



**DISASTER MANAGEMENT &
MITIGATION (ACE533)
V SEMESTER R-16**

PREPARED BY

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UNIT-I

ENVIRONMENTAL HAZARDS & DISASTERS

Environmental hazard



- ⦿ **Environmental hazard' is the state of events which has the potential to threaten the surrounding natural environment and adversely affect people's health. This term incorporates topics like pollution and natural disasters such as storms and earthquakes.**

Hazards can be categorized in five types:

- 1. Chemical**
- 2. Physical**
- 3. Mechanical**
- 4. Biological**
- 5. Psychosocial**

- ⦿ **Chemical hazards and toxic substances pose a wide range of health hazards (such as irritation, sensitization, and carcinogenicity) and physical hazards (such as flammability, corrosion, and reactivity).**

- ⦿ **Chemical hazards are defined in the globally harmonized system and in the European union chemical regulations. They are caused by chemical substances causing significant damage to the environment The label is particularly applicable towards substances with aquatic toxicity.**
- ⦿ **A physical hazard is a type of occupational hazard that involves environmental hazards that can cause harm with or without contact.**

- ◎ **Biological hazards, also known as biohazards, refer to biological substances that pose a threat to the health of living organisms, primarily that of humans. This can include medical waste or samples of a microorganism, virus or toxin (from a biological source) that can affect human health**

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DEFINITIONS OF DISASTER

- “A disaster can be defined as any occurrence that cause damage, ecological disruption, loss of human life, deterioration of health and health services on a scale, sufficient to warrant an extraordinary response from outside the affected community or area”.

(W.H.O.)

- “A disaster can be defined as an occurrence either nature or manmade that causes human suffering and creates human needs that victims cannot alleviate without assistance”.

American Red Cross (ARC)

TYPES OF DISASTER



PRINCIPLES OF DISASTER MANAGEMENT

- **Disaster management is the responsibility of all spheres of government**
- **Disaster management should use resources that exist for a day-to-day purpose.**
- **Organizations should function as an extension of their core business**
- **Individuals are responsible for their own safety.**
- **Disaster management planning should focus on large-scale events.**



- ① **Environmental Stress**
- ① **Stressors that are found in our surroundings are called environmental stressors. Everyday life is full of environmental stressors that cause minor irritations. If you use an alarm clock to wake up, the loud noise from your alarm is an environmental stressor. Extreme temperatures are also environmental stressors and can lead to discomfort.**

Other common environmental stressors include:

- ◎ **Noise**
- ◎ **Crowding**
- ◎ **Air quality**
- ◎ **Colors**
- ◎ **Tornadoes and other natural disasters**
- ◎ **War and other manmade disasters**

Environmental stressors can be grouped into the following categories:

- ⦿ Physical stress refers to brief but intense exposures to kinetic energy. This is a type of ecological disturbance because of its acute, episodic nature. Examples include volcanic eruptions, windstorms, and explosions.**
- ⦿ Wildfire is also a disturbance, during which much of the biomass of an ecosystem is combusted, and the dominant species may be killed.**
- ⦿ Thermal stress occurs when releases of heat influence ecosystems, as happens in the vicinity of natural hot-water vents on the ocean floor, and near industrial discharges of heated water.**

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- ① **Environmental disaster is defined as a specific event caused by human activity that results in a seriously negative effect on the environment. Sometimes a natural disaster can become an environmental disaster, but that is a topic to be discussed elsewhere.**

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- ◎ **In most cases environmental disasters are caused by human error, accident, lack of foresight, corner cutting during industrial processes, greed, or by simple incompetence. In other words without some kind of human intervention they would never have happened. They are also often characterised by firm authoritative denials that anything serious has even happened.**

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- ⦿ **Lack of foresight is a common cause of an environmental disaster. In agriculture a classic example of is the increasing salinity of soils in hot climates. With the need to produce more food, a warm climate seems ideal for European-style agriculture, once the existing vegetation has been cleared. The one proviso is that there must be plenty of water.**
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Steps of the landscape approach:

The seven steps of the landscape approach:

- **Carry out an initial assessment of the risk landscape.**
- **Conduct an in-depth stakeholder analysis and power mapping.**
- **Stimulate multi-stakeholder processes and create groups of the willing.**

- **Conduct a collaborative, in-depth problem and solution analysis.**
- **Carry out collaborative (action) planning.**
- **Organise collaborative implementation.**
- **Promote adaptive management.**

Carry out an initial assessment of the risk landscape:

- **Find common concerns as an entry point.**
- **Understand drivers of risk, capacities and assets of communities and the wider social and natural environment.**
- **Understand the hydrology (when disaster risks are water related).**

- ◎ **Landscape approach :**
- ◎ **Applying the landscape approach helps to overcome barriers by sector and contributes to effect risk management by connecting all stakeholders involved, starting with the communities at risk in the landscape.**

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- ◎ **Ecosystem approach** : The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.

Perception approach



- ◎ **Perception approach**
- ◎ **Perception : perception is a reality.**
- ◎ **Perception: the mental process of identifying, sorting & arranging stimulus data into meaningful patterns.**
- ◎ **The process of gathering sensory information and assigning meaning to it.**

- ① **Human ecology & its application in geographical researches:**

- ① **HUMAN ECOLOGY:**

Human ecology is a study of the relationship between humans and their natural, social, and built environments.

Human ecology has been defined as a type of analysis applied to the relations in human beings that was traditionally applied to plants and animals in ecology. Toward this aim, human ecologists (which can include sociologists) integrate diverse perspectives from a broad spectrum of disciplines covering "



UNIT-II

TYPES OF ENVIRONMENTAL HAZARDS & DISASTERS

Types of Environmental hazards & Disasters



- ◎ **Types of Environmental hazards & Disasters:**
- ◎ **A natural disaster is a major adverse event resulting from natural processes of the Earth; examples include floods, volcanic eruptions, earthquakes, tsunamis, and other geologic processes.**

- ◎ **A natural disaster can cause loss of life or property damage, and typically leaves some economic damage in its wake, the severity of which depends on the affected population's resilience, or ability to recover.**
- ◎ **An adverse event will not rise to the level of a disaster if it occurs in an area without vulnerable population. In a vulnerable area, however, such as San Francisco, an earthquake can have disastrous consequences and leave lasting damage, requiring years to repair.**

In 2012, there were 905 natural catastrophes worldwide, 93% of which were weather-related disasters. Overall costs were US\$170 billion and insured losses \$70 billion. 2012 was a moderate year.

