


## UNIT-IV

### SOCIAL ISSUES AND ENVIRONMENT

Human beings live in both natural and social world. Our technological development has strong impacts on the natural as well as the social components. When we talk of development, it cannot be perceived as development only for a privileged few who would have a high standard of living and would derive all the benefits. Development also does not mean an increase in the GNP (Gross National Product) of a few affluent nations. Development has to be visualized in a holistic manner, where it brings benefits to all, not only for the present generation, but also for the future generations. There is an urgent need to inter-link the social aspects with development and environment. In this unit we shall discuss various social issues in relation to environment.

#### FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPMENT

*Sustainable development is defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs.* This definition was given by the Norwegian Prime Minister, G.H. Brundtland, who was also the Director of World Health Organisation (WHO). Today sustainable development has become a buzz word and hundreds of programmes have been initiated in the name of sustainable development. If you want to test whether or not a proposal will achieve the goals of sustainability just try to find out the following. Does it protect our biodiversity? Does it prevent soil erosion? Does it slow down population growth? Does it increase forest cover? Does it cut off the emissions of CFC, SO<sub>x</sub>, NO<sub>x</sub> and CO<sub>2</sub>? Does it reduce waste generation and does it bring benefits to all? These are only a few parameters for achieving sustainable growth. Until now development has been human-oriented, that too mainly, for a few rich nations. They have touched the greatest heights of scientific and technological development, but at what cost? The air we breathe, the water we drink and the food we eat have all been badly polluted. Our natural resources are just dwindling due to over exploitation. If growth continues in the same way, very soon we will be facing a doom's day - as suggested by Meadows et al (1972) in their world famous academic report *The Limits to Growth*. This is unsustainable development which will lead to a collapse of the interrelated systems of this earth. Although the fears about such unsustainable growth and development started in 1970's, yet a clear discussion on sustainable development emerged on an international level in 1992, in the UN Conference on Environment and Development (UNCED), popularly known as The Earth Summit, held at Rio de Janeiro, Brazil. The Rio Declaration aims at a new and equitable global partnership through the creation of new levels of cooperation among states. Out of its five significant agreements Agenda-21 proposes a global programme of action on sustainable development in social, economic and political context for the 21st Century. These are the key aspects for sustainable development:

 Inter-generational equity: This emphasizes that we should minimize any adverse impacts on resources and environment for future generations i.e. we should hand over a safe, healthy and resourceful environment to our future generations. This can be possible only if we stop over-exploitation of resources, reduce waste discharge and emissions and maintain ecological balance.

(b) Intra-generational equity: This emphasizes that the development processes should seek to minimize the wealth gaps within and between nations. The Human Development Report of United Nations (2001) emphasizes that the benefits of technology should seek to achieve the goals of intra-generational equity. The technology should address the problems of the developing countries, producing drought tolerant varieties for uncertain climates, vaccines for infectious diseases, clean fuels for domestic and industrial use. This type of technological development will support the economic growth of the poor countries and help in narrowing the wealth gap and lead to sustainability. Measures for Sustainable Development: Some of the important measures for sustainable development are as follows:

Using appropriate technology is one which is locally adaptable, eco-friendly, resource-efficient and culturally suitable. It mostly involves local resources and local labour. Indigenous technologies are more useful, cost-effective and sustainable.

Nature is often taken as a model, using the natural conditions of that region as its components. This concept is known as design with nature. The Technology should use less of resources and should produce minimum waste.

**Reduce, Reuse, Recycle approach:** The 3-R approach advocating minimization of resource use, using them again and again instead of passing it on to the waste stream and recycling the materials goes a long way in achieving the goals of sustainability. It reduces pressure on our resources as well as reduces waste generation and pollution.

**Prompting environmental education and awareness:** Making environmental education the centre of all learning process will greatly help in changing the thinking and attitude of people towards our earth and the environment. Introducing the subject right from the school stage will inculcate a feeling of belongingness to earth in the small children. 'Earth thinking' will gradually get incorporated in our thinking and action which will greatly help in transforming our life styles to sustainable ones.

**Resource utilization as per carrying capacity:** Any system can sustain a limited number of organisms on a long-term basis which is known as its carrying capacity. In case of human beings, the carrying capacity concept becomes all the more complex. It is because unlike other animals, human beings, not only need food to live, but need so many other things to maintain the quality of life. Sustainability of a system depends largely upon the carrying capacity of the system. If the carrying capacity of a system is crossed (say, by over exploitation of a resource), environmental degradation starts and continues till it reaches a point of no return.

