

MODULE 3

EXTREME EVENTS & DISASTERS

The topics covered in this module are:

- Water related extreme events & disasters
- Disaster prone areas in India
- Mitigation of disasters
- Soil erosion by water

OBJECTIVE (S) OF THE MODULE

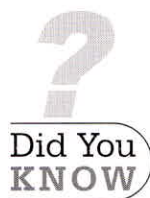
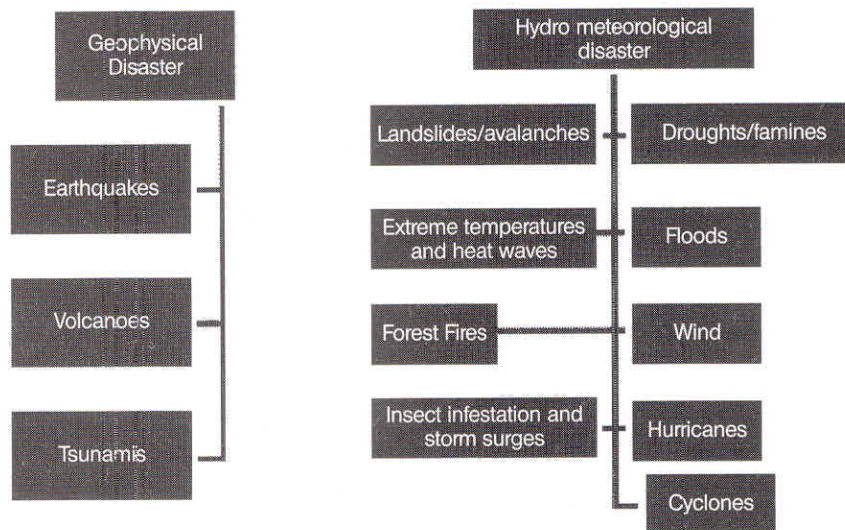
- The trainer informs the following module objectives to participants:
- Learn about the water related disasters;
- Understand and realise the linkages between IWRM and disaster management practices and processes;
- Understand the disaster risk reduction initiatives;
- Understand the use of knowledge, education, training, innovation and information sharing to build safe and resilient communities.
- Understand the correlation between hazard, vulnerability and assessment of risk;
- Evaluate disaster risk reduction initiatives; and
- Learn the types and control of soil erosion by water.

WATER RELATED EXTREME EVENTS & DISASTERS

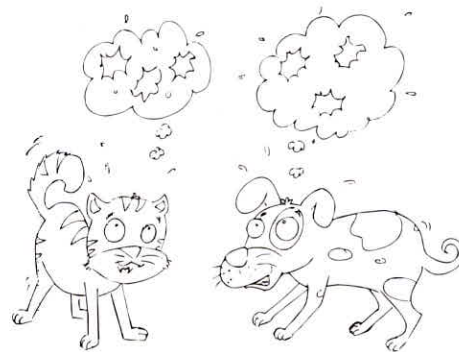
WHAT IS A DISASTER?

A disaster is a serious disruption of the functioning of a society or community that causes widespread human, material or environmental loss which exceeds the capacity of the affected society to cope without external intervention.

According to the World Disaster Report (WDR, 2003) the most common natural disasters are classified into two categories:



Drought ranks as the single most common cause of severe food shortages in developing countries



Activity

What defines a disaster in India? Discuss.

In this training we will concentrate on the first classification particularly in the context of water related ones. Past observations have shown that globally there is an increase in the number of disasters and their total economic impacts (World Data Report, 2003) with about 90% of these natural disasters caused by severe weather and extreme climate events.

A number of severe weather and extreme climate-related issues in recent years have led to disasters of the devastating consequences to many countries, thus arousing keener interest of the general public and policy makers.

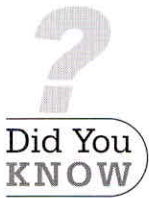
DISASTER CONSEQUENCES

Effects on Physical Health - injuries, disease and death

Effects on emotional well-being - distress, fear and anxiety, high-risk behaviors like drinking and psychological illness like depression

Damage to property and services - damage, destruction, or service disruption;

Effects on the community - interruption of activities, closure of schools, workplaces and government offices, unemployment, displacement of people whose homes are damaged, economic losses and transportation.



Drought in India has resulted in tens of millions of deaths over the course of the 18th, 19th, and 20th centuries.

LEARNING COMMON TERMS



Hazard - A potentially damaging physical event, human activity or phenomenon that has potential to cause loss of life or injury, property damage, socioeconomic disruption of life and environmental degradation, among others.

Vulnerability - A set of conditions resulting from physical, social, economic and environmental factors that increase the susceptibility of a community to the impact of disasters or the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard.

Disaster = Hazard + Vulnerability

Risk - The probability of harmful effects or loss resulting from the interaction between natural hazards and vulnerable conditions of people and property.

Risk = (Hazard X Vulnerability)/Capacity

Mitigation - Short and long term actions, programs or policies in advance of a natural hazard or in its early stages, to reduce the degree of risk to people, property and productive capacity.

Impacts - Specific effects, consequences or outcomes of hazards or disasters.

Preparedness - Pre-disaster activities designed to increase the level of readiness or improve operational capabilities for responding to an emergency.

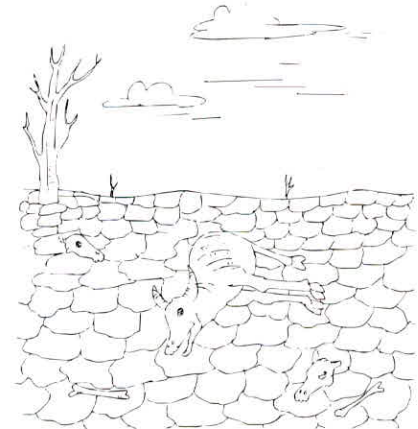
Response - Actions taken immediately before, during or immediately after a disaster to reduce the impacts and improve recovery.

Resilience/Capacity - The capability of the community to cope with disasters.

DROUGHT

What do you think when you hear the word drought? Do you think "dry," "hot," "dusty," or "cracked earth," or even "no water"? If so, you're on the right track!

When a place is in a drought, it is dry and hot,



Drought

often dusty; cracks may appear in the soil, and rivers, lakes, streams, and other sources of water can run dry. A drought means that a place has less precipitation (rain or snow) than normal over a few months or even longer.

