

The word disaster has its roots in the Italian word 'Disastro'.

The prefix 'dis' which means BAD and 'astro' which mean star.

Therefore disaster means any calamitous situation blamed on an unfavourable position, of a star.

Disaster is an occurrence that causes widespread damage and destruction leading to loss of life and property.

Definition- Disaster is any Tragic Event that can cause damage to life and property and destroy the economic, social and cultural life of people. It can cause of many number of deaths.

It affect people adversely, beyond the normal capacity of the individuals to face using their own resources and cause a serious disruption to the function of the society.

Initially the focus of the concern of disaster was on the discussion of the aftermath of a disaster event.

But now the focus of disaster has shifted towards 'Delineation' on the circumstances that lead to disasters. This change of focus is the result of two important aspects.

→ One is the recognition of the capability for negative (harmful) effect to a great extent, the potential damage from such situations.

→ The second is the realization that the consequences of all disaster are similar in nature.

More importantly insights into disaster pave way for finding ways to prevent disaster from occurring and for reducing their impact.

→ It is thus imperative that we gain a thorough understanding of how we can manage their impact. Impending disastrous situations that can not be prevented or condensed.

→ To understand disaster it is essential to understand the concept of 'Hazard' and 'Risk'.

Hazard - word, traces its origin to the word 'Hasard' in old French az - zahr in Arabic means chance or luck. It is define as a source of potential loss or circumstances that have potential to cause harm. Hazard can be:

Natural, Technological, Chemical, Biological, Radiological

→ Hazard means a potential source of danger and are impending exogenous events whose possible characteristics and frequency of occurrence can be approximated.

Hazard are said to be the primary sources of risk which result in disaster.

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Natural Disasters are -

- a) Hydrological Disaster (Flood)
- T b) Coastal & Marine Disaster
- Y c) Atmospheric Disaster (Green Gas)
- P Wind Related - Cyclone, Storm, Hurricane, Tornado
- E Water " - Floods, Cloud burst, drought
- S Earth " - Earthquake, Tsunamis, Avalanche, Landslides

Man Made Disasters are -

- a) Wars, Battle, Riots, Local Conflicts
- b) Accidents of Trains, Vehicles, Aeroplanes
- c) Industrial Accidents
- d) Fire
- e) Nuclear Explosion Accidents
- f) Deforestation
- L g) Soil erosion, Air and water Pollution.

→ The effects of disasters causes destruction of Natural Resources, Property. As a result of sudden calamity, normal function of Society is displaced immensely.

• The magnitude of a Disaster depend upon the density of population in the affected Area. A Major Disaster has Enormous Capacity to displace the normal life of the Peoples.

• An important Environmental Consequences of a Disaster is the Damage caused to an Ecosystem (Relation b/w Air, water and Land) by

- a) Pollution of Rivers
- b) " " Groundwater
- c) Dust & Heat in Atmosphere

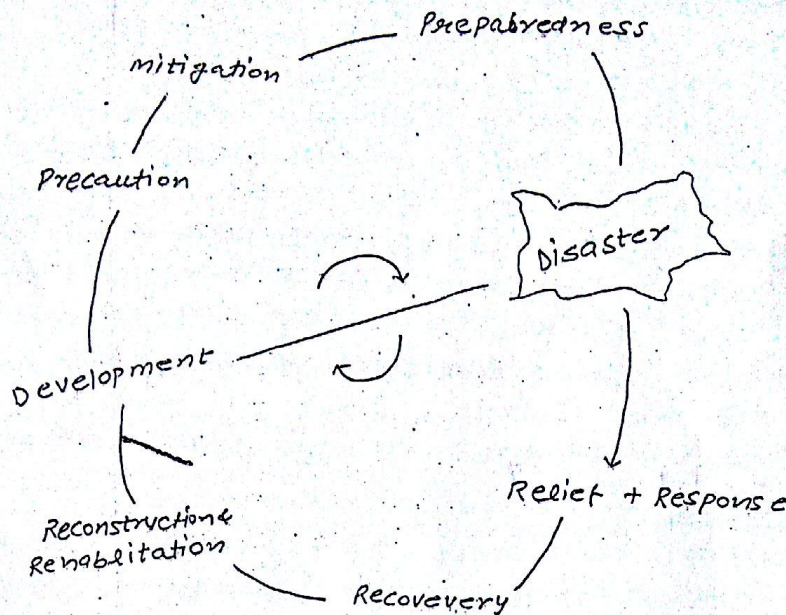
• In most of the cases of Disaster management External Assistance, both technical and Financial is needed from the Govt. as well as from the Public.

