

## Unit-V

### Drinking water, Sanitation and Public Health

Adequate sanitation, together with good hygiene and safe water, are fundamental to good health and to social and economic development. That is why, in 2008, the Prime Minister of India quoted Mahatma Gandhi who said in 1923, “sanitation is more important than independence”. Improvements in one or more of these three components of good health can substantially reduce the rates of morbidity and the severity of various diseases and improve the quality of life of huge numbers of people, particularly children, in developing countries.

Although linked, and often mutually supporting, these three components have different public health characteristics. Lack of sanitation leads to disease, as was first noted scientifically in 1842 in Chadwick's. The diseases associated with poor sanitation are particularly correlated with poverty and infancy and alone account for about 10% of the global burden of disease. At any given time close to half of the urban populations of Africa, Asia, and Latin America have a disease associated with poor sanitation, hygiene, and water.

**Sanitation** is the means of promoting hygiene through the prevention of human contact with hazards of wastes especially faeces, by proper treatment and disposal of the waste, often mixed into wastewater. These hazards may be physical, microbiological, biological or chemical agents of disease. Wastes that can cause health problems include human and animal excreta, solid wastes, domestic wastewater (sewage or grey<sub>water</sub>), industrial wastes, and agricultural wastes.

Hygienic means of prevention may involve engineering solutions (e.g., sanitary sewers, sewage treatment, surface runoff management, solid waste management, excreta management), simple technologies (e.g., pit latrines, dry toilets, urine-diverting dry toilets, septic tanks), or even simply by behaviour changes in personal hygiene practices, such as hand washing with soap.

Providing sanitation to people requires a systems approach, rather than only focusing on the toilet or wastewater treatment plant itself. The experience of the user, excreta and wastewater collection methods, transportation or conveyance of waste, treatment, and reuse or disposal is called the Sanitation chain and all need to be thoroughly considered.

Of human excreta, faeces are the most dangerous to health. One gram of fresh faeces from an infected person can contain around  $10^6$  viral pathogens,  $10^6$ – $10^8$  bacterial pathogens,  $10^4$  protozoan cysts or eggs, and  $10$ – $10^4$  helminth eggs.

The main objective of a sanitation system is to protect and promote human health by providing a clean environment and breaking the cycle of disease. Lack of improved sanitation access have serious health impact on human kind. In fact, by improving access to safe sanitation and changing hygiene behaviours, diarrhoea health impacts - the first death cause of child death under 5 can be reduced significantly.

**Public health** refers to "the science and art of preventing disease, prolonging life and promoting human health through organized efforts and informed choices of society, organizations, public and private, communities and individuals". It is concerned with threats to health based on population health analysis.

The focus of public health intervention is to improve health and quality of life through prevention and treatment of disease and other physical and mental health conditions. This is done through surveillance of cases and health indicators, and through promotion of healthy behaviours. Examples of common public health measures include promotion of hand washing, breastfeeding, delivery of vaccinations, suicide prevention and distribution of condoms to control the spread of sexually transmitted diseases.

A healthy person is characterized by the following features:

1. Cheerfulness
2. Self confidence and control
3. perfect sleep at night
4. Free from unnecessary anxiety
5. Stable mental attitude
6. Courage to face reality

Distribution of pollution - free drinking water and proper maintenance of sanitation is important in order to maintain proper health conditions or public health.

## **Urbanization**

Increase in population of urban areas due to migration of rural population to the cities is known as Urbanization.

### **Causes**

The growth of urban population may be due to the following reasons,

1. Employment
2. Education
3. Medical care
4. Industrialization
5. Increase in standard of living etc.,

### **Environmental Impacts**

1. Alternation of land
2. Loss of agricultural land
3. Loss of biodiversity
4. Depletion of energy resources
5. Increase in air pollution
6. Degradation of water quality
7. Unsanitary conditions noise pollution
8. Global warming
9. Acid rains
10. Ozone layer depletion etc.,

## **Industrialization**

Increase in various industries such as paper, textile footwear, pharmaceutical, rubber, glass, fertilizers, fibre, photochemical and food processing industries etc., is known as Industrialization

### **Causes**

Industrialization may be due to the following reasons,

1. Increase in population
2. Increase in standards of living
3. Availability of raw materials
4. Advanced technology etc.,

### **Environmental Impacts**

1. Air pollution
2. Water pollution
3. Soil pollution
4. Thermal pollution
5. Noise pollution
6. Global warming
7. Acid rains

8. Ozone layer depletion
9. Effects on human health etc.,

### **Control measures**

1. Controlling the pollutant at the source itself by using pollution control devices
2. Using latest equipment technology
3. Using alternate sources of energy
4. Proper maintenance of machines
5. Strict enforcement of pollution control Acts

## **Transportation**

Movement of people and goods from one place to another place is known as Transportation. The modes of transportation include air, water and road.

Buses, trucks, jeeps, cars autos etc., are the important means of road transportation which causes huge damage to the global environment.

### **Causes**

Causes for transportation includes,

1. Increase in population
2. Urbanization
3. Industrialization
4. Commercial activities
5. Increase in standards of living
6. Advanced technology etc.,

### **Environmental Impacts**

1. Air pollution
2. Noise pollution
3. Global warming
4. Acid rains
5. Ozone layer depletion
6. Road mishaps etc.,

### **Control measures**

1. Engine modification
2. Using natural fuels
3. Encouraging mass transport
4. Providing proper signals on the way of transportation
5. Proper maintenance of roads
6. Strict enforcement of pollution control Acts etc.,

## Green Revolution

The **Green Revolution** refers to a set of research and development of technology transfer initiatives occurring between the 1930s and the late 1960s, that increased agricultural production worldwide, particularly in the developing world, beginning most markedly in the late 1960s.

The initiatives resulted in the adoption of new technologies, including: new, high-yielding varieties (HYVs) of cereals, especially dwarf wheat's and rice's, in association with chemical fertilizers and agro-chemicals, and with controlled water-supply (usually involving irrigation) and new methods of cultivation, including mechanization. All of these together were seen as a 'package of practices' to supersede 'traditional' technology and to be adopted as a whole.

The initiatives, led by Norman Borlaug, the "Father of the Green Revolution", who received the Nobel Peace Prize in 1970, credited with saving over a billion people from starvation, involved the development of high-yielding varieties of cereal grains, expansion of irrigation infrastructure, modernization of management techniques, distribution of hybridized seeds, synthetic fertilizers, and pesticides to farmers.