Carrying capacity has two basic components: A) Supporting capacity i.e. the capacity to regenerate B) Assimilative capacity i.e. the capacity to tolerate different stresses. In order to attain sustainability it is very important to utilize the resources based upon the above two properties of the system. Consumption should not exceed regeneration and changes should not be allowed to occur beyond the tolerance capacity of the system.

## URBAN PROBLEMS RELATED TO ENERGY

Cities are the main centers of economic growth, trade, education, innovations and employment. Until recently, a big majority of human population lived in rural areas and their economic activities centered around agriculture, cattle rearing, fishing, hunting or some cottage industry. It was some 200 years ago, with the dawn of Industrial era, the cities showed a rapid development. 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.

## RAINWATER HARVESTING

Rainwater harvesting is a technique of increasing the recharge of groundwater by capturing and storing rainwater. This is done by constructing special water-harvesting structures like dug wells, percolation pits, lagoons, check dams etc. Rainwater, wherever it falls, is captured and pollution of this water is prevented.

Rainwater harvesting has the following objectives:

- (i) to reduce run off loss
- (ii) to avoid flooding of roads
- (iii) to meet the increasing demands of water
- (iv) to raise the water table by recharging ground water
- (v) to reduce groundwater contamination
- (vi) to supplement groundwater supplies during lean season.

Rainwater can be mainly harvested by any one of the following methods:

- (i) by storing in tanks or reservoirs above or below ground.
- (ii) by constructing pits, dug-wells, lagoons, trench or check-dams on small rivulets
- (iii) by recharging the groundwater.

## **WATERSHED MANAGEMENT**

The land area drained by a river is known as the river basin. The watershed is defined as the land area from which water drains under gravity to a common drainage channel. Thus, watershed is a delineated area with a well-defined topographic boundary and one water outlet. The watershed can range from a few square kilometers to few thousand square kilometers in size. In the watershed the hydrological conditions are such that water becomes concentrated within a particular location like a river or a reservoir, by which the watershed is drained. The watershed comprises complex interactions of soil, landform, vegetation, land use activities and water. People and animals are an integral part of a watershed having mutual impacts on each other. We may live anywhere, we would be living in some watershed. A watershed affects us as it is directly involved in sustained food production, water supply for irrigation, power generation, transportation as well as for influencing sedimentation and erosion, vegetation growth, floods and droughts. Thus, management of watersheds, treating them as a basic functional unit, is extremely important and the first such Integrated Watershed Management was adopted in 1949 by the Damodar Valley Corporation. Watershed degradation: The watersheds are very often found to be degraded due to uncontrolled, unplanned and unscientific land use activities. Overgrazing, deforestation, mining, construction activities, industrialization, shifting cultivation, natural and artificial fires, soil erosion and ignorance of local people have been responsible for degradation of various watersheds. Objectives of Watershed Management: Rational utilization of land and water resources for optimum production causing minimum damage to the natural resources is known as watershed management.

The objectives of watershed management are as follows:

- (i) To rehabilitate the watershed through proper land use adopting conservation strategies for minimizing soil erosion and moisture retention so as to ensure good productivity of the land for the farmers.
- (ii) To manage the watershed for beneficial developmental activities like domestic water supply, irrigation, hydropower generation etc.
- (iii) To minimize the risks of floods, droughts and landslides.
- (iv) To develop rural areas in the region with clear plans for improving the economy of the region. Watershed Management Practices In the Fifth Five Year Plan, watershed management approach was included with a number of programmes for it and a national policy was developed. In watershed management, the aspects of development are considered with regard to the availability of resources. The practices of conservation and development of land and water are taken up with respect to their suitability for peoples' benefit as well as sustainability.

**RESETTLEMENT AND REHABILITATION ISSUES Problems and Concerns**  
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, underprivileged 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. Same is the case with Tehri Dam on the river Bhagirathi, construction of which was green signalled after three decades of long campaign against the project by the noted activist Sunderlal Bahuguna the propagator of Chipko Movement. The immediate impact of the Tehri Dam would be on the 10,000 residents of the Tehri town. While displacement is looming large over the people, rehabilitation has become a more burning issue.

(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 tribals 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.

## **REHABILITATION ISSUES**

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.
- (ii) Displacement further increases their poverty due to loss of land, home, jobs, food insecurity.
- (iii) 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.
- (iv) The tribals are not familiar with the market policies and trends. Even if they get cash compensation, they get alienated in the modern economic set-up.