45% were meteorological (storms), 36% were hydrological (floods), 12% were climatologically (heat waves, cold waves, droughts, wildfires) and 7% were geophysical events (earthquakes and volcanic eruptions). Between 1980 and 2011 geophysical events accounted for 14% of all natural

- ◎ **Earthquakes**
- ◎ **An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves. At the Earth's surface, earthquakes manifest themselves by vibration, shaking and sometimes displacement of the ground.**

- ◎ **Volcanoes can cause widespread destruction and consequent disaster in several ways. The effects include the volcanic eruption itself that may cause harm following the explosion of the volcano or the fall of rock. Second, lava may be produced during the eruption of a volcano.**

- ◎ **Man induced hazards & Disasters**
- ◎ **Anthropogenic hazards or human-made hazards can result in the form of a human-made disaster. In this case, anthropogenic means threats having an element of human intent, negligence, or error; or involving a failure of a human-made system.**

- ◎ **This is as opposed to natural_hazards that cause natural disasters. Either can result in huge losses of life and property as well as damage to peoples' mental, physical and social well-being.**
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- ◎ **Anthropogenic hazards and disasters are of three types:**
 - (i) Physical hazards (land slides, soil erosion, Earthquakes)**
 - (ii) Chemical hazards and disasters (sudden out break of lethal poisonous gases from industries, nuclear explosion, leakage of radioactive elements).**

Endo-genic Hazards & Exo-genic Hazards

⦿ Endo-genic Hazards

Hazards which originate inside the surface of the earth are termed as endogenic hazards. E.g. Volcanic, Earthquake

⦿ Exo-genic Hazards

Hazards which originate above the surface of the earth (in the atmosphere) are called exogenic hazards.

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- ◎ **Natural hazards are further subdivided into two categories:**
- ◎ **(i) Planetary hazards and**
- ◎ **(ii) Extraterrestrial hazards and disasters.**

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UNIT-III

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- ① . **Atmospheric Hazards**
- ② **Natural hazards that originate in the atmosphere of the earth are called atmospheric hazards. These include cyclones, tornadoes, droughts, thunderstorms etc. Drought, Rainfall, Snowfall, Winds, Hailstorm**
- ③ **B. Hydrospheric Hazards**
- ④ **Those natural hazards that are related to water in the atmosphere are termed as hydrospheric hazards. Wave Currents, Tsunamis, Floods**

Lithospheric Hazards

- ◎ **Lithospheric hazards are those natural hazards that occur near to the surface of the earth. It includes the following hazards: Landslides, weathering, erosion, shifting, avalanches, sink Holes**
- ◎ **Calcium carbonate inside the surface of the earth is dissolved by the underground running water and taken away with it, creating holes. This causes the earth to become hollow and eventually the earth above it settles down under load.**

- ⦿ **(i) Physical hazards (land slides, soil erosion, Earthquakes)**
- ⦿ **(ii) Chemical hazards and disasters (sudden out break of lethal poisonous gases from industries, nuclear explosion, leakage of radioactive elements,**
- ⦿ **(iii) Biological hazards and disaster (sudden rise in population of species in a given habited).**

- ◎ **EARTHQUAKE HAZARDS IN INDIA**
- ◎ **Seismic zonation map shows that India is highly vulnerable for earthquake hazards. India has witnessed more than 650 earthquakes of Magnitude >5 during the last hundred years and earthquake disaster is increasing alarmingly here.**

- ◎ In addition to very active northern and northeastern seismicity, the recent events in Killari (Maharashtra) and Jabalpur (Madhya Pradesh) in the Peninsular India have raised many problems to seismologists.
- ◎ The occurrence of earthquakes can be explained with the concept of "Plate Tectonics" Based on this three broad categories of earthquakes can be recognised. 1) those occurring at the subduction/collision zones (Inter-plates),
- ◎ 2) those at mid-oceanic ridges .
- ◎ 3) those at intra-plates (Acharrya, 1999). Seismic events in India mainly belong to the first category though a few third category events are also known.

- ◎ **EARTHQUAKE PREDICTION**
- ◎ **Research on earthquake prediction started since early sixties. Intensive work is going on all over the world in this regard involving expenditure of billions of dollars. The precise prediction of seismic events remains elusive and unattainable goal as yet in spite of these efforts.**
- ◎ **The MSK (Medvedev-Sponheuer-Karnik) intensity broadly associated with the various seismic zones is VI (or less), VII, VIII and IX (and above) for Zones 2, 3, 4 and 5, respectively, corresponding to Maximum Considered Earthquake (MCE).**

- ◎ **EARTHQUAKE HAZARD ZONATION, RISK EVALUATION AND MITIGATION**

The importance of seismological studies lies in the fact that information generated can be used to mitigate the earthquake hazards. Preparation of seismotectonic/seismic zonation maps is the first step in this direction.

- ◎ **The basic data required for the preparation of these maps are (i) A carefully compiled earthquake catalogue incorporating details about magnitude, location of epicenter, depth of focus *etc.*,**

- (ii) Delineation of seismic source zones from all possible sources like recurrence relation, tectono-geological consideration, palaeoseismicity *etc.*,**
- (iii) Estimation of upper bound magnitude through statistical procedure, cumulative seismic energy release, active fault length *etc.* and**

These are also useful for planning human settlements that would remain safe during the occurrence of an earthquake.

Seismic risk evaluation is also possible from these maps.

- ◎ **Several types of volcanic Eruptions**
- ◎ **Several types of volcanic eruptions—during which lava, tephra (ash, lapilli, volcanic bombs and blocks), and assorted gases are expelled from a volcanic vent or fissure have been distinguished by volcanologists.**

Volcanoes

- Volcanoes are lava filled mountains that erupt when the pressure becomes too great for them to hold it inside
- The contents that a volcano spews forth is called magma when it's below the surface and lava once it reaches the surface
- Only a fraction of the world's volcanoes are actually on land, the rest are on the ocean floor
- Indonesia has the most volcanoes of all the countries in the world

- ◎ **These are often named after famous volcanoes where that type of behavior has been observed. Some volcanoes may exhibit only one characteristic type of eruption during a period of activity, while others may display an entire sequence of types all in one eruptive series.**