The **Green Revolution in India** was a period when agriculture in India increased its yields due to improved agronomic technology. Green Revolution allowed developing countries, like India, to overcome poor agricultural productivity. It started in India in the early 1960s and led to an increase in food grain production, especially in Punjab, Haryana and Uttar Pradesh during the early phase. The main development was higher-yielding varieties of wheat, which were developed by many scientists, including American agronomist Dr. Norman Borlaug, Indian geneticist M. S. Swaminathan, and others. The Indian Council of Agricultural Research also claims credit for enabling the Green Revolution, in part by developing rust resistant strains of wheat.

The introduction of high-yielding varieties of seeds and the increased use of chemical fertilizers and irrigation led to the increase in production needed to make the country self-sufficient in food grains, thus improving agriculture in India. The methods adopted included the use of high-yielding varieties (HYVs) of seeds with modern farming methods. The production of wheat has produced the best results in fuelling self-sufficiency of India. Along with high-yielding seeds and irrigation facilities (which includes, use of insecticides, herbicide, use of pesticides, consolidation of holdings, use of chemical or synthetic fertilizers, use of sprinklers or drip irrigational systems and use of advanced machinery), the enthusiasm of farmers mobilised the idea of agricultural revolution.

Due to the rise in use of chemical pesticides and fertilizers there was a negative effects on the soil and the land such as land degradation.

## **Sustainability**

In ecology, sustainability (from *sustain* and *ability*) is the property of biological systems to remain diverse and productive indefinitely. Long-lived and healthy wetlands and forests are examples of sustainable biological systems. In more general terms, sustainability is the endurance of systems and processes. It is defined as an ability of an ecosystem to continue function in the same manner in times to come without being for change by external agencies.

### **Criteria for sustainability**

1. No wastage of natural resources
2. Usage of renewable resources only
3. Minimizing environmental pollution
4. Stabilizing human population

### **Sustainable development**

The organizing principle for sustainability is sustainable development, which includes the four interconnected domains: ecology, economics, politics and culture. It is defined as the development that meets needs of the present without compromising the ability of future generation to meet their own needs. Sustainable development must balance the needs of society, economy and environment.

The important components of sustainable development are:

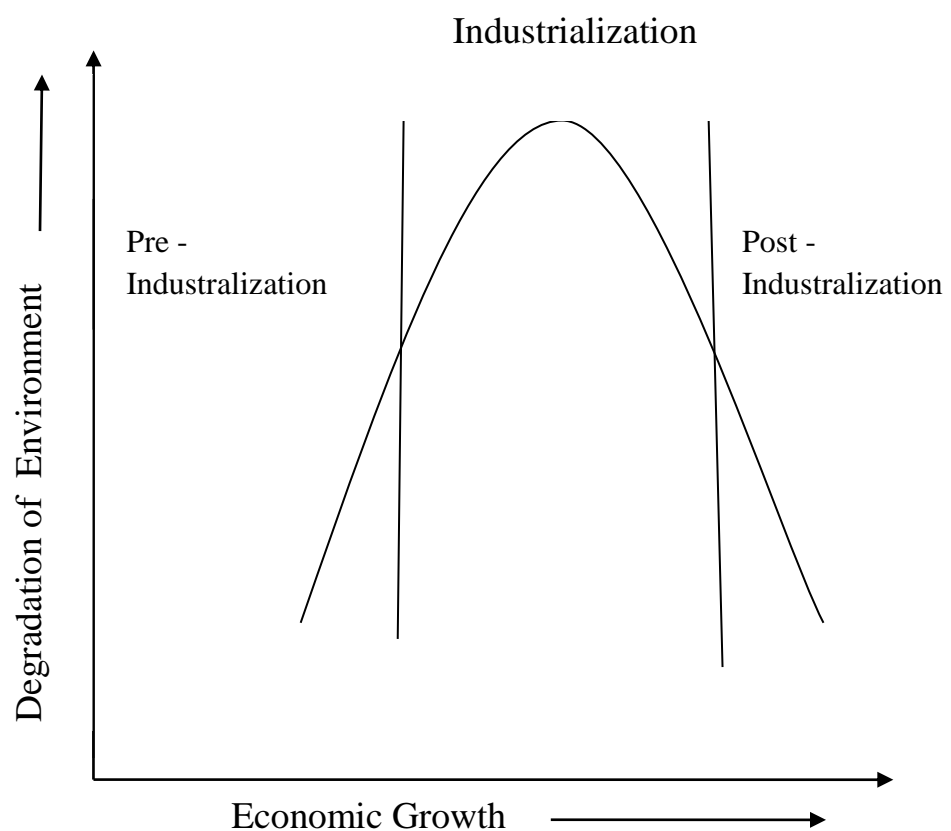
1. Environmental protection
2. Economic development
3. Community development
4. Decrease in population growth

Sustainability measurement is a term that denotes the measurements used as the quantitative basis for the informed management of sustainability. At the global scale, carrying capacity of Earth and ecological footprint are the measures of sustainability. The Ecological footprint measures human consumption in terms of the biologically productive land needed to provide the resources, and absorb the wastes of the average global citizen. In 2008 it required 2.7 global hectares per person, 30% more than the natural biological capacity of 2.1 global hectares (assuming no provision for other organisms). The resulting ecological deficit must be met from unsustainable extra sources and these are obtained in three ways: embedded in the goods and services of world trade; taken from the past (e.g. fossil fuels); or borrowed from the future as unsustainable resource usage (e.g. by over exploiting forests and fisheries).

## Economy and Environment

The environment is our wealth. It is an important component of the society. It is a general belief that, we cannot have both economic development and environmental quality simultaneously based on the opinion that, if we want to improve economically, then we must sacrifice the environment. The relationship between economic growth and environmental quality implied inverted "U" relationship or "dell" relationship.

At low levels of development, the environmental degradation is limited due to impact of economic activity. As the extraction intensity of natural resources is accelerated because of industrialization, the environmental degradation also gets accelerated. So, after a nation reaches a level of income at which people demand efficient infrastructure, technologies and cleaner environment, there results a steady decline of environmental degradation as shown in below figure.



The natural environment is an important component of the economic system and without natural environment, the economic system will not be able to function. Hence, in recent years economists have started treating the natural environment in the same way as they treat labour and capital as an asset and a resource. According to environmental economists, environmental degradation is the result of the failure of the market system to put the deserving value on the environment, even though environment serves economic functions and provides economic and other benefits. It is argued that, because environmental assets are free or under-priced, they tend to be over used, resulting in environmental damage. Hence during industrialization, putting a price on environment is must in order to avoid degradation of environment.

## **Environmental Impact Assessment**

The environmental impact assessment (EIA) process is an interdisciplinary and multistep procedure to ensure that environmental considerations are included in decisions regarding projects that may impact the environment. Simply defined, the EIA process helps identify the possible environmental effects of a proposed activity and how those impacts can be mitigated.

