MARUDHAR KESARI JAIN COLLEGE FOR WOMEN, VANNIYAMBADI

DEPARTMENT OF SOCIAL WORK

CLASS	: I MASTER OF SOCIAL WORK
SUBJECT CODE	:23PSW23
SUBJECT NAME	: DISASTER MANAGEMENT-II

SYLLABUS

UNIT – I

1.0 Introduction to disaster

1.1Meaning of Hazard, Risk, Vulnerability, Disaster Meaning, Nature, Importance, Dimensions & Scope of Disaster Management, Disaster Management Cycle, Natural Disasters.

1.2 Meaning and nature of natural disasters, types: Hydrological Disasters -Flood, Flash flood, Drought, cloud burst, Geological Disasters- Earthquakes, Tsunamis, Landslides, valances, Volcanic, eruptions, Mudflow, Wind related Cyclone, Storm, Storm surge, Tidal waves, Heat and cold Waves, Climatic Change, Global warming, Sea Level rise, Ozone Depletion.

Meaning of Hazard

A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. A hazard is a source or a situation with the potential for harm in terms of human injury or ill-health, damage to property, damage to the environment, or a combination of these. Hazards may be natural, anthropogenic or socionatural in origin. **Natural hazards** are predominantly associated with natural processes and phenomena. **Anthropogenic hazards**, or human-induced hazards, are induced entirely or predominantly by human activities and choices. This term does not include the occurrence or risk of armed conflicts and other situations of social instability or tension which are subject to international humanitarian law and national legislation. Several hazards are **socio natural**, in that they are associated with a combination of natural and anthropogenic factors, including environmental degradation and climate change.

Divisions of Hazard

- **Multi-hazard** means (1) the selection of multiple major hazards that the country faces, and (2) the specific contexts where hazardous events may occur simultaneously, cascadingly or cumulatively over time, and taking into account the potential interrelated effects.
- **Biological hazards** are of organic origin or conveyed by biological vectors, including pathogenic microorganisms, toxins and bioactive substances. Examples are bacteria, viruses or parasites, as well as venomous wildlife and insects, poisonous plants and mosquitoes carrying disease-causing agents.
- **Environmental hazards** may include chemical, natural and biological hazards. They can be created by environmental degradation or physical or chemical pollution in the air, water and soil. However, many of the processes and phenomena that fall into this category may be termed drivers of hazard and risk rather than hazards in themselves, such as soil degradation, deforestation, loss of biodiversity, salinization and sea-level rise.
- **Geological or geophysical hazards** originate from internal earth processes. Examples are earthquakes, volcanic activity and emissions, and related geophysical processes such as mass movements, landslides, rockslides, surface collapses and debris or mud flows. Hydrometeorological factors are important contributors to some of these processes. Tsunamis are difficult to categorize: although they are triggered by undersea earthquakes and other geological events, they essentially become an oceanic process that is manifested as a coastal water-related hazard.
- **Hydrometeorological hazards** are of atmospheric, hydrological or oceanographic origin. Examples are tropical cyclones (also known as typhoons and hurricanes); floods, including flash floods; drought; heatwaves and cold spells; and coastal storm surges. Hydrometeorological conditions may also be a factor in other hazards such as landslides, wildland fires, locust plagues, epidemics and in the transport and dispersal of toxic substances and volcanic eruption material.

- **Technological hazards** originate from technological or industrial conditions, dangerous procedures, infrastructure failures or specific human activities. Examples include industrial pollution, nuclear radiation, toxic wastes, dam failures, transport accidents, factory explosions, fires and chemical spills. Technological hazards also may arise directly as a result of the impacts of a natural hazard event.

Meaning of Risk

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

The definition of disaster risk reflects the concept of hazardous events and disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socioeconomic development, disaster risks can be assessed and mapped, in broad terms at least.

It is important to consider the social and economic contexts in which disaster risks occur and that people do not necessarily share the same perceptions of risk and their underlying risk factors.

Acceptable risk, or tolerable risk, is therefore an important sub term; the extent to which a disaster risk is deemed acceptable or tolerable depends on existing social, economic, political, cultural, technical and environmental conditions. In engineering terms, acceptable risk is also used to assess and define the structural and non-structural measures that are needed in order to reduce possible harm to people, property, services and systems to a chosen tolerated level, according to codes or "accepted practice" which are based on known probabilities of hazards and other factors.

Residual risk is the disaster risk that remains even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained. The presence of residual risk implies a continuing need to develop and support effective capacities for emergency services, preparedness, response and recovery, together with socioeconomic policies such as safety nets and risk transfer mechanisms, as part of a holistic approach.

Meaning of Vulnerability

Vulnerability describes the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors.

Vulnerability is the inability to resist a hazard or to respond when a disaster has occurred. For instance, people who live on plains are more vulnerable to floods than people who live higher up.

Vulnerability is an essential element for defining disaster impacts and their collective threat to people. Floods, droughts, cyclones, earthquakes and landslides have been recurrent phenomena in India, which makes it traditionally vulnerable to natural disasters. Its unique geo-climatic conditions widen the scope of such natural catastrophes that cause great damage or loss of life.

Vulnerability is about the degree of potential damage to which an individual, a community, assets or systems is/are exposed under the conditions determined by physical, social, economic and environmental factors or processes depending on types of disaster, no matter if they are not natural or common, for example,

1) Environmental emergencies: the release of a highly toxic cloud of methyl isocyanate (1984 Bhopal), reactor at the Chernobyl Nuclear Power Plant in Ukraine exploded (1986)

2) Complex emergencies: characterized by an active high-level armed conflict as in South Sudan from 2011

3) Pandemic emergencies: global disease outbreak (HIV/AIDS, Spanish/Asian/Hong Kong influenza/COVID-19)

Disaster Meaning

Disasters are serious disruptions to the functioning of a community that exceed its capacity to cope using its own resources. Disasters can be caused by natural, man-made and technological hazards, as well as various factors that influence the exposure and vulnerability of a community.

A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.

The effect of the disaster can be immediate and localized, but is often widespread and could last for a long period of time. The effect may test or exceed the capacity of a community or society to cope using its own resources, and therefore may require assistance from external sources, which could include neighbouring jurisdictions, or those at the national or international levels.

Emergency is sometimes used interchangeably with the term disaster, as, for example, in the context of biological and technological hazards or health emergencies, which, however, can also relate to hazardous events that do not result in the serious disruption of the functioning of a community or society.

Disaster damage occurs during and immediately after the disaster. This is usually measured in physical units (e.g., square meters of housing, kilometres of roads, etc.), and describes the total or partial destruction of physical assets, the disruption of basic services and damages to sources of livelihood in the affected area.

Disaster impact is the total effect, including negative effects (e.g., economic losses) and positive effects (e.g., economic gains), of a hazardous event or a disaster. The term includes economic, human and environmental impacts, and may include death, injuries, disease and other negative effects on human physical, mental and social well-being.

Nature of Disaster Management

Disaster management is how we deal with the human, material, economic or environmental impacts of said disaster, it is the process of how we "prepare for, respond to and learn from the effects of major failures". Though often caused by nature, disasters can have human origins.

Disaster Management is the strategy and course of action to be the time of any such disaster to save as much life as possible. It can be divided into two parts:

Pre- disaster Management*:*

Pre- disaster management phase is concerned with the complete preparation and planning in order to enable us to face any kind of situation.

The first step includes identifying the pro-disaster areas.

The second step includes collecting information about intensity of disaster and probable sites of disaster using predictive intensity maps and hazard maps.

Next step is to get training for disaster management

Another important aspect of pre-disaster management is spreading awareness among the common people through various awareness programmes.

Post-disaster management:

Post-disaster management is concerned with the situation that arise after a disaster has occurred. It includes the following components:

The primary concern is to provide help victims preferably with participation of local people.

Establishment of help centres to provide all kind of possible help required by the people.

Categorisation of help materials that are received from the help centres and distributing them efficiently to the people affected by the disaster.

Importance of Disaster management:

A disaster can also impact the social fabric of a community. In this way, disaster management can help communities rebuild their communities and reconnect people with each other. Communities can begin to rebuild their local infrastructure after a disaster, which will also improve the economic health of a community.

1.Saves Lives

During disasters, a crisis is an acute event that is fast moving and changing. Therefore, effective emergency planning and response is vital. A lack of coordination and response to disasters can have serious and long-lasting impacts on a community and can also lead to more deaths. Disaster management can help to enhance the ability of emergency responders to save lives. When appropriate infrastructure is set up and training is completed to improve disaster response, communities can survive the stress and distress caused by disasters.

2. Improves Community Resilience

When disaster strikes, response teams have the unenviable task of trying to help people in extreme conditions. The task can be extremely tough as an unprepared and untrained response team will have limited knowledge of the people they are working with. However, training helps to improve the effectiveness of a disaster management response team. Having the skills needed to help people in extreme conditions is one of the key elements of disaster management training.

3. Promotes Disease Prevention

Disasters cause an enormous number of deaths. However, they also create an additional health risk to those affected. People affected by disasters are frequently exposed to a range of illnesses which can cause further death. Communicable diseases, such as malaria, are much more likely to occur during and after a disaster because a lack of healthcare facilities, clean water, food and proper hygiene is common. Through disaster management practices, communities can improve their health and mitigate the impact of disasters.

