



FLOODING AND SUSTAINABLE DEVELOPMENT – CAUSES, EFFECT AND SOLUTION

BY

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Introduction

We are confronted with the fact that disasters are increasing in frequency and magnitude worldwide and they result in considerable human, environmental and material losses to communities, diversion of resources, and have also slowed down the process towards sustainable development.

“Flooding is the single most destructive type of natural disaster that strikes humans and their livelihoods around the world. In the last decade, there has been catastrophic flooding experienced in Africa, Asia, Europe, America and elsewhere.”(United Nations)







**BASIC CONCEPTS
IN
DISASTER MANAGEMENT, FLOOD
AND
SUSTAINABLE DEVELOPMENT**

Conceptual Clarification



- ▶ **Emergency**
 - ▶ A life threatening situation which puts people at risk of death or severe deterioration in their health status or living conditions, and which has the potential to outstrip the normal coping capacity of the individual, family, community and state support systems.
- ▶ **Disaster**
 - ▶ A disaster is a serious disruption of the functioning of a society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using only its own resources
- ▶ **Hazard**
 - ▶ Is defined as a danger or source of danger or potential harm and which threatens human safety when provoked. The term Hazard is also used mean dangers, risks or problems.
- ▶ **Risk**
 - ▶ Risk refers to the expected or anticipated losses (lives lost, people injured, property damaged, and economic activities or livelihoods disrupted) from the impact of a given hazard on a vulnerable element over a specific period of time.

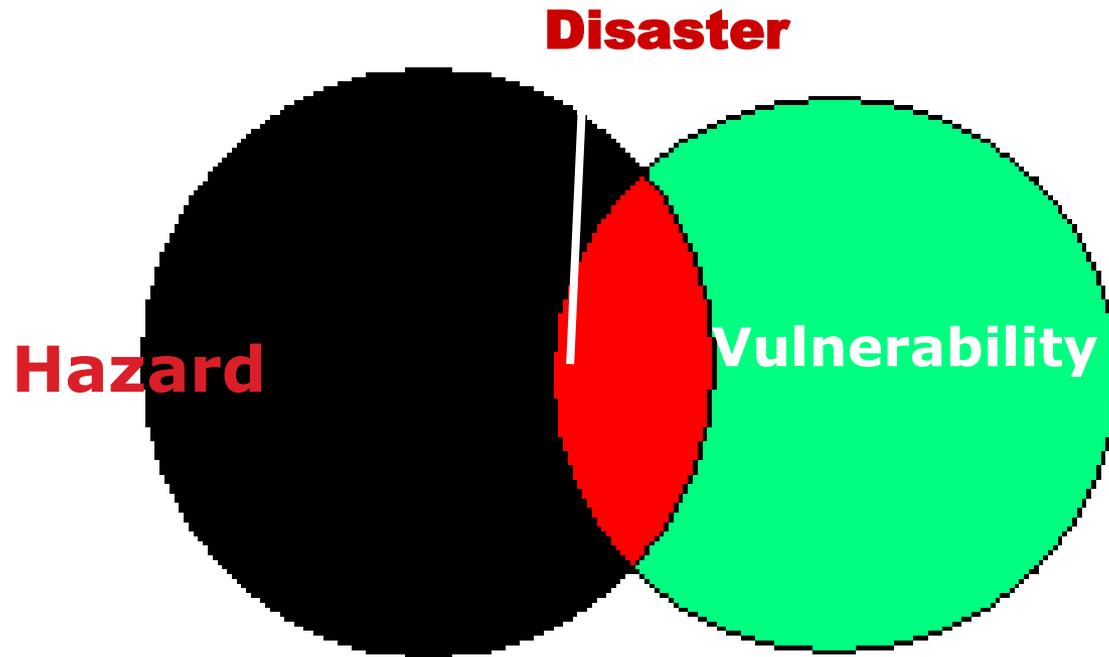
DISASTER AND VULNERABILITY



Disaster occurs when an adverse or unfortunate event (a calamity, a serious mishap) affects the lives of people property and the environment. A disaster occurs when hazards and vulnerabilities meet. Disaster can be slow in their onset or sudden in nature.

