

Introduction to the Concept of 'Disaster Risk'

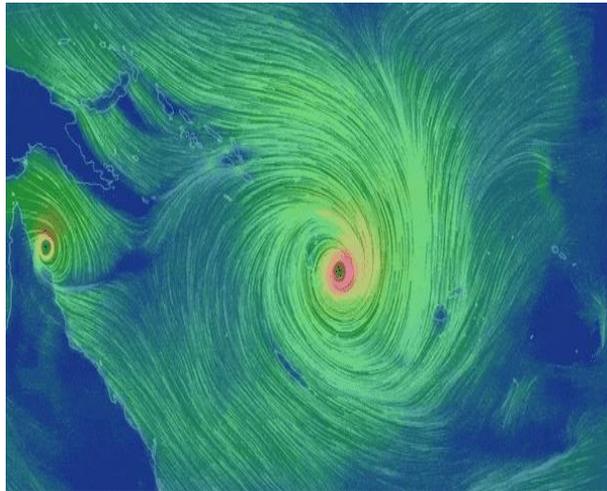


Ankur Srivastava

Research Associate & Program Coordinator

What is disaster?

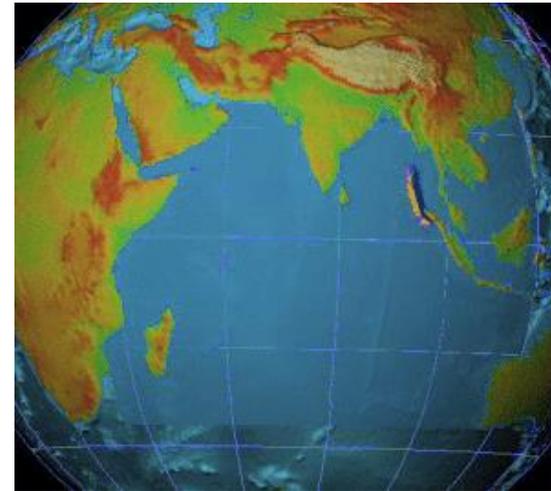
Disasters of 21st Century



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** that exceed the community's or society's ability to cope using its own resources.



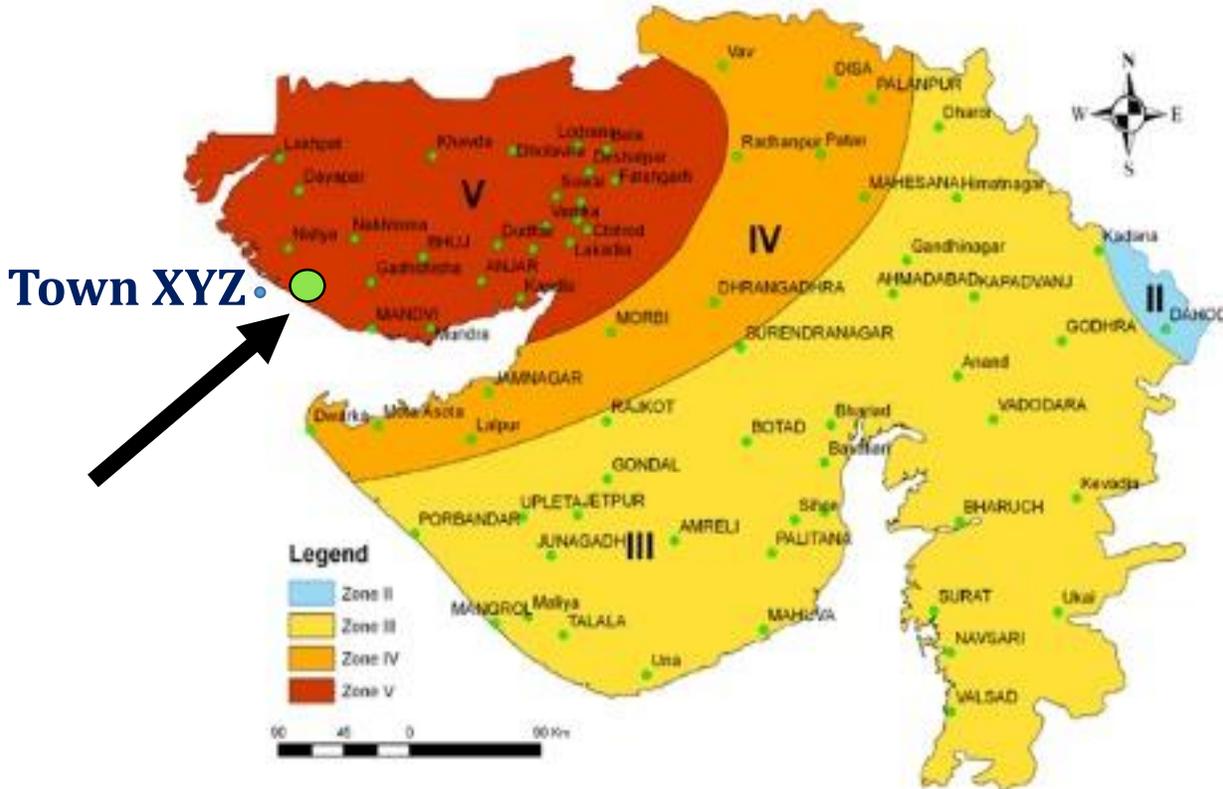
What is 'disaster risk'?

- 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.

