C H A P T E R - II

CONCEPTUAL FOUNDATION OF ENVIRONMENTAL EDUCATION

Environmental education has emerged as a pragmatic response to the problems of human environment. The concept of environmental education is still evolving and hence it is necessary that the subject must be understood in its proper perspective. In the words of Amandou Mahatar M'Bow, former Director General of UNESCO :

> In an area as new....as that of environmental education, clarification of concepts and principles, which should guide our action is of crucial importance. What must be done is to state as clearly as possible not only what is meant by environmental education, but .... above all, its specific functions as a part of the general effort to develop and bring about a renewal in education in order to prepare each individual, squarely to shoulder his responsibilities[1].

To get a complete understanding of the meaning and nature of environmental education, one has to understand the environment, different environmental problems, the history and philosophy of environmental education first.

Meaning of 'Environment'

The Mc Graw Hill Encyclopaedia of Environmental Science defines 'environment'as sum total of all the conditions and influences that affect the life and development of organisms. The Tbilisi Conference defined environment as a sum total of natural, artifical, and social components of the material world which are or may be in direct interaction with man.

Here man means mankind as a whole. Environment has thus two basic components : biophysical and socio-cultural. The bio-physical components include all living organisms, like plants, animals, bacteria, viruses etc. and the biosphere comprising lithosphere, hydrosphere and atmosphere. It also includes climatic factors like light, temperature, precipitation, wind and physiographic factors like altitude, steepness, weathering and erosive agents like sea, wind, rain, ice, and soil factors like nature of the parent rock and humus. The interaction between these biological and physical factors decides the type of habitat and organisms in an area. The socio-cultural factors consist of man's economic, social, political and intellectual activities and their products such as modes of production, industry, education, technology, means of transport and commerce, culture, housing, bridges and highways etc. Darwin's 'Descent of Man' describes man's biological evolution to the present stage through continuous interaction with the environment. J. Bronowski in his 'Ascent of Man'[2] portrays the cultural evolution of mankind and its interaction with environment to reach the present level of culture.

The total environment is dynamic and is always in a state of flux. Its ecosystem comprising the complex web of interaction between its biotic and abiotic components makes it self-balancing, self-adjusting and self-purifying. Ideally, there is no waste in a stable ecosystem. Its substances cycle naturally through many biogeochemical cycles like water, carbon, oxygen,nitrogen,phosphorus cycles etc. In the environment plants, animals and microorganisms thrive with only minor change in number.

Genesis of Environmental Problems

Throughout history man adapted the environment, transformed, destroyed and improved it through its cultural evolution. The resulting interventions were mostly local in nature at the initial stage and people did not realise its consequence. Advent of modern science and technology, combined with man's greed and caprice to exploit the resources of the earth beyond point of redemption led to the creation of environmental problems. The industrial revolution of the seventeenth century probably signalled the beginning of 'pangs of modernity'an euphemism for environmental problems. The unprecedented rapid growth in human population, science, technology, modern production and consumption processes and last but not the least change in human life style have wrought serious havoc in the environment resulting in gross interference in its ecological processes and thereby endangering the health and even very survival of man on earth. Notwithstanding the heavy debate over the extent and nature of the environmental crisis, it is generally agreed that the environment is in trouble and the 'planet is in peril'[3]. To get a complete picture of the environmental scenario, there is a need to discuss a few environmental problems, with their ramifications, damages and implications for humanity. Few of the serious environmental problems have been discussed below.

Environmental Problems

Population Explosion

The world population crossed five billion mark in July 1987. At the turn of the century, this figure is likely to be between 6 to 6.5 billion. If the current population growth rate remains unaltered, India's population at that time is

likely to be around one billion. According to an UN population estimate at the prevailing rate of population growth, India will outstrip China in population around the middle of next century. The 'carrying capacity' of an environment in terms of population is decided by such factors as existing environmental conditions, availability of life-supporting system, limits of tolerance of species inhabiting it etc. Despite war, famine, natural disasters, and diseases men by their ingenuity have overcome such natural checks and balances and continued to multiply crossing the carrying capacity. A peculiar characteristic of population explosion has been the tendency in developed countries towards zero population growth, whereas most of the developing countries register nearly three-fourths of the increase in world population. The pyramidal age structure in developing countries with pre-ponderance of young further accentuates the problems and accelerates the growth. About 72 per cent of people in these countries are below 35 years of age. Another characteristic of this growth has been what is often called 'population implosion', the migration to metropolis, cities and urban areas by people from countryside. The villages are gradually being depopulated and squatter settlements, slums and shanty-towns, notorious for vice, criminality, prostitution, squalor, poverty, insanitation and disease etc, are on the rise. Thomas Robert Malthus (1926) in his 'Essay on the Principle of Population'[4] had warned that rapid population growth is the real cause of poverty among nations. Paul Ehrlich (1972)[5] had identified population explosion to be at the root of all forms of environmental degradation. Although his prediction of hundreds of million of people starving to death in the 1970s has not come true, humanity, continues to be tormented and languished by

population explosion. The UN International Conference on Population held at Mexico City in 1984 had called upon nations to rectify the disequilibrium between rate of change in population and changes in resources, environment and development. Solution of the crisis lies in limiting family size, improving living standards, reducing infant mortality, providing social security and above all spreading population education. Changing attitudes, regarding sex of the child, abortion and giving up religious obscurantism also help in alleviating the problem.