**There are no Natural Disasters,
but
Natural Hazards**

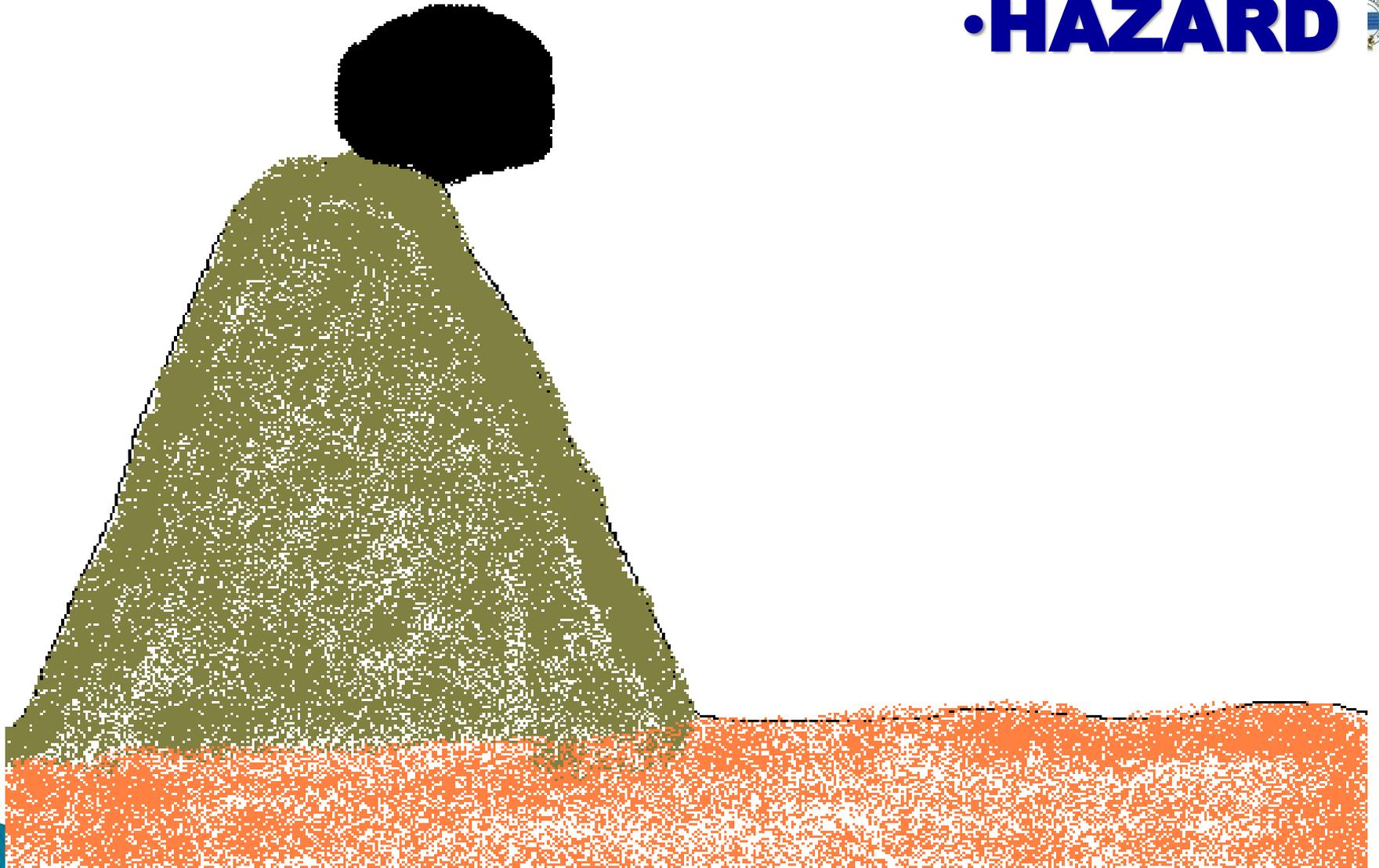
DISASTER AND VULNERABILITY



RISK



• **HAZARD** 



HAZARD

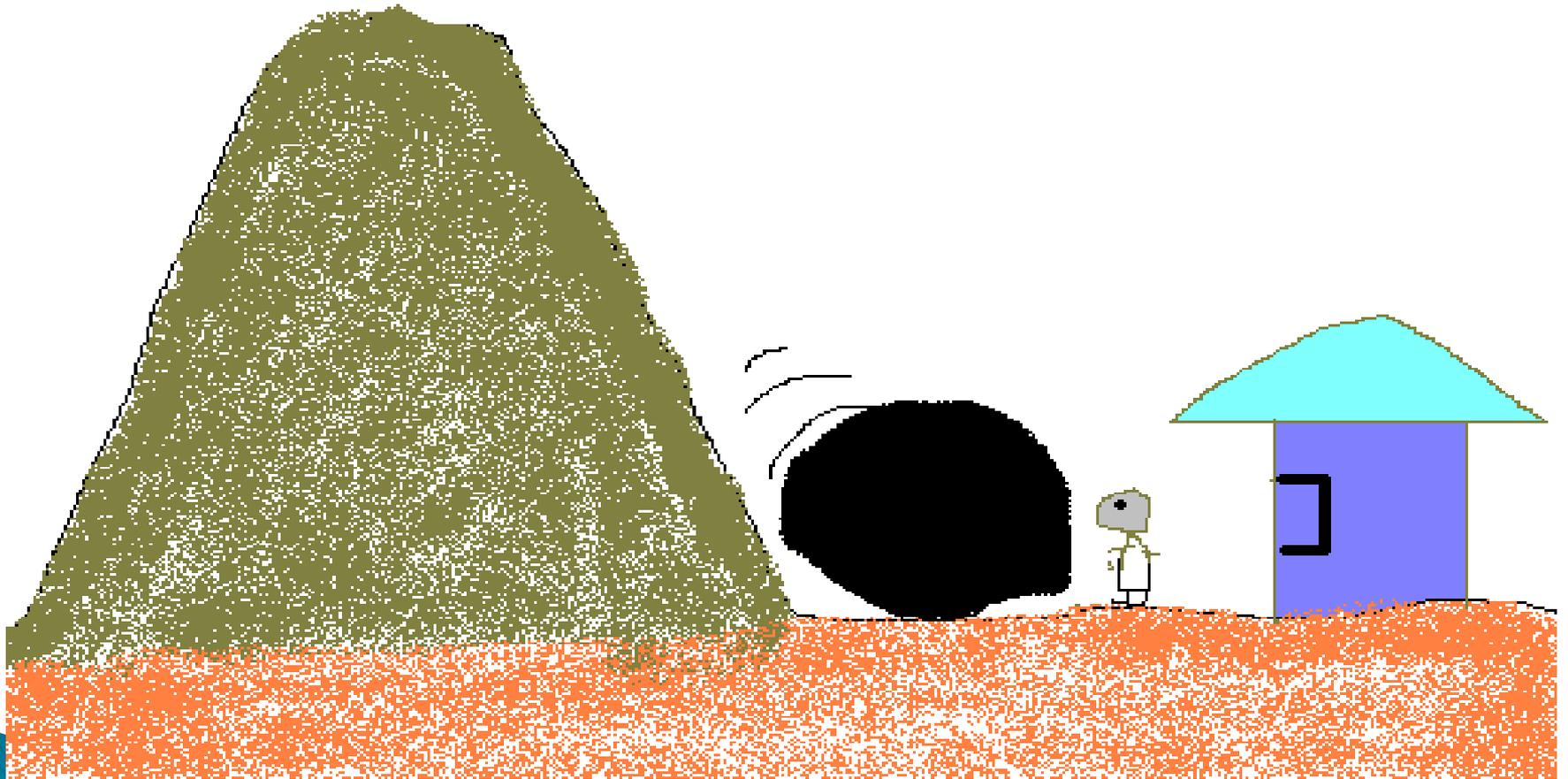
+

= RISK

VULNERABILITY



•DISASTER



•HAZARDS



- ▶ Is a defined as a danger or source of danger or potential harm and which threatens human safety when provoked. The term Hazard is also used mean dangers, risks or problems.
- ▶ Hazards can be in several forms: Dormant or sleeping (when there are no human beings exposed to it), Armed (there is a person or people in the vicinity; there is risk) or Active (human reaction time is too slow to combat the effect of the hazard; it is too late to prevent the consequences of the hazard).



Disaster Management

Disaster management is the **coordination** and **integration** of all activities necessary to **build, sustain and improve** the capability for disaster **prevention, mitigation, preparedness, response and recovery**.

Emergency Management

This is the discipline of dealing with and avoiding risks, particularly those that have catastrophic consequences for communities, regions or entire Countries.

Sustainable development



- ▶ **Sustainable development** is the **development** that meets the needs of the present without compromising the ability of future generations to meet their own needs
- ▶ The overall goal of sustainable development (SD) is the long-term stability of the economy and environment; this is only achievable through the integration and acknowledgement of economic, environmental, and social concerns throughout the decision-making process.
- ▶ A possible consequence of climate change is an increased frequency of extreme meteorological events that cause floods. Devastating floods destroy cultural landscapes and undermine sustainable development by breaking continuity.

Sustainable development and Flooding

- ▶ Floods are not considered hazards in all place and at all times. Floods are in fact a normal and essential component of agriculture and ecological systems, they provide the basis for the regeneration of crops, plant and aquatic life (Wisner, Ibid). As noted by Leaf, (1997) in Wisner et al (2004), a majority of villagers who live and cope with floods in Bangladesh disapprove of attempts to stop floods entirely. Thus, it is not all floods that are hazardous or destructive, some are beneficial 
- ▶ While flood protection is necessary for the present generation to attain a fair degree of freedom from disastrous events, it must be done in such a way that future generations are not adversely affected.
- ▶ sustainable flood defence schemes should therefore "avoid as far as possible committing future generations to inappropriate options for defence".

