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THE LAW AND PRACTICE ON DISASTER ISSUES

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AN OUTLINE OF
NATURAL AND MAN-MADE DISASTERS

Oluyemisi A. BAMBOSE

ABSTRACT

On a daily basis, a part of the world experiences a disaster. Disasters are global occurrences with devastating effects. Certain occurrences are natural, as they arise without direct human involvement. These are natural disasters. Though it is not possible to control the events from occurring, efforts can be made to alleviate the effect on human lives and environment. There are also occurrences that are as a result of human activities, mistakes or malicious intent referred to as man-made disasters. In certain situations, there are multiple disasters which are referred to as complex disasters. The severity or effect of any disaster is dependent on the management or response, prior, during or after the occurrence.

This chapter outlines the different classes of disaster, discusses selected events resulting in disaster and mitigating steps in reducing the effects. Some recommendations are made and in conclusion, it is advocated that there should be very effective awareness programmes for different communities prone to

specific disasters and that there should be collective efforts in addressing situations of disasters.

Keywords: Natural Disaster, Man-Made Disaster, Complex Disaster.

MEANING AND DEFINITION

The word “disaster” derives from Middle French *désastre* and from Old Italian *disastro*,¹ which in turn comes from the Greek prefix “bad star.”² The root of the word “disaster” (“bad star” in Greek) comes from an astrological theme in which the ancients used to refer to the destruction or deconstruction of a star as a disaster.³ Cooplar further states that the term disaster “is derived from the Latin roots *dis-* and *astro*, meaning “away from the stars” or, in other words, an event to be blamed on an unfortunate astrological configuration.”⁴

The term “disaster” is synonymous with devastation, catastrophe, calamity and tragedy. Different authors have however made attempts to describe or define disaster.⁵ Syed defines disaster as an overwhelming ecological disruption occurring on a scale sufficient to require outside assistance.⁶ Oztaysi *et al* quoted Fritz, and defined disaster as

an event, concentrated in time and space, in which a society or a relatively self-sufficient subdivision of a society, undergoes severe danger and incurs such losses to its members and physical appurtenances that the social structure is disrupted and

- 1 Definitions Available at <http://www.definitions.net/definition/Disaster>. (last accessed 27th November 2017).
- 2 Definition Available at <http://www.definitions.net/definition/Disaster>. (last accessed 27th November 2017).
- 3 *supra*
- 4 D.P. Coppola, *Introduction to International Disaster Management*, (2006, Elsevier, Amsterdam).
- 5 David A. McEntire *Disaster Response and Recovery: Strategies and Tactics for Resilience*. (2015, Wiley and Sons) 37.
- 6 Syed, M.H. (2009) *Encyclopaedia of Disaster Management*, Himalaya Publishing House, India.

the fulfilment of all or some of the essential functions of the society is prevented.⁷

The International Federation of Red Cross and Red Crescent Societies (IFRC) describes disaster as the combination of hazard, vulnerability and inability to reduce the potential consequences of risk.⁸ McEntire posits that disasters are usually as a result of hazards and may trigger off a disaster⁹ and defines a hazard as “a physical, technological, or intentional agent such as an earthquake, industrial explosion, or terrorist bombing.”¹⁰

A disaster is a natural or man-made hazard that has come to fruition, resulting in an event of substantial extent causing significant physical damage or destruction, loss of life, or drastic change to the environment. Chroust says that a disaster is a sudden unplanned event that causes great damage or serious loss to an organisation.¹¹ Chroust *et al* further defines disaster as a natural or man-made event that negatively affects life, property, livelihood or industry often resulting in permanent changes to human societies, ecosystems and environment.¹² A disaster is therefore any tragic event with great loss stemming from events which include earthquakes, floods, catastrophic accidents, fires and explosions.

Disasters is the consequence of inappropriately managed risks. The risks are the product of hazards and vulnerability. When

- 7 Öztaysi B., Behret H., Kabak Ö., Sari I.U., Kahraman C. “Fuzzy Inference Systems for Disaster Response”. Chapter 4. In: Vitoriano B., Montero J., Ruan D. (eds) *Decision Aid Models for Disaster Management and Emergencies*. Atlantis Computational Intelligence Systems, vol 7. (2013, Atlantis Press, Paris) 75
- 8 Url-1: Available at <http://www.ifrc.org/en/what-we-do/disaster-management/about-disaster-management/> (Last accessed 24th November 2017)
- 9 David A. McEntire *Disaster Response and Recovery: Strategies and Tactics for Resilience*. (2007, Wiley and Sons)
- 10 *Ibid*
- 11 Gerhard Chroust ICT Support for Disaster Management Available at https://www.researchgate.net/profile/Gerhard_Chroust/publication/287568853_ICT_support_for_disaster_management/links/56ae1ac308ae28588c61aaf6/ICT-support-for-disaster-management.pdf Accessed 27th November 2017.
- 12 G Chroust, O Giinther, M Roth, H Sturmand PZiehesberger “First Responder in Regional Disaster: A Case of Social Responsibility”. In *Social Responsibility: Range of Perspectives per Topic and Countries*. (2015, Bentham Science Publishers) 80.

a hazard has effect on vulnerable people it is called a disaster while hazards that strike in areas with low vulnerability are not considered a disaster, as is the case in uninhabited regions.

CLASSIFICATION

Disasters are said to be as a result of hazards.¹³ It has been opined that with the intervention of human actions, hazards can be prevented from resulting into disasters. It may be argued, that all disasters are as a result of human failure to introduce appropriate disaster management measures and therefore all disasters are human-made.

McEntire states that hazards are present for many different reasons.¹⁴ He further states that some hazards naturally occur in the environment, whereas others are the result of human activity, mistakes or malicious intent.¹⁵ Hazards resulting in disasters may be divided into two classifications. Disaster can therefore be divided into two, namely natural or man-made disasters. Schoitsch has suggested a third classification. He opines that at times, natural disaster can be interwoven leading to what is generally termed, complex disasters. According to the International Federation of Red Cross and Red Crescent Societies, some disasters can result from several different hazards or, more often, to a complex combination of both natural and man-made causes and different causes of vulnerability.¹⁶ Examples of such complex combination given by the International Federation of Red Cross and Red Crescent Societies are food insecurity, epidemics, conflicts and displaced populations.¹⁷ The third classification is termed complex disaster. The different classifications are hereby discussed.

13 David A. McEntire *Disaster Response and Recovery: Strategies and Tactics for Resilience*. (2007, Wiley and Sons).

14 *Ibid*

15 *Ibid*

16 Complex/manmade hazards: complex emergencies- Available at <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/complex-emergencies/> Accessed 27th November 2017.

17 *Ibid*

A. Natural Disaster

Natural disasters are naturally occurring physical phenomena caused either by rapid or slow onset events.¹⁸ It is a consequence when a natural hazard affects humans and/or the built environment. Natural disasters arise without direct human involvement. Natural hazards kill tens of thousands of people and destroy billions of naira and millions of dollars of habitat and property each year. Natural disaster can become more severe because of human actions or inactions prior, during or after the disaster itself. The effects of a natural disaster may be escalated if there is no appropriate emergency management or a coordinated response. In such cases, the result is huge financial loss, severe environmental damage and or massive loss of human lives. Though it may not be possible to control nature and to stop the development of natural phenomena, however, efforts could be made to avoid disasters and alleviate the effects on human lives, infrastructure and property.

The rapid growth of the world's population and its increased concentration often in hazardous environment has escalated both the frequency and severity of natural disasters. In developing countries, the tropical climate, unstable land forms, poor or no budgetary allocation for disaster prevention and lack of planning are cumulating factors that make effects of natural disasters more severe in these regions.

Natural disasters have been classified according to the origins. According to the IFRC, the classification are as follows:¹⁹ Geophysical origin which include earthquakes, volcanic eruptions and landslides; climatic origin examples of which are drought, flood, cyclone, locust, forest fire, extreme temperatures, drought and wildfires; hydrological origin which include avalanches and floods; meteorological origin like cyclones and storms/wave

18 Types of disasters – IFRC Available at <https://www.bing.com/search?q=Natural%20disasters%20are%20naturally%20occurring%20physical%20phenomena%20caused%20either%20by%20rapid%20or%20slow%20onset%20events&form=SWAUA2> Accessed 26th November 2017.

19 Types of disasters: Definition of hazard Url-1: <http://www.ifrc.org/en/what-we-do/disaster-management/about-disaster-management/> accessed 24-11-2017.

surges, and biological origin which include epidemics and insect/animal plagues.

As mentioned earlier in this paper, though natural disaster is said to arise without direct human involvement, human or human related factors may escalate and or aggravate the impact.

Factors that may escalate natural disaster

Rapid growth of the world's population coupled with urbanisation is noted as major causes of escalation in natural disasters in the 21st century. The effects these will have on the environment has been a cause of concerns for experts. While this trend has been noted in Europe, Middle East and North Africa, this does not exclude other parts of the world.

Brauch in a study of the Mediterranean, analysed the relationship between urbanization in relation to population growth and climate change and natural disasters as outcomes of environmental stress for the Mediterranean space.²⁰

Other escalating factors include increased concentration often in hazardous environment aggravating both the frequency and severity of natural disasters; deforestation and non-engineered constructions which make the disaster-prone areas more vulnerable and in many developing nations, poor or no budgetary allocation for disaster prevention has led to loss of lives and properties.

It is apt to however state that, though it may not be possible to control nature and to stop the development of natural phenomena, but efforts could be made to avoid disasters and alleviate their effects on human lives, infrastructure and property.

²⁰ Hans Günter Brauch *Urbanization and Natural Disasters in the Mediterranean: Population Growth and Climate Change in the 21st Century* Available in <http://www.bvsde.paho.org/bvsacd/cd46/cap11-urbani.pdf> Accessed 25th November 2017.

A PRÉCIS OF THE VARYING FORMS OF SELECTED NATURAL DISASTERS

There are certain major adverse events that may be predictable. There are others that are not predictable and the occurrence cannot be controlled. These are known as natural disasters. There are many events that fall into this category. However, for the purpose of this work, selected examples will be discussed.

I. AVALANCHE

Meaning

An avalanche is when a large batch of snow on the side of a mountain slides quickly down the mountain. It is a rapid flow of snow down a sloping surface. In an avalanche, lots of material or mixtures of different types of material fall or slide rapidly under the force of gravity.

Types of Avalanche

Avalanches are often classified by what they are made of. There are snow avalanche, ice avalanche, rock avalanche or soil avalanche. A mixture of these is classified as debris avalanche.

Causes of Avalanches

An avalanche is caused when a build-up of snow is released down a slope, and it is one of the major dangers faced in the mountains in winter. Avalanches are typically triggered in a starting zone from a mechanical failure in the snowpack when the forces on the snow exceed its strength but sometimes only with gradually widening. Weather might be the biggest factor that can cause an avalanche. It plays a huge role in the development of snow on the ground.

Snowpack which builds up over the season, and during winter, may be strong or weak. Avalanches occur if the bond is weak or even if you have a strong bond in the upper layers of the snowpack, and the layers beneath it are weak. The presence of humans in these areas trigger off avalanches.

The terrain of a place may aggravate an avalanche. Snow built on a steep slope may cause an avalanche to happen. Avalanches develop on slopes between 25°- 55° and it starts on slopes between the 35°- 45° range.

Effect of Avalanches

Because they are so sudden and the snow can move very quickly and with a lot of strength, an avalanche can sometimes be dangerous for whoever or whatever is in its path.