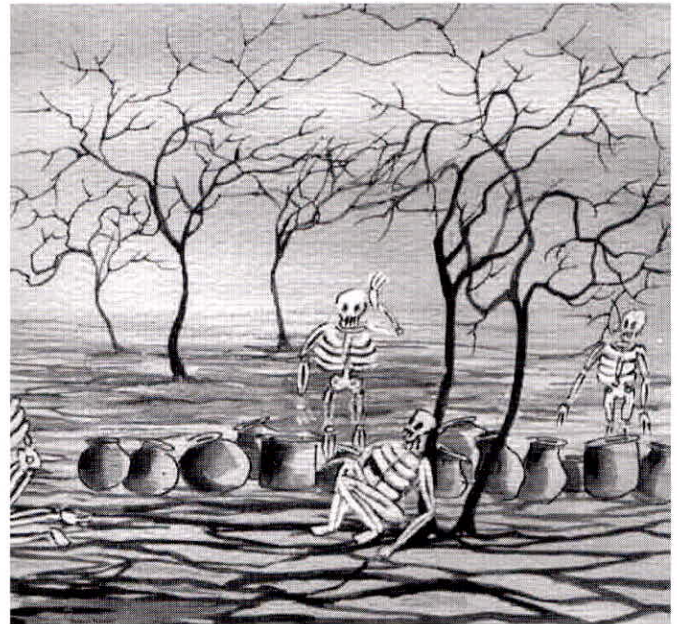
What causes this? How does drought really affect us? How can we be prepared for drought? These are all important questions that we will answer as we explore drought.

How does drought affect our lives?

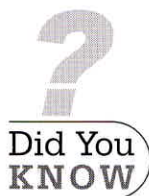
When we have a drought, it can affect our communities and our environment in many different ways.

Everything in the environment is connected, just like everything in our communities is connected. Each different way that drought affects us is what we call an impact of drought.

Drought affects our lives in many different ways because water is such an important part of so many of our activities. We need water to live, and animals and plants do too. We need water to grow the food we eat. We also use water for many different things in our lives, like washing dishes, cooking, bathing, and swimming or river rafting. Water is also used to help produce the electricity we use to operate the lights in our houses and the video games you may like to play. When we don't have enough water for these activities because of a drought, many people and many different things will be affected in many different ways.



Drought effects our life largely



The average rainfall of India is about 119 cm.

TYPES OF DROUGHT

There are 4 types of drought:

Meteorological: referring to a lack of precipitation.

Agricultural: referring to a lack of moisture in the soil where crops grow.

Hydrological: referring to low levels of water in lakes and reservoirs.

Socioeconomic: referring to water shortages affecting people in society (drinking water and running water).



Some impacts of drought

- The risks of infectious diseases (such as cholera, typhoid fever, diarrhoea, acute respiratory infections and measles) are all increased by a lack of water supply and sanitation services.
- Malnutrition and displacement of the population can be brought on by a drought emergency;
- The ability of people to access health-care services is undermined by the disruptions that attend drought emergencies. The disruptions include forced migration, loss of buying power, and the erosion of coping capacities, all of which contribute to an overall increase in morbidity and mortality.
- Health services might not have adequate water-supply and sanitation facilities, which only adds to the health risks; and
- The worst case scenario of these impacts is death through hunger and malnutrition particularly among the poor and the vulnerable groups.

FLOOD

A flood is an unusual high-water period in which water overflows its natural or artificial banks onto normally dry land. It is a regular and natural occurrence to which communities must adapt as part of the usual living conditions that can affect them at any time.

What Causes A Flood

A flood is caused by a combination of heavy rainfall causing river / oceans to over flow their banks, and can happen at any time of the year, not just in the winter.

Floods generally develop over a period of days, when there is too much rainwater to fit in the rivers and water covers the ground next to it (the 'floodplain'). However, floods can happen very quickly when lots of heavy rain falls over a short period of time. These 'flash floods' occur with little or no warning and cause bigger loss of human life than any other type of flooding.

Coastal areas are also at risk from sea flooding, when storms and big waves bring seawater into the ground. The worst types of flooding may occur if there is a combination of storms, 'spring tides' and low atmospheric pressure.



Heavy rains

Effects of Flood

Flooding can be very dangerous - only 15cms of fast-flowing water is needed to knock you off your feet! Flood water can disrupt public and personal transport by cutting off roads and railway lines, as well as communication links when telephone lines are damaged. Floods disrupt normal drainage systems in cities, and sewage spills are common, which represents a serious health hazard, along with standing water and wet materials in the home. Bacteria, mould and viruses, cause disease, trigger allergic reactions, and continue to damage materials long after a flood.

Floods can distribute large amounts of water and suspended sediment over vast areas, restocking valuable soil nutrients to agricultural lands. In contrast, soil can be eroded by heavy amounts of fast flowing water, destroying crops, destroying agricultural land / buildings and drowning farm animals.

Severe floods not only ruin homes / businesses and destroy personal property, but the water left behind causes further damage to property and contents. The environment and wildlife are also at risk when damage when damage to businesses causes the accidental discharge of toxic materials like paints, pesticides, petrol etc.

Floodwater can severely disrupt public and personal transport by cutting off roads and railway lines, as well as communication links when telephone lines are damaged.

Unfortunately, flooding not only disrupts many people's lives each year, but it frequently creates personal tragedies when people are swept away and drowned.



Car caught during floods



Did You
KNOW

A car can be taken away in as little as 2 feet of water.

Activity

Trainer divides the participants into groups and asks each group to collect information about the last year's floods in India. What was the temperature in spring? What was the average snow level in the winter? What is the situation this year as compared to the last one? Are floods/flash floods expected? Know results from each group and discuss.



Read
and
Repeat

Floods are not always disastrous and disruptive; they have some positive impacts such as:

- Nutrients - in the case of the Nile River before the Aswan High Dam of Egypt was built, the Nile flooded every spring bringing much needed enrichment and moisture to the fertile soil of its floodplains;
- Recharge - floods replenishes ground water systems by recharging the underground aquifers;
- Replenishes - reservoirs are filled which enhances the national water security; and
- Washes away - accumulated waste from water channels and improve the channel water flow.