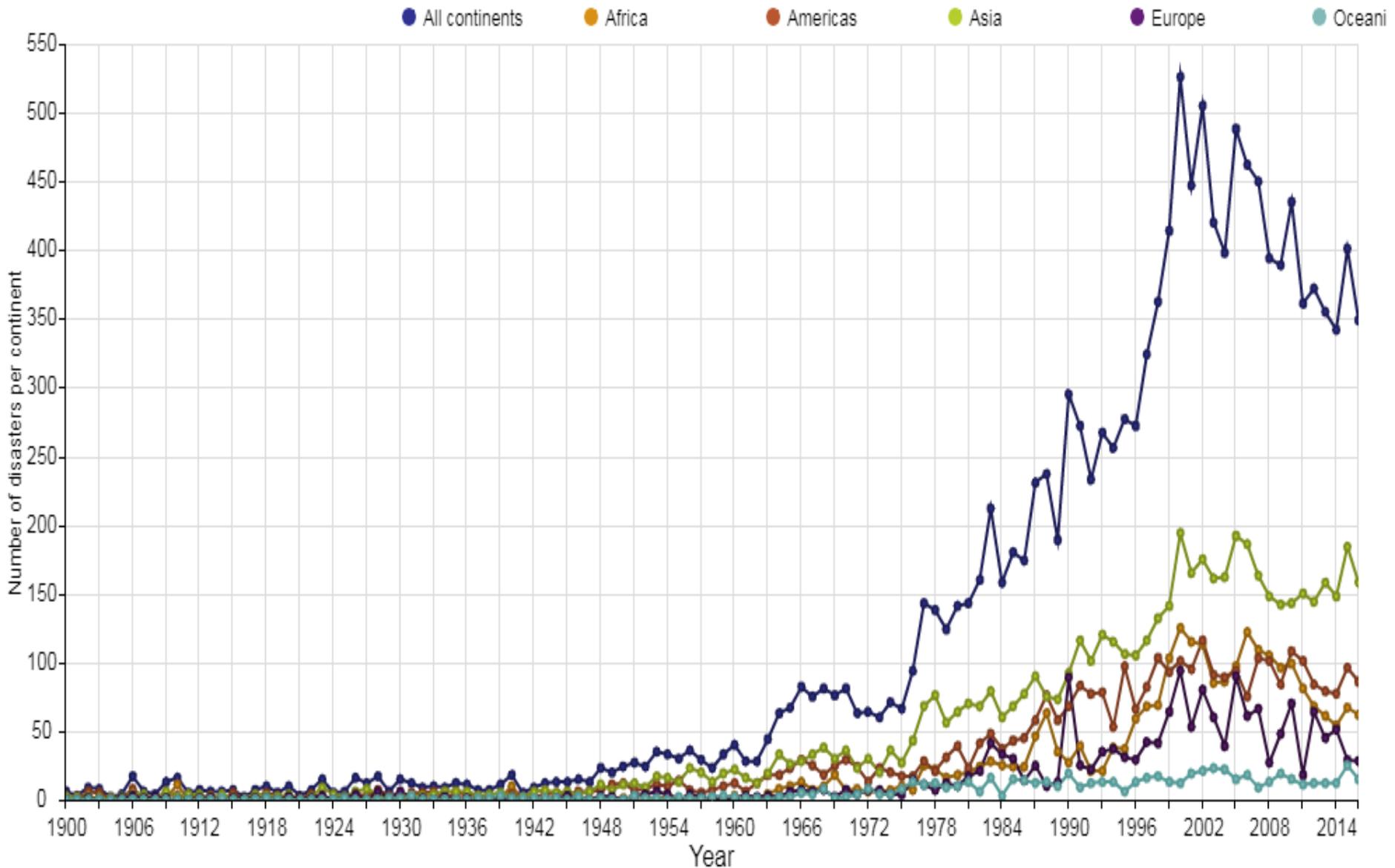
Global Disaster Statistics

- ▶ According to the Centre for Research of the Epidemiology on Disasters (CRED) Data in 2012, 25% of the world's landmass and nearly 75% of its population is at risk of disasters. 
- ▶ In the year 2012, natural disasters had a devastating impact on human society.
- ▶ Worldwide, 357 reported natural disasters caused the death of more than 9,655 people, made 122.9 million victims and caused a record amount of US\$ 157.3 billion of damages.
- ▶ The main burden of disaster impacts was carried by a small number of countries in 2012 including Nigeria.
- ▶ The countries that made up the top 10 ranking in terms of disaster mortality in 2012 represented 68.2% of global disaster mortality.
- ▶ The top 10 countries for the number of victims and damages accounted for 76.2% and 95.0% respectively of the global reported number of victims and damages from natural disasters in 2012. Nigeria was number 7.