Water Pollution Eighty per cent of all diseases in human beings can be attributed to polluted water. In India 70 per cent of available water is polluted (Basu, 1986)[6]. Industrial effluents, sewage, garbage, bio-waste, chemicals of many kinds including artificial fertilisers, pesticides, herbicides, detergents and even animal carcasses mix with water making it unsuitable for human use and disrupt aquatic ecosystems. Lakes and rivers on receiving organic waste and chemicals containing nitrogen and phosphorus, get eutrophicated when their threshold for bio-degradation is crossed. Such rivers and lakes get clogged with growth of algae. These algae die and settle down at the lake bottom giving rise to a spurt of microbial decomposition and making heavy biological oxygen demand on water. In the process all oxygen in the river gets depleted leading to death of aquatic life. The water emanates a smell of hydrogen sulphide, indicating the death of the lake. Hence, the amount of dissolved oxygen in a lake/river water is a good parameter of its water quality. In India, the Dal and Wuler lakes of Kashmir, Pushkar in Rajasthan and lake Ooty in Tamil Nadu have been eutrophicated severely. Hussain Sagar lake at Hyderabad is on its way to eutrophication (CSE, 1985)[7].

With modernisation of society and run towards the luxuries men have added more than a million chemicals to the biosphere. But hardly a thousand of them have been scanned through rigorous safety evaluation system[8]. Many of these chemicals are released into water and cause water pollution. Heavy metals like cadmium, lead, mercury and arsenic etc.on entering the body damage the brain and central nervous system. They can produce cancer, sterility, abnormal foetus, kidney disfunction etc. The tragedy that struck residents of Minamata Bay and Niigata Islands during 1953 and 1965 due to consumption of fish contaminated by methyl mercury chloride is a classic example. Even DDT which has been banned in many countries have been detected in copious amounts in tissues of Eskimoes and in Penguins, who inhabit places where DDT was never sprayed. Pesticide residues have been detected in 20 per cent of 100 random sample of breast milk in Tamil Nadu in amounts beyond maximum resistance limit[9]. Most of the chemicals referred to above have entered man through food chain and in sizable quantities through bio-magnification. The ecosystems of oceans are being continuously disrupted by sewage, effluents, radio-active wastes and spills from large oil-tankers. In June 1989 a Maltan oil tanker, MVP on collision with another ship in Arabian Sea near Bomaby spread 5,500 tons of furnace oil covering 700 miles of Bomaby coast[10]. The Torrey Canyon disaster in North Sea drew world-wide attention. Oil being highly toxic to fishes, plankton, marine birds and even hump-back whale, oil spills cause colossal damage. The oil slick in the Persian Gulf near Kuwait during Gulf war drew loud protests from environmentalists all over the world.

Air Pollution Emissions from factories and industries, automobile exhaust, rail engines, aeroplanes, and other

internal combustion engines that burn fossil fuel, thermal power plants, quarry and mining activities, nuclear fallouts, dust and particulate matter etc. pollute the air. Major air currents above the earth spread air pollutants world-wide. Breathing polluted air causes respiratory diseases like tuberculosis, bronchitis, allergy, emphysema and aggravates asthma. Inhalation of sulphur dioxide causes burning and irritation. Carbon monoxide and nitrogen oxide inhalation affect haemoglobin. Some pollutants like asbestos dust etc. are even carcinogenic. Sulphur dioxide causes total destruction of plants, flourine compounds on entering body of of cattle through food chain cause them to loose weight, and develop abnormal bone and teeth. Peroxyl acetyl nitrate (PAN) suppresses photosynthesis and causes leaves of many plants to collapse. Leaves too become discoloured and curled[11]. Air pollution causes acid rain, smog, greenhouse effect and depletion of ozone layer and has the potential for affecting global climate adversely. These effects have been described very briefly in the following paragraphs.

Acid Rain Air pollutants like oxides of sulphur and nitrogen react with water vapour and oxygen in the air to form sulphuric acid and nitric acid respectively. These acids fall to earth either in the wet form with rain water and in other forms of precipitation or deposited as dry gases. Acid rain turn water in lakes and rivers acidic, thereby reducing the size and diversity of fish population. Vegetation is destroyed. It causes corrosion of outdoor equipment, building and works of art especially in urban areas. Acid rain also leaches nutrients from soil reducing its fertility. Some experts ascribe stone cancer seen on Tajmahal to acid rain caused by Mathura refinery. Although India is not severely

affected by acid rain, many other unindustrialised countries in the tropics are experiencing it due to release of oxides of nitrogen and hydrocarbons from forest clearance, agricultural activities and biomass burning. Because water droplets are removed from the atmosphere rapidly, acid rain is a regional or continental rather than global phenomenon.