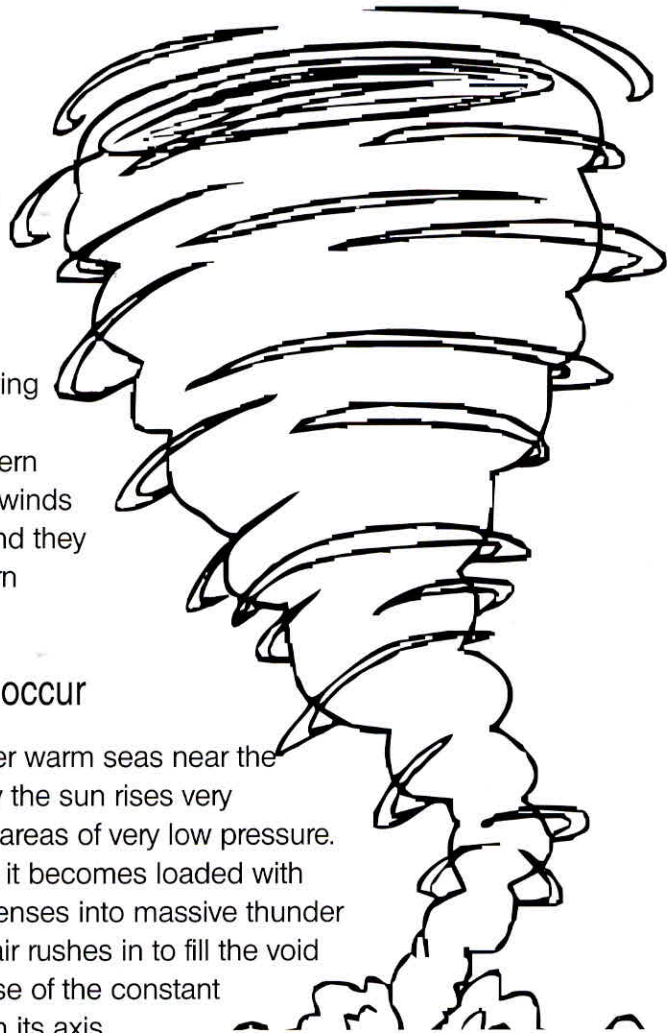
CYCLONE



Before starting this topic, make the participants clear about the difference between cyclone and tsunami.

- A cyclone is a large scale low pressure system with a defined circulation of wind.
- A tsunami is an immensely high wall of water that is usually generated by an earthquake undersea. It is a single, large wave series of waves, it can - and frequently does - devastate a seaside community and even entire coastlines where it makes landfall.

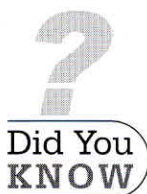
A cyclone is a huge strong wind system which blows around the center of the intense low pressure area. Cyclone is the local name of Indian Ocean and the South Pacific Ocean, but in the Northwest Pacific Ocean they are known as typhoons, and in the Northeast Pacific Ocean and North Atlantic, they are known as hurricanes. Since the cyclones form in the tropical region, they are also known as tropical storms, tropical revolving storms or tropical cyclones. In the northern hemisphere, cyclone winds blow anticlockwise and they reverse in the southern hemisphere.



Cyclone

How do cyclones occur

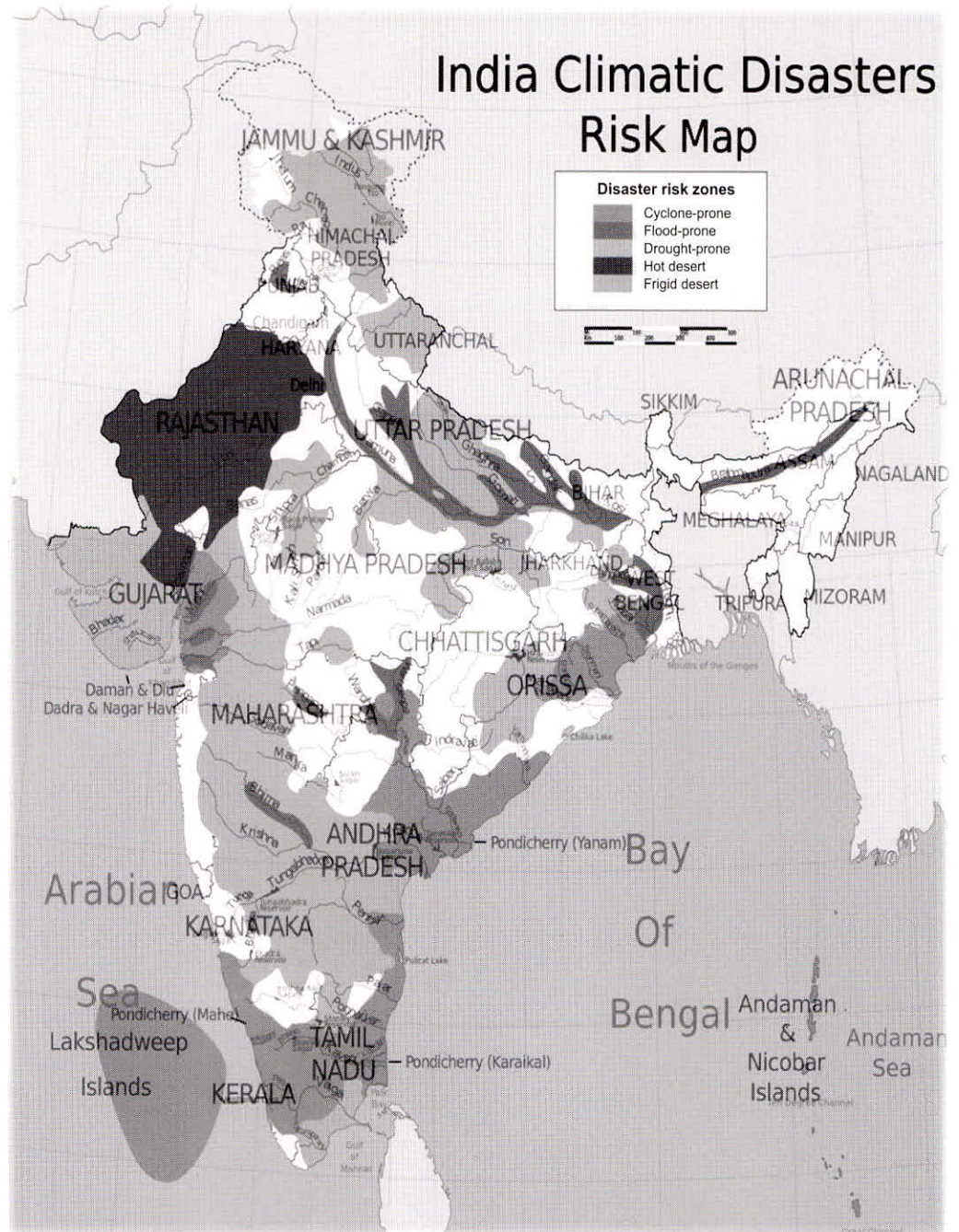
Cyclones develop over warm seas near the equator. Air heated by the sun rises very swiftly, which creates areas of very low pressure. As the warm air rises, it becomes loaded with moisture which condenses into massive thunder clouds. Surrounding air rushes in to fill the void that is left. But because of the constant turning of the earth on its axis, the air is bent inwards and then spiral upwards. The swirling winds rotate faster and faster, forming a huge circle which can be up to 500-1000 km across. At the center of the storm is a calm, cloudless area called the eye - where there is no rain, and the winds are fairly light.