Most Prone Areas of Avalanches

Mountainous areas throughout the Arctic and temperate regions and those which have slope angles between 25°C and 60°C are at risk of avalanche. Avalanche is more severe in Europe than in North America especially the western part.²¹ Avalanche-prone areas are Peru near the Andes Mountain, Argentina, Italy especially the Swiss Alps Mountain, the French Alps, Canada, Afghanistan, Slovakia, Austria, Mount Everest in Nepal, and Iceland.²²

Examples of Disasters Resulting From Avalanches

On May 31st 1970, an earthquake off the coast of Peru caused a substantial section of the north slope of Mt. Huascarán to collapse, killing over 202,000 people. Situated in the Cordillera Blanca, the world's highest tropical mountain range. The avalanche moved down hill burying the towns of up to 300 feet of rock and debris.²³

Over a 24-hour period during World War 1, Italian and Austrian forces died in a series of avalanches that occurred at the Tyrolean Alps on December 13th 1916 with about 10,000 casualties caused by a mixture of heavy snowfall and man-made explosives.²⁴

21 Available in <https://people.uwec.edu/jolhm/eh3/group4/references/nsidc.htm>.

22 *Ibid*

23 The 10 Deadliest Avalanche Events in History Available in <http://unofficialnetworks.com/2013/04/30/10-deadly-avalanches/>

24 *Ibid*

It is reported that on September 4th 1618 the entire town of Plurs, Switzerland was wiped off the face of the earth when a massive avalanche, buried the town. There were about 2,427 casualties.²⁵

In Asia, on April 7th 2012, an avalanche hit a Pakistani military base near Siachen Glacier region, trapping and killing soldiers and civilians.²⁶

In Wellington, Washington, United States of America on March 1st 1910 there was an avalanche after a severe snow fall for several days resulting in several feet of snow. A few days after as a result of a lightning strike, a slab of snow broke loose from the side of Windy Mountain during a violent thunderstorm. A ten-foot high mass of snow, half a mile long and a quarter of a mile wide, fell toward the town killing many people.²⁷

Protective/mitigating Measures

Explosives are used to trigger avalanches on potentially unstable slopes so that the avalanches will occur when people are not endangered.

Devices such as avalanche rakes (large reinforced fencing) are used on slopes to hold snow in place, and diversion structures such as dams or wedges are used at the base of the slope, split or deflect the snow in an avalanche.

Afforestation of the avalanche-prone area is adopted to hold down soil and trees.

Issuing early warning of an impending avalanche is an effective measure adopted after predicting the occurrence of avalanches through scientific analysis.

25 *Ibid*

26 *Ibid*

27 *Ibid*

II. DROUGHT

Meaning

Because of regional differences and perceptions, it is difficult to give a concise definition of drought. However, it is generally said to be a deficiency of precipitation over an extended period of time — usually a season or more — resulting in a water shortage for some activity, group, or environmental sector.²⁸ Considering drought from the operational perspective, it is a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield.²⁹

*Types of Droughts*³⁰

Meteorological drought, Agricultural drought, Hydrological drought and Socio-economic drought.

Causes

Drought can be caused by not receiving rain or snow over a period of time. Another cause of drought is the change in the wind patterns that move clouds and moisture through the atmosphere causing a place not to receive its normal amount of rain or snow over a long period of time. Annual dry seasons in the tropics significantly increase the chances of a drought developing and this may subsequently cause bush fires. Periods of heat can aggravate and significantly worsen drought conditions by hastening evaporation of water vapour.

Effects

Like other hazards resulting in disaster, this natural phenomenon may result in reduction in water quality, hunger, war, civil unrest, malnutrition, famine, habitat change, mass migration, reduced

28 University of Nebraska—Lincoln UNL Institute of Agriculture and Natural Resources UNLWater Available in <https://water.unl.edu/drought/whatisdrought>. Accessed 27th November 2017.

29 *Ibid*

30 *Ibid*

electricity production, the risk of contracting waterborne diseases such as diarrhoea, a major killer of children around the world, due to use of contaminated water. Drought threatens the livelihood of people and causes widespread death and famine.

Most prone areas of drought

In Africa, countries like Zimbabwe, Angola, Ethiopia, Somalia, Swaziland and Algiers have all experienced disasters as a result of drought. In the United States of America, States like Arizona, Alabama, Louisiana, Georgia and New Mexico had similar experiences of disaster as a result of drought. In Asia, India, Madhya Pradesh, along with the western states of Rajasthan and Gujarat have suffered the effect of drought and in Europe, Southern Europe has experienced drought.

Examples of Disasters resulting from Drought

In Africa, Zimbabwe, a country formerly known as the food basket of Africa, suffered perennial shortages, erratic rains due to climate change in many years which led to severe drought in 2016.³¹ In July 2016, the then President, Mugabe, declared a state of disaster in regard to severely affected areas and declared an emergency of drought.³² A UNICEF report in 2011 stated that in Ethiopia, an estimated 8 million of Ethiopia's 60 million people were at risk due to East Africa drought recorded as one of the worst drought in decades.³³ The drought resulted in a food crisis across Kenya, Somalia, Ethiopia, and Djibouti.

According to a UNICEF report, in India, nearly 130 million people living in 12 states were seriously affected by what was termed the worst drought in 100 years.³⁴ Madhya Pradesh, and

31 Zimbabwe declares 'state of disaster' due to drought 5 February 2016 Available in <https://www.theguardian.com/world/2016/feb/05/zimbabwe-declares-state-of-disaster-drought-robot-mugabe> Accessed 30th November 2017.

32 *Ibid*

33 Drought Disaster Available in <https://www.unicef.org/drought/drought-countries.htm> Accessed 30 November 2017.

34 *Ibid*

some of the western states of Rajasthan and Gujarat and Andhra Pradesh in the south were affected by severe drought caused by failure of monsoon rains.³⁵ There were similar reports of drought in Pakistan, sparking fears of a massive humanitarian crisis³⁶ and UNICEF also having concern for three countries in Southeast Asia namely Indonesia, the Philippines and Timor-Leste.³⁷

In the United States of America, Dylan Stableford reported that Georgia, Arizona, New Mexico, Texas and some other states recorded very severe drought in 2012.³⁸ It is reported that in 2017, the Southern Europe, especially in the regions of Castile and Leon, the largest cereal growing region in Spain, has been particularly badly affected, with the effect of drought with crop losses estimated at around 60 to 70 percent.³⁹

Protective /Mitigating measures

Some of the protective measures include dams, cloud seeding, desalination, drought monitoring, land use, outdoor water-use restriction and rainwater harvesting.

³⁵ *Ibid*

³⁶ Southeast Asia Globe editorial "Southeast Asia facing severe drought" February 12, 2016 Available in <http://sea-globe.com/southeast-asia-facing-severe-drought/>. Accessed November 30th 2016.

³⁷ Dylan Stableford "U.S. declares drought-stricken states largest natural disaster area ever" July 12 2012 Available in <https://www.yahoo.com/news/blogs/lookout/us-natural-disaster-area-drought-150130308.html> Accessed on 30th November 2017.

³⁸ Dylan Stableford "U.S. declares drought-stricken states largest natural disaster area ever" July 12 2012 Available in <https://www.yahoo.com/news/blogs/lookout/us-natural-disaster-area-drought-150130308.html> Accessed on 30th November 2017.

³⁹ Isla Binnie and Paul Day "One of worst droughts in decades devastates South Europe crops" July 14, 2017 Available in <https://www.reuters.com/article/us-europe-farming-drought/one-of-worst-droughts-in-decades-devastates-south-europe-crops-idUSKBN19Z1XW> Accessed on 30th November 2017.

III. HEAT IN EXCESS

Meaning

Excessive heat or heat wave is a prolonged period of excessively hot weather, which may be accompanied by high humidity. In the United States of America, heat wave can be defined as a period of at least two consecutive days of excessive hot weather. However, the definition of heat wave vary. In North-Eastern US, heat wave is typically defined as three consecutive days where the temperature exceeds 90 degree F (32.2 degree C),⁴⁰ in Demark, and Netherlands, it exceeds 28 degree C (82.4 degree F) and in Sweden, weather exceeding 250c (77.00f). In Adelaide, heat wave is defined as five consecutive days at or above 35 degree C (95 degree F).⁴¹ Therefore, heat wave or excessive heat definition varies as the weather vary in each and every country.⁴²

Causes

A heat wave can occur in certain regions when a low pressure offshore and high pressure inland combine to form a Bergwind.⁴³ It may also occur in other regions when a high pressure system originating in the Gulf of Mexico becomes stationary just off the Atlantic Seaboard (typically known as a Bermuda High.⁴⁴

⁴⁰ Sofia Aivalioti "Electricity Sector Adaptation To Heat Waves" Sabin Center for Climate Change Law, Columbia Law School "January 2015 Available in <http://columbiaclimate.com/files/2016/06/Aivalioti-2015-01-Electricity-Sector-Adaptation-to-Heat-Waves.pdf>" Accessed on 7th December 2017.

⁴¹ Extreme heat sends SA temperatures above 40 degrees Celsius <http://www.abc.net.au/news/2015-12-17/summer-heat-spell-grips-much-of-south-australia/7037720>.

⁴² Q Yin and Jinfeng Wang "The association between consecutive days' heat wave and cardiovascular disease mortality in Beijing, China" 2017 Feb 23 in BMC Public Health. 2017; 17: 223. Available in <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5322604/> Accessed on 8th December 2017.

⁴³ "Climate Change in Africa" Climate Emergency Institute Available in https://www.climateemergencyinstitute.com/climate_change.html Accessed on 8th December 2017.

⁴⁴ Available in <https://sites.google.com/a/student.glenview34.org/horrifying-heat-waves/> Accessed on 8th December 2017.

Effects of excessive heat (heat wave)

The consequences of heat in excess can be subdivided into parts:

Health effects: Excessive heat causes: Heat exhaustion, heat stroke, heat syncope, sun burn, heat rash, thousands of deaths from hyperthermia, and psychological effects;

Sociological/economic effect: Catastrophic crop failures, widespread power outages due to increased use of air conditioning;

Physical effects: Excessive heat also do cause roads and highways to buckle, water lines to burst and power transformer to detonate (causing fire).

Most prone areas of Heat Wave/Excessive Heat

Heat wave occur mostly in Denmark, United States of America Netherlands, Western State of South Africa, Adelaide in Australia.

Examples of Disasters Resulting From Heat Wave

An example is the European Heat Wave in 2003.⁴⁵ The 2003 European heat wave, resulted in a health crisis in several countries as well as a drought which led to a crop shortage. In the Ukraine, 75% of wheat crops were lost, and at least 14,802 casualties were recorded in France alone.⁴⁶ The extreme temperatures also resulted in forest fires and counter-intuitively, even flooding.⁴⁷

Protective/ Mitigating Measures

Measures that can be taken include early warning signs, information on heat shelters and availability of water at train stations and strategic places.

45 Josef 25 Worst Natural Disasters Ever Recorded September 20 2017 Available in <http://list25.com/25-worst-natural-disasters-recorded/> Accessed on 8th December 2017.

46 Available in https://drive.uqu.edu.sa/_/maatia/files/Disaster%20Part1.pdf Accessed on 8th December 2017.

47 Josef 25 Worst Natural Disasters Ever Recorded September 20 2017 Available <http://list25.com/25-worst-natural-disasters-recorded/>.

IV. HURRICANE, ALSO CALLED TYPHOON OR CYCLONE

Meaning

Hurricane is a type of tropical cyclone. The cyclone is accompanied by thunderstorms and in the Northern hemisphere, a counter clockwise circulation of winds where the earth surface. It is an intense rotating organic weather system that processes maximum sustained winds exceeding 119km/hr (74mph). It forms and intensifies over tropical organic region. It is not the wind that causes the majority of the death and destruction, but water/ flood, from tidal surge.

Types of hurricane

Hurricane is categorized according to the strength of their winds using the Saffir-Simpson.

There are different names for different types of hurricane some of which are: Andrea, Barry, Jerry, Katrina, Nestor; Olga; Pablo; Sandy Harvey, Irma, and Maria.

Effect of hurricane

Some of the effects are:

- a. *Storm surge* – It is the fast uprising of sea level that happens when a hurricane approaches coast. Another effect is the rip tides. Rip tides are strong sea current. Heavy rainfall, tornados and high winds come with hurricane.
- b. *Economic loss and Heritage loss* – The effect of hurricanes cannot be overestimated. As a result of Hurricane Andrew in 1992, the United Nations put the Everglades in Florida in the USA on the list of World Heritage sites in Danger.⁴⁸ In 2017, Hurricane Irma was reported to have again threatened the Everglades in Florida.⁴⁹ The Everglades is acclaimed

48 Maddie Stone Why the Everglades Might Never Look the Same After Hurricane (9 October 2017) Available in Irma <https://gizmodo.com/irma-is-but-the-latest-disaster-to-strike-the-everglade-1803072231>. Accessed 30th November 2017.