Smog · Due to temperature of inversion effects, sometimes, smoke, sulphur dioxide and carbon monoxide and other effluents of fossil fuel combustion, mix with cold fog to form smog. Smog is highly toxic and harmful to life. During the 1950s, some 4000 people were killed due to smog in London. Another type of smog called photochemical smog is formed due to reaction of sunlight with automobile exhaust, particularly hydrocarbons and nitrogen oxides. This type of smog contains a mixture of undesirable gases like ozone and PAN. Ozone causes eye-burning, impairs lungs functioning and brings damage to trees and crops. Harmful effects of PAN have been discussed earlier.

Greenhouse effect The glass of a greenhouse allows sunlight to stream in freely but blocks heat from escaping, mainly by preventing the warm air inside the greenhouse from mixing with outside air. In a similar fashion gases like carbon dioxide, methane, water vapour, oxides of nitrogen, chlorofluorocarbons (CFCs) emitted from different sources on earth are transparent to incoming solar radiation but trap heat near the surface of the earth by more efficiently absorbing the longer wavelength infrared radiation released by the earth. This results in global warming up and the phenomenon is called greenhouse effect. The chief sources of greenhouse gases are combustion of fossil fuels, industrial practices, rice cultivation, cattle breeding, bio-mass burning, deforestation, microbial activity in municipal land-fills and swamps. All these are increasing day by day resulting in greater production of these gases. Carbon dioxide concentration which

was about 280 parts per million (ppm) at the end of the last century, has risen to the current level of about 350 ppm and is likely to be 380 ppm by 2000 AD. Computer simulation models show that the concentration may double by 2050 AD[12]. Similarly concentration of methane has risen from 700 parts per billion (ppb) at the beginning of this century to the present level of 1700 ppb. Methane traps 20 times as much heat as carbon dioxide but is significantly less abundant. However, direct world- wide measurement shows that methane level is growing more rapidly than carbon dioxide.

In the absence of clear quantitative historical record, it is difficult to tell how the doubling of carbon dioxide and other greenhouse gases will affect us. Mathematical models show a modest increase between 3.0°C and 5.5°C in eath's surface temperature. Change in precipitation and temperature could threaten natural ecosystems, agricultural production and human settlement patterns. Stream run-off may be reduced due to speed evaporation affecting irrigation and water quality[13]. In coastal areas the sea level may rise between 3-8 metres due to melting of polar ice caps and snow at high mountain peaks. In the resulting deluge low lying cities like Bombay, Dhaka, Calcutta and the entire Maldives island may be submerged. Heat distribution profile of the earth, along with wind pattern and rainfall may change, resulting in less wheat production in Europe and USSR and leading to collapse of world economy. In short, global climatic change would have economic, political and social consequences.

Depletion of Ozone Layer The ozone layer in the stratosphere extending between 25-35 kms. in the atmosphere serves as a shield protecting the planet from harmful effects of ultraviolet radiations. This layer is however thinning out

due to the wide-spread use of a group of chemicals called chloro-fluoro--carbons (CFCs). These chemicals are used in aerosol sprays, refrigerators and room air conditioners as refrigerating liquid and in blowing of plastic foams etc. Use of these chemicals are on the increase in the modern world. Cold vortex measurements in the Antarctic region in 1985 have indicated a 40 per cent thinning in ozone layer and even a ozone hole of the size of USA has been created over Antarctica[14]. Destruction of ozone layer and resulting exposure to ultraviolet radiation can speed up aging of skin, produce skin cancers and cataracts, damage crops and phytoplankton, the basis of food chain in sea and stunt growth of many plant and marine life. Fortunately, the world community has become conscious of the problem and the Montreal Protocol have been signed in 1987 in Canada aimed at reducing production of CFCs and replacing them with other harmless substitutes.

Noise Pollution | Automobiles, trains, aeroplanes, industry, machinery, factory sirens, market places etc are the major sources of noise pollution. A jet engine during take-off produces noise pollution of highest degree. It has been observed that on exposure to rock music guinea-pigs suffer loss of hearing. Continuous exposure to high levels of sound (those exceeding 90 decibels) results in emotional distress, rise in blood pressure, tension, increased heart beat and may lead to loss of hearing.

Radio-active Pollution Radio-active emissions like Alpha, Beta, Gamma-rays and neutrons emitted from accidents in nuclear power plants, atomic explosions, nuclear testing, radio isotopes, radio-active wastes of nuclear reactors, X-ray

machines and even picture tubes of televisions and electron microscopes are sources of radio-active pollution. Exposure to radiation beyond threshold limits of 0.5 rem/year can cause radiation sickness, cancer, leukaemia,abnormal foetus in pregnant mother and even death depending upon doses received. Chernobyl and Three Miles Island nuclear power plant accidents illustrate the hazards of radio-active pollution. Nuclear waste material buried in stainless steel containers or dumped in the ocean are intensely toxic for thousands of years, If buried in seismically unstable zones such containers may burst and pollute ground water. Radiation exposure also can bring about genetic changes and mutant genes in the recipient.