4. Reduces Poverty

A natural disaster can have devastating effects on a community. It can push people into poverty and change the lives of entire communities. However, a lot of people affected by a disaster are more likely to stay poor if they are not prepared. A lack of planning prior to a disaster can leave people without basic emergency supplies like food, water, clothing or medicine. By better preparing for disasters, communities can mitigate the threat of poverty, hunger and disease.

5. Improves Health

Disasters, along with their aftermaths, can have a negative effect on a community's health. Disasters, along with lack of health services and clean water can lead to increased sickness, lack of immunity and a higher risk of infection. Therefore, it is essential that communities have access to health professionals, have a good supply of water and adequate sanitation facilities, and have access to emergency medical care during and after a disaster.

6. Reshapes Communities

Disasters can have a huge impact on the local economy. Communities often suffer huge financial losses during a disaster and therefore may struggle to cope with these losses. A disaster can also impact the social fabric of a community. In this way, disaster management can help communities rebuild their communities and reconnect people with each other. Communities can begin to rebuild their local infrastructure after a disaster, which will also improve the economic health of a community. In many cases, this will benefit the economy as a whole, while also improving the environment in which people live.

7. Strengthens Security

Terrorist groups exploit disasters to cause further bloodshed and chaos. The causes and consequences of disasters can act as a magnet for people with bad intentions to commit acts of terrorism. There are some social conditions which make terrorist activities more likely in certain areas. Examples include poor governance, overcrowding and high levels of poverty. After a disaster, communities must be vigilant in the protection of their security.

8. Promotes Stability

Disasters can disrupt social order, economic activity, and the flow of trade. At their worst, disasters can create insecurity, mistrust, ethnic tensions, hatred and violence. These conflicts, if not addressed, can negatively impact the stability of communities and the effectiveness of local security forces. After a disaster, people who would normally rely on law enforcement agencies to provide security are likely to turn to alternative sources of law and order. This may increase the amount of crime and violence which takes place.

9. Promotes the Protection of Natural Resources

Disasters can be devastating to the lives of people living in an area and can cause environmental degradation. If a disaster negatively affects the environment or local ecosystems, it may also lead to species extinctions, loss of indigenous knowledge, and the general destruction of entire ecosystems. At the same time, disasters can also have a detrimental impact on the social and economic structure of a community, leaving it vulnerable to social instability and human trafficking. Communities must plan for disasters and work to secure their natural resources to ensure they are prepared for the next disaster.

10. Strengthens Social Contracting and Trust

Disasters can undermine social and political stability. Governments, large corporations and other important organisations often fail to provide people with protection during or after a disaster, which can lead to increasing social inequalities, distrust, hostility and violence. This, in turn, can lead to weaker social institutions and increased individual susceptibility to aggression and coercion.

Dimensions of Disaster Management:

A single word – each beginning with the letter 'v' – represents respectively each of disaster's seven dimensions:

1.values

Prevention: The primary aim of disaster management is **to prevent disasters from occurring or to reduce the likelihood of their occurrence**. This includes measures such as land use planning, building codes and regulations, early warning systems, and hazard mitigation measures to minimize the risk of disasters.

Integrity/ Honesty.

Creativity.

Accountability/ Transparency.

Right Attitude/ Dignity.

Empathy.

(2) volition

Volition, also known as will or conation, is **the cognitive process by which an individual decides on and commits to a particular course of action**. It is defined as purposive striving and is one of the primary human psychological functions.

(3) velocity,

(4) vicinity, (5) vision, (6) victims, and (7) vulnerability.

Scope of Disaster Management

The term "Disaster Management" encompasses the complete realm of disaster-related activities. Traditionally people tend to think of disaster management only in terms of the post-disaster actions taken by relief and reconstruction officials; yet disaster management covers a much broader scope, and many modern disaster managers may find themselves far more involved in pre-disaster activities than in post-disaster response. Those are-

1. The refugee field of disaster management is highly specialized and requires not only many

development skills but also a broader awareness of political, legal, and humanitarian issues.

2. DM aims and objectives, elements, Natural/man-made Disasters,

3. Victims, Relief Systems,

4. Phases of Disaster Response/Relief Operations, Government's Role,

5. Refugee Assistance Models,

6. Prevention and Mitigation Tools, Preparedness Tools,

7. Tools of Post-Disaster Management, Mapping,

8. Aerial Photography and Remote Sensing,

9. Information Management,

10. Logistics, Epidemiology.

Disaster Management Cycle

Disaster management typically is broken down into four stages: prevention, preparedness, response, and recovery. Managing and responding to disasters effectively requires paying careful attention to each stage. Despite being separated into different stages, each with its own goals, the cycle is designed to be holistic, as each stage is interdependent and builds on the previous one to achieve better outcomes.

The cycle involves the following five stages:

1. Prevention

The best way to address a disaster is by being proactive. This means identifying potential hazards and devising safeguards to mitigate their impact. Although this stage in the cycle involves putting permanent measures into place that can help minimize disaster risk, it's important to acknowledge that disasters can't always be prevented.

Prevention involves scenarios such as the following:

Implementing an evacuation plan in a school, for example, showing teachers how to lead students to safety in the event of a tornado or fire

Planning and designing a city in a way that minimizes the risk of flooding, for example, with the use of locks, dams or channels to divert water away from populous areas

2. Mitigation

Mitigation aims to minimize the loss of human life that would result from a disaster. Both structural and non-structural measures may be taken. A structural measure means changing the physical characteristics of a building or an environment to curb the effects of a disaster. For example, clearing trees away from a house can ensure that dangerous storms don't knock down the trees and send them crashing into homes and public buildings.

Non-structural measures involve adopting or amending building codes to optimize safety for all future building construction.

3. Preparedness

Preparedness is an ongoing process in which individuals, communities, businesses and organizations can plan and train for what they'll do in the event of a disaster. Preparedness is defined by ongoing training, evaluating and corrective action, ensuring the highest level of readiness.

Fire drills, active-shooter drills and evacuation rehearsals are all good examples of the preparedness stage.

4. Response

Response is what happens after the disaster occurs. It involves both short- and long-term responses. Ideally, the disaster-management leader will coordinate the use of resources (including personnel, supplies and equipment) to help restore personal and environmental safety, as well as to minimize the risk of any additional property damage.

During the response stage, any ongoing hazards are removed from the area; for example, in the aftermath of a wildfire, any lingering fires will be put out, and areas that pose a high flammability risk will be stabilized.

5. Recovery

The fifth stage in the disaster-management cycle is recovery. This can take a long time, sometimes years or decades. For example, some areas in New Orleans have yet to fully recover from Hurricane Katrina in 2005. It involves stabilizing the area and restoring all essential community functions. Recovery requires prioritization: first, essential services like food, clean water, utilities, transportation and healthcare will be restored, with less-essential services being prioritized later. Ultimately, this stage is about helping individuals, communities, businesses and organizations return to normal or a new normal depending on the impact of the disaster.

6. Disaster:

An event that causes significant damage to people, property and infrastructure. Natural disasters often cause destruction on a massive scale. Certain natural disasters such as wildfires cause destruction of animal habitat as well as damage to property and loss of life.

7. Reconstruction:

Activities aimed at rebuilding infrastructure and housing. This can often take years and many activities may also blend back into mitigation, such as retrofitting schools to make them more earthquake resistant.

Meaning of natural disasters

“A major event brought about by the natural processes of the Earth that causes widespread destruction to the environment and loss of life.”

However, some natural hazards can also be provoked or affected by anthropogenic factors. For instance, landslides can be triggered by deforestation, mining and agricultural activities.

Natural disasters often cause destruction on a massive scale. Certain natural disasters such as wildfires cause destruction of animal habitat as well as damage to property and loss of life.

Nature of natural disasters

A natural disaster is the highly harmful impact on a society or community following a natural hazard event. Some examples of natural hazard events include: flooding, drought, earthquake, tropical cyclone, lightning, tsunami, volcanic activity, wildfire. A natural disaster can cause loss of life or damage property, and typically leaves economic damage in its wake. The severity of the damage depends on the affected population's resilience and on the infrastructure available. Scholars have been saying that the term natural disaster is unsuitable and should be abandoned. Instead, the simpler term disaster could be used, while also specifying the category (or type) of hazard. A disaster is a result of a natural or human-made hazard impacting a vulnerable community. It is the combination of the hazard along with exposure of a vulnerable society that results in a disaster.

The term natural disaster has been called a misnomer already in 1976. A disaster is a result of a natural hazard impacting a vulnerable community. But disasters can be avoided. Earthquakes, droughts, floods, storms, and other events lead to disasters because of human action and inaction. Poor land and policy planning and deregulation can create worse conditions. They often involve development activities that ignore or fail to reduce the disaster risks. Nature alone is blamed for disasters even when disasters result from failures in development. Disasters also result from failure of societies to prepare. Examples for such failures include inadequate building norms, marginalization of people, inequities, overexploitation of resources, extreme urban sprawl and climate change.

Types: Hydrological Disasters –

Hydrological Disasters are described as a sudden and violent event caused due to the change in the quality, distribution or movement of water below the surface or in the atmosphere. For example, a tsunami is a large column of water or waves caused by the displacement of a large volume of water. They are generally caused due to earthquakes or volcanic eruptions under the sea.