49 Maddie Stone Why the Everglades Might Never Look the Same After Hurricane (9 October 2017) Available in Irma <https://gizmodo.com/irma-is-but-the-latest-disaster-to-strike-the-everglade-1803072231>. Accessed 30th November 2017.

to be “an internationally-recognized ecological treasure, home to alligators, panthers, manatees, crocodiles, more than 300 species of birds, and hundreds of rare or endemic plants.”⁵⁰

Most Prone Areas of Hurricane

In 2017, the United States of America witnessed one of the worst hurricane seasons with very “hyperactive” Atlantic Hurricane seasons which began since June 1st 2017 till November 2017. Specifically, Louisiana, New Orleans, Caribbean Island, Trinidad and Tobago, Gulf of Mexico are all prone to hurricane.

Examples of Disasters caused by Hurricane

An example of a hurricane is, Hurricane Andrew in August 1992. The storm was responsible for 65 fatalities and US \$26 billion in property damages. Hurricane Andrew became the 5th costliest hurricane in US history after Hurricanes Katrina, Wilma, and Ike. On August 25th 2017, Category 4 hurricane Harvey happened in Texas causing around \$180 billion in damage, a bit lower than the largest estimates of Hurricane Katrina.⁵¹ Hurricane Harvey flooded one-third of Houston, forcing 39,000 people into shelters and damaging 203,000 homes.⁵² In October 2017, the State of Florida in the United States of America was hit by Hurricane Irma which was a natural disaster that reached the North American shores with an estimated damage of up to \$100 billion.⁵³

In Europe, in autumn 2017, Hurricane Ophelia struck in Ireland and the United Kingdom.⁵⁴ Three people were killed,

⁵⁰ *Ibid*

⁵¹ Josef 25 Worst Natural Disasters Ever Recorded September 20th 2017 Available in <http://list25.com/25-worst-natural-disasters-recorded/> Accessed 30th November 2017.

⁵² *Ibid*

⁵³ Josef 25 Worst Natural Disasters Ever Recorded September 20th 2017 Available in <http://list25.com/25-worst-natural-disasters-recorded/>.

⁵⁴ “Hurricane Ophelia: Three people die as storm hits Ireland” BBC News 17th October 2017 Available in <http://www.bbc.com/news/uk-41627442> Accessed 7th December 2017.

22,000 people were left without electricity and internet was cut off for some households across the UK.⁵⁵ In 2014, Hurricane Gonzalo, struck the United Kingdom on October 21st causing serious problem of power in about 18, 000 homes⁵⁶ and there were cancellation of several flights.

Protective/Mitigation Measures

Some of the following measures may be adopted; planning for safe and effective evacuation, developing hurricane program training, aids, quick response and recovery and post- storm assessment.

V. LOCUST/INSECT SWARM

Meaning

A large insect that lives in hot countries and flies in large groups, destroying all plants and crops of that area. A plague of locusts is a devastating natural disaster. These infestations have been feared and revered throughout history. Unfortunately, they still wreak havoc today.

Types

Locusts are related to grasshoppers and the two insects look similar. The desert locust is a type of locust which is notorious.⁵⁷ According to *National Geographic*, “A desert locust swarm can be 460 square miles (1,200 square kilometers) in size and pack between 40 and 80 million locusts into less than half a square mile (one square kilometer).”⁵⁸ Other types of locusts which may

⁵⁵ Ophelia: What a Tropical Storm Is Doing in Europe” BBC News Available in <http://www.newsweek.com/hurricane-ophelia-what-tropical-storm-doing-europe-683647> Accessed 7th December 2017.

⁵⁶ Available in <http://www.cbsnews.com/news/battered-bermuda-cleans-up-after-hurricane-gonzalo/>.

⁵⁷ “Locust/grasshopper. Operations Guidebook Revision: 2nd January 89” US Agency for International Development Available in http://pdf.usaid.gov/pdf_docs/PNABC136.pdf Accessed November 4th 2017.

⁵⁸ “Locust” National Geographic Available in <http://channel.nationalgeographic.com/animals/bugs/articles/locust/>.

cause a disaster include the African Migratory Locust, the Red Locust, the Brown Locust and the Senegalese Grasshopper.⁵⁹

Causes

When environmental conditions produce many green plants and promote breeding, locusts can congregate into thick, mobile, ravenous swarms.

Effect

Each locust can eat its weight in plants each day, so a swarm of such size would eat 423 million pounds (192 million kilograms) of plants every day.⁶⁰ They are a severe agricultural threat. Desert locust plagues may threaten the economic livelihood, while locust swarms devastate crops and cause major agricultural damage attendant human misery, famine and starvation.⁶¹ Generally it adversely impact global food security. Locust swarms are typically in motion and can cover vast distances.⁶²

Most Prone Areas

They occur in many parts of the world, but today locusts are most destructive in sustenance farming regions of Africa. They are also found in Middle East and Asia.

Examples of Disaster as a result of Locust Swarm

It is recorded that between 1985 and 1987, after a period of severe drought, there was so much rain which created a conducive environment for the locust in the Southern Africa to the Horn of Africa and from there, across the Sahel to Northern Africa.⁶³ Locust swarm was also recorded in Karco of the Union of South Africa

59 *Ibid*

60 "About Locust" National Geographic December 15 2009 Available in <https://www.nationalgeographic.com/animals/invertebrates/group/locusts/> Accessed 7th December 2017.

61 *Ibid*

62 *Ibid*

63 *Ibid*

and Southern Botswana, Southern Zambia and Namibia.⁶⁴ Other areas that had been affected are the Sahelian nations including the Cape Verde Islands, parts of North Africa and Southwest Asia.⁶⁵

Protective/ Mitigating Measures

There are different measures adopted to mitigate against the disaster of locust swarm. Factors to be considered in adopting any measure include the size of the area affected, accessibility to the terrain, environmental concerns including human habitation. Other measures adopted include the use of aerial or ground equipment or through the application of pesticide for locust control.

VI. TORNADO

Meaning

A tornado is a very narrow, violently rotating column of air that extends from the base of a cumuliform cloud (such as a thunderstorm) to the ground.⁶⁶ It is a powerful column of winds around a center of low atmospheric pressure. It looks like a large black funnel hanging down from a storm cloud. The narrow end will move over the earth, wiping back and forth. The wind inside a tornado spiral inward and upward with a lot of speed and power.⁶⁷ It creates an internal vacuum that then sucks up anything it passes over. When the tunnel touches a structure, the fierce winds have the ability to tear it apart. This makes the tornado the most dangerous storm known to mankind. A tornado can form quickly, sometimes in a minute or less. It can travel across the ground at high speed, and then just suddenly vanish.⁶⁸

64 *Ibid*

65 *Ibid*

66 "Severe Weather 101" National Severe Storm Laboratory Available in <http://www.nssl.noaa.gov/education/svrwx101/tornadoes/> Accessed on 9 December 2017

67 The Tornado June 29 1998 Available in www.tsgc.utexas.edu/stars/tornado.html Accessed on 9th December 2017.

68 Available in http://www.academia.edu/23710233/OOPL_Slides_ENVIRONMEN TAL_HAZARDS Accessed on 9th December 2017.

Types/Classification

There are basically two types. These are classic tornadoes which is said to form from the mesocyclone of a supercell⁶⁹ and the land spouts tornadoes which is of a weaker type.⁷⁰

Causes of Tornado

Tornadoes conditions are formed when different temperature and humidity form to cause thunderclouds.

There has been some discussions and possible linkages between climate change and tornado outbreak, as nearly almost all always happen following a severe weather event.⁷¹

Effects

The effect of tornadoes could be environmental as it could cause destruction of buildings and trees. It could also be economic as the effect could result in food shortage and rebuilding of major structures. Injury and loss of lives are very common effects of tornadoes.

Most Prone Areas

The most tornado-prone area in the United States is called Tornado Alley.⁷² The states that are mostly affected include Texas, Oklahoma, Kansas and Nebraska. Other regions prone to tornadoes include Argentina, Australia, Bangladesh, Canada, Germany, and the United Kingdom.⁷³

69 Available in http://www.answers.com/Q/How_many_types_of_tornado_are_there Accessed on 9th December 2017.

70 *Ibid*

71 Karl Mathiesen "Extreme weather already on increase due to climate change, study finds" 27 April 2015 Available in <https://www.theguardian.com/environment/2015/apr/27/extreme-weather-already-on-increase-due-to-climate-change-study-finds> Accessed on 9th December 2017.

72 "Tornado Alley: The Most Tornado Prone Region in the World" available in <http://www.worldatlas.com/articles/what-is-tornado-alley-where-are-tornadoes-most-likely-to-occur-where-is-the-tornado-belt.html> Accessed on 4th November 2017

73 "Severe Weather 101" National Severe Storm Laboratory Available in <http://www.nssl.noaa.gov/education/svrwx101/tornadoes/> accessed on 8th December 2017.

Examples of Disaster as a result of Tornadoes

On May 27th 1997, it was reported that multiple tornadoes resulting in disaster occurred in the Williamson and Travis counties in central Texas causing injuries, deaths, and an estimated 20 million dollars in personal and commercial insured losses.⁷⁴ Between April 25th and 28th, 2011, a tornado resulted in a disaster known as the "Super Outbreak."⁷⁵ Erdman reports that this occurrence was reported to be one of the worst tornado outbreaks in U.S. history.⁷⁶ The report stated that the tornado claimed more than 300 lives, injured 2,775 and was responsible for \$10.8 billion in total damage, making it the costliest tornado outbreak in U.S. history. In 2013, Oklahoma experienced back-to-back tornado events; the deadliest was in Moore, Oklahoma, where 25 people died and almost 400 were injured.⁷⁷

Protective/Mitigating Measures

While you can't stop a tornado from hitting, there are mitigating measures against the devastating effects. In areas prone to tornadoes safety measures such as staying prepared by having safety kits, like batteries, torch, water, food, staying tuned to weather announcements and knowing where to shelter, like in the basement, are some of the measures.⁷⁸ Flying and falling objects are the major causes of injuries and death during a tornado. It is therefore important that adequate preparation is made when there is an impending tornado.

74 "Tornado Disaster -- Texas, May 1997" Centers for Disease Control and Prevention MMWR November 14, 1997 / 46(45);1069-1073 Available in <https://www.cdc.gov/mmwr/preview/mmwrhtml/00049839.htm> Accessed on 5th December 2017.

75 Jon Erdman "April 2011 Tornado Super Outbreak: 17 Things That Shocked Us Most" Tornado News Available in <https://weather.com/storms/tornado/news/april-2011-superoutbreak-tornadoes> Accessed 5th December 2017.

76 Jon Erdman "April 2011 Tornado Super Outbreak: 17 Things That Shocked Us Most" Tornado News Available in <https://weather.com/storms/tornado/news/april-2011-superoutbreak-tornadoes> Accessed 5th December 2017.

77 "Staying Safe in a Tornado" Centers for Disease Control and Prevention Available in <https://www.cdc.gov/features/tornadosafety/index.html> Accessed 5th December 2017.

78 "Staying Safe in a Tornado" Centers for Disease Control and Prevention Available in <https://www.cdc.gov/features/tornadosafety/index.html>.

VII. TSUNAMI

Meaning

Tsunami is a Japanese word with the English translation: "harbor wave." It is derived from a Japanese term meaning wave ("nami") in a harbour ("tsu").⁷⁹ A tsunami is a series of ocean waves with very long wavelengths (typically hundreds of kilometers). Tsunamis has been referred to as "tidal waves." Tsunamis have no connection with tides; the popular name, tidal wave, is entirely misleading.⁸⁰ A tsunami's impact upon a coastline is dependent upon the tidal level at the time a tsunami strikes, tsunamis are unrelated to the tides. (Tides result from the gravitational influences of the moon, sun, and planets).

Types

According to a report by the International Tsunami Information Center of UNESCO, tsunamis can be classified into the following categories. These are local tsunami, meteorological tsunami, micro tsunami, ocean-wide tsunami, regional tsunami, teletsunami or distant tsunami.⁸¹

Causes

According to Windle, tsunami is caused by large-scale disturbances of the ocean, such as earthquakes, landslide, volcanic eruptions, explosions, meteorites.⁸² It is further stated that for tsunamis that are generated by underwater earthquakes, the amplitude (i.e. wave height) of the tsunami is determined by the amount by which the

79 Available in 2017 International Tsunami Information Center | A UNESCO/IOC-NOAA Partnership Available in http://itic.ioc-unesco.org/index.php?option=com_content&view=article&id=1860:1-tsunami-classification&catid=2118&Itemid=2441 Accessed 7th December 2017.

