

**Introduction to Concept of**

**‘Disaster Risk’**



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**Research Associate & Program Coordinator**



#Disaster

#DisasterManagement

#DisasterRisk

#DisasterRiskReduction

#DisasterRiskMangement

#NoNaturalDisaster



# DISASTER



# DISASTER



# DISASTER RISK





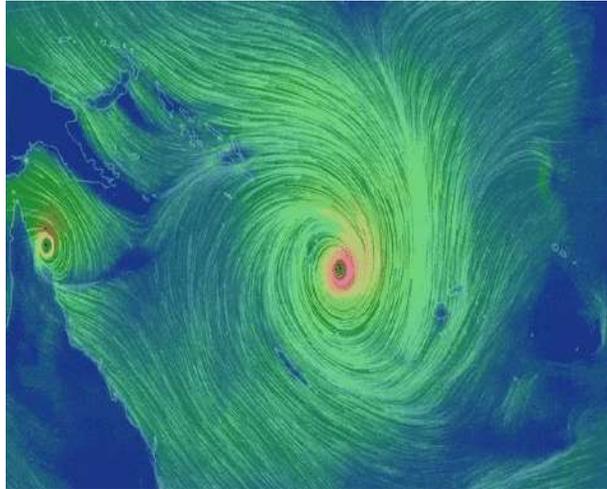
$$\text{DISASTER RISK} \propto \frac{\text{HAZARD * VULNERABILITY* EXPOSURE}}{\text{COPING CAPACITY}}$$



# What is disaster?

આપત્તિ શું છે ?

## Disasters of 21<sup>st</sup> Century



**1999 Super Cyclone**  
**Orissa**



**2001 Bhuj Earthquake**  
**Gujarat**



**2004 Tsunami**  
**Southern India**



**2013 Flash Floods**  
**Uttarakhand**

# What is disaster?



**Loss of Life (Social Loss)**



**Damage to Property  
(Economic Loss)**



# What is disaster?



**Environmental Degradation**



# What is disaster?

A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes **loss or damage to property, loss of human life or injury or illness to human beings; or damage or degradation of environment** such that **it exceeds the community's or society's ability to cope using its own resources.**



# 10 hurt, 2 critical after fire burns down home

DC CORRESPONDENT  
HYDERABAD, APRIL 9

Two kids were injured seriously and 10 others of a family suffered minor injuries in a fire at Talabkatta in the wee hours of Saturday. Police said the mishap which gutted the house could have occurred due to a short circuit.

Neighbours entered the house with the help of the police by breaking the asbestos sheet roof and rescued the residents. Around 12 people were sleeping in the house at the time of the incident. A bike parked outside was burnt and a she goat tied outside the house also died.

Bhawaninagar inspector B. Srinivasa Rao said the house on road #2A at Salam Chowk in Talabkatta, belonged to 66-year-old Mohammed Shaikh Sayeed Sahab. He and his two sons Shaikh Farooq and Shaikh Mahboob and their families were staying in the house. Police said around 16 persons including eight kids were in the house.

On Saturday at around 5.15 am fire broke out in the house. Sayeed, who saw the fire, rushed out. By the time neighbours and police arrived, the house was engulfed in fire. "Some neighbours and cops broke the asbestos roof and rescued the residents," Mr Srinivasa Rao said.

By then, two fire tenders from Moghalpura and Malakpet rushed to



The house which was destroyed in the fire at Bhawaninagar on Saturday morning. — DC

## TWO OF THE CHILDREN STILL FIGHTING FOR THEIR LIVES

DC CORRESPONDENT  
HYDERABAD, APRIL 9

Two-year-old Noor and 12-year-old Muzamil are critical after they were injured in a fire at their home in Bhawaninagar in the wee hours of Saturday. "Eight children are admitted in hospitals of which three are boys. Two of them are in a critical condition

and we can comment on their condition only after 48 hours," said Dr Lalu Prasad, senior paediatrician at Niloufer Hospital.

The remaining children aged between four and 10 years are recuperating in separate wards.

These children suffered mild burns but are stable and are recovering fast.

the spot. The rescued persons were shifted to Osmania Hospital. The injured suffered suffocation due to the smoke but were not burnt.

Of the 12 injured 12-

year-old Sk Muzamil and five-and-a-half year-old Saba, both grandchildren of Sayeed, were shifted to Niloufer hospital and their condition is said to be critical.

# Was 2001 Bhuj Earthquake a Disaster?





# What is 'disaster risk' (આપત્તિ જોખમ)?

- The **potential** loss of life, injury, or destroyed or damaged assets which **could** occur to a system, society or a community in a specific period of time.
- Determined probabilistically as a function of hazard, exposure, vulnerability and capacity.

વિનાશક ઘટના (Hazard) X ખુલ્લાપણું (Exposure) X અસામર્થ્યો (Vulnerability)

આપત્તિનું જોખમ

α

પહોંચી વળવાની ક્ષમતા (Coping Capacity)



# #Disaster-vs-Disaster Risk

Disaster is an actual event or series of events that has already happened and has already caused loss of life & property and environment degradation.

Disaster Risk is “the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time”.

Disaster Risk is possibility/ probability of occurrence of disaster.



# Story of Town XYZ

**Lets assume:**

A Study about Town XYZ reveals that:

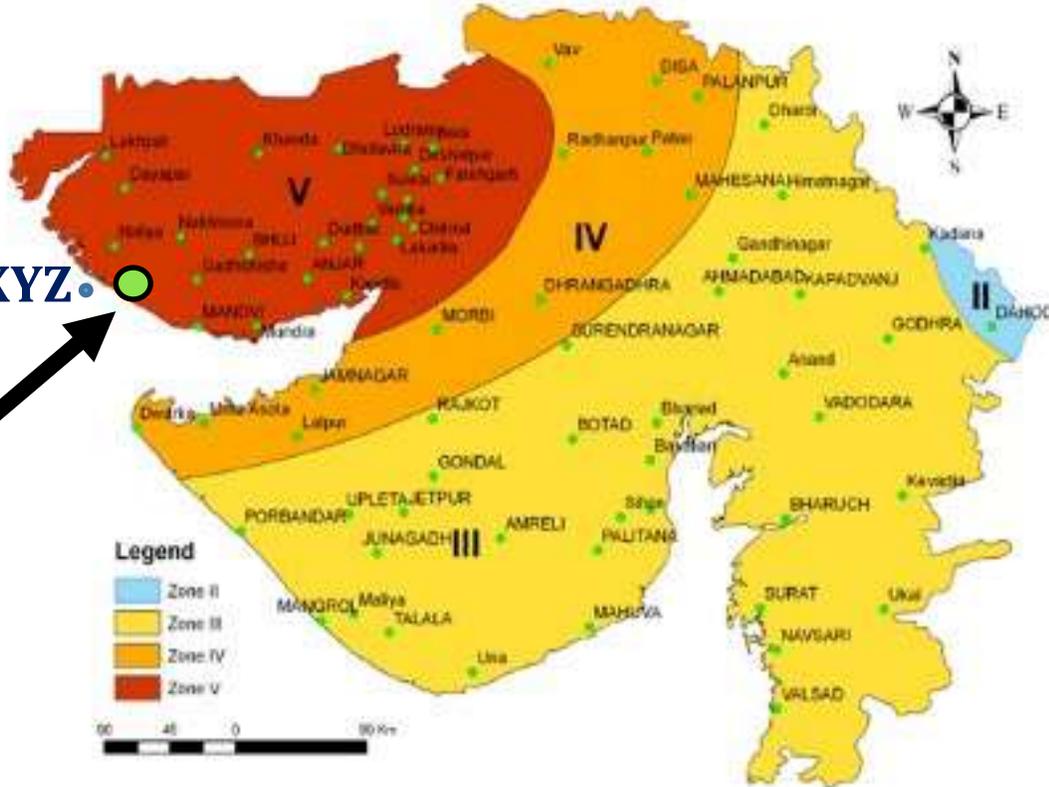
If 7.7 Mw Earthquake strikes in near future:

1. Fatalities: **100+**
2. Severely Injured: **1000+**
3. Loss/ Damage of Property: **₹ 100 Million+**

Information about Town XYZ

1. Only 4% of total households are Earthquake Resistant.
2. Only 10% of the population know about Earthquake Safety.

**Town XYZ.**



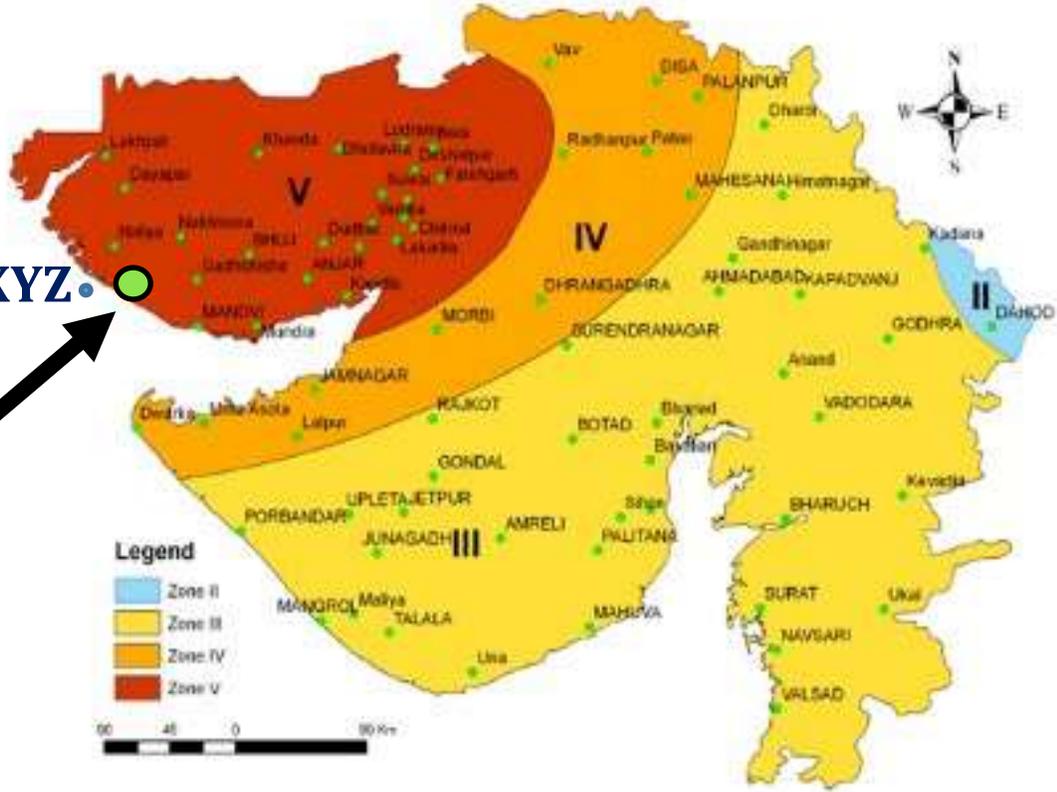
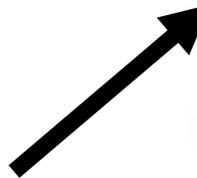
**Seismic Zoning Map of Gujarat**



# What is 'disaster risk' of Town XYZ?

**Lets assume:**

**Town XYZ**



**Seismic Zoning Map of Gujarat**

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If 7.7 Mw Earthquake strikes in near future:

1. **Fatalities: 100+**
2. **Severely Injured: 1000+**
3. **Loss/ Damage of Property: ₹ 100 Million+**



**Potential loss of life, injury, or destroyed or damaged assets**



**Disaster Risk**

$\alpha$

**Hazard x Exposure x Vulnerability**

**Coping Capacity**



# विनाशक घटना (Hazard)

A process, phenomenon or human activity that **may cause** loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.



Cyclone



Earthquake



Floods



# What is a 'hazard'?

So anything, which can be a process or a substance (e.g. nuclear fuel) or an establishment (e.g. petroleum refinery, power plants etc.) can be a hazard.

- To put it in simple words, if there is anything which **can** cause harm to life, property or both, is what hazard really is!
- **Hazards can be natural or man-made (anthropogenic).**
- For example, natural hazards are Earthquake, Flood, etc., while, man-made hazards are all those events which takes place due to human causes or in fact, negligence, like explosions or oil-spills.



# Hazard for Town XYZ

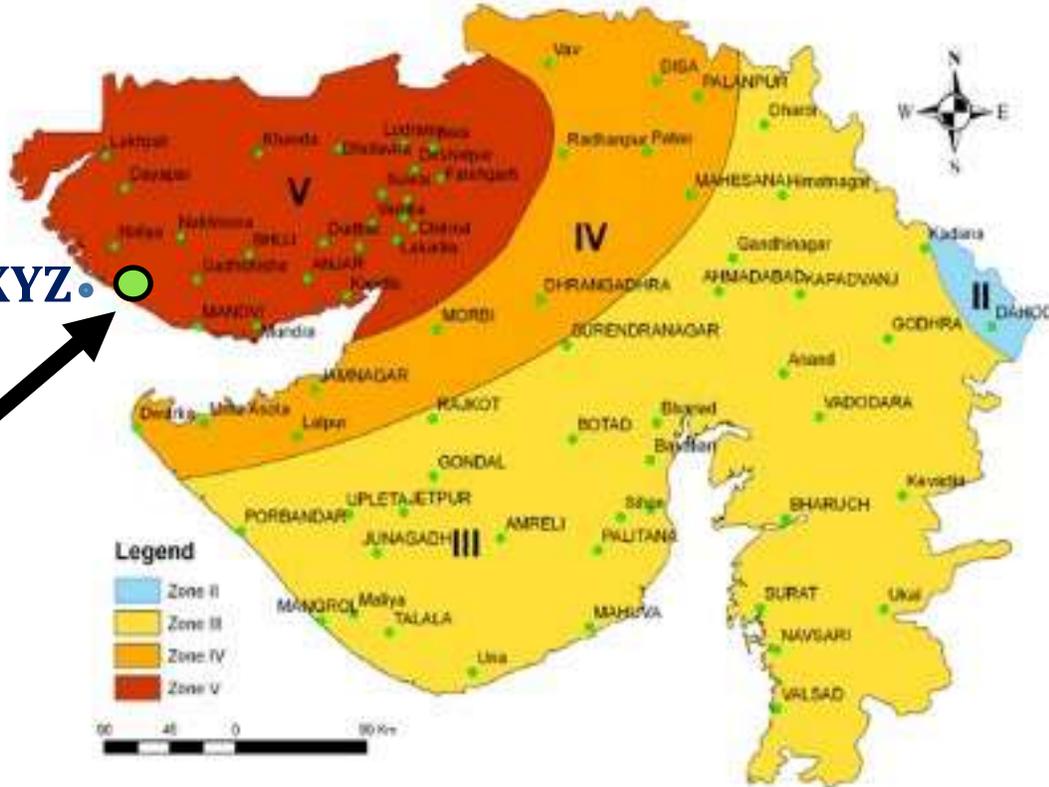
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**Town XYZ.**



**Hazard under consideration for Town XYZ is Earthquake**

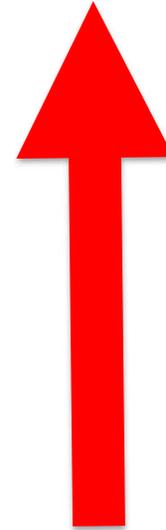
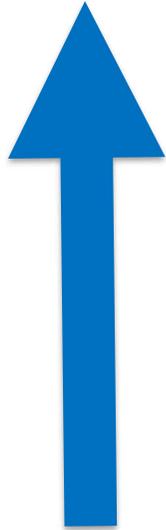
**Seismic Zoning Map of Gujarat**



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# Hazard

# Disaster Risk





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**Disaster Risk**  $\alpha$  **Hazard**



# #Disaster-vs-Hazard

Hazards are the natural or manmade phenomena that have capacity or potential to cause disaster. It not necessarily mean that every time they occur they cause loss of life, property and environment degradation.

Earthquake, Cyclone, Floods are “hazards” and not “disaster”.