(v) The land acquisition laws ignore the communal ownership of property, which is an inbuilt system amongst the tribals. Thus the tribals lose their communitarian basis of economic and cultural existence.

(vi) 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 totally ignores communal settlement.

(vii) 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. Rehabilitation Policy There is a need for a comprehensive National Rehabilitation Policy.

### **ENVIRONMENTAL ETHICS—Issues and Possible Solutions**

Environmental ethics refers to the issues, principles and guidelines relating to human interactions with their environment. It is rightly said, The environmental crisis is an outward manifestation of the crisis of mind and spirit. It all depends on how do we think and act. If we think Man is all powerful and the supreme creature on this earth and man is the master of nature and can harness it at his will, it reflects our human-centric thinking. On the other hand, if we think Nature has provided us with all the resources for leading a beautiful life and she nourishes us like a mother, we should respect her and nurture her, this is an earth-centric thinking. The first view urges us to march ahead gloriously to conquer the nature and establish our supremacy over nature through technological innovations, economic growth and development without much botheration to care for the damage done to the planet earth. The second view urges us to live on this earth as a part of it, like any other creation of Nature and live sustainably. So, we can see that our acts will follow what we think. If we want to check the environmental crisis, we will have to transform our thinking and attitude. That in turn, would transform our deeds, leading to a better environment and better future. These two world-views are discussed here in relation to environmental protection: (a) Anthropocentric Worldview: This view is guiding most industrial societies. It puts human beings in the center giving them the highest status. Man is considered to be most capable for managing the planet earth. The guiding principles of this view are: (i) Man is the planet's most important species and is the in-charge of the rest of nature.

(ii) Earth has an unlimited supply of resources and it all belongs to us.

(iii) Economic growth is very good and more the growth, the better it is, because it raises our quality of life and the potential for economic growth is unlimited.

(iv) A healthy environment depends upon a healthy economy.

(v) The success of mankind depends upon how good managers we are for deriving benefits for us from nature.

(b) Eco-centric Worldview: This is based on earth-wisdom. The basic beliefs are as follows:

(i) Nature exists not for human beings alone, but for all the species.

(ii) The earth resources are limited and they do not belong only to human beings.

(iii) Economic growth is good till it encourages earth-sustaining development and discourages earth-degrading development.



(iv) A healthy economy depends upon a healthy environment.

(v) The success of mankind depends upon how best we can cooperate with the rest of the nature while trying to use the resources of nature for our benefit.

Environmental ethics can provide us the guidelines for putting our beliefs into action and help us decide what to do when faced with crucial situations. Some important ethical guidelines known as Earth ethics or Environmental Ethics are as follows:

You should love and honour the earth since it has blessed you with life and governs your survival.

You should keep each day sacred to earth and celebrate the turning of its seasons.

You should not hold yourself above other living things and have no right to drive them to extinction.

You should be grateful to the plants and animals which nourish you by giving you food.

You should limit your offsprings because too many people will overburden the earth.

You should not waste your resources on destructive weapons.

You should not run after gains at the cost of nature, rather should strive to restore its damaged majesty.

You should not conceal from others the effects you have caused by your actions on earth.

You should not steal from future generations their right to live in a clean and safe planet by impoverishing or polluting it.

You should consume the material goods in moderate amounts so that all may share the earth's precious treasure of resources.

If we critically go through the above ten commandments for earth ethics and reflect upon the same, we will find that various religions teach us the same things in one form or the other. Our Vedas have glorified each and every component of nature as gods or goddesses so that people have a feeling of reverence for them. Our religious and cultural rituals make us perform such actions that would help in the conservation of nature and natural resources. The concept of ahimsa (non-violence) in Buddhism and Jainism ensure the protection and conservation of all forms of life, thereby keeping the ecological balance of the earth intact.

Our teachings on having fewer wants ensures to put limits to growth and thus, guide us to have an eco-centric life style.

## **GLOBAL WARMING**

Troposphere, the lowermost layer of the atmosphere, traps heat by a natural process due to the presence of certain gases. This effect is called Green House Effect as it is similar to the warming effect observed in the horticultural green house made of glass. The amount of heat trapped in the atmosphere depends mostly on the concentrations of heat trapping, or green house, gases and the length of time they stay in the atmosphere. The major green house gases are carbon dioxide, ozone, methane, nitrous oxide, chlorofluorocarbons (CFCs) and water vapours.