Harmful effects o volcanic eruptions

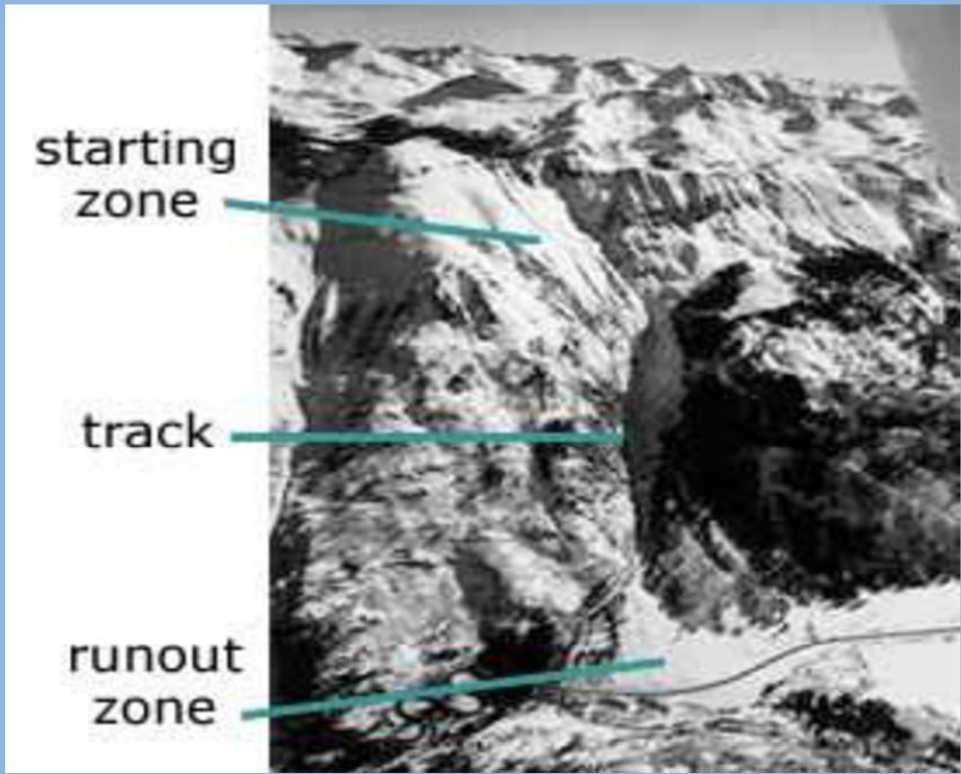
- ⦿ **Volcanoes affect people in many ways, some are good, some are not. Some of the bad ways are that houses, buildings, roads, and fields can get covered with *ash*. As long as you can get the ash off (especially if it is wet), your house may not collapse, but often the people leave because of the ash and are not around to continually clean off their roofs. If the *ashfall* is really heavy it can make it impossible to breathe.**



- ① **Volcanoes can cause widespread destruction and consequent disaster in several ways. The effects include the volcanic eruption itself that may cause harm following the explosion of the volcano or the fall of rock. Second, lava may be produced during the eruption of a volcano.**

How Are Earthquakes and Volcanoes Distributed?

- ◎ **Volcanoes Distributed all over the world in different countries and continents but are not found in every country.**
- ◎ **Found mostly on the coastline**
- ◎ **Especially on tectonic plate boundaries**



Volcano prone areas:

- ◎ **'The Ring of Fire'**
- ◎ **Around the Pacific plate.**
- ◎ **Across the North and South Atlantic ocean**
- ◎ **There are still anomalies - Hot spots**

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Earthquakes

Millions of tiny earthquakes happen everyday, but we only manage to notice the bigger, major ones.

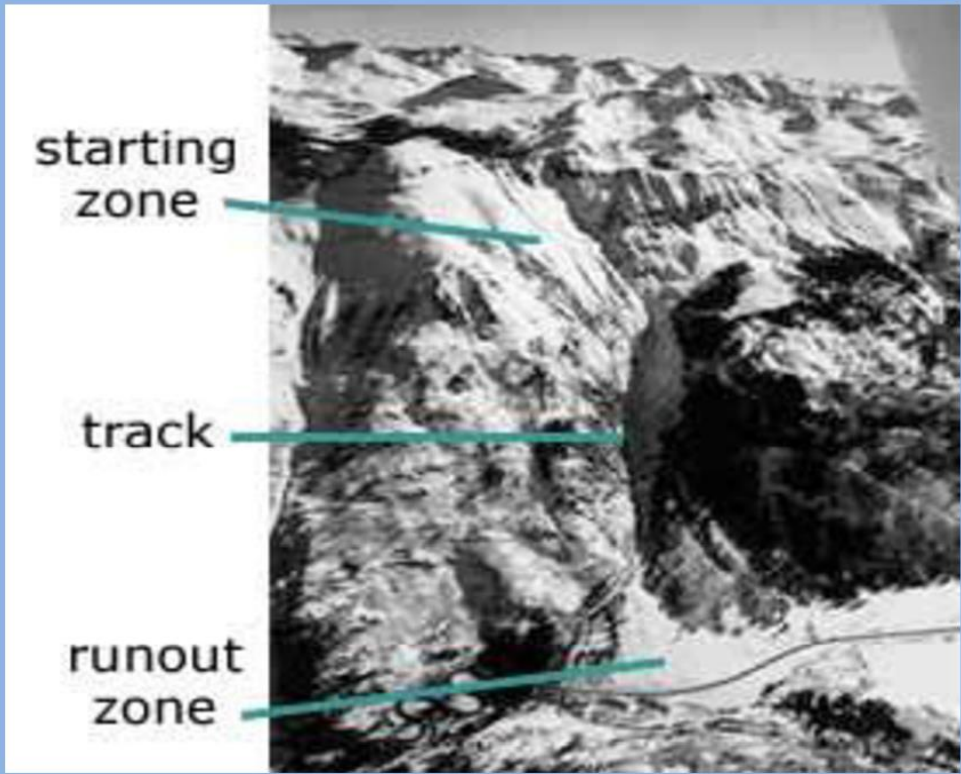
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Earthquake prone areas:

- ◎ **Around Pacific Ocean**
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- ◎ **Eastern side of Eurasian plate**
- ◎ **Western side of North American plate**

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- ◎ **Some of the good ways that volcanoes affect people include producing spectacular scenery, and producing very rich soils for farming.**

Gases

- ◎ **Water vapor, the most common gas released by volcanoes, causes few problems. Sulfur dioxide, carbon dioxide and hydrogen are released in smaller amounts. Carbon monoxide, hydrogen sulfide, and hydrogen fluoride are also released but typically less than 1 percent by volume. Gases pose the greatest hazard close to the *vent* where concentrations are greatest. Away from the vent the gases quickly become diluted by air³**

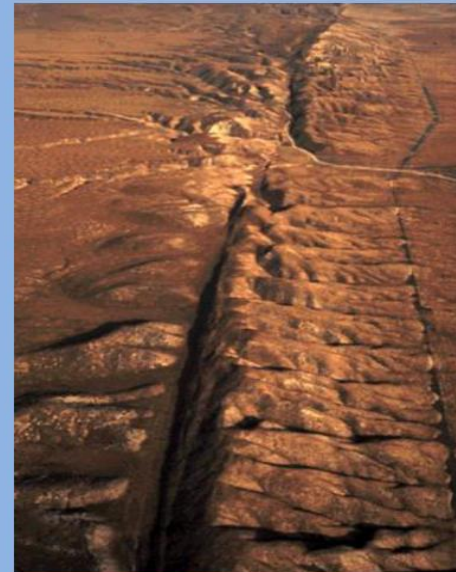
CAUSES OF EARTHQUAKE:

- ⦿ **Earthquakes are one of the most dangerous natural disasters on Earth. This is because they strike with little or no warning, and can cause catastrophic damage. All that shaking comes from deep underground, but as you know, the surface shakes a lot too, which is where all the damage occurs. Buildings fall down, roads and bridges collapse, and land and mud come sliding down from hillsides.**

- ◎ **Faults and Elastic Rebound**
- ◎ **The place where the bumping and sliding occurs along the plate boundaries is called a fault. Plate boundaries can have many faults, and most of the world's earthquakes occur along plate boundaries for this reason.**
- ◎ **The 'Ring of Fire' is an area where most of the world's earthquakes occur because it lines up with many of the plate boundaries.**

Earthquakes

- Earthquakes are caused by the release of built up pressure caused by the shifting of tectonic plates
- Earthquakes usually occur on fault lines, or areas where tectonic plates meet
- The size of an earthquake is measured using the logarithmic based Richter scale



- ① **The theory of elastic rebound explains that faults slip during an earthquake and cause ground shaking.**
- ② **The theory also explains what happens to the land around the fault once it does slip. The ground slowly gets deformed as it sticks, and then 'rebounds' back into shape once it breaks free.**

- ◎ **Tectonic plates are what make up the earth's crust, its outermost layer. These plates fit together like puzzle pieces but they don't stay in one place. They're always moving because the part of the earth underneath them is like a fluid**

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What is Earthquake?

- An **Earthquake** is the result of a **sudden release of energy** in the earth's crust that creates **seismic waves**.
- The seismic activity of an area refers to the frequency, type and size of earthquakes experienced over a period of time



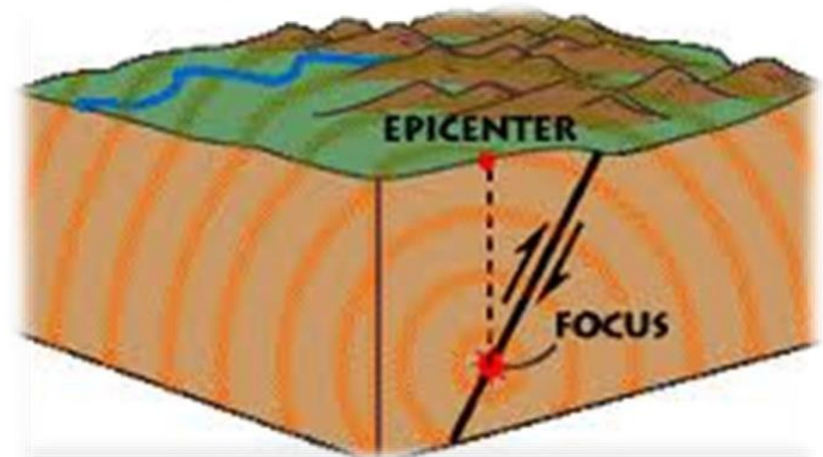
Terms Related To Earthquake

Focus(Hypocenter):

Focus is the point on the fault where rupture occurs and the location from which seismic waves are released.

Epicenter:

Epicenter is the point on the earth's surface that is directly above the focus ,the point where an earthquake or underground explosion originates.



Causes Of Earthquake

The **primary cause of an earthquake is faults** on the crust of the earth.

“A Fault is a break or fracture b/w two blocks of rocks in response to stress.”

☐ This movement may occur rapidly, in the form of an **earthquake** or may occur slowly, in the form of **creep**.

☐ Earth scientists use the **angle of the fault** with respect to the surface (known as the dip) and the **direction of slip** along the fault to classify faults.

- ◎ **Exo-genic Hazards**
- ◎ **Hazards which originate above the surface of the earth (in the atmosphere) are called exogenic hazards. These can be further sub-divided into the following categories:**

- ① **Atmospheric Hazards**
- ① **Natural hazards that originate in the atmosphere of the earth are called atmospheric hazards. These include cyclones, tornadoes, droughts, thunderstorms etc. Drought, Rainfall, Snowfall, Winds, Hailstorm**

- ◎ **Hydrospheric Hazards**
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- ◎ **C. Lithospheric Hazards**
- ◎ **Lithospheric hazards are those natural hazards that occur near to the surface of the earth. It includes the following hazards: Landslides, weathering, erosion, shifting, avalanches, sink Holes**

ATMOSPHERIC HAZARDS

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- ◎ **As with tropical cyclones, they are known by different names in different regions (Nor'easter, Pacific_Northwest windstorms, European_windstorm, East Asian-northwest Pacific storms, Sudestada and Australian_east_coast_cyclones).**

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Hailstorm



- ◎ **Hailstorms are falls of rain drops that arrive as ice, rather than melting before they hit the ground. A particularly damaging hailstorm hit Munich, Germany, on July 12, 1984, causing about 2 billion dollars in insurance claims.**

Heat waves

- ⦿ **A heat wave is a period of unusually and excessively hot weather. The worst heat wave in recent history was the European Heat Wave of 2003.**
- ⦿ **A summer heat wave in Victoria, Australia, created conditions which fuelled the massive bushfires in 2009. Melbourne experienced three days in a row of temperatures exceeding 40°C (104°F) with some regional areas sweltering through much higher temperatures. The bushfires, collectively known as "Black Saturday", were partly the act of arsonists.**

- ◎ **The 2010 Northern Hemisphere summer resulted in severe heat waves, which killed over 2,000 people. It resulted in hundreds of wildfires which causing widespread air pollution, and burned thousands of square miles of forest.**
- ◎ **Heat waves can occur in the ocean as well as on land with significant effects (often on a large scale) e.g. coral bleaching.**

◎ Tornadoes



- ① **An exceptionally clearly developed single-cell Cumulonimbus incus Big displaying the classic anvil shape; associated gusts may occur from the direct proximity to several times the height of the cloud.**

Hailstorm



- ◎ **Hailstorms are falls of rain drops that arrive as ice, rather than melting before they hit the ground. A particularly damaging hailstorm hit Munich, Germany, on July 12, 1984, causing about 2 billion dollars in insurance claims.**

Heat waves

- ⦿ **A heat wave is a period of unusually and excessively hot weather. The worst heat wave in recent history was the European Heat Wave of 2003.**
- ⦿ **A summer heat wave in Victoria, Australia, created conditions which fuelled the massive bushfires in 2009. Melbourne experienced three days in a row of temperatures exceeding 40°C (104°F) with some regional areas sweltering through much higher temperatures. The bushfires, collectively known as "Black Saturday", were partly the act of arsonists.**