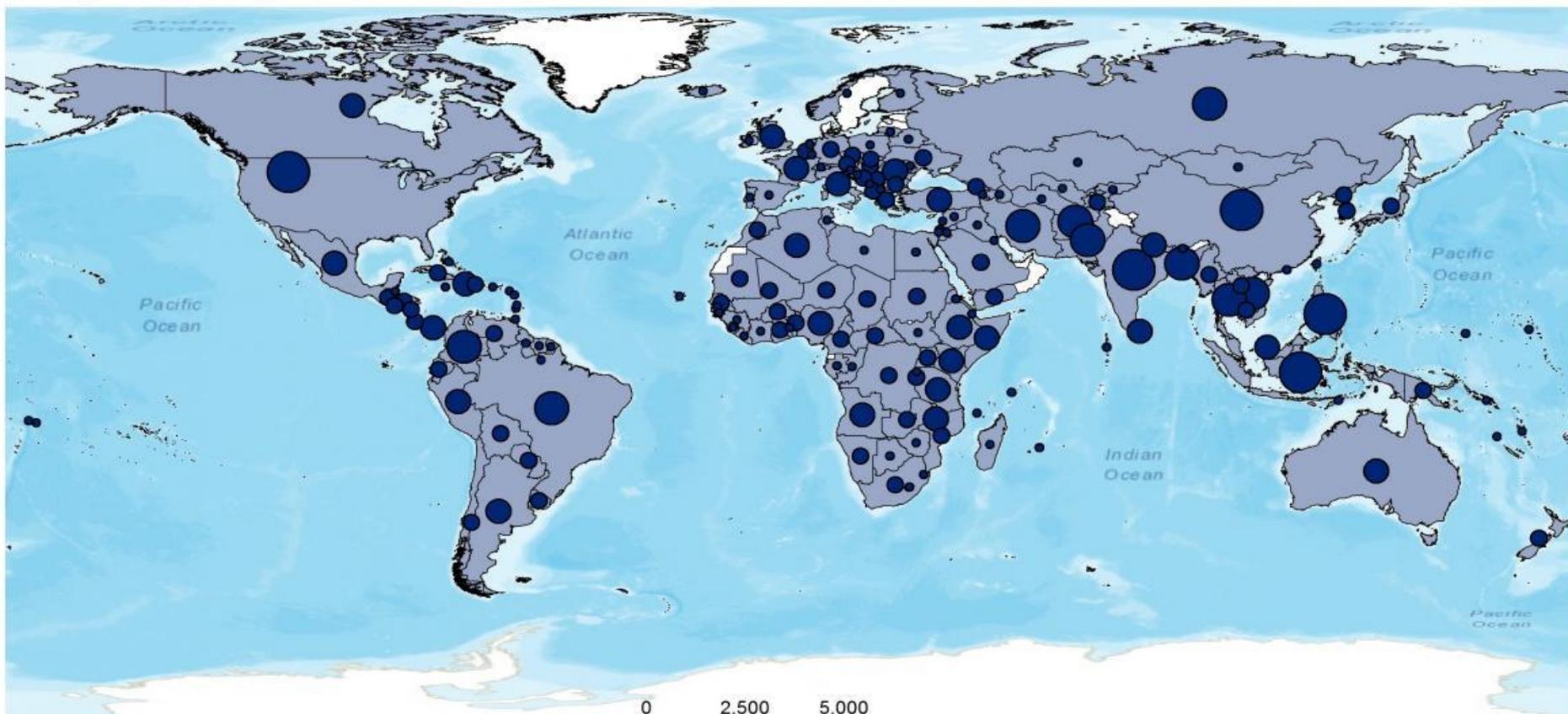
Global Disaster Statistics

- ▶ Hydro-meteorological disasters accounted for 75% of all reported disasters in 2012. 
- ▶ Hydrological disasters (floods and wet mass movements) took the largest share in natural disaster occurrence in 2012 (49.4%).
- ▶ Meteorological disasters (storms) represented 25.2% of the total disaster occurrence in 2012.
- ▶ Climatological disasters (extreme temperatures, droughts and wildfires) took in 2012 a 23.8% share of total disaster occurrence, far above the share of 14.9% per year on average for 2002-2011.

Total number of reported natural disasters in the world 1960–2016



Number of flood events per Country 1986-2015



- No flood reported
- Flood affected country

Number of flood 1986 - 2015

- 1 - 11
- 12 - 28
- 29 - 48
- 49 - 90
- 91 - 222

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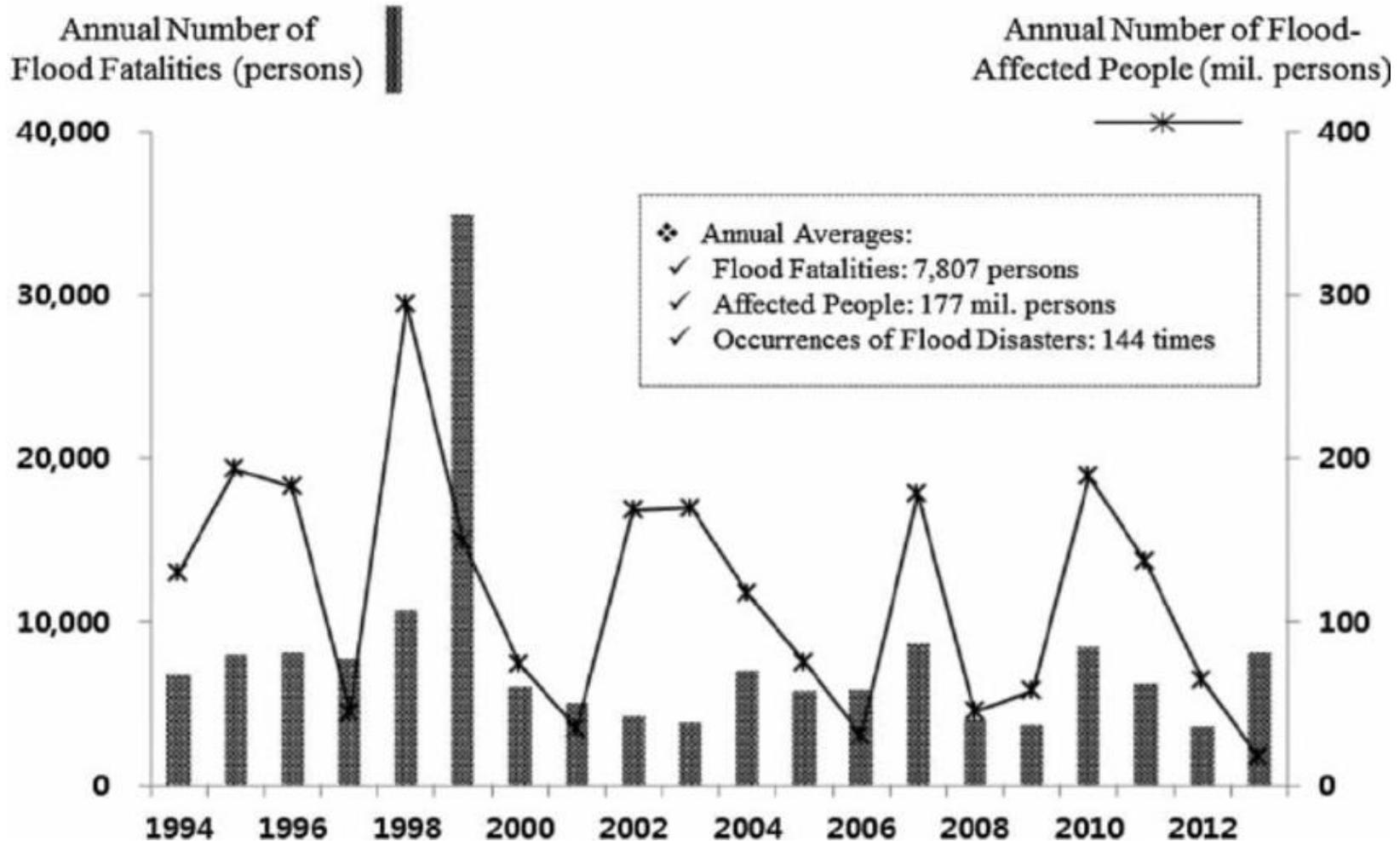


**Centre for Research on the
Epidemiology of Disasters
CRED**

Author: Alizée Vanderveken, Research Assistant at CRED
Projection: WGS84 / Classification: Jenks
Source: EM-DAT (2016), GAUL (2016), ESRI (2016)