### **Carbon dioxide**

It contributes about 55% to global warming from green house gases produced by human activity. Industrial countries account for about 76% of annual emissions. The main sources are fossil fuel burning (67%) and deforestation, other forms of land clearing and

burning (33%). CO<sub>2</sub> stays in the atmosphere for about 500 years. CO<sub>2</sub> concentration in the atmosphere was 355 ppm in 1990 that is increasing at a rate of 1.5 ppm every year.

### **Chlorofluorocarbons (CFCs)**

These are believed to be responsible for 24% of the human contribution to greenhouse gases. They also deplete ozone in the stratosphere. The main sources of CFCs include leaking air conditioners and refrigerators, evaporation of industrial solvents, production of plastic foams, aerosols, propellants etc. CFCs take 10-15 years to reach the stratosphere and generally trap 1500 to 7000 times more heat per molecule than CO<sub>2</sub> while they are in the troposphere. This heating effect in the troposphere may be partially offset by the cooling caused when CFCs deplete ozone during their 65 to 110 years stay in the stratosphere. Atmospheric concentration of CFC is 0.00225 ppm that is increasing at a rate of 0.5% annually.

### **Methane (CH<sub>4</sub>)**

It accounts for 18% of the increased greenhouse gases. Methane is produced when bacteria break down dead organic matter in moist places that lack oxygen such as swamps, natural wetlands, paddy fields, landfills and digestive tracts of cattle, sheep and termites. Production and use of oil and natural gas and incomplete burning of organic material are also significant sources of methane. Methane stays in the atmosphere for 7-10 years. Each methane molecule traps about 25 times as much heat as a CO<sub>2</sub> molecule. Atmospheric concentration of methane is 1.675 ppm and it is increasing at a rate of 1% annually.

### **Nitrous Oxide (N<sub>2</sub>O)**

It is responsible for 6% of the human input of green house gases. Besides trapping heat in the troposphere it also depletes ozone in the stratosphere. It is released from nylon products, from burning of biomass and nitrogen rich fuels ( especially coal ) and from the break down of nitrogen fertilizers in soil, livestock wastes and nitrate contaminated ground water. Its life span in the troposphere is 140-190 years and it traps about 230 times as much heat per molecule as CO<sub>2</sub>. The atmospheric concentration of N<sub>2</sub>O is 0.3 ppm and is increasing at a rate of 0.2% annually.

### **Impacts of Enhanced Greenhouse Effect**

The enhanced greenhouse effect will not only cause global warming but will also affect various other climatic and natural processes.

- (i) Global temperature increase
- (ii) Rise in Sea Level
- (iii) Effects on Human Health
- iv) Higher temperature and humidity will increase/aggravate respiratory and skin diseases.
- (v) Effects on Agriculture

### **Control Measures to Global Warming**

To slow down enhanced global warming the following steps will be important:



- (i) Cut down the current rate of use of CFCs and fossil fuel.
- (ii) Use energy more efficiently.
- (iii) Shift to renewable energy resources.
- (iv) Increase Nuclear Power Plants for electricity production.
- (v) Shift from coal to natural gas.
- (vi) Trap and use methane as a fuel.
- (vii) Reduce beef production.
- (viii) Adopt sustainable agriculture.
- (ix) Stabilize population growth.
- (x) Efficiently remove CO<sub>2</sub> from smoke stacks.
- (xi) Plant more trees.
- (xii) Remove atmospheric CO<sub>2</sub> by utilizing photosynthetic algae.

## ACID RAIN

Oxides of sulfur and nitrogen originating from industrial operations and fossil fuel combustion are the major sources of acid forming gases. Acid forming gases are oxidised over several days by which time they travel several thousand kilometers. In the atmosphere these gases are ultimately converted into sulfuric and nitric acids. Hydrogen chloride emission forms hydrochloric acid. These acids cause acidic rain. Acid rain is only one component of acidic deposition. Acidic deposition is the total of wet acidic deposition (acid rain) and dry deposition. Rain water is turned acidic when its pH falls below 5.6 (Fig. 6.3). In fact clean or natural rain water has a pH of 5.6 at 20°C because of formation of carbonic acid due to dissolution of CO<sub>2</sub> in water. The Adirondack Lakes located in the state of New York are known to receive acid rains. The strong acids like sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) and nitric acid (HNO<sub>3</sub>) dissolved or formed in rainwater dissociate or release hydrogen ions thereby increasing the acidity in rain drops.

## Effects of acid rain

Acid rain causes a number of harmful effects below pH 5.1. The effects are visible in the aquatic system even at pH less than 5.5.

