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Environmental Education

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Chapter One

Basic Concepts of Environment

The concept of environment is complex and comprehensive of several factors influencing it. It is not merely the air, water and soil that form our environment but also the soil and economical conditions of our life.

It is usually defined as the aggregate of all external conditions and influences the life and the development of an organism, human behavior or society. The internal and external environments comprise the total environment. For descriptive purposes, environment has been divided into components, viz. physical, biological and psychosocial, all closely related.

The concept of total global environment is the product of convergence of many forces – industrialization, the effects and dangers of weapons of mass destruction, with overall global technological advancements which make communication, ecological studies of nature and man-made environment easier than thought earlier.

Thus the concept of total global environment is derived directly from ecological studies of the outcome of the convergence of the above forces. These studies base their work on the basic principles of ecology which may be summed up as follows:

1. All forms of life are interdependent.

2. The stability of ecosystems is dependent on their diversity and complexity.

All sources – food, water, minerals, energy, etc. are finite. The health of humans, like all living organisms, is dependent on an ecosystem that sustains life. Healthy ecosystems are cradles for healthy organisms. Yet there is abundant evidence that many life-support systems are far from healthy, placing an increased burden on human health. In some areas of the world, gains in life expectancy and quality of life made during the twentieth century are at risk of being reversed in the twenty-first century. The consequences of ecosystem degradation to human health are numerous, and include health risks from unsafe drinking water, polluted air, climate change, emerging new diseases, and the resurgence of old diseases owing to ecological imbalances. Reversing this damage is possible in some cases, but not in others. Prevention of ecological damage is by far the most efficient strategy.

The developing countries are in desperate need of development in order to meet the basic essentials for life of their millions of people. The process of development through the advancement of technology alters the delicate system of environment constantly and has numerous adverse effects on the status of ecosystem. During the course of time, population –driven development has increased as well as technically mediated interference as a part of our way of living, but human solidarity may have decreased somewhat. Our aspiration for greater material wealth has made many individuals more isolated, living wasteful lives which have put strain on the eco-health. Good eco-health has, more or less, come to be regarded as something unchangeable and obvious. The nonstop degradation of environmental resources has made people more aware of the susceptibility and defenselessness of the biosphere to the human intervention through environmental manipulation. Therefore, there is a need to change people's attitude and grow awareness in them with regard to the environment. There is no doubt in the fact that development is an inevitable need of all the nations, but should not be at the cost of the global environmental health. This will hopefully lead us to an era of complete harmony between human and environment. Since the environment in which we live is of special interest and importance to us, there is an urgent need to know the status of the

environmental health and to develop appropriate strategy for proper restoration of the Earth's ecosystem.

Defining Ecosystems

An ecological system may be defined as a community of plants and animals interacting with each other and their abiotic, or natural, environment. Typically, ecosystems are differentiated on the basis of dominant vegetation, topography, climate, or some other criteria. Boreal forests, for example, are characterized by the predominance of coniferous trees; prairies are characterized by the predominance of grasses; the Arctic tundra is determined partly by the harsh climatic zone. In most areas of the world, the human community is an important and often dominant component of the ecosystem. Ecosystems include not only natural areas (e.g., forests, lakes, marine coastal systems) but also human-constructed systems (e.g., urban ecosystems, agro ecosystems, and impoundments). Human populations are increasingly concentrated in urban ecosystems, and it is estimated that, by the year 2010, 50 percent of the world's population will be living in urban areas.

A landscape comprises a mosaic of ecosystems, including towns, rivers, lakes, agricultural systems, and so on. Precise boundaries between ecosystems are often difficult to establish. Often regions slide into one another gradually, over a protracted "transition" zone, as for example between the boreal forest and the Taiga regions of Canada.

Ecology is the study of the interaction between organisms and their environment. The environment is a combination of the physical environment, like temperature, water availability, etc, and any influences on an organism exerted by other organisms- the biotic environment. Ecology can be considered on a wide scale, moving from an individual molecule to the entire global ecosystem. However, four identifiable subdivisions of scale or levels are of particular interest:

- (i) Individual: the response of individuals to their environment is the key issue.

- (ii) Populations: at the level of populations of a single species, the determinants of abundance and population fluctuation dominate. Communities are
- (iii) Communities: are the mixtures of populations of different species found in a defined area.
- (iv) Ecosystems: comprise the biotic community in conjunction with associated complex of physical factors that characterize the physical environment

In another words there are four identifiable subdivisions of scale which ecologists investigate and at each scale the subjects of interest to ecologists change. At the individual level it is the considering the response of individuals to their environments; at the population level it is the examining the response of populations of a single species to the environment; at the communities level it is the composition and structure of a community and the abiotic components of the environment such as energy flow, food webs and the cycling of nutrients.

The living organisms and their non-living environment are inseparably inter-related and interact upon each other. Any unit, in which there is interaction between organisms and their physio-chemical environment and between organisms and materials between the two, is called ecosystem. Ecosystem is the functional unit of ecology and represents the highest level of ecological integration which is energy based.

Components of Ecosystem

Although the ecosystem concept recognizes that the biotic communities and their environment are inseparable, yet they are divided into (i) biotic and (ii) abiotic components for the convenience of study.

I. Biotic Components or biotic environment of ecosystem

Ecosystems have lots of different living organisms that interact with each other. Biotic means relating to, produced by, or caused by living [organisms](#) . The living organisms in an ecosystem can be divided into three categories: producers, consumers and decomposers. They are all important parts of an ecosystem.

A. Producers

Solar energy is primarily trapped by the chloroplast machinery of green plants to build organic material. Green plants take simple inorganic materials like salt, water, carbon dioxide, etc. and produce their own food which is in the form of carbohydrates. They actually convert solar energy into chemical energy during photosynthesis. These organisms are, therefore, called autotrophs which mean self food producing as they synthesize their own food. All chlorophyll bearing plants such as algae, grass and trees are producers. The green plants ranging in size from microscopic phytoplankton of aquatic habitats to the gigantic trees of the tropical rain forest are the main producers in the ecosystem. Producers are the green plants. They make their own food. Consumers are animals and they get their energy from the producers or from organisms that eat producers.

B. Consumers

All other forms of life which do not possess chlorophyll cannot produce their own food and depend upon others and obtain their food by consuming other plants or animals. Therefore, they are called heterotrophs. Fungi, most of the bacteria, and animals derive their food directly or indirectly from the food produced by green plants and are examples of heterotrophs.

There are three types of consumers: herbivores, carnivores and omnivores.

Herbivores are animals that eat plants, carnivores are animals that eat herbivores and sometimes other carnivores, and omnivores are animals that eat plants and other.

Some of consumers live on or in other organisms (hosts) and derive their food from the host's body. These are called parasites. Some organisms prey upon other organisms like a frog preying upon a grasshopper and these are called predators.

C. Decomposers

The third types of living organism in an ecosystem are the [decomposers](#). Decomposers are plants and animals that break down dead plants and animals into organic materials that go back into the soil.

Both the primary producers and the secondary producers have their life cycles, and new generation of populations develop while old ones die. What happens to the dead? If the materials so locked in the body of the organisms are not returned to soil and atmosphere, the cycling of materials will stop and the earth will be full of dead organic matter. There is a continuous breaking up of decomposition of these organic materials taking place every where in all ecosystems. Some organisms with a specialized mode of nutrition and life, like fungi, bacteria, etc. constantly decompose the dead organic materials into simple inorganic substances and during the process derive their food and energy. These are called decomposers or reducers. In fact decomposers are also a form of consumers who derive their food from dead parts of the primary and secondary producers. The role of decomposers is very special and important in the ecosystem as without their activity the entire cycle of minerals is liable to get blocked, that is in their absence, the basic elements of life would remain blocked in the complex molecules of the wastes and remains of other living forms, rendering them unavailable to the producers to the production in the ecosystem.

Food Chains and Food Webs:

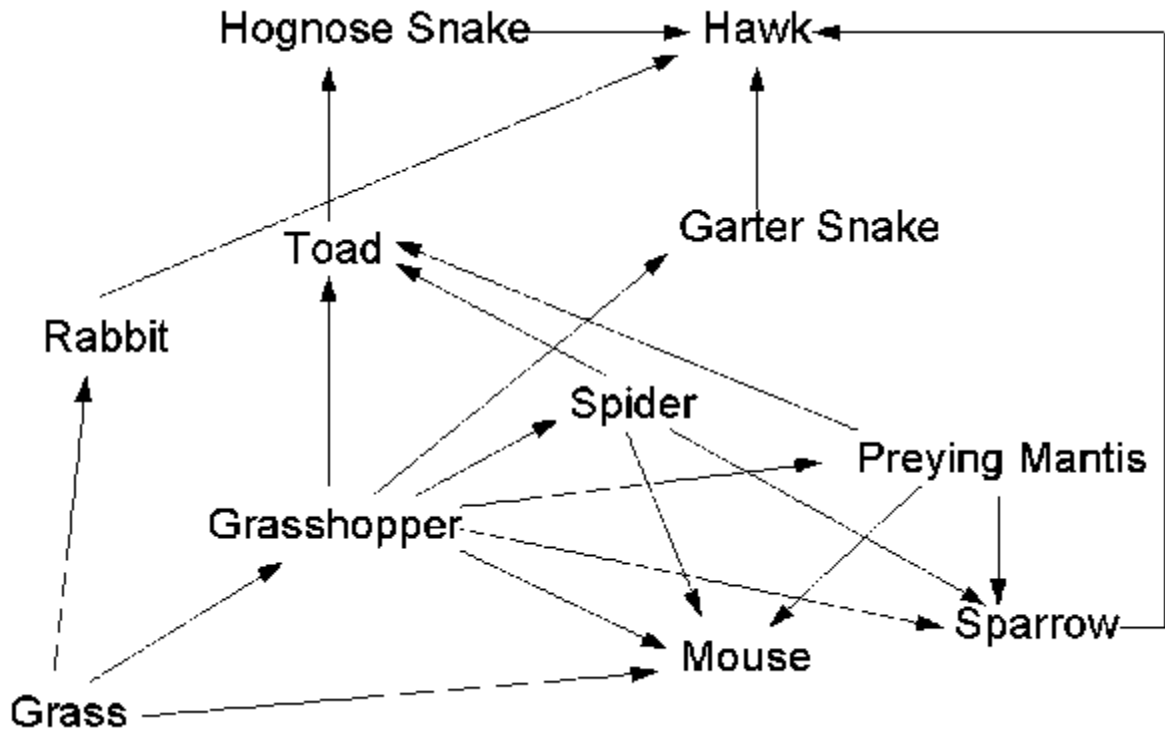
A food chain is the path of food from a given final consumer back to a producer. For instance, a typical food chain in a field ecosystem might be:

Grass ---> grasshopper --> mouse ---> snake ---> hawk

Food chain is the process or sequence of the transfer of food energy from one organism to another in an ecological community. A food chain begins with a producer, usually a green plant or alga that creates its own food through photosynthesis. In the typical predatory food chain, producers are eaten by primary consumers (herbivores) which are eaten by secondary consumers (carnivores), some of which may in turn be eaten by tertiary consumers (the top carnivore in the chain). Many species of animals in an

ecological community feed on both plants and animals and thus play multiple roles in the chain. Parasites feed on living tissues, generally without killing their hosts, and may themselves be hosts to smaller parasites. In addition, organisms that die without being eaten are consumed by detritivores, some of which serve as prey for other consumers. The complex system of interrelated food chains in an environment is known as a food web.

The real world, of course, is more complicated than a simple food chain. While many organisms do specialize in their diets, other organisms do not. Hawks don't limit their diets to snakes, snakes eat things other than mice, and mice eat grass as well as grasshoppers, and so on. A more realistic depiction of who eats whom is called a food web; an example is shown below:



It is when we have a picture of a food web in front of us that the definition of food chain makes more sense. We can now see that a food web consists of interlocking food chains, and that the only way to untangle the chains is to trace *back* along a given food chain to its source. In some cases, the organisms may already be dead. Thus, a food web is a

network of energy flows in and out of the ecosystem of interest. Such flows can be very large, and some ecosystems depend almost entirely on energy that is imported. A food chain is one particular route through a food web.

A food web helps depict how an ecosystem is structured and functions. Most published food webs omit predation on minor species, the quantities of food consumed, the temporal variation of the flows, and many other details.

Along a simple food chain, A eats B, B eats C, and so on. For example, the energy that plants capture from the sun during photosynthesis may end up in the tissues of a hawk. It gets there via a bird that the hawk has eaten, the insects that were eaten by the bird, and the plants on which the insects fed. Each stage of the food chain is called a trophic level. More generally, the trophic levels are separated into producers (the plants), herbivores or primary consumers (the insects), carnivores or secondary consumers (the bird), and top carnivores or tertiary consumers (the hawk).

Food chains may involve parasites as well as predators. The lice feeding in the feathers of the hawk are yet another trophic level. When decaying vegetation, dead animals, or both are the energy sources, the food chains are described as detrital. Food chains are usually short; the shortest have two levels. One way to describe and simplify various food chains is to count the most common number of levels from the top to the bottom of the web. Most food chains are three or four trophic levels long (if parasites are excluded), though there are longer ones.

II. Abiotic Components of Ecosystem

Abiotic components or abiotic environment of ecosystem are non-living chemical and physical factors in the [environment](#). In another words abiotic component are inorganic and organic substances and climatic factors which may be classified as soil, [light](#), [temperature](#), [water](#), [atmospheric gases](#), and wind. As it was mentioned earlier ecosystems are complex systems of populations of organisms and their controlling environment, and that the term environment includes both the abiotic or physical environment, and the biotic or biological environment. The abiotic environment can be divided into a number

of major subsystems, traditionally termed "spheres". These partially extend beyond the biosphere in some cases, and so the focus or our interest in these systems is within the 20 Km thickness of the biosphere, with which all the spheres interact and is the most active zone of all these spheres. As the biosphere and its function shows clearly, there is continuous exchange of energy and materials between all of the elements in the systems.

A. Atmosphere

The atmosphere is the shell of gases around the Earth that is retained by the Earth's [gravity](#). The shell extends to thousands of kilometers above the surface of the planet, but most of this skin of gas is so diffuse as to be at near vacuum conditions by human standards. These gases consist primarily of the elements nitrogen, oxygen, and argon, and smaller amounts of hydrogen, carbon dioxide, water vapor, helium, neon, krypton, xenon, and others. The most important attribute of air is its life-sustaining property. Human and animal life would not be possible without oxygen in the atmosphere. The lowest part of the atmosphere is the troposphere which is about 10 km thick and contains approximately two thirds of the mass of gas which makes up the whole of biosphere. The junction of the troposphere with the layer above, the stratosphere is the tropopause and it marks a change in the direction of the vertical temperature gradient through the atmosphere. Life is confined to the lower part of the troposphere, below about 6.5Km. Above that altitude permanent life is impossible as the constant low temperature ensures that all water is permanently frozen. The atmosphere provides oxygen and carbon dioxide for the plants and animals in an ecosystem. The atmosphere is also part of the water cycle. Without the complex interactions and elements in the atmosphere, there would be no life at all.

B. water

Without water there would be no life. Water is a large percentage of the cells that make up all living organisms. In fact, you may have heard that humans can go longer without food than they can without water. It's true! Without water all life would die. In addition to being an important part of cells, water is also used by plants to carry and distribute the nutrients they need to survive. Water constitutes the bulk of the living tissues of plants and animals. Most physiological and biochemical processes occur in an aqueous matrix. Water is the medium of life for aquatic habitats. The rain forest and the desert provide an

adequate picture for relationship of water and the vegetation. Water is constantly moving on Earth's surface and changing back and forth between ice, liquid water, and water vapor.

The water cycle begins when the Sun heats the water in the oceans and causes it to evaporate and enter the atmosphere as water vapor. Some of this water vapor falls as precipitation directly back into the oceans, completing a short cycle. Some of the water vapor, however, reaches land, where it may fall as snow or rain. Melted snow or rain enters rivers or lakes on the land. Due to the force of gravity, the water in the rivers eventually empties back into the oceans. Melted snow or rain also may enter the ground. Groundwater may be stored for hundreds or thousands of years, but it will eventually reach the surface as springs or small pools known as seeps. Even snow that forms glacial ice or becomes part of the polar caps and is kept out of the cycle for thousands of years eventually melts or is warmed by the Sun and turned into water vapor, entering the atmosphere and falling again as precipitation. All water that falls on land eventually returns to the ocean, completing the water cycle.

The hydrosphere consists of the bodies of water that cover 71 percent of Earth's surface. The largest of these are the oceans, which contain over 97 percent of all water on Earth.

C. Soil

Soil is a critical part of an ecosystem. It provides important nutrients for the plants in an ecosystem. It helps anchor the plants to keep them in place. Soil absorbs and holds water for plants and animals to use and provides a home for lots of living organisms. **Soil**, the loose material that covers the land surfaces of Earth and supports the growth of plants. In general, soil is an unconsolidated, or loose, combination of inorganic and organic materials. The inorganic components of soil are principally the products of rocks and minerals that have been gradually broken down by weather, chemical action, and other natural processes. The organic materials are composed of debris from [plants](#) and from the decomposition of the many tiny life forms that inhabit the soil.

Soils comprise a mixture of inorganic and organic components: minerals, air, water, and plant and animal material. Mineral and organic particles generally compose roughly 50 percent of a soil's volume. The other 50 percent consists of pores, open areas of various shapes and sizes. Networks of pores hold water within the soil and also provide a means of water transport. Oxygen and other gases move through pore spaces in soil. Pores also serve as passageways for small animals and provide room for the growth of plant roots. Soil scientists also characterize soils according to how effectively they retain and transport water. Once water enters the soil from rain or irrigation, gravity comes into play, causing water to trickle downward. Water is also taken up in great quantities by the roots of plants. Soils differ in their capacity to retain moisture against the pull exerted by gravity and by plant roots. Coarse soils, such as those consisting of mostly of sand, tend to hold less water than do soils with finer textures, such as those with a greater proportion of clays.

Water also moves through soil pores independently of gravity. This movement can occur via capillary action, in which water molecules move because they are more attracted to the pore walls than to one another. Such movement tends to occur from wetter to drier areas of the soil. The movement from soil to plant roots can also depend on how tightly water molecules are bound to soil particles. The attraction of water molecules to each other is an example of cohesion. The attraction of water molecules to other materials, such as soil or plant roots, is a type of adhesion. These effects, which determine the so-called matrix potential of the soil, depend largely on the size and arrangement of the soil particles. Another factor that can affect water movement is referred to as the osmotic potential. The osmotic potential hinges on the amount of dissolved salts in the soil. Soils high in soluble salt tend to reduce uptake of water by plant roots and seeds.