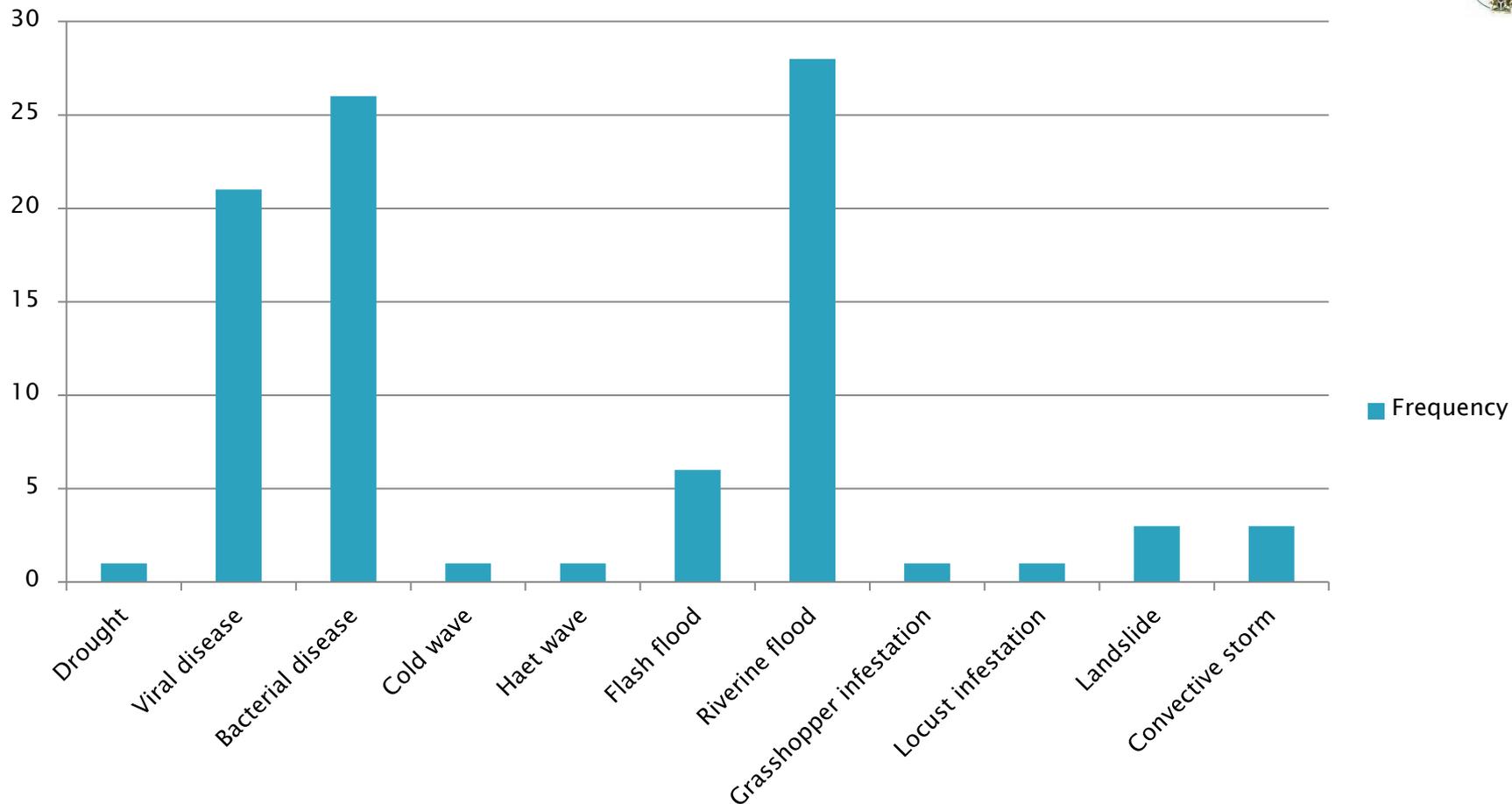
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Flood Effects on Human Population



Global statistics of flood effects on humans over the last two decades. Data: EM-DAT ver.12.07 (created on 10 March 2014).

Top 10 Disasters in Nigeria 1900-2019 Sorted by Frequency of Occurrence



Source: "EM-DAT: The OFDA/CRED International Disaster Database, Universite catholique de Louvain, Brussels, Belgium"; available at www.preventionweb.net –

Top 10 Number of Natural Disasters in Nigeria 1900-2019 Sorted by Numbers of Total Affected People



Disaster	Year	Total Affected
Flood	2012	7000867
Drought	1983	3000000
Flood	2018 (Dec)	2000000
Flood	2018 (Sept)	1922332
Flood	2010	1500200
Flood	1994	580000
Flood	1988	300000
Flood	2003	210000
Flood	2009	150000
Flood	2015	100420

Source: "EM-DAT: The OFDA/CRED International Disaster Database, Universite catholique de Louvain, Brussels, Belgium"; available at www.preventionweb.net

Top 10 Number of Natural Disasters in Nigeria 1900–2019 sorted by Economy loss in US\$



Disaster	Year	Damage ('000 US\$)
Flood	2012	500,000
Flood	2018	275,000
Drought	1983	71,103
Flood	1994	66,500
Flood	2010	30,000
Flood	2015	25,000
Flood	1985	8,000
Flood	2000	4,805
Flood	2011	4,500
Flood	2001	3,000

Source: "EM–DAT: The OFDA/CRED International Disaster Database, Universite catholique de Louvain, Brussels, Belgium"; available at www.preventionweb.net – Updated 29th Jan, 2019

FLOOD



- Floods have been identified to affect more people and cause more economic losses than any other hazard (Wisner et al, 2004).
- **Flooding does not necessarily occur as the hazard event in itself, but is usually the result of a combination of some other geographic phenomena and human activity within any given location (PDNA, 2012)**

FLOOD CONTD...



- According to Post Disaster Needs Assessment (PDNA) conducted in Nigeria in 2012, Flooding is considered the most common and recurring disaster in Nigeria by the National Emergency Management Agency. And this is a trend likely to continue.
- Floods have been identified to affect more people and cause more economic losses than any other hazard (Wisner et al, 2004).

TYPES OF FLOOD

Floods are of various types.

- i. **Riverine floods** are normally restricted to flood plains where silt have been deposited and the land levelled so that it is good for agriculture and cheap for modern constructions.
- ii. **Flash floods**, on the other hand occur in the hilly upper reaches of river basins, when heavy rain over a limited area drains rapidly into a main channel (Wisner et al, 2004).
- iii. Floods may also be **associated with dams**. While dams can be designed to help reduce flood risk, they can be inadequate or inappropriate for the task or at best provide a false sense of security.
- iv. **Urban Flooding:** Flooding in urban areas can be caused either by flash floods, coastal floods, or river floods, but there is also a specific flood type that is called urban flooding.
- v. **Coastal Flood:** Coastal flood is the flooding of the coast caused by severe storm. The storm wind pushes the water up and creates high waves.
- vi. **Pluvial Flood:** Pluvial flood or Ponding is a type of flood that occurs in relatively flat areas. When more rainwater enters a water system than can be stored, or can leave the system, flooding occurs.



CAUSES OF FLOODING IN NIGERIA



The causes of flooding, erosion, and gully formation differ by location, but are largely human. These include:

(a) Improper building and infrastructure design, location, and construction, as well as inadequate drainage;



CAUSES OF FLOODING IN NIGERIA

The causes of flooding, erosion, and gully formation differ by location, but are largely human. These include:

(b) Poor solid waste management in urban and peri-urban areas that chokes the already inadequate drainage meant to prevent flooding and erosion;



CAUSES OF FLOODING IN NIGERIA

(c) Destructive and unsustainable land-use practices that remove protective vegetation over, overgrazing, deforestation, cultivation of marginal lands, and uncontrolled mining.



CAUSES OF FLOODING IN NIGERIA

(d) Poor Urban Planning and lack of Enforcement of Building Code:



Lack of drainages and building on water ways or flood plains

The trend towards urbanization provides additional pressures on the environment and increases vulnerability to natural hazards, particularly among the poor. The urban poor tend to live in informal settlements, and their housing is often inadequately constructed.

- Encroachment into areas of higher vulnerability occurs when a larger population seeks new places to live.