The purpose of the EIA process is to inform decision-makers and the public of the environmental consequences of implementing a proposed project. The EIA document itself is a technical tool that identifies, predicts, and analyzes impacts on the physical environment, as well as social, cultural, and health impacts. If the EIA process is successful, it identifies alternatives and mitigation measures to reduce the environmental impact of a proposed project.

The EIA process also serves an important procedural role in the overall decision-making process by promoting transparency and public involvement. It is important to note that the EIA process does not guarantee that a project will be modified or rejected if the process reveals that there will be serious environmental impacts. In some countries, a decision-maker may, in fact, choose the most environmentally-harmful alternative, as long as the consequences are disclosed in the EIA. In other words, the EIA process ensures an informed decision, but not necessarily an environmentally beneficial decision.

### **Benefits of the EIA Process**

- Potentially screens out environmentally-unsound projects
- Proposes modified designs to reduce environmental impacts
- Identifies feasible alternatives
- Predicts significant adverse impacts
- Identifies mitigation measures to reduce, offset, or eliminate major impacts
- Engages and informs potentially affected communities and individuals
- Influences decision-making and the development of terms and conditions

### **WHO PREPARES AN EIA?**

Depending on the EIA system, responsibility for producing an EIA will be assigned to one of two parties: (1) the government agency or ministry, or (2) the project proponent.

If EIA laws permit, either party may opt to hire a consultant to prepare the EIA or handle specific portions of the EIA process, such as public participation or technical studies. Some EIA laws recognize the inherent conflict of interest produced when a mining company or other project proponent hires a consultant to prepare an EIA.

Using a consultant carries the risk that the document will be biased in favour of proceeding with the project. If a consultant is hired by the mining company, conflicts may arise

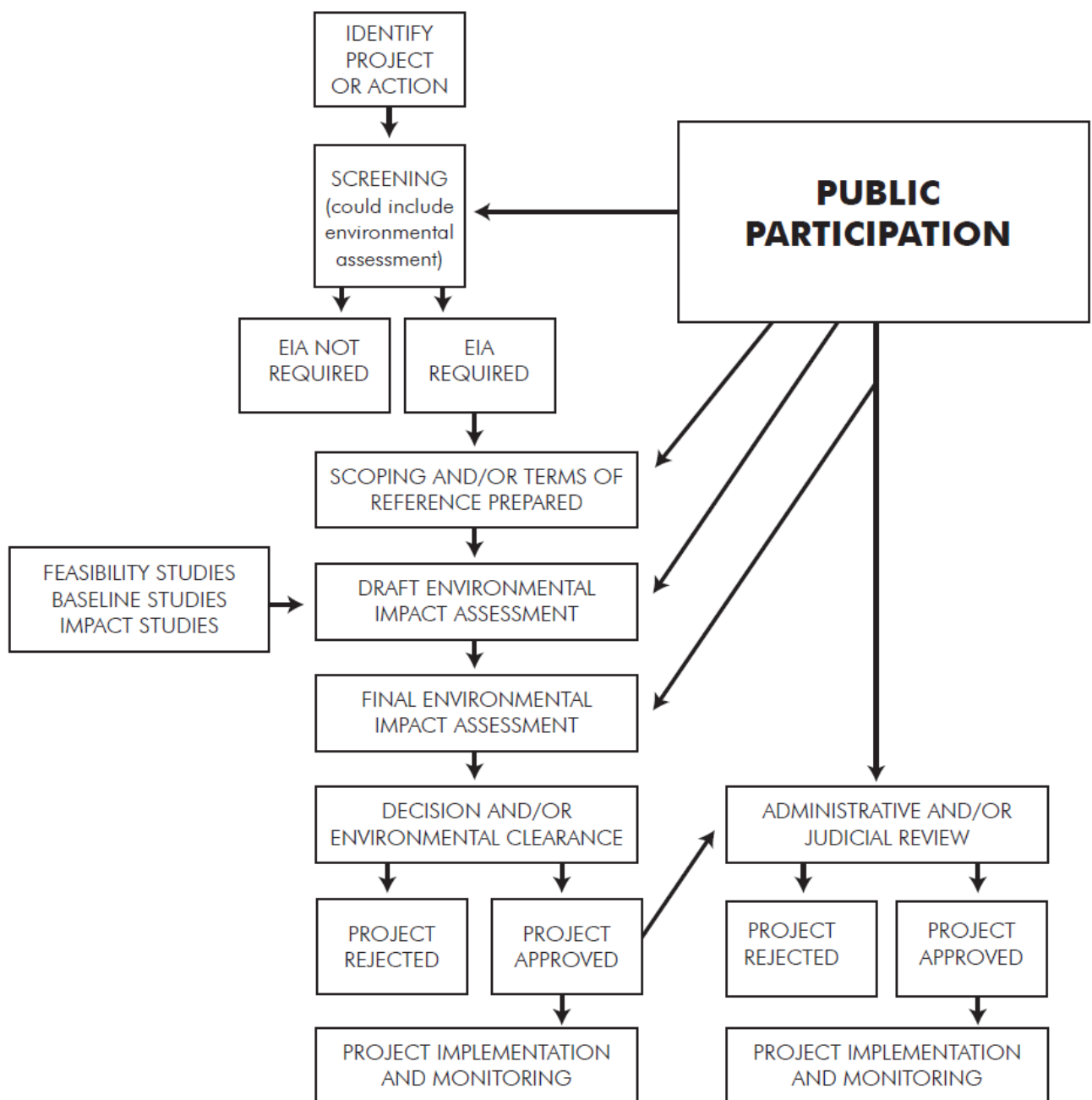


if the consultant believes it will receive future work if the project is approved, or even indirect benefits from related activities (e.g., consulting work for a port where ore will be exported). Some laws require consultants to be registered with the government and/or professionally accredited in EIA preparation. In some instances, a consultant may be required to file a statement disclosing any financial or other interest in the outcome of the project.

### STAGES OF THE EIA PROCESS

The EIA process, while not uniform from country to country, generally consists of a set of procedural steps culminating in a written impact assessment report that will inform the decision-maker whether to approve or reject a proposed project.

The flowchart below depicts the basic elements of good EIA practice :



### Identifying and Defining the Project or Activity

Although this step may seem relatively simple, defining a “project” for the purposes of an EIA can become complex and even controversial if a mining project is large, has several phases, or involves multiple sites. The goal of this step is to define the project with enough specificity to accurately determine the zone of possible impacts and to include activities that are closely connected with the proposal so that the entire scope of environmental impacts is evaluated.

## **Screening**

The screening process determines whether a particular project warrants preparation of an EIA. The threshold requirements for an EIA vary from country to country – some laws provide a list of the types of activities or projects that will require an EIA, others require an EIA for any project that may have a significant impact on the environment or for projects that exceed a certain monetary value. In some cases, particularly if the possible impacts of a project are not known, a preliminary environmental assessment will be prepared to determine whether the project warrants an EIA.