In soil, water carries out the essential function of bringing mineral nutrients to plants. But the balance between water and air in the soil can be delicate. An overabundance of water will saturate the soil and fill pore spaces needed for the transport of oxygen. The resulting oxygen deficiency can kill plants. Fertile soils permit an exchange between plants and the atmosphere, as oxygen diffuses into the soil and is used by roots for respiration. In turn, the resulting carbon dioxide diffuses through pore spaces and returns to the atmosphere.

This exchange is most efficient in soils with a high degree of porosity. For farmers, gardeners, landscapers, and others with a professional interest in soil health, the process of aeration, making holes in the soil surface to permit the exchange of air, is a crucial activity. The burrowing of earthworms and other soil inhabitants provides a natural and beneficial form of aeration.

D. Light and Temperature

The heat and light from the sun are critical parts of an ecosystem. The Sun is the source of energy for life on Earth and is the strongest modulator of the human physical environment. In fact, the Sun's influence extends throughout the solar system, both through photons, which provide heat, light, and ionization, and through the continuous outflow of a magnetized, supersonic ionized gas known as the solar wind.

Sunlight, in the broad sense, is the total spectrum of the electromagnetic radiation given off by the Sun. In the sun exceedingly high temperature acts a nuclear furnace where nuclear rearrangement like continuous transmutation of hydrogen atoms into helium is taking place. This process releases fantastically high amounts of energy which radiates out in all directions in the form of electromagnetic waves called solar radiation. Solar radiation is [radiant energy](#) emitted by the sun from a [nuclear fusion](#) reaction that creates electromagnetic energy. About half of the radiation is in the visible short-wave part of the [electromagnetic spectrum](#). The other half is mostly in the near-infra part, with some in the [ultraviolet](#) part of the spectrum. When ultraviolet radiation is not absorbed by the atmosphere or other protective coating, it can cause a change in the skin color of humans.

All the energy in an ecosystem originates as radiation from the sun or solar radiation consisting of the sun's heat helps water evaporate and return to the atmosphere where it is [cycled](#) back into water. The heat also keeps plants and animals warm. Without light from the sun there would be no [photosynthesis](#) and plants wouldn't have the energy they need to make food. During photosynthesis, plants trap light energy with their leaves. Plants use the energy of the sun to change water and carbon dioxide into a sugar called glucose. Glucose is used by plants for energy and to make other substances like cellulose and

starch. Cellulose is used in building cell walls. Starch is stored in seeds and other plant parts as a food source.

Types of Ecosystem

Generally there are two main types of ecosystem namely called aquatic ecosystem and terrestrial ecosystem.

1. Aquatic ecosystem:

An aquatic ecosystem is an ecosystem located in water bodies. Communities of organisms that are dependent on each other and on their environment live in aquatic ecosystems. The two main types of aquatic ecosystems are marine ecosystem and freshwater ecosystem.

a. Marin Ecosystems

Marine ecosystems cover approximately 71% of the Earth's surface and contain approximately 97% of the planet's water. They generate 32% of the world's net primary production. They are distinguished from freshwater ecosystems by the presence of dissolved compounds, especially salts, in the water. Approximately 85% of the dissolved materials in seawater are sodium and chlorine. Seawater has an average salinity of 35 parts per thousand of water. Actual salinity varies among different marine ecosystems. Marine ecosystems can be divided into the following zones: oceanic (the relatively shallow part of the ocean that lies over the continental shelf; profundal (bottom or deep water); benthic (bottom substrates); inertidal (the area between high and low tides); [estuaries](#); [salt marshes](#); [coral reefs](#); and [hydrothermal vents](#) (where [chemosynthetic sulfur bacteria](#) form the food base).

Environmental problems concerning marine ecosystems include unsustainable exploitation of marine resources (for example [over fishing](#) of certain species), [water pollution](#), and building on coastal areas.

b. Freshwater ecosystem

Freshwater ecosystems cover 0.8% of the Earth's surface and contain 0.009% of its total water. They generate nearly 3% of its net primary production. Freshwater ecosystems

contain 41% of the world's known fish species. The term **fresh water** refers to bodies of water containing low concentrations of dissolved [salts](#) and other total dissolved solids. Fresh water is an important renewable resource, necessary for the survival of most terrestrial organisms, and required by humans for drinking and agriculture, among many other uses. Fresh Water generally contains less than 1,000 milligrams-per-liter of dissolved solids.

There are three basic types of freshwater ecosystems:

- Lentic: slow-moving water, including [pools](#), [ponds](#), and [lakes](#).
- Lotic: rapidly-moving water, for example [streams](#) and [rivers](#).
- [Wetlands](#): areas where the soil is saturated or inundated for at least part of the time.

2. Terrestrial ecosystem:

Terrestrial ecosystem is referred to a community of organisms and their environment that occurs on the land masses of continents and islands. Terrestrial ecosystems are distinguished from aquatic ecosystems by the lower availability of water and the consequent importance of water as a limiting factor. Terrestrial ecosystems are characterized by greater temperature fluctuations on both a diurnal and seasonal basis than occur in aquatic ecosystems in similar climates. The availability of light is greater in terrestrial ecosystems than in aquatic ecosystems because the atmosphere is more transparent than water. Gases are more available in terrestrial ecosystems than in aquatic ecosystems. Those gases include carbon dioxide that serves as a substrate for photosynthesis, oxygen that serves as a substrate in aerobic respiration, and nitrogen that serves as a substrate for nitrogen fixation. Terrestrial environments are segmented into a subterranean portion from which most water and ions are obtained, and an atmospheric portion from which gases are obtained and where the physical energy of light is transformed into the organic energy of carbon-carbon bonds through the process of photosynthesis.

The organisms in terrestrial ecosystems are integrated into a functional unit by specific, dynamic relationships due to the coupled processes of energy and chemical flow. Those

relationships can be summarized by schematic diagrams of trophic webs, which place organisms according to their feeding relationships. The base of the food web is occupied by green plants, which are the only organisms capable of utilizing the energy of the Sun and inorganic nutrients obtained from the soil to produce organic molecules. Terrestrial food webs can be broken into two segments based on the status of the plant material that enters them. Grazing food webs are associated with the consumption of living plant material by herbivores. Detritus food webs are associated with the consumption of dead plant material by detritivores. The relative importance of those two types of food webs varies considerably in different types of terrestrial ecosystems. Grazing food webs are more important in grasslands, where over half of net primary productivity may be consumed by herbivores. Detritus food webs are more important in forests, where less than 5% of net primary productivity may be consumed by herbivores.

There is one type of extensive terrestrial ecosystem due solely to human activities and many types that are natural ecosystems. Those natural ecosystems reflect the variation of precipitation and temperature over Earth's surface. The smallest land areas are occupied by tundra and temperate grassland ecosystems, and the largest land area is occupied by tropical forest. The most productive ecosystems are temperate and tropical forests, and the least productive are deserts and tundras .

Chapter Two

ENVIRONMENTAL EDUCATION

1.2 CONCEPT OF ENVIRONMENTAL EDUCATION

Nature is fascinating. It embodies the spirit of creation. Man has made it more beautiful. But for him, nature would not have been so enjoyable as it is. He has converted the wild forests into parks, gardens, orchards and cities and he deserves all praise for that. But in doing that and in his attempts to make it more comfortable, he has often destroyed forests recklessly, polluted air and water, de-spoiled nature ruthlessly. The inevitable consequence is an ominous deterioration of environment. He did not take precautions, so he is in a crisis today.

Now, the time has come for man to be more careful, lest he invite catastrophe. How can it be done?

Obviously environmental education, imparted with sincerity is the only answer. Environmental education will not only open our eyes to the havoc but also inform us as to how we can intertwine progress and life on this planet that they exist together. We can save this earth only if we organize environmental education programmes on a larger scale.

Defining environmental education is not an easy task, because the specific content areas of environmental education have never been well-defined. It is universally agreed that environmental education should be interdisciplinary, drawing from biological, sociological, anthropological, economic, and political and human

resources. It is also agreed that a conceptual approach to imparting environmental education is always best.

The definition of environmental education, given by the groups working on the subject, apparently differs from one another in phrases only. One definition is already mentioned above; it is given by IUCN commission on education, international working committee on environmental education in the school curriculum, Paris, 1970.

Report of the conference of African Educators, EDC and CREDO, Nairobi, African social studies programmes 1968 states “Environmental education is the process of creating an awareness and an understanding of the evolving social and physical environment as a whole, its natural, man-made, cultural, spiritual resources, together with the rational use and conservation of these resources for development”. To sum up, we can list the main concepts derived out of environmental education as follows:

- (i) Environmental Education (EE) is not simply a theme to be added to the curricula as a separate discipline.
- (ii) Environmental education is the outcome of a re-orientation and dove-tailing of various disciplines.
- (iii) Environmental education is education through, about and for environment.
- (iv) It is both a style and subject matter of education.
- (v) Environmental education is a study of factors influencing ecosystems, mental and physical growth, etc.
- (vi) Environmental education is a process of creation of individual and collective commitment to improve the quality of life.

1.2.1 Concept and Definitions of Environmental Education

Defining environmental education is rather a difficult task. There is no all embracing definition of environmental education. In practice, it can mean gardening local studies, outdoor science, or almost anything that school cares to evolve. A completely acceptable definition of environmental education has not yet been found.