80 *Ibid*

81 *Ibid*

82 Lauren Windle "What is a tsunami, how are they formed and what are some of the worst disasters?" *The Sun* 7 September 2017 Available in <https://www.thesun.co.uk/tech/1992625/tsunami-how-formed-earthquake-worst-disasters/> Accessed 7th December 2017.

sea-floor is displaced. Similarly, the wavelength and period of the tsunami are determined by the size and shape of the underwater disturbance.⁸³

Effects

Tsunamis are among the most devastating natural calamities. The earthquake-generated waves can quickly engulf low-lying land and bring widespread destruction and death. They can deposit sand and debris far inland from where they came ashore.

Tsunamis have great erosion potential, stripping beaches of sand that may have taken years to accumulate and undermining trees and other coastal vegetation. Capable of inundating, or flooding, hundreds of meters inland past the typical high-water level, the fast-moving water associated with the inundating tsunami can crush homes and other coastal structures. The effects of a tsunami are devastating. The effects of the tsunami on the country during this period range from destruction and damage, death, injury, millions of dollars in financial loss, and long-lasting psychological problems for the inhabitants of the region.

Tsunami victims suffer psychology problems in the days and weeks after the destruction. This could even continue for years – often their entire life time. A study by the World Health Organisation on survivors of the tsunami in Sri Lanka on December 24th 2004 confirmed this.⁸⁴

83 *Ibid*

84 Frank Neuner and Elisabeth Schauer, Claudia Catani, Martina Ruf and Thomas Elbert Post-tsunami Stress: A Study of Posttraumatic Stress Disorder in Children Living in Three Severely Affected Regions in Sri Lanka Available in <https://pdfs.semanticscholar.org/6691/3c8c8dbec95010126f4d4f25793dea3cd83d3.pdf> Accessed on 7th December 2017.

Most Prone Areas

Although tsunamis are seen in every ocean on Earth, 80 percent of it occur in the Pacific "Ring of Fire" – The Pacific Ocean.⁸⁵ Other areas prone to tsunamis are Kolkata, India, Tokyo-Yokohama, Japan,⁸⁶ Coast of Chile, Southern part of New Zealand, coast of Mexico and Turkey.⁸⁷

Examples of Disaster as a result of Tsunami

One of the recorded disasters that occurred as a result of tsunami is the Indian Ocean Tsunami of 2004 which occurred on December 26th 2004. According to a UNESCO report, the majority of that Indian Ocean tsunamis were generated by earthquakes, volcanic eruptions, landslides, and unknown causes and the death toll was about one thousand people.⁸⁸ In 2011, the Tohoku earthquake and tsunami took place with 15,884 deaths resulting in the tsunami, making it one of the most expensive natural disasters ever recorded, costing the US equivalent of \$300 billion.⁸⁹

Protective/mitigating

Two ways to find out if a tsunami may be coming and which is protective are discussed below.

1. Natural warning

Strong ground shaking, a loud ocean roar, or the water receding unusually far exposing the sea floor are all nature's warnings that a tsunami may be coming.

⁸⁵ <https://borgenproject.org/10-worst-tsunamis/>.

⁸⁶ Jenni Ryall "These are the riskiest cities in the world for natural disasters" New.com Available in <http://www.news.com.au/world/these-are-the-riskiest-cities-in-the-world-for-natural-disasters/news-story/6b59d0d41548b999869a0f344a0d10cb> Accessed 5th December 2017.

⁸⁷ Lauren Windle "What is a tsunami, how are they formed and what are some of the worst disasters?" The Sun 7 September 2017 Available in <https://www.thesun.co.uk/tech/1992625/tsunami-how-formed-earthquake-worst-disasters/> Accessed 7th December 2017.

⁸⁸ "Indian Ocean Tsunami 2004" http://itic.ioc-unesco.org/index.php?option=com_content&view=category&id=1136&Itemid=1373.

⁸⁹ <https://borgenproject.org/10-worst-tsunamis/>.

2. Official warning

A tsunami warning may be issued. Tsunami warnings might come via radio, television, telephone, text message, door-to-door contact by emergency responders, NOAA weather radios, or in some cases, by outdoor sirens.

VIII. VOLCANIC ERUPTION

Meaning

The word 'volcano' is derived from the name 'volcano', a volcanic island in the Aeolian island of Italy, whose name in turn originates from Vulcan, the name of a god of fire in Roman mythology.⁹⁰ A volcano is an opening, or rupture in a planet's surface or crust which allows hot magma, volcanic ash and gases to escape from the magma chamber below the surface.

Types of volcanic eruption

The variety of volcanic eruption makes them very difficult to classify, for this reason they are placed into two general categories:

Explosive Volcanoes

Volcanoes are explosive where magma are produced by the melting of subducted oceanic plates and other materials which is thicker (and more viscous), consequently blocking magma conduit inside the volcano, traps and compresses gases, causing pressure to build and creating conditions for a possible explosive eruption. An example of those that are explosive is Mount Helens.

Effusive Volcanoes

Effusive volcanic eruptions such as Hawaii on the other hand are relatively gentle and produce enormous volumes of lava annually. They produce low viscosity magma (with large releases of gases) that is very fluid and cools to form a dark basaltic rock.

⁹⁰ Amina Alhassan "Volcanoes' science of violence" June 18 2011 Available in <https://www.dailytrust.com.ng/news/general/volcanoes-science-of-.../6956.html> Accessed on 5th December 2017.

Causes

Volcanoes erupt because of density and pressure. In a report, the cause of volcanic eruption that causes disaster was stated thus:

The lower density of the magma relative to the surrounding rocks causes it to rise (like air bubbles in syrup). It will rise to the surface or to a depth that is determined by the density of the magma and the weight of the rocks above it. As the magma rises, bubbles start to form from the gas dissolved in the magma. The gas bubbles exert tremendous pressure. This pressure helps to bring the magma to the surface and forces it in the air, sometimes to great heights.⁹¹

Effects of volcanic eruptions

Volcanic eruptions indeed produce hazardous materials which have tremendous effects on the environment, climate and physical health of the victims so exposed and they are associated with deterioration of social and economic conditions. These effects include problems of respiratory systems (clogging lungs), eyes and skin, psychological effects, injuries, transportation and communication problems, building collapses and power outage etc. However, soils around volcanoes have been found to be good sites for crops production as the soil therein tends to be fertile.

Most Prone Areas of Volcanoes

The "Ring of Fire" that encircles the Pacific Ocean – which stretches up the West Coast of the Americas, around and across to Asia, looping down to the east of Japan, before overwhelming much of Indonesia and the Philippines and whipping around Australasia – boasts the most, with 452 volcanic eruptions.⁹²

91 "Why are there volcanoes? Why do they erupt?" Oregon state University Available in <http://volcano.oregonstate.edu/why-are-there-volcanoes> Accessed on 5th December 2017.

92 Huge Morris "Mapped : The countries with the most volcanoes – where does Indonesia rank" 27 November 2017 Available in <http://www.telegraph.co.uk/travel/maps-and-graphics/mapped-the-worlds-most-dangerous-volcanoes/>

Mount Agung, on the Indonesian island of Bali,⁹³ United States of America, Russia, Japan, Chile, Ethiopia, and Papua New Guinea.

Examples of Volcanoes resulting in Disaster

One of the volcanic eruptions resulting in a disaster is the Nevado Del Ruiz volcano eruption in Colombia in 1985.⁹⁴ It is reported that Nevado Del Ruiz, known locally as "the Sleeping Lion", had not erupted for nearly 150 years.⁹⁵ The stratovolcano is said to be the second largest volcano-related disaster of the 20th century.⁹⁶ The volcano produced an enormous flow that buried and devastated the town of Armero in Tolima on November 13th 1985.⁹⁷ What became known as the "Armero tragedy" caused the death of 25,000 people.⁹⁸

Protective/ Mitigating Measures

To prevent or at least reduce the impact of this hazard, a series of measures must be taken before, during and after a volcanic eruption. The preparation of hazard maps helps to determine whether a volcano is potentially hazardous and to assess the risk. Monitoring of volcanoes by satellite needs to increase in order to detect possible changes. The public must be informed and educated on the result of possible dangers. Emergency and evacuation plans must be worked out.

93 Huge Morris "Mapped : The countries with the most volcanoes – where does Indonesia rank" 27th November 2017. Telegraph Available in <http://www.telegraph.co.uk/travel/maps-and-graphics/mapped-the-worlds-most-dangerous-volcanoes/>

94 "1985: Volcano kills thousands in Colombia" BBC on this day Available in http://news.bbc.co.uk/onthisday/hi/dates/stories/november/13/newsid_2539000/2539731.stm

95 *Ibid*

96 "10 years since Dec 26, 2004 Indian Ocean Tsunami" International Tsunami Information Center Available in http://itic.ioc-unesco.org/index.php?option=com_content&view=category&id=1136&Itemid=1373.

97 *Ibid*

98 *Ibid*

IX. FLOOD

Meaning

Flood can be defined as an overflow of large quantities of water onto a normally dry land. Floods make an enormous impact on the environment and society.

Types/ Classification

There are different types of flood or classification of flooding. Floods may be classified as flash floods, rapid on-set floods and slow on-set floods.⁹⁹ Flash floods are extremely dangerous. Flood is also classified as coastal, urban, riverine, fluvial, reservoir and pluvial flooding.¹⁰⁰ Flood has also been classified as riverine, dam failure and storm surge.¹⁰¹

Causes of Flooding

Flooding happens in many ways due to overflow of streams, rivers, lakes or oceans or as a result of excessive rain.¹⁰² Flooding may be caused by a number of natural causes or physical factors.

Effects of Flooding

Floods destroy drainage systems in cities, causing raw sewage to spill out into bodies of water, buildings can be significantly damaged and even destroyed, toxic materials such as paint, pesticide and gasoline can be released into the rivers, lakes, bays, and ocean, killing maritime life. Floods may also cause millions

99 Chris Dolan "Hazard-Wise: Classroom Resources for Teachers on Natural Hazards & Disasters" Available in <https://books.google.com.ng/books?isbn=0788127314> Accessed on 8th December 2017.

100 James Hubbard "Types of flood and flooding impact" Ambiantal Environment assessment September 20th, 2012 <http://www.ambiantal.co.uk/types-of-flood-and-flooding-impact/>.

101 "Types of Flooding" State Emergency Service Available in <https://www.ses.vic.gov.au/get-ready/floodsafe/types-of-floods>.

102 River flooding and management BBC Available in http://www.bbc.co.uk/schools/gcsebitesize/geography/water_rivers/river_flooding_management_rev1.shtml.

of dollars' worth of damage to a city, both evicting people from their homes and ruining businesses. Floods cause significant amounts of erosion to coasts, leading to more frequent flooding if not repaired. Loss of livestock and farmland are serious effects in countries that are dependent on agriculture.

There are benefits that may accrue from flooding. Floods do make a slight positive impact on the environment. Floods spread sediment containing beneficial nutrients to topsoil that might never arrive there otherwise.

Areas prone to Flooding

Countries prone to flood include Bangladesh, China, India, and Cambodia. Any plain low-lying area adjacent a river, lagoon or lake is also more likely to have floods anytime the water level rises.

Examples of Disaster as a result of Flooding

In 1928, the Saint Francis Dam in Los Angeles was filled with 12.5 billion gallons of water — enough water for one year for a population of 1.2 million people. However, on March 12th 1928, the dam broke, unleashing a 78 foot wall of water. It obliterated houses, ranches, automobiles, animals, and people. In roughly one hour, more than 500 people were killed and Santa Paula was overrun by water.¹⁰³

On Friday, April 18th 1997, the Red River flooded over the dikes into Grand Forks, North Dakota¹⁰⁴ spreading over a large area of Grand Forks and East Grand Forks. About 60,000 people were rendered homeless and downtown Grand Forks was left in flames. The damage was so extensive that it was weeks before people could return and rebuild their homes, and their lives.¹⁰⁵

103 Case Study: St. Francis Dam (California, 1928) Available in <http://damfailures.org/case-study/st-francis-dam-california-1928/> Accessed on 7th December 2017.