Floods

A flood refers to an overflow of water that submerges land which is usually dry. A water body like a river or lake might have varying volumes of water in different seasons, however, the water overflow is labelled as a flood only when such overflow covers land that is otherwise used or inhabited by people or wildlife. Floods can develop over an extended period of time or occur within a matter of minutes. There are various types of floods classified on the basis of source of floodwater, factors triggering the flood, and the area flooded. Several factors can cause floods like heavy rainfall, dam breakdown, landslides and earthquakes that change the courses of rivers, and tsunamis. Floods of large scale can cause significant property damage and deaths. **For example**, one of the worst floods in recent times is the 1931 China floods which led to the death of more than 2,500,000 people and millions of animals.

A hydrological disaster which is flood refers to the water overflow that immerses normally dry land. A water course such as a lake or river might have unreliable water volume in different periods, but, the overflow of the water is labelled as the flood only when this overflow wraps land that is inhabited or utilised through wildlife or people. There are several kinds of floods and these are divided according to the flooded area, floodwater source, and factors that trigger the flood.

Floods are the most frequent type of natural disaster and occur when an overflow of water submerges land that is usually dry. Floods are often caused by heavy rainfall, rapid snowmelt or a storm surge from a tropical cyclone or tsunami in coastal areas.

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There are 3 common types of floods:

Flash floods are caused by rapid and excessive rainfall that raises water heights quickly, and rivers, streams, channels or roads may be overtaken.

River floods are caused when consistent rain or snow melt forces a river to exceed capacity.

Coastal floods are caused by storm surges associated with tropical cyclones and tsunami.

Between 80-90% of all documented disasters from natural hazards during the past 10 years have resulted from floods, droughts, tropical cyclones, heat waves and severe storms. Floods are also increasing in frequency and intensity, and the frequency and intensity of extreme precipitation is expected to continue to increase due to climate change.

Flash flood

Flash Floods can be caused by a number of things, but is most often due to extremely heavy rainfall from thunderstorms. Flash Floods can occur due to Dam or Levee Breaks, and/or Mudslides (Debris Flow).

The intensity of the rainfall, the location and distribution of the rainfall, the land use and topography, vegetation types and growth/density, soil type, and soil water-content all determine just how quickly the Flash Flooding may occur, and influence where it may occur.

Urban Areas are also prone to flooding in short time-spans and, sometimes, rainfall (from the same storm) over an urban area will cause flooding faster and more-severe than in the suburbs or countryside. The impervious surfaces in the urban areas do not allow water to infiltrate the ground, and the water runs off to the low spots very quickly.

Flash Flooding occurs so quickly that people are caught off-guard. Their situation may become dangerous if they encounter high, fast-moving water while traveling. If people are at their homes or businesses, the water may rise quickly and trap them, or cause damage to the property without them having a chance to protect the property.

Flash flooding is a specific type of flooding that occurs in a short time frame after a precipitation event – generally less than six hours. It often is caused by heavy or excessive rainfall and happens in areas near rivers or lakes, but it also can happen in places with no water bodies nearby.

Flash floods induce severe impacts in both the built and the natural environment. The effects of flash floods can be catastrophic and show extensive diversity, ranging from damages in buildings and infrastructure to impacts on vegetation, human lives and livestock.

Most flash floods associated with rainfall are produced by thunderstorms; that is, deep, moist convection. A single thunderstorm cell is unlikely to produce enough rainfall to cause a flash flood, so the typical flash flood is the result of several thunderstorms moving successively over the same area, known as ‘training’ thunderstorms, because it resembles the passage of cars in a train. A succession of thunderstorms results when new thunderstorms pass repeatedly over the same place while the overall system of thunderstorms is very nearly stationary.

A flash flood is generally characterised by raging torrents after heavy rains, a dam or levee failure or a sudden release of water in a previously stopped passage (i.e., by debris or ice) that rips through riverbeds, urban streets, or mountain canyons sweeping away everything in its path. Steep terrain tends to concentrate runoff into streams very quickly and is often a contributory factor. Changes in soil properties (e.g., burn areas from wildfires), hydrophobic or impervious soils, removal of surface vegetation, and excess runoff from warm rainfall on significant snowpack can also be important contributors (NOAA, no date a; AMS, 2017).

Drought

The term 'Drought' in simple words is the absence of water for a long period of time, at a place where it is considered abnormal as compared to its usual conditions. The distribution of water on the earth's surface is not even. Some places have lots of freshwater e.g. rivers, lakes, lagoons, ponds etc. and they are continuously replenished by rainfall and water from underground.

Hydrological drought is brought about when the water reserves available in sources such as aquifers, lakes and reservoirs fall below a locally significant threshold. Hydrological drought tends to show up more slowly because it involves stored water that is used but not replenished.

Shortage of water, Dry and hot winds, rise in temperature, and consequent evaporation of moisture from the ground contribute to conditions of drought. Droughts also result in crop failure too. Droughts have a major impact on the ecosystem and agriculture of the affected regions. Also, droughts harm the local economy of the region. Droughts are considered a natural disaster as it disturbs our whole ecosystem.

Drought is considered as the recurring feature of the climate in most parts of the world. These days regular droughts have become more extreme and more unpredictable because of climatic changes. Also, studies based on dendrochronology, confirm that the drought-affected by global warming goes back to 1900.

Millennium Drought in Australia (1997–2009) is a well-known historical drought. The drought led to a water supply crisis across the country. As a result of it, many desalination plants were built for the first time. These plants are meant for the process of removing salt from seawater. The State of Texas in 2011, lived under a drought emergency declaration for the whole year. The state suffered severe economic losses.

Types of Droughts

Meteorological Drought

This type of drought occurs when there is a prolonged time with less than average rainfall. Meteorological drought usually paves the way for other kinds of drought. Meteorological drought refers to a precipitation deficiency, possibly combined with increased potential evapotranspiration, extending over a large area and spanning an extensive period of time.

Agricultural Drought

This type of drought affects crop production or the ecology of the range. The conditions of drought can arise independently due to any change in precipitation levels, irrigation, or soil conditions. Erosion occurs because of poorly planned agricultural attempts. This causes a shortfall in water available to the crops causes drought. However, the traditional drought occurs due to an extended period of below-average rainfall.

Hydrological Drought

This type of drought occurs when the water reserves available to us fall below a significant threshold. These sources are that are aquifers, lakes and reservoirs fall. Hydrological drought

tends to show up more slowly. Hydrological drought is a broad term related to negative anomalies in surface and subsurface water. Examples are below-normal groundwater levels or water levels in lakes, declining wetland area, and decreased river discharge. Groundwater drought and streamflow drought are sometimes defined separately as below-normal groundwater levels and below-normal river discharge, respectively.

Socio-Economic Drought

Socio-Economic Drought refers to the abnormal water shortage that affects socio economic condition of a region. Socioeconomic drought is associated with the impacts of the three above-mentioned types. It can refer to a failure of water resources systems to meet water demands and to ecological or health-related impacts of drought. An overview of the most important drought impacts is provided. It can be noted that more types of drought impacts are related to hydrological drought than to meteorological drought.

Causes of Drought

A drought is mainly the cause of drier conditions. It is comparable to normal conditions that eventually lead to water supply problems. Really hot temperatures which eventually cause the moisture to evaporate from the soil can make drought worse. If any region is hot and dry, it doesn't always mean that it is going through a drought. The dry season greatly increases drought occurrence. It is characterized by its low humidity, with watering holes and cracks, and rivers drying up. Due to the lack of these watering holes, many animals unwillingly migrate. This migration is due to the lack of water in search of more fertile lands.

Land and water temperatures cause droughts. As the temperature increases, more water evaporates and severe weather conditions also increase. Landscapes and crops need more water for their survival and growth and thus the overall demand for water increases gradually. Drought also occurs by air circulation and weather patterns. The water we have today is all the water we ever have now. Water available is moved by the weather patterns in the air all around. This is changing constantly.

Soil moisture levels also lead to drought. There is the evaporation of water for the creation of clouds when the soil moisture depletes. Demand, need, and supply of water issues are also a cause of droughts. The demand for water by people can worsen the situation depending on how the region reacts. Especially when the weather conditions, temperatures, or air patterns push a region toward a drought. Excessive irrigation is excellent for papa contributing to drought.

DroughtManagement

The strategy for this management is basically threefold.

Close monitoring of the emerging drought scenario so as develop an advance warning system

Relief measures required for providing immediate succor to the affected population and the upkeep of the cattle wealth, and if possible, to integrate it with long term objectives and

Hammering out an alternative crop strategy for maximum possible retrieval of the Kharif crop and a better ensuing Rabi crop.

Since drought prediction methods are at a very nascent stage, IMD has made efforts to provide a long-range forecast of monsoon rainfall. In 1988, a parametric power regression model was developed on the basis of global and regional meteorological and oceanic parameters (physically related monsoon and rainfall) for estimating the monsoon rainfall of India. The model is successful in estimating the correct nature of monsoon and can be utilized for drought mitigation planning. IMD carries out rainfall monitoring unto district level on a real time basis.

Cloud burst

Cloudburst is an extreme amount of rainfall over a small area, mostly 100 mm per hour. It causes havoc and destruction on a large scale.

Cloudburst is defined as a geo-hydrological hazard. The aggressiveness in nature and the scale of destruction of rainfall are scary at times. In India, cloudburst occurs during the time of the South-West Monsoon from the month of June. Cloudburst is difficult to predict since it occurs suddenly with a catastrophic force and thereby inflicts enormous losses due to inundation and erosion.