Disaster Management - Since the time of 'Earth Summit' at 'Rio De Janeiro' held in June 1992, the Disaster Management experts have focussed/stressed on Capacity Building to mitigate the sufferings of most environment related Disasters. It has been used as a tool to minimise the Risk. Risk is considered as an exposure to Hazard.

• Disaster Risk is considered as a product of Hazard and Vulnerability and can be minimized with Capacity Building.

Its expression could be in the form of a Notation:

$$\text{Risk} = \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity Building}}$$



→ One can not shut one self from the Risk of Natural / Man made Disasters / Hazards.

Risk management is therefore the most important Pre-Disaster Intervention measures.

It is based on the Basic mechanism of Thermal Expansion + Contraction, and uses this model for Disaster Response + Recovery.

→ Principally it is Incentive Based and Involved Disaster Intervention measures of Prevention, Mitigation and Preparedness as shown in diagram.

The Past Disaster measures called Crisis Management, which includes Relief and Response, Reconstruction and Rehabilitation again in sequence as shown in figure.

Note: It is also based on the assumption that such Disaster Impacts would be limited to National Jurisdictions.

Example — The Impact of Tsunami Quake of 26th Dec 2004 shattered these assumptions as the Tsunami Tragedy struck at 13 Nations of Asia and Africa. Though the Epicentre of the quake lies in Indonesia. In this Crisis Management, India took the leading part, inspite of being one of the worst Hit Nations of Killer Waves (Tsunami).

Hazards — The damage or risks that are posed by the natural as well as manmade disaster forces particularly to life on Earth are termed as Hazards.

So our concern is to know how these forces (Hazards) are manifested that pose damage to life on the Earth. While human beings on Earth can't stop these natural forces (Hazards) from happening/occurring but they can certainly take measures to protect life, not only of their own but also of plants and animals.

All these natural Hazards / Forces pose dangers, not only through one happening but may also be the cause of other happenings. For example -

The earthquake may cause landslides. A Landslide may break the bank of the river to cause floods or may block the road for traffic. Sometime whole town is destroyed by Landslide.

Man Made Disasters:-

It is the duty or present concern of the Man on earth to know how man's hand either causing or accelerating the natural Disasters. This way we can treat a man made Disaster as a concept in itself.

If the nature is destroying one part of earth, it is renewing its another part. But man is also a destruction agent, and that too in a very short time.

These destruction man made Disaster are generally associated with pollution, Fires, Dam failures, droughts, Gas and other chemical leaks including bombing, terrorism + other civil strifes.

Distribution + Correlation of the Man made Disasters:-

The man made disasters do not happen with certainly Regularity. nor they are evenly Distributed over the surface of the earth. The term Disaster Prone or Earthquake Prone are used to describe the distribution aspect of most Hazards including terrorism, and civil Strifes that happen very often these days.

The correlation refers to the relationship in which one thing affect or depend on the other. This is often described as Vulnerability.

Vulnerability - It is refers to how an Individual or a Community as a whole or even an area is exposed to the risk / danger / Hazard.

⇒ The vulnerability of the poor and Backward classes to natural disasters is the highest among all other population groups. Similar, a deforested Area is more Vulnerable to floods and droughts than a forested area. This Correlation varies a great deal.

3 chief features of Vulnerability are:

a) It combines with a hazard to turn a situation into a disaster.

- It precludes a disaster - vulnerability contributes to and^{P3}
Impedes Disaster Response. Disaster Response
is described as one's reaction to a disaster.
It may even persist long after a disaster has struck.

Factors Affecting Vulnerability -

The important factors determine the vulnerability of a particular area are as follow -

- i) Location
- ii) Poverty among Population
- iii) Density of "
- iv) Threshold Population (People living at the bottom - very poor)
- v) Unconformity of the Area (Geological)

Role of an Engineer in Disaster Control -

- a) Preparing equipments and procedure when Disaster occur like

Planning (How to reduce the effect of Disaster)

- b) Preparedness can be take in many ways including:

- a) Construction of Shelters
- b) Installation of Warning signals
- c) Creation of Backup Life Line services (Power, Light Supply & Sewage Arrangements)

- c) Evacuation Plan - (How to save people, get out peoples)

↳ By Transport, Air Help

Preparedness is a continuous cycle of planning, organising, Training, evaluation and improvement of activities to ensure effective coordination and capability.