**“Atom Bomb itself wasn't a disaster. It was only when it was dropped on Hiroshima & Nagasaki it rained Havoc”.**



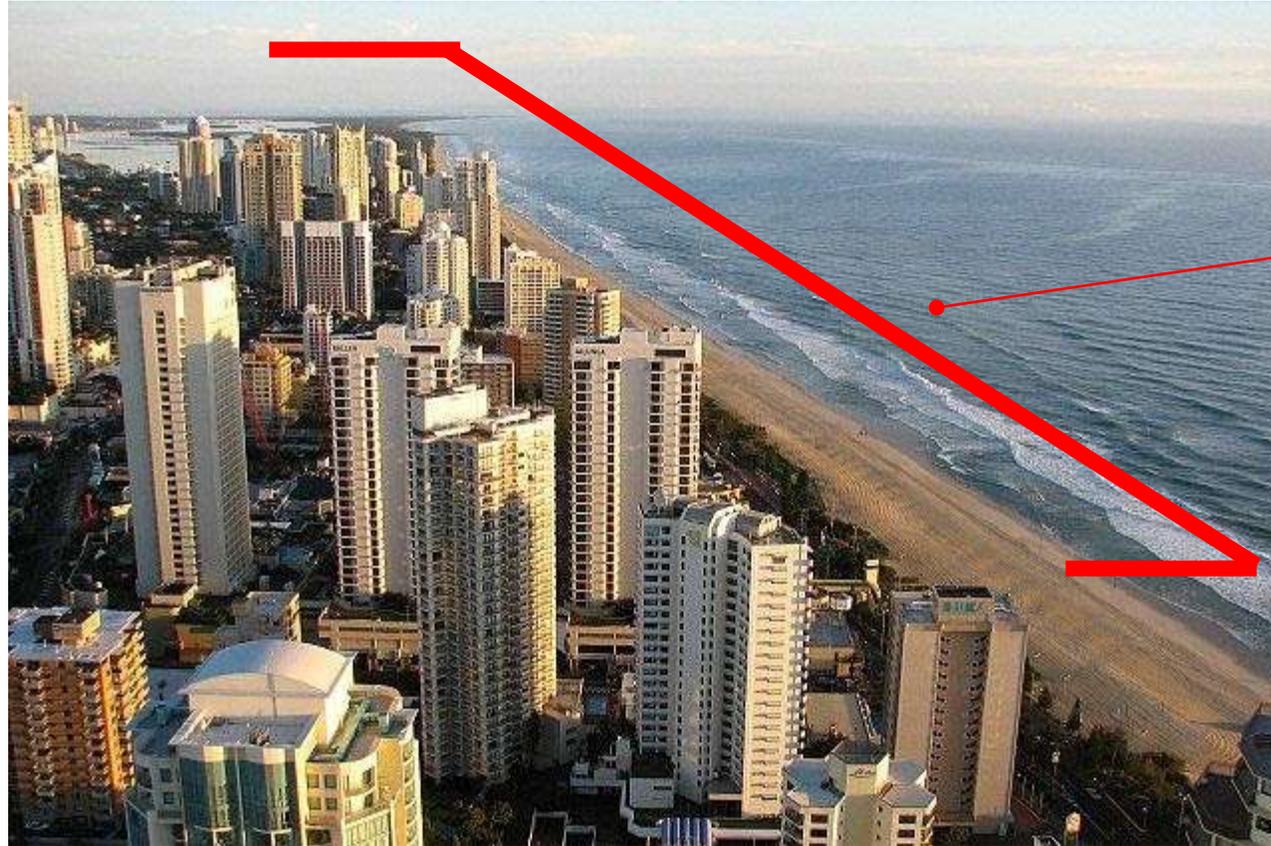
$$\text{Disaster Risk} \propto \frac{\text{Hazard} \times \text{Exposure} \times \text{Vulnerability}}{\text{Coping Capacity}}$$



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# ખુલ્લાપણું (Exposure)

The **situation** of people, infrastructure, housing, production capacities and other tangible human assets **located in hazard-prone areas**



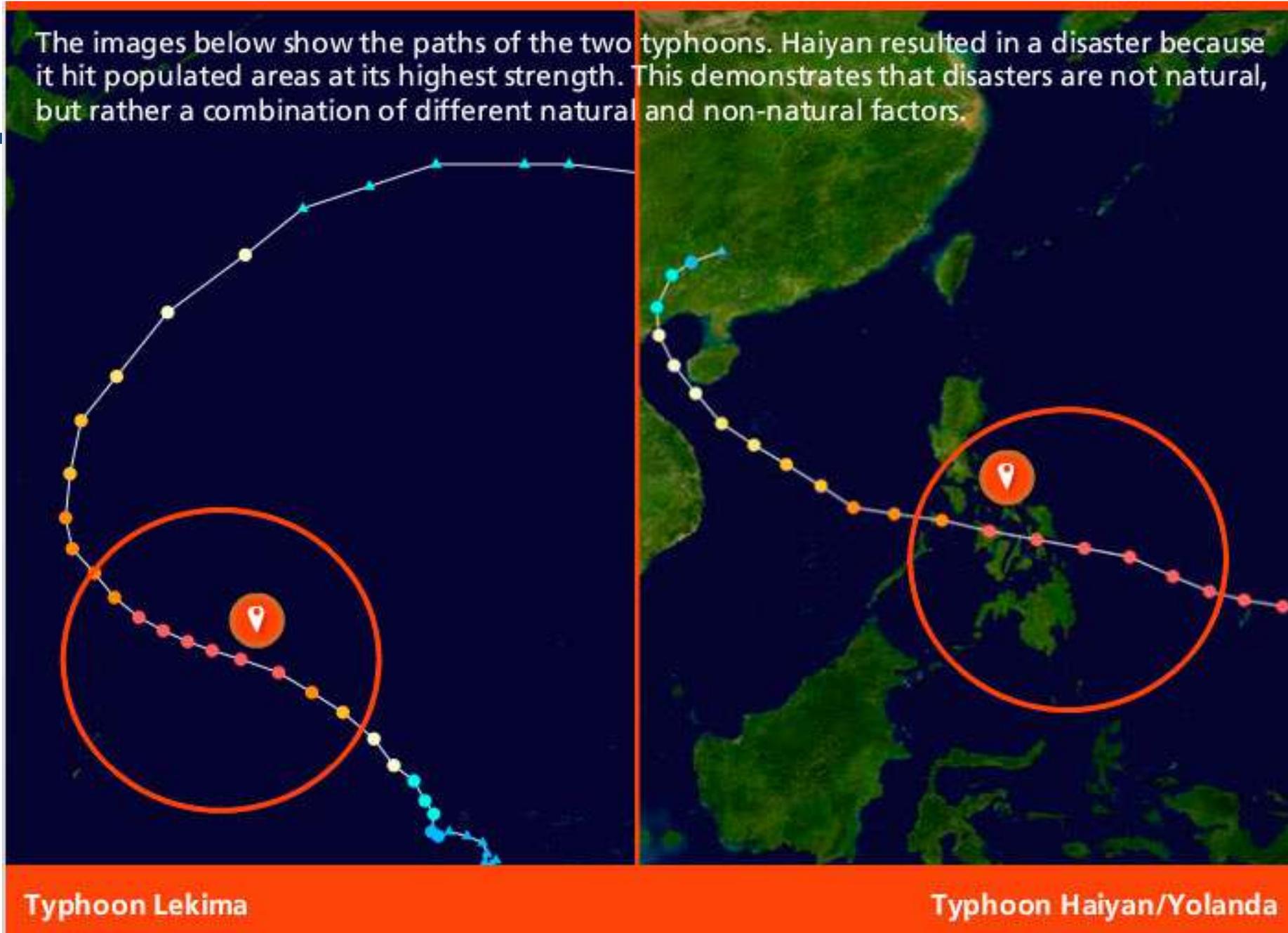
Exposed!



# ખુલ્લાપણું (Exposure)

**Why do we need to understand exposure?**

The images below show the paths of the two typhoons. Haiyan resulted in a disaster because it hit populated areas at its highest strength. This demonstrates that disasters are not natural, but rather a combination of different natural and non-natural factors.



Typhoon Lekima

Typhoon Haiyan/Yolanda

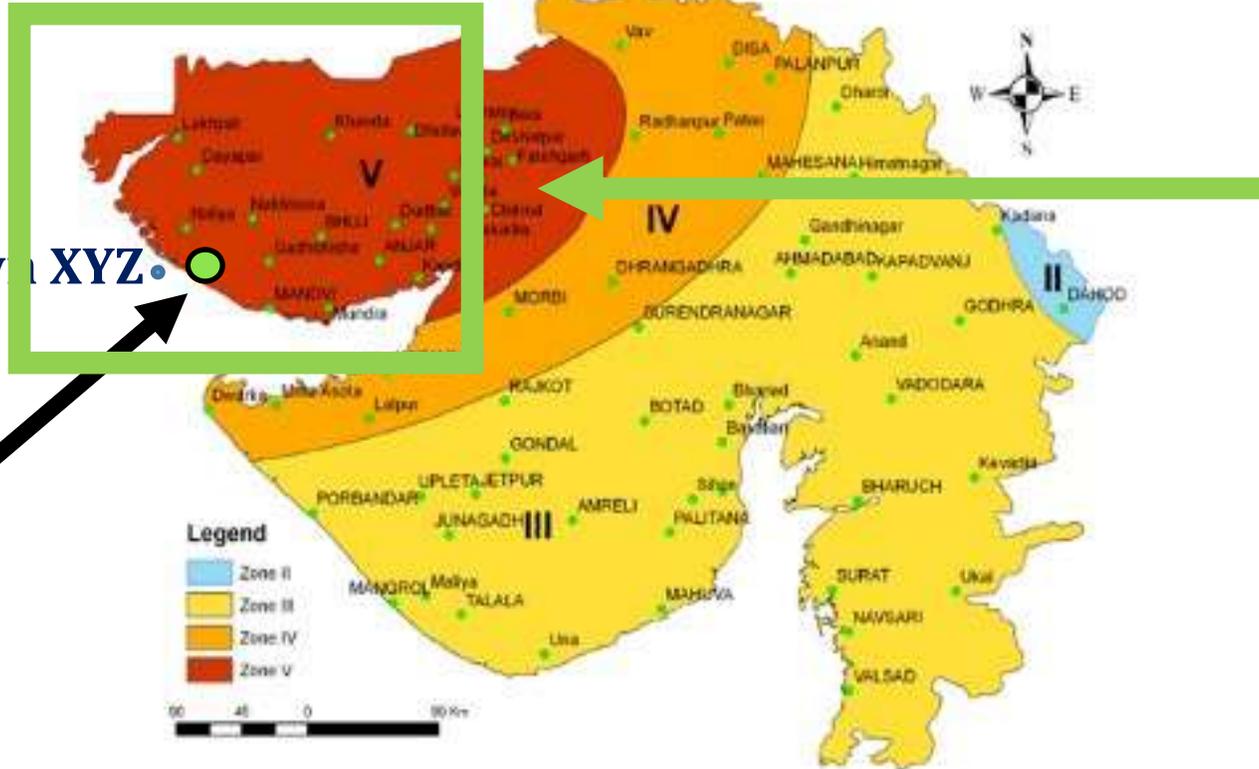


- In October 2013 a Category 5 super typhoon (known as Lekima) hit the North West Pacific Ocean. Its winds reached peaks of around 240 kilometres per hour, but caused no impact on people or assets.
- In November 2013 another Category 5 Super Typhoon Haiyan (Yolanda) hit the region, with winds peaking at 315 kilometres per hour. Haiyan affected 11 million people, causing more than 6000 casualties and the loss of more than 1.5 billion US dollars.