The “Environmental Education Act of 1970”, landmark legislation which reflects a national commitment to the search for enlightened lifestyles, has provided its own definition of environmental education. The language of the senate report explaining the act follows: Environmental education is an integrated process which deals with man’s inter-relationship with his natural and man-made surroundings, including the relation of population growth, pollution, resource allocation and depletion, conservation technology, and urban and rural planning to the total human environment (The United States Environmental Act, 1970).

Environmental education is a study of the factors influencing ecosystems, mental and physical growth, living and working conditions, decaying cities, and population pressures. Environmental education is intended to promote among citizens the awareness and understanding of the environment, our relationship to it, and the concern and responsible action necessary to assure our survival and to improve the quality of life.

As stated in the Act, environmental education is a design for national reform because it will run through every aspect of formal and nonformal education, improves philosophies of life and help each citizen to acquire a new and more viable life style.

IUCN Commission of Education, international working meeting on environmental education in the school curriculum, Paris, UNESCO, 1970 has defined environmental education as follows:

“Environmental education is the process of recognizing value and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture and his biophysical surroundings (Council of Europe, 1976). Environmental education also entails practice in decision making and self formulation of a code of behavior about issues concerning environmental quality” (International Union for Conservation of Nature and Natural Resources Conference at Nevada).

“Environmental education is an integral part of the education process. It should be centered on partial problems and be of inter-disciplinary character. It should aim at building up a sense of values, contribute to public well being and concern itself with the survival of the human species. Its force should reside mainly in the initiative of the learners and their involvement in action and it should be guided by both immediate and future subjects of concern”. Finnish National Commission for UNESCO, Report of the Seminar on Environmental Education, Jammi, Finland, 1974, defines environmental education as,

“Environmental education is a way of implementing the goals of environmental protection. Environmental education is not a separate branch of science or subject of study. It should be carried out according to the principle of life-long integral education”.

The US office of education has offered the following two working definitions:

- (i) “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 the development of skills and insights needed to understand the structure, requirements and impact of interactions within and among various environmental entities, sub-systems, and system.
- (ii) The term environmental education means the educational process dealing with man’s relationship with his nature and manmade surroundings, and includes the relation of population, pollution, resource allocation and depletion, conservation, transportation, technology, and urban and rural planning to the total human development.

It is a means of organizing the work in school so that a study of school’s immediate surroundings or of the community in which it is situated can provide starting points for learning. In other words, such studies can provide starting points for learning rather than clearly defined areas of knowledge. It is often far from clear what the desired outcomes of these studies should be for individual children.

The above mentioned definitions have a tilt towards cognitive aspects of learners. Perhaps a considerable emphasis also needs to be put on aspects which relate to values, feeling and attitude analysis in environmental education. Without such an emphasis, environmental education will be nothing more than a facile exercise in glibness.

The problem with many environmental education definitions is that they end at the leave of cultivating the skills, developmental and problem solving feelings,

politics and economics. Agne and Nash (1974) put such definitions in allopathic models of environmental education, because they treat surface symptoms (admittedly important ones) such as water and air pollution, solid wastes, and over population, without effectively getting at the attitudes, values and beliefs, and feeling which cause environmental deterioration. They define environmental education as a total psychopolitical approach to thinking, valuing and acting which will enable person to identify the over simplifications, distortions, contradictions and oversights in their world-views, so that they can understand and resolve the destructive influences these have on psychological, physical, social and non-human environment.

1.3 NATURE AND SCOPE OF ENVIRONMENTAL EDUCATION

Despite its recent origin, the theme of environmental education has, for good or ill, directed our attention to a number of problems, both old and new, concerning the question of what education is and what is ought to be, in a world society tormented by profound and persistent crisis. These crisis are particularly discernable in the matter of human fellowship and the growing discrepancies between culture – the second nature created by man and the original biogenetic nature of the planet.

There are two widely differing views of what environmental education is, or should be with the framework of our civilization.

Considered in broad terms, environmental education is a pretext for working out a brand theory of education embracing all the philosophical, social and educational ideas that converge to form the new education. It synthesizes them in a way which is more enthusiastic than critical, and presents them as something original produced by the creativity and imagination of a revolutionary way of thinking.

In the narrow sense of term, environmental education is not a panacea for all the present and future ills of our civilization; it is rather, a pragmatic response to the defacement of the environment, both in affluent societies, where pollution results from poverty.

Such a realistic conception is devoid of any illusions about the possibility of giving environmental education to a small holder, whose biological needs prevent him from entertaining ideas such as brother tree or sister bird.

Thus environmental education, considered in this narrow sense, is not a pretext but a modest texture. It is not a complex universe but a province with familiar, rustic land marks. Unlike the contentious attitude of certain radicalized middle class educators who question the policies, methods and relationships of the participants in the educational process within the framework of the capitalist economy, the narrow approach, seeks to establish an experimental station on a pioneer front and to develop on educational practice that is of a restricted nature.

A series of questions on the uncertainties surrounding this new pedagogical development are formulated: What is environmental education? Is it a new subject to be included in the curriculum? Is it an aspect of one of the subjects which taught today for all of them? It is a new teaching method? Is it a new type of education aimed at the conservation of nature, hygiene and general health? Is it a new approach to education, seeking to interest and involve people in world problems? Is it an attempt to save mankind from impending disasters? Is it education for economic development? Is it a new integrated approach to education which seeks to link the student to his immediate surrounding, with a view to improving the interaction

between man and his environment? These questions have not yet been answered satisfactorily; and many other could be asked.

Environmental education is a process of creation of individual and collective commitment to improve the quality of the life through self knowledge and an understanding of the physical, political, socio-economic and behavioural concerns of man. Moreover, it is a continuous, individual and community education process that is an integral part of the complicated web of communication for human understanding.

Perceived in different ways in different institutions and nations, environmental education has not progressed as a distinctive, integrated discipline. Instead it is an evolving field, developing response to the growing concern with national and international environmental problems.

Environmental education is usually problem focussed rather than discipline centered. It is often organised around broad themes of environmental management and involves the detailed study of one or more topics of environment concern like conservation of nature and natural resources, human ecology, wild life management, etc.

Environmental studies are largely experimental, experiential with an emphasis on field work, so that environmental problems can be studied in the systems where they occur.

Environmental education is education through, about and for environment. Its scope is very wide. A lot of teaching-learning can be carried out through environment and that is the first aspect of environmental education. Its second aspect covers

teaching-learning about environment. This is important for man has to tackle his environment every day for his survival, sustenance and prosperity.

Environmental education is both a style and subject matter of education. In so far as the style is concerned, it means using environment as a teaching-learning aid and as an approach to education. In so far as the subject matter or the content is concerned, it means teaching about the components and constituents of environment. In so far as the teaching for environment is concerned, it means controlling the environment, establishing proper ecological equilibrium which entails proper use and conservation of resources and also involves control of environmental degradation.

Even though the definition of environmental education seems to be simple and superficial, it is actually very comprehensive and deep, for it denotes that environmental education is a medium and process of education and that it covers man's relationship with his natural as well as social and manmade environment and also includes the relationship of population, industrialization, pollution, resource allocation and depletion, conservation, transportation, technology, energy, rural and urban planning, etc. So environmental education has a multidisciplinary character. It is intended to promote among citizens the awareness and understanding of the environment, our relationship with it, and the concerns and responsible actions necessary to assure our survival and to improve the quality of life.

Various definitions of environmental education reflect a different set of personal priorities but have a similar core of essential characteristics.

The most important of these characteristics is the awareness of inter-relationship between man and environment, and the understanding of both the nature

and implications of human impact on the environment. This is an explicit component of every popular definition and is presented in some as the only definitive element. But it is not in itself a sufficient condition to distinguish environmental education from many other academic areas including Geography, Ecology, Agricultural Science Geology and Engineering all of which involve in characteristic ways the study of inter-relationship by a more holistic or integrative approach than any of these other areas. It is in agreement with the current international trend of comprehensive inter-disciplinary studies on environmental issues.

Awareness of the environment begins at least at birth, and most likely before with the first sharp cry of the child emerging from the most comfortable life sustaining environment, it will come into the environment we know.

In that sense, environmental education begins with education itself. It is as basic as learning to arrange one's toys, care for one's room and personal hygiene, one's home, school yard or farmyard; and it is as sophisticated as caring about a growing hole in the ozone layer, depletion of rain forests, photochemical fog, land management and urban planning. It lasts a lifetime as one's own life undergoes an ever changing, ever evolving, ever threatened environment. It is life long learning in about and for that environment with an accent on action in a process of problem solving and the slow development of an environmental ethic inseparable from social morality, life style and principled behavior.

Environmental studies cover the study of all system of air, land, water, energy and life that surround man. It includes all sciences directed to system-level of understanding of the environment drawing especially upon such disciplines as

methodology, geophysics, oceanography and ecology and such field as Physics, Chemistry, Biology, Mathematics and Engineering . . . Environmental systems contain the complex processes that must be mastered and the solution of such human problems as the maintenance of renewable resources, the conservation of non-renewable resources, reducing the effects of natural disasters, abating pollution by man and coping with natural pollution, etc.

The term environmental studies programme has been used some what loosely to cover any organized programme of study or individual course whose purpose or effect is to produce greater awareness or improved understanding of the complex elements of the natural and manmade environment of man's role in changing the environment, and of the impact of the environment on humans.