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

Story of Town XYZ

Lets assume:



Seismic Zoning Map of Gujarat

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.**



सत्यमेव जयते

What is 'disaster risk' of Town XYZ?

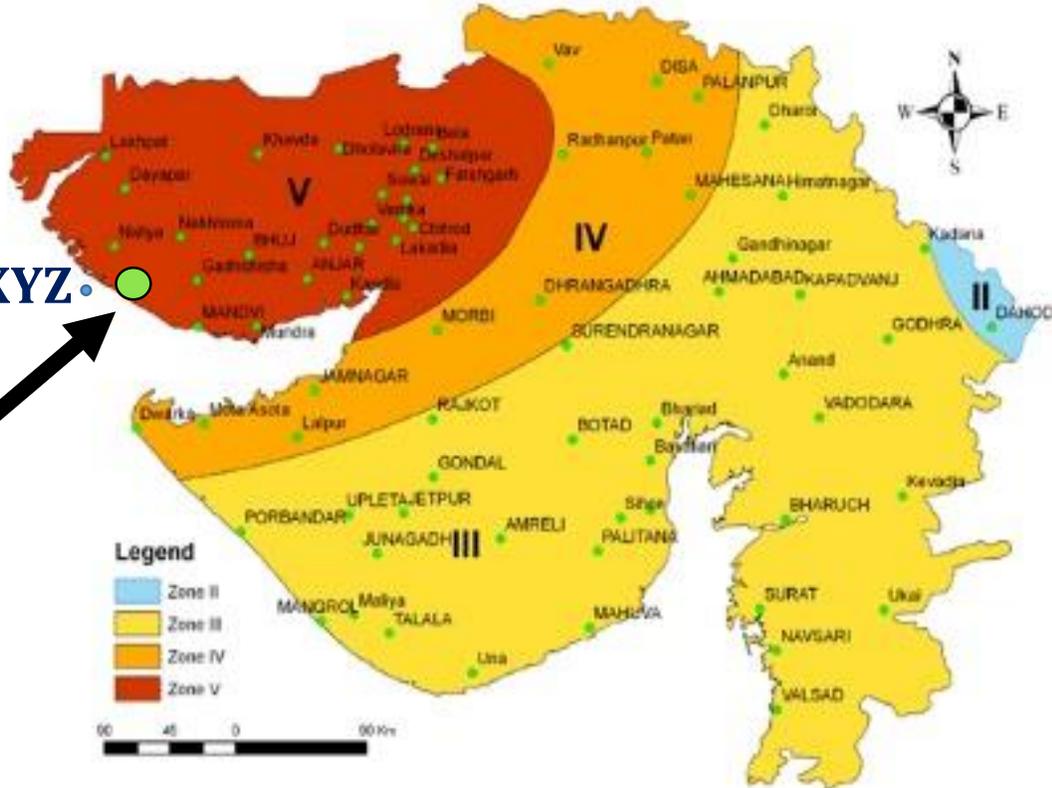
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Town XYZ.



Seismic Zoning Map of Gujarat



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



#Disaster-vs-DisasterRisk

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.



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

What is a '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

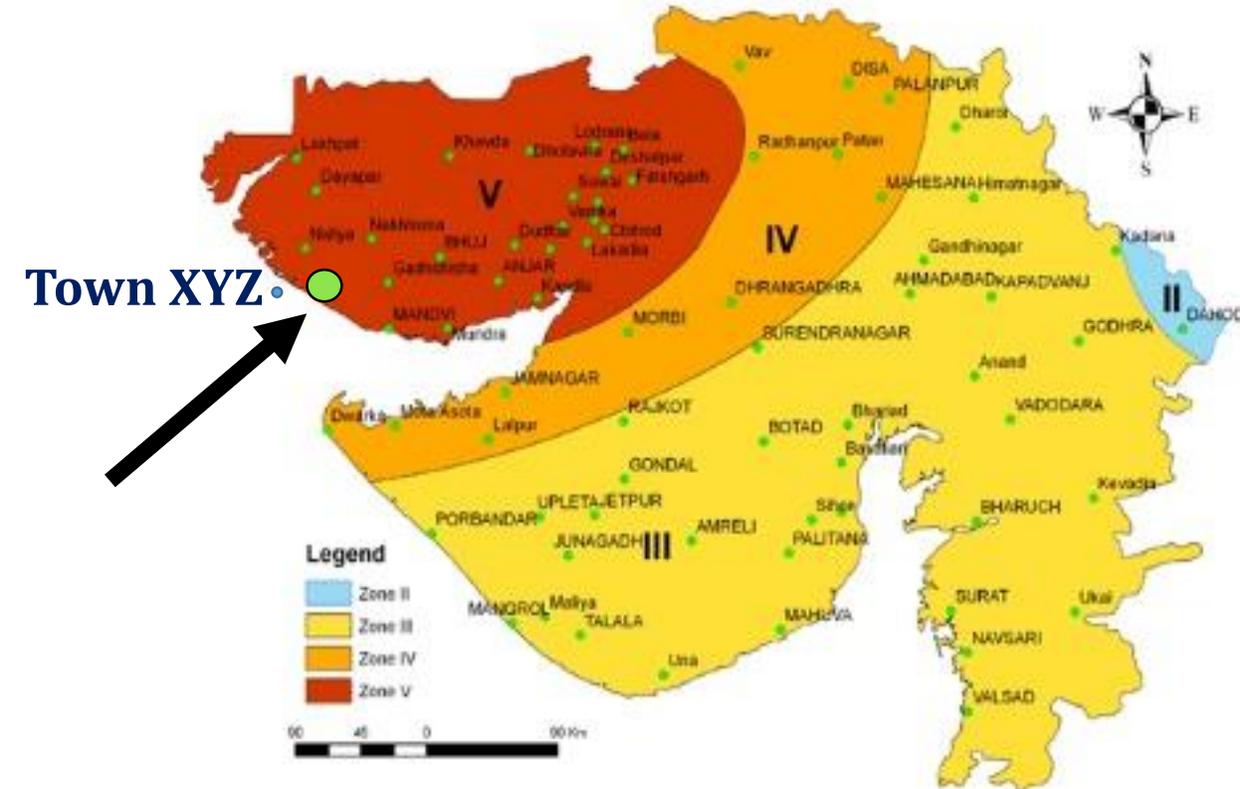
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If 7.7 Mw Earthquake strikes in near future:

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Hazard under consideration for Town XYZ is Earthquake

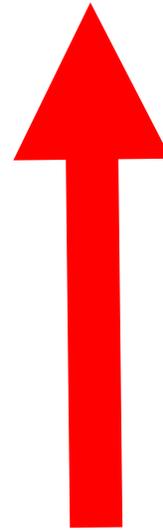
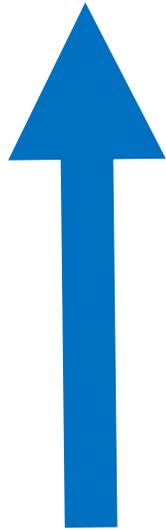


Seismic Zoning Map of Gujarat



Hazard

Disaster Risk





Disaster Risk α **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”.

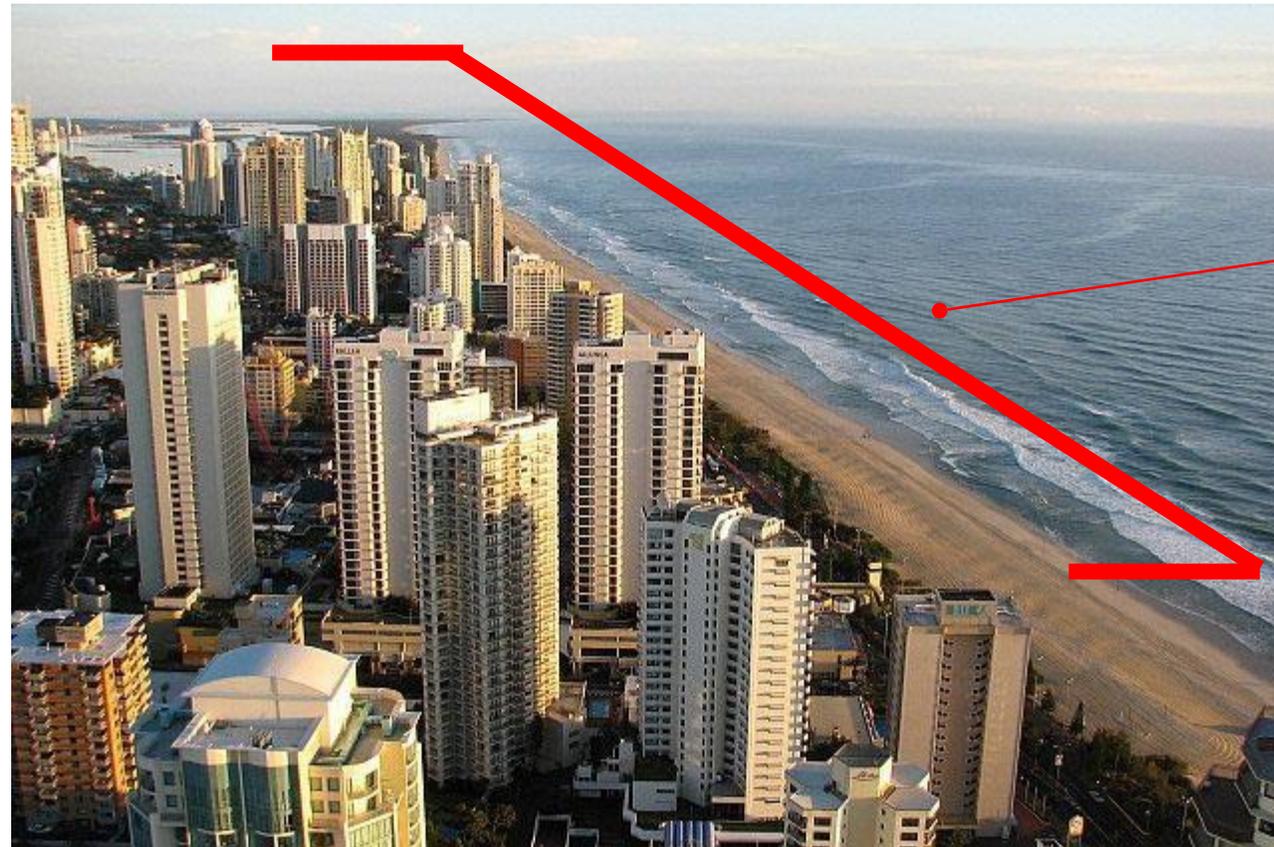


$$\text{Disaster Risk} \propto \frac{\text{Hazard} \times \text{Exposure} \times \text{Vulnerability}}{\text{Coping Capacity}}$$



What is 'exposure'?