It causes deterioration of buildings especially made of marble e.g. monuments like Taj Mahal. Crystals of calcium and magnesium sulphate are formed as a result of corrosion caused by acid rain.

It damages stone statues. Priceless stone statues in Greece and Italy have been partially dissolved by acid rain.

It damages metals and car finishes.

Aquatic life especially fish are badly affected by lake acidification.

Aquatic animals suffer from toxicity of metals such as aluminium, mercury, manganese, zinc and lead which leak from the surrounding rocks due to acid rain.

It results in reproductive failure, and killing of fish.

Many lakes of Sweden, Norway, Canada have become fishless due to acid rain.

It damages foliage and weakens trees.

It makes trees more susceptible to stresses like cold temperature, drought, etc. Many insects and fungi are more tolerant to acidic conditions and hence they can attack the susceptible trees and cause diseases.

### Control of Acid Rain

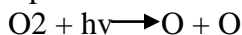
Emission of SO<sub>2</sub> and NO<sub>2</sub> from industries and power plants should be reduced by using pollution control equipments.

Liming of lakes and soils should be done to correct the adverse effects of acid rain.

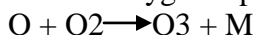
A coating of protective layer of inert polymer should be given in the interior of water pipes for drinking water.

### OZONE LAYER DEPLETION

For the last 450 million years the earth has had a natural sunscreen in the stratosphere called the ozone layer. This layer filters out harmful ultraviolet radiations from the sunlight and thus protects various life forms on the earth. Ozone is a form of oxygen. The molecule of oxygen contains two atoms whereas that of ozone contains three (O<sub>3</sub>). In the stratosphere ozone is continuously being created by the absorption of short wavelength ultraviolet (UV) radiations. Ultraviolet radiations less than 242 nanometers decompose molecular oxygen into atomic oxygen (O) by photolytic decomposition.

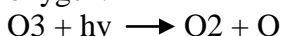


The atomic oxygen rapidly reacts with molecular oxygen to form ozone.



(M is a third body necessary to carry away the energy released in the reaction).

Ozone thus formed distributes itself in the stratosphere and absorbs harmful ultraviolet radiations (200 to 320 nm) and is continuously being converted back to molecular oxygen.



Absorption of UV radiations results in heating of the stratosphere. The net result of the above reactions is an equilibrium concentration of ozone. Ozone concentration in about 24 km of the stratosphere i.e. from 16 km to 40 Km away from earth is about 10 ppm (as compared to 0.05 ppm concentration of harmful tropospheric ozone). This equilibrium is disturbed by reactive atoms of chlorine, bromine etc. which destroy ozone molecules and result is thinning of ozone layer generally called ozone hole. The amount of atmospheric ozone is measured by Dobson Spectrometer, and is expressed in Dobson units (DU). One DU is equivalent to a 0.01 mm thickness of pure ozone at the density it would possess if it were brought to ground level (1atm) pressure. Normally over temperate latitude its concentration is about 350 DU, over tropics it is 250 DU whereas at subpolar regions (except when ozone thinning occurs) it is on an average 450 DU. It is because of the stratospheric winds which transport ozone from tropical towards polar regions.

### Effects of Ozone Depletion

Ozone depletion in the stratosphere will result in more UV radiation reaching the earth especially UV-B (290-320 nm). The UV-B radiations affect DNA and the photosynthetic chemicals. Any change in DNA can result in mutation and cancer. Cases of skin cancer (basal and squamous cell carcinoma) which do not cause death but cause disfigurement will increase.

Easy absorption of UV rays by the lens and cornea of eye will result in increase in incidents of cataract.

Melanin producing cells of the epidermis (important for human immune system) will be destroyed by UV-rays resulting in immuno-suppression. Fair people (cant produce enough melanin) will be at a greater risk of UV exposure.

Phytoplanktons are sensitive to UV exposure. Ozone depletion will result in decrease in their population thereby affecting the population of zooplankton, fish, marine animals, infact the whole aquatic food chain.

Yield of vital crops like corn, rice, soybean, cotton, bean, pea, sorghum and wheat will decrease.

Degradation of paints, plastics and other polymer material will result in economic loss due to effects of UV radiation resulting from ozone 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 wont 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. The Chernobyl nuclear accident, 1986 has resulted in wide spread contamination by radioactive substances. (already mentioned in air pollution episodes). The devastation caused by nuclear bombs are not only immediate but may be long lasting. Towards, the end of World War II, bombing of Dresden, Germany caused huge firestorms. This caused particle ladden updrafts in the atmosphere.