Environmental education is education through, about and for environment. Its scope is, therefore, very wide. It begins from using environment as a medium of learning and includes all that Kalidasa, Wordsworth and others have said in appreciation of nature and also all that scientists and scholars have disclosed about our physical and social environment, and finally it includes all that we say and do for conserving our resources and for beautifying our surroundings including urban and country planning.

Teaching and learning about environment is important for man has to tackle his environment every day for his survival, sustenance and prosperity. Environmental education is a life long process and is aimed at not merely imparting knowledge and understanding man's total environment and of the methods and their application for improving our near and distant surroundings, but it also aims at inculcating skills,

attitudes and values necessary to understand, appreciate and improve the quality of life in biosphere. Environmental education is a way of implementing the goals of environmental protection. It is not a separate branch of science or subject of study, it should be carried out according to the principle of life long integral education.

Environmental education as a naturalistic type of education with a distinctly ecological bias that really amounts to ecology, respect for nature, knowledge of the ecosystems in general and of the local ecosystem. Its limited nature means that it is but one more subject on the curriculum – let us call it simply ecology – which will become more complicated and reaches the higher levels in the educational system, if its inclusion throughout the educational process is accepted.

Environmental education as a perspective to be given to all the subjects on the curriculum, a second trend, means that, without altering the subjects on the curriculum, teachers will give them an ecological or economic slant towards environmental problems. If teachers are to do this they will have to be given a lengthy and costly training. Unless they have a profound insight into the mechanisms of nature and the aggressive process of the economy and technology, they will not be able to carry out this difficult task successfully.

Environmental education as a new style of education, an all-round approach to education with ambitious goals, which will seek to make pupils fully aware of the problems connected with their environment, so that they will be able to tackle these problems with a sense of responsibility and with the technical skills which will enable them to contribute, alongside other members of their community, to their solution. This awareness of environmental problems is social awareness rather than ecological

awareness. Such problems will be solved through collective action aimed at eradicating the social and economic causes of the degradation of the human environment. The political aspects of this search for solutions may give rise to conflicts of various kinds. One such conflict and not the least, is the collision between the educational system and the private interests which operate in alliance with the powers on of the state.

Environmental education should be broad, open to the internationalist spirit; it should not offer protection to narrow minded chauvinism. It is not difficult to discern the propagandistic aims of the great industrial powers who have no hesitation in using hard technology in the areas of influence while recommending developing countries to see soft technology.

Environmental education in the narrow sense of the term is not intended to replace general education or to become a world with its own laws. It should have a clearly defined objective: on all round understanding of the natural system and the social system. The treatment of reality as a whole, the consolidation of the various subjects so that they form an environmental science which will enable students to get a unified view of the world. However, a distinction should be made in the accomplishment of this task, between the realm of nature, which is one of necessity and the realm of man, the key note of which is freedom. It is extremely important that the systems theory should be applied to the total reality of the environment, but it is also essential to realize that there cannot be harmony between the social system and the natural system unless the relations between men are harmonious and national.

An understanding of the situation as it is should enable students to decide what it should be.

Thus environmental education is not merely a matter of inculcating respect for the natural order or appreciation of it. It will be a scientific and practical study of environmental problems which originate in human relations rather than in man's relationship with things.

Such an environmental education is forward-looking; it concerns all ages and is designed for all social strata, it helps to raise the standard of living and the quality of life in local communities through collective self-management and seeks to give tangible expression to the highest social values inspired by human civilization. Ultimately, the integrating capacity of a steadily maintained environmental education tends to blur the boundaries between the formal and nonformal aspects of education.

1.4 IMPORTANCE OF ENVIRONMENTAL EDUCATION

For children to develop an environmental ethic, we must redefine the objectives of formal education. Schooling has been and to a greater extent still is, for the purpose of enabling the individual to extract the maximum advantage from the natural and social environment in which he operates. This perhaps was reasonable when we could move away from ecological crisis. With our growing awareness of the finite capacity of the biosphere, however and man's ability to alter its life support system drastically and permanently, we realize that the central objective of education must shift. Man and environment must now be presented in schools as a single system in which the activities of the individual must be adjusted to the capacities of the environment. Only in this way can both man and environment be maintained in a

healthy state. We must help children to perceive themselves as part of their environment the object environment is taken over as a personal responsibility – a pre-requisite for self determination.

The main understandings developed in schools are:

1. The complementarities of organisms and their environment.
2. The selectivity of the individual into input and output.
3. The extent of interconnections from an individual outwards.
4. The enabling and constraining properties of energy and material resources.
5. The significance of short term and long term change.
6. The consequences of individual, society and environment of human life styles.
7. The choice of criteria and the procedures available for guiding and managing change.

To achieve these objectives, skills must be developed for realizing them. They will include:

1. Skills of data acquisition, handling and presentation.
2. The formulation and testing of hypotheses.
3. Skills of prediction and evaluation.
4. Skills of imagination prediction and creativity to complement those of science.
5. Behavioral skills needed to achieve objectives as a member of society.

Attitudes to be fostered might include

1. A sense of identity with one's environment enjoyment of it and respect for the processes upon which it depends.
2. A critical attitude to received information.

3. A sense of community with other people and other living things.
4. Respect for oneself and for the unique human capacity to overcome biological and other environmental constraints.
5. A sense of continuity with the past and future.
6. A sense of responsibility for making choices of action consistent with caring for the future as well as the present.
7. A commitment to contribute personal talents to participation in the improvement of environmental quality.

These concepts, skills and attitudes, expressed in a form suited to the prevailing circumstances, can provide a basis for the construction of a checklist of objectives against which a programme of studies may be arranged and assessed.

Goals of Environmental Education

Goals, objectives and principles of environmental education were formulated at an international conference held at Tbilisi, Georgia in 1977.

The internationally decided goals of environmental education are;

1. To foster a clear awareness of and concern about economic, social, political and ecological interdependence in urban and rural areas;
2. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;
and
3. To create new patterns of behavior in individuals, groups and society as a whole towards environment.

Objectives of Environmental Education

The categories of environmental objectives that flow from the goals state earlier are:

1. **Awareness:** To help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.
2. **Knowledge:** To help social groups and individuals gain a variety of experiences and acquire a basic understanding of the environment and associated problems.
3. **Attitudes:** To help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for an active participation.
4. **Skills:** To help social groups and individuals acquire the skills for identifying and solving environmental problems.
5. **Participation:** To provide social groups and individuals with an opportunity to be actively involved at all levels towards resolution of environmental problems (UNESCO, 1978).

The specific aims of environmental education fall into three groups:

- (a) **Cognitive aims:** These include imparting knowledge about environment and an ability to think which will enable the individual and his social group to work out political solution to the wide variety of problems connected with environment.
- (b) **Normative aims:** These relate to the inculcation of ecological awareness which will be conducive to the creation of modification of value models enabling the individual and the group to identify the factors that upset the environment equilibrium and protest against them.

- (c) **Technical and applicative aims:** This means planning collective practices which preserve, improve and restore the quality of life, as understood by the community in the light of formal and nonformal education in such a way that demands made by economic development do not conflict with biological rhythms of ecosystems.

Clear comprehension of these objectives of environmental education is very essential for successful formulation implementation and evaluation of programmes.

The UNESCO states that environmental education goal 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, motivations and commitment to work individually and collectively towards solutions of current problems and the prevention of new one.

The National Council of Educational Research and Training (NCERT) explains the objectives as follows:

1. To recognise the interdependence among materials in the physical environment, plant and animal life, for survival, growth and development.
2. To take decision individually and collectively and initiate actions for social, cultural and economic survival, growth and development and for conservation of nature and natural resources.
3. To identify human, material, space and time resources in the environment.
4. To recognize ways of making effective use of environmental resources for social, economic and cultural survival, growth and development.

5. To take decisions for the effective use of resources, to recognize the special significance of conservation of natural resources and initial or support community efforts for the purpose.
6. To understand that many diseases may be prevented by efforts leading to village community cleanliness, environmental sanitation, removal and prevention of pollution.
7. To recognize simple physical, biological, chemical principles and laws and cause and effect relationship with reference to real life situations and use these principles and laws to explain changes in the environment.
8. To recognize changes taking places in the environment in the modes of self-adoption and self-management and take suitable decisions individually and collectively.

1.4.1 Objectives of Environmental Education in the Three Domains

(a) Cognitive domain

1. To help acquire knowledge of the immediate environment.
2. To help acquire knowledge of the environment beyond the immediate environment including distant environment.
3. To help understand the biotic and abiotic environment.
4. To help understand the effect of unchecked population growth or unplanned resource utilization on the world of tomorrow.
5. To examine trends in the growth of population and interpret them for the socio-economic development of the country.

6. To evaluate the utilization of physical and human resources and suggest remedial measures.
7. To help diagnose the cause of social tensions and to suggest methods for avoiding them.
8. To help diagnose the different causes of environment pollution and to suggest remedial measures.

Beside the foregoing objectives, the following skills and abilities also fall in the cognitive domain.

1. To help develop observational skills and notice details usually not seen by an untrained eye.
2. To help develop skills required for making discriminations in form, shape, sound, touch habits and habitats.
3. To help develop ability to draw unbiased inferences and conclusions.
4. To help develop ability to make meaningful suggestions.