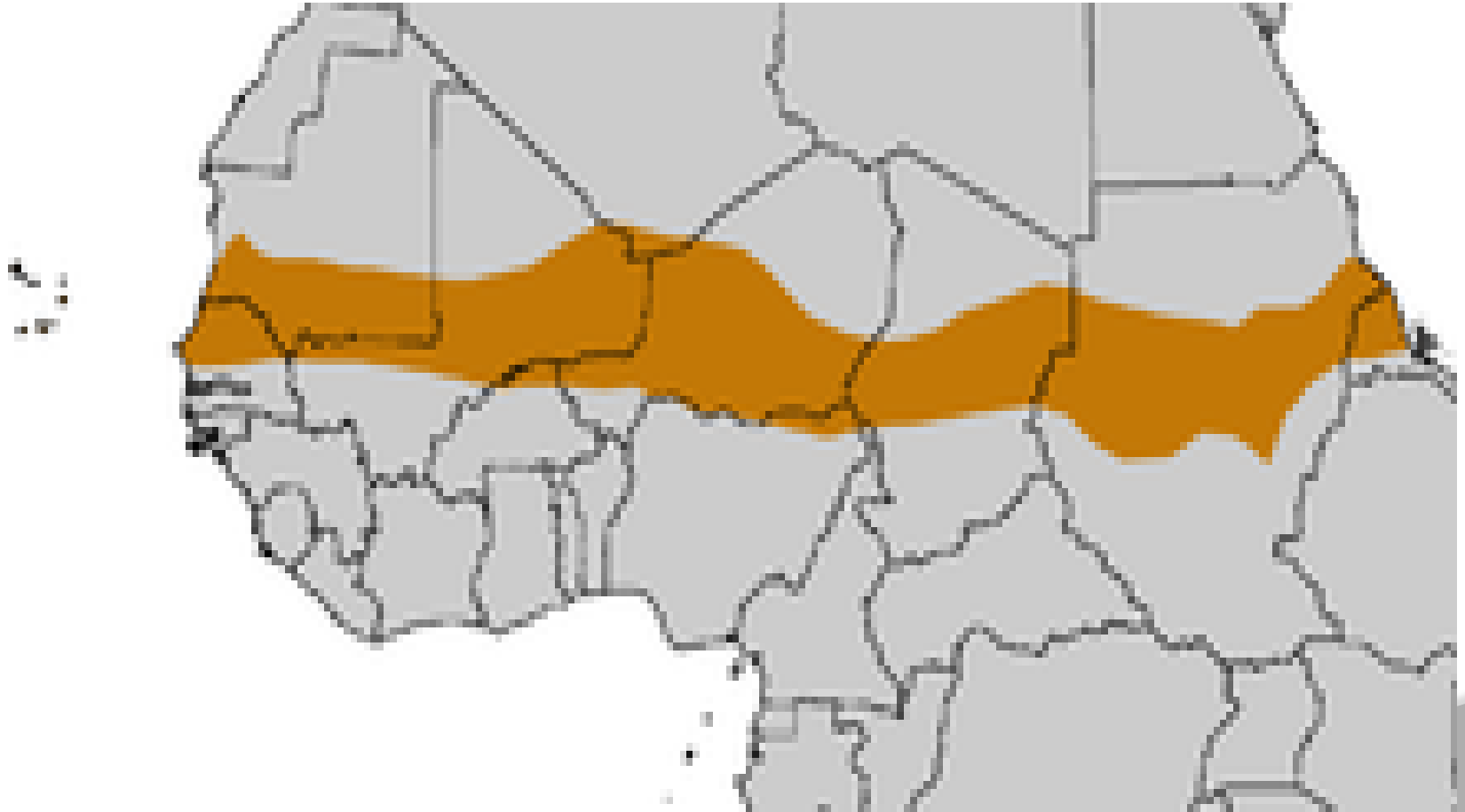
- ◎ **The 2010 Northern Hemisphere summer resulted in severe heat waves, which killed over 2,000 people. It resulted in hundreds of wildfires which causing widespread air pollution, and burned thousands of square miles of forest.**
- ◎ **Heat waves can occur in the ocean as well as on land with significant effects (often on a large scale) e.g. coral bleaching.**

◎ Tornadoes



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◎ Droughts



- ◎ **Drought is unusual dryness of soil, resulting in crop failure and shortage of water for other uses, caused by significantly lower rainfall than average over a prolonged period. Hot dry winds, high temperatures and consequent evaporation of moisture from the ground can contribute to conditions of drought.**

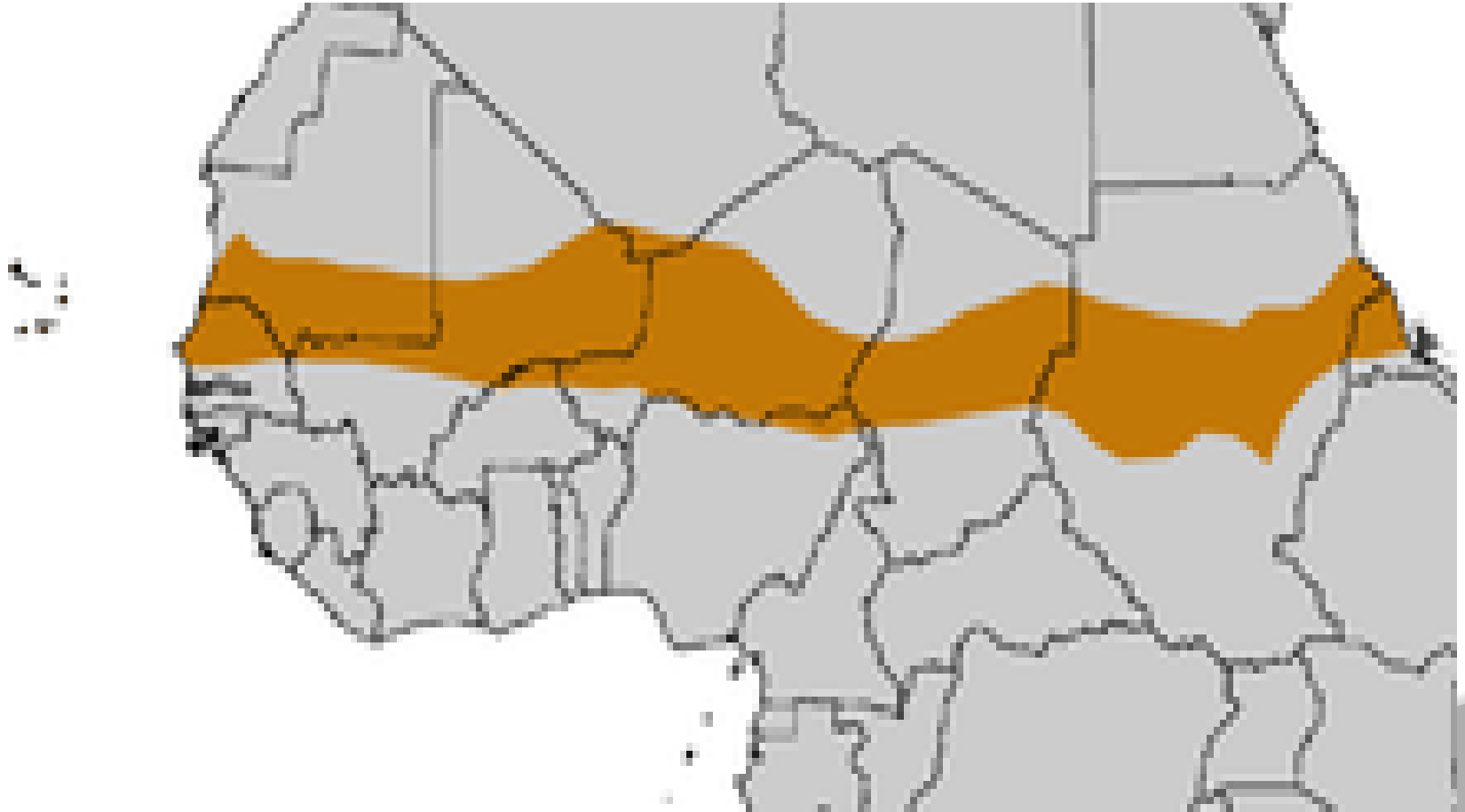
- ◎ **Well-known historical droughts include:**
- ◎ **1900 India killing between 250,000 to 3.25 million.**
- ◎ **1921–22 Soviet Union in which over 5 million perished from starvation due to drought**
- ◎ **1928–30 Northwest China resulting in over 3 million deaths by famine.**
- ◎ **1936 and 1941 Sichuan Province China resulting in 5 million and 2.5 million deaths respectively.**

