated the national Livelihood Zoning work carried out in November 2008. Generation of maps and analysis was done using ArcView GIS software.

The main identified hazards in Namibia based on available literature include: climatic related conditions such as drought conditions; floods; veld and forest fires; human and animal diseases; as well as poisonous plants and bush encroachment in livestock production areas; other types of hazards (crop pests; wildlife attack; and deforestation); and economic hazards.

Namibia is naturally prone to **drought conditions** due to low rainfall pattern, dry temperature conditions and poor soil types. The impacts of drought among other areas include: the drying up of boreholes; poor grazing fields and overgrazing in highly livestock dense areas; reduction in herd size of livestock and other domesticated animals.

Namibia also experiences **extreme weather conditions** of very hot and very cold that have varying impacts on crops and livestock. Very high temperatures lead to increased rates of water loss through evaporation and transpiration. This leads to wilting and possible death of the plant and livestock<sup>1</sup>.

<sup>1</sup> The southern region of Karas lost over 2000 small stock due to a cold spell in .....2007.

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Growth rates also drop the colder it becomes. Many plant species are also sensitive to frost, growing only in places free of frost, particularly tropical fruit trees.

**Flooding** is also a major hazard in Namibia. The main areas which are prone to flooding include: the Caprivi Floodplains in the northeast; Mariental Town in the Hardap Region in south through the Hardap Dam; Cuvelai area in the North Central regions; and Walvis Bay in the Western part, **Kavango river flood plains**. The floods occur during the rainy season and normally start in January/February and peak during March through May and then recede until end July/August. The primary **causes** of flooding in most areas within Namibia are heavy and above average rainfall and rising floodwaters from neighboring countries, particularly Angola and Zambia.

The impact of the floods varies from one area to another and these include: **reduced harvest in the floodplains; inaccessibility to a number of health and education facilities during the period of the floods; damage to homesteads and infrastructure ; loss of both humans and domestic animals through drowning; increased outbreak of water-borne diseases such as increased incidence of diarrhoeal illnesses; cholera; and malaria; and poor crop performance due to persistent heavy rainfall and flooding and complete destruction of crop fields.** increase the availability of ground water to trees and via boreholes to humans; redistribute nutrients and organic debris downstream good for cultivation; availability of fish and fishing is made simple with floodwater; floodplains provide ideal breeding and feeding habitat for fish, amphibians, birds, and aquatic fauna, and support a diverse flora; electricity generation;

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**Wild fire outbreak** is also a major hazard in Namibia and is mainly a result of uncontrolled, controlled, prescribed and naturally occurring fires. The most fire prone months are August and September with the most burned regions being Kavango, Omusati, Otjozondjupa, Kunene, Caprivi and Omaheke. Approximately 6.2 to 7.4% of Namibia's total land surface is burned every year. The general impacts of wild fires include the following: destruction of grazing fields; destruction of valuable timber species; reduction in soil fertility; burning of livestock, wildlife, homes and people; and contribution to global pollution though very difficult to quantify.

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The **outbreaks of most human diseases** are seasonal in nature except for HIV and AIDS. According to statistics from Ministry of Health, Malaria remains the top cause of morbidity in the Pediatric department followed by Diarrhea and Pneumonia. The trend of Malaria is slightly increasing by year with on average 1 percentage difference. The period for outbreak of malaria is mostly between the months of January and June. Malaria is most prevalent in the northern part of Namibia. Diarrhea occurs during the dry season when the water quality in the villages is worse just before the rainy season. The other human diseases, which are common in Namibia include: Bilharzia; Scurvy (December to January); colds and flu (February to June); and sore eyes (in July due to wind and dust).

There are a number of **livestock diseases** and the occurrence varies from one area to another. The most common and significant diseases among cattle include: anthrax; Foot and Mouth Diseases (FMDs); Black quarter or black leg; Botulism; and lumpy skin disease; sarcoptic mange amongst goats; rabies among dogs; newcastle disease amongst chickens. Anthrax and Foot and Mouth diseases are largely from cross-border and wildlife movements such as the free roaming of buffalo. Foot and Mouth diseases (FMDs) do not commonly occur in Namibia other than in the Caprivi and those parts of Namibia along the eastern border. Other livestock diseases include: bovine pleuropneumonia (lung sickness in cattle); Rift Valley fever; blue tongue; and African horse sickness. **The map below shows the distribution of animal diseases throughout Namibia.**

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There are a number of **plant types that are toxic** and at times fatal to domestic livestock and communities suffer huge losses of livestock. These poisonous plants are common throughout the country, particularly in areas where livestock densities are high like the northern regions and they vary according to livestock types. Poisonous plants are very common in communal grazing fields and rangeland.

The other types of hazards experienced in Namibia include **crop pests** (locusts; birds; and armyworm), and **wildlife attack** (elephants often destroy the community fields and this happen every season during the ploughing period and lions attack cattle though occasionally). **Deforestation** is also a major concern as it contributes to soil erosion. Over 70 percent of households in rural areas rely heavily on charcoal and firewood.

In Namibia there are also a number of economic hazards and these include high unemployment levels, poor market prices of livestock products, rising oil prices and rising food prices. Namibia relies on food imports from other countries and as a result this has raised the standard of living through importation of food. The other compounding factor is that with the recession experienced during the period 2008 to 2009, the economy has also experienced low demand and poor prices for mineral deposits.

The study, therefore, **concludes** the following:

- The major hazards which affect the livelihoods in Namibia include drought and other climate related conditions, floods, wild fires, human and animal diseases, poisonous plants and other forms of hazards. The impacts of these hazards vary from one location to another and also from one time period to another.
- The most common hazard in Namibia is drought due to low rainfall received per year. The drought prone regions include Karas, Hardap, Erongo, western parts of Kunene and Khomas.