(b) Affective Objectives of Environmental Education

1. To help acquire interest in the flora and fauna of the near and also distant environment.
2. To help evince interest in the people and problems of the community and society.
3. To show tolerance towards different castes, races, religions and cultures.
4. To appreciate the gifts of nature.
5. To love the neighbors and value mankind as a whole.
6. To value quality, liberty, fraternity, truth and justice.
7. To respect the national boundaries of all countries.
8. To value cleanliness and purity of our environment.

1.5 NEED AND IMPORTANCE OF ENVIRONMENTAL EDUCATION

In pre-industrial times, the major role of education was to pass on the culture that had made the society cohesive and successful. Change was frowned upon, tradition held away. In such societies, formal education was primarily for the young and for privileged classes that had time to explore new directions.

In past industrial times, change gained the upper hand from tradition. New information necessary for success in society proceeded to accumulate rapidly. Education became necessary for more and more people. At first this increased education was based on new factual material, but as knowledge accumulated it has become increasingly necessary for the young to acquire the process of learning rather than transmission of tradition.

In today's world, education has become a life long process. It proceeds both formally and nonformally through schools, private organizations, communication media and continuing experiences. No serious or effective modification or improvement of attitudes and behaviour of man towards his environment can occur without broad educational efforts at all levels of our society. People need to learn way to perceive environmental problems and opportunities, to acquire the information for forming and evaluating alternative actions, and to develop the cultural skills for living according to chosen alternatives. All of this demands a high and continuing educational input. It is the only effective way to deal with the constant and rapid change in our current cultural environment.

Educational systems must provide the learner with the skills of continuous learning and a continuing flow of information about man and his environment.

In the 21st century, we have put incredible amount of money and time for research. We and the planet we live on, have been subjects of innumerable studies and experiments. The facts and figures have poured out in an ever growing steam. When environmentalists, educationalists, scientists, etc. set back to look at the facts and figures these studies produced, they realized that lack of efficiency and effectiveness in teaching, lack of awareness about environment, over population, depletion and pollution were already reducing our standards of living and imperiling our future.

Education and research here is necessary because many environmental problems cannot be solved by Government alone. They can be solved by individuals, and the individuals must be educated to know what needs to be done. With our enormous ignorance of vital environmental problem it is disheartening to realise that in many nations including our own, more time and money has been spent on environmental destructive activities than constructive ones.

1.5.1 Recognition of the Need for Environmental Education

The basic characteristic of environmental consciousness have existed for thousands of years it follows that environmental education has also been part of the same cultural tradition. But the aims of environmental education have not always held a place of great importance – not indeed has there been a need for this, for the major problems have remained until recent years in relatively localized state. It is only the present realization of global repercussions of human interference that demands on urgent reappraisal of the current status and philosophy of environmental education.

Some years ago, the public was forced by circumstances to endure and accept the ultimate responsibility for environmental degradation it should be well informed

about the nature and implications of relevant human activities. The need for a better understanding of the nature, extent and ultimate implications of human impact on the natural environment is perhaps, as suggested by Frankel, the most pressing and most important aspect of education for the coming decades.

The need for environmental education has also been expressed by numerous other individuals and has been formally acknowledged at both the background to the US Environmental Education Act that: “We, as a society can no longer afford the luxury of not knowing the environmental consequences of our decisions. The citizens of this country, both present and future, must understand this ecosystem and the interrelationships between its parts. Each phase of education, from pre-school through adult and continuing education, must be reformed to permit the introduction of ecological understanding”.

A similar statement was made, as a prelude to recommendations for international action, at the UN Conference on the human environment: Education and training on environmental problems are vital to the long term success of environmental policies because they are the only means of mobilizing an enlightened and responsible population, and of securing the manpower needed for practical action programs.

1. In many cases, industrialized countries not only export serious environmental problems, but also do not always propose solutions that interest under developed countries. Conciliation between the interests of development and social progress in regions of the third world and preservation of the environment demand a well prepared population and enlightened institutions that could bring about the process

- of creating new forms of action and economic activities that would respect the necessity of maintaining the ecological balance. Environmental education has a significant contribution to render in this process.
2. No individual isolated effort can alone solve the problems of environmental degradation. These problems are clearly international and must be solved through international cooperation. Such cooperative action presupposes a common understanding of the environmental problems and an acceptance of responsibility for their ultimate solution. It is the prime function of environmental education to develop this understanding and responsibility.
 3. Environmental education seeks to develop, from the individual to the population level and for every cultural, geographical, age and intellectual group, an awareness of the complex and dynamic interrelationship between man and his total environment, a concern for the quality of human life, and a personal commitment to environmental conservation.
 4. Environmental education develops among people, an awareness of interrelationship between man and environment and the understanding of both the nature and implications of human impact on the environment.
 5. Environmental education is intended to promote among citizens the awareness and understanding of the environment, our relationship to it, and the concern and responsible action necessary to assure our survival and to improve quality of life.

1.6 ENVIRONMENTAL EDUCATION IN SCHOOLS

For children to develop environmental ethics, we must redefine the objectives of formal education. Schooling has been an exercise for the purpose of enabling the

individual to extract the maximum advantage from the natural and social environment in which he operates. This, perhaps, was reasonable when we could move away from the ecological crisis, with our growing awareness of the finite capacity of the biosphere, and man's ability to alter its life support systems drastically and permanently, we realize that the central objective of education must shift.

Man and environment must now be presented in schools as a single system in which the activities of the individual must be adjusted to the capacities of the environment. Only in this way, can both man and environment be maintained in a healthy state. We must help children "to perceive themselves as part of their environment".

The "object" environment is to be taken as a personal responsibility a pre-requisite for self-determination. Accordingly, the ideas to be developed in schools are:

1. The complementally character of organism and environment.
2. The selectivity of the individual into input and output.
3. The extent of interconnectedness from an individual outwards.
4. The enabling and constraining properties of energy and material resources.
5. The significance of short term and long term changes.
6. The consequences of individual, society and environment of human life styles.
7. The choice of criteria and the procedures available for guiding and managing changes.

To achieve these objectives, skills must be developed for realising them. They include:

1. Skills of data-acquisition, handling and presentation.
2. The formulation and testing of hypotheses.
3. Skills of prediction and evaluation.
4. Skills of imagination and creativity to complement to those of science.

1.6.1 Environmental Education and School Curriculum

The formulation of the curricula material on environmental education is of a more difficult nature than that of history of literature. A well designed program should be based not only on the needs but also should be on the skills of the learner. The curriculum projects should be planned horizontally as well as vertically. Disciplines, such as social sciences and science should not be studied in isolation. The curriculum should be flexible so material can be presented according to the backgrounds, needs and aspiration of the student; the curriculum should have vocational, citizenships and personal goal.

There are two models of environmental education curriculum suggested by Hungerford and Peyton (UNESCO Environmental Education Series 22) one model is called the interdisciplinary (single subject) model. This relies primarily on all disciplines and relevant components of many disciplines drawn upon to create a distinct environmental education unit, course or module. The other model is called multidisciplinary because environmental education components are infused into other established disciplines where appropriate.

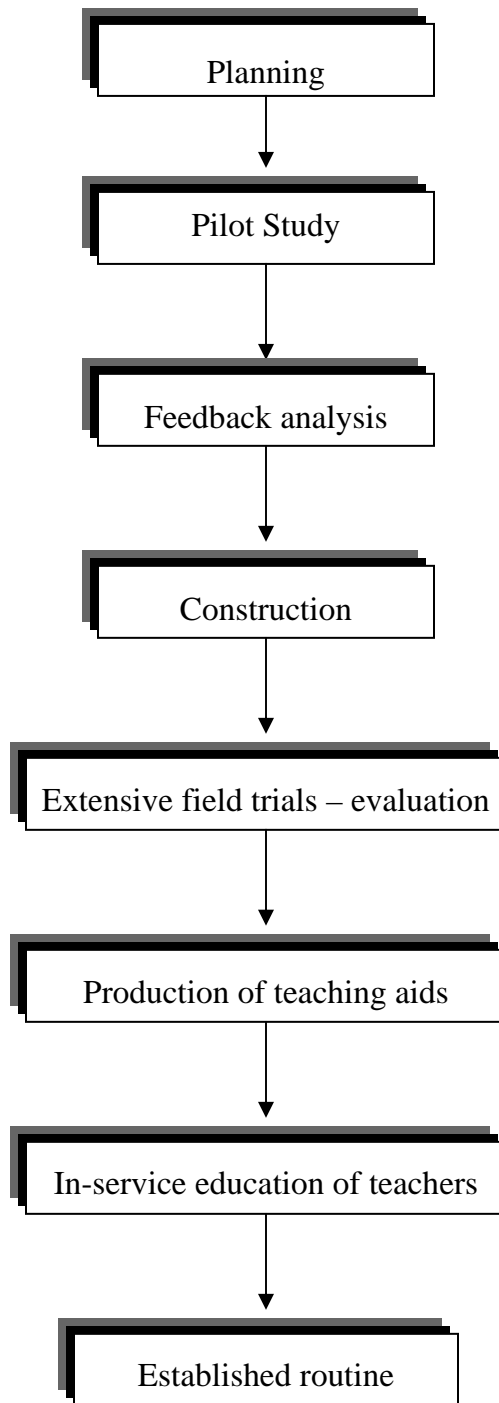


Figure 1: Model of curriculum development in environmental education
 (developed by Swedish National Board of Education, 1968)