- ◎ **The 1997–2009 Millenium Drought in Australian led to a water supply crisis across much of the country. As a result many desalination plants were built for the first time (see list).**
- ◎ **In 2006, Sichuan Province China experienced its worst drought in modern times with nearly 8 million people and over 7 million cattle facing water shortages.**

- ◎ **12-year drought that was devastating southwest Western Australia, southeast South Australia, Victoria and northern Tasmania was "very severe and without historical precedent".**
- ◎ **In 2011, the State of Texas lived under a drought emergency declaration for the entire calendar year. The drought caused the Bastrop fires.**

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- ◎ **Flood control methods are used to reduce or prevent the detrimental effects of flood waters.**
- ◎ **Flood relief methods are used to reduce the effects of flood waters or high water levels.**

Some methods of flood control have been practiced since ancient times. These methods include planting vegetation to retain extra water, terracing hillsides to slow flow downhill, and the construction of floodways (man-made channels to divert floodwater). Other techniques include the construction of levees, lakes, dams, reservoirs, retention ponds to hold extra water during times of flooding.

- ◎ **Dams**
- ◎ **Many dams and their associated reservoirs are designed completely or partially to aid in flood protection and control. Many large dams have flood-control reservations in which the level of a reservoir must be kept below a certain elevation before the onset of the rainy/summer melt season to allow a certain amount of space in which floodwaters can fill.**

- ◎ **Diversion canals**
- ◎ **Main article: Flood control channel**
- ◎ **Floods can be controlled by redirecting excess water to purpose-built canals or floodways, which in turn divert the water to temporary holding ponds or other bodies of water where there is a lower risk or impact to flooding. Examples of flood control channels include the Red River Floodway that protects the City of Winnipeg (Canada) and the Manggahan Floodway that protects the City of Manila (Philippines).**

Flood plains and groundwater replenishment

- ⦿ Excess water can be used for groundwater replenishment by diversion onto land that can absorb the water. This technique can reduce the impact of later droughts by using the ground as a natural reservoir. It is being used in California, where orchards and vineyards can be flooded without damaging crops, or in other places wilderness areas have been re-engineered to act as floodplains.**

River defences

- ◎ **In many countries, rivers are prone to floods and are often carefully managed. Defenses such as levees, bunds, reservoirs, and weirs are used to prevent rivers from bursting their banks.**
- ◎ **A weir, also known as a lowhead dam, is most often used to create millponds, but on the Humber River in Toronto, a weir was built near Raymore Drive to prevent a recurrence of the flood damage caused by Hurricane Hazel in October 1954.**

- ◎ **Coastal defenses**
- ◎ **Coastal flooding has been addressed with coastal defences, such as sea walls, beach nourishment, and barrier islands.**
- ◎ **Tide gates are used in conjunction with dykes and culverts. They can be placed at the mouth of streams or small rivers, where an estuary begins or where tributary streams, or drainage ditches connect to sloughs. Tide gates close during incoming tides to prevent tidal waters from moving upland, and open during outgoing tides to allow waters to drain out via the culvert and into the estuary side of the dike. The opening and closing of the gates is driven by a difference in water level on either side of the gate.**

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Soil Erosion

- ① **When things erode, they wear away due to some force acting on them. Just look at any coastline, and you will notice how the constant pounding force from wind and waves causes erosion of the rocky structures, leaving behind all kinds of interesting cliffs, caves and structures. Soil is not immune to erosion, and like rocks along a coastline, soil can erode due to the effects of forces, such as water, wind and farming practices. In this lesson, we will learn about soil erosion and the factors that cause it.**

Soil is naturally created when small pieces of weathered rocks and minerals mix with organic materials from decaying plants and animals. Soil creation is a slow process, taking many years. However, the soil that is created is constantly subjected to natural and manmade forces that disrupt it.

- ◎ **Soil erosion is defined as the wearing away of topsoil. Topsoil is the top layer of soil and is the most fertile because it contains the most organic, nutrient-rich materials. Therefore, this is the layer that farmers want to protect for growing their**
- ◎ **crops and ranchers want to protect for growing grasses for their cattle to graze on.**

Water Erosion and Surface Water Runoff

- ◎ One of the main causes of soil erosion is water erosion, which is the loss of topsoil due to water. Raindrops fall directly on topsoil. The impact of the raindrops loosens the material bonding it together, allowing small fragments to detach. If the rainfall continues, water gathers on the ground, causing water flow on the land surface, known as surface water runoff. This runoff carries the detached soil materials away and deposits them elsewhere.**

Sheet Erosion

There are different types of soil erosion caused by water.