Pollution continues to be one of the grave environmental problems. There is a world-wide debate about the causes of pollution. It may be worth-mentioning here the views of Barry Commoner, the American social scientist who holds a different perception. According to Commoner[15] pollution and resulting environmental degradation are not due to population or affluence but the methods of production, which are polluting and energy consuming. In the similar lines Schumacher suggests to develop 'appropriate technology', the one that produces goods with minimal waste and pollution. He calls it 'technology with human face' in his book 'Small is Beautiful'[16].

Deforestation Forests are vital to human existence as they provide fuel, fodder, timber, food and medicine. They also check soil erosion, clean air by using up carbon dioxide in photosynthesis, help in rainfall, serve as wind breakers during storm and cyclone in coastal areas, provide habitat for wild animals and above all provide recreation for mankind. National Forest Policy stipulates that on the average 33% of the land area should have forest cover. But forests are continuously being denuded to meet increasing demand of people

for grazing of live-stock, timber, fuel, agriculture, shifting cultivation, urbanisation, mining, quarry operations, and for construction of hydro-electric projects, hill roads, industries. As per photographs of earth taken from remote sensing satellites, India's forest cover is around 10 per cent. In Orissa, forest area has been reduced from 31 per cent in 1975 to 25 per cent in 1985. Present (1988) forest denudation in the state is roughly 2.53 per cent per year[17]. The 'Chipko Movement' in the foot hills of the Himalayas spearheaded by Sunderlal Bahuguna and others and the 'APKO Movement' in Karnataka heralded public campaign for saving forests. Another similar movement was launched in Sambalpur district of Orissa against the bauxite mining project of Bharat Aluminium Company (BALCO) in the Gandhamardan Hills, situated on the Eastern Ghats and is continuing till date. The programme of 'social forestry' is being undertaken on a large scale in rural areas to provide fuel and fodder. Green belts are being created around all urban areas to purify polluted air. These schemes will alleviate to certain extent the pressure on forests. Tropical rain forests covering nearly 6 per cent of earth's surface contain about half of the planet's plant and animal species. Conservation of these forests is essential for climatic stability of the biosphere, conservation of gene pool, safeguarding watersheds, allowing evolutionary processes to continue, providing stock of plants and animals for research and also for tourism and recreation. These forests constitute about 30 per cent of world's total forest. The denudation of tropical rain forests is occuring at the rate of 11-40 hectares per minute (Mabberley, 1983)[18]. At this rate the world will lose bulk of its rain forests by the year 2000 AD and very little of such forests will remain in India.

Extinction of Species As per International Union for Conservation of Nature and Natural Resources (IUCN) report India has about 45,000 species of plants and 65,000 species of animals out of nearly 5-10 billion species of plants and animals that are found in the world (Birch,1986)[19] Conservation of all these species are required for preservation of the gene pool so essential, for our survival. The economic benefits and the 'land ethic argument' which hold that land have to foster all living beings, not human beings alone, also justify the conservation of species. Genetic and ecological diversity (species richness), safe- number within the carrying capacity of an environment, tolerance threshold etc. are natural parameters that decide the viability of a species. However many species are becoming extinct or endangered due to loss of habitat on account of deforestation, pollution of habitat. Indiscriminate hunting of animals have also resulted and accelerated species extinction. The present species loss per year is 10,000 times greater than the naturally occuring background extinction rate that existed prior to the appearance of human beings[20]. The loss is so colossal that, Moonis Raza (1988) calls this age as age of extinction[21]. The 'Red Data Book' of IUCN and the 'Green Book'of Botanical Survey of India enlist endangered/rare species.

Launching of Man and Biosphere Programme (MAB)' and the 'World Conservation Strategy (WCS)' have helped conservation of species through 'in-situ' and 'ex-situ' methods. Monitoring the endangered species, education and training as well as international co-operation have helped to halt species extinction to some extent. Saving the endangered American Condors and success stories of white tiger in India through captive breeding are the examples of such efforts of

IUCN and the 'World Wide Fund for Nature (WWF)'. Selective hunting, sometime helps conservation, as is being done with African elephants. Social boycott of people using fur-coats, banning trade in ivory and export of frog legs are steps in right direction. Voluntary organisations like 'Beauty without Cruelty' 'Green Peace' etc. are doing excellent job in conservation of species.

Depletion of Natural Resources The natural resources of the earth, particularly the non-renewable ones like fossil fuels and minerals are being depleted at a fast rate causing severe concern, since their regular supply is vital for sustainable development. Resource use is growing at a rate of six per cent per year. By 2000 AD all silver mines and easily mined crude oil deposits will be exhausted (Meadows,1983)[22]. The earth is like a space-ship with respect to its resources. Overburdening of this space-ship 'Earth' with waste and squandering away its precious resources may lead to its extinction. As the Meadows puts it ;

> A society with a high level of industrialisation and resource use may be non-sustainable. It may be self-extinguishing if it exhausts the natural resources on which it depends.[23].