Tropical cyclones are amongst the most powerful and destructive meteorological systems on earth. Globally, 80 to 100 cyclones develop over tropical oceans each year.

DISASTER PRONE AREAS IN INDIA

Almost 85% of India's area is vulnerable to one or multiple hazard. Of the 28 states and 7 union territories, 22 are disaster-prone. It is vulnerable to wind storms spawned in the Bay of Bengal and the Arabian Sea, earthquakes caused by active crustal movement in the Himalayan mountains, floods brought by monsoons, and droughts in the country's arid and semi-arid regions. Nearly 57% of the country is vulnerable to earthquake (high seismic zones III-V), 68% to drought, 8% to cyclones and 12% to floods. India has also become a lot more vulnerable to tsunamis since the 2004 Indian Ocean tsunami.



[Source: Wikipedia]



Did You
KNOW

A cloudburst is a sudden rainfall which can be quite unexpected, very abrupt, and rather drenching. In some cloudbursts, up to 5 inches (almost 13 centimeters) of rain can fall in an hour, often in the form of extremely large droplets.



Read
and
Repeat

Uttarakhand Disaster (2013)

It is believed that a combination of events caused the devastation in Kedarnath town. A massive landslide occurred upstream in the north-east region of Kedar valley. At the same time, the flash floods were triggered by very heavy rainfall due to cloudburst and Glacial Lake Outburst Flood (GLOF) in the north-west of the valley. The debris from the landslide and water from the floods travelled down the slope, channeled into the glacier, and came down to Kedarnath town.



Did You
KNOW

The Indian subcontinent is among the world's most disaster prone areas.

FLOOD PRONE

About 30 million people are affected annually. Floods in the Indo-Gangetic-Brahmaputra plains are an annual feature. On an average, a few hundred lives are lost, millions are rendered homeless and several hectares of crops are damaged every year.

Nearly 75% of the total rainfall occurs over a short monsoon season (June - September). 40 million hectares, or 12% of Indian land, is considered prone to floods.

Floods are a recurrent phenomenon in at least 5 states - Assam, Bihar, Orissa, Uttar Pradesh and West Bengal.

On account of climate change, floods have also taken place in recent years in areas that are normally not flood prone. In 2006, drought prone parts of Rajasthan experienced floods.

State Wise Flood Prone Area Of India (million Hectare)

Uttar Pradesh	7.336
Bihar	4.26
Punjab	3.7
Rajasthan	3.26
Assam	3.15
West Bengal	2.65
Haryana	2.35
Orissa	1.4
Andhra Pradesh	1.39
Gujarat	1.39
Kerala	0.87
Tamil Nadu	0.45
Tripura	0.33
Madhya Pradesh	0.26
Himachal Pradesh	0.23
Maharashtra	0.23
Jammu & Kashmir	0.08
Manipur	0.08
Delhi	0.05
Karnataka	0.02
Meghalaya	0.02
Pondicherry	0.01

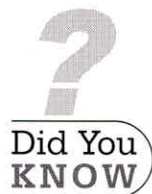
[Source: www.wrmin.nic.in]

DROUGHT PRONE

About 50 million people are affected annually by drought. Of approximately 90 million hectares of rain-fed areas, about 40 million hectares are prone to scanty or no rainfall.

Rainfall is poor in nine meteorological subdivisions out of 36 subdivision (each meteorological sub division covers a geographic area of more than ten revenue districts in India).

In India, annually 33% area receives rainfall less than 750 mm (low rainfall area) and 35 % area receives between 750 to 1125 mm medium rainfall rainfall) and only 32 % fall in the high rainfall (>1126 mm) zone.

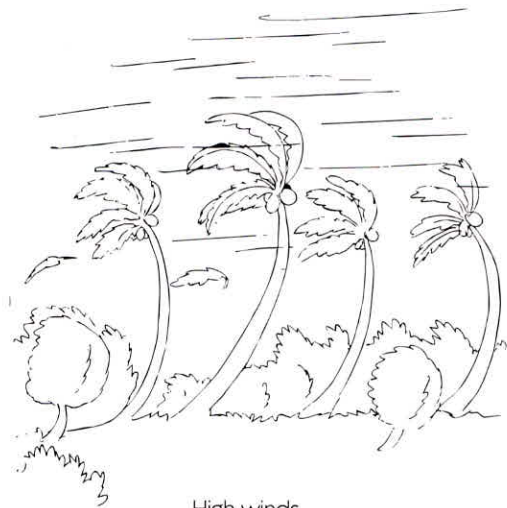


Approximately 50 million people are affected annually by drought.

CYCLONE PRONE

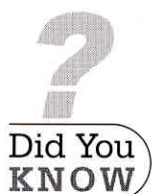
About 8% of the land is vulnerable to cyclones of which coastal areas experience two or three tropical cyclones of varying intensity each year.

The Indian continent is considered to be the worst cyclone-affected part of the world, as a result of low-depth ocean bed topography and coastal configuration. The principal threat from a cyclone are in the form of gales and strong winds; torrential rain and high tidal waves/storm surges. Most casualties are caused due to coastal inundation by tidal waves and storm surges.



High winds

Cyclones typically strike the East Coast of India, along the Bay of Bengal, i.e. the states of West Bengal, Orissa, Andhra Pradesh and Tamil Nadu, but also parts of Maharashtra and Gujarat at the Arabian Sea West Coast.



Cyclonic activities on the east coast of India are more severe than on the west coast.

MITIGATION OF DISASTERS

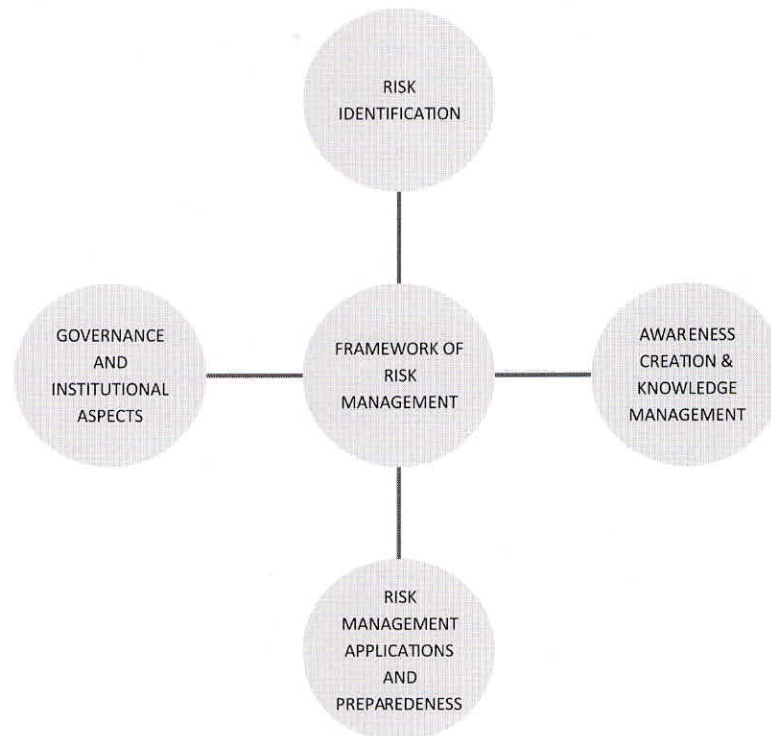
RISK REDUCTION AND MANAGEMENT

Disaster risk reduction entails continuous and integrated multi-sectoral, multidisciplinary process of planning, and implementation of interventions of both pre and post-disaster risk duration.