# Exposure of Town XYZ

**Lets assume:**



The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.

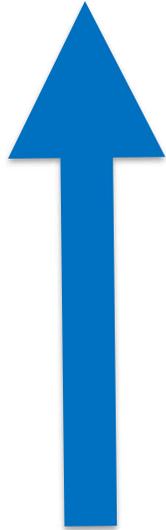
**Town XYZ is situated in Zone V.**

**Seismic Zoning Map of Gujarat**

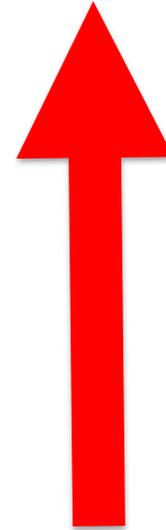


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# Exposure



# Disaster Risk





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**Disaster Risk**  $\propto$  **Exposure**



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# Food for thought

- What is exposure in case of COVID 19 pandemic?



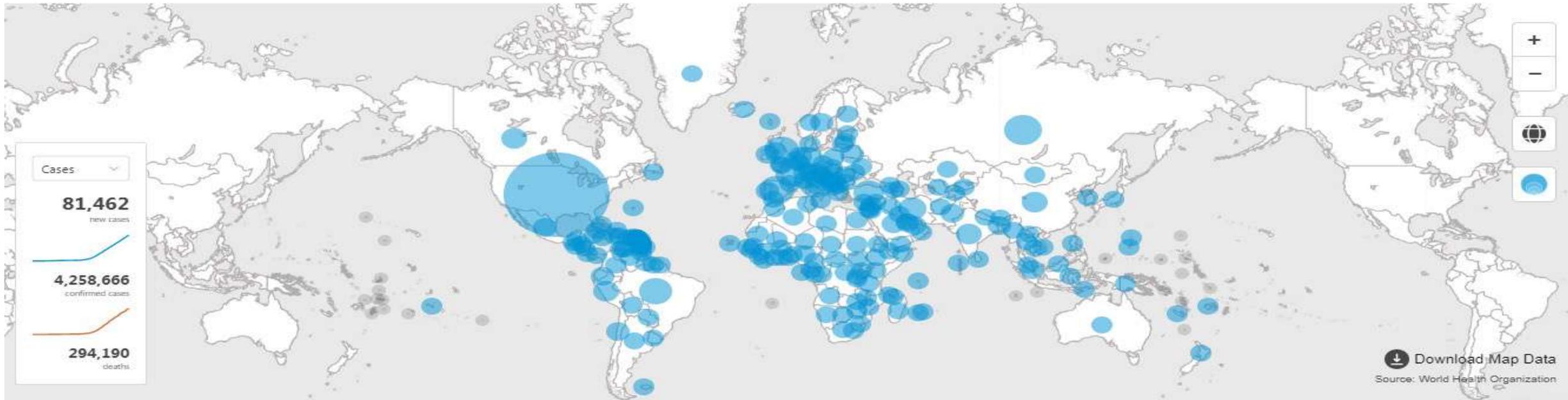
Search by Country, Territory, or Area

## WHO Coronavirus Disease (COVID-19) Dashboard

Data last updated: 2020/5/14, 7:10pm CEST

Overview

Explorer



**Globally**, as of **7:10pm CEST, 14 May 2020**, there have been **4,258,666 confirmed cases** of COVID-19, including **294,190 deaths**, reported to WHO.





$$\text{Disaster Risk} \propto \frac{\text{Hazard} \times \text{Exposure} \times \text{Vulnerability}}{\text{Coping Capacity}}$$







# असामर्थ्य (Vulnerability)

The **conditions** determined by physical, social, economic and environmental factors or processes which **increase the susceptibility** of an individual, a community, assets or systems **to the impacts of hazards**

By including vulnerability in our understanding of disaster risk, we acknowledge the fact that disaster risk not only depends on the severity of hazard or the number of people or assets exposed, but that it is also a reflection of the susceptibility of people and economic assets to suffer loss and damage.



- **Physical factors**

e.g. poor design and construction of buildings, unregulated land use planning, etc.

- **Social factors**

e.g. poverty and inequality, marginalisation, social exclusion and discrimination by gender, social status, disability and age (amongst other factors) psychological factors, etc.

- **Economic factors**

e.g. the uninsured informal sector, vulnerable rural livelihoods, dependence on single industries, globalisation of business and supply chains, etc.

- **Environmental factors**

e.g. poor environmental management, overconsumption of natural resources, decline of risk regulating ecosystem services, climate change, etc.



# Vulnerability of Town XYZ

**Lets assume:**

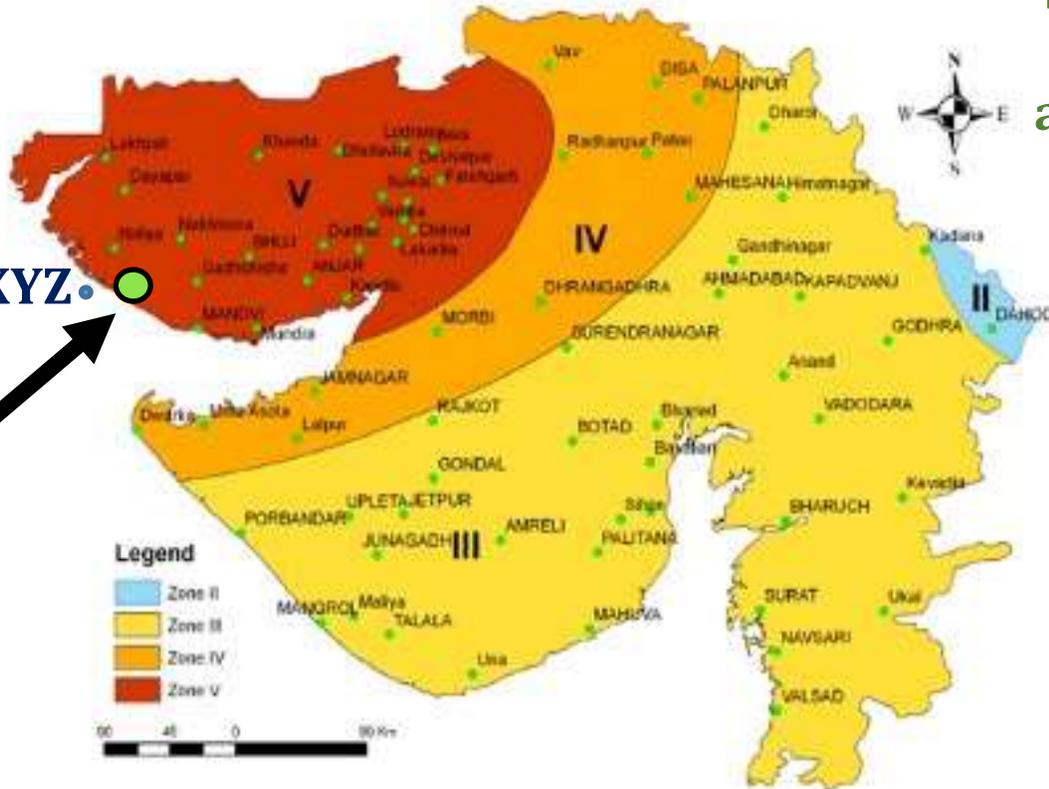
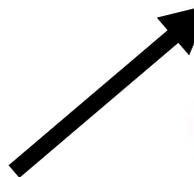
The conditions which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.