CAUSES OF FLOODING IN NIGERIA

(d) Climate change and cultural resistance to change



CAUSES OF FLOODING IN NIGERIA

(e) Poor Dam and Water Management

2020 Example:

The Management of Oyan Dam in Ogun State reported that:

- a. The dam capacity of about 270million cubic litres has gotten in July
- b. 5 Million cubic litres of water was released in July
- c. In August 8 to 10 million cubic litres of water was be released
- d. In September, 18 million cubic litres of water was released
- e. In October, 23 million cubic litres of water was released
- f. While 11 million cubic litres was released in November

The release of water from the dam will impacted heavily on Ikorodu and Kosofe LGAs of Lagos State and communities in Ogun State and affected the people , properties and farmland.

The question is why was dam full to capacity in July?

Why was the water not used for dry season farming?

Why was there no release of water before the rainy Season?

This situation is similar in many of our dams



Impacts of Flood



- ▶ Loss of lives and property
- ▶ Agony
- ▶ Economic loss
- ▶ Loss of livelihood
- ▶ Social Dislocation
- ▶ Disruption of School System
- ▶ Leads to displacement of people
- ▶ Environmental pollution and health challenges
- ▶ Community conflict
- ▶ Damage to Infrastructure

Flood impacts have social, economical and environmental consequence which affect the sustainable development of any Country.

CASE STUDY: IMPACT OF 2012 FLOOD IN NIGERIA

- ▶ The unprecedented flood that ravaged parts of Nigeria between July and December 2012 
- ▶ Affected over 7 million people
- ▶ Displaced 2.3 million people
- ▶ Killed 363 persons
- ▶ Destroyed or damaged about 597,476 houses in 34 States.
- ▶ Total value of damage and losses across all sectors was estimated at N2.6 trillion (\$16.9 billion).
- ▶ The overall impact of the flood on real GDP growth was estimated at 1.4 percent i.e. N570 billion in nominal terms (PDNA Report, 2012).