## **Scoping**

Scoping is a stage, usually involving the public and other interested parties, that identifies the key environmental issues that should be addressed in an EIA. This step provides one of the first opportunities for members of the public or NGOs to learn about a proposed project and to voice their opinions. Scoping may also reveal similar or connected activities that may be occurring in the vicinity of a project, or identify problems that need to be mitigated or that may cause the project to be cancelled.

## **Preparing Terms of Reference**

The Terms of Reference serve as a roadmap for EIA preparation and should ideally encompass the issues and impacts that have been identified during the scoping process. A draft Terms of Reference may be made available for public review and comment. Public review at this early stage of the process provides a key opportunity to ensure that the EIA is properly framed and will address issues of community concern.

### **Generally the terms of reference will include the following**

- A description of the project
- A list of the agencies or ministries responsible for overseeing the EIA process and making decisions
- The geographic area to be studied (also called the ‘impact zone’)
- EIA requirements in applicable laws or regulations
- Impacts and issues to be studied
- Mitigation and/or monitoring systems to be designed
- Provisions for public involvement
- Key stakeholders
- Timeframe for completing the EIA process
- Expected work product

## **Preparing Draft EIA**

A draft EIA is prepared in accordance with the Terms of Reference and/or the range of issues identified during the scoping process. The draft EIA must also meet the content requirements of the overarching EIA law or regulations. This step will ideally engage a wide range of technical specialists to evaluate baseline conditions, predict the likely impacts of the project, and design mitigation measures.

## **Public Participation**

Best EIA practice involves and engages the public at numerous points throughout the process with a two-way exchange of information and views. Public participation may consist of informational meetings, public hearings, and opportunities to provide written comments about a proposed project. However, there are no consistent rules for public participation among current EIA systems. Even within a particular country, there can be variations in the quality and extent of public involvement in the EIA process, depending on the type of project being considered, the communities that may be affected, or government agencies that are overseeing the project.

## **Preparing Final EIA**

This step produces a final impact assessment report that addresses the viewpoints and comments of the parties that reviewed the draft EIA. These comments may prompt revisions or additions to the text of the draft EIA. In some cases, the final EIA will contain an appendix summarizing all of the comments received from the public and other interested parties and provide responses to those comments.

## **Decision**

A decision to approve or reject a mining project is generally based on the final EIA, but in some instances, an environmental clearance may be just one step in the mine permitting process. The decision may be accompanied by certain conditions that must be fulfilled, such as posting a reclamation bond or filing an Environmental Management Plan.

## **Administrative or Judicial Review**

Depending on the jurisdiction, there may be opportunities for a party to seek administrative and/or judicial review of the final decision and the EIA process. An appeal may address procedural flaws in the EIA process, such as a failure to hold any required public hearings, or may point to substantive issues that the decision-maker failed to consider. A country's judicial review or administrative procedure act, or sometimes the EIA law itself, will usually identify the kinds of issues that can be raised in an appeal and the type of relief that may be granted.

## **Project Implementation**

Provided all regulatory requirements are met and permits are obtained, mine development will proceed following the project decision and once opportunities for administrative and/or judicial review are exhausted.

## **Monitoring**

Monitoring is an important part of project implementation. Monitoring serves three purposes: (1) ensuring that required mitigation measures are being implemented (2) evaluating whether mitigation measures are working effectively; and (3) validating the accuracy of models or projections that were used during the impact assessment process.

## **SOCIAL ISSUES**

India is the largest contributor to world population growth, adding about 17 million people every year to an already huge population of over one billion. Although more than two-thirds of India's population still lives in the rural areas, it has experienced rapid urbanization over the last two decades. India has attained food sufficiency in spite of its growing population. It has also created a large base of skilled scientific and technical human resources with a diversified industrial base. However, the benefits of this impressive growth have been substantially offset by environmental degradation.

Even though India has a rich tradition of environment conservation, large scale environment degradation has resulted from population pressures, industrialization and the indiscriminate use of forest areas for fuel, power generation and irrigation purposes. The spread of input-intensive green technology has given India, of a certain measure of food security, but it has been at the cost of falling water tables, degrading soils, poor management of irrigation systems and the harmful side-effects of increasing pesticide and fertiliser use. Industrial growth and uncontrolled urbanisation pollute water, air and land.

Similarly, rapid economic growth led to changing lifestyle such as increasing use of automobiles and plastics are also putting an immense stress on resources and the environment. All these circumstances raise the issue of how to achieve environmentally sustainable economic development. In this context, it is fundamental that policy-makers and the public understand how society and the economy have changed, and how they cause environmental degradation.

### **FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPMENT.**

Sustainable development has been defined as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, Brundtland Commission 1987). In other words, when people make decisions about how to use the Earth's resources such as forests, water, minerals, wildlife, etc. they must take into account not only how much of these resources they are using, what processes they used to get these resources, and who has access to these resources. Are enough resources going to be left for our future generations to use and will the environment be left as we know it today? Therefore, development plans have to ensure: sustainable and equitable use of resources for meeting the needs of the present and future generations without causing damage to environment.

The primary objective of sustainable development is to reduce the absolute poverty of the world's poor through providing lasting and secure livelihoods that minimize resource depletion, environmental degradation, cultural disruption and social instability.

It also considers the equity between countries and continents races and closes, gender and ages. It includes social and economic development. It is a process which leads to a better quality of life while reducing the impact on the environment.

To ensure sustainable development, any activity that is expected to bring about economic growth must also consider its environmental impacts for long term growth and development. Long term economic development is inter linked with environmental practices.

Practicing sustainable development poses a challenge because people must learn to live on the world's ecological interest and not on ecological capital. To accomplish sustainable development, a number of areas have to be organised.

Those are

1. Improving energy efficiency
2. Saving forests
3. Safeguarding biodiversity
4. Adopting water resources management
5. Managing coastal zones and ocean fisheries
6. Arresting pollution
7. Planning cities better
8. Accomplishing a second green revolution
9. Stabilizing world population
10. Stopping environmentally destructive subsidies

## **URBAN PROBLEMS RELATED TO ENERGY**

Cities are the main centres of economic growth, trade, education, innovations and employment. Until recently, a big majority of human population lived in rural areas and their economic activities cantered around agriculture, cattle rearing, fishing, hunting or some cottage industry. Now about 50 percent of the world population lives in urban areas and there is increasing movement of rural folk to cities in search of employment.

The urban growth is so fast that it is becoming difficult to accommodate all the industrial, commercial and residential facilities within a limited municipal boundary. As a result, there is spreading of the cities into the sub-urban or rural areas too, a phenomenon known as urban sprawl. In developing countries too urban growth is very fast and in most of the cases it is uncontrollable and unplanned growth. In contrast to the rural set-up the urban set-up is densely populated, consumes a lot of energy and materials and generates a lot of waste.