104 "1997 Floods in the Red River of the North and Missouri River Basins in North Dakota and Western Minnesota" US Geographical Survey Available in <https://pubs.usgs.gov/of/1997/0575/report.pdf> Accessed on 7th December 2017.

105 *Ibid*

The Mozambique flood that took place between February and March 2000 after very heavy rain claimed over 800 lives.¹⁰⁶ Another flood claiming lives took place in January 2013,¹⁰⁷ and in February 2017, there was another disaster in Mozambique as a result of flood.¹⁰⁸

Protective/ Mitigating Measures

Flood management techniques include river engineering, afforestation and planning controls to restrict urban development on floodplain.

X. EARTHQUAKE

Meaning

An earthquake (also known as a quake, tremor or temblor) is the result of a sudden release of energy in the Earth's crust that creates seismic waves. Earthquakes are measured using observations from seismometers.

Types/classification of Earthquakes

Earthquake could be classified according to magnitude, size and intensity. According to magnitude, the earthquake can be classified as great, major, strong, moderate, light, minor and insignificant.¹⁰⁹ According to size and intensity, they are classified as fore-shock, main-shock and after-shock.

106 Anita Powell! February 24 "Deadly Floods Hit Mozambique" Available in <https://www.voanews.com/a/united-nations-reports-devastating-damages-after-mozambique-flood/1595319.html> Accessed on 8th December 2017.

107 *Ibid*

108 Tomas Cumbana "Mozambique: Storm Dineo Kills Seven and Destroys 20,000 Homes" Newsweek 17 February 2017 Available in 013http://www.newsweek.com/mozambique-storm-dineo-557810 Accessed on 30th November 2017.

109 "How earthquakes are measured" CBS NEWS Available in <https://www.cbsnews.com/pictures/how-earthquakes-are-measured/3/> Accessed on 30 November 2017; "earthquake magnitude - Michigan Technological University" Available in www.gco.tntu.edu/UPSeis/magnitude.html.

Causes of Earthquakes

There are different causes of earthquake. It could be as a result of natural cause by movement in the earth crust as a result of geological fault, volcanic eruptions and landslide.¹¹⁰ Stress built up at point of weakness may cause a rock to deform. Earthquake are said to last for a few minutes and this is not the immediate cause of the disaster which follows. It is the aftermath triggered by it that results into disaster. These include fire, flood, tsunami, building collapse, gas explosion, fire, avalanches and such other secondary causes.

The cause of earthquake can also be induced due to activities on land. Activities such as mining, drilling, blasting could trigger off an earthquake.

Most earthquake-related deaths are caused by the collapse of structures and the construction practices play a tremendous role in the death toll of an earthquake.¹¹¹

Effects of Earthquakes

Earthquakes can result in landslides, tsunamis, fires due to gas rupture, collapsed buildings and loss of lives.

Areas Prone to Earthquakes

Botswana,¹¹² Mexico, Tajikistan in India and the Indian subcontinent are generally prone areas of earthquake.

110 Peace Ezebuio "Earthquake: Everything you must know about this catastrophic disaster" Available in <https://answersafrica.com/earthquake-everything-you-must-know-about-this-catastrophic-natural-disaster.html> Accessed 30th November 2017.

111 Allen, Clarence R. and Nordquist, John M. Foreshock, Main Shock, and Larger Aftershocks of the Borrego Mountain Earthquake. In: The Borrego Mountain Earthquake of April 9, 1968. ((1972) Geological Survey Professional Paper. No.787. United States Geological Survey, Washington, DC, pp. 16-23. Available in <http://resolver.caltech.edu/CaltechAUTHORS:20140917-144224324> Accessed 30th November 2017.

112 Joey Millar "Botswana rocked by strongest EVER earthquake - hours after South Africa struck" April 3rd 2017 Available in <https://www.express.co.uk/news/world/787427/earthquake-botswana-largest-ever-south-africa> Accessed 6th December 2017.

Examples of the earthquake causing disaster

Since 1138, earthquakes has resulted in disaster. The Aleppo Earthquake occurred on August 9th 1138.¹¹³ The disaster was named after the city of Aleppo in Syria, now called Halab. Its death toll was approximated at 230,000 as the city was destroyed along with its surrounding areas.¹¹⁴ The continent of Asia has recorded many cases of earthquake disasters. The Great Tokyo Earthquake which happened in Kanto, Japan, on September 1 1923 was equally devastating.¹¹⁵ In China, the Haiyuan Earthquake also known as the 1920 Gansu Earthquake, occurred with a death toll of 240,000, on December 16th 1920.¹¹⁶ In another recorded disaster in China, the Great Tangshan earthquake regarded as the deadliest earthquake of the 20th century, occurred on July 27th 1976 causing the death of 240,000 people and injuring 164,000 more.¹¹⁷ In the Caribbean's, Haiti suffered from a disaster in 2010 where it was reported that according to official estimates, 300,000 were also injured, 1.3 million displaced, 97,294 houses destroyed and 188,383 damaged.¹¹⁸ In Europe, earthquake struck, on May 11th 2011, and at least eight people were reported dead when the quake rocked southern Spain and 15,000 people were rendered homeless.¹¹⁹ In Africa, a Nabro volcanic eruption happened in the southern red region of Eritrea on June 12th 2011 affecting about 5000 people.

113 NBC News.com "The top 10 deadliest earthquakes in history Available in http://www.nbcnews.com/id/42029974/ns/world_news-asia_pacific/t/top-deadliest-earthquakes-history/#.Wh_TpbcljIU.

114 *Ibid*

115 *Ibid*

116 <http://list25.com/25-worst-natural-disasters-recorded/>

117 <http://list25.com/25-worst-natural-disasters-recorded/>

118 NBC News.com "The top 10 deadliest earthquakes in history Available in http://www.nbcnews.com/id/42029974/ns/world_news-asia_pacific/t/top-deadliest-earthquakes-history/#.Wh_TpbcljIU

119 "Spain earthquake: up to 15,000 left homeless The Telegraph Available in <http://www.telegraph.co.uk/news/worldnews/europe/spain/8508784/Spain-earthquake-up-to-15000-left-homeless.html> accessed 30th November 2017

Mitigation/ Prevention of Earthquake

It may not be possible to prevent the occurrence of an earthquake. However, there can be ways to mitigate the effect. This may include early warning, putting in safety structures in buildings in earthquake-prone areas and proper planning.

XI. FAMINE

Meaning

A famine is a widespread scarcity of food. Nearly every continent in the world has experienced a period of famine throughout history.

Types/classification

There is no definite classification for famine. The classification available on famine is that leading to famine.¹²⁰ This is based on the level of food shortage. The classification is as follows – minimal stage is the phase 1, stressed stage is phase 2, crisis stage is phase 3, emergency stage is phase 4 and famine is the stage 5.¹²¹

Causes

Famine is caused by several factors including crop failure, population unbalance or government policies. Famine may be as a result of a drought. Long-term climate change is a contributing factor to the occurrence of drought. Famines result from a combination of "triple failure": production failure, access failure and response failure.¹²²

120 "Integrated Phase Classification" FEWS NET Available in <http://www.fews.net/IPC> Accessed on 7th December 2017.

121 *Ibid*

122 "Famine in Somalia: causes and solutions" Oxfam International" Available in <https://www.oxfam.org/es/node/3573> Accessed on 6th December 2017.

Effects of famine

This phenomenon is usually accompanied or followed by regional malnutrition, starvation, epidemic, and increased mortality.

Areas prone to famine

Some countries, particularly in sub-Sahara Africa and Ethiopia¹²³ continue to have extreme cases of famine.

Examples of the famine causing disaster

The famine that occurred in Ethiopia and Eritrea between 1983 and 1985 for a period of two years was reported to claim over 400, 000 lives.

Protective/Mitigating measures

These measures could be long term and short term. In a famine situation, humanitarian aid is very important as a short term measure. On the other hand, diversification of the economy and strengthening local food system resilience is a long term measure.¹²⁴

XII. THUNDERSTORM*Meaning*

Thunderstorms are simply electrical storms. They are characterized by the presence of lightning and its acoustic effect on the Earth's atmosphere.

Causes

Thunderstorms result from the rapid upward movement of warm moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses,

and forms cumulonimbus clouds (these are clouds that can reach heights of over 20km). Furthermore, as the rising air reaches its dew point, water droplets form and begin falling the long distance through the clouds towards the Earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at the Earth's surface and causes strong winds associated commonly with thunderstorms. Generally, thunderstorms require three conditions to form: moisture, an unstable air mass and a lifting force (heat).

The thunderstorm life cycle includes; The developing stage, maturing stage and the dissipating stage.

Type/Classification

There are 3 types of thunderstorms. They include the following:

- i. Single-cell thunderstorms occur in temperate regions of the world.
- ii. Multicell cluster thunderstorms: These types of storms are stronger than the single-cell storms.
- iii. Multicell lines thunderstorms: This kind of storm is also known as "Wind of the Stony Lake." Supercell thunderstorms is the most powerful type of thunderstorm.

Effects

Thunderstorms result in heavy precipitation. Thunderstorms disrupt human life in more than one way. The felling of millions of trees, deaths due to lightning hazard and wind shear are just some of the manifestations. All thunderstorms produce lightning which often strikes away from the area where it is raining and is known to fall as far as 10 miles away from the rainfall area.

Areas Prone to Thunderstorm

Roughly, there are about 1800 thunderstorms occurring at any moment across the world and Kampala, Uganda, holds the record of about 240 thunderstorm per day, annually. Asia is also an area prone to thunderstorm.

123 "Africa's famine: Country by country" BBC News Available in <http://news.bbc.co.uk/2/hi/africa/2027079.stm> Accessed on 7th December 2017.

124 Suresh Babu and Paul Dorosh "Strategies for preventing recurring famines and building resilient food systems" April 6th, 2017 International Food policy Research Institute Available in <http://www.ifpri.org/blog/strategies-preventing-recurring-famines-and-building-resilient-food-systems>. Accessed on 6th December 2017.

Disasters caused as a result of Thunderstorm

Examples of disasters include a thunderstorm in 2007, in Ushari Dara, a remote mountain village in north-western Pakistan that killed 30 people.¹²⁵ The crash of LANSIA Flight 508 which killed 91 people and a fuel explosion in Dronka, Egypt caused by lightning in 1994 which killed 469.¹²⁶

Protective and Mitigating Measures

Thunderstorm cannot be prevented. However, the effects can be mitigated. Protective measures in a thunderstorm situation is best done and more effective before the occurrence. Avoiding the use of electronic gadgets during rainfall, use of proper roofing materials during construction, securing roof tops and doors, staying indoors and if necessary, evacuation and having an emergency survival kit ready are some measures to mitigate the effects of thunder.

B. HUMAN/MAN-MADE DISASTER

They are as a result of human intent, error or as a result of failed systems. Often, these are as a result of neglect or ignorance and over the years, such disaster have claimed several lives. They are human-caused events that occur in or close to human settlements. Disasters having an element of human intent or negligence are called man-made disasters. They include, civil disorder, chemical/oil spill, toxic/hazardous waste, human stampede, war, mass murder, riots, terrorists accidents, fire: bush fire, wild fire, firestone, power outage, structural collapse, dam failure, telecommunication outage, plane, rail, and auto crashes. These man-made disasters can further be classified into technological disasters, sociological and transportation disasters. Some of these events can also occur as the result of a natural disaster. A few of these man-made disasters are discussed below.

¹²⁵ "Lightning kills 30 people in Pakistan's north". Reuters. 2007-07-20. Accessed on 7th December 2017.