These drought conditions dry up bore holes in rural areas, make grazing fields be in poor conditions particularly in livestock dense areas and contributes to a reduction in the herd size of the livestock. The other climatic related hazards include high temperatures which lead to wilting and death of plants and also frost which affects tropical fruit trees.

- Floods are also a major hazard in Namibia particularly in the Caprivi Region and are mainly caused by heavy rainfall. Since 2007 other regions in the North Central have also started experiencing floods after 50 years. The main areas which are prone to hazards include: Caprivi, North Central regions, Hardap, and Walvis Bay in the western part. However, several other areas also experience localized floods due to the nature of the river system. The impacts of floods are numerous both positive and negative but the most common ones include damage to homesteads and infrastructure and inaccessibility to a number of health and education facilities.
- The other hazard major hazard in Namibia is wild fires. These fires are a result of uncontrolled, controlled and naturally occurring fires. According to the Directorate of Forest Management in the Ministry of Agriculture, about 6.2 to 7.4 percent of Namibian total land surface is burned almost every year. These fires affect the grazing fields, soil fertility, reduce the available timber and contribute to global pollution though very difficult to quantify.
- The outbreaks of most serious, large scale human diseases are seasonal in nature except for HIV and AIDS. According to statistics from Ministry of Health, malaria remains the top cause of morbidity in the Pediatric Department followed by Diarrhoea and Pneumonia. The worst period for malaria outbreak is mostly between January and June. Cholera is also a threatening disease in some regions of Namibia although the impact to livelihoods is not significant. Other human diseases, which are common in Namibia but not significant include: Bilharzia; Scurvy; colds and flu; and eye infections
- There are a number of livestock diseases and the occurrence varies from one area to another. The most common and significant diseases among cattle include: anthrax; foot and mouth diseases (FMDs); black quarter or black leg; Botulism; and the lumpy skin disease; sarcoptic mange among goats; rabies among dogs; Newcastle disease among chickens.
- There are a number of plant types that are toxic and at times fatal to domestic livestock and communities suffer huge losses of livestock. These poisonous plants encroaches the grazing fields and are common throughout the country, particularly in areas where livestock densities are high like the northern regions and they vary according to livestock types. Poisonous plants are very common in communal grazing fields and rangeland.
- The other environmental types of hazards experienced in Namibia include crop pests (locusts; birds; and armyworm), and wildlife attack (elephants often destroy the community fields and this happen every season during the ploughing period and occasional attacks by lions on cattle. Deforestation is also a major concern as it contributes to soil erosion. Over 70 percent of households in rural areas rely heavily on charcoal and firewood for cooking and heating.
- Economic hazards in Namibia include high unemployment levels, poor market prices of livestock products, rising oil prices and rising food prices.

- The identified hazards affect livelihoods differently from one area to another. The main hazards which are significant include: drought, floods, wildfires, animal diseases, and poisonous plants. However, these hazards are seasonal and vary overtime.

The study **recommends** the following:

- The climatic conditions of Namibia are dry in nature and this makes the country be prone to drought throughout the year. Therefore there is need to come up with strategies which can help in reducing some of the contributing factors such as intensify on the construction of dams to harvest both rain and flood water which can be used both for irrigation and domestic needs during drought periods. There is also need to intensify on afforestation to reduce the rate at which water evaporates and also to some extent to offset the rate at which trees are being cut for both firewood and charcoal.
- In the case of floods, there is need to closely build a very strong early warning system both locally and at regional level. Namibia should easily be in a position to get information on rainfall situation and water levels in major rivers from neighboring countries for preparedness during flooding periods. The early warning system should also clearly integrate information systems from all sectors so that the approach to overcome the impact of floods should be multi-sectoral in nature.
- The floods which have affected some regions from the 2007/08 season after a break of about 50 years have indicated that the current settlement patterns have to be redesigned, some settlers have to be moved to relatively higher grounds and there is also need to improve the drainage system. There is also need to re-design some towns like Oshakati and Mariental in Hardap. Some dwelling structures built in some of these towns are in the catchment areas of water.
- Namibia experiences wild fires almost every year. Most of the fires are man-made. These fire outbreaks can best be controlled by conducting sensitization campaigns at community level on the benefits they derive from the forest and construction and maintenance of firebreaks. However, the naturally caused d fires are hard to control.
- On human diseases the Ministry of Health is doing a lot to reduce the incidence of disease outbreak. However, there is need to increase the awareness among communities to go to hospital for assistance and report any new disease outbreak so that they are controlled earlier.
- The outbreak of animal diseases, particularly livestock diseases, is mostly restricted to densely areas which are mostly in the northern part of Namibia. The most common disease is the Foot and Mouth Disease (FMD) due to cross-border movements of animals. However, the other disease outbreaks are under control by the Directorate of veterinary Services. What is needed is to raise community awareness on the need to report any disease outbreaks to veterinary officials in their respective constituencies and regions.

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## 1.0 Introduction

The Government of the Republic of Namibia, through the Directorate of Emergency Management (DEM), in the Office of the Prime Minister is implementing the National Action Plan (NAP) for Disaster Risk Management. The NAP prioritizes the development of maps that show areas that are prone to particular hazards.

The resultant hazard maps are intended to assist in understanding hazards in Namibia by describing the different dimensions of risks, taking into account the frequency, intensity and duration of each hazard. The main purpose of the hazard maps is to inform policy makers, planners, disaster reduction specialists and government partners to understand and manage the hazards effectively and efficiently.