Disaster— It is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. All Disaster are hence the result of introduce appropriate disaster Management.

Example— Earthquake, Drought, Floods etc.

Disaster Control— Measures taken before, during, or after hostile action or natural or manmade disasters to reduce the probability of damage, minimize its effects, and initiate Recovery is called Disaster Control.

→ Disaster could be controlled by Awareness. It is better to be in safe side, and to maximum extent possible human disasters should be eliminated.

Hydrological Disaster— It refers to a violent, sudden and destructive change either in the quality of earth's water or in the distribution or movement of water on land, below the surface or in the atmosphere.

example— Floods, Eruptions, Tsunami Floods

Floods— Floods are among the most frequent and costly natural disasters.

Cause → Heavy or steady Rain for several hours/days that saturates the ground cause Flood.

→ Flash Floods occur suddenly due to rapidly rising water along a stream or lowlying Area.

Limnic Eruptions — It is a rare type of natural disaster in which CO_2 suddenly erupts from deep lake water, suffocating wildlife, livestock and humans. Such an eruption may also cause tsunamis in the lake as the rising CO_2 displaces water. Scientists believe landslides, Volcanic Activity or explosions can trigger such an eruption.

Tsunami— It is a series of ocean waves that sends huge surges of water, sometimes reaching ht. of over 100 feet onto land. These can cause widespread destruction when they crash onto shore.

Tsunamis race across the sea at upto 500 m/h.

These waves are typically caused by large, undersea earthquakes at tectonic plate boundaries. When the ocean floor at a plate boundary rises or falls suddenly it displaces the water above it and launches the rolling waves that will become a tsunami.

It may also be caused by underwater landslides or volcanic eruptions.

Types of Floods -

a) General Flood - gradually rising of water level of river, lakes and ground water table due to high rain or snow melt is the primary cause of floods.

→ When a water splits / overflow the water body over its normal / natural boundaries due to rise of water level, the surrounding / Adjoining area is Flooded.

Disaster in the form of floods took 77 lives in U.P. and 38 in U.K. in Aug 2011.

Other example is of Kedarnath Flood.

b) Storm Surge / Coastal Floods -

It is caused by wind set.

The water level rises in the sea/lake in the form of sea wave setup by strong wind flow which moves towards the sea/lake coast.

This wind setup can be inflated by the Normal astronomical Tide and MSL can rise by 5 m or more.

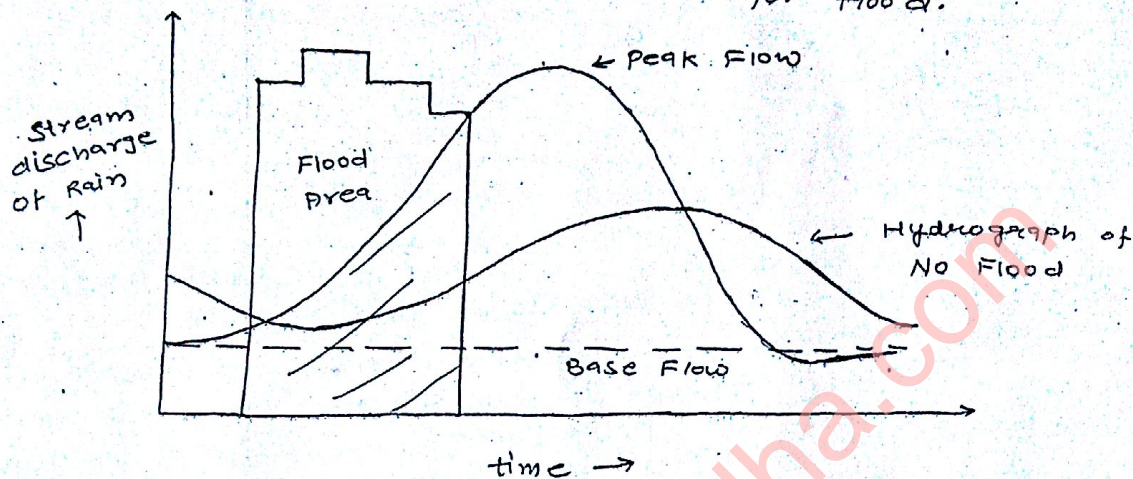
Flash Flood - There may be dam burst or a thunder storm or a Tsunami which may cause violent flood / splash of great water, called the Flash Flood.