It occurs mainly in mountainous areas when the warm air currents rise from the ground towards clouds. It carries the falling raindrops along with it. Thus, the rainfall fails to occur steadily, and the clouds have excessive condensation. There is also an accumulation of a large amount of water at high altitudes. The warm air from below restricts the fall of water.

After Effects of Cloudbursts

Continuous and violent rainfall can result in heavy floods that can be dangerous. It also causes-

- Debris flows
- Landslides
- Mudslides
- Flooding
- Mass Movements
- Drownings
- Road closures and cloudburst
- Accidents

Cloudbursts in hilly terrains can be disastrous and cause massive destruction to life and property as most of the water gets concentrated in the valleys and gullies.

It can cause damage to the flora and fauna of the particular area and public utilities.

A **cloudburst** is the maximum volume of precipitation in a short time. Hailstorms and thunder occasionally accompany it. It is effective in creating floods. Cloudbursts can quickly create large amounts of water. But, they are rare because they occur only when a huge amount of air is lifted by geographical aspects like a line of hills or a mountain range. Generally, cloudbursts do not last for more than a few minutes.

Cloudbursts happen when drenched clouds cannot cause rain because of the rising movement of the extremely hot current of air. Rather than falling, raindrops get larger in dimension and are forced up because of the air current. Finally, they will be heavier to carry and fall, leading to more rainfall than normal.

Geological Disasters

A Geological Disaster, also known as a geologic hazard, refers to a natural event that can cause significant damage or harm to human society and infrastructure. These events are often caused by geological processes, such as earthquakes, volcanic eruptions, landslides, and tsunamis. Geological disasters can occur anywhere in the world, but are often more frequent in regions with active tectonic activity.

Geological disasters are catastrophic events that result from natural processes in the Earth's crust, including earthquakes, landslides, rock falls, ground fissures, etc. These disasters can cause significant damage to infrastructure, property, and human lives, as well as impact the environment and natural resources. This chapter provides an overview of the origin and types of main terrestrial geological disasters, and introduces the risk assessment and management strategies used for geological disaster researches by using equipment-based and remote sensing-based approaches.

Earthquakes

An earthquake occurs due to sudden transient motion of the ground as a result of release of elastic energy in a matter of few seconds. The impact of the event is most traumatic because it affects large areas, occurs all of a sudden and is unpredictable.

Earthquakes are among the most deadly natural hazards. There are around 100 earthquakes each year of a size that could cause serious damage. They strike without warning and many of the Earth's earthquake zones coincide with areas of high population density. When large earthquakes occur in such areas the results can be catastrophic, with terrible loss of human lives and untold economic cost.

Earthquakes demonstrate that the Earth continues to be a dynamic planet, changing each day through internal tectonic forces. The crust of the Earth consists of various elastic rocks in which energy is stored during crustal deformation caused by the tectonic forces. When the strain builds to a level that exceeds the strength of a weak part of the Earth's crust, such as along a geological fault, then opposite sides of the fault suddenly slip, and an earthquake occurs. The common parameters for describing the characteristics of an earthquake source are the location of the hypocentre or the epicentre (the point on the Earth's surface immediately above the hypocentre). Measures of the strength of shaking and the total energy release in the earthquake are also needed.

An earthquake is the sudden release of strain energy in the Earth's crust, resulting in waves of shaking that radiate outwards from the earthquake source. When stresses in the crust exceed the strength of the rock, it breaks along lines of weakness, either a pre-existing or new fault plane. The point where an earthquake starts is termed the focus or hypocentre and may be many kilometres deep within the earth. The point at the surface directly above the focus is called the earthquake epicentre.

An **earthquake** is what happens when two blocks of the earth suddenly slip past one another. The surface where they slip is called the **fault** or **fault plane**. The location below the earth's surface where the earthquake starts is called the **hypocentre**, and the location directly above it on the surface of the earth is called the **epicentre**.

Sometimes an earthquake has **foreshocks**. These are smaller earthquakes that happen in the same place as the larger earthquake that follows. Scientists can't tell that an earthquake is a foreshock until the larger earthquake happens. The largest, main earthquake is called the **mainshock**. Mainshocks always have **aftershocks** that follow. These are smaller earthquakes that occur afterwards in the same place as the mainshock.

Causes an Earthquake

Earthquakes occur due to sudden tectonic movements within the Earth's crust. The Earth's crust is divided into large sections called tectonic plates, which float on the semi-fluid layer known as the asthenosphere. These plates are constantly in motion, albeit very slowly.

When two tectonic plates interact, various types of boundaries can form, such as convergent and divergent and transform boundaries. The most powerful and destructive earthquakes typically occur at convergent boundaries, where two plates collide or slide past each other.

At a convergent boundary, one tectonic plate may be forced beneath another in a process called subduction. As the plates collide or slide past each other, immense pressure and friction build-up. Eventually, the stress becomes too great, causing the rocks along the plate boundaries to break and slip. This sudden release of stored energy generates seismic waves, resulting in an earthquake.

In addition to tectonic movements, other geological activities can also trigger earthquakes. Volcanic activity, for instance, can cause earthquakes when magma rises through the Earth's crust, creating pressure and fracturing the rocks around the volcano. The disturbances caused by these movements and ruptures within the Earth's crust generate vibrations that propagate in all directions, shaking the ground. These vibrations are the seismic waves that travel through the Earth and are detected by seismographs.

It's important to note that the build-up of stress and the subsequent release of energy in the form of shock waves are the fundamental mechanisms behind earthquakes. The magnitude or strength of an earthquake is determined by the amount of energy released during this process.

Before the Earthquake

Make Connections Flexible

Ensure that gas lines and appliances are properly installed with flexible connections. This helps prevent gas leaks and reduces the risk of fire hazards during an earthquake.

Create an Earthquake Readiness Plan

Develop a well-thought-out plan that includes identifying a shelter area in your home. Stock up on essential supplies such as canned food, a well-stocked first aid kit, ample water, dust masks, goggles, firefighting equipment, a flashlight and a working battery-operated radio. These provisions will prove invaluable in the event of an earthquake.

Consult Architects and Structural Engineers

Building sturdy structures is vital for minimizing earthquake damage and ensuring the safety of occupants. If you reside in an earthquake-prone area, it's crucial to consult with architects and structural engineers before constructing buildings. They can guide you in implementing the necessary measures and adhering to regulations set by the disaster management committee.

Spread Awareness

Share the knowledge and importance of earthquake preparedness with your friends and family. By educating those around you, you contribute to creating a safer community.

During the Earthquake

When an earthquake strikes, quick thinking and appropriate actions can save lives. Here are some important guidelines to follow:

Stay Indoors

Remain indoors until the shaking stops and it is officially announced that it is safe to exit. Taking cover beneath a sturdy table or bed can provide vital protection against falling objects.

Avoid Hazardous Areas

Steer clear of bookcases, heavy furniture and appliances that may topple over during the earthquake. Your safety should always be the top priority.

Find a Safe Spot

Seek shelter under a sturdy piece of furniture, such as a table or bed. Hold on to a post or any other fixture to maintain stability and minimize the risk of injury.

If Outdoors, Move to an Open Area

If you are outside when the earthquake occurs, find a clear spot away from buildings, trees and power lines. These objects pose a significant danger during seismic activity.

After the Earthquake

Once the earthquake subsides, it's important to proceed with caution and take the following measures:

Administer First Aid

Attend to individuals with minor injuries using first aid kits. For those with more severe injuries, it's essential to wait for professional medical help and avoid moving them until it is safe.

CPR and Rescue Breathing

If someone is not breathing, administer rescue breathing. If the person has no pulse, perform CPR (cardiopulmonary resuscitation) until medical assistance arrives.

Be Mindful of Hazards

Attend any tumbling shelves or falling items and be cautious around damaged walls made of bricks or other unstable materials. Your safety should be a priority.

Check Gas and Power Connections

Inspect gas valves for leaks and turn off the main power switch if damage is possible. Unplug broken appliances until they can be properly repaired.

Stay Clear of Power Lines

Keep a safe distance from downed power lines and any objects or appliances in contact with them. Electricity poses a significant risk, so exercise caution.

Tsunamis

Tsunamis, also known as seismic sea waves, are massive ocean waves that are typically caused by underwater earthquakes, volcanic eruptions, or landslides. These waves can travel at high speeds across vast distances and can cause significant damage when they reach the shore. Tsunamis can be extremely dangerous and deadly, as they can flood coastal areas, destroy buildings and infrastructure, and cause widespread devastation.

Tsunamis are ocean waves triggered by:

1. Large earthquakes that occur near or under the ocean
2. Volcanic eruptions
3. Submarine landslides
4. Onshore landslides in which large volumes of debris fall into the water

Scientists do not use the term "tidal wave" because these waves are not caused by tides. Tsunami waves are unlike typical ocean waves generated by wind and storms, and most tsunamis do not "break" like the curling, wind-generated waves popular with surfers.

Tsunamis typically consist of multiple waves that rush ashore like a fast-rising tide with powerful currents. When tsunamis approach shore, they behave like a very fast-moving tide that extends much farther inland than normal water. If a tsunami-causing disturbance occurs close to the coastline, a resulting tsunami can reach coastal communities within minutes. A rule of thumb is that if you see the tsunami, it is too late to outrun it. Even small tsunamis (6 feet in height, for example) are associated with extremely strong currents, capable of knocking someone off their feet. As a result of complex interactions with the coast, tsunami waves can persist for many hours.