The hazard mapping exercise also takes into account the peoples' livelihoods to show the impact of the different types of hazards in terms of how people survive and get on with their lives.

The main identified hazards in Namibia based on available literature include: climatic related conditions such as drought conditions; floods; veldt and forest fires; human and animal diseases; poisonous plants and bush encroachment in livestock production areas; and other types of hazards such as crop pests; wildlife attack; and deforestation.

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## 2.0 Objective

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The objectives of hazard mapping are to

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- assist in the understanding of the information about hazards in Namibia,
- inform policy makers, development planners, disaster managers and development partners on the nature and distribution of hazards in Namibia,
- Provide prediction of food insecurity, floods, veld and forest fires and human and animal disease outbreaks.

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## 3.0 Methodology

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The study involved literature review, data collection on hazards and relevant information pertaining to hazard mapping and analysis, and interviews with key stakeholders and involved the following:

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- (i). Analyzing existing maps.

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The combined influence of low, erratic rainfall and high evaporation rates result in the regular occurrence of drought situation, which is considered to be an extreme shortage of water. Drought limits vary within the country depending on the cut off of what is considered normal rainfall in a particular area but generally occur throughout the country. Low rainfall experienced for a number of consecutive dry years has also cumulative effects of leading to severe drought condition. Figure 1 above shows variations in water deficit. The southeastern parts are the ones with very high water deficits throughout the year.

**4.1.1.1 Rainfall pattern**

Namibia has an arid to semi-arid climate with average annual rainfall ranging between below 25mm in the Namib Desert in the western part to more than 600mm in the Caprivi Region in the northeast. The northeastern area of the country, covering 25 percent of the land area has on average more than 350mm annually. Figures 1 and 2 below show the distribution of average rainfall and the percentage variation in annual rainfall in Namibia, respectively.

Rainfall is seasonal and can vary tremendously over time and in space and there are uncertainties almost every year. The rainy season starts in October through March and April with heavy rainfall expected in January. Periodic dry spells are normally expected during the month of February almost every year.

The availability of water varies geographically and that rainfall is extremely variable and unpredictable from year to year and from month to month<sup>2</sup>. The greatest variations in year-to-year rainfall are mostly experienced in the southern and western parts of the country. These variations in rainfall patterns, coupled with long periods of hot and dry weather, make it very difficult for crop growth due to inadequate and unpredictable availability of water. The growth of natural pastures is likewise limited.

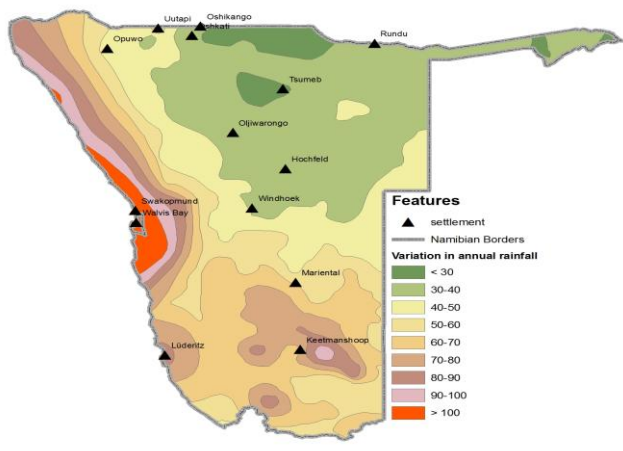
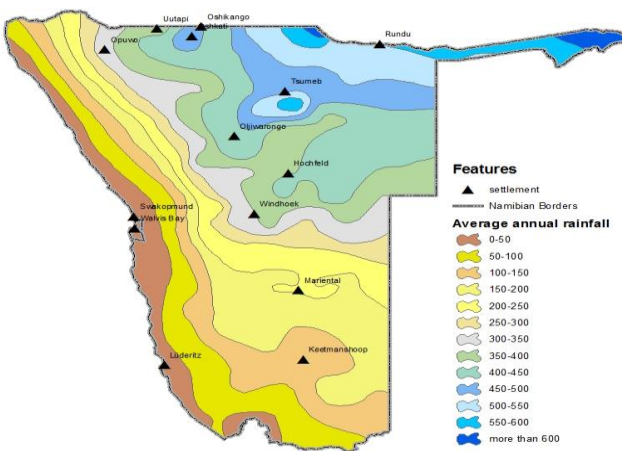
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Figure 2

Average Annual Rainfall for Namibia

Figure 3

Percentage Variation in Annual Rainfall



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Source: An Atlas of Namibia

source: An Atlas of Namibia

#### 4.1.1.2 Temperatures and potential evaporation

Besides rainfall, temperatures also play a crucial role in crop growth and growth of natural pasture. The average annual temperatures varies from one area to another and also from one season to the other and it ranges as low as 5°C to 30°C. Average minimum and maximum temperatures in winter (June to August) vary between 7°C and 23°C, while in summer (December-March) vary between 16°C and 30°C. Figure 3 below shows the average distribution of temperature in Namibia.

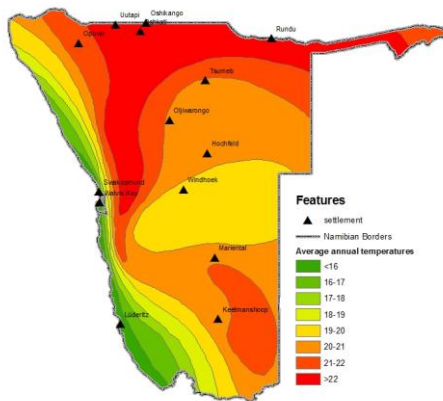
Due to high temperatures and many cloudless days potential evaporation, on average, exceeds rainfall. The greatest volumes of water generally evaporate in areas of least rainfall where the air is driest. The southeastern part of Namibia is the driest with highest water deficits while the northeastern part has low levels of water deficits. However, evaporation is very low along the coastal areas of Namib Desert because of low temperatures influenced by the cold Bengula current from the Atlantic Ocean. Figure 4 below shows the average rates of evaporation per year.