**Information about Town XYZ**

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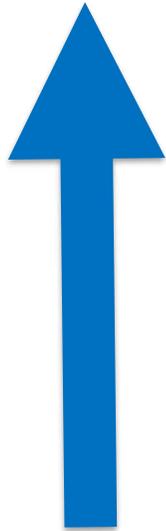


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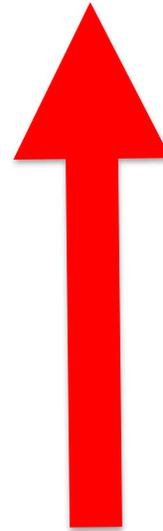


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# Vulnerability



# Disaster Risk





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# **Disaster Risk** $\alpha$ **Vulnerability**



$$\text{Disaster Risk} \propto \frac{\text{Hazard} \times \text{Exposure} \times \text{Vulnerability}}{\text{Coping Capacity}}$$



# પહોંચી વળવાની ક્ષમતા (Coping Capacity)

The **ability** of people, organizations and systems, using available skills and resources, **to manage adverse conditions, risk or disasters.**

- The capacity to cope requires continuing **awareness, resources** and **good management**, both in normal times as well as during disasters or adverse conditions.

- Coping capacities contribute to the reduction of disaster risks.

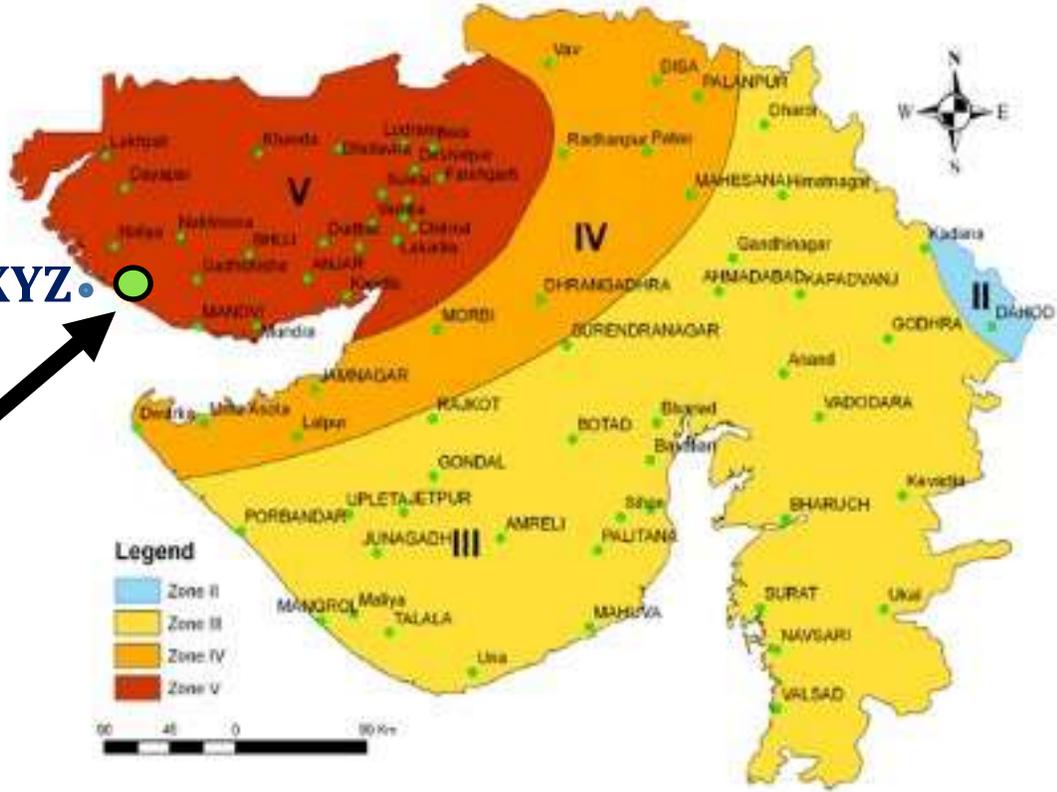
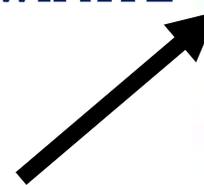
# Coping Capacity of Town XYZ

**Lets assume:**

Coping capacity is the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters



**Town XYZ**



**Seismic Zoning Map of Gujarat**

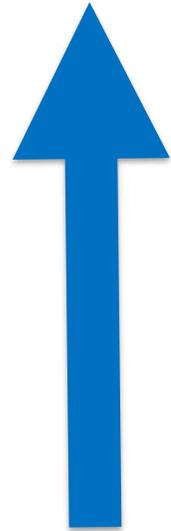
**Information about Town XYZ**

- Only 4% of total households are Earthquake Resistant. +++++
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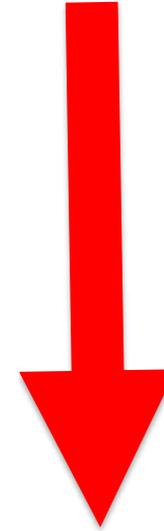


# Disaster Risk & Coping Capacity

**Coping Capacity**



**Disaster Risk**





# Disaster Risk & Coping Capacity

1

**Disaster Risk**

$\alpha$

**Coping Capacity**



$$\text{DISASTER RISK} \propto \frac{\text{HAZARD * VULNERABILITY* EXPOSURE}}{\text{COPING CAPACITY}}$$



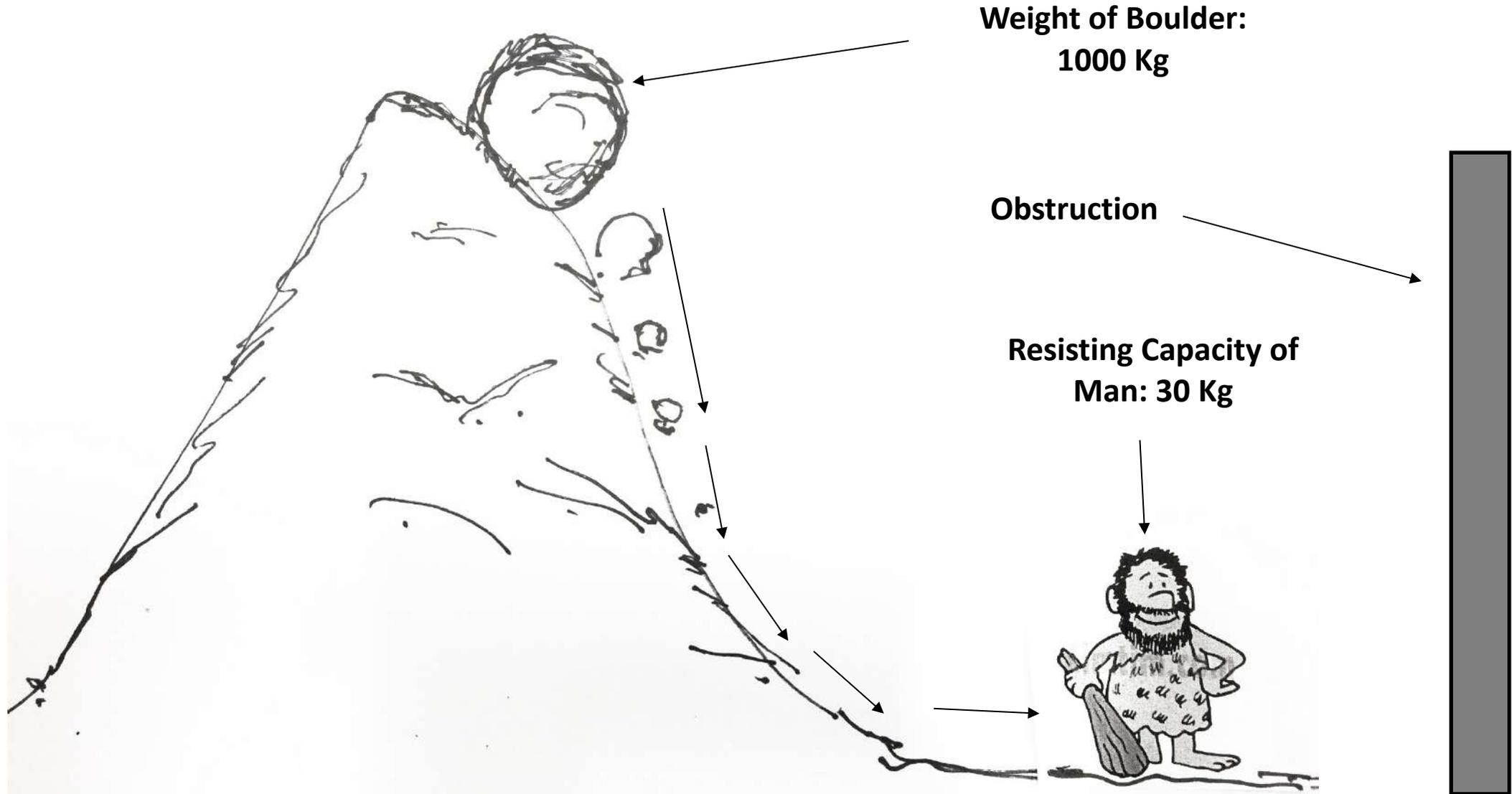
# So what is a 'Disaster' then?