Causes tsunamis

Tsunamis are usually caused by large undersea earthquakes, which create powerful seismic waves that can displace large amounts of water. The displacement of water then generates a series of long waves that can travel great distances across the ocean, sometimes reaching heights of over 100 feet by the time they reach land. Other causes of tsunamis include volcanic eruptions, landslides, and meteorite impacts. However, the majority of tsunamis are caused by earthquakes.

Types of tsunamis

There are two main types of tsunamis:

- Local tsunamis and

- Distant tsunamis.

Local tsunamis are relatively small and occur near the source of the earthquake, volcanic eruption, or landslide that generated them. They typically affect coastlines within a few hundred kilometres of the source and are characterized by short periods between waves and high wave amplitudes.

Distant tsunamis, on the other hand, are much larger and occur far from the source of the disturbance. They are often caused by earthquakes that occur on the ocean floor, and they can travel thousands of kilometres across the ocean before reaching land. Distant tsunamis are characterized by long wave periods (up to an hour or more) and lower wave amplitudes, but they can still cause significant damage and loss of life when they reach shore.

Impacts of tsunamis on the environment

Tsunamis can have significant impacts on the environment, both in the nearshore and offshore areas. Some of the impacts include:

- **Coastal erosion:** Tsunamis can cause significant coastal erosion, especially in areas with soft sediment or sandy beaches.
- **Habitat destruction:** The nearshore and offshore habitats can be destroyed or altered by the impact of the waves.
- **Coral reef damage:** Coral reefs can be damaged or destroyed by tsunamis due to the powerful wave action and debris.
- **Water quality:** Tsunamis can impact water quality by stirring up sediments, introducing pollutants and contaminating water sources.
- **Marine life:** Tsunamis can cause the displacement or death of marine life, especially in the nearshore and intertidal areas.
- **Coastal infrastructure:** Tsunamis can cause significant damage to coastal infrastructure such as buildings, roads, bridges, and other infrastructure.
- **Debris accumulation:** Tsunamis can deposit debris along the coastline, which can cause additional environmental and health hazards.

Landslides

A landslide is defined as the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of "mass wasting," which denotes any down-slope movement of soil and rock under the direct influence of gravity.

Landslides are more widespread than any other geological event, and can occur anywhere in the world. They occur when large masses of soil, rocks or debris move down a slope due to a natural phenomenon or human activity. Mudslides or debris flows are also a common type of fast-moving landslide.

Landslides can accompany heavy rains or follow droughts, earthquakes or volcanic eruptions. Areas most vulnerable to landslides include:

steep terrain, including areas at the bottom of canyons; land previously burned by wildfires; land that has been modified due to human activity, such as deforestation or construction; channels along a stream or river; any area were surface runoff is directed or land is heavily saturated. Between 1998-2017, landslides affected an estimated 4.8 million people and cause more than 18 000 deaths.

Impact:

Landslides can cause high mortality and injuries from rapidly flowing water and debris. The most common cause of death in a landslide is trauma or suffocation by entrapment.

Broken power, water, gas or sewage pipes can also result in injury or illness in the population affected, such as water-borne diseases, electrocution or lacerations from falling debris. People affected by landslides can also have short- and long-term mental health effects due to loss of family, property, livestock or crops.

Landslides can also greatly impact the health system and essential services, such as water, electricity or communication lines.

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Types of Landslides

There are many ways to describe a landslide. The nature of a landslide's movement and the type of material involved are two of the most common.

Landslide Movement

There are several ways of describing how a landslide moves. These include falls, topples, translational slides, lateral spreads, and flows. In falls and topples, heavy blocks of material fall after separating from a very steep slope or cliff. Boulders tumbling down a slope would be a fall or topple.

Landslide Material

A landslide can involve rock, soil, vegetation, water, or some combination of all these. A landslide caused by a volcano can also contain hot volcanic ash and lava from the eruption. A landslide high in the mountains may have snow and snowmelt. Volcanic landslides, also called lahars, are among the most devastating type of landslides.

Other Factors

Another factor that might be important for describing landslides is the speed of the movement. Some landslides move at many meters per second, while others creep along at an centimetre or two a year. The amount of water, ice, or air in the earth should also be considered.

Martian Landslide

In December 2008, scientists announced that they had found evidence of the largest landslide ever. Because of a giant asteroid impact billions of years ago, the smooth northern hemisphere of Mars is sharply separated from the irregular southern highlands.

Falls Landslides

It means falling of some material or debris or rocks etc., from a slope or a cliff which leads to a collection of this debris at the base of the slope.

Topple Landslides

These can occur because of some fractures between the rocks and the tilt of the rocks because of gravity without collapsing. Here, we see the forward rotational movement of the material.

Slides

It is a kind of landslide when a piece of the rock slides downwards and gets separated from it.

Spread

It happens on flat terrain and gentle slopes and can occur because of softer material.

Causes of Landslide:

Landslides are caused by various factors, which are mentioned below:

It can be caused because of heavy rain.

Deforestation is also one of the main reasons for landslides because trees, plants, etc., keep the soil particles compact and due to deforestation, the mountain slopes lose their protective layers because of which the water of the rain flows with unimpeded speed on these slopes.

It can be caused by earthquakes as well.

For example, in the Himalayas, the tremor occurred because earthquakes unstabilized the mountains, which led to landslides.

Volcanic eruptions in specific regions can also cause landslides.

Landslides often occur in mountain regions while making roads and construction; a large number of rocks has to be removed, which can cause landslides over there.

In the regions of North East India, landslides occur because of shifting agriculture.

Due to the increasing population, a large number of houses are being created, which leads to the creation of a large number of debris which can cause landslides.

Effects of Landslide

Landslides can disturb the social and economic environment with the number of other damages which are mentioned below:

Short Term Impacts

- The natural beauty of the area is damaged.
- Loss of life and property
- Roadblocks
- Destruction of railway lines
- Channel blocking because of the falling of rocks.
- It leads to the diversion of river water, which can cause floods as well.

Long Term Impacts

- Landscape changes can be permanent.
- The loss of fertile land or cultivation land.
- Erosion and soil loss can lead to environmental problems.
- Population shifting and migration.
- Effects on the sources of water.
- Some roads can be damaged or closed permanently.

Prevention and Mitigation

The following measures can be taken in this regard:

- The country should identify the vulnerable areas and actions should be taken in this regard on a priority basis.
- Early warning systems and monitoring systems should be there.
- Hazard mapping can be done to identify the areas which are more prone to landslides.
- Restriction on the construction in the risky areas should be imposed.
- Afforestation programs should take place.
- Restricting development in landslide areas and protecting the existing ones.
- The country should specify codes or standards etc. For the construction of the buildings and other purposes in such areas of risk.
- Insurance facilities should be taken by the people to deal with the loss.
- Terrace farming should be adopted in hilly areas.
- Response teams should be quick to deal with landslides if they occur.

Valances

A substantial number of secondary geological disasters have resulted from big earthquakes in the circum-Pacific seismic band and the Mediterranean Himalayan seismic region in recent years.

This type of geological disaster results in a large number of casualties and damage to property, and it makes rescue efforts and recovery more difficult. Geological disasters in coastal and marine areas were also triggered by the earthquake's epicentre in the highlands. Tsunamis and other geological disasters are widespread in the ocean. Large strain energy released during an earthquake travel as seismic waves in all directions through the Earth's layers, reflecting and refracting at each interface.

These waves are of two types - body waves and surface waves; the latter is restricted to near the Earth's surface.

Body waves consist of Primary Waves (P-waves) and Secondary Waves (S-waves), and surface waves consist of Love waves and Rayleigh waves. Under P-waves, material particles undergo extensional and compressional strains along the direction of energy transmission, but under S-waves, oscillate at right angles to it. Love waves cause surface motions similar to that by S-waves, but with no vertical component. Rayleigh wave makes a material particles oscillate in an

elliptic path in the vertical plane (with horizontal motion along direction of energy transmission).

Volcanic

Volcanoes spew hot, dangerous gases, ash, lava, and rock that are powerfully destructive. People have died from volcanic blasts. Volcanic eruptions can result in additional threats to health, such as floods, mudslides, power outages, drinking water contamination, and wildfires.

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Volcanic ash

Exposure to ash can be harmful. Infants, elderly people, and people with respiratory conditions such as asthma, emphysema, and other chronic lung diseases may have problems if they breathe in volcanic ash. Ash is gritty, abrasive, sometimes corrosive, and always unpleasant. Small ash particles can abrade (scratch) the front of the eye. Ash particles may contain crystalline silica, a material that causes a respiratory disease called silicosis.

Gases

Most gases from a volcano quickly blow away. However, heavy gases such as carbon dioxide and hydrogen sulphide can collect in low-lying areas. The most common volcanic gas is water vapor, followed by carbon dioxide and sulphur dioxide. Sulphur dioxide can cause breathing problems in both healthy people and people with asthma and other respiratory problems. Other volcanic gases include hydrogen chloride, carbon monoxide, and hydrogen fluoride. Amounts of these gases vary widely from one volcanic eruption to the next.

Volcanic gases are particularly hazardous as they cannot be seen and, because they are denser than ambient air, can 'pond' in depressions around an active volcano. High concentrations of volcanic gas may also be a health hazard inside planes. Sulphur gases convert to sulphate aerosols (mainly sulphuric acid) which, if they reach the stratosphere, may remain there for years, causing short-term climate changes.