Natural resources are not distributed and used in proportion to population and land area, among countries/continents. The developed countries with only one quarter of world's population consume about 80 per cent of world's resources and the developing countries with three quarters of world's population consume less than one quarter of the world's resources. The pollution and resources load per person in developed countries on the world environmental system is about 10-20 times the load generated by a person in a developing country (Forrester 1983)[24]. Continuous cycling and recycling

of natural resources by using waste products is absolutely essential to maintain a stable economic growth and reasonable standard of living in future. Production processes should produce more easily biodegradable products, unlike plastics to help recycling. Garbage, solid waste, and effluents from factories should be recycled to retrieve minerals and other useful material .

Land Use Due to demographic pessure land is under stress, on account of agriculture, industrialisation, urbanisation, railways and highways etc. In our country extreme imbalance in land use can be seen in Punjab where 84 per cent of geographical area is under cultivation and only 4 per cent has forest cover (Kang, 1982)[25]. Government decision to set up a National Test Range for missiles at Baliapal, occupying thousands of acres of fertile agricultural land for defence purpose is against the principles of land use. The move is being resisted by natives through a voluntary organisation 'Ganatantrick Adhikar Suraksha Samiti'. Though the short video film 'Voices of Baliapal' by Ranjan Palit and Vasudha Joshi vividly portraying wanton misuse of land has received international acclaim, Government continue to be unconcerned. To correct imbalances in land use a national land use policy for proportioning land based on topography, soil characteristics and climate etc. for short-term and long-term use is urgently required.

Soil Erosion About 175 million hectares of land constituting 53 per cent of India's total land area is susceptible to serious soil degradation due to desertification, salination, alkalisation, waterlogging, deforestation and overgrazing. The country loses about 5-6 thousand million tons of top-soil every year at a rate of 10 tons/year. At this rate the entire

top soil may be lost in about 250 years (Kanwar, 1978)[26]. Without top soil, which has taken several hundred years for its formation, land becomes barren and is the starting point of desertification. Proper land use planning, success in social forestry and halting the deforestation can check soil erosion to some extent. The national technology mission on waste-land development will also help to save the soil.

Energy Crisis Energy is required for cooking, transport, running industries and lighting the buildings and the streets. Although per capita consumption of energy in developing countries is 4-7 times less than developed countries, rapid growth in energy consumption is now occuring in these countries compared to developed countries, since these countries areseeking to industrialise to raise their living standards. The energy crisis is being felt through shortage, and increased price for fuels. The organisation of petroleum exporting countries (OPEC) control 75 per cent of all crude oil reserves. The war between Iraq and Allied Nations concerning liberation of Kuwait was essentially a war to control the petroleum reserves in the gulf region. The 25 per cent hike in petrol prices in India due to this war, the adverse balance of payment positions and the IMF loans are all manifestations of the energy crisis. Seventy-five per cent of Indian population use non-commercial sources like wood, animal dung and agricultural waste as fuel. A sharp rise has occured in the price of wood and coal in the last decade. Development of alternative sources like solar, nuclear, wind and tidal and bio-gas hold promise for solving energy crisis.

Ecological Disruption The subtle and fragile relationships in an ecosystem can be disrupted due to external factors like

human intervention. Any change in an ecosystem that is imposed from outside often triggers off a chain reaction that may sometimes be irreversible. All the environmental problems described afore are cause as well as manifestation of an ecological crisis in environment. Extinction of 'Dodo' and the threat from hydro-electric power projects are two classic examples that amply illustrate the ecological imbalance due to human intervention. Dodo, the flightless bird of Mauritius became extinct due to hunting by colonial rulers and the dogs that they brought with them. Calvaria majora, a species of plant whose fruit was eaten by Dodo and the hard seeds passing through its digestive tract became softened facilitating germination after excretion by the bird, became nearly extinct after disappearance of the bird. Recently only few seeds have germinated after being forcibly fed to turkeys.

Large hydro-electric projects, once considered a blessing and architectural wonder are being looked with scepticism from environment point of view. President Hosseni Mubbarak once said that the challenge before Egypt is to cope with Aswan dam. Such projects are ecological disasters as they, submerge vast tracts of forest land, uproot local people mostly tribals from their home and hearth, cause waterlogging and salination due to canal network, change microclimate of the area, create breeding ground for disease vectors like mosquitoes and snails etc. Dams also have the potential for causing earthquake due to reservoir induced seismicity. Despite protests Government of India have given green signal to such hydro-electric projects like Sardar Sarovar, Narmada Sagar and one at Tehri. Fasts undertaken by Mr. Sunderlal Bahuguna, Baba Amte have produced no effect. However, Kerala Shastra Sahitya Parishad's struggle forced government to shelve the 'Silent Valley Project'.

Introduction of new strains of high yielding cereals, large scale monoculture,& introduction of widespectrum of insecticides etc. have exacerbated the ecological crisis.

Environmental Problems of Developing Countries

In additon to the environmental problems described earlier developing countries also suffer from poor quality of life in terms of housing, sanitation, food and nutrition etc. Natural disasters like flood, drought, cyclones and earthquakes also ravage these countries. Most of the environmental problems in developing countries emanate from poverty and ignorance. Mr. Maurice F. Strong, Secretary General of Stockholm Conference rightly commented at Founix -

> In the developing countries most of the environmental problems are caused by under development. Therefore developing countries must direct their efforts to development, bearing in mind their priorities and needs to safeguard and improve the environment (Clark et al, 1982)[27].