**When the 'disaster risk' exceeds the 'coping capacity' of the 'exposed' assets, the incident of a hazard turns into a 'disaster.'**



# Case Study: Japan

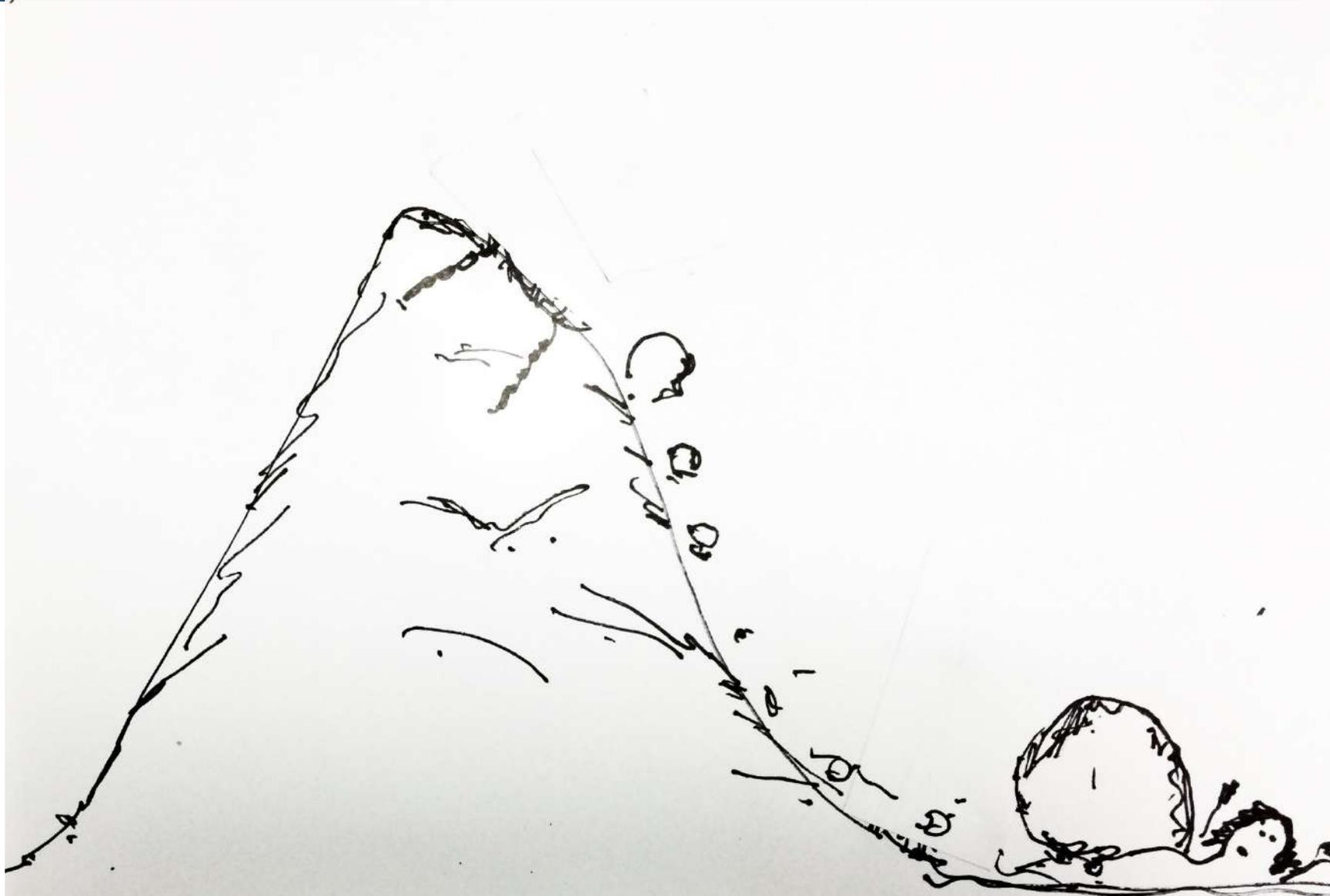






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# What is a 'disaster'?





# What is a 'disaster'?

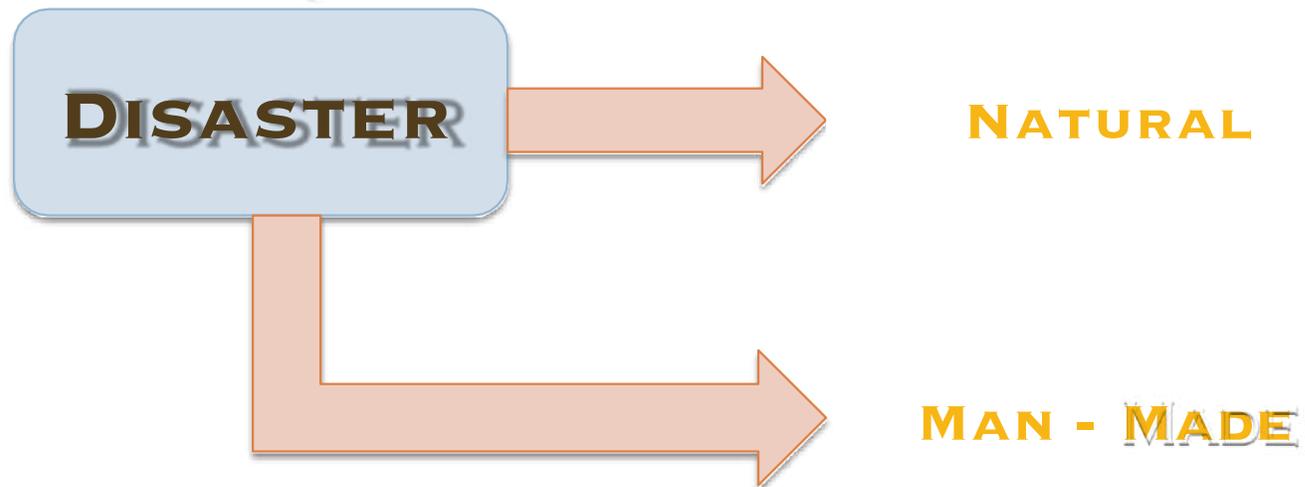
- There will always be a disaster risk owing to the hazards we are surrounded by, the vulnerabilities of the exposed assets.
- But, if we have the capacity to deal with it, there will be no disaster. It will merely be a 'hazardous' event which would require immediate attention!
- Thus, disaster is an event where the lurking disaster risks exceeds the coping capacities.



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# Types of Disaster

Disasters have been categorised into:





# Types of Disaster: Food for thought

- Do you think it is wise to categorize disasters into natural and man-made?
- Think of it this way.
  - In case of hazards like earthquake or cyclone or tsunami, they are all natural phenomenon which can not be stopped. However, knowingly we build our houses in hazard prone zones and above that, we do not even take care of our vulnerabilities to increase our coping capacities. So, we, humans, are actually increasing the disaster risks to an extent where it is becoming a disaster. **So, are these disasters really are natural or are we responsible for it in some ways?**
  - In case of hazards like **oil-spills** and **refinery explosions**, it is off course, the humans who are responsible. **To sum it up, are there any disasters which are natural?**



# #Disasters\_Are\_Not\_Natural



Disaster has nothing to do with stars or fortune. Its thy karma!