The energy requirements of urban population are much higher than that of rural ones. This is because urban people have a higher standard of life and their life style demands more energy inputs in every sphere of life.

The energy demanding activities include:

- i. Residential and commercial lighting.
- ii. Transportation means including automobiles and public transport for moving from residence to workplace.
- iii. Modern life-style using a large number of electrical gadgets in everyday life.
- iv. Industrial plants using a big proportion of energy.
- v. A large amount of waste generation which has to be disposed off properly using energy based techniques.
- vi. Control and prevention of air and water pollution which need energy dependent technologies.

Due to high population density and high energy demanding activities, the urban problems related to energy are much more magnified as compared to the rural population.

## **WATER CONSERVATION**

Water being one of the most precious and indispensable resources needs to be conserved. The following strategies can be adopted for conservation of water.

- i. Decreasing run-off losses: Huge water-loss occurs due to run-off on most of the soils, which can be reduced by allowing most of the water to infiltrate into the soil. This can be achieved by using contour cultivation, terrace farming, water spreading, chemical treatment or improved water-storage system.
- ii. Reducing evaporation losses: This is more relevant in humid regions. Horizontal barriers of asphalt placed below the soil surface increase water availability and increase crop yield by 35-40%. This is more effective on sandy soil but less effective on loamy sand soils. A co-polymer of starch and acrylonitrile called 'super slupher' has been reported to absorb water up to 1400 times its weight. The chemical has been found to be useful for sandy soils.
- iii. Storing water in soil: Storage of water takes place in the soil root zone in humid regions when the soil is wetted to field capacity. By leaving the soil fallow for one season water can be made available for the crop grown in next season.
- iv. Reducing irrigation losses
- v. Preventing wastage of water: This can be done in households, commercial buildings and public places.
- vi. Increasing block pricing: The consumer has to pay a proportionately higher bill with higher use of water. This helps in economic use of water by the consumers.
- vii. Rainwater harvesting
- viii. Watershed management

## **RESETTLEMENT AND REHABILITATION ISSUES**

Economic development raises the quality and standard of living of the people of a country. Developmental projects are planned to bring benefits to the society. However, in the process of development, very often there is over-exploitation of natural resources and degradation of the environment. Besides this, quite often, the native people of the project site are directly affected.

These native people are generally the poorest of the poor, under-privileged tribal people. Various types of projects result in the displacement of the native people who undergo tremendous economic and psychological distress, as the socio-economic and ecological base of the local community is disturbed.

#### **(a) Displacement problems due to dams**

The big river valley projects have one of the most serious socio-economic impacts due to large scale displacement of local people from their ancestral home and loss of their traditional profession or occupation. India is one of countries in the world leading in big dam construction and in the last 50 years more than 20 million people are estimated to have been directly or indirectly affected by these dams.

The Hirakund Dam has displaced more than 20,000 people residing in about 250 villages. The Bhakra Nangal Dam was constructed during 1950's and till now it has not been possible to rehabilitate even half of the displaced persons.

#### **(b) Displacement due to Mining**

Mining is another developmental activity, which causes displacement of the native people. Several thousands of hectares of land area is covered in mining operation and the native people are displaced. Sometimes displacement of local people is due to accidents occurring in mined areas like subsidence of land that often leads to shifting of people.

#### **(c) Displacement due to Creation of National Parks**

When some forest area is covered under a National Park, it is a welcome step for conservation of the natural resources. However, it also has a social aspect associated with it which is often neglected. A major portion of the forest is declared as core-area, where the entry of local dwellers or tribal's is prohibited. When these villagers are deprived of their ancestral right or access to the forests, they usually retaliate by starting destructive activities. There is a need to look into their problems and provide them some employment.

In India, most of the displacements have resulted due to land acquisition by the government for various reasons. For this purpose, the government has the Land Acquisition Act, 1894 which empowers it to serve notice to the people to vacate their lands if there is a need as per government planning. Provision of cash compensation in lieu of the land vacated exists in section 16 of the Act.

The major issues related to displacement and rehabilitation are as follows:

(i) Tribals are usually the most affected amongst the displaced who are already poor. Displacement further increases their poverty due to loss of land, home, jobs, food insecurity, loss of access to common property assets, increased morbidity and mortality and social isolation.

(ii) Break up of families is an important social issue arising due to displacement in which the women are the worst affected and they are not even given cash/land compensation.

(iii) The tribal's are not familiar with the market policies and trends. Even if they get cash compensation, they get alienated in the modern economic set-up.

(iv) The land acquisition laws ignore the communal ownership of property, which is an inbuilt system amongst the tribal's. Thus the tribal's lose their communitarian basis of economic and cultural existence. They feel like fish out of water.

(v) Kinship systems, marriages, social and cultural functions, their folk-songs, dances and activities vanish with their displacement. Even when they are resettled, it is individual-based resettlement, which to- tally ignores communal settlement.

(vi) Loss of identity and loss of the intimate link between the people and the environment is one of the biggest loss. The age-long indigenous knowledge, which has been inherited and experienced by them about the flora, fauna, their uses etc. gets lost.

There is a need to raise public awareness on these issues to bring the resettlement and rehabilitation plans on a humane footing and to honour the human rights of the ousters.

## **CLIMATE CHANGE**

Climate is the average weather of an area. It is the general weather conditions, seasonal variations and extremes of weather in a region. Such conditions which average over a long period- at least 30 years is called climate. Anthropogenic (man-made) activities are upsetting the delicate balance that has established between various components of the environment. Green house gases are increasing in the atmosphere resulting in increase in the average global temperature. This may upset the hydrological cycle, result in floods and droughts in different regions of the world, cause sea level rise, changes in agriculture productivity, famines and death of humans as well as live stock.

The global change in temperature will not be uniform everywhere and will fluctuate in different regions. The places at higher latitudes will be warmed up more during late autumn and winter than the places in tropics. Poles may experience 2 to 3 times more warming than the global average, while warming in the tropics may be only 50 to 100% on an average. The increased warming at poles will reduce the thermal gradient between the equator and high latitude regions decreasing the energy available to the heat engine that drives the global weather machine. This will disturb the global pattern of winds and ocean currents as well as the timing and distribution of rainfall. Shifting of ocean currents may change the climate of Iceland and Britain and may result in cooling at a time when rest of the world warms. By a temperature increase of 1.5 to 4.5°C the global hydrological cycle is expected to intensify by 5 to 10%. Disturbed rainfall will result in some areas be- coming wetter and the others drier. Although rainfall may increase, higher temperatures will result in more evapotranspiration leading to annual water deficit in crop fields. Climatic change may also leads to global warming, acid rains and ozone layer depletion.