## **WASTELAND RECLAMATION**

Economically unproductive lands suffering from environmental deterioration are known as wastelands. The wastelands include saltaffected 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 as we have already discussed.

### **Wasteland Reclamation Practices**

Wasteland reclamation and development in our country falls under the purview of Wasteland Development Board, which works to fulfill the following objectives:

To improve the physical structure and quality of the marginal soils.

To improve the availability of good quality water for irrigating these lands.

To prevent soil erosion, flooding and landslides.

To conserve the biological resources of the land for sustainable use.

Some important reclamation practices are discussed here.

(i) Land development and leaching: For reclamation of the salt affected soil, it is necessary to remove the salts from the root-zone which is usually achieved by leaching i.e. by applying excess amount of water to push down the salts. After a survey of the extent of salinity problem, soil texture, depth of impermeable layer and water table, land leveling is done to facilitate efficient and uniform application of water. After leveling and ploughing, the field is banded in small plots and leaching is done. In continuous leaching, 0.5 to 1.0 cm water is required to remove 90% of soluble salts from each cm of the soil depending upon texture. If we use intermittent sprinkling with 25 cm water, it reduces about 90% salinity in the upper 60 cm layer.

(ii) Drainage: This is required for water-logged soil reclamation where excess water is removed by artificial drainage.

(a) Surface drainage: This is used in areas where water stands on the fields after heavy rains by providing ditches to runoff the excess water. Usually 30-45 cm deep ditches lying parallel to each other at 20-60 m distance are able to remove 5 cm of water within 24 hours.

(b) Sub-surface drainage: Horizontal sub-surface drainage is provided in the form of perforated corrugated PVC pipes or open-jointed pipes with an envelope of gravel 2-3 m below the land surface. Chances of evaporation of water leading to accumulation of salts almost become nil in this method. The World Bank has funded sub-surface drainage system at Sampla, Rohtak (Haryana) for reducing soil salinity by this method.

(iii) Irrigation Practices: Surface irrigation with precise land leveling, smoothening and efficient hydraulic design help to reduce water logging and salinity. High frequency irrigation with controlled amount of water helps to maintain better water availability in the upper root zone. Thin and frequent irrigations have been found to be more useful for better crop yield when the irrigation water is saline as compared to few heavy irrigations.

(iv) Selection of tolerant crops and crop rotations: Tolerance of crops to salts is found to range from sensitive, semi-tolerant, tolerant to highly tolerant. Barley, sugar beet and date-palm are highly tolerant crops which do not suffer from any reduction in crop yield even at a high salinity with electrical conductivity (EC) of 10 dS/m. Wheat, sorghum, pearl millet, soyabean, mustard and coconut are salt-tolerant crops. Rice, millets, maize, pulses, sunflower, sugarcane and many vegetables like bottle gourd, brinjal etc. are semi-tolerant. These different crop combinations can be grown on saline soils.

(v) Gypsum amendment: Amendment of sodic soils with gypsum is recommended for reducing soil sodicity as calcium of gypsum replaces sodium from the exchangeable sites.

(vi) Green-manures, fertilizers and biofertilizers: Application of farm yard manure or nitrogen fertilizers have been found to improve saline soils. Green manuring with dhaincha (*Sesbania aculeata*) sunhemp or guar have also been reported to improve salt-affected soils. Blue green algae have been found to be quite promising as biofertilizers for improving salt-affected soils.

(vii) Afforestation Programmes: The National Commission on Agriculture (NCA) launched several afforestation schemes in the VIth plan to cope up with the problem of spreading wasteland. The National Wasteland Development Board, in the Ministry of Environment and Forests has set a target of bringing 5 million ha of wasteland annually under firewood and fodder plantation.

(viii) Social Forestry Programmes: These programmes mostly involve strip plantation on road, rail and canal-sides, rehabilitation of degraded forest lands, farm-forestry, wasteland forest development etc.

## **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.

In LDCs - No. of people is very high, but per capita use of resources and waste generated are less.

In MDCs - No. of people is low, but per capita use of resources and wastes generated are very high. The overall environmental impact of these two types of consumerism may be same or even greater in case of MDCs. Thus, consumerism varies with the country and USA is known for maximum consumerism. The throw-away attitude and luxurious life-style of the west results in very high resource use as compared to less developed countries. With every unit of energy, mineral or any resource used there is waste generation and pollution in the environment.