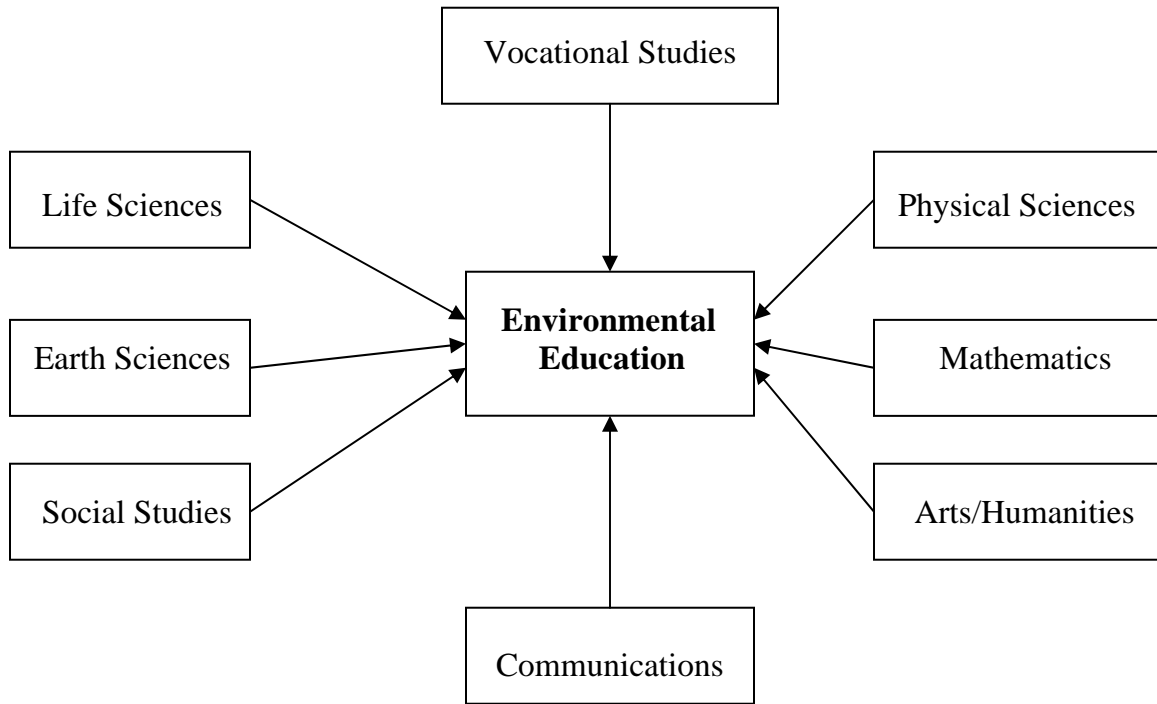


Figure 2: Inter-disciplinary or conceptual or infused model

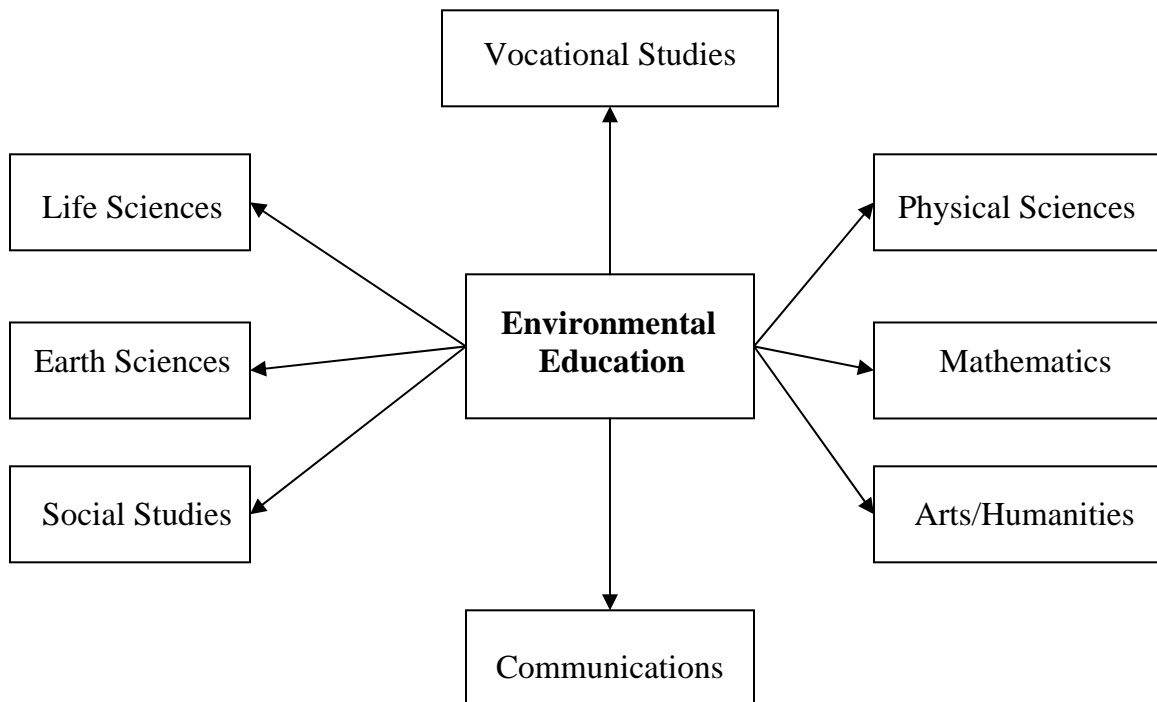


Figure 3: Infusion of integration or multidisciplinary model

1.6.2 Environmental Education at the Pre-Primary and Primary Levels

Environmental education starts at home and in its immediate neighborhood, activities, particularly group activities, are important at this stage. Manipulative skills are developed through helping in the home and at play. Some informal training is received in personal hygiene, and problems of food and water contamination.

At the pre-primary level the basic objective is to address the child's emotional orientation to nature and to the environment of home and neighborhood. This level is followed by more formal schooling at the primary school (ages 5-7 years and 11-14 years).

Mental alertness towards the environment seems to develop in most children at the age of 9-10 years. They can appreciate the interactions of man and nature and the relationship between hygiene and nutrition and are ready to accept the demonstrations of such interrelationships. These ages provide a most challenging task for teachers and curricula designers, activity planners and teaching educators. Teachers of these age groups often need a choice of resource materials, help and counseling services.

1.6.3 Environmental Education at the Secondary Level

Students enter secondary schools between the ages of 11 and 14 and leave between ages 16 and 19. They thus enter as children and leave as adolescents. Secondary school students are usually receptive and strongly motivated, and

are capable of assimilating an environmental education, that is (a) value oriented, (b) community oriented and (c) concerned with human well-being.

Since secondary education was often oriented to traditional disciplines, there was little room for teachers to make use of integrative environmental elements. Multidirectional environmental knowledge implies a diversity of skills. In some countries the emphasis was on introducing environmental aspects into school science courses and integrating these later.

1.6.4 Role of Teacher in Environmental Education

Traditionally a teacher has been regarded as an agent of social change and modernization. He has been called “the maker of history”, ‘the builder of the nation’ and ‘the social engineer’ children and especially children in the plastic period of their life emulate their teachers and draw inspiration from them. A teacher, therefore, can play an important role in promoting environmental awareness and understanding among his students.

The functions of the teacher may be summarized as follows:

1. to arouse the children’s interest in the environment and to raise challenging problems.
2. to discuss the approach to problems or topics.
3. to organize working groups and to provide with the help of work cards the lines of enquiry.
4. to arrange visits or expeditions.
5. to provide reference materials for children’s use.
6. to provide materials needed for practical work.

7. to arrange for visiting speakers.
8. to initiate and develop discussion and debate.
9. to provide facilities for displays and exhibitions of the work carried out.

1.6.5 Role of National Resource Centre for Environmental Education

For policy information coordination of all academic activities and providing academic resource support, there should be an apex body at the national level. The specific functions of the National Resource Centre include:

1. Development of curricula and instructional materials with reference to the needs of the environment at the local, regional, national levels;
2. Preparation of books and reference material.
3. Determining educational methods and media.
4. Serving as a consultative body in environmental education.
5. Acting as a clearing-house and information centre for environmental education.
6. Promoting collaborative relationships among environmental education associations, research and education.
7. Encouraging and facilitating the contribution to environmental education programmes of non-governmental agencies including voluntary bodies.

Attitude to be Fostered Might include

1. A sense of identifying with one's environment, enjoyment of it and respect for the processes upon which it depends.
2. A sense of community with other people, and other living things.
3. Respect for oneself and for the unique human capacity to overcome biological and other environmental constraints.

4. A sense of continuity with the past and future.
5. A commitment to contribute personal talents to participation in the improvement of environmental quality.

These concepts, skills and attitudes, expressed in a form suited to the prevailing circumstances, can provide a basis for the construction of a checklist of objectives against which a programme of studies may be arranged and assessed.

1.7 ENVIRONMENTAL STUDIES IN SCHOOLS' CURRICULUM

Ever enlightened individual has realized that the environmental education should be a part of the school curriculum. But, there seems to be some controversy over how and where to place environmental education in the current school curriculum. Of the several basic approaches, the three commonly acknowledged are,

- (i) Integration within the subject disciplines.
- (ii) Creation of separate courses and relegation to the extra curricular and
- (iii) Out-of-school programmes.