In broad terms it will include:

- Hazard prevention and minimisation;
- Reducing exposure, severity and susceptibility;
- Emergency preparedness and coping capacity;
- Rapid and effective response; and
- Post disaster recovery and rehabilitation.

Disaster management aims to reduce the vulnerability to the effect of environmental hazards (both natural and human-induced) to a manageable and acceptable level by enhancing community resilience and integrating sustainable risk management initiatives within the national planning processes.



RISK FACTORS

As demand for potable water starts to outstrip supply by increasing amounts in coming years, India would face a slew of subsequent problems, such as food shortages, intrastate, and international conflict.

Poverty

The single most important factor that increases the vulnerability of people to disaster is poverty. An impoverished community with low education levels usually lacks the economic and political influence to cope with the fortunes of their environment.

Unregulated development

Ungoverned development growth, together with uncontrolled population growth lead to settlements in hazardous areas, susceptibility to disease, competition for scarce resources, and civil conflict. Disaster losses are significantly reduced when the people of any given society are organized with effective laws and controls to protect the population from potentially hazardous areas, access to public utilities, medical care, education, and economic resources.



Poverty increases vulnerability to disasters

Rapid urbanization and migration

Rapid population growth and migration are related to the rapid urbanization phenomenon. It is characterized by the rural poor or civilians in an area of conflict moving to cities in search of economic opportunities and security. These massive numbers of urban poor increasingly find fewer safe and desirable places available to build their houses.

Social and cultural transitions

Many of the inevitable changes that occur in all societies lead to an increase in society's vulnerability to disasters. All societies are in a constant state of transition and change. These transitions are often extremely disruptive and uneven, leaving gaps in social coping mechanisms and technology. A good example of this situation is when normally nomadic communities become sedentary, rural people who move to urban areas, and both rural and urban people who move from one economic level to another. More broadly, these characters are typical of a shift from non-industrialized to industrializing societies.

Environmental degradation

Many disasters are either caused or aggravated by environmental degradation. Deforestation contributes to rapid rainfall-runoff, which leads to flooding. The destruction of mangrove swamps decreases the coastlines' ability to resist tropical winds and storm surges.

The creation of drought conditions - and the relative severity and length of time the drought lasts - is mainly a natural phenomenon. Human-induced contributions to

drought conditions include: poor cropping patterns, overgrazing, the stripping of topsoil, poor conservation techniques, depletion of both the surface and groundwater water supply, and, to an extent, unchecked urbanization.

Lack of awareness and information

Disasters can also occur when people who are vulnerable, have not been educated on how to get out of harm's way or take protective measures at the start of a disaster event. This ignorance may not necessarily be a function of poverty, but a lack of awareness of what measures can be taken to build safe structures on safe building sites. People may be unaware of safe evacuation routes and procedures. Others may be unaware of where to turn for assistance in times of acute distress. In most disaster-prone communities, there is a wealth of understanding about disaster threats and responses. This understanding should be incorporated into external initiatives and planning.

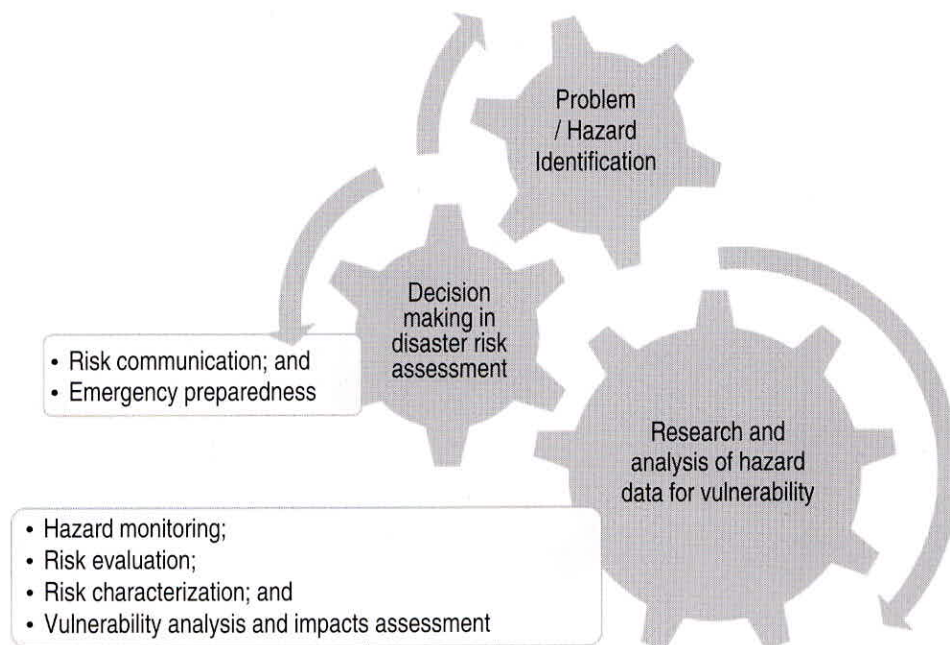
War and civil conflicts

War and civil conflicts are regarded as hazards or extreme events that produce disasters. War and civil conflict often cause population displacement.

Change in climatic patterns

Climate change may have significant effect on the patterns and trends of hydro-climatic hazards and disasters.

RISK ASSESSMENT



FLOOD RISK MANAGEMENT & PREPAREDNESS

Structural Measures

Embankments: Embankments have been extensively used for protection against floods of important towns and lands. However, the embankments are now the best means of communication in the flood-prone areas and are being recklessly used for transportation of materials by tractors and other heavy vehicles. During floods, people shift to the embankments for temporary shelter and often settle down there for good. Thus, embankments and their slopes become permanent settlements to flood victims and their livestock. It messes up proper maintenance, and embankments become susceptible to breaches during floods. Whenever there are lapses in maintenance, the protected areas are exposed to serious flood hazards.