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

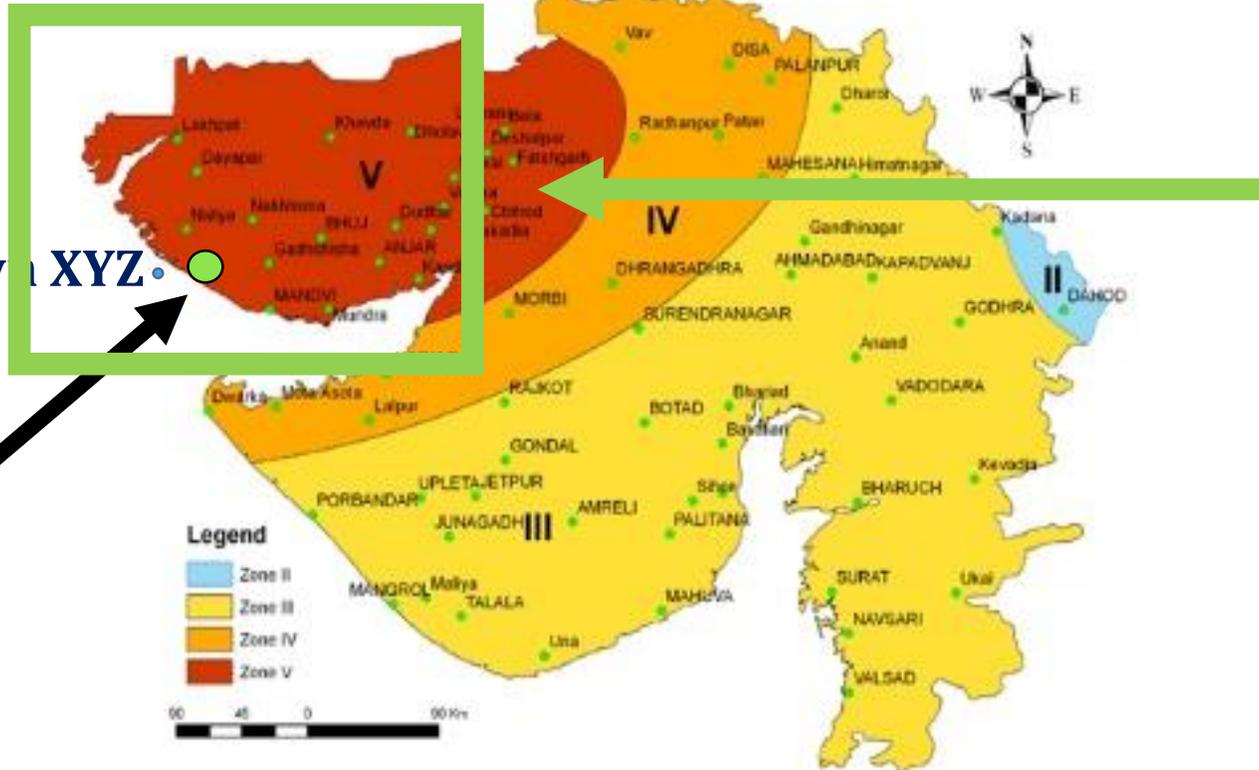


Exposed!



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



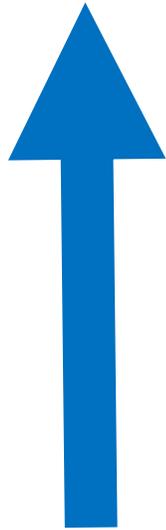
What is 'exposure'?

- *Measures of exposure can include the **number of people** or **types of assets** in an area.*
- *Let's say that there is an imminent danger of a forest fire, in that case the exposure would be of the forest area and the flora and fauna of the area!*
- *To put it simply, if you feel that you can be affected by a hazard, you are exposed!*

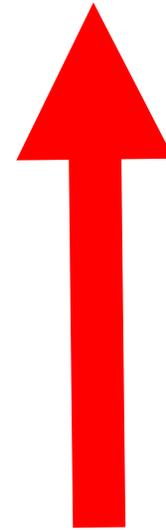




Exposure



Disaster Risk





Disaster Risk \propto **Exposure**



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Food for thought

- What is exposure in case of COVID 19 pandemic?