Figure 4

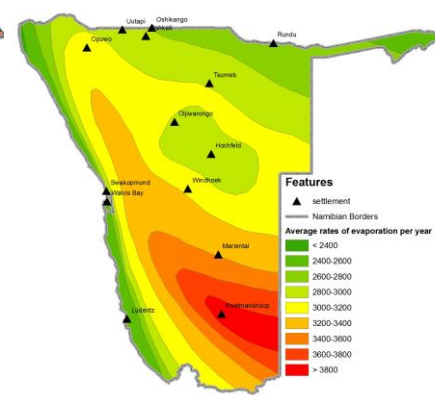
Figure 5

Average Annual Temperatures for Namibia

Average Rates of Evaporation Per Year



Source: An Atlas of Namibia



source: An Atlas of Namibia

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¶ The availability of water varies geographically and that rainfall is extremely variable and unpredictable from year to year and from month to month<sup>3</sup>. The greatest variations in year-to-year rainfall are mostly experienced in the southern and western parts of the country. These variations in rainfall patterns, coupled with long periods of hot and dry weather, make it very difficult for crop growth due to inadequate and unpredictable availability of water. The growth of natural pastures is likewise limited.¶

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#### 4.1 Occurrence of drought situation

Source: An Atlas of Namibia

#### 4.1.1 Impacts of general drought conditions

The impacts of drought are mostly negative on livelihoods and include:

- (i) The drying up of boreholes in the rural areas due to repeated conditions;
- (ii) Greatly reduced land carrying capacity and overgrazing in high livestock density areas;
- (iii) Reduction in the conditions of livestock and hence the value of livestock; and
- (iv) Reduction in herd size of livestock through distress sales. The commonly affected animals include cattle, goats, donkeys, sheep and horses.

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#### (v) Impact on crops (cereals) and food security

Include the losses over a period of time say between 2002-2007

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#### 4.5 Impact of hot temperatures and frost

Most plants grow best when temperatures fall within specific limits. However, extreme conditions of very hot and very cold temperatures have varying impacts on crops. Very high temperatures lead to increased rates of water loss through evaporation and transpiration. This leads to wilting and possible death of the plant. Growth rates also drop the colder it becomes. Many plant species, particularly tropical fruit trees, are also sensitive to frost, and are growing only in places free of frost.

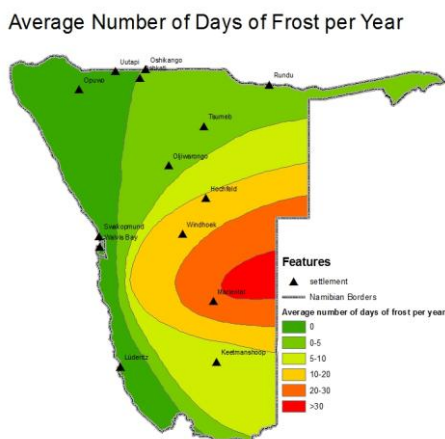


Figure 6



Source: An Atlas of Namibia

### 5.1 Causes of Floods

The primary **causes** of flooding in most areas within Namibia are above average rainfall and floodwater from neighboring countries, particularly Angola and Zambia. The other factors which contribute to flooding include: high population growth rates in towns and cities that has led to unplanned informal settlements that are either close to a waterway or block the natural flow of a river or lacks proper drainage facilities; narrow bridge culverts that are not routinely cleared of debris; reluctance of vulnerable people to flood disasters to relocate to high ground; and inadequate expertise and knowledge in disaster risk management at regional and constituency levels.

Some factors that contribute to severe damage as a result of flooding are related to preparedness in nature and these include: absence of an effective flood early warning system, particularly during the 2007/08 floods in the north central regions; lack of inter-country sharing of early warning information between bordering countries, particularly Angola and Zambia; and inadequate water level monitoring stations along some major floodplains such as the Cuvelai Delta.

### 5.2 River systems and characteristics of floods

The characteristics of floods in Namibia vary depending on river systems, which include perennial rivers and their floodplains as well as the typical ephemeral rivers. In the normally dry ephemeral rivers a flood is any flow and the frequency, intensity, duration and distance of floods vary greatly.

On the other hand, perennial rivers are associated with floodplains. Perennial rivers in Namibia occur only on the national borders and are shared with neighbouring states. The Kunene River originates in Angola, the Kavango River is shared with Angola and Botswana, the eastern Caprivi Rivers (the Zambezi, Kwando, Linyanti? and Chobe?) originate in Zambia, and Orange River originates in Lesotho and is shared with South Africa. These rivers carry large volumes of water and the local rainfall contribution is negligible.

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### 5.3 Frequency and period of floods occurrence

Caprivi Region is threatened annually by flooding from the Zambezi River and along the Kabe Flood Plain. This normally starts in March and peaks in April, May and June and then recedes until the end of August. People move to higher-lying areas and take their livestock there for safety. Chobe, Kwando, Linyati?? However, the Caprivi has been frequented by floods almost every other year due to its geographical vulnerability with three major floods recorded since 2003. Flooding in the Caprivi, therefore, is considered a normal and yearly event.