Watershed Management: Timely cleaning, de-silting and deepening of natural water reservoir and drainage channels (both urban and rural) must be taken up.

Reservoirs: The entire natural water storage place should be cleaned on a regular basis. Encroachments on tanks and ponds or natural drainage channel share to be removed well before the onset of monsoon.

Natural water retention basins: Construction and protection of all the flood protection embankments, ring bunds and other bunds. Dams and levees can also be constructed which can be used as temporary storing space which reduces the chances of lower plains getting flooded.

Buildings on elevated area: The buildings in flood prone areas should be built on an elevated area and if necessary on stilts and platforms.

However, complete flood control in terms of structural methods of flood protection is neither economically viable nor these are environment friendly. Therefore, non-structural methods are becoming popular in mitigating flood disaster.

Non-Structural Measures

Plain Zoning: Flood plain zoning, which places restrictions on the use of land on flood plains, can reduce the cost of flood damage. Local governments may pass laws that prevent uncontrolled building or development on flood plains to limit flood risks and to protect nearby property. Landowners in areas that adopt local ordinances or laws to limit development on flood plains can purchase flood insurance to help cover the cost of damage from floods.

Flood Forecasting and warning: These are issued for different areas mostly by the Central water Commission/ Meteorological department and by the State Irrigation/ Flood Department.

Measures /Action plans in flood areas



Before starting this topic, know the participant's ideas for action. Trainer asks the participants to prepare posters for the population, showing actions to be taken during a flood. The results of their work must be reviewed, hang the posters and arrange an exhibition for everyone to see each poster.

During

1. All doors and windows of the building must be closed;
2. It is necessary to turn off the gas, water and electricity supply;
3. You must not go near the river or any other water reservoir;
4. It is necessary to make an elevated place selected in advance or the roof of a stable building;
5. It is necessary to signal with a colored cloth fastened to a stick during the day and give periodic light signals after dark;
6. If you are in a car, the driver must avoid the source of the flood;
7. If a car gets stuck in the mud you must not stay inside; water can easily wash away the car. It is necessary to leave it and get to an elevated place (tree, hill or roof).

After

1. It is necessary to wait until the danger is completely over;
2. After returning home, check the building for cracks and other damages in order to find out whether it is safe. Make sure that there is no danger of the building falling down;
3. Do not turn on electricity; do not use electrical equipment until you are sure that it is completely dry;
4. Be very careful about animals, especially venomous snakes that may find a shelter in your building during a flood;
5. You must also be careful with hanging furniture, pictures and lamps, because they may fall down;
6. All products that got wet must be discarded;
7. The risk of an epidemic is high; there is a danger of water contamination;
8. Due to the sewage and water supply system damages you must drink only bottled water until the disastrous consequences are fully extinguished.

Activity

"Brainstorming": What items should not be located on the first floor? Give a list of easily perishable goods. Discuss.

DROUGHT RISK MANAGEMENT AND PREPAREDNESS

Judicious use of surface and groundwater

In drought prone areas rainwater is the main source of surface and ground water recharge. Because of more intense use of ground water in most parts of the country during the last few years, recharge of ground water did not take place. Water management issues of current concern, therefore, are:

- (a) Less exploitation of groundwater for irrigation,
- (b) Increased concentration of salts in the soil profile and groundwater,
- (c) Increased concentration of specific ions like fluorides and nitrates in the water and
- (d) Lack of availability/reduced availability of drinking water for animals in natural storage structures such as ponds, lakes etc.

Immediate steps are needed to make efficient use of available surface and groundwater in drought prone areas-

- (a) Resorting to drip and sprinkler practices wherever possible, especially for commercial crops including fruit orchards.
- (b) Construction of watershed structures at the right spot where water recharge can be enhanced, will be used for life saving irrigation at critical stages of crop growth and during drought situations.

Cloud Seeding

The South African cloud seeding experiment was carried out during 1991-1995 with new technology. The results showed statistical increase in rainfall in all types of clouds (i.e. small to large). This gave impetus to cloud seeding research in different parts of the globe.

The inner region of peninsular India is a rain shadow region. The seasonal monsoon rainfall in these areas is lower compared to all India mean monsoon rainfall. The rainfall variability is larger. The region is drought prone.

In the prolonged monsoon-dry conditions, there are demands for the cloud seeding operations from the state governments. The cloud seeding programs with modern technology have been carried out by state governments of Karnataka, Andhra Pradesh and Maharashtra since 2003.

Cloud seeding does not produce rain. It enhances rainfall which otherwise would have fallen in area. Both guidelines and research pertaining to cloud seeding are needed. Claims concerning the efficacy of cloud seeding as a positive intervention need to be validated through more studies, as there is no conclusive evidence that cloud seeding is actually effective in producing rain.

Micro Irrigation Systems

The overall development of the agriculture sector and the intended growth rate in GDP is largely dependent on the judicious use of the available water resources.

While the irrigation projects (major and medium) have contributed to the development of water resources, the conventional methods of water conveyance and irrigation, being highly inefficient, has led not only to wastage of water but also to several ecological problems like water logging, salinisation and soil degradation rendering productive agricultural lands unproductive.

It has been acknowledged that the use of modern irrigation methods like drip and sprinkler irrigation is the only alternative for efficient utilization of surface as well as ground water resources. The evapo-transpiration losses could be minimized and crop yield optimized by micro-irrigation systems.



The need of the hour is to -

- i. promote cultivation of crops under crop diversification through sprinklers/drip irrigation systems;
- ii. promote protective irrigation through micro irrigation systems through incentives; and
- iii. advise on the cropping systems to be covered under protective irrigation through appropriate micro irrigation systems.

Drought Monitoring

Continuous observation of rainfall levels & comparisons with usage levels help prevent man-made drought

Land Use

Planned crop rotation results in minimized erosion & allow farmers to plant less water dependent crops in drier years dependent crops in dry years.

Crop Selection

- Avoid growing of drought prone crops like maize, cotton etc.
- Growing drought resistant grain crops like sorghum, pearl millet, finger millet, fox tail millet etc.
- Growing drought resistant legume crops like pigeonpea, green gram, horse gram etc.
- Growing of oil seed crops like castor, sunflower, niger, sesame, safflower etc.


Crops like corn and cotton require assured rainfall even for giving a normal yield. These crops have no capacity to recover from any moisture stress during their

growing period. These crops also require higher nutrient application which means more money losses for the crop failure during drought.

Water Recycle

Wastewater (sewage) should be treated & purified for reuse.