¹²⁶ Evans, D. "An appraisal of underground gas storage technologies and incidents, for the development of risk assessment methodology" (PDF). British Geological Survey. Health and Safety Executive: 121. Retrieved 2008-08-14.

i. Arson/Fire*Meaning*

A fire has been defined by the UCL Estate Department as "an undesirable event which emits heat, smoke and/or flame, which has the potential to cause damage, may require intervention either mechanical or human or has a cost implication."¹²⁷

Setting fire with malice to property is known in legal parlance as Arson. It is when a person deliberately or intentionally set fire to a property in order to destroy it, with a criminal intent. A fire disaster has been defined as an event involving more than 25 deaths.¹²⁸

The Uniform Crime Report (UCR) of the Federal Bureau of Investigation defines arson as: "any wilful or malicious burning or attempt to burn, with or without intent to defraud, a dwelling house, public building, motor vehicle or aircraft and personal property of another."¹²⁹

Types/Classification of Fire

Fire can be classified as natural, accidental, incendiary or origin not known.¹³⁰ Fires have different classification. They include forest fire, wild/bush fire and according to the intensity of the fire, fire is classified as Class A, B, C, D.

Causes of Fire

Lack of prevention and safety regulations and equipment like fire detecting system and fire safety equipment are known causes

¹²⁷ UCL Estates Construction, Maintenance & Fire Safety Available at <http://www.ucl.ac.uk/estates/maintenance/fire/incidents/> accessed on 8th December 2017.

¹²⁸ M. Cavallini, M.F. Papagni, and F.W. Baruffaldi Preis "Fire Disasters in the Twentieth Century" 2007 Jun 30; 20(2): 101-103 Available in <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3188063/> Accessed on 6th December 2017.

¹²⁹ M. Cavallini, M.F. Papagni, and F.W. Baruffaldi Preis "Fire Disasters in the Twentieth Century" 2007 Jun 30; 20(2): 101-103 Available in <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3188063/> Accessed on 6th December 2017.

¹³⁰ Thomas J. Gardner, Terry M. Anderson, *Criminal Law Cengage Learning*, pg 418

of fire. Bad planning and defective installation in construction can cause fire. Explosion of flammable materials can cause a fire disaster. In recent times, terrorist criminal activities are causes of fire.

Effects of Fire

Apart from the tangible effect on man which include physical burns, there are mental and psychological effect, there is also the effect on property.¹³¹ There is also the effect on the natural environment and ecosystem. Apart from the adverse effect of contamination of water, the effect may however be positive. The burning of forest habitat by fires can serve a number of important and beneficial ecological functions such as maintaining vegetation succession regimes and contributing to soil fertility.¹³²

Areas Prone to Fire

The areas include Trinidad and Tobago,¹³³ Australia, with an average of 2,000 wildfires a year,¹³⁴ and South of France.¹³⁵ In Nigeria, Kwara State in Northern Nigeria has been recognised as a fire-prone area.¹³⁶

Disasters Caused as a Result of Fire

In Europe, the Barcelona fire in 1987, and in 1988, the fire disaster in London are examples of devastating fire disasters in Europe

131 Drew Martin, Mai Tomida, Brian Meacham "Environmental impact of Fire" *Fire Science Reviews* December 2016, 5:5 Available in <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3188063/> Accessed on 6th December 2019.

132 De Bano, L.F., Neary, D.G. and Ffolhott, P.F. *Fire Effects of Ecosystems*. (1998) New York: John Wiley and Sons.

133 Fires Available in <http://www.odpm.gov.tt/node/19> accessed on 6th December 2017.

134 Natural Disaster Association <http://www.n-d-a.org/fire.php> accessed on 6th December 2017.

135 *Ibid*

136 "Kwara Leads in Fire Disasters | NEMA Nigeria" Available in nema.gov.ng/kwara-leads-in-fire-disasters accessed on 6 December 2017

due to terrorist attacks.¹³⁷ In 1984, there was a LPG explosion in Mexico resulting in many deaths. In June 2017, the Grenfell Tower fire disaster occurred becoming one of the deadliest fire incidents in the 20th Century.¹³⁸ On December 7th 2017, the State of California was on fire resulting into loss of properties and life.¹³⁹

Protection/Mitigating Measures

Regular inspection and servicing fire equipment, installation of fire alarms, quick evacuation are a few measures to mitigate or prevent fire or the effects. In the construction of buildings, the use of fire resistant material in construction, for example, concrete bricks as opposed to wood, is another preventive measure and the practice of storing flammable items such as fuel, wood and paint away from important structures such as dwelling spaces are some of the preventive measures identified.¹⁴⁰

ii. Oil Spill

Meaning

An oil spill is a form of pollution and is a phenomenon common to oil producing areas around the globe. It is the release of a liquid petroleum hydrocarbon into the environment (especially the marine areas) mostly due to human activities.

Oil spills at sea are generally much more damaging than those on land, since they can spread for hundreds of nautical miles in a thin oil slick which can cover beaches with a thin coating of oil.

137 Available in <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3188063/> Accessed on 6th December 2017.

138 "The Latest: London Fire Deadliest in UK Since 20th Century" *US News* <https://www.usnews.com/news/.../the-latest-moment-of-silence-for-london-fire-victims> London Fire Deadliest in UK Since 20th Century.

139 Richard Halsey "Why are California's homes burning? It isn't natural disaster it's bad planning" *Los Angeles Times* 7 December 2017 Available in <http://www.latimes.com/opinion/op-ed/la-oe-halsey-socal-fires-why-20171207-story.html> accessed on 8th December 2017.

140 <http://www.odpm.gov.tt/node/19>

This can kill sea bird, mammals, shellfish and other organisms it coats. Oil spills on ground are more readily containable if a makeshift earth dam can rapidly bulldoze around the spill site before most oil escapes.

Types/Classification

Oil spill may be classified according to geographical source. Oil spill may also be as a result of deliberate or routine or operational discharges of ships. Oil spill has also been classified as Class A, B, C, D and non petroleum/non fluid oil.¹⁴¹

Causes of Oil Spills

Oil spills can be caused by many factors. Carelessness or deliberate dumping by humans and natural causes such as floods, hurricanes, and storms are a few of them. The majority of the accidents occur due to human error or carelessness, which fall under controlled factors. High incidence of oil spills and marine accidents are caused by human error. Maritime transportation has grown steadily and the quantity of illegal oil discharges has grown with the volume of traffic.¹⁴² The term 'oil spill' is usually applied to marine oil spills, where oil is released into the ocean or coastal waters; but spills may also occur on land. Oil spills may be due to the release/escape of crude oil from drilling rigs, oil wells, tankers and offshore platforms, as well as the spills or refined petroleum products (such as diesel gasoline etc.) or the spill of any refuse or waste oil.¹⁴³ Oil spills may result from intentional or unintentional releases into oceanic or coastal waters. According to Baker, other causes include blowout, pipeline failure, road and

141 Jennifer King "Types of Oil Spills" Sciencing April 25th 2017 Available in <https://sciencing.com/types-oil-spills-6593214.html> Accessed on 6th December 2017; See also "Types of Crude Oil" EPA Available in <https://www.epa.gov/emergency-response/types-crude-oil> Accessed on December 6th 2017.

142 <http://ieeexplore.ieee.org/abstract/document/6352042?reload=true>

143 Jennifer King "Types of Oil Spills" Sciencing April 25th 2017 Available in <https://sciencing.com/types-oil-spills-6593214.html> Accessed on 6 December 2017; See also "Types of Crude Oil" EPA Available in <https://www.epa.gov/emergency-response/types-crude-oil> Accessed on December 6th 2017.

rail accidents.¹⁴⁴ Lack of regular maintenance of the pipelines and storage tanks, oil production operations, engineering drill account for some cases of oil spill. Sabotage has also been identified as a cause of oil spill.¹⁴⁵ In Nigeria, oil bunkering, resulting in break of pipes to steal oil, is a major cause of this hazard.¹⁴⁶

Human mistakes are not the only reason for such accidents. They may also occur due to break down of machineries or intentional spills due to vandalism, sabotage or wars. Illegal dumping of oil is also an important factor that needs to be mentioned.

Effect of Oil Spill

Oil spill is a major threat to ocean ecosystems and their health and has long-lasting effect on the natural environment. Pollution is another effect and may lead to death.

Areas Prone to Oil Spill

Areas along the coastal regions are prone to oil spill. The coastal zone of the Brazilian State of Maranhão is an area characterized by a large variety of human activities and services, in particular in the Itaquí-Bacanga port complex, and it is prone to oil spills resulting from the processes of transportation, storage, and tank cleaning.¹⁴⁷ Akwa Ibom State in the Delta Region of Nigeria is one such areas.¹⁴⁸

144 Baker J.M. (1985) Causes and Classification of Oil Spills. In: Cairns J. (eds) *Ecoaccidents*. Springer, Boston, MA

145 Peter C. Nwilo and Olusegun T. Badejo "Impacts and Management of Oil Spill Pollution along the Nigerian Coastal Areas" Available in https://www.fig.net/resources/publications/figpub/pub36/chapters/chapter_8.pdf Accessed on December 5th 2017.

146 *Ibid*

147 "A socioeconomic and natural vulnerability index for oil spills in an Amazonian harbour: A case study using GIS and remote sensing" Science Direct Available in <http://www.sciencedirect.com/science/article/pii/S0301479710001179>

148 Available in http://www.stakeholderdemocracy.org/stockholm/wp-content/uploads/2015/04/Annex-8-OIL-SPILLS-IN-THE-NIGER-DELTA_PROPOSALS-FOR-AN-EFFECTIVE-NONJUDICIAL-GRIEVANCE-MECHANISM_JEI-29-JULY-2014_FINAL-1.pdf Oil Spills In The Niger Delta: Proposals For An Effective Non-Judicial Grievance Mechanism

Disasters Caused by Oil Spill

GOCON's Escravos spill in 1978 of about 300,000 barrels, Idaho Oil Spill of January 1998, of about 40,000 barrels, Texaco Funiwa-5 blowout in 1980 of about 400,000 barrels¹⁴⁹ are examples of oil spill in Nigeria.¹⁵⁰

Preventive and Mitigating Measures

Early detection of oil spill and oil spill monitoring by authorized agencies are effective ways of preventing oil spills and the attendant hazards. For example, since 2007, the European Maritime Safety Agency's oil spill monitoring and vessel detection service, 'CleanSeaNet' has been continuously monitoring the EU waters.¹⁵¹

iii. Toxic/Hazardous Waste*Meaning*

Hazardous/toxic waste catastrophes are caused by people. Hazardous, a broader term, refers to all wastes that are dangerous for any reason, including those that are toxic. Toxic commonly refers to poisonous substances which cause death or serious injury to humans and animals by interfering with normal body physiology. The terms are often used interchangeably and the waste can pose a long-term risk to health or environment. There is a technical difference, and it is important, as well, to recognize that distinction. Waste includes all items that people no longer have any use for, which they either intend to get rid of or have already discarded. Additionally, wastes are such items which

149 Peter C. Nwilo and Olusegun T. Badejo "Impacts and Management of Oil Spill Pollution along the Nigerian Coastal Areas" Available in https://www.fig.net/resources/publications/figpub/pub36/chapters/chapter_8.pdf Accessed on December 5th 2017

150 J. C. Udoh and E. M. Ekanem

151 Suman Singha, Tim J. Bellerby, Olaf Trieschmann, "Satellite Oil Spill Detection Using Artificial Neural Networks", Selected Topics in Applied Earth Observations and Remote Sensing IEEE Journal of, vol. 6, pp. 2355-2363, 2013, ISSN 1939-1404 Available in <http://ieeexplore.ieee.org/abstract/document/6352042/?reload=true> Accessed 6th December 2017.

people are required to discard, for example by lay because of their hazardous properties. Many items can be considered as waste e.g., household rubbish, sewage sludge, wastes from manufacturing activities, packaging items, discarded cars, old electronic gadgets, garden waste, old paint containers etc. Thus, all our daily activities can give rise to a large variety of different wastes arising from different sources.

These are poisonous by-products of manufacturing, farming, city septic systems, construction, automotive garages, laboratories, hospitals, and other industries. The waste may be liquid, solid, or sludge and contain chemicals, heavy metals, radiation, dangerous pathogens, or other toxins. Even households generate hazardous waste from items such as batteries, used computer equipment, and leftover paints or pesticides.

The definition of hazardous waste varies from one country to another. One of the most widely used definitions, however, is contained in the U.S. Resource Conservation and Recovery Act of 1976 (RCRA).¹⁵² RCRA considers wastes toxic and/or hazardous if they "cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed."¹⁵³

Types/Classification

Hazardous waste can be classified into the following defined hazard classes: flammable liquid, combustible liquid, flammable solid, oxidizer, organic peroxide, corrosive, flammable gas, non-flammable gas, etiologic agents.