The Cuvelai Delta causes flooding with flood waters from southern Angola coupled with heavy and prolonged rainfall in the northern central regions of Namibia. Although Northern Central Namibia is situated in a flood plain, floods are relatively rare in the area, with the last flood of similar impact as that in 2007-2008 being said to have occurred in the 1950s. The characteristic of 2008 flood was that it strongly affected the urban and semi-urban lowland flood prone areas, causing extensive damages to buildings and infrastructures.

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### 5.4 Impact of flooding

The impact of the floods varies from one area to another and there are both positive and negative effects in nature and these include:

#### 5.4.1 Positive impacts:

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- (i) People harvest reeds in the floodplain;
- (ii) Increase the availability of ground water to trees and via boreholes to humans;
- (iii) Redistribute nutrients and organic debris downstream, which is good for cultivation;
- (iv) Availability of fish and fishing is made simple with floodwater;
- (v) Floodplains provide ideal breeding and feeding habitat for fish, amphibians, birds, and aquatic fauna, and support a diverse flora and
- (vi) Electricity generation.

#### 5.4.2 Negative impacts:

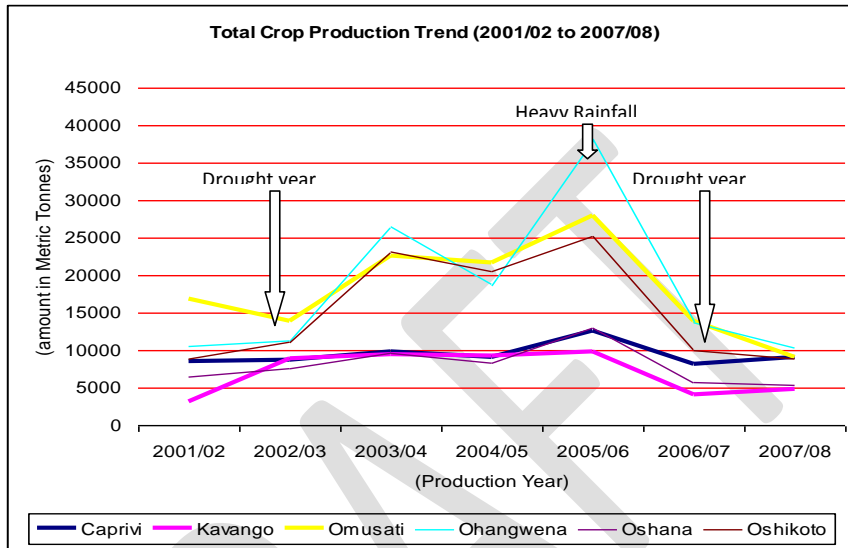
- (i) Inaccessibility to a number of health and education facilities during the period of the floods;
- (ii) Damage to homesteads and infrastructure (road networks, clinics, classrooms, and collapse of both the public and the private tap system) during the flooding period. Informal settlements are worst hit in some urban areas such as towns of Oshakati in Oshana Region and Katima Mulilo in Caprivi Region;

- (iii) Loss of both human and domestic animal life through drowning;
- (iv) Increased outbreak of water-borne diseases such as increased incidence of diarrhoeal illnesses; cholera; and malaria; and

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Graph 1

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- (v) Poor crop performance due to persistent heavy rainfall and flooding and complete destruction of crop fields. Graph 1<sup>5</sup> below shows the crop production trend in selected flood affected regions in the northern parts of Namibia. The fluctuations in crop production are mainly due to heavy rainfall, flooding and drought. For example, crop production was low during 2002/03, 2004/05 and 2006/07 mainly due to low rainfall and consequently drought conditions,

## 6.0 Veld and Forest Fires

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<sup>5</sup> Data Source: Crop prospects and Food Security Report, June 2008.



(v) There is a contribution to global pollution although this is very difficult to quantify.

(Include the fire losses over a period of time say between 2002-2007

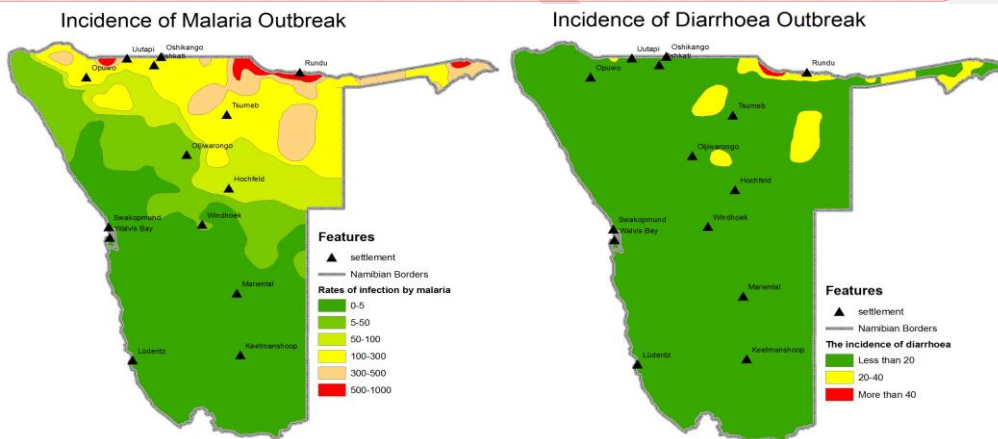
**7.0 Human diseases**

The outbreaks of most serious, large scale human diseases are seasonal in nature except for HIV and AIDS. According to statistics from Ministry of Health, malaria remains the top cause of morbidity in the Pediatric Department followed by Diarrhoea and Pneumonia. According to statistics from Ministry of Health, Malaria shows a slightly increasing year-on-year trend with, on average, 1 percentage difference<sup>6</sup>. The worst period for malaria outbreak is mostly between January and June. Malaria is most prevalent in the northern part of Namibia. Diarrhoea occurs during the dry season just before the rainy season when water quality in the villages is at its worst. Figure 9 and 10 show regions, which are prone to malaria and diarrhoea, respectively.