Measures / Action plans in drought areas

 <p>Before starting this topic, know the participant's ideas for action. Trainer asks the participants to prepare posters that focus on actions taken before, during and after a drought. The results of their work must be reviewed, hang the posters and arrange an exhibition for everyone to see each poster.</p>	<p style="text-align: center;">During</p> <ol style="list-style-type: none"> 1. Avoid the effects of high temperatures; 2. Wear light-colored air-penetrable clothing (preferably cotton) and a hat. Remember, that sunburned skin does not secrete sweat and does not cool; 3. Walk unhurriedly; try to spend as much time as possible in the shade; 4. In case of overheating (hyperthermia), immediately move to a shady, cool, breezy area or take a shower; 5. Consume adequate amounts of water (stay hydrated); Try to cool your body to avoid sunstroke. 	<p style="text-align: center;">After</p> <ol style="list-style-type: none"> 1. If anyone faints after sunstroke, emergency medical measures should be taken: Begin basic cardiopulmonary resuscitation (CPR) immediately and call for Emergency Medical Services/Assistance (EMS) if possible; 2. Contact local government agencies to obtain information about disaster and aid for the population.
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CYCLONE RISK MANAGEMENT AND PREPAREDNESS

Hazard Mapping

Hazard mapping for cyclones represents the results of cyclone hazard assessment on a map, showing the frequency/probability of occurrences of various intensities or durations. Cyclones cannot be predicted several days in advance. Past records and paths can give the pattern of occurrence for particular wind speeds. A hazard map will illustrate the areas vulnerable to the cyclone, and associated storm surge and flood in any given time. It will be useful to estimate the severity of the cyclone and potential damage intensities in the region. The map is prepared with data inputs of past climatological records, history of wind speed, frequency of flooding etc.

Land Use Planning

Land use planning should be systematically considered for cyclones so that least critical activities are located in vulnerable regions. Location of settlements in the flood plains is of utmost risk. Policies should be in place to regulate land use and enforcement of building codes. Vulnerable areas should be kept for parks, grazing grounds or flood diversion instead of human settlements.

Engineered Structures

Structures need to be built to withstand wind forces. Good site selection is also important. The public infrastructures including buildings for electricity services, communication facilities, hospitals, schools, rural healthcare centres and community centres should be engineered structures. The people should also be encouraged to construct engineered structures for their homes.

Safe Community Shelter

The community should identify safe community shelter. If not, the community should select some resistant buildings among the existing buildings in the area to be used as cyclone shelters for the community members in case of a cyclone. These buildings could be government offices or public buildings, like schools, community halls, or privately owned buildings. The safe routes to the shelters should also be identified.

Early Warning

Early warning system for cyclone should also be established. Some community members should be assigned for monitoring, receiving and dissemination of early warning to the community. The assigned persons should have a clear understanding on where and how to get the early warning, the message contents of the early warning and how to disseminate the early warning. The community should identify the signals to be used at every stage of the cyclone for evacuation. Early warning dissemination system for isolated remote households and those who are in the sea should also be identified.

Evacuation Mapping

The community should also prepare the evacuation map which identifies safe places and the routes to be used for evacuation. This should be informed to the community in advance of the cyclone season.

Public Awareness

Public awareness through education is the key to saving many lives. It has been proved that most of the damage to lives and livelihoods are due to lack of public education and awareness. These can be done through various public awareness generation strategies. Emphasis should be given on using the existing awareness generation mechanisms in order to make it more acceptable and easily

understood. Public awareness can be generated through banners/posters, display boards, skill-based competition programs in school/public gatherings/group discussions, documentary film/TV show, mock drills and simulation exercises, pamphlets, booklets and handouts, song and drama in street plays, poster contest, photo exhibitions, street drama and shows on cyclone and other related disasters.

At the community level, public awareness programs should also include interpretation of early warning and proper utilization of early warnings, identified safe shelters and identified safe routes for evacuation and signals to be practiced in every stage of early warning.

Mangrove Plantation

Mangroves protect the coastal area from storm surge and wind which accompanied with cyclones. The tangle of branches slows the flow of water. The community should also participate in the mangrove plantation which could be organized by the local authorities, NGOs or the community itself. Mangroves also help in erosion-control and coastal conservation.

Saline Embankments

Another activity that can be taken up as part of the community based mitigation are construction of saline embankments to protect habitation, agriculture crop and important installations along the coast from sea water inundation due to storm surge.

Artificial Hills (Mounds)

Construction of artificial hills act as a strong community shelter for immediate evacuation after receiving a warning. These earthen hills can be used for safe shelters for the livestock populations.

Measures / Action plans in cyclones areas



Before starting this topic, know the participant's ideas for action. Trainer asks the participants to prepare posters that focus on actions taken before, during and after a drought.

During

1. If during a strong gust you are in a building, it is necessary to close and fasten windows and doors; it is preferable to stay away from the windows in order to avoid being injured by flying glass that can be broken by different items flying in the air due to the high winds. It is better to stay in internal rooms that do not have windows - in a corridor or a bathroom;

After

1. If the wind has felled any power transmission lines, it is unsafe to draw near them because of the electrocution risk. It is better to inform the local authorities so that the problem can be addressed in the shortest possible time. In case of fire it is better to avoid it and call a fire department;
2. Do not go near the objects that are suspiciously bent (pillars,

The results of their work must be reviewed, hang the posters and arrange an exhibition for everyone to see each poster.

2. Turn off all electrical devices;
 3. Stay in the building until the wind is over. Remember that after a storm is over it may be repeated;
 4. If the building was damaged e.g.: the roof was torn off while you are inside, it is better to move to the less damaged part of the building or get under some massive furniture until the storm is over;
 5. If during a strong gust you are in the street, avoid the various items that may fall from balconies. Quickly find a shelter in a stable building. Protect yourself from things flying in the air. You can protect yourself with your hands or a scarf. It is necessary to protect the eyes, nose and mouth from dust;
 6. Remember that the wind speed is higher in narrow spaces between buildings;
 7. If you are in a wildlife area, try to find a place protected from the wind. If there is no such place nearby, lie down on the ground;
 8. If you are in a car it is better to stay there and close the windows. Do not park the car under unstable objects that can break down and fall on the car.
- transmission poles, trees) that might have survived the storm but can still fall down afterwards;
3. Be careful while using gas and electrical equipment because they might be damaged and gas might be leaking. If a high voltage line has fallen on your electric equipment it might be under high voltage;
 4. If you are in a damaged building, move to the less damaged part of the building or get under some massive furniture until the storm is over; after the storm is over take your documents and leave the building.

SOIL EROSION BY WATER

WHAT IS SOIL EROSION?