152 William C. Blackman, Jr. *Definition of Hazardous Waste Basic Hazardous Waste Management*, Third Edition CRC Press pp. 37.

153 *Ibid*

Causes of Hazardous Waste

Deposit of accumulation of toxic waste as a result of flooding can be a cause of a disaster of hazardous waste. Other causes of hazardous waste include nuclear waste, industrial waste, universal waste, medical waste, construction waste and electronic waste.

Effects of Hazardous Waste

When any of these classes of hazardous waste is disposed in our community or environment, it causes infection, injuries, loss of life of plants and animals and even cultural properties. Toxic waste is waste material that can cause death, injury or birth defects to living creatures. It spreads quite easily and can contaminate lakes, rivers, and the atmosphere. There are many types of hazardous waste that pose varying degrees of danger to public safety and environmental health and medical issues like cancer, physical anomalies and birth defects, respiratory illnesses and injuries. Disposal of these materials can be challenging and often needs to be handled by professionals. The effect of Hazardous waste can be classified as chemical risks, biological risks, physical risk and environmental risks.

Areas prone to Hazardous Waste

Due to the fact that developed countries tend to move their waste to less developed countries, and because these countries are not able to effectively handle the effects, developing countries are prone to hazardous waste.¹⁵⁴ The Koko Toxic Waste incidence is a good example. The Italian who was the key actor in the incidence, bought a piece of land in the small community with the intention of importing and disposing toxic waste from industrial nations who had strict laws on pollution.¹⁵⁵

154 Grasso d, Kahn D, Kaseva, M. E. and Mbuligwe S. E – “Hazardous Waste” HAZARDOUS WASTE MANAGEMENT Encyclopaedia of Life Support Systems (EOLSS) Available in <http://www.eolss.net/sample-chapters/c09/e1-08-00-00.pdf>

155 Segun Gbadegesin “Multinational Corporation Developed Nations and Environmental Racism: Toxic Waste, Exploration, and Eco-Catastrophe” in *Faces of Environmental Racism: Confronting Issues of Global Justice*. 2nd ed.’ ed Laura Westra, Bill E. Lawson (Oxford: Rowman & Littlefield Publishers, Inc., 2001) 188.

Disasters as a result of Hazardous Waste

Love Canal hazardous waste disaster which occurred in Niagara Falls, New York in the late 20th century. The name “Love Canal” was derived from William T. Love, the industrialist who dug the canal that eventually led to the disaster. The cause of the disaster was the dumping of waste of all types ranging from chemical warfare materials, chemical waste and refuse by residents, companies and even the government.¹⁵⁶ In Nigeria, the Koko Toxic Waste incident in 1988 is a good example.¹⁵⁷ An Italian company registered in Nigeria imported toxic waste into a small town in Delta State of Nigeria under the disguise that it was industrial chemical.¹⁵⁸

Preventive and Mitigating Measures

Hazardous waste disasters can be prevented by regulations and policies especially regulations restricting waste disposal in environmentally sensitive areas.¹⁵⁹ The active monitoring to be done by designated agencies in areas prone to risk. Inspection and maintenance of equipment and proper citing of industry with high risk of hazardous waste.¹⁶⁰

156 John McNamara “The Love Canal Hazardous-Waste Disaster” The Gilder Lehrman Institute of American History Available in <https://www.gilderlehrman.org/content/love-canal-hazardous-waste-disaster> Accessed on 7th December 2017.

157 Toxic waste in Koko The Nation March 17, 2017 Available in <http://thenationonlineng.net/toxic-waste-koko/> Accessed on 7th December 2017.

158 Segun Gbadegesin “Multinational Corporation Developed Nations and Environmental Racism: Toxic Waste, Exploration, and Eco-Catastrophe” in *Faces of Environmental Racism: Confronting Issues of Global Justice*. 2nd ed.’ ed Laura Westra, Bill E. Lawson (Oxford: Rowman & Littlefield Publishers, Inc., 2001) 188.

159 Timothy J. Flynn, Stuart G. Walesh, James G. Titus, and Michael C. Barth “Implications of Sea Level Rise for Hazardous Waste Sites in Coastal Floodplains” Available in <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.391.7715&rep=rep1&type=pdf> Accessed 7th December 2017.

160 *Ibid*

iv. Human Stampede

Meaning

A stampede is an act of mass impulse amongst a group of people in which the crowd collectively begins running with no clear direction or purpose. Human stampede often occur during religious gatherings and sporting activities. There is a distinction between stampede and crushes. Crushes are very often and mistakenly referred to as stampedes but unlike true stampedes it causes a lot of death. It has been suggested that with crushes, crowd density rather than size is important, with a density of about four people per square meter beginning to be dangerous even if the crowd is not very large.

Types/classification of Stampede

Stampede can be classified according to the loss of lives in the incidence. The classification can then be as stated below:

- Class I – mild stampedes with injuries and no death;
- Class II – moderate stampedes with one to ten deaths;
- Class III – severe stampedes with eleven to hundred deaths;
- Class IV – devastating stampedes with 101 to 1000 deaths;
- Class V – catastrophic stampedes with over 1000 deaths

In another classification, stampede can be according to who or what was involved in the stampede. There are therefore the following classification of human and non-human/cattle stampede. However, the discussion will be on human stampede.

Human Stampede

Human stampede is a man-made disaster which has not been completely understood, neither has it been fully documented, recorded or researched. The world population has continued to increase and be even more concentrated in urban settings. This has increased the gatherings of large crowds in various venues under different circumstances and with this comes the risk of

various crowd disasters ranging from crowd bursting to human stampeding. A sudden rapid movement or reaction of a mass of people in response to a particular circumstance or stimulus is known as a human stampede. The Merriam-Webster dictionary defines it as a 'mass movement of people at a common impulse'.

Causes of Stampede

Acquisitive panic is said to be a cause of stampede. A stampede may occur when a group of people in a bid to lay hold or acquire something as on "black Friday" rush headlong in a panic. It may also occur where a large crowd as a result or panic occasioned by fright to get away from danger as when running away from an explosion or fire in a theatre move headlong. It usually occur during religious, social, musical, political, professional and sporting gatherings and other events that tend to involve a large number of people. They occur in times of panic as a result of fire or explosion as people try to get away urgently. It is also common when the crowd are trying to get towards something.

Effect of Stampede

Human stampede has been linked with dire consequences all over the world and has resulted in several degrees of human injuries and deaths. One key word in the definitions of stampede is the word 'impulse' and often it results in death and injuries. Other effects are structural damage of public facilities, loss of valuables etc. all of these have made it a veritable threat to public safety and a notable disaster among nations.

Areas Prone to the Disaster of Stampede

Any area where there is a sudden, rapid movement or reaction of a mass of people in response to a particular circumstance or stimulus is prone to stampede.

Examples of Disaster as a result of Stampede

On May 30th 1883, after the Brooklyn Bridge was declared open a few days before, there was a stampede on the bridge, after a false alarm that the bridge was collapsing. Hundreds of people ran for their lives and causing a stampede that led to many death.¹⁶¹ An example of human stampede in Nigeria is the November 2013 stampede in a Church in Enugu town in Anambra State where more than 100,000, people gathered in a church built to contain 5,000 people and many people died as a result.¹⁶² The March 2014 Nigerian Immigration Service interview stampede of more than 6.5 million applicants for 5000 jobs is another example. The Shanghai stampede occurred in December 2014 where 36 people were killed and 47 were injured during a New Year celebration.¹⁶³

Preventive and Mitigating Measures

In a stampede involving livestock, cowboys attempt to turn the moving herd into itself so that it runs in circles rather than running off a cliff or into a river and also to avoid damaging human lives and property.¹⁶⁴ Tactics used to do this include firing a pistol which creates noise causing the leaders of the stampede to turn.¹⁶⁵

Animals that stampede like cattle are less likely to do so after having eaten and spread out in smaller groups to digest.¹⁶⁶ To

161 Jaya Saxena "130 Years Ago, Elephants Solved Panic On the Brooklyn Bridge" New York Historical society May 29, 2014 Available in <http://behindthescenes.nyhistory.org/elephants-panic-brooklyn-bridge-1883/> Accessed on 8th December 2017.

162 Christopher Isiguzo and Emanuel Ugwu "Nigeria: Anambra Stampede - CAN Bans Political Campaigns in Churches" This Day Nov 5, 2013 Available in <http://allafrica.com/stories/201311050824.html> Accessed on 8th December 2017.

163 Jonathan Kaiman "Shanghai: dozens killed and injured in stampede at New Year celebrations" The Guardian 1 January 2015 Available in <https://www.theguardian.com/world/2014/dec/31/shanghai-35-people-killed-42-injured-new-year-crush>. Accessed on 7th December 2017.

164 <https://ipfs.io/ipfs/QmXoypizjW3WknFiJnKLwHCnL72vedxjQkDDPImXW6u6u/wiki/Stampede.html>.

165 *Ibid*

166 *Ibid*

further reduce the risk of stampedes, in animals, it is said that cowboys sometimes sing or whistle to calm the herds which are disquieted by nightfall.¹⁶⁷ Those on watch at night avoid doing things which could startle the herd and even distance themselves before dismounting a horse or lighting a match.

Improved understanding of crowd behaviour and more systematic research will help design mitigation strategies that can be implemented across the world to prevent human stampedes

v. War*Meaning*

A war can be defined as a state of open, armed, often prolonged conflict carried on between nations, states, or parties or the period of such conflict or the techniques and procedures of war; military science. War is the waging of armed conflict against the enemy or a legal state created by a declaration of war and ended by official declaration during which the international rules of war apply. In 2003, Richard Smalley identified war as the sixth (of ten) biggest problems facing humanity in the next fifty years.

Types/Classification of War

The first classification of the types of war is discussed below:¹⁶⁸ asymmetric war, biological war, chemical war, civil war, conventional war, cyber war, nuclear war, total war, unconventional war, war of aggression.

Wars have also been classified as border wars, cold war, frontline war, proxy war, range war, religious war, total war and nuclear war.¹⁶⁹

167 *Ibid*

168 "What are the types of wars that exist?" Quora Available in <https://www.quora.com/What-are-the-types-of-wars-that-exist> Accessed on 7th December 2017.

169 Types of war https://en.wikipedia.org/wiki/Outline_of_war

Causes of War

There is no single cause of war. There are many factors that cause war.¹⁷⁰ They include power tussle, ethnicity, sociocultural differences, elimination of resurgent rivals, economic factors, marginalization, hatred. Generally, poverty and political, social, and economic inequalities between groups may cause war.¹⁷¹

Effect of War

Civilian casualties, military personnel suffer mental and physical injuries, and depression, negative socio-economic effects, forced migration and refugee development. Health challenge, brain drains, malnutrition and hunger.

Areas Prone to War

The Middle East has the reputation of being one of the most conflict-prone areas in the world.¹⁷² Other areas include North Africa, Ethiopia, Angola, Israel, and Vietnam.¹⁷³

Example of Disaster as a Result of War

The deadliest war in history in terms of cumulative number of deaths since its start is the second world war from 1939 – 1945 with 60 – 80 million deaths. Proportionally speaking, the most destructive war in modern history is the War of the Triple Alliance which took the lives of over 60% of Paraguay's population. According to Steve Pinker, examples of wars in the world are the Nigerian civil war 1966-1970 also known as the Biafra war, the Iraq Afghanistan war, the Gulf war, the US-Iraq war, Korean war, Vietnam war, and so on. The US-Iraq war of 2003 is another

170 R.J. Rummel "Causes And Conditions Of International Conflict And War" *Understanding Conflict And War*: Vol. 4: War, Power, Peace Available in <https://www.hawaii.edu/powerkills/WPP.CHAP16.HTM>.

171 Root causes of violent conflict in developing countries Available in <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122271/> Accessed on 7th December 2017.