#NoNaturalDisaster

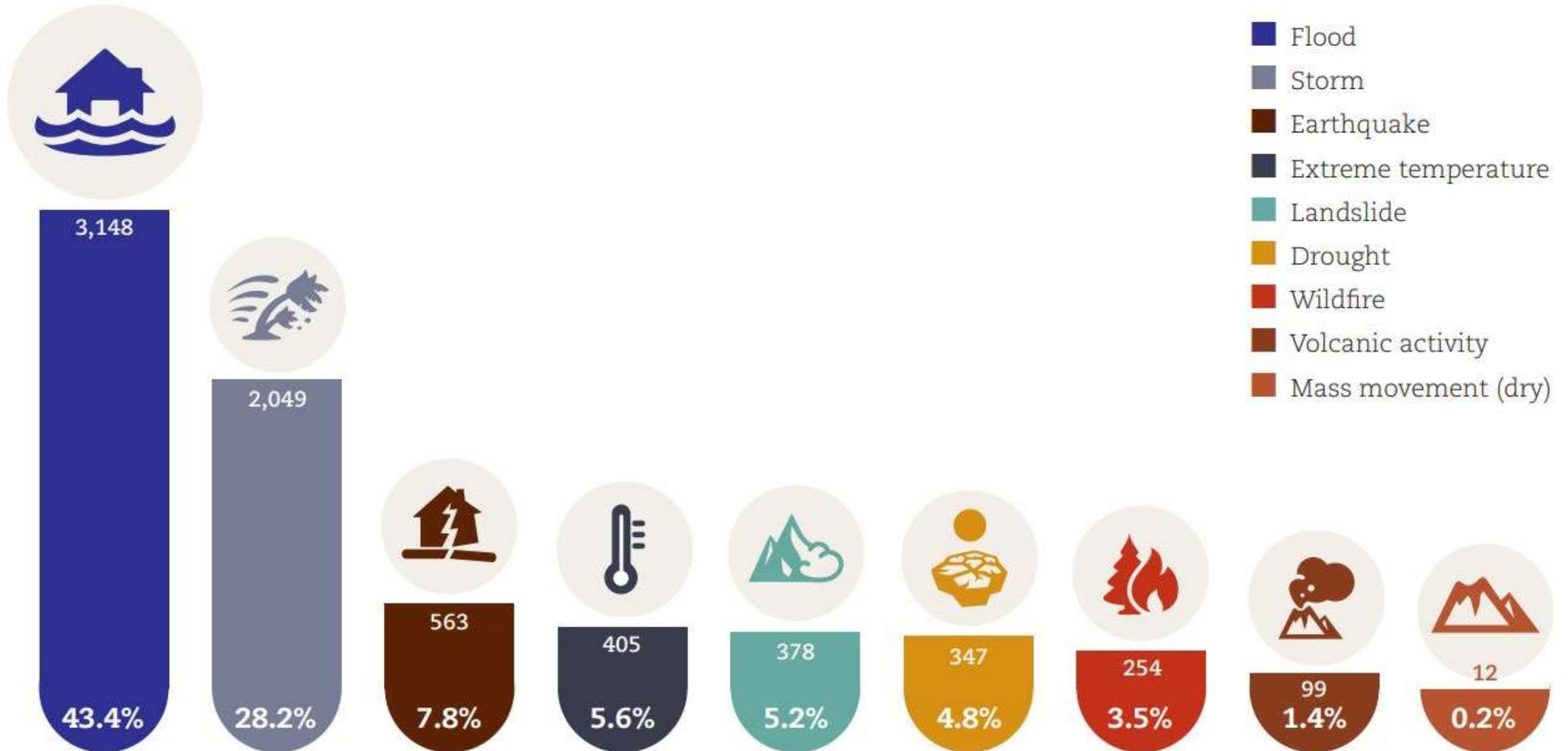


# Definition of a Disaster

This has been taken from the *Disaster Management Act of India, 2005*

“**Disaster** means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.”

# Why do we need to worry? Occurrences (1998-2017)

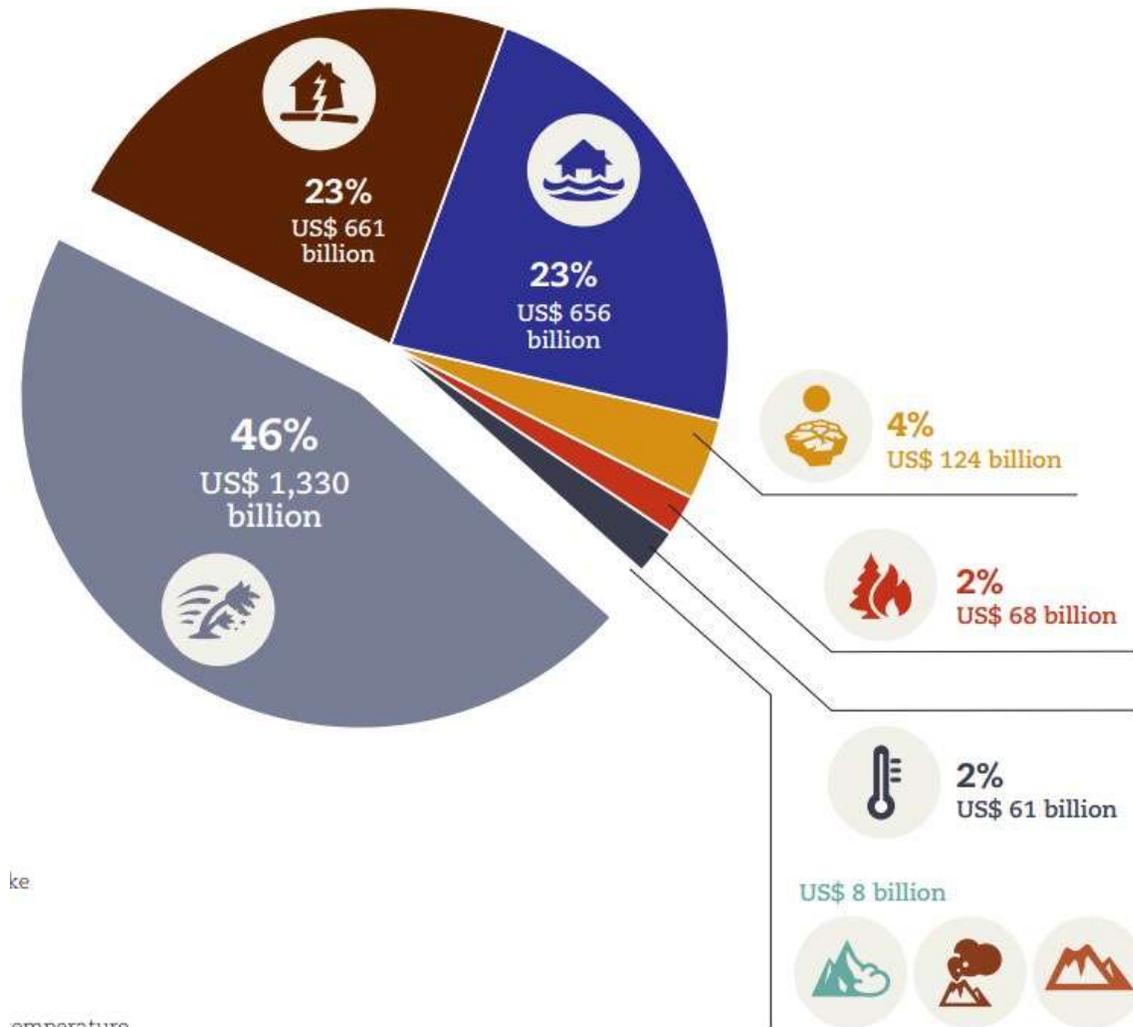




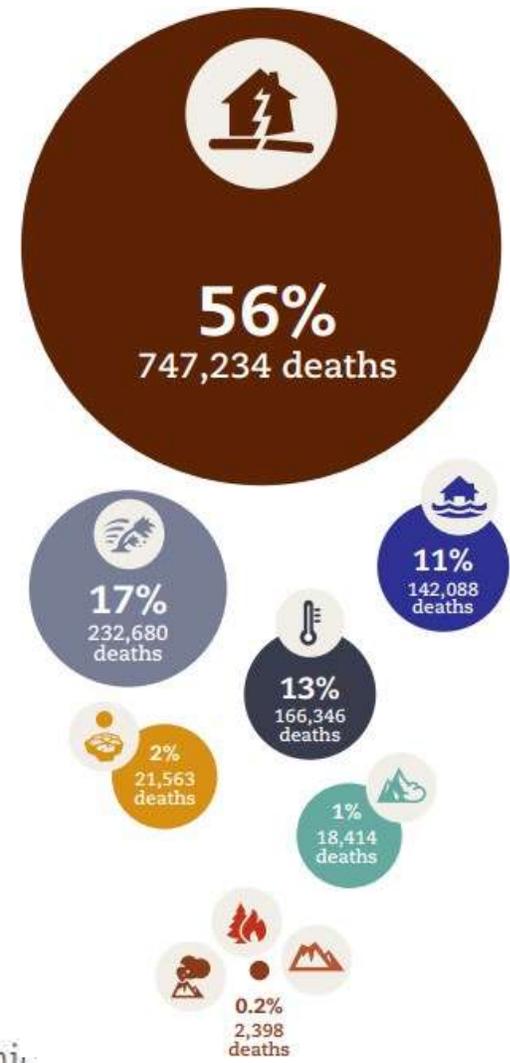
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# Effect of Disaster (1998 – 2017)

## Economic Losses



## Deaths



- Storm
- Earthquake
- Flood
- Drought
- Wildfire
- Extreme temperature
- Others : Landslide, Volcanic activity, Mass movement

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emperature  
andslide, Volcanic activity, Mass movement



# Effect of disaster in India (1998 – 2017)



13 lakh Killed



440 crore Injured, Homeless, Displaced



US\$ 2908 Bn. Direct Economic Loss



# Effects of the Gujarat Earthquake 2001

## Damage & Loss Assessment

Direct

- Human lives (13805)
- Livestock, other animals
- Private property
- Municipal infrastructure
- Power/ telecommunications infrastructure
- Health/ education assets
- Estimate: Rs. 9900 crore

Indirect

- Export/ import
- Agricultural output
- Industry/services output
- Remittance income
- Fall in earning potential due to disability, trauma
- Unemployment
- Health hazard
- Estimate: Rs. 3000 crore

Tertiary

- Long-term development
- Overall investment climate
- Fund reallocation
- Community migration/relocation
- Estimate: Rs. 10100 crore



# We need to manage disasters, but how?

Now that we have a clear idea of how bad disasters can be, we obviously need to manage it. This is how disaster management came into being.