→ Most of the floods are preceded by heavy rain in the catchment / Basin and melting of snow for several days. During this period even a common man gets an idea of floods and this period of flood is called the Probability period of flood. During the Probability period there is heavy rain in the catchment + heavy runoff of water in the streams / River.

Statistically information collected from flood prone stream / River has globally revealed that there is Probability of occurring floods once during a Ten Year Period.

Forecasting of Flood - The Central Water Commission (CWC) has about 132 Flood Forecasting stations in the country which cover almost all the Interstate Flood prone Rivers. More than 6000 forecasts are issued annually. Most of the floods/snow melts are during the monsoon season i.e. from June to August annually.

→ The period of Peak flow depicted/show in River flow hydrograph may indicate possible flooding above the max. water level in the River i.e. when it touches the top of the Banks. Which also serves as a warning on TV screens and Computer Networks for flood.



DROUGHT - Heat Waves, Forest Fire + Drought also cause disasters and Human suffering all over the world. In India due to the Erratic monsoon both low & medium Rainfall Regions are vulnerable to the Periodic Drought.

Almost 68% of the total area in India is Drought prone.

Experience on National level shows that almost every 3rd year there is drought and some states there may be successive drought year which go on increasing the vulnerability of the people in these areas.

In the drought area safe mechanised Drought oriented farming method in many drought prone Area of the country is used.

Typical effect of droughts -

- a) Failure of crops.
- b) Soil Erosion.
- c) Famine conditions.
- d) Acute drinking water crisis.
- e) Reduced Energy Production.
- f) Widespread unemployment.
- g) High and rising prices of all commodities.
- h) Health problem + diseases
- i) Death (Human, Animals)

Hazard Assessment - Both private and Govt. Agencies closely monitor drought. They prepare mitigation strategies based on evaluation and Assessment of the security of the drought.

Main Mitigation strategies for Drought -

- Vegetation Cover** - It provides the environmental improvement help to restore Ecology in the region. There are few places on Earth which are totally devoid of Rain-fall. Rain Vegetation Cover helps Rainwater to seep under-ground. over a period of time precipitation also has improved as have been experienced in some district of Rajasthan.
- Water Supply Augmentation** - It can be done through Rain-Water Harvesting, Canal Irrigation, Contour Bunding and other improved agricultural practices.
- Land Use** - In drought prone areas need special attention in respect of earmarking atleast 35% of land for Green belts that are many cultivated plants which can help to improve land use pattern.
- Livelihood Planning** - main problem found in drought prone Areas is Famine. It is therefore important to have a definite Plan of providing Livelihood to vulnerable section of the society / Area people.
 - To some people off farming employment opportunities could be provided.
 - Livelihood Planning will substantially improve the ecology in the drought prone Region.

Climatological Disaster - The Disaster caused by the Climate / Atmosphere temperature variability is called Climatological Disaster. It is categorized into 3 categories -

- Disaster caused by Extreme temp.**
 - It can be further classified into
- Heat Wave** - It is a delayed period exceptionally Hot and sometimes sultry weather, relative to Normal Climate pattern of a certain region.
 - The Heat wave in Europe in 2003 was the hottest summer on record since 1540, recording a death of 70,000.
- Cold wave** - It can be both a lengthened period of terribly cold weather and a sudden assault of very cold wave over a large Area / Region. The cold wave of Jan 2013 that took India (North) under its grip, caused 233 death. Apart from after winter storm. Damage caused by Snow wave / Ice is known as winter storm. It causes extensive damage to building, Infrastructure + Traffic.
 - A severe winter storm hit Chicago in 1932. The mixture of ice + snow, wind + hail shut down the transportation and communication of the state for 2 days that time.

- Drought - It is a long enduring event caused by lack/scarcity of Rain. It results in deficiency in a region's water supply and can lead to losses in agriculture and distress in Inland Navigation + Hydropower plants and caused a scarcity of Drinking Water + Famine.
- In India Agriculture makes up 6% of Gross Domestic Product. Agriculture mainly depends upon Rain.
- c) Fire in Forests.

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