Eruptions

If a lot of gas is trapped within magma, pressure will build and build until eventually the magma erupts explosively out of the volcano. It's a bit like a bottle of fizzy pop: gas is trapped in the liquid but if you shake the bottle the gas wants to escape. This builds pressure inside the bottle and when you release the pressure by opening the bottle, the gas rushes out of the top carrying some of the liquid with it. Phreatomagmatic eruptions are a type of explosive eruption that results from magma erupting through water.

Effusive eruptions

If a magma has low viscosity (it is runny), gas can escape easily, so when the magma erupts at the surface it forms lava flows. These eruptions are (relatively!) gentle, effusive eruptions. If a magma rises very slowly within the conduit. or throat, of the volcano, all the gas can escape.

Mudflow

Mudflow refers to the mountains or other deep valleys, steep terrain regions, because of heavy rain, blizzard, or other natural disasters caused by landslides and special with a large number of sediment and rocks in the torrent, is essentially a strong surface change, only when the debris flow of human living.

A mud flow is **a geologic phenomenon whereby a wet, viscous fluid mass of fine-to-coarse-grained material flows rapidly and turbulently downslope, usually in a drainageway**. Typically, a torrential rainfall or very rapid snowmelt runoff is the initiating factor.

Mudflows occur on steep slopes where vegetation is not sufficient to prevent rapid erosion but can occur on gentle slopes if other conditions are met. Other factors are heavy precipitation in short periods and an easily erodible source material. Mudflows can be generated in any climatic regime but are most common in arid and semiarid areas.

A mud flow is a mass of water and fine-grained earth materials that flows down a stream, ravine, canyon, arroyo, or gulch. If more than half of the solids in the mass are larger than sand grains—-rocks, stones, boulders—the event is called a debris flow.

Wind related- Cyclone

Tropical cyclones, also known as typhoons or hurricanes, are among the most destructive weather phenomena. They are intense circular storms that originate over warm tropical oceans, and have maximum sustained wind speeds exceeding 119 kilometres per hour and heavy rains.

The health impacts of tropical cyclones depend on the number of people living in low-lying coastal areas in the storm's direct path, the built environment including building design, and whether there is sufficient time for warning and evacuation.

Tropical cyclones, may directly and indirectly affect health in many ways, for example by:

increasing cases of drowning and other physical trauma;

increasing risks of water- and vector-borne infectious diseases;

increasing mental health effects associated with emergency situations;

disrupting health systems, facilities and services, leaving communities without access to health care when they are needed most;

damaging basic infrastructure, such as food and water supplies and safe shelter.

Cyclone, any large system of winds that circulates about a centre of low atmospheric pressure in a counterclockwise direction north of the Equator and in a clockwise direction to the south. Cyclonic winds move across nearly all regions of the Earth except the equatorial belt and are generally associated with rain or snow. Also occurring in much the same areas are anticyclones, wind systems that rotate about a high-pressure centre. Anticyclones are so called because they have a flow opposite to that of cyclones—i.e., an outward-spiralling motion, with the winds rotating clockwise in the Northern Hemisphere and counterclockwise in the Southern.

Storm

Windstorm, a wind that is strong enough to cause at least light damage to trees and buildings and may or may not be accompanied by precipitation. Wind speeds during a windstorm typically exceed 55 km (34 miles) per hour. Wind damage can be attributed to gusts (short bursts of high-speed winds) or longer periods of stronger sustained winds. Although tornadoes and tropical cyclones also produce wind damage, they are usually classified separately.

Windstorms may last for just a few minutes when caused by downbursts from thunderstorms, or they may last for hours (and even several days) when they result from large-scale weather systems. A windstorm that travels in a straight line and is caused by the gust front (the boundary between descending cold air and warm air at the surface) of an approaching thunderstorm is called a derecho.

Longer-period windstorms have two main causes: (1) large differences in atmospheric pressure across a region and (2) strong jet-stream winds overhead. Horizontal pressure differences may accelerate the surface winds substantially as air travels from a region of higher atmospheric pressure to one of lower. In addition, the vertical turbulent mixing of stronger jet-stream winds aloft can produce strong gusty winds at ground level.

Storms are generated when a center of low pressure develops with the system of high pressure surrounding it. It is marked by high wind moving at great wind speed. The regions that lie close to the equator receive more heat from the sun. Due to this, the warm air rises. This suggests that the warm air from the equator moves in to take its place. On the other hand, the air at the poles is colder than the air at the equator. Thus, as the warmer air rises, the cooler air from the poles race in. Consequently, wind currents move from poles to warmer latitudes due to the uneven heating of the earth's surface.

There are many types of storms like Dust storms, in which the visibility gets badly impacted as the wind picks up large quantities of sand, soil. Hailstorm occurs due to the precipitation of chunks of ice. Ice storm, that is one of the most dangerous forms of winter storms. It occurs when surface temperatures are

below freezing, but a thick layer of above-freezing air remains aloft, rain can fall into the freezing layer and freeze upon impact into a glaze of ice. The snowstorm is characterized by heavy snowfall. Thunderstorms, Cyclones, and so on.

Thunderstorm

A thunderstorm is characterized by the presence of lightning along with thunder. Generally, it develops in hot and humid regions like India. High temperature creates strong and upward currents. These currents carry moisture, that is, water vapor along with them to higher altitudes. This is followed by the process of condensation and rain again. These pressure variations are accompanied by thunder, lightning, and strong winds.

Conversion of Thunderstorm to Cyclone

When moisture changes to the liquid form of water, that is, water drops, it leads to the release of heat to the atmosphere. Thus, the heat released in this way warms the surrounding air and gives rise to a pressure drop. All of these consequences lead the air to rush in towards the center of the storm. This cycle creates large low-pressure systems with strong high-speed winds swirling around them. This is how the cyclone forms.

Storm surge

Storm surges, defined as masses of water that are pushed toward the shore by meteorologic forces, are a primary cause of the injuries, deaths, and structural damages associated with hurricanes, cyclones, northeasters, and other coastal storms. When the advancing surge of water coincides with high tides, the resulting rise in sea level is further exacerbated. Storm surges may reach several dozen feet under the right conditions, as was the case in Hurricane Katrina.

As storm surge, the temporary rise in sea level beneath a storm, becomes dangerous when the storm — typically a hurricane or other tropical storm — reaches land. The water is unable to escape anywhere but onto land as the storm moves toward the shore, which causes flooding along the coast and other types of hurricane damage. For example, the force of waves and currents can cause land to erode and buildings to be destroyed. Saltwater that gets into freshwater lakes, streams, and aquifers is hazardous to aquatic life and contaminates drinking water.

A storm surge is a rise in sea level that occurs during tropical cyclones, intense storms also known as typhoons or hurricanes. The storms produce strong winds that push the water into shore, which can lead to flooding. This makes storm surges very dangerous for coastal regions.

A storm surge is primarily caused by the relationship between the winds and the ocean's surface. The water level rises where the winds are strongest. In addition, water is pushed in the direction the winds are blowing. The rotation of the Earth causes winds to move toward the right in the Northern Hemisphere and toward the left in the Southern Hemisphere—a phenomenon known as the Coriolis effect. If a cyclone develops in the Northern Hemisphere, the surge will be largest in the right-forward part of the storm. In the Southern Hemisphere, the surge will be largest in the left-forward part of the cyclone.

Storm Surges and Coastal Communities

Tropical cyclones, and the storm surges they generate, are a serious hazard for coastal areas in tropical and subtropical regions of the world.

When a cyclone hits land, the accompanying storm surge will most often flood the surrounding coastal area. Flooding is responsible for most deaths and economic damage associated with tropical cyclone landfalls.

Improvements in forecasting cyclones and issuing early warnings to the public have become indispensable as both coastal populations and the occurrence of extreme storms continue to rise.

Tidal waves

The tidal wave (Tsunami) harm will likewise be upgraded over the back-reef seashore as the ocean level ascents, particularly closer to the underlying shoreline in the immersion zone. Extra defensive strategies or adaptations might be essential to lessen the tidal wave harm profoundly upgraded by future ocean level ascent for the low-lying zones of the reef-lined coasts. The negative impacts of the debasing of the reef surface harshness on both immersion separation and tidal wave harm are not as huge as ocean level ascent. The outcomes introduced here give seaside directors a gage of how tidal wave dangers change over bordering reefs considering environmental change-related ocean level ascent and coral fading.

The use of renewable energy continues to grow across the globe. While Iceland runs on 100 percent renewable electricity, other countries are following suit by exploring possible options. Tidal energy is one of them.

Tidal energy might be able to deliver reliable and predictable clean energy. It is similar to wind turbines but tidal turbines are made of a tower structure that is linked to the sea floor with numerous turbines attached under the water. The energy that can be produced will then be propelled through a system of substations and underwater cables, and passed into the national grid.

This kind of renewable energy source is still being tested for its potential. The largest European site, once it is fully operational, is estimated to generate 86 megawatts (MW) that could power up to 42,000 homes. While it can generate useful amounts of power, it may not produce as much energy as wind and solar power.

Tidal energy is still in the works for some countries that are trying to harness its power. It is gaining as much interest as wind and solar power, which continue to be large sources of electricity. If further research proves to be successful, tidal power could be the next big thing.