## **NUCLEAR ACCIDENTS AND HOLOCAUST**

Nuclear accidents can occur at any stage of the nuclear fuel cycle. However, the possibility of reactor accidents is viewed more seriously because the effects of reactor accidents are more drastic.

Many estimates of hypothetical accidents in a nuclear power station are made. Such estimates are made taking into consideration various parameters like reactor safety measures which if fail would release large amount of reactor contents, that is, radioactive debris affecting a substantial portion of human population within a particular site in a particular area.

The modern fusion bombs (nuclear bombs) are of the explosive force of 500 kilotons and 10 megatons. In case of a world war total nuclear exchange of more than 5,000 megatons can be expected. Nuclear bombardment will cause combustion of wood, plastics, petroleum, forests etc. Large quantity of black soot will be carried to the stratosphere.

Black soot will absorb solar radiations and won't allow the radiations to reach the earth. Therefore, cooling will result. The infrared radiations which are re-radiated from the atmosphere to the earth will have very less water vapours and carbon dioxide to absorb them. If they leave the lower atmosphere the green house effect will be disturbed and cooling will occur.

Due to this cooling effect, water evaporation will also reduce. Therefore, infra-red radiations absorbing water vapours will reduce in the atmosphere. This will also cause cooling. In the stratosphere there won't be significant moisture to rainout the thick soot. So, due to nuclear explosions, a phenomenon opposite to global warming will occur. This is called nuclear winter. It may result in lower global temperature. Even the summer time will experience freezing temperature. It will drastically affect crop production. Crop productivity will reduce substantially causing famines and human sufferings.

## **WASTELAND RECLAMATION**

Economically unproductive lands suffering from environmental deterioration are known as wastelands. The wastelands include salt affected lands, sandy areas, gullied areas, undulating uplands, barren hill-ridge etc. Snow covered areas, glacial areas and areas rendered barren after Jhum cultivation are also included in wastelands. More than half of our country's geographical area (about 175 million ha) is estimated to be wasteland, thus indicating the seriousness of the problem for a country like ours which has to support 1/6th of the world's population.

Maximum wasteland areas in our country lie in Rajasthan (36 million ha) followed by M.P. and Andhra Pradesh. In Haryana the wastelands cover about 8.4% of the total land area and most of it comprises saline, sodic or sandy land areas.

Wastelands are formed by natural processes, which include undulating uplands, snow-covered lands, coastal saline areas, sandy areas etc. or by anthropogenic (man-made) activities leading to eroded, saline or waterlogged lands.

The major anthropogenic activities leading to waste land formation are deforestation, overgrazing, mining and erroneous agricultural practices. Although deserts are wastelands formed by natural process, but there are many human activities which accelerate the spreading of desert. Hence, wasteland practices have to be adopted for effective utilization of resources.

## **CONSUMERISM AND WASTE PRODUCTS**

Consumerism refers to the consumption of resources by the people. While early human societies used to consume much less resources, with the dawn of industrial era, consumerism has shown an exponential rise. It has been related both to the increase in the population size as well as increase in our demands due to change in life-style. Earlier we used to live a much simpler life and used to have fewer wants. In the modern society our needs have multiplied and so consumerism of resources has also multiplied.

Our population was less than 1 million for thousands of years ever since we evolved on this earth. Today we have crossed the six billion mark and are likely to reach 11 billion by 2045 as per World Bank estimates. Let us see how the changing population trends influence consumerism of natural resources and generation of wastes.

Two types of conditions of population and consumerism exist.

(i) People over-population: It occurs when there are more people than available supplies of food, water and other important resources in the area. Excessive population pressure causes degradation of the limited resources, and there is absolute poverty, under-nourishment and premature deaths.

This occurs in less developed countries (LDCs). Here due to large number of people, adequate resources are not available for all. So there is less per capita consumption although overall consumption is high.

(ii) Consumption over-population: This occurs in the more developed countries (MDCs). Here population size is smaller while resources are in abundance and due to luxurious life-style per capita consumption of resources is very high. More the consumption of resources more is the waste generation and greater is the degradation of the environment.

## **DISASTER MANAGEMENT**

Natural calamities, of different types and intensities affect nations all over the world. The Indian subcontinent is very vulnerable to droughts, floods, cyclones, earthquakes, landslides, and forest fires. While not all natural calamities can be predicted and prevented, a state of preparedness and ability to respond quickly to natural calamity can considerably mitigate loss of life and property and human suffering, and restore normalcy at the earliest.

### **‘Post Disaster Management’ and ‘Disaster Mitigation’**

The post disaster approach towards dealing with natural disasters, involving problems such as evacuation, warnings, communications, search and rescue, fire- fighting, medical and psychiatric assistance, provision of relief, shelter, etc, is generally referred to as ‘Post Disaster Management’ . It is a primarily a ‘Reactive Mechanism’ to the natural disasters.

‘Mitigation’ means lessening the negative impact of the natural hazards. It is defined as sustained action taken to reduce long term vulnerability of human life and the recovery property to natural hazards. While the preparatory, response and the recovery phases of emergency management relate to specific events. Mitigation activities have the potential to produce repetitive benefits over time. It is a ‘Proactive approach’ to natural disasters

### **Multidisciplinary and Multi- sectoral nature of Disaster Management**

Disaster management is a multidisciplinary area in which a wide range of issues that range from forecasting, warning, evacuation, search and rescue, relief, reconstruction and rehabilitation are included. It is also multi-sectoral as it involves administrators, scientists, planners, volunteers and communities.

### **Guidelines for effective management of mitigation program**

1. Pre- disaster mitigation can help in ensuring foster recovery from the impacts of disasters.
2. Mitigation measures must ensure protection of the natural and cultural assets of the community
3. Hazard reduction methods must take into account the various hazards faced by the affected community & their desires and priorities
4. Any mitigation programme must also ensure an effective partnership between the Govt, Scientific, private sector, NGOs and the community

### **The main elements of a mitigation strategy**

1. Risk assessment and Vulnerability analysis: This involves the identification of hotspot areas of prime concern, collection of information on past natural hazards, information on the population and infrastructure.
2. Applied research and technology transfer: There is a need to establish or upgrade observation equipment and networks, monitor the hazardous properly, improve the quality of forecasting and warning.