Development aimed at socio-economic upliftment of masses, is necessary as long as disparities in income and living standards exist within/between countries. But developmental efforts often upset the delicate balance of nature. They also put environment under severe strain. Therefore, the question before the developing countries is : should development be postponed till all environmental problems are solved in the globe ? The answer requires a thorough analysis of the relationship between environment and development.

Environment and Development The challenge before the humanity today is how to harmonise economy and social goals with ecologically sound management of resources and

environment. Prior to the 70s environment and development were considered antithetical. But now-a-days both are considered to supplement each other. Preservation of environment in third world countries, instead of being contrasted with development, should be considered as a necessary dimension of development. Environmental protection prevents ecological catastrophes, which would otherwise put staggering cost on the economy. On the other hand, without development, poverty, hunger and misery would expand and affect adversely the environment. In the opinion of WCED, (1987):

> Environment and development are not separate challenges ; they are inexorably linked. Sustainable development cannot subsist upon a deteriorating environmental resource base ; the environment can not be protected when growth leaves out of account the costs of environmental destruction. They are linked in a complex system of cause and effect[28].

So it is futile to argue now a days, whether we should have environment or development. But development should not be lopsided. The kind of development and technology to be applied, should be carefully selected after assessing its impact on environment so that there is minimal damage to environment and posterity can be given a biosphere with intact life-supporting systems. The link between ecology and economy may be reviewed in this perspective.

Economy and Ecology Both the words 'economy' and 'ecology' share a common origin from ancient Greek word 'Oikos', meaning home or community. The loss of conceptual unity in origin between these words and the dichotomy between them is a tragedy for the planet. Now economics is something one

worries about when he is in trouble and ecology is something one worries about when every thing else is in fairly good shape. Economics and ecology should be completely integrated in decision making and law making process, not just to promote development but also to promote and protect environment. Economy should not be just about production of wealth and ecology should not be just about protection of nature. They should both aim at improving the lots of mankind. The ecologist should strive to hand on to posterity a habitable planet and the economist in putting it to better use.

Having discussed the environmental problems one can go in for understanding the history and philosophy of environmental education, its meaning, objectives and guiding principles.

History of Environmental Education

Although it is very difficult to pinpoint exactly when man first realised about environmental problems and their baneful consequences, many publications warnings and tragic events brought into focus the havoc wrought by these problems.

In 1962, Rachel Carson published the book 'Silent Spring'[29] which authentically documented and brought into forefront the chemical poisoning of the environment, particularly by synthetic insecticides such as DDT. She asked people, how would they visualize a world without flowers and bird song caused due to chemicalisation. The publication of the book, considered the beginning of environmental movement, triggered off the ecological revolution by stirring up public conscience. But it took not less than 10 years for DDT to be banned in USA.

U.Thant, the former Secretary General of UN in a speech exorted members of the general assembly in 1969 ;

> I donot seem overdramatic but I can only conclude from the information that is available to me as secretary general that members of the UN have perhaps ten years left in which ..... a global partnership be launched to cut the arms race, to improve human environment and to diffuse population explosion .... If such a global partnership is not launched within the next decade, then I very much fear that the problems I have mentioned will have reached such staggering proportions that they will be beyond our capacity to control(Quoted by Meadows et al ,1972)[30].

The global partnership suggested by U.Thant had already begun at Rome in 1968 when a group of 30 eminent persons- industrialists, scientists, educationists, economists and other prominent citizens formed the 'Club of Rome'. The Club of Rome prepared a simulated computerised global model for the future of the earth, feeding into the computer data pertaining to world pollution, industrialisation, population and resource depletion at Massachusetts Institute of Technology in USA. The results contained in the publication 'Limits to Growth'[31] predicted serious catastrophic changes in the world if the existing trends in the aforesaid four parameters continued.

'Earth Day' was observed in April 1970 in USA and many other countries. It was a cultural happening where debates, discussions were held, speeches delivered and oaths taken to live in harmony with nature. The Club of Rome's work gave impetus to prepare a number of global models to characterise the environmental trends in the years to come. Foremost among them were :

- 'The Strategy for Survival'sponsored by the Club of Rome in collaboration with USA and FRG (Mesarovic et al, 1974)[32].

- 'The Latin American World Model' produced at Bariloche Foundation, Argentina (Herrera et al,1976)[33].

- 'System Analysis and Research Unit (SARU) Model' developed by the UK, Department of Environment (Roberts, 1976)[34].

- The 'UN World Input-Output Model' developed at Brandeis University for the United Nations (Leontieff, 1972)[35].

- 'Interfuture' the Organisation of Economic Cooperation and Development (OECD)[36] sponsored model, and

- The 'Global 2000 Report to the President of USA' prepared by U.S. Government (CEQ, 1980)[37].

All these models conveyed in clear terms that there will be increased environmental stress in days ahead. In spite of their inherent limitations they confirmed the trends expressed in 'Limits to Growth'.