Heat and cold Waves

Cold Wave

In some regions, a cold wave is known as a cold snap or cold spell. It is a weather phenomenon associated with the cooling of the air. According to the U.S. National Weather Service, "Cold wave is defined as a rapid fall in temperature within a 24-hour period and required substantially increased protection to agriculture, industry, commerce, and social activities."

The criteria or basis for a cold wave are the rates at which the temperature falls, and the minimum to which it falls. Here to know is that the minimum temperature is dependent on the geographical region and time of year. A cold wave of sufficient magnitude and duration may be defined as a cold air outbreak (CAO).

Heat Wave

It is a weather phenomenon when an abnormal temperature rises in a period more than the normal maximum temperatures that occur during the summer season.

According to World Meteorological Organisation, a heat wave is defined as five or more consecutive days of prolonged heat in which the daily maximum temperature is higher than the average maximum temperature by 5 degrees Celsius or more.

Reasons	**Heat Wave**	**Cold Wave**
Definition	Period of prolonged, abnormally high surface temperatures relative to those normally expected. It may span from several days to several weeks.	Cold Wave is a speedy fall in temperature over a 24-hour period that requires considerably enhanced protection for agriculture, industry, commerce, and social activities.

Criteria	When the maximum temperature of a region increases by at least 40 degrees Celsius for Plains and at least 30 degrees Celsius for Hilly regions. According to IMD, For five or more consecutive days during which the daily maximum temperature surpasses the average maximum temperature by 5 degrees Celsius or more.	When the minimum temperature is 10 degrees Celsius or below and is 4.5 degrees Celsius less than normal for two consecutive days.
Regions in India	Hot weather is experienced in certain parts of India during the months of March to July.	Cold and dry winds blow in northwest India during the months of November and April.
Health Impacts	Dehydration, heat cramps, heat exhaustion, and heatstroke. It also causes weakness, dizziness, headache nausea, muscle cramps, and sweating. People living in extreme temperatures and resultant atmospheric conditions may cause physiological stress and sometimes result in death.	Prolonged exposure to cold wave conditions, lowers the temperature of the body as the body loses heat faster than it can produce by muscle contractions, metabolism, and shivering. Illness related to coldwaves is frostnip, chilblains, frostbite, etc.
Prevention	One of the best ways to prevent illness due to heat waves is to avoid prolonged exposure to the outdoor environment. Wear light-weight, light colour clothes which can absorb sweat from the skin, wear clothes with loose fittings which allow more air circulation; cover the head with a well-ventilated cap or hat while going outside in hot sunny weather, avoid dehydration, etc.	Avoid prolonged exposure to the outdoor environment, dress clothes that retain body warmth and help minimise loss of heat, protect eyes from cold and wind by wearing glasses, maintain body heat by eating proper food, avoid touching metal mainly with wet hands as it can cause frost-bite in case of extreme cold temperatures. It is suggested that not to drink beverages that contain alcohol or caffeine and do not smoke tobacco as it is harmful to the lungs.
Phenomenon	El Nino (warm phase). During El Nino, surface winds across the entire tropical Pacific are weaker than usual. Ocean temperatures in the central and eastern tropical Pacific Ocean are warmer than average.	La Nina (cold phase). In this, the surface winds across the entire tropical Pacific are stronger than usual, and most of the tropical Pacific Ocean is cooler than average.

Therefore, we can say that the severity and the frequency of occurrence of cold and heat waves depend upon several factors including the geographical location, climatic conditions of the region, etc. It has been seen that heat and cold wave conditions cause thermal stress to the human body that may lead to various health problems and even a threat to life. These also have an adverse impact on agriculture and industrial production. In various countries, heat and cold waves account for more deaths than any other natural disaster.

Climatic Change

Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun’s activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.

Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.

The main greenhouse gases that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and cutting down forests can also release carbon dioxide. Agriculture, oil and gas operations are major sources of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the main sectors causing greenhouse gases.

Natural Causes of Climate Change

Some amount of climate change can be attributed to natural phenomena. Over the course of Earth's existence, volcanic eruptions, fluctuations in solar radiation, tectonic shifts, and even small changes in our orbit have all had observable effects on planetary warming and cooling patterns. But climate records are able to show that today's global warming—particularly what has occurred since the start of the industrial revolution—is happening much, much faster than ever before.

Human-Driven Causes of Climate Change

Scientists agree that human activity is the primary driver of what we're seeing now worldwide. (This type of climate change is sometimes referred to as *anthropogenic*, which is just a way of saying "caused by human beings.") The unchecked burning of fossil fuels over the past 150 years has drastically increased the presence of atmospheric greenhouse gases, most notably carbon dioxide. At the same time, logging and development have led to the widespread destruction of forests, wetlands, and other carbon sinks—natural resources that store carbon dioxide and prevent it from being released into the atmosphere.

Transportation

The cars, trucks, ships, and planes that we use to transport ourselves and our goods are a major source of global greenhouse gas emissions. (In the United States, they actually constitute the single-largest source.) Burning petroleum-based fuel in combustion engines releases massive amounts of carbon dioxide into the atmosphere.

Electricity generation

As of 2021, nearly 60 percent of the electricity used in the United States comes from the burning of coal, natural gas, and other fossil fuels. Because of the electricity sector's historical investment in these dirty energy sources, it accounts for roughly a quarter of U.S. greenhouse gas emissions, including carbon dioxide, methane, and nitrous oxide.

That history is undergoing a major change, however: As renewable energy sources like wind and solar become cheaper and easier to develop, utilities are turning to them more frequently. The percentage of clean, renewable energy is growing every year—and with that growth comes a corresponding decrease in pollutants. But while things are moving in the right direction, they're not moving fast enough.

Industry & Manufacturing

The factories and facilities that produce our goods are significant sources of greenhouse gases; in 2020, they were responsible for fully 24 percent of U.S. emissions. Most industrial emissions come from the production of a small set of carbon-intensive products, including basic chemicals, iron and steel, cement and concrete, aluminium, glass, and paper. To manufacture the building blocks of our infrastructure and the vast array of products demanded by consumers, producers must burn through massive amounts of energy. In addition, older facilities in need of efficiency upgrades frequently leak these gases, along with other harmful forms of air pollution.

Agriculture

The advent of modern, industrialized agriculture has significantly altered the vital but delicate relationship between soil and the climate—so much so that agriculture accounted for 11 percent of U.S. greenhouse gas emissions in 2020. This sector is especially notorious for giving off large amounts of nitrous oxide and methane, powerful gases that are highly effective at trapping heat. The widespread adoption of chemical fertilizers, combined with certain crop-management practices that prioritize high yields over soil health, means that agriculture accounts for nearly three-quarters of the nitrous oxide found in our atmosphere. Meanwhile, large-scale industrialized livestock production continues to be a significant source of atmospheric methane, which is emitted as a function of the digestive processes of cattle and other ruminants.

Oil & Gas Development

Oil and gas lead to emissions at every stage of their production and consumption—not only when they're burned as fuel, but just as soon as we drill a hole in the ground to begin extracting them. Fossil fuel development is a major source of methane, which invariably leaks from oil and gas operations: drilling, fracking, transporting, and refining.

Buildings

Unsurprisingly, given how much time we spend inside of them, our buildings—both residential and commercial—emit a lot of greenhouse gases. Heating, cooling, cooking, running appliances, and maintaining other building-wide systems accounted for 13 percent of U.S. emissions overall in 2020. And even worse, some 30 percent of the energy used in U.S. buildings goes to waste, on average.Every day, great strides are being made in energy efficiency, allowing us to achieve the same (or even better) results with less energy expended.

Deforestation

Another way we're injecting more greenhouse gas into the atmosphere is through the clearcutting of the world's forests and the degradation of its wetlands. Vegetation and soil store carbon by keeping it at ground level or underground. Through logging and other forms of development, we're cutting down or digging up vegetative biomass and releasing all of its stored carbon into the air.

Our Lifestyle Choices

The decisions we make every day as individuals—which products we purchase, how much electricity we consume, how we get around, what we eat (and what we don't—food waste makes up 4 percent of total U.S. greenhouse gas emissions)—add up to our single, unique carbon footprints. Put all of them together and you end up with humanity's collective carbon footprint. The first step in reducing it is for us to acknowledge the uneven distribution of climate change's causes and effects, and for those who bear the greatest responsibility for global greenhouse gas emissions to slash them without bringing further harm to those who are least responsible.

The big, climate-affecting decisions made by utilities, industries, and governments are shaped, in the end, by *us*: our needs, our demands, our priorities.

Global warming

Global warming is the phenomenon of a gradual increase in the temperature near the earth's surface. This phenomenon has been observed over the past one or two centuries. This change has disturbed the climatic pattern of the earth. However, the concept of global warming is quite controversial but the scientists have provided relevant data in support of the fact that the temperature of the earth is rising constantly.

There are several causes of global warming, which have a negative effect on humans, plants and animals. These causes may be natural or might be the outcome of human activities. In order to curb the issues, it is very important to understand the negative impacts of global warming.

Man-made Causes of Global Warming

Deforestation

Plants are the main source of oxygen. They take in carbon dioxide and release oxygen thereby maintaining environmental balance. Forests are being depleted for many domestic and commercial purposes. This has led to an environmental imbalance, thereby giving rise to global warming.