**Figure 9**

**Figure 10**

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Data Source of Figures 8 and 9: An Atlas of Namibia and Ministry of Health

The trend of HIV/AIDS is also increasing with 1 percentage difference on average per year. The highest prevalences in the country are in Caprivi, Ohangwena, Omusati and Erongo. According to poverty profiles for most regions HIV and AIDS has increased the numbers of orphans and consequently dependency ratios.

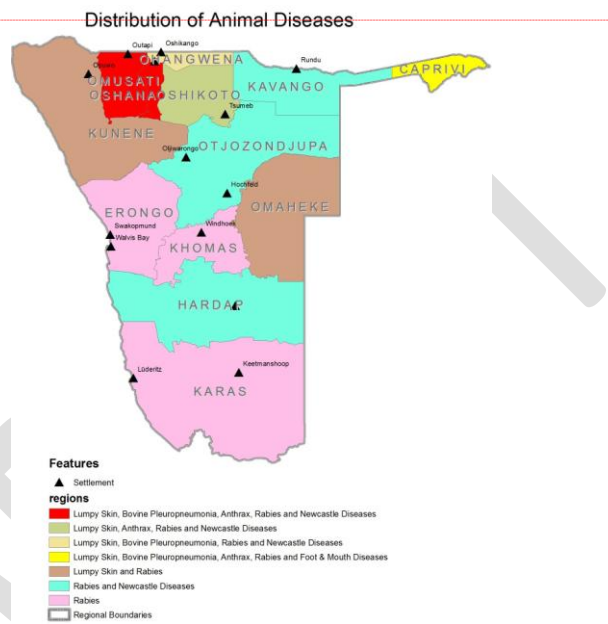
<sup>6</sup> Health Information Report (2002/2003 – 2004/2005)



Anthrax and foot and mouth diseases are largely transmitted from cross-border sources and wildlife movements such as the free roaming buffalo. Foot and mouth diseases (FMDs) do not commonly occur in Namibia other than in the Caprivi and along the eastern border.

Other livestock diseases include: contagious bovine pleuropneumonia (lung sickness in cattle); Rift Valley fever; blue tongue; and African horse sickness. Figure 12 below shows the distribution of animal diseases throughout Namibia.

**Figure 12**



**Comment [UN5]:** Show trends over years

Data source: Directorate of Veterinary Services

[Include the losses over a period of time say between 2002-2007](#)

### 9.0 Poisonous Plants in Livestock Production

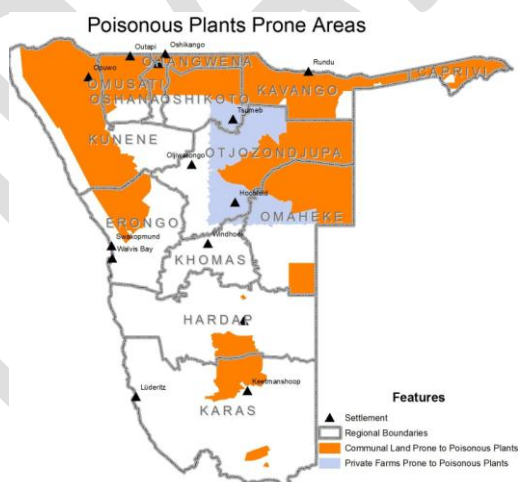
There are a number of plant types that are toxic and at times fatal to domestic livestock and communities suffer huge losses of livestock. These poisonous plants encroach the grazing fields and are common throughout the country, particularly in areas where livestock densities are high like the northern regions and they vary according to livestock types.

The biggest livestock killer is the poison leaf or *gifblaar* (*Dichaphetalum cymosum*). Poison leaf causes death by inhibiting cellular respiration in animals, which leads to heart failure within 24 hours of ingestion. The causative agent is monofluoroacetic acid contained in the plants' leaves, particularly of young plants, that are most dangerous in early spring.

Poisonous plants are very common in communal grazing fields and rangeland. Communities herd their livestock away from areas with poisonous plants at the onset of the rainy season to avoid loss of livestock. Newly resettled communities do not seem to have any traditional knowledge of these poisonous plants.

Other poisonous plants which are also common in most regions though less toxic include: *Urginea sanguinea* (*sangkop*), which is more dangerous to small stock; *Geigeria ornativa* (*vermeerbos*), which is dangerous only when ingested in large quantities; and *Gnidia polycephala* (*januariebos*), which flowers in the driest period between July and August. Poisonous plants thrive in trampled or overgrazed areas. Figure 13 below shows areas which are prone to poisonous plants. [\(We may need to demonstrate the effects of poisonous plants with figures showing livestock losses due poisoning\)](#)

Figure 13



#### 10.0 Other types of hazards:

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The other types of hazards experienced in Namibia include crop pests (locusts; birds; and armyworm), and wildlife attack (elephants often destroy the community fields and this happen every season during the ploughing period and occasional attacks by lions on cattle).

Deforestation is also a major concern as it contributes to soil erosion. Over 70 percent of households in rural areas rely heavily on charcoal and firewood for cooking and heating.

[Also include maritime pollution – Ministry of Works and Transport and Fish and Marine Resources](#)

**11.0 Economic Hazards and Informal Settlement**

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In Namibia there are a number of economic hazards and these include high unemployment levels, poor market prices of livestock products, rising oil prices and rising food prices. Namibia relies on food imports from other countries and as a result this has raised the standard of living through importation of food. The other compounding factor is that with the recession experienced during the period 2008 to 2009, the economy has also experienced low demand and poor prices for mineral deposits.