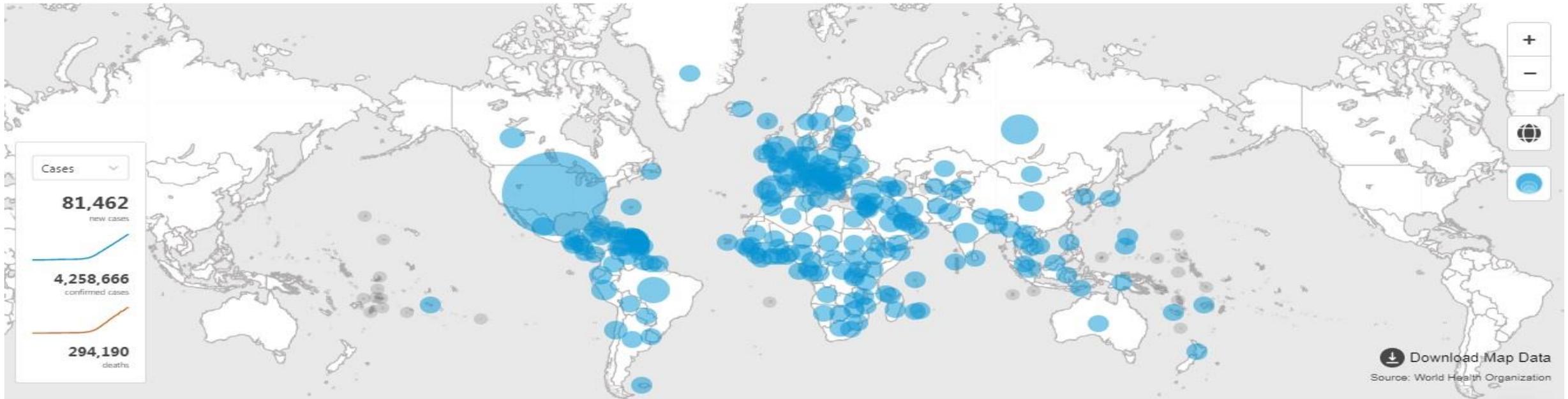


Search by Country, Territory, or Area

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.





Disaster Risk

α

Hazard x Exposure x Vulnerability

Coping Capacity



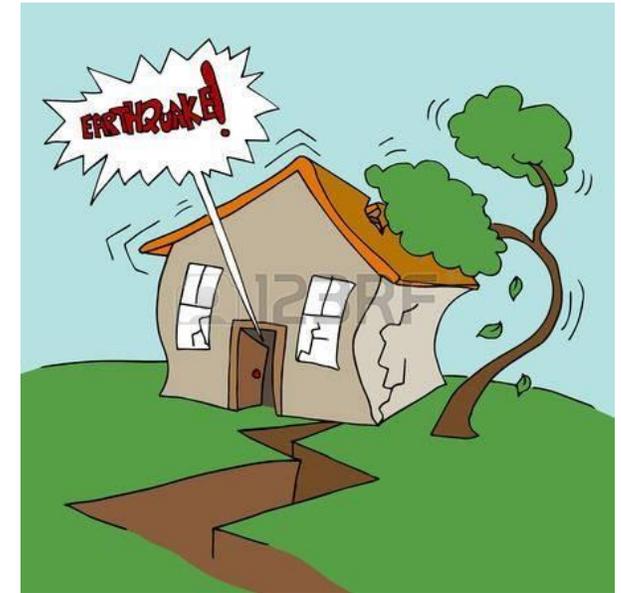
What is 'Vulnerability'?

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**

Vulnerability is a characteristic of those 'assets' which are exposed!

-If you build your house in an area which is prone to flood or earthquake, you are **vulnerable**.

-Let's say that you have built your house no matter what, but if you have not taken any measure to deal with it, then you are **more vulnerable!**



Vulnerability of Town XYZ

Lets assume:

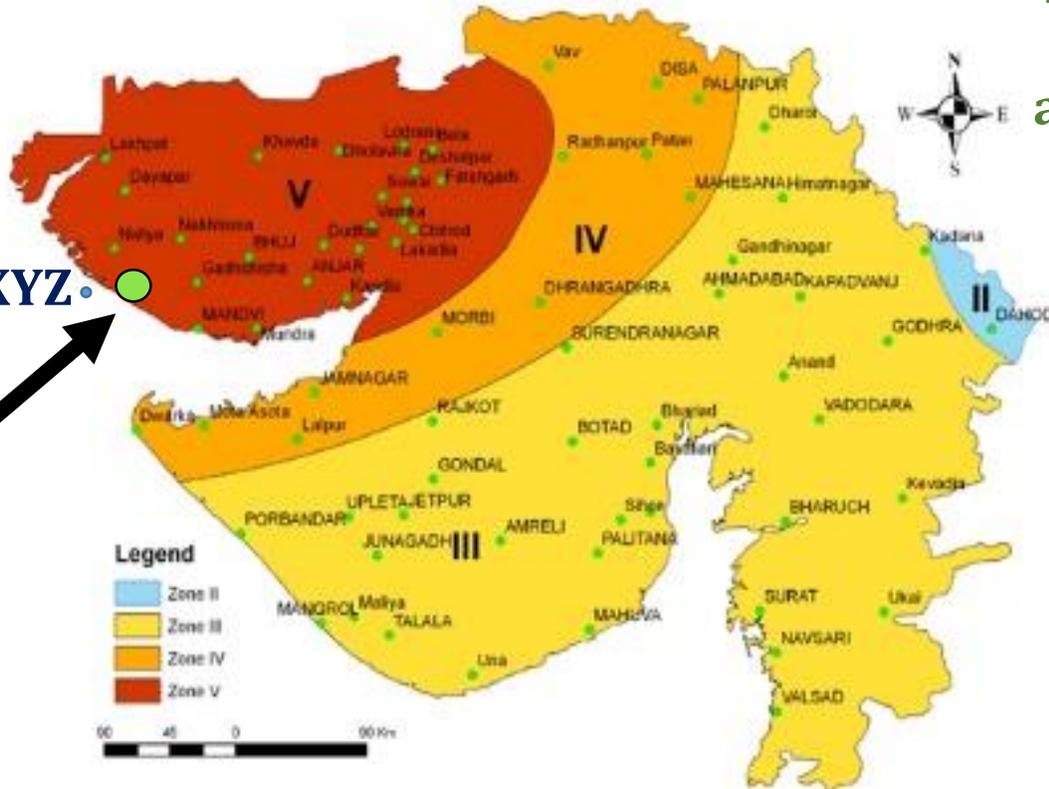
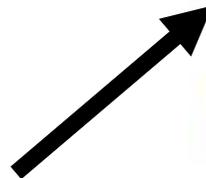
The conditions which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.