3. Public awareness and training: Training to be given to officials & staff of various Departments involved in state & district level.
4. Institutional mechanisms: There is need to emphasize on proactive and pre-disaster measures rather than post-disaster response. It is thus essential to have a permanent administrative structure which can monitor the developmental activities across departments and provides suggestions for necessary mitigation measures. The national disaster management centre (NDMC) can perform such a task. Professional like architects, structural engineers, doctors and chemical engineers who are involved with management of hazardous chemicals, can be asked to form groups that can design specific mitigation measures.
5. Incentives and resources for mitigation: Provide stable source of funding for all mitigation programs.
6. Land use planning and regulations .
7. Hazard resistant design and construction.
8. Structural and Constructional reinforcement of existing buildings: This can be done by the insertion of walls, specially on chored frames, construction of new frame systems, designing residential electrical equipment above flood level, designing water storage tanks to be able to withstand cyclonic winds, earthquakes & floods.

**Some of the causes, effects and mitigation measures of the disasters commonly occurring in India are detailed below**

**FLOODS:** Floods can be caused by natural, ecological or anthropogenic factors either individually or as a combined result. Human activities such as deforestation and shifting cultivation can also contribute to floods. Heavy rainfall is the main cause of floods in the rivers. The breaches to tanks and reservoirs due to inflow of large quantities of water from excessive rainfall also result in floods. Floods occur sometimes in a flash due to intensive rains at the time of cyclones next to Bangladesh, India is the most flood – affected country in the world. The west coast of India has an advantage, it has western ghats with thick forests which act as natural buffer to floods.

*Effects:* floods cause heavy suffering to people living in low lying areas because the houses and the properties are inundated or washed away. Most of the victims are rural folks who are economically poor. Floods also damage standing crops and livestock.



The *mitigation measures* for floods include both structural and non structural measures. The structural measures include

1. Reservoirs for impounding monsoon flows to be released in a regular manner after the peak flood flow passes.
2. Prevention of over –bank spilling by the construction of embankments and flood walls.
3. Improvement of flow conditions in the channel and anti erosion measures.
4. Improved drainage

Non-Structural measures include

1. Flood-plain management such as Flood Plain zoning and flood proofing including disaster preparedness.
2. Maintaining wet lands.
3. Flood forecasting and warning services.
4. Disaster relief and public health measures.
5. Flood insurance.

### ***Case study***

*Since 2006, Mumbai faces flooding in most of the Suburban Locations Like Andheri, Dahisar, Goregaon, Malad Subway, Milan Subway, Santacruz, Chembur, Dombivali, Worli etc which are low line areas and also highly affected during Monsoon and Heavy rainfall. Because of Unstable weather, Mismanagement of Natural Resources by People, Old or No proper drainage systems and Real Estate development, Mumbai is underwater Mostly every year even if Bombay Municipal Corporation tries it level best to help the disaster.*

*Flood 2006 will never be forgotten by any person who was in Mumbai during the day, everything was like stand Still, the Transportation, Private Vehicles, Mobile Services and all major communication and transport channels stopped. Still salute to mumbaikers for the Humanity shown that day by helping each others at their level best. Someone helped giving Biscuits and Few by preparing whatever fast food like Vada pav, samosas etc. Lots of NGO's and Private organizations came up for the help. All this happened within couple of hours of very heavy rain in Mumbai. Many lost their lives and many saved it loosing just their belongings like Mobiles and bags etc. Every person stayed where they were for next 24 hours.*

*Flood 2007 of Mumbai was not as hard as 2006, few of the slums and people staying in low line ground floor locations faced terrible problems. People of Mumbai are now tough enough to face such flooding disaster's and bomb blasts and Epidemics and Diseases because of flood. Mumbai Flood Pictures can speak much better than this article.*

*Now in 2008 and 2009 Flooding in Mumbai is comparatively low because of not so heavy rainfall. Almost opposite situation like cloud seeding experiments are undertaken to save Mumbai from low rainfall.*

**EARTH QUAKES:** An abrupt and tremendous release of energy stored in the rocks and the earth's crust through the action of tectonic process is described as an earth quake. Some areas on the planet earth are so located that more than one tectonic plate constantly change against one another and an earthquake can result when one or more of these plates move against the others at high speed. In certain regions of earth, earth quakes occur with regularity. In India, Assam and the Himalayan regions are more infested with earthquakes. The intensity of earth quake is measured on Richter scale. As of now there is no way of predicting an earth quake. Earthquake by themselves do not cause casualties but the houses collapse due to poor construction. The construction of quake-proof houses may reduce human loss but it may be economically difficult for poor countries. The Government of countries which are quake prone should ensure that the infrastructure could withstand earth quakes.

### **Case Study**

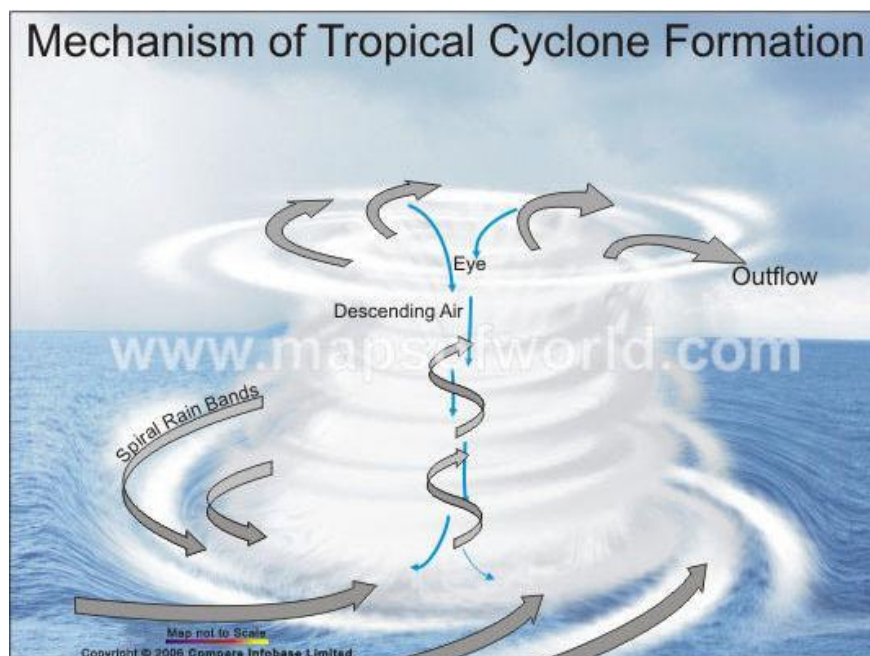
*On 26 January 2001 an earthquake registering 7.9 on the Richter scale devastated the Indian state of Gujarat. It was the second largest recorded earthquake in India, the largest being in 1737, and was the worst natural disaster in India in more than 50 years.*

*The earthquake struck at approximately 8.46am local time, its epicentre located 80 kilometres north-east of the city of Bhuj .The place in the earth's crust where an earthquake occurs is known as the focus. The epicentre of an earthquake is the place directly above the focus. The shock waves or tremors from the Gujurat earthquake lasted about two minutes, followed by aftershocks for more than a month. The scale of the impact of the earthquake is almost impossible to comprehend. The shock or seismic waves spread out in a 700 kilometre circumference from the epicentre, and within this area the devastation was immense. There were more than 20,000 deaths and 167,000 people injured. Four districts of Gujarat lay in ruin and altogether, 21 districts were affected.*