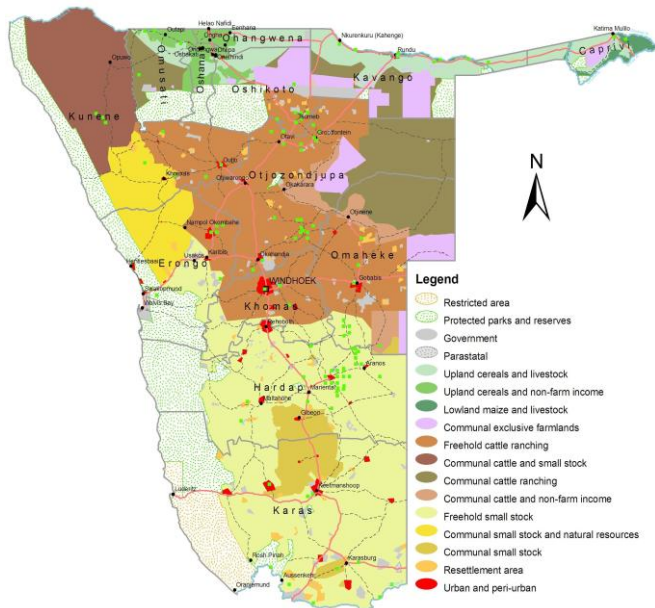
Unemployment levels are also high in Namibia with an average of 15 percent of unemployed people at regional level. Most of those who are not employed live in informal settlements characterized by low levels of income, no electricity, poor sanitation, increased use of firewood for cooking and in some cases are prone to flooding and water borne diseases. The informal settlers are hard hit by economic hardships and they have very few alternative sources of both food and income.

[Are we able to map the informal settlements and superimpose population densities in these settlements](#)

**12.0 Livelihoods and Hazards**

The identified hazards affect livelihoods differently from one area to another. The main hazards which are significant include: drought, floods, wildfires, animal diseases, and poisonous plants. However, these hazards are seasonal and vary overtime. Table 1 in the annex provides a listing of hazards, livelihood zones and the level of impact to the zones. Figure 14 below shows the spatial distribution of livelihood zones in Namibia.

Figure



14

Source: Livelihood zoning exercise, November 2008

Is there a way the hazards can be overlaid on the livelihood zones - e.g. most frequent hazards with adverse impact overlaid on livelihood zones.

### 13.0 Conclusions

The major hazards which affect the livelihoods in Namibia include drought and other climate related conditions, floods, wild fires, human and animal diseases, poisonous plants and economic hazards. The impacts of these hazards vary from one location to another and also from one time period to another.

The most common hazard in Namibia is drought due to low rainfall received annually. Drought prone regions include Karas, Hardap, Erongo, western parts of Kunene and Khomas. These drought conditions dry up bore holes in rural areas, and reduce the carrying capacity of grazing fields particularly in livestock dense areas. This contributes to the worsening of livestock conditions and consequently reducing their value on the market and to some extent the reduction in herd size of livestock through deaths. The other climatic related hazards include high temperatures which lead to wilting and death of plants and also frost which affects tropical fruit trees and grazing fields.

Floods are also a major hazard in Namibia, particularly in the Caprivi Region, and are mainly caused by increased flow of water in major river systems due to heavy rains in the neighbouring countries. Since 2007 other regions in the North Central have also started experiencing floods after a break of 50 years. The main areas which are prone to hazards include: Caprivi, North Central regions, Hardap, and Walvis Bay in the western part. However, several other areas also experience localized floods

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due to the nature of the river system. The impacts of floods are numerous both positive and negative but the most common ones include damage to homesteads and infrastructure and inaccessibility to a number of health and education facilities.

The other hazard major hazard in Namibia is wild fires. These fires are a result of uncontrolled, controlled and naturally occurring fires. According to the Directorate of Forest Management in the Ministry of Agriculture, about 6.2 to 7.4 percent of Namibian total land surface is burned almost every year. These fires affect the grazing fields, soil fertility, reduce the available timber and contribute to global pollution though very difficult to quantify.

The outbreaks of most serious, large scale human diseases are seasonal in nature except for HIV and AIDS. According to statistics from Ministry of Health, malaria remains the top cause of morbidity in the Pediatric Department followed by Diarrhoea and Pneumonia. The worst period for malaria outbreak is mostly between January and June. Cholera is also a threatening disease in some regions of Namibia although the impact to livelihoods is not significant. Other human diseases, which are common in Namibia but not significant include: Bilharzia; Scurvy; colds and flu; and eye infections

There are a number of livestock diseases and the occurrence varies from one area to another. The most common and significant diseases among cattle include: anthrax; foot and mouth diseases (FMDs); black quarter or black leg; Botulism; and the lumpy skin disease; sarcoptic mange among goats; rabies among dogs; Newcastle disease among chickens.

There are a number of plant types that are toxic and at times fatal to domestic livestock and communities suffer huge losses of livestock. These poisonous plants encroaches the grazing fields and are common throughout the country, particularly in areas where livestock densities are high like the northern regions and they vary according to livestock types. Poisonous plants are very common in communal grazing fields and rangeland.

The other environmental types of hazards experienced in Namibia include crop pests (locusts; birds; and armyworm), and wildlife attack (elephants often destroy the community fields and this happen every season during the ploughing period and occasional attacks by lions on cattle. Deforestation is also a major concern as it contributes to soil erosion. Over 70 percent of households in rural areas rely heavily on charcoal and firewood for cooking and heating.