Use of Vehicles

The use of vehicles, even for a very short distance results in various gaseous emissions. Vehicles burn fossil fuels which emit a large amount of carbon dioxide and other toxins into the atmosphere resulting in a temperature increase.

Chlorofluorocarbon

With the excessive use of air conditioners and refrigerators, humans have been adding CFCs into the environment which affects the atmospheric ozone layer. The ozone layer protects the earth surface from the harmful ultraviolet rays emitted by the sun. The CFCs have led to ozone layer depletion making way for the ultraviolet rays, thereby increasing the temperature of the earth.

Industrial Development

With the advent of industrialization, the temperature of the earth has been increasing rapidly. The harmful emissions from the factories add to the increasing temperature of the earth.

Agriculture

Various farming activities produce carbon dioxide and methane gas. These add to the greenhouse gases in the atmosphere and increase the temperature of the earth.

Overpopulation

An increase in population means more people breathing. This leads to an increase in the level of carbon dioxide, the primary gas causing global warming, in the atmosphere.

Natural Causes of Global Warming

Volcanoes

Volcanoes are one of the largest natural contributors to global warming. The ash and smoke emitted during volcanic eruptions goes out into the atmosphere and affects the climate.

Water Vapour

Water vapour is a kind of greenhouse gas. Due to the increase in the earth's temperature, more water gets evaporated from the water bodies and stays in the atmosphere adding to global warming.

Melting Permafrost

Permafrost is frozen soil that has environmental gases trapped in it for several years and is present below Earth's surface. It is present in glaciers. As the permafrost melts, it releases the gases back into the atmosphere, increasing Earth's temperature.

Forest Blazes

Forest blazes or forest fires emit a large amount of carbon-containing smoke. These gases are released into the atmosphere and increase the earth's temperature resulting in global warming.

Rise in Temperature

Global warming has led to an incredible increase in earth's temperature. Since 1880, the earth's temperature has increased by ~1 degrees. This has resulted in an increase in the melting of glaciers, which have led to an increase in the sea level. This could have devastating effects on coastal regions.

Threats to the Ecosystem

Global warming has affected the coral reefs that can lead to the loss of plant and animal lives. Increase in global temperatures has made the fragility of coral reefs even worse.

Climate Change

Global warming has led to a change in climatic conditions. There are droughts at some places and floods at some. This climatic imbalance is the result of global warming.

Spread of Diseases

Global warming leads to a change in the patterns of heat and humidity. This has led to the movement of mosquitoes that carry and spread diseases.

High Mortality Rates

Due to an increase in floods, tsunamis and other natural calamities, the average death toll usually increases. Also, such events can bring about the spread of diseases that can hamper human life.

Loss of Natural Habitat

A global shift in the climate leads to the loss of habitats of several plants and animals. In this case, the animals need to migrate from their natural habitat and many of them even become extinct. This is yet another major impact of global warming on biodiversity.

Sea Level rise

Sea-level rise is one of the most significant effects of climate change. High projected rates of future sea-level rise have captured the attention of the world. Particularly, countries which are located in low-lying areas as well as small islands are concerned that their land areas would be decreased due to inundation and coastal erosion and, at worst, a large proportion of their population may be forced to migrate to other countries. Therefore, this issue has resulted in heightened attention internationally, as the effects of climate change become apparent.

The level of the sea varies with time and space due to physical processes, such as tide and waves. Mean sea level at a given position is defined as the height of the sea surface averaged over a period of time, such as a month or a year, long enough that fluctuations caused by tide and waves are largely removed. Mean sea level has also spatial distribution in the world. The mean sea level averaged over the global oceans is called global mean sea level (GMSL). The changes in local mean sea level usually differ from that of GMSL, because phenomena dominating in regional and local scales modify the global mean change. When we refer to sea-level change (rise) in this paper, it means the change (increase) in mean sea level, including both global and local, in a general sense. A specific word such as "global (local) sea-level rise" is used to denote the increase in global (local) mean sea level, where it is necessary to distinguish the two terms. The causes of changes in sea level are not limited to those related to climate change.

Mean sea level rise and climatological wind speed changes occur as part of the ongoing climate change and future projections of both variables are still highly uncertain. Here the Baltic Sea's response in extreme sea levels to perturbations in mean sea level and wind speeds is investigated in a series of simulations with a newly developed storm surge model based on the nucleus for European modelling of the ocean (NEMO)-Nordic. A simple linear model with only two tenable parameters is found to capture the changes in the return levels extremely well.

Ozone Depletion

Ozone depletion, gradual thinning of Earth's ozone layer in the upper atmosphere caused by the release of chemical compounds containing gaseous chlorine or bromine from industry and other human activities. The thinning is most pronounced in the polar regions, especially over Antarctica. Ozone depletion is a major environmental problem because it increases the amount of ultraviolet (UV) radiation that reaches Earth's surface, which increases the rate of skin cancer, eye cataracts, and genetic and immune system damage. The Montreal Protocol, ratified in 1987, was the first of several comprehensive international agreements enacted to halt the production and use of ozone-depleting chemicals. As a result of continued international cooperation on this issue, the ozone layer is expected to recover over time.

The ozone layer is mainly found in the lower portion of the earth's atmosphere. It has the potential to absorb around 97-99% of the harmful ultraviolet radiations coming from the sun that can damage life on earth. If the ozone layer was absent, millions of people would develop skin diseases and may have weakened immune systems.

Ozone Layer Depletion

"Ozone layer depletion is the gradual thinning of the earth's ozone layer in the upper atmosphere caused due to the release of chemical compounds containing gaseous bromine or chlorine from industries or other human activities."

Some compounds release chlorine and bromine on exposure to high ultraviolet light, which then contributes to ozone layer depletion. Such compounds are known as Ozone Depleting Substances (ODS).

The ozone-depleting substances that contain chlorine include chlorofluorocarbon, carbon tetrachloride, hydrochlorofluorocarbons, and methyl chloroform. Whereas, the ozone-depleting substances that contain bromine are halons, methyl bromide, and hydro Bromo fluorocarbons.

Chlorofluorocarbons are the most abundant ozone-depleting substance. It is only when the chlorine atom reacts with some other molecule, it does not react with ozone.

Montreal Protocol was proposed in 1987 to stop the use, production and import of ozone-depleting substances and minimise their concentration in the atmosphere to protect the ozone layer of the earth.

Causes of Ozone Layer Depletion

Ozone layer depletion is a major concern and is associated with a number of factors. The main causes responsible for the depletion of the ozone layer are listed below:

Chlorofluorocarbons

Chlorofluorocarbons or CFCs are the main cause of ozone layer depletion. These are released by solvents, spray aerosols, refrigerators, air-conditioners, etc.The molecules of chlorofluorocarbons in the stratosphere are broken down by ultraviolet radiations and release chlorine atoms. These atoms react with ozone and destroy it.

Unregulated Rocket Launches Researchers say that the unregulated launching of rockets results in much more depletion of the ozone layer than the CFCs do. If not controlled, this might result in a huge loss of the ozone layer by the year 2050.

Nitrogenous Compounds

The nitrogenous compounds such as NO_2, NO, N_2O are highly responsible for the depletion of the ozone layer.

Natural Causes

The ozone layer has been found to be depleted by certain natural processes such as Sun-spots and stratospheric winds. But it does not cause more than 1-2% of the ozone layer depletion.

The volcanic eruptions are also responsible for the depletion of the ozone layer.

Ozone Depleting Substances (ODS)

"Ozone-depleting substances are the substances such as chlorofluorocarbons, halons, carbon tetrachloride, hydrofluorocarbons, etc. that are responsible for the depletion of the ozone layer."

Effects Of Ozone Layer Depletion

The depletion of the ozone layer has harmful effects on the environment. Let us see the major effects of ozone layer depletion on man and environment.

Effects on Human Health

Humans will be directly exposed to the harmful ultraviolet radiation of the sun due to the depletion of the ozone layer. This might result in serious health issues among humans, such as skin diseases, cancer, sunburns, cataract, quick ageing and weak immune system.

Effects on Animals

Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.

Effects on the Environment

Strong ultraviolet rays may lead to minimal growth, flowering and photosynthesis in plants. The forests also have to bear the harmful effects of the ultraviolet rays.

Effects on Marine Life

Planktons are greatly affected by the exposure to harmful ultraviolet rays. These are higher in the aquatic food chain. If the planktons are destroyed, the organisms present in the food chain are also affected.

Solutions to Ozone Layer Depletion

The depletion of the ozone layer is a serious issue and various programmes have been launched by the government of various countries to prevent it. However, steps should be taken at the individual level as well to prevent the depletion of the ozone layer.

Following are some points that would help in preventing this problem at a global level:

Avoid Using ODS

Reduce the use of ozone depleting substances. E.g. avoid the use of CFCs in refrigerators and air conditioners, replacing the halon-based fire extinguishers, etc.

Minimise the Use of Vehicles

The vehicles emit a large amount of greenhouse gases that lead to global warming as well as ozone depletion. Therefore, the use of vehicles should be minimised as much as possible.

Use Eco-friendly Cleaning Products

Most of the cleaning products have chlorine and bromine releasing chemicals that find a way into the atmosphere and affect the ozone layer. These should be substituted with natural products to protect the environment.

Use of Nitrous Oxide should be Prohibited

The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer. People should be made aware of the harmful effects of nitrous oxide and the products emitting the gas so that its use is minimised at the individual level as well.