Erosion is a natural process by which the soil is worn away by wind, water, and other forces. It becomes a problem when human activity causes it to take place at a much more rapid pace than under natural conditions. Soil erosion

is the greatest threat to the Nation's soil productivity and the greatest source of pollutants in our waterways.

Why Control Erosion?

- Reduces soil productivity and contaminates air and water.
- Increases the cost of farming and contributes to lower profits for farmers and higher food prices for consumers.
- On farm damage - lower yields of crops or forage, higher fertilizer costs, increased fuel costs to till the tougher subsoil and higher bills for equipment maintenance.
- Clogs storm drains and drainage channels causing increased costs for street and drain maintenance.
- Clogs rivers and decreases reservoir capacity.
- Restricts navigation, reduces recreation potential and scenic value and increases the hazards and severity of flooding.
- Movement of plant nutrients, pesticides and other chemicals off the land.
- Loss of fish and wildlife habitat and polluted water supplies.
- A very serious safety hazard when the sediment covers road surfaces.



Erosion of soil

Classifying Erosion

Sheet Erosion

It is the movement of soil from raindrop splash and runoff over a uniform slope. It typically occurs evenly over a uniform slope and goes unnoticed by most of the rich topsoil has been misplaced. Deposition of the eroded soil occurs at the bottom of the slope or in low areas. Lighter-coloured soils on knolls, changes in soil horizon thickness and low crop yields on shoulder slopes and knolls are other indicators.

Rill Erosion

Rill erosion results when surface water runoff concentrates, forming small yet well-defined channels. These distinct channels where the soil has been washed away are called rills when they are small enough to not interfere with field machinery operations. In many cases, rills are filled in each year as part of tillage operations.

Gully Erosion

Gully erosion is an advanced stage of rill erosion where surface channels are

eroded to the point where they become a nuisance factor in normal tillage operations. Surface water runoff, causing gully formation or the enlarging of existing gullies, is usually the result of improper outlet design for local surface and subsurface drainage systems. The soil instability of gully banks, usually associated with seepage of groundwater, leads to sloughing and slumping (caving-in) on bank slopes. Such failures usually occur during spring months when the soil water conditions are most conducive to the problem.

Stream Bank Erosion

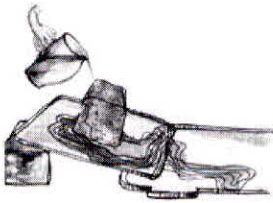
Natural streams and constructed drainage channels act as outlets for surface water runoff and subsurface drainage systems. Bank erosion is the progressive undercutting, scouring and slumping of these drainage ways. Poor construction practices, inadequate maintenance, uncontrolled livestock access and cropping too close can all lead to bank erosion problems.

Control Factors

Slope

The steeper the slope, the greater the erosion, as a result of the increased velocity (swiftness) of water-flow. The length of the slope is very important, because the larger the size of the sloping area, the greater the concentration of the flooding water.

Activity



Arrange two trays, a box, sand, brick and water. Put one end of a tray on a brick and other end on the other tray so that it slopes downwards. Make a sand castle by mixing sand with water on the tray using a plastic box.

Slowly drip water on to the cube. You will see that the sand crumble and take a new shape.

This happens because the soil erodes when water hits it. Thus, the steeper the slope, the greater the erosion.

Soil texture

Soil texture is the size distribution of soil particles. The size of particles never changes. A sandy soil, therefore, remains sandy and a clayey soil remains clayey. The three main particles are sand, silt and clay. The more sandy a soil the easier it will erode.

Soil structure

The term soil structure means the grouping or arrangement of soil particles. Overcultivation and compaction cause the soil to lose its structure and cohesion (ability to stick together) and it erodes more easily.

Terrain unit

The crest (top of the slope) is usually well drained as soil moisture moves downhill, leaving air in the pore spaces most of the time. Over time, the fine (clay) particles are carried downslope leaving the soil sandy.

Plant roots can penetrate easily to deep levels and withdraw enough soil water from there. These soils have a lower erosion potential and are normally more stable.

Organic material

The organic material is the "glue" that binds the soil particles together and plays an important role in preventing soil erosion. Organic matter is the main source of energy for soil organisms, both plant and animal. It also influences the infiltration capacity of the soil, therefore reducing runoff.

Vegetation cover

The loss of protective vegetation through overgrazing, ploughing and fire makes soil vulnerable to being swept away by wind and water. Plants provide protective cover on the land and prevent soil erosion for the following reasons:

- Plants slow down water as it flows over the land and this allows much of the rain to soak into the ground.
- Plant roots hold the soil in place and prevent it from being blown or washed away.
- Plants break the impact of a raindrop before it runs into the ground, reducing the soil's ability to wear away.
- Plants in wetlands and on the banks of rivers are important as they slow down the flow of the water and their roots bind the soil, preventing erosion.

Land use

Grass is the best natural soil protector against soil erosion because of its relatively dense cover. Small grains, such as wheat, offer a considerable obstruction to surface wash. Row crops such as maize and potatoes offer little cover during the early growth stages and thereby encourage erosion.

Fallowed areas, where no crop is grown and all the residue has been incorporated into the soil, are most subject to erosion.

Preventing Erosion

Some of the following steps can be implemented to prevent soil erosion:

- The use of contour ploughing and windbreaks
- Leave unploughed grass strips between ploughed lands (strip cropping)
- Make sure that there are always plants growing on the ground, and that the soil is rich in humus

- Avoid overgrazing
- Allow indigenous plants to grow along riverbanks
- Conserve wetlands
- Cultivate land, using a crop rotation system
- Minimum or no tillage
- Encourage water infiltration and reduce water runoff



Activity

Fit a house plant into the neck of the plastic cup. Fit another pot with soil into the second plastic cup. Pour water into both the pots. You will find that the water passes quickly through the pot with soil and the water accumulated in the cup is muddy.

This is because most soil has been washed away. Thus, plants help in preventing soil erosion.



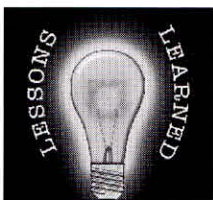
**Did You
KNOW**

Two major bodies dealing with disaster management in India are:

National Institute of Disaster Management (NIDM) - is a premier institute for training and capacity development programs for managing natural disasters in India, on a national as well as regional basis.

National Disaster Management Authority (NDMA) - is an independent, autonomous, and constitutionally established disaster preparedness federal institution mandate and responsible to deal with whole spectrum of disaster management and preparedness in the country.

LESSONS LEARNED



1. There is a very close link between disaster management and IWRM;
2. Water related disasters have significant social and economic impacts; and
3. An IWRM approach can be used to improve on the management of water related disasters particularly in the context of droughts, floods, landslides and cyclones.
4. Simple techniques can prevent soil erosion and its huge impacts.