In Namibia there are also a number of economic hazards and these include high unemployment levels, poor market prices of livestock products, rising oil prices and rising food prices. Namibia relies

on food imports from other countries and as a result this has raised the standard of living through importation of food. The other compounding factor is that with the recession experienced during the period 2008 to 2009, the economy has also experienced low demand and poor prices for mineral deposits.

The identified hazards affect livelihoods differently from one area to another. The main hazards which are significant include: drought, floods, wildfires, animal diseases, and poisonous plants. However, these hazards are seasonal and vary overtime.

Is there a trend analysis done to provide a pattern upon which forecasts can be made or based on?

#### **14.0 Recommendations**

Can recommendations be related to patterns/trends to support preparedness. E.g Frequency of drought cycles.

The climatic conditions of Namibia are dry in nature and this makes the country be prone to drought throughout the year. Therefore there is need to come up with strategies which can help in reducing some of the contributing factors such as intensify on the construction of dams to harvest both rain and flood water which can be used both for irrigation and domestic needs during drought periods. There is also need to intensify on afforestation to reduce the rate at which water evaporates and also to some extent to offset the rate at which trees are being cut for both firewood and charcoal.

In the case of floods, there is need to closely build a very strong early warning system both locally and at regional level. Namibia should easily be in a position to get information on rainfall situation and water levels in major rivers from neighboring countries for preparedness during flooding periods. The early warning system should also clearly integrate information systems from all sectors so that the approach to overcome the impact of floods should be multi-sectoral in nature.

The floods which have affected some regions from the 2007/08 season after a break of about 50 years have indicated that the current settlement patterns have to be redesigned, some settlers have to be moved to relatively higher grounds and there is also need to improve the drainage system. There is also need to re-design some towns like Oshakati and Mariental in Hardap. Some dwelling structures built in some of these towns are in the catchment areas of water.

Namibia experiences wild fires almost every year. Most of the fires are man-made. These fire outbreaks can best be controlled by conducting sensitization campaigns at community level on the

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benefits they derive from the forest and construction and maintenance of firebreaks. However, the naturally cause fires are hard to control.

On human diseases the Ministry of Health is doing a lot to reduce the incidence of disease outbreak. However, there is need to increase the awareness among communities to go to hospital for assistance and report any new disease outbreak so that they are controlled earlier.

The outbreak of animal diseases, particularly livestock diseases, is mostly restricted to highly density areas which are mostly in the northern part of Namibia. The most common disease is the foot and mouth disease (FMD) due to cross-border movements of animals. However, the other disease outbreaks are under control by the Directorate of veterinary Services. What is needed is to raise community awareness on the need to report any disease outbreaks to veterinary officials in their respective constituencies and regions.

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## Annexes

No.	Hazard	Affected Livelihood Zones	Affected Regions	Impact to the livelihood
1	Drought and other related climatic conditions (hot temperatures and frost)	Communal cattle and small stock	North-west Kunene	High
		Communal small stock and natural resources	South-western parts of Kunene and northern Erongo	High
		Freehold small stock	Southern parts of Khomas, Hardap and Khomas	High
		Communal small stock	Hardap and Karas	High
2	Floods	Upland cereals and livestock	Omusati, Oshana and Ohangwena	High
		Upland cereals and non-farm income	North-east Omusati, northern Oshana, north-west Oshikoto and western Ohangwena	High
		Lowland maize and livestock	Low attitude areas of Caprivi (riverine woodlands, eastern floodplains, Katima Mulilo, Impalila Island) and the Kavango River Basin	Medium
		Communal cattle ranching	Omusati, Oshikoto and Kavango	High
		Communal exclusive farmlands	Oshikoto and Kavango	High
		Freehold cattle ranching	Southern part of Oshikoto and eastern part of Kunene	High
		Freehold small stock	Hardap (Hardap Dam and the Fish River)	High
3	Wild fires	Upland cereals and livestock	Omusati, Oshana and Ohangwena	High
		Upland cereals and non-farm income	North-east Omusati, northern Oshana, north-west Oshikoto and western Ohangwena	High
		Lowland maize and livestock	Low attitude areas of Caprivi (riverine woodlands, eastern floodplains, Katima Mulilo, Impalila Island) and the Kavango River Basin	High
		Communal cattle ranching	Omusati, Oshikoto and Kavango	High
		Communal exclusive farmlands	Oshikoto and Kavango	High
		Freehold cattle ranching	Southern part of Oshikoto and eastern part of Kunene	High

4	Animal diseases	Upland cereals and livestock	Omusati, Oshana and Ohangwena	Medium
		Upland cereals and non-farm income	North-east Omusati, northern Oshana, north-west Oshikoto and western Ohangwena	Medium
		Lowland maize and livestock	Low attitude areas of Caprivi (riverine woodlands, eastern floodplains, Katima Mulilo, Impalila Island) and the Kavango River Basin	Medium
		Communal cattle ranching	Omusati, Oshikoto and Kavango	Medium
		Communal exclusive farmlands	Oshikoto and Kavango	Medium
		Freehold cattle ranching	Southern part of Oshikoto and eastern part of Kunene	Medium
5	Poisonous plants and bush encroachment	Upland cereals and livestock	Omusati, Oshana and Ohangwena	Low
		Upland cereals and non-farm income	North-east Omusati, northern Oshana, north-west Oshikoto and western Ohangwena	Low
		Lowland maize and livestock	Low attitude areas of Caprivi (riverine woodlands, eastern floodplains, Katima Mulilo, Impalila Island) and the Kavango River Basin	Low
		Communal cattle ranching	Omusati, Oshikoto and Kavango	Low
		Communal exclusive farmlands	Oshikoto and Kavango	Low
		Freehold cattle ranching	Southern part of Oshikoto and eastern part of Kunene	Low