*Around 300,000 families and at least 3 million children aged 14 and under were affected. Around 600,000 people were left homeless. In the city of Bhuj, more than 3,000 inhabitants of the city lost their lives, the main hospital was crushed and close to 90% of the buildings was destroyed. Nothing was left of the town of Bhachau. The town resembled a quarry. Few structures remained standing.*

**CYCLONES:** Cyclone is a meteorological phenomena of intense depressions forming over the open oceans and moving towards the land on the shore. In reaching the shores, it moves into the interior of the land or along the shorelines. The cyclone once formed may be active from days to weeks and affects many days to weeks and affects many areas, even countries depending on the nature and the intensity. Globally North West pacific regions are more prone to cyclones. The Indian Ocean is one of the six major cyclone prone regions of the world. India has a long coastline of 5700 kms, which is exposed to tropical cyclones arising in the Bay of Bengal and the Arabian Sea. The eastern coastline is more prone to cyclones as it is hit by about 80 percent of the total cyclones generated in the region. In India, cyclones originating from Bay of Bengal are more in number and intensity. In India, cyclones occur usually between April and May and also between October and December. The damage depends on the intensity of cyclone, the damage to human life, crops, settlements roads, communications, tanks, canals, and livestock sometimes their occurrence slow down the developmental activities of the areas.



***Mitigation measures are:***

- Installation of early warning systems
- Developing communication infrastructure
- Developing shelter belts
- Construction of permanent houses
- Training and education land use control and settlement planning.

**LAND SLIDES:** They are recurring phenomena in Himalayan region. It is a geological process which includes a wide range of mass movements, such as rock falls, deep failure of slopes and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors affecting the original slope stability erosion by rivers, glaciers, or ocean waves create over steepened slopes. In recent years, however, intensive construction activity and the destabilizing forces of nature have aggravated the problem. Landslides occur as a result of changes on the slope, sudden or gradual either in its composition, structure, hydrology or vegetation. The changes can be due to geology, climate, weathering, changing land use and earth quakes.

- § Rock and soil slopes are weakened through saturation by snowmelt or heavy rains earthquakes create stresses that make weak slopes fail.
- § Volcanic eruptions produce loose ash deposits, heavy rain, and debris flows.
- § Vibrations from traffic, machinery, thunder and blasting can trigger weak slopes.
- § Groundwater pressure acting to destabilize the slope.
- § Excess weight from accumulation of rain or snow, stockpiling of rock or ore, from waste piles, or from man- made structures may stress weak slopes to failure and other structures.

**Measures to prevent landslides** are drainage measures, erosion control measures such as bamboo check dams, terracing, jute and coir netting and rock fall control measures such as grass plantation, vegetated dry masonry walls, preventing deforestation and improving forestation. A significant reduction in the hazards caused by landslides can be achieved by preventing the exposure of population and by physically controlling the land slides.





**TSUNAMI** The term Tsunami comes from the Japanese language, meaning harbor (*tsu*) and wave (*nami*). A Tsunami is generated when the sea floor abruptly deforms and vertically displaces the overlying water. It is the wave disturbance that rapidly displaces a large mass of water like an undersea earth quake, volcanic eruption or submarine land slide. Tectonic earthquakes are a particular kind of earthquakes that are associated with earth's crustal deformation; when these earthquakes occur beneath the sea, the water above the deformed area is displaced from its equilibrium position. Waves are formed as the displaced water mass, which acts under the influence of gravity attempts to regain its equilibrium. When large areas of the sea floor elevate or subside, a tsunami can be created. Tsunami wave can travel at the speed of a commercial jet plane, over 800 km/h. they can move from one side of the pacific ocean in less than a day. The waves can be extremely dangerous and damaging when they reach the shore. The wave travels across the ocean at speed of 500-1000 km/ha. As the wave approaches the land, it compresses-some times upto a highest of 30mts and the sheer weight of water is enough the crush the objects in its path, often reducing the building to their foundations and scouring exposed ground to the bed rock. When there is a tsunami warning:

1. If you are at home and there is a tsunami warning, you should make sure your entire family is aware of the tsunami. Your family should evacuate your house if you live in a tsunami evacuation zone.
2. If you are at the beach or near the ocean and you feel the earth shake, move immediately to higher ground. Do not wait for a tsunami warning to be announced.
3. If you are on a ship or boat, do not return to port if you are at sea and a tsunami warning has been issued for your area. Tsunami can cause rapid changes in water level and unpredictable dangerous current in harbours and ports.



## **Case Study**

*On the morning of Sunday, 26 December 2004, there was a severe earthquake in the Indian Ocean off the coast of northern Sumatra, Indonesia. The earthquake measured 9.0 on the Richter scale and was followed by aftershocks ranging from 6.3 to 7.0 in severity in a zone 1,000 kilometres north to the Andaman Islands. The underwater earthquake also resulted in a powerful tsunami ('soo-na-mi', from the Japanese words meaning 'harbour wave'). The wave travelled quickly under the ocean, building to a wall of water up to 10 metres high when it reached the shallow coastal waters and causing massive destruction when it hit land. Without an effective warning system and disaster plan, many people did not know to move quickly to higher ground to escape the wave and its load of debris. In some places the sea receded for hundreds of metres before the wave rushed in. Curious people looking at this strange occurrence from the beaches did not recognise this as a sign of danger, and as a result were killed by the tsunami. The tsunami caused extraordinary damage.*

*The death toll was put at roughly 187,000, with nearly 43,000 missing and many hundreds of thousands injured and suffering trauma and the grief of losing family members, their homes and their livelihoods. Countries lost people with the knowledge and skills that were needed for their ongoing development. Roads, bridges, water and electricity supplies, health centres and schools were destroyed. The landscape was altered unrecognisably, with some areas lifted high out of the water while others were washed entirely away. Debris and waste were scattered widely and salt inundated farmland and underground water supplies. One of the most severely affected areas was that closest to the epicentre, the province of Aceh on Sumatra, Indonesia. More than 130,000 people died and 36,786 were still missing in December 2005.*

*The highest tolls were among the women and children who were in the low lying coastal areas while their husbands were at sea fishing. Over 800 kilometres of coast was severely affected, often up to five kilometres inland. At least 654 villages were damaged or destroyed, more than 500,000 people lost their homes, and more than 150,000 children were left without schools. To add to the devastation an earthquake measuring 8.7 on the Richter scale struck the west coast of Sumatra near the island of Nias on 28 March 2005.*