Information about Town XYZ

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

Town XYZ.

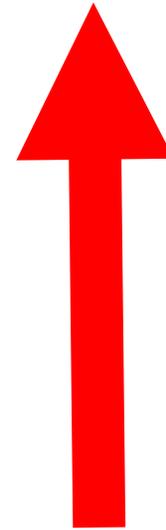
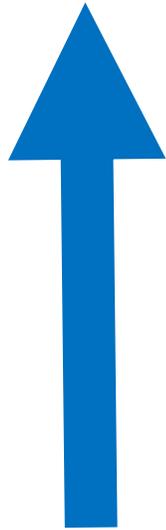


Seismic Zoning Map of Gujarat



Hazard

Vulnerability





Disaster Risk α **Vulnerability**



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



What is '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.

**If you have the capacity to deal with the disaster risk, you are good to go,
else it is a disaster!**

Coping Capacity of Town XYZ

Lets assume:

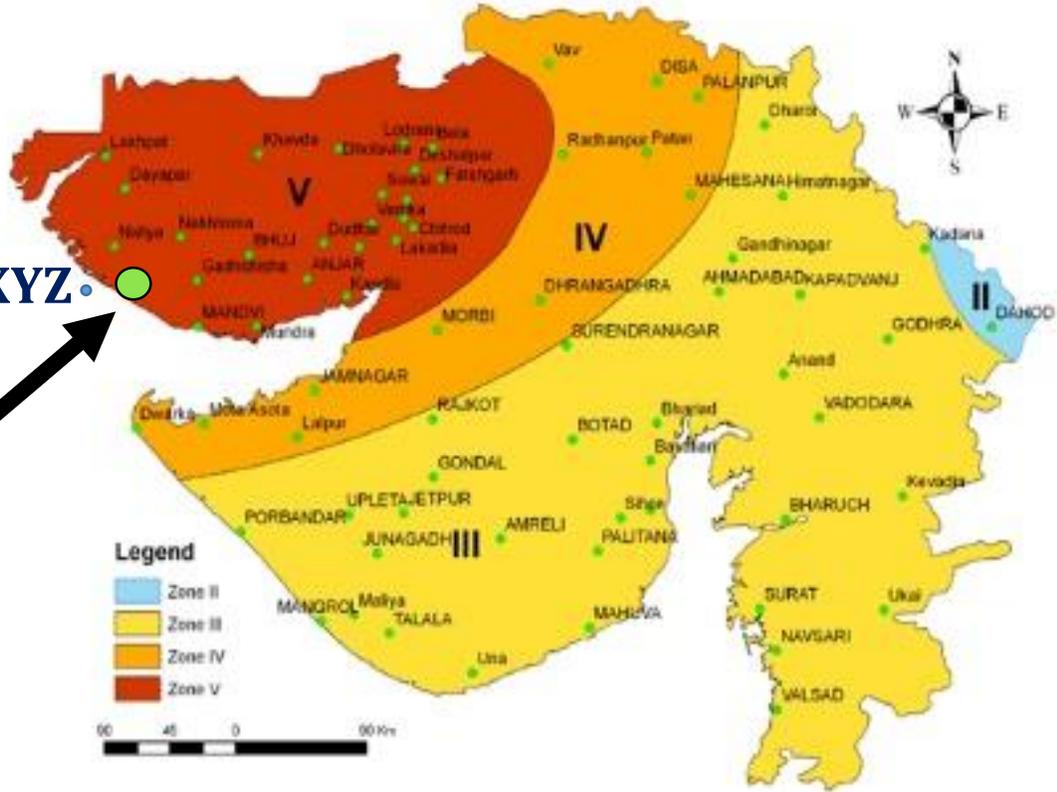
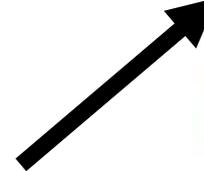
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Town XYZ.



Seismic Zoning Map of Gujarat



What is Capacity?

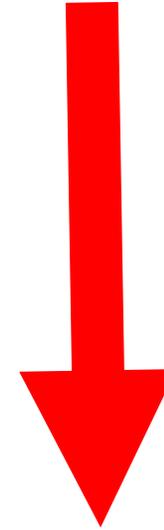
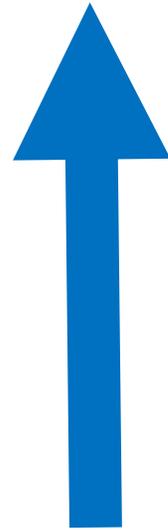




Disaster Risk & Coping Capacity

Coping Capacity

Disaster Risk





Disaster Risk & Coping Capacity

1

$$\text{Disaster Risk} \propto \frac{1}{\text{Coping Capacity}}$$



What is 'disaster risk'?

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

Case 1: We often hear about avalanches in the upper reaches of Himalayas, but we never call it a disaster. Why? Because, there is an imminent hazard but nothing is exposed and if nothing is exposed, there will be no vulnerabilities.