172 Dec 13, 2015 – Available in <https://history105.libraries.wsu.edu/.../12/.../the-start-of-the-conflict-prone-middle-eas...>

173 Conflict-prone countries *The Economist* Available in <http://www.economist.co.uk/node/5084685>.

example of war causing disaster. Officially, the war on Iraq ended in 2011 with the withdrawal of virtually all of America's combat troops. But the havoc wreaked by the US invasion and regime change goes on. Over a hundred thousand Iraqis were killed in the war itself, but many more died in the aftermath from sectarian violence and the obliterated infrastructure. On the American side, the deaths approached 4,500, with tens of thousands shattered in body and spirit. For the U.S. taxpayer, the price is over a trillion dollars, with billions lost to sheer corruption in the so-called rebuilding.

Preventive and Mitigating Measures

These include dialogue, tolerance, planning ahead, establishing peace institutions, involvement of religious groups e.g. the Second Vatican Council, the involvement of anti-war movements, awareness, lobbying and peaceful demonstrations.

Similarities/Differences between Man-Made and Natural Disasters

Natural disasters are brought about by change in natural phenomenon or what is known as acts of God. The extent of loss experienced is dependent on the vulnerability of the population. As such, this means that this can only occur in areas that are susceptible to vulnerability. On the other hand, man-made disasters are influenced by humans and they are often as a result of negligence and human error among other factors.

Despite the difference between these two, it is ideal to note that they can cause irrevocable damage if the right measures are not put in place to avoid the same. This is where the need for disaster preparedness comes in. It goes a long way to cushion people from the after effects of such happenings. There are several sources that provide useful resources that make it possible to meet this end.

Whether the disaster is natural or man-made, the manner in which action is taken goes a long way to determine how people fare from the experience. In both instances, casualties should be treated immediately and the best way to meet this end is placing the necessary measures in place that counteract this. Note that the costs associated with handling of the man-made and natural disasters are enormous every year and this negatively affects the economy.

vi. Terrorism

The act of terrorism is a man-made disaster and it is a key security threat all over the world.

Meaning and Definition

The definition of terrorism has proved controversial and even the United Nations attempt failed.

Terrorism comes from French word '*terrorisme*' in turn derived from the Latin word '*terrere*' meaning 'I frighten', use of violence and treats to intimidate or coerce, especially for political purposes.¹⁷⁴ Common definitions of terrorism refer only to those violent acts which are intended to create fear (terror) are perpetuated for a religious, political or ideological goals and deliberately target or disregard the safety of civilians. All terrorists' acts involve violence or the threat of violence. Terrorists attempt not only to cause panic but also to undermine confidence in the government and political leadership of their target country. Terrorism, is designed to have psychological effects that reach far beyond its impact on the immediate victims or object of an attack.

Types of Terrorism

There are different forms of terrorism, with their own characteristics. Below are some of the common types of terrorism.

¹⁷⁴ Wilkinson P. (1974) Concepts of Terror and Terrorism. In: *Political Terrorism. Studies in Comparative Politics*. Palgrave, London Available in https://link.springer.com/chapter/10.1007/978-1-349-15550-7_1#citeas. Accessed on 14th December 2017.

- i) *State terrorism* which is original form of terrorism is the systematic use of terror by a government in order to control its population. It is carried out entirely by the group holding power in a country and not a non-governmental organisation.
- ii) *Religious terrorism* motivated by religious ideologies and grievances which may be dangerous due to the fanaticism of those who practice it and their willingness to sacrifice themselves for the cause.
- iii) *Right wing terrorism* aims to combat liberal governments and preserve traditional social orders and is commonly characterised by militants and gangs.
- iv) *Left wing terrorism* seek to overthrow capitalist democracies and establish socialist or communist governments in their place.
- v) *Pathological terrorism* is the use of terrorism by individuals who utilize such strategies for the sheer joy of terrorizing others as seen in school shootings and serial killing scenarios.
- vi) *Issue-oriented terrorism* is carried out for the purpose of advancing a specific issue. Commonly, these issues are social in nature or deal with the environment.
- vii) *Separatist terrorism*, typical of minorities within a nation state that desire their own state, seek to cause fragmentation within a country and establish a new state.
- viii) *Narco-terrorism* referred to organisations that gain funds through the sale of drugs and or using violence to make the sale of drugs easier.

Causes of Terrorism

The causes of terrorism can be historical, cultural, political, social, psychological, economic or religious — or any combination of

these. However, these causes can be traced down to poverty and marginalization.

Characteristics of Terrorism

Terrorism is characterised by the different stages including planning and organisation stages. All terrorists share one characteristic: they never commit actions randomly and senselessly. It is often targeted at innocent civilians in order to create an atmosphere of fear, intimidation and insecurity and there are weapons of terrorism of which the use of bomb is the most common while other weapons include firearms, chemical and biological weapons.

Areas prone to Terrorism

It is reported that more than 72% of terrorist deaths last year occurred in just five countries mainly in Middle East, Asia and Africa.¹⁷⁵ The countries are Libya, Egypt, Somalia, India, Yemen, Syria, Pakistan, Nigeria, Afghanistan and Iraq.

Examples of Terrorism Causing Disaster

In Africa, recent acts of terrorism caused by groups like Boko Haram in Nigeria, Al-shabaab in Somalia, and Al Qaeda in Algeria are stated to be recent. However, act of terrorism have been recorded before this era. Examples of terrorism include the Sousse beach resort killing of 38 people in Tunisia on June 26th 2015,¹⁷⁶ and the killing of about 150 people in a University campus in Kenya on April 2nd 2015. The 2011 bombing of the United Nations Building in Abuja resulted in the death of 23 people and many injured on August 26.¹⁷⁷

175 Dominic Dudley "The Ten Countries Most Affected By Terrorism" Forbes Nov 18, 2016 Available in <https://www.forbes.com/sites/domiculdudley/2016/11/18/countries-most-affected-by-terrorism/#78b6de5430d9> Accessed on 13th December 2107.

176 Wycliffe Muga "Recent terrorists attacks in Africa" Star Mar. 26th, 2016, Available in https://www.the-star.co.ke/news/2016/03/26/recent-terrorists-attacks-in-africa_c1320034 accessed 14th December 2017.

177 Christopher Bartolotta "Terrorism in Nigeria: the Rise of Boko Haram" World Policy September 19, 2011 Available in <http://www.worldpolicy.org/blog/2011/09/19/terrorism-nigeria-rise-boko-haram> Accessed on 14th December 2017.

In the United States of America, one of the significant and dramatic terrorist attack took place on September 11th 2001 when the Islamic extremist group al-Qaeda hijacked four airplanes and carried out an attack killing almost 3,000 people.¹⁷⁸

In the Middle East, one of the deadliest terrorist attack took place in Egypt, in November, when an Islamic militant bombed and sprayed gun fire in a mosque leaving 350 people dead.¹⁷⁹

The Effect of Terrorism

The effect of terrorism covers a wide area and cannot be over-emphasised. The act of terrorism paralyzes almost all sections, sectors and activities of any community. Terrorism impedes peace and progressive development and hinders political development. It affects rapid economic growth and it distorts socio-cultural equilibrium which may lead to environmental deterioration.

The effect of terrorism results in conflict and leads to dislocation of people from their base resulting in disruption of economic activities. On the social sphere, family welfare services, health, housing, community development are affected.

Other areas affected by terrorism include education, especially in the Boko Haram terrorism in Nigeria where the major target of the boko haram is to frustrate the western education which they regarded as sinful. Agriculture and food supply, security, social amenities and the environment are also affected.

The environment has always formed a central part of the development focus. Conflict lead to environmental degradation, poverty and hindered rapid economic growth and development. Other effects are pollution by war equipment on the environment by gases, chemical and toxics, radio-actives, which may scare away foreign investors and the refugee problems to neighbouring countries and cities.

178 Peter L Bergen "September 11 Attacks" Encyclopaedia Britannica available in <https://www.britannica.com/event/September-11-attacks> Accessed on 14th December 2017

179 Declan Walsh and Nour Youssef "Militants Kill 305 at Sufi Mosque in Egypt's Deadliest Terrorist Attack." The New York Times November. 24, 2017, Available in <https://www.nytimes.com/2017/11/24/world/middleeast/mosque-attack-egypt.html> Accessed on 14th December 2017.

Protective/Mitigating Measures

There are different protective measures. Some are physical or structural in the sense that structures such as protective design of houses, vehicle barriers, perimeter walls, strengthened perimeter columns, blast resistant glazing, are in place. On the other hand, awareness and vigilance in the environment and reporting suspicious activities to the relevant agencies are other measures. There should be adequate response and recovery measures in place

C. COMPLEX DISASTER

This is a disaster occurring where there is no single root cause. This is more common in developing countries. A specific disaster may spawn a secondary disaster that increases the impact.¹⁸⁰ A classic example is an earthquake that causes a tsunami, resulting in coastal flooding. One specific event may spawn another type of disaster. For example, a hurricane may cause flooding by excessive rain or by pulling seawater onshore, also called a storm surge. A volcanic eruption is particularly prone to spawning additional events like avalanche, earthquakes, structural fires and wildfires, flooding from melting of mountain snow and ice, landslides, mudslides, thunderstorms and, if the volcano is located in or near the ocean, tsunamis.

Examples of Disasters resulting in Complex Disaster

Indian Ocean Earthquake: The Sumatra-Andaman earthquake, it was estimated to have a magnitude of 9.15, and occurred on December 26th 2004. While the earthquake itself lasted for only 10 seconds, it caused a tsunami that killed an estimated 200,000 to 310,000 people along the shores of Indonesia, Sri Lanka, South India, and Thailand with one death even occurring at Port Elizabeth in South Africa, 8,000 miles away from the epicenter.¹⁸¹

¹⁸⁰ Ian Davis "Disaster Risk Management in Asia and the Pacific" Available in <https://book.google.com.ng/books?isbn=1317644875> Accessed 10th December 2017.

¹⁸¹ <http://list25.com/25-worst-natural-disasters-recrded/>

Another example of a complex disaster is hurricane Andrew. This disaster was formed by a tropical wave that moved to the West Coast of Africa on August 14th 1992. During the next few days, it developed into a destructive tropical cyclone. The storm was responsible for 65 fatalities and US \$26 billion in property damages becoming the 5th costliest hurricane in US history after hurricanes Katrina, Wilma, and Ike.¹⁸² Another Example was Tōhoku Earthquake and Tsunami in 2011. A quake followed by a tsunami was reported to have hit the East Coast of Japan on March 11th 2011 killing 15,894 people with 6,152 injured and 2,562 people missing. It was also said to have caused a near nuclear disaster when there was a partial meltdown in 3 reactors of the Fukushima Daiichi nuclear power plant, which is the 2nd largest nuclear disaster after Chernob.¹⁸³

Food-security emergencies may also result in complex disasters with multiple root causes.¹⁸⁴ Severe drought and/or conflict can produce an acute food emergency, whereas chronic food insecurity is often a reflection of poverty, a worsening debt crisis, and the economic effects at household level of the HIV/AIDS pandemic or mismanagement or abuse of water resources.¹⁸⁵

RECOMMENDATIONS AND CONCLUSION

The havoc caused by natural and man-made hazards that has been recorded in history has been enormous. On daily basis, a part of the world, experiences a disaster. This points to the fact that disasters are inevitable. However, the magnitude of the effect of disaster can be greatly reduced. There is therefore the need for proper awareness of causes of disasters and what to do in the

¹⁸² *Ibid*

¹⁸³ *Ibid*

¹⁸⁴ International Federation of Red Cross and Red Crescent Societies "Complex/manmade hazards: famine, food insecurity" <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/famine-food-insecurity/>

¹⁸⁵ International Federation of Red Cross and Red Crescent Societies (IFRC) "Complex/manmade hazards: famine, food insecurity" <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/definition-of-hazard/famine-food-insecurity/> Accessed 30th November 2017.

event of a particular hazard as each has its peculiarities. Adequate planning to mitigate against occurrence and effects are germane. Very sound preparation is vital to forestall or reduce the impact of hazards

To aid the recovery process in an event of a disaster, humanitarian aid from not only the big agencies are important. Community response and engagement go a long way especially with respect to essential clothing, food and temporary accommodation to lessen the effect of the disaster. Governmental effort at the planning/preparedness stages before the occurrence of a disaster and the response/ recovery stages at the occurrence and after the disaster is very important in determining the impact of such disaster in a given community.

In any given situation, whether before, during or after a disaster, all hands must be on deck to find a solution either on a short term or long term basis to handle the present and future problems.

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