- **Sheet erosion is erosion that occurs fairly evenly over an area. As raindrops loosen soil, the surface water runoff can transport topsoil in a uniform fashion, almost like a bed sheet sliding off of a bed. This can be so subtle that it might not even be noticed until much of the valuable, nutrient-rich topsoil has already been washed away. If a farmer heads out to his field and sees an accumulation of soil and crop residue at one end of his field, he should be worried about sheet erosion.**

- ◎ **Rill Erosion**
- ◎ **Rill erosion is erosion that results in small, short-lived and well-defined streams. When rainfall does not soak into the soil, it can gather on the surface and run downhill, forming small channels of water called rills. You can use this fact as a memory jogger if you remember that 'a little rill will run downhill.' A rill will dry up after the rainfall, but you may still see the stream bed that was created by the temporary stream.**



UNIT-IV

EMERGING APPROACHES IN DISASTER MANAGEMENT-

◎ Emerging approaches in Disaster Management- Three Stages

1. Pre- disaster stage (preparedness)
2. Emergency Stage
3. Post disaster stage rehabilitation.

Pre- disaster stage (preparedness)

- ◎ The first phase is focused on taking precautionary measures before an actual disaster or emergency takes place to reduce its scope. Prevention includes the process of danger identification, assessment of life and property threat in order to limit potential causalities, and adverse impact of natural and technological hazards.**

- ① **The goal of emergency preparedness programs is to achieve a satisfactory level of readiness to respond to any emergency situation through programs that strengthen the technical and managerial capacity of governments, organizations, and communities.**
- ① **These measures can be described as logistical readiness to deal with disasters and can be enhanced by having response mechanisms and procedures, rehearsals, developing long-term and short-term strategies, public education and building early warning systems.**

Preparedness can also take the form of ensuring that strategic reserves of food, equipment, water, medicines and other essentials are maintained in cases of national or local catastrophes. During the preparedness phase, governments, organizations, and individuals develop plans to save lives, minimize disaster damage, and enhance disaster response operations.

Preparedness measures include preparedness plans; emergency exercises/ training; warning systems; emergency communications systems; evacuations plans and training; resource inventories; emergency personnel/contact lists; mutual aid agreements; and public information/education.

- ① **As with mitigations efforts, preparedness actions depend on the incorporation of appropriate measures in national and regional development plans.**
- ① **In addition, their effectiveness depends on the availability of information on hazards, emergency risks and the countermeasures to be taken, and on the degree to which government agencies, non-governmental organizations and the general public are able to make use of this information.**

Emergency stages of disaster management

Emergency Stage:

- ◎ The aim of emergency response is to provide immediate assistance to maintain life, improve health and support the morale of the affected population. Such assistance may range from providing specific but limited aid, range from providing specific but limited aid, such as assisting refugees with transport, temporary shelter, and food, to establishing semi-permanent settlement in camps and other locations.**

It also may involve initial repairs to damaged infrastructure. The focus in the response phase is on meeting the basic needs of the people until more permanent and sustainable solutions can be found. Humanitarian organizations are often strongly present in this phase of the disaster management cycle.

- ◎ **Unlike prevention and preparation phases, response is undertaken during a disaster situation. The aim of the response procedures is to save lives, reduce victims' suffering and alleviate economical losses. Crucial for this phase is the implementation of the plans formulated and prepared prior to the event in the preparation phase**

- ⦿ **Crucial for this phase is the implementation of the plans formulated and prepared prior to the event in the preparation phase. Numerous organisations, such as state emergency units, police forces, fire brigades and ambulances, are deployed to combat the immediate effects of the catastrophe.**

- ⦿ **Disaster management plan geared towards this stage should include:**
- ⦿ **Reducing the possibility of further damage or injuries**
- ⦿ **Accelerating recovery activities**
- ⦿ **Assisting emergency services**
- ⦿ **Returning systems to ordinary levels**

Pos-t disaster stage rehabilitation

- ⦿ During a recovery phase, which takes place after an incident had occurred, affected community is assisted in restoration of concerned area. The phase comprises initial rehabilitation during which services are restored to their regular order, so local governments and responsible agencies regain the ability to manage the ongoing recovery processes and repair of social, physical and economic damage.**

- ① **As the emergency is brought under control, the affected population is capable of undertaking a growing number of activities aimed at restoring their lives and the infrastructure that supports them.**
- ① **There is no distinct point at which immediate relief changes into recovery and then into long-term sustainable development. There will be many opportunities during the recovery period to enhance prevention and increase preparedness, thus reducing vulnerability.**

- ① **Ideally, there should be a smooth transition from recovery to on-going development. Recovery activities continue until all systems return to normal or better.**
- ① **Recovery measures, both short and long term, include returning vital life-support systems to minimum operating standards; temporary housing; public information; health and safety education; reconstruction; counselling programs; and economic impact studies.**

Recovery Targets and Actual Progress

- ◎ **The government planned the reconstruction and rehabilitation phase to be spread over three to five years (GOSL, 2005c). Nevertheless, there were pronouncements at the political level that all permanent housing needs would be met within a year. Over time, it has become clear that these were optimistic pledges.**

- ◎ **In fact, housing needs, for example, had not been met fully even by the end of 2006, while reconstruction of damaged schools and hospitals, and rehabilitation of roads, bridges, etc. is likely to take longer than envisaged.**

An integrated approach for disaster preparedness:

- ◎ The State Plan for preparedness and mitigation attempts to protect the lives and properties of the people of Delhi from potentially devastating hazards by the implementation of an effective long term Delhi Disaster Management Policy. The initiatives under this plan lay down certain objectives and suggest definitive strategies leading to the achievement of goals in a set time frame.**

- ◎ **The strategies for hazard loss reduction aim at reducing losses in the event of a future occurrence of a hazard. Mitigation measures need to be considered in land use and site planning activities. Necessary mitigation measures need to be built into the design and costing of development projects.**

- ◎ **Disaster Preparedness**
- ◎ **Preparedness and focuses on plans to respond to a disaster threat or occurrence. It takes into account an estimation of emergency needs and identifies the resources to meet these needs. It also involves preparation of well-designed plans to structure the entire post-disaster response, and familiarising the stakeholders, particularly the communities through training and simulation exercises.**

- ◎ **Preparedness has to be supported by the necessary legislation. means a readiness to cope with disasters or similar emergencies which cannot be avoided. The first objective of preparedness is to reduce the disaster impact through appropriate actions and improve the capacity of those who are likely to be affected most**

- ① **The first phase is focused on taking precautionary measures before an actual disaster or emergency takes place to reduce its scope.**
- ① **Prevention includes the process of danger identification, assessment of life and property threat in order to limit potential causalities, and adverse impact of natural and technological hazards.**
- ① **Improving environmental policies, raising people's awareness through education and carrying out correct risk assessments all constitute for primary objectives of this stage.**

- ① **The goal of emergency preparedness programs is to achieve a satisfactory level of readiness to respond to any emergency situation through programs that strengthen the technical and managerial capacity of governments, organizations, and communities.**
- ② **These measures can be described as logistical readiness to deal with disasters and can be enhanced by having response mechanisms and procedures, rehearsals, developing long-term and short-term strategies, public education and building early warning systems**



UNIT-V

DISASTER MANAGEMENT

Role of Meteorological observatory:

- ⦿ Meteorological observatory department undertakes observations, communications, forecasting and weather services.**
- ⦿ In collaboration with the Indian Space Research Organisation, the Meteorological observatory department also uses the IRS series and the Indian National Satellite System (INSAT) for weather monitoring of the Indian subcontinent.**
- ⦿ Meteorological observatory department was the first weather bureau of a developing country to develop and maintain its own satellite system.**

- ◎ **Indian Meteorological observatory department is one of the 6 worldwide Regional Specialised Meteorological Centres of the Tropical Cyclone Programme of the World Weather Watch of the World Meteorological Organization.**
- ◎ **It is regional nodal agency for forecasting, naming and disseminating warnings about tropical cyclone in the Indian Ocean north of the Equator.**

- 1. To collect seismogram readings from station networks throughout the world in cooperation with other seismological data centers and organizations.**
- 2. To edit and preserve the readings for analysis in computer-readable form.**
- 3. To compute focal coordinates and magnitudes for each event for which adequate data are available and to publish monthly a bulletin containing the fullest possible listing of original data and the parameters derived there from.**

- 4. To prepare and publish a regional catalog of earthquakes.**
- 5. To undertake such research and development efforts as may be relevant to improving the execution of the abovementioned tasks, and which are within the terms of these statutes**

- 6. To provide such other services to institutions or individual scientists and engineers throughout the world as are compatible with the execution of the abovementioned tasks, and with the data and facilities available within the Centre.**
- 7. To undertake such other relevant activities as may be approved by the Governing Council on its own motion or on the recommendation of the Executive Committee.**

- ◎ **Volcanology (also spelled vulcanology) is the study of volcanoes, lava, magma, and related geological, geophysical and geochemical phenomena. The term *volcanology* is derived from the Latin word *Vulcan*. Vulcan was the ancient Roman god of fire.**

- ⦿ **A volcanologist is a geologist who studies the eruptive activity and formation of volcanoes, and their current and historic eruptions.**
- ⦿ **Volcanologists frequently visit volcanoes, especially active ones, to observe volcanic eruptions, collect eruptive products including tephra (such as ash or pumice), rock and lava samples.**
- ⦿ **One major focus of enquiry is the prediction of eruptions; there is currently no accurate way to do this, but predicting eruptions, like predicting earthquakes, could save many lives.**

- ◎ **the first volcanological observatory, the Vesuvius Observatory, was founded in the Kingdom of the Two Sicilies.**
- ◎ **Seismic observations are made using seismographs deployed near volcanic areas, watching out for increased seismicity during volcanic events, in particular looking for long period harmonic tremors, which signal magma movement through volcanic conduits.**

Surface deformation monitoring includes the use of geodetic techniques such as leveling, tilt, strain, angle and distance measurements through tilt meters, total stations and EDMs. This also includes GNSS observations and InSAR. Surface deformation indicates magma upwelling: increased magma supply produces bulges in the volcanic center's surface

- ◎ **Gas emissions may be monitored with equipment including portable ultra-violet spectrometers (COSPEC, now superseded by the miniDOAS), which analyzes the presence of volcanic gases such as sulfur dioxide; or by infra-red spectroscopy (FTIR). Increased gas emissions, and more particularly changes in gas compositions, may signal an impending volcanic eruption.**

- ◎ **Floods and droughts are recurrent hydrological phenomenon causing huge losses to lives, livelihood, properties and infrastructure due to non-uniformly distributed rainfall both in time and space leading to the dimensionally opposite problems of flood and drought in different parts of the country.**
- ◎ **Out of 3290 lakh hectares geographical area, 40 million hectares is prone to floods which show high risk, vulnerability and is one of the most common hydrologic extremes frequently experienced by our country.**

- ◎ **drought and flood problems in India are highlighted along with some of the important management issues requiring immediate attention. Furthermore, it presents the recently developed non-structural techniques for flood forecasting, flood plain zoning, glacial lake outburst modeling and decision support system.**

Hydrological disasters

- ⦿ **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.**

Floods:

- ◎ **A flood is an overflow of water that 'submerges' land. The EU Floods Directive defines a flood as a temporary covering by water of land which is usually not covered by water.**
- ◎ **In the sense of 'flowing water', the word may also be applied to the inflow of the tides. Flooding may result from the volume of water within a body of water, such as a river or lake, which overflows causing the result that some of the water escapes its usual boundaries**

- ◎ **Limnic eruptions**
- ◎ **A limnic eruption occurs when a gas, usually CO₂, suddenly erupts from deep lake water, posing the threat of suffocating wildlife, livestock and humans. Such an eruption may also cause tsunamis in the lake as the rising gas displaces water.**

Tsunami

- ◎ **A tsunami also known as a seismic sea wave or as a tidal wave, is a series of waves in a water body caused by the displacement of a large volume of water, generally in an ocean or a large lake. Tsunamis can be caused by undersea earthquakes such as the 2004 Boxing Day tsunami, or by landslides such as the one in 1958 at Lituya Bay, Alaska, or by volcanic eruptions such as the ancient eruption of Santorini. On March 11, 2011, a tsunami occurred near Fukushima, Japan and spread through the Pacific.**

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- ① **GIS database include following information which is beneficial in disaster management.**
- ① **Use of different satellite imageries (Remote Sensing data) ex. Quickbird, SPOT, IKONOS for GIS data creation.**
- ① **Preparation of base map of different themes using satellite imageries.**
- ① **Thematic maps such as hydro geomorphologic map, slope map, terrain map, and DEM generation in GIS. It is used for disaster planning.**

- ⦿ **Macro and micro level maps used for identifying vulnerability and threat condition**
- ⦿ **Identification of safe locations and zones for rehabilitation**
- ⦿ **Road and location maps used for finding alternate routes, shelters and locations**

- ⦿ **Planning of evacuation and operation**
- ⦿ **Management of Rehabilitation and post-disaster reconstruction.**
- ⦿ **Suitable locations identifying scientifically for construction of houses and shelters**
- ⦿ **No construction areas identified and rehabilitation of existing people can be done.**

GIS solutions for different hazards:

1. Earthquake

- ⦿ GIS can be useful for monitoring historical sites of earthquake also to Response & data management for recovery.
- ⦿ It's also useful for Impact assessment.

Flood

- ◎ **Flood mapping from Macro level to Micro level.**
- ◎ **Flood Zone mapping.**
- ◎ **Detecting Potential Site of Flood in reference with rainfall**
- ◎ **Elevation Mapping**
- ◎ **Preparing Response map in response to manage after flood situations**

world meteorological organizations:

- ◎ **The World Meteorological Organization (WMO) is an intergovernmental organization with a membership of 191 Member States and Territories. It originated from the International Meteorological Organization (IMO), which was founded in 1873.**

Thank
You