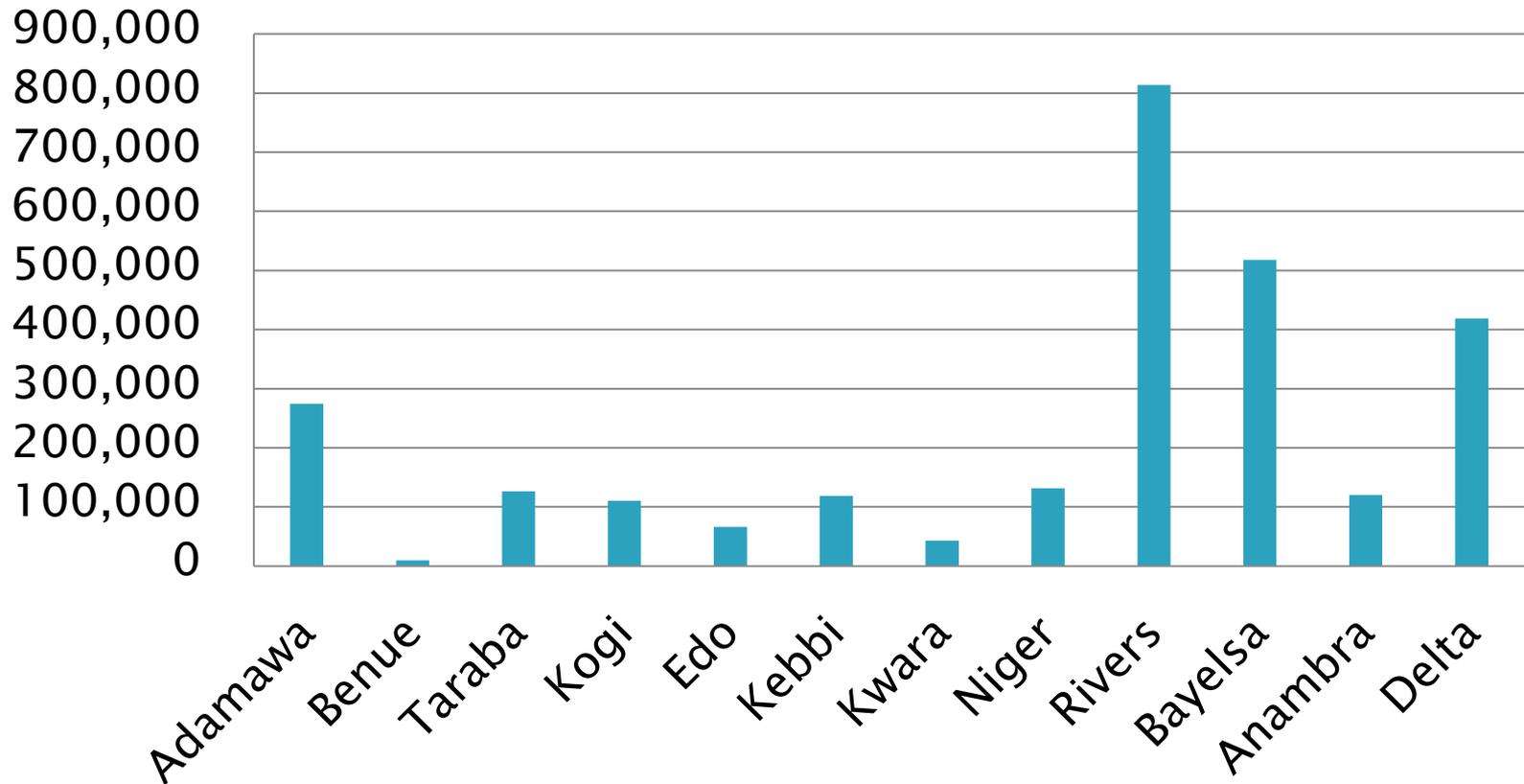
CASE STUDY: IMPACT OF 2018 FLOOD



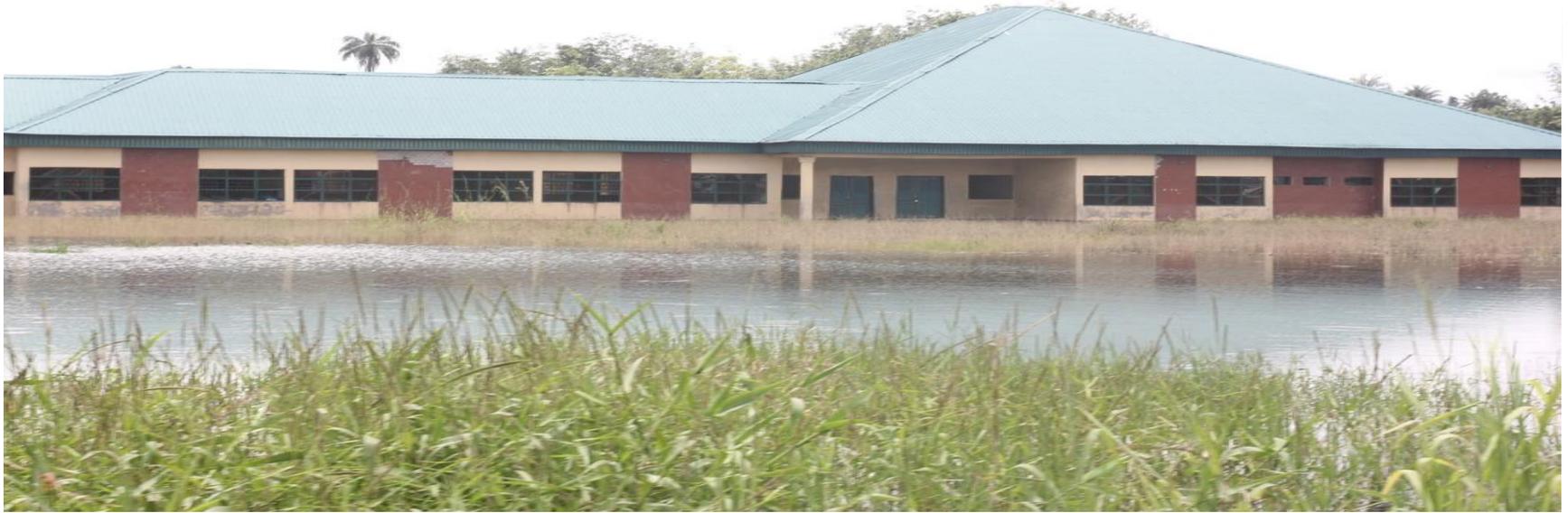
State	LGA affected	Population affected	Persons in Need	*IDPs
Adamawa	14	274,332	13,818	24,149
Benue	3	9,826	6,252	7,397
Taraba	10	126,225	19,644	36,849
Kogi	9	110,594	18,463	69,645
Edo	5	66,372	1,143	71,583
Kebbi	19	118,606	13,924	83,547
Kwara	8	42,939	21,000	21,000
Niger	22	131,423	17,629	17,629
Rivers	5	813,860	21,816	40,323
Bayelsa	7	517,694	230,085	
Anambra	9	120,000	7,641	63,011
Delta	16	418,361	13,283	45,201
Total		2,750,232	384,698	480,334



Population Affected by 2018 Flood



SCHOOLS AFFECTED BY FLOOD IN RIVERS AND BAYELSA IN 2018



IMPACT OF 2020 FLOOD



S/No	States	No. of LG affected	Persons affected
1	Abia	12	6,000
2	Adamawa	6	2,400
3	Akwa Ibom	13	5,200
4	Anambra	1	400
5	Bauchi	9	3,600
6	Bayelsa	8	3,200
7	Benue	13	5,200
8	Borno	11	4,400
9	Cross Rivers	14	5,600
10	Delta	18	7,200
11	Ebonyi	1	400
12	Edo	4	1,600
13	Enugu	1	400

IMPACT OF 2020 FLOOD CONT'D



S/No	States	No. of LG affected	Persons affected
14	FCT	3	1,200
15	Gombe	7	2,800
16	Imo	5	2,000
17	Jigawa	16	6,400
18	Kaduna	10	4,000
19	Kano	20	8,000
20	Katsina	11	4,400
21	Kebbi	21	8,400
22	Kogi	6	2,400
23	Kwara	11	4,400
24	Lagos	3	1,200
25	Nassarawa	2	800
26	Niger	22	8,800

IMPACT OF 2020 FLOOD CONT'D



S/No	States	No. of LG affected	Persons affected
27	Ogun	8	3,200
28	Oyo	9	3,600
29	Plateau	2	800
30	Rivers	17	6,800
31	Sokoto	8	3,200
32	Taraba	4	1,600
33	Yobe	11	4,400
34	Zamfara	13	5,200
	TOTALS	320	129,200

2020 FLOODING IN GORONYO RIVER



2020 FLOOD IN GWAGWALADA



Farmlands Destroyed By Floods in Kebbi State





Rescue Operations by NEMA staff in Kaduna State



FLOOD RISK REDUCTION MEASURES



NON STRUCTURAL

- ▶ Delineation of Flood prone areas and enforce the building codes
- ▶ Automated Flood Notifications
- ▶ Public Education
- ▶ Flood Insurance
- ▶ Audible Flood Warning System for Individual Property
- ▶ Involuntary resettlement
 - Property Acquisition and Structure Demolition
 - Structure Demolition and Rebuild
 - Property Acquisition and Structure Relocation
 - Property Acquisition, Demolition or Relocation, and Re-sale
 - Structure Elevation
 - Abandon Basement and Fill
 - Flood proofing of Structures

FLOOD RISK REDUCTION MEASURES



STRUCTURAL

- ▶ Levee/Floodwall Protection for Multiple Structures
- ▶ Levee/Wall for a Single Structure
- ▶ Storm Water Detention Facilities
- ▶ Storm Water System Control
- ▶ Raising facility onto platform (wood, metal, concrete)
- ▶ River Training/Dredging

Unsustainable Flood Management Practices



- ✓ Focus only on reducing flooding and reducing the susceptibility or vulnerability to flood damage
- ✓ *Such measures often reduce the socio-economic development potential of floodplains*
- ✓ **They are problem driven and are carried out in isolation**
- ✓ *Specifying an issue in terms of a problem can lead to the implicit exclusion of other feasible options. The adverse impacts of a particular solution on downstream and upstream areas, on other elements of the hydrological cycle and on riverine ecosystems tend to be ignored*

Unsustainable Flood Management Practices (2)



- ▶ Express the risk of flooding simply as the "Exceedance probability of a flood of a given magnitude on a particular stretch of river" leading to the setting of design standards for protection.
- ▶ *This can be challenged through Uncertainties related to the frequency and magnitude of extreme events, possibly caused by climate change.*

Sustainable Flood Management Approach



Integrated flood management (IFM)

This is the integration of land and water management in a river basin using a combination of measures. These focus on coping with floods within a framework of integrated water resources management (IWRM) and adopting risk management principles, while at the same time recognizing that floods have beneficial impacts and can never be fully controlled.

This is the approach to flood management that improves the functioning of the river basin as a whole, recognizing that floods have beneficial impacts and can never be fully controlled.

Such an approach seeks to maximize the productivity of floodplains and minimize loss to life, subordinating flood loss reduction to the overall goal of maximizing the efficient use of the floodplain.