The publication of 'Journal of Environmental Education' in 1969 by a group of concerned educators is another land mark in the emergence of environmental education.

Catastrophic events like the London smog of 1952, Minamata tragedy of 1953, the Torrey Canyon disaster of 1967 and the acid rain problems of 60s got widespread publicity and forced people to rethink about the state of global environment.

The 70s of this century will be probably known in the history of mankind as the decade of environmental revolution. The International Council of Scientific Union along with UNESCO launched the 'Man and Biosphere' programme which led to a series of meetings and international discussions. The 1970 U.S. Environmental Act defined the goal of environmental education in USA, with other countries following the suit. The IUCN sponsored ' International Conference on Environmental Education in School Curriculum' held at Neveda in 1970[38] defined 'Environmental Education'and exorted states for its incorporation into the school curricula.

The first UN sponsored 'Conference on Human Environment' held at Stockholm, Sweden in October 1972 assessed on a global level the damage done to environment and contemplated on ways and means of preventing and solving environmental problems. Recommendation of this conference led to the creation of an independent body United Nation Environment Programme (UNEP) with headquarters at Nairobi, Kenya. UNESCO in co-operation with UNEP launched the UNESCO-UNEP International Environmental Education Programme (IEEP) in 1975 in UNESCO secretariat in Paris aimed at assisting governments, national, regional and international institutions to incorporate environmental education into formal and non-formal education systems and programmes. In October same year under the auspices of this programme an 'International Environmental Education Workshop' was held in Belgrade. The global framework for environmental education entitled 'Belgrade Charter'[39] was born here. The charter recognised the urgent need for environmental education and provided a frame of reference for designing environmental education programmes to be discussed in regional workshops world-wide. This was followed up in meeting of experts on

environmental education, held in 1976-77 in Africa, Arab States, Asia and the Pacific, Europe and North America and in Latin America and the Caribbean region. They reviewed and evaluated the Belgrade recommendations in the light of regional and sub-regional priorities.

The Inter-governmental Conference on Environmental Education organised in October 1977 in Tbilisi, USSR outlined a substantive structure of environmental education, which was to become prototype for environmental education programmes world-wide. The recommendations of this conference are contained in the historic document known as 'The Tbilisi Declaration'[40]. The UNEP-IEEP environmental education newsletter 'Connect' is being published in five languages to share information and developments in the field. Continuing the global efforts, 10 years after Tbilisi an 'UNESCO-UNEP International Congress on Environmental Education and Training' was held at Moscow, USSR in 1987 to review progress and trends in Environmental Education since Tbilisi conference, the state of environment and its educational training implications and discussion of environmental education strategy for 1990s[41]. The strategy for environmental education and training for the 1990s adopted by the congress was being edited and to be published at the time of writing this report.

Philosophy of Environmental Education

The philosophy of environmental education can be conceptualised best in terms of the relationship between man and nature. Three types of value orientation is possible in such relationships : submission, domination and mutuality. Those subscribing to submission, consider themselves as being

quite powerless before nature and other forces, as what happened when the primitive man lived in caves. Francis Bacon stated centuries ago that nature to be commanded must be obeyed. Domination emphasises the welfare of self at the expense of others, including nature. This view is predominant in western culture and even some say it has Biblical sanction. 'Genesis' in old Testament supports such view ;

> And God blessed them and had said onto them Be fruitful and multiply and replenish the earth and subdue it, and have dominion over every living thing that moveth upon the earth[42].

Ralph Waldo Emerson had said, "Nothing is rich but the inexhaustible wealth of nature. She shows us only surfaces but she is a million fathoms deep". This type of value orientation gives rise to 'parasitism' tendency to plunder and exploit nature and begets 'master-slave' relationship between man and nature.

Mutuality promotes a value-orientation in consonance with Indian culture, a type of symbiotic relationship between man and nature, aimed at the welfare of both. It considers non-humans on equal terms and of having intrinsic worth in themselves. This of course, does not preclude the use of resources of nature, for there is no way it could be avoided. But emphasis here is utilisation, rather than exploitation to the point of no return. The tribal people of Andaman and Bastar (M.P) are examples of mutuality between man and nature.

The philosophy of environmental education aims at the inculcation of an environmental ethic amongst men, asking them to live in communion with nature. The philosopher Cicero

believed that the Universe was one of order(contrary to modern scientific theory that 'entropy' or disorder characterise it), harmony and balance between man and nature. There was a purpose behind the existence of everything. In his words "who cannot wonder at this harmony of things in nature, at this symphony of nature which seems to will the well being of the world"[43].

One has to remember that nature is older than culture and culture rests on nature. Today it is becoming doubtful if nature can continue to support culture. Modern technology sometimes seems like a parasite that is about to devour its host. The well being of humanity rests on putting a check to the rat race for unbridled growth and exploitation of nature. One can enjoy bounties of nature by giving up greed and the best way to be happy as ancient sages had said is not to add to one's riches but taking away some of men's wishes.