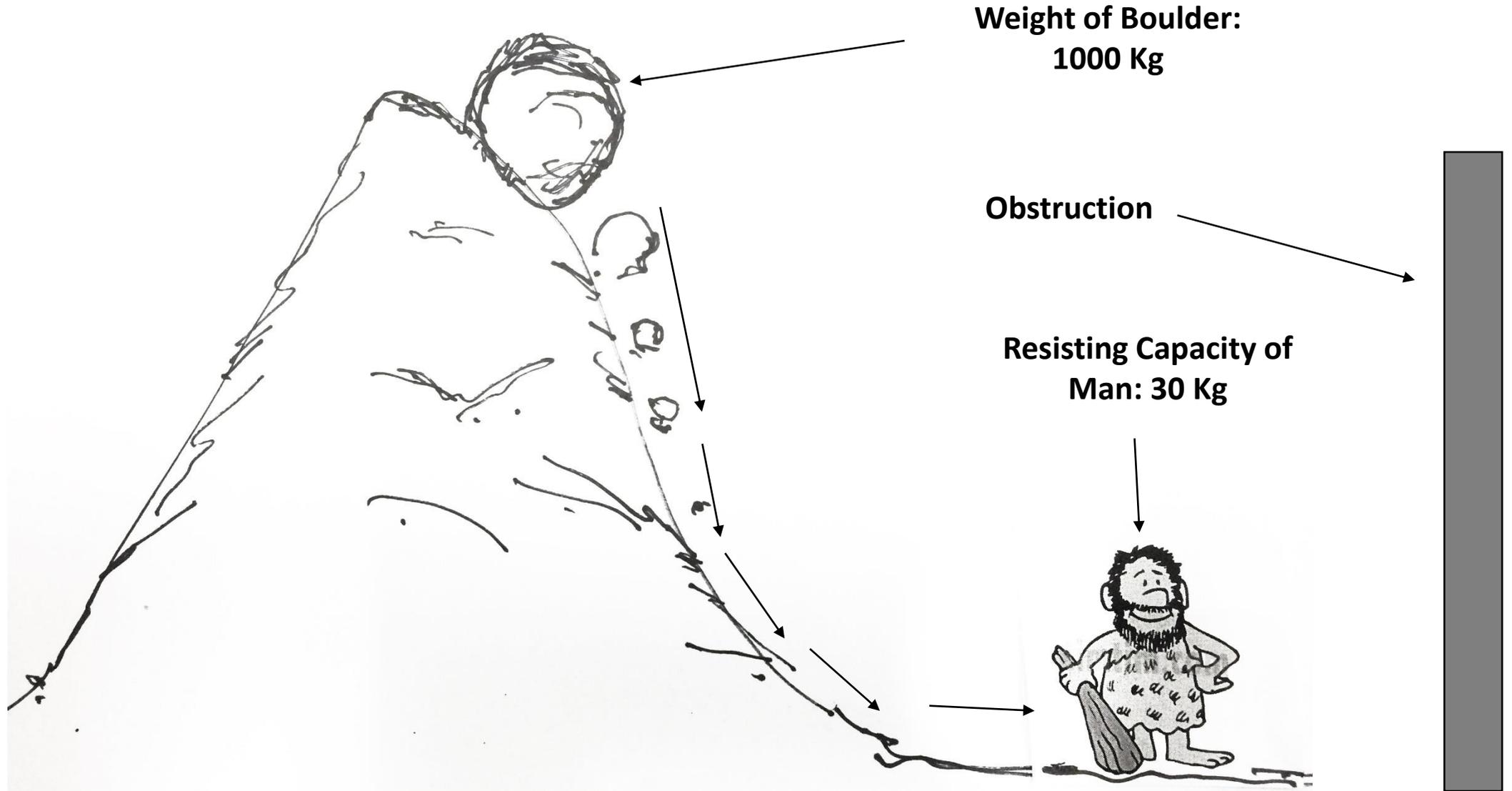
Case 2: Let's assume another scenario. We build a strong house in an earthquake prone area and there is an earthquake. Nothing happens to the building or the people living inside it. In this case, there is a hazard and the building is exposed, but, the building has very less or no vulnerability at all.

Case 3: In the same scenario, let's say that although the building is strong but the people inside are not aware of what to do in an earthquake. So, all the 200 people inside the building start running out. This creates a stampede and when they come out, other building outside, which are not so strong, collapses causing injury and death. In this case, the vulnerability of the people due to the lack of knowledge raises the disaster risk.



So what is a 'Disaster' then?