Underlying Factors in Integrated Flood Management



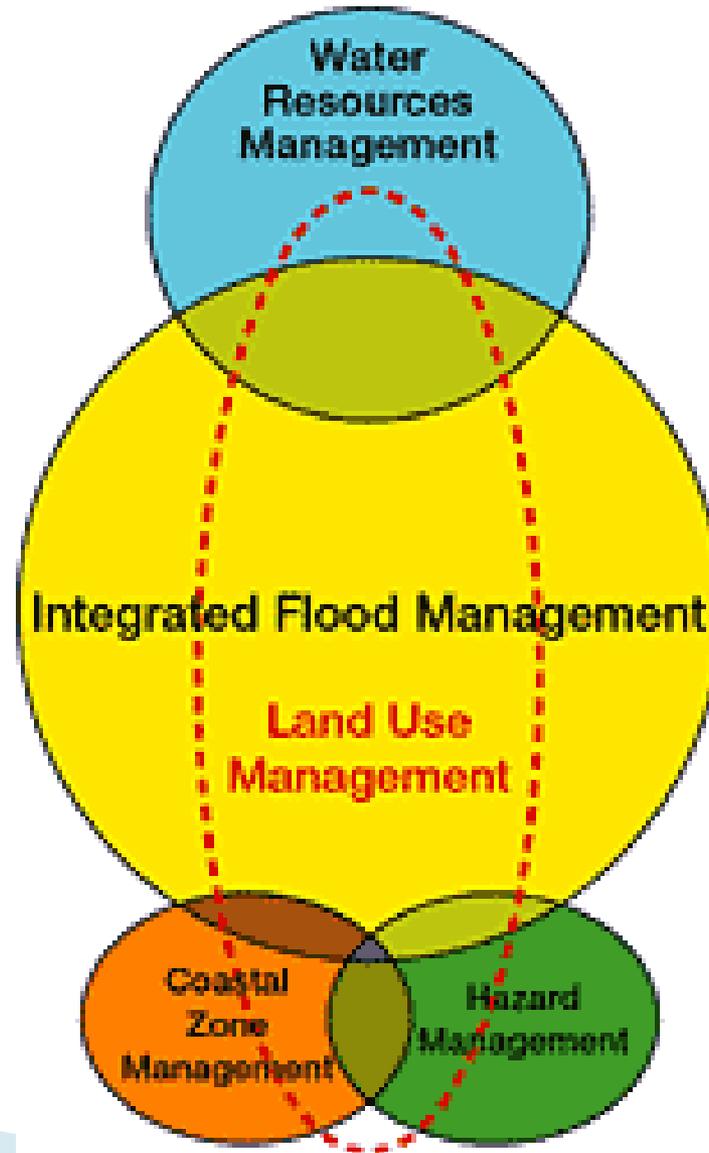
- ▶ Changes in land use across the basin affect runoff and the probability of a flood of a given magnitude.
- ▶ Changes in the intensity and duration of precipitation patterns as a result of climate change could increase flash floods and seasonal floods.
- ▶ The likelihood that existing flood protection measures could fail and how such situations should be managed need to be considered.
- ▶ Riverine aquatic ecosystems provide many benefits such as: clean drinking water, food, flood mitigation and recreational opportunities.
- ▶ A trade-off between competing interests in a river basin is required to determine the magnitude and variability of the flow regime needed within a basin to maximize the benefits to society and maintain a healthy riverine ecosystem.

Underlying Factors in Integrated Flood Management



- ▶ A river basin is dynamic over time and space. There are a series of interactions between water, soil/sediment and pollutants/nutrients.
- ▶ Population growth and economic activities exert pressure on the natural system.
- ▶ Increased economic activities in floodplains increase vulnerability to flooding.
- ▶ High level of investment in floodplains, and the lack of alternative land in many countries, means that abandoning flood-prone areas cannot be a viable option for flood damage reduction.

Elements of Integrated Flood Management:



Elements of Integrated Flood Management:



1. *Ensure a Participatory Approach*

- ▶ IFM should be based on a participatory approach involving users, planners and policy-makers at all levels and should be open, transparent, inclusive and communicative.
- ▶ Decentralization of decision-making is necessary, with full public consultation and involvement of stakeholders in planning and implementation.
- ▶ Gender, religious and cultural differences must be taken into consideration
- ▶ An appropriate combination of both the "bottom-up" and "top-down" approaches needs to be adopted.
- ▶ Coordination at the Federal level to promote coordination and cooperation at State and LGA levels.

Elements of Integrated Flood Management:



2. *Integrate Land and Water Management*

- ▶ Land use planning and water management must be combined in one synthesized plan, through coordination of land and water management authorities to achieve consistency in planning.
- ▶ The three main elements of river basin management (water quantity, water quality, and the processes of erosion and deposition) should be linked in planning.
- ▶ Effect of land use changes on the various elements of the hydrological cycle need to be taken into consideration.

Elements of Integrated Flood Management:



3. *Manage the Water Cycle as a Whole*

- ▶ Flood management plans must be intertwined with drought management through the effective use of floodwater and/or by maximizing the "positive" aspects of floods.
- ▶ Need to manage all floods and not just some.
- ▶ Seek multi-beneficial solutions that serve several different purposes simultaneously.

Elements of Integrated Flood Management:



4. *Adopt Integrated Hazard Management Approaches*

- ▶ Flood management should be integrated into a wider risk management system of 'all hazard' emergency planning and management.
- ▶ Experts from all sectors, involving different disciplines, should be involved in the implementation of disaster management plans.
- ▶ Consistency in approaches to natural hazard management in all relevant national or local plans should be ensured.
- ▶ Flood management strategies should involve a combination of complementary options
- ▶ An appropriate combination of structural and non-structural measures must be evaluated, adopted and implemented, recognizing the merits and demerits of both types of measures.
- ▶ Early warnings and forecasts, that are key inputs for the reduction of the social and economic impact of all natural hazards – including floods, should be strengthened.

Challenges of Flood Risk Management in Nigeria



Some of the challenges in reducing and mitigating flood risk in Nigeria are related to:

- i. Inadequate flood control infrastructure ;
Drainages, Dams, Embankment, e.t.c
- ii. Silted dams and Rivers;
- iii. Dam monitoring and maintenance;
- iv. Inadequate flood risk awareness by stakeholders;
- v. Poor solid waste, sewage, drainage, and flood zone management;
- vi. Poor Town Planning and enforcement of building codes
- vii. Resistance of populace to early warning instructions; Cultural affiliation and lack of alternative

Recommendation for Flood Risk Management

- ▶ **Improvement of institutions and incentives** by establishing an integrated Flood Risk Management system.
- ▶ **Improve information on risk assessment and decision support system** by establishing a flood risk assessment modeling platform; undertaking national Hazard Mapping; and establishing open Disaster Risk Information and decision support system to improve inter-agency coordination/information
- ▶ **Improving Forecasting and Early Warning** by establishing EWS linked to decision support system; strengthening the Hydrological Service; and Strengthening the meteorological service
- ▶ **Strengthening the nations Disaster Preparedness** by developing national and state contingency plans; updating National and State database on past disaster, critical infrastructure and supplies; and improving National and State disaster risk awareness and alerts



Recommendation for Flood Risk Management



- ▶ **Build community resilience** by ensuring risk sensitive land use planning, building design and compliance
- ▶ **Invest in infrastructure** as waste management, roads, drainages, flood management structure and subsidized housing for relocation of poor citizens
- ▶ **Setting up of risk financing facilities** across the country
- ▶ **Preparation and implementation of Integrated Flood Management** in all parts of the country.

CONCLUSION:

FLOOD RISK REDUCTION MEASURES AND SUSTAINABLE DEVELOPMENT



- ▶ Many objects of flood protection infrastructure have been criticized in the context of sustainable development as solutions closing options for future generations and introducing unacceptable disturbance to ecosystems.
- ▶ However, Soft measures that do not involve large structural components can be rated as more sustainable than hard measures, yet the latter may be indispensable in particular circumstances. A distributed small-scale structural approach, such as source control, flood proofing, building codes, extending permeable areas etc, are also sustainable.



**Thank You
For
Your Attention**