Meaning and Definition of Environmental Education

The term 'environmental education' has two components 'environment'and 'education'. As defined earlier environment refers to the sum total of all conditions and influences affecting the life and development of organisms. In the present context, mankind is the referent. 'Education' is forming desirable attitudes, values, skills, understanding and interest. Environmental education is, therefore, forming desirable belief , attitude, value, interest and understanding etc. about the environment so as to preserve it and improve it for survival of the present and future mankind.

While understanding the meaning of environmental education three of its connotations i.e. education, about,

through and for the environment are implicit in the meaning.

- Education ABOUT environment means making environment a subject of investigation. It is based on a specific topic or a restricted area in which the main concern is to gain information and comprehension. It can be done in the classroom as well as in the field.

- Education THROUGH environment usually connotes using environment as a medium for study, the use of real life situations as the basis for learning and enquiry. It is essentially an approach or method of enquiry usually conducted through field work.

- Education FOR the environment means education for conserving and improving the environment, a study of environmental problems and working for their prevention and solution. Problem solving, decision making, development of an environmental ethic and critical judgement are called for here. It is in this sense that Stockholm Conference recognises the term'environmental education!

There is no universally accepted definition of environmental education, for different authorities, scientists, ecologists, economists and educationists have defined the term as per their philosophy, needs and perceptions. Some of them are discussed below :

The U.S. Environmental Education Act (1970) defined environmental education in terms of relationships :

> Environmental education means the educational process dealing with man's relationship with his natural and man-made surroundings and includes the relation of population, pollution, resource depletion and allocation, conservation, transportation, technology and rural and urban planning to the total human environment (Section 3 (2), [44].

Probably, a more comprehensive definition involving understanding and skills is the one given by the 'US Office of Education'.

> Environmental education is the process that fosters greater understanding of society's environmental problems and also the process of environmental problem solving and decision making ... It involves development of skills and insights needed to understand the structure, requirements and impact of interactions within and among various environmental entities, sub - systems and systems.

The above mentioned definitions do not give any emphasis to the affective aspects like values, feelings and attitudes. The following definition arrived at the IUCN sponsored workshop on environmental education in school curriculum takes care of the affective components as well.

> Environmental education is the process of recognising values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his cultural and biophysical surroundings. Environmental education also entails practice in decision making, and self formulation of a code of behaviour about issues concerning environmental quality[45].

From an analysis of all the definitions given above it follows that environmental education involves :-

- Knowledge and understanding of environment, its associated problems and future consequences.
- Understanding and appreciation of the subtle relationship between man and nature.
- Value clarification, development of attitude and interest concerning environment.
- Development of skills in environmental problem solving and decision making.

Goals and Objectives of Environmental Education

The goal of environmental education as contained in 'The Belgrade Charter' is :

> To develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivation and commitment to work individually and collectively towards solutions of current problems and the prevention of new ones.

The objectives which are implicit in the above mentioned goal are :

1. **Awareness** : to help individuals and social groups acquire an awareness of and sensitivity to the total environment and its allied problems.
2. **Knowledge** : to help individuals and social groups acquire basic understanding of the total environment, its associated problems and humanity's critically responsible presence and role in it.

3. **Attitude :** to help individuals and social groups acquire social values, strong feelings of concern for the environment and the motivation for actively participating in its protection and improvement.

4. **Skills :** to help individuals and social groups acquire the skills for solving environmental problems.

5. **Evaluation ability :** to help individuals and social groups evaluate environmental measures and education programmes in terms of ecological, political, economic, social, aesthetic and education factors.

6. **Participation :** to help individuals and social groups develop a sense of responsibility and urgency regarding environmental problems to ensure appropriate action to solve those problems.

The overall goals of environmental education according to the Tbilisi Conference recommendations are :-

(i) to foster clear awareness of, and concern about economic, social, political and ecological interdependence in urban and rural areas ;

(ii) to provide every person with opportunities to acquire knowledge, values, attitudes, commitment and skills needed to protect and imrpove the environment ;

(iii) to create new patterns of behaviour of individuals, groups and society as a whole towards the environment.

The objectives of environmental education arrived at Tbilisi Conference is almost similar to those decided at Belgrade conference and relate to development and acquisition of awareness, knowledge, attitudes and participation.

Guiding Principles of Environmental Education

The guiding principles of environmental education as per Tbilisi Conference 1977 are as follows:
Environmental Education should :

- consider the environment in its totality-natural and built, technological and social (economic, political, technological, cultural-historical moral, aesthetic) ;

- be a continuous lifelong process, beginning at the pre-school level and continuing through all formal and non-formal stages ;

- be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective ;

- examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas ;

- focus on current and potential environmental situations ; while taking into account the historical perspective ;

- promote the value and necessity of local, national and international co-operation in the prevention and solution of environmental problems ;

- explicitly consider environmental aspects in plans for development and growth ;

- enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences ;

- relate environmental sensitivity, knowledge, problem solving skills and values clarification to every age ; but with special emphasis on environmental sensitivity to the learner's own community in early years ;

- help learners discover the symptoms and real causes of environmental problems ;

- emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem solving ;

- utilise diverse learning environments and a broad array of educational approaches to teaching/learning about, from and for the environment with due stress on practical activities and first-hand experience.

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