The following definition of Disaster Management has been taken from the Disaster Management Act (DM Act), 2003.

**Disaster Management means a continuous and integrated process of planning and implementation of measures for:**

- 1. Mitigating the risk of disasters;**
- 2. Mitigating the severity of disasters;**
- 3. Capacity - building;**
- 4. Emergency preparedness;**
- 5. Assessing the effects of disasters;**
- 6. Providing emergency relief and rescue; and**
- 7. Post-disaster rehabilitation and reconstruction**



# Managing disasters: Disaster Management Cycle

## Prevention

Measures taken to **avoid** the occurrence of a disaster

## Mitigation

Measure aimed at **reducing** the impact or effect of disaster

## Preparedness

State of **readiness** which enables stakeholders to mobilize, organize and provide relief to deal with an impending or actual disaster or the effect of a disaster

## Response

Measures taken **during or immediate after** a declaration of disaster to diminish, or alleviate any suffering, pain, injury or distress or hardship caused on account of the disaster

## Recovery

The actions taken by the community and all the government and the non-government agencies to **reset the condition** after disaster and minimise the vulnerability of the same kind of disaster in future





# What is 'Prevention & Mitigation'?

- **Prevention** expresses the concept and intention to completely avoid potential adverse impacts of hazardous events.
- **Mitigation:** In case, disaster risks cannot be eliminated, prevention aims at reducing vulnerability and exposure in such contexts where, as a result, the risk of disaster is removed.
- Examples
  - Dams Or Embankments
  - Land - Use Regulations
  - Seismic Engineering Designs
  - Immunization

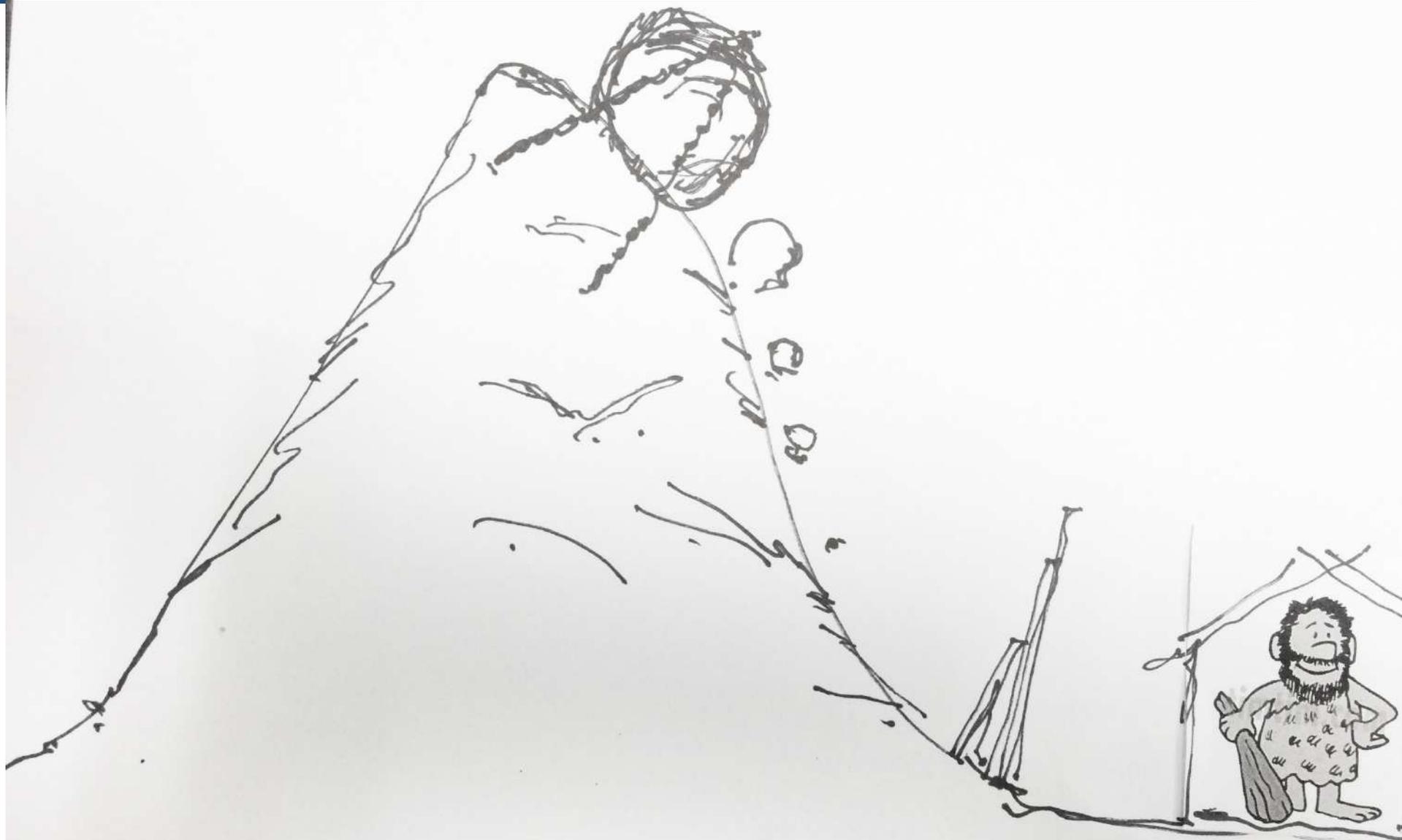


# Prevention





# Mitigation





# What is 'Preparedness'?

- Aim is to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response to sustained recovery
- Examples
  - ▣ Preparation of DM Plans
  - ▣ Plan Testing or Exercising
  - ▣ Establishment of inter-agency agreements
  - ▣ Development of systems for public warning and distribution of information
  - ▣ Emergency Communication
  - ▣ Emergency Response Personnel Training
  - ▣ Securing Adequate Resources
  - ▣ Public education



# What is 'Response'?

- Focused on immediate and short-term needs
  
- Examples
  - ▣ Public Warning & Evacuation
  - ▣ Search & Rescue
  - ▣ First Aid
  - ▣ Arrangements for Shelter
  - ▣ Fatality Management
  - ▣ Sanitation
  - ▣ Law & Order
  - ▣ Resumption of Critical Infrastructure
  - ▣ Media Management
  - ▣ VIP Visits
  - ▣ Donation Management



# What is 'Reconstruction & Rehabilitation'?

- **Restoring or Improving** Economic, Physical, Social, Cultural And Environmental assets, systems and activities, of a disaster affected community or society, aligning with the principles of **Sustainable Development** and “**Build Back Better**”, to avoid or reduce future disaster risk.
- **Examples**
  - Primary Requirements (Water, Food, Shelters)
  - Waste disposal
  - Debris clearance
  - Decontamination
  - Environment clearance
  - Damage assessment
  - Reconstruction (Houses, Roads and Bridges, Industrial, Commercial and Residential buildings, drainage system etc.)
  - Restore Resources (Electricity, water, gas)
  - Restore Communication
  - Restore all emergency services
  - Restart the Education centres( Schools, colleges)
  - Employment opportunity
  - Political stability
  - Cultural recovery
  - Treatment for Post Traumatic Stress Disorder
  - Relocate community



# From Disaster Management to Disaster Risk Management

*We need to manage risks, not just disasters.*

- Don't you think disaster management is more of a reactive measure? You are right!
- Taking cognisance of this and powered by the researches that are going on around the world, we are slowly shifting towards disaster risk management.
- **Disaster Risk Management (DRM) is primarily the management of disaster risks in a way such that those risks never become a disaster!**
- You may have heard of a term, Disaster Risk Reduction. What is disaster risk reduction?
- **Disaster Risk Reduction (DRR) is all that we do to ensure that we have managed the risks that we know about and be prepared to deal with the ones that we do not know about.**



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# From disaster management to disaster risk management



BUILDING RESILIENCE

- Disaster Risk Reduction is aimed at **preventing new** and **reducing existing** disaster risk and **managing residual** risk, all of which contribute to strengthening resilience and therefore to the achievement of Sustainable Development.
- To sum it up,

**Disaster Risk Management (DRM) =**

**Disaster Risk Reduction (DRR) + Disaster Management (DM)**



# Resilience to disaster: Way forward

- **Resilience** is the ability of a system, community or society exposed to hazards to
  - resist,
  - absorb,
  - accommodate to and
  - recover fromthe effects of the hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions
  
- How do we become resilient? It is a complex net of many elements.
  - It is multi-disciplinary, trans-disciplinary.
    - Technical science, social science, medical science, environmentalists etc., everyone is involved, directly or indirectly.
  
- Just to get an idea of how this will work:
  - Hazard -> Early warning -> Information dissemination -> Impact -> Rescue & Relief -> Reconstruction & Rehabilitation -> Building back better (All this is according to DM Cycle and SFDRR)



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# Thank You

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