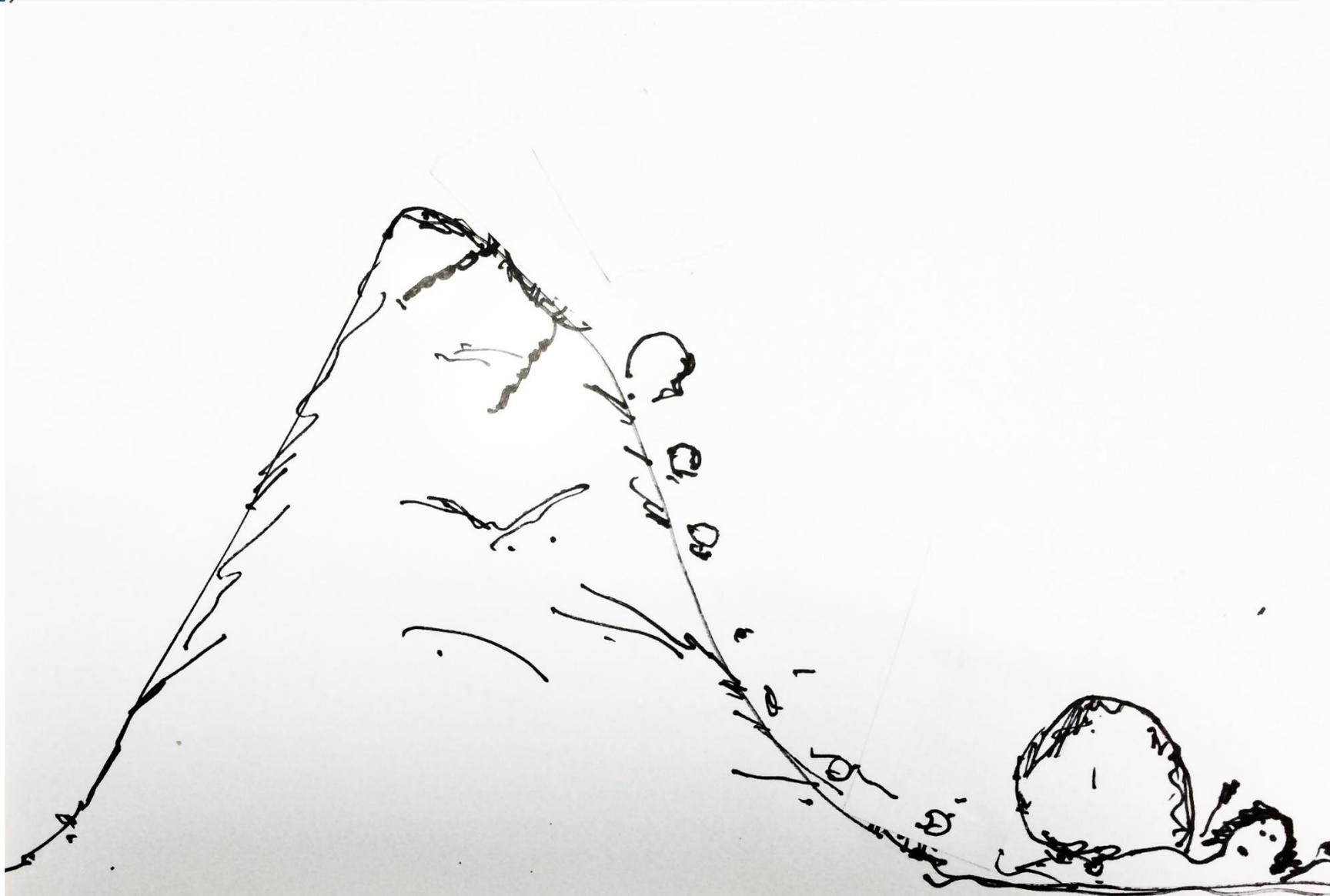
When the 'disaster risk' exceeds the 'coping capacity' of the 'exposed' assets, the incident of a hazard turns into a 'disaster.'





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What is a 'disaster'?





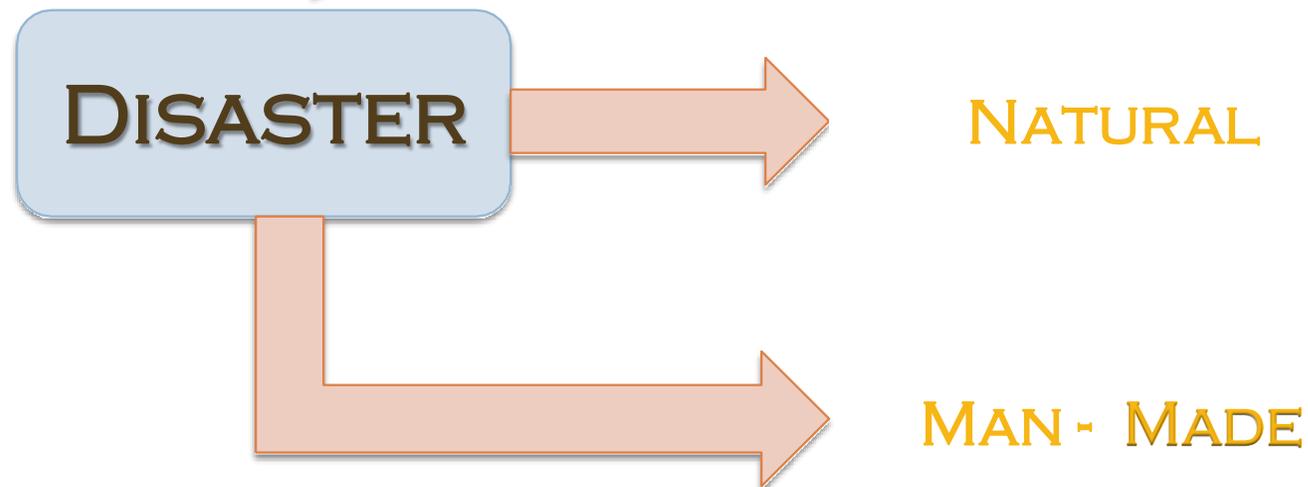
What is a 'disaster'?

- 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.



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!



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.”



Definition of a Disaster

This has been taken from the ***Gujarat Disaster Management Act of 2003.***

An actual or imminent event, whether natural or otherwise occurring in any part of the State which causes, or threatens to cause all or any of the following:

1. Widespread loss or damage to property, both immovable and movable; or
2. Widespread loss of human life or injury or illness to human beings; or
3. Damage or degradation of environment

And any of the effects specified in sub-clauses (1) to (3) is such as to be **beyond the capacity of the affected community to cope up with using its own resources** and which disrupts the normal functioning of the community.