Most of the school educators readily opt for integration, principle and practicability seem to merge more easily here.

At the secondary level, an integrated approach is also preferred. The environmental education content can be injected into natural science subjects and environmental themes into current science courses.

The environmental learning can be achieved through the study of statistics at the secondary level. In addition to that, even arts, and humanities can be considered. This can be emphasized to point that environmental education draws on all subject disciplines and reflects environment through competent citizens.

The roots of desirable human behavior should result from ecological crisis. It should also provide for emotional motivation for studying man-environment relationship and for discovering beauty in the nature and in ourselves. Through these subjects, imagination, intuition, creativity, concern, etc. of the internal environment of children should be stimulated for the development of personal environmental ethic.

In short “integration” is currently the dominant approach to getting environmental education into schools. Separate courses in environmental education at the school level exist in some countries, which are not at all common.

Identifying the content of environmental education for schools is a very challenging task. The difficulty is due to, as Smyth says, “the all embracing nature of its subject matter and the diversity of approaches and attitudes among those who promote environmental education”. But one thing is certain that the content must be related to the local environment and cultural content of the community surrounding the school.

Environmental studies at the primary level commonly begin in the classroom, the school compound and the immediate community. As one progresses through the school grades, more distant environment and more abstract environmental concerns become the foci of the study.

In the secondary stage almost in all the countries, a study about the environment of other regions is highlighted rather than their own. The tenet should have been “think globally and act locally”. This principle is not sufficiently applied in secondary education programmes.

According to Krasiletk, there is a tendency in under developed countries to study and worry more about problems of regions of advanced stage of industrialization than about those themes which to them are typical and more urgent. Instead of topics of industrial pollution and inappropriate use of natural resources being given more prominence, the problems of nutrition, basic sanitation, housing, agriculture and employment should receive more attention in environmental education. For example, in Thailand, in secondary stage, some of the topics are “Electricity is valuable”, “The land we live in”, “I love trees”, “Air pollution”, etc. But it must be flexible enough to suit the conditions of local environment. In the “content”, more emphasis is given for skills and attitude to achieve participation of students in the community work.

1.8 PRINCIPLES OF TEACHING ENVIRONMENTAL EDUCATION

Guiding Principles for Environmental Education

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

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

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

Environmental education should 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;

Environmental education should focus on current and potential environmental situations while taking into account the historical perspective;

Environmental education should promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems;

Environmental education should explicitly consider environmental aspects in plans for development and growth;

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

Environmental education should 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;

Environmental education should help learners discover the symptoms and real causes of environmental problems;

Environmental education should emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem solving skills;

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

The environmental education helps in programming learning experiences from simple to complex. It is this principle that makes environmental education as a medium of learning different subjects.

The environmental education helps a child proceed from indefinite ideas to definite ones. The first principles of thoughts which are vague will become clear later as it grows and environmental education helps in sharpening the development of the observational skills for definiteness.

The environmental education helps a child proceed from concrete to abstract. This is a very simple education maxim and does not need any elaboration.

The environmental education helps the ordering of learning experiences from empirical to rational which is a very important educational maxim preferred by Herbert Spencer.

The environmental education provides for the self development of the child. Children are encouraged to conduct their own investigations and draw their own conclusions. The programmes of environmental education provide for self instruction and self discovery.

The programmes of environmental education create delightful and pleasurable excitement in children because of the beauty and glory of the environment issued as teaching aid by the teachers.

The environmental education makes the child's education problem-based for understanding environment.

The environmental education has social relevance.

In conclusion, environmental education is a subject of a very practical nature and is also supported by sound pedagogical principles.

1.9 RECOMMENDATIONS ON ENVIRONMENTAL EDUCATION

Though educators have highlighted the relevance of environmental education in schools, they, on their own, cannot proceed. They have to accept the recommendations of experts in different areas of activity. Such recommendations have been made regarding study materials, proper motivational aids, the extent of pupils' participation, techniques, etc. Some of these are discussed here:

1. At school level, for environmental education, there is an urgent need for textbooks and teaching aids for environmental education. Books on case studies, photographs, charts, maps, slides, films and other audio-visual aids on environmental problems are necessary. Encouragement and financial assistance are also needed.
2. The environmental education at school level should aim at creating environmental awareness.
3. The environmental concepts should be integrated in existing courses in physical, natural and social sciences.
4. Students should be exposed to the concept of nature education and the experience of participating in nature conservation programmes.
5. Extra curricular environmental programmes for school children are a powerful tool for imparting environmental education to children and should be increasingly encouraged. Such programmes should incorporate adventure, learning, grass root action and links with both environmental offenders and beneficiaries.

6. Several techniques for providing extra curricular environmental education to school children are available. These include distributing in the classroom entertaining children's magazines on environment, organizing of nature and science club visits to exhibitions and museums, organizing painting and essay competitions and exhibitions, participation in community environmental action programmes and using songs, plays, folk tales, puppet shows and environmental games and puzzles.
7. Environmental magazines for the use of and by teachers should be brought out.
8. Correspondence courses in environmental education for primary and secondary school teachers should be initiated by teachers' training institutions.
9. Periodical workshops/seminars on environmental topics should be arranged.

The recommendations do not stop here. Depending on circumstances, needs of the time, requirements of the society and availability of resources, more recommendations on environmental education are to be made to incorporate in school environmental activities.

1.10 ENVIRONMENTAL AWARENESS AND EDUCATION

The home community and the school are the three basic spheres of environmental education. Efforts in all these spheres, as well as efforts to combine the impacts of these foci, form the ideal approach towards creating appropriate perceptions of environmental problems and solutions with the creation of environmental awareness.

The environmental education starts from the very home and its immediate neighborhood. A child's perception of the environment develops partly from formal

schooling in nursery schools, then pre-primary institutions, temples, churches and partly from nonformal education at home. Young children first learn to see and understand what is happening around them and begin to feel how they are related to it primarily through contact with their mothers. As they grow older, education at home is fundamental to develop ethics and attitudes. Mothers can insist patterns of behavior that can lead to marked savings in food, water and energy consumption. Trained teachers can contribute much to increasing children's awareness of environmental issues at nurseries and kindergartens.

Active consciousness towards natural environment begins to develop in most children at the age of 9-11 years. They can appreciate the interaction of the people and nature and are ready to accept the demonstrations of such inter-relationship. But it should always be remembered that the perception of the environment is not necessarily an academic exercise pursued totally through book learning. It is the art of developing a sense of the significance of the environment through an "awareness" of positive and negative impacts.

Students enter high schools as children and leave as adolescents. These students are usually receptive and strongly motivated and are capable of assimilating an environmental education that is (i) value oriented, (ii) community oriented and (iii) concerned with human well being.

Considerable progress has been made in formulating guidelines and policies for environmental education. One of the major aims of the International Environmental Education Programme (IEEP) of UNESCO and UNEP is the incorporation of basic environmental considerations into primary and secondary

curricula. Such environmental considerations include a study of soil, plants and animals, water, air and their interaction with the human environment as well as considerations of basic human needs, health, sustainable development, etc.

IEEP which began in 1975 has over recent years, been successful in encouraging the inclusion of such material into national curricula. More than 60 countries have introduced environmental education into their educational plans, policies, and reforms.

Nonformal education is also extremely important in enhancing the awareness of the child on environment. Young people often participate in tree planting, nature conservation, wild life protection projects and other such activities outside the school.

Thus, a proper awareness about environmental education goes a long way in planning and conducting different activities connected with environmental issues of the times.

1.11 DEVELOPMENT OF ENVIRONMENTAL AWARENESS IN CHILDREN

The chief objective of environmental education is that individual and social groups should acquire awareness and knowledge, develop attitude, skills and abilities, and participate in solving the real life environmental problem.

The environmental education aims at developing in the child an awareness and understanding of the physical and social environment in its totality. Environmental studies involve a child's investigation and systemic exploration of his own natural and social environment and prepare himself to solve the problems for improving his life.

Environmental education is a process of providing learning experiences to obtain knowledge, understanding, skills and awareness with desirable attitudinal

changes about man's relationship with his natural and man made surroundings which includes the relation of population, pollution, resource allocation, transportation, technology and urban and rural planning to the total human environment.

Environmental awareness may be defined as to help the social groups and individuals to gain a variety of experiences in and acquire a basic understanding of environment and its associated problems. World educators and environmental specialists have repeatedly pointed out that any solution to the environmental crisis will require environmental awareness and understanding to be deeply rooted in the educational systems at all level.

Environmental awareness has the main task of providing the understanding of physical and biological components of the environment and their interdependence.

The United Nation Conference on Human Environment (Stockholm, June, 1971) was a major event for those concerned with the quality of the world's environment. One of the recommendations of the conference resulted in the creation United Nations Environmental Programme (UNEP) while other recommendation specially constituted the foundation of framework for cooperative effort in international, which state that environmental awareness may be developed by:

- Identifying, analyzing and understanding the needs and problems of personal life including health, vocation, etc.
- Social life at different levels, viz. family, caste, community, religion, town or village life, state and country.
- National life including civic, economic, etc.

Environmental awareness may also be developed when we:

- appreciate, promote and use the environment to improve health, vocation and social and national life.
- interact with Government and social agencies and utilise the development facilities provided by these agencies in his/her individual capacity and also for organising certain community activities.
- Develop the aesthetic sense to appreciate beauty and adopt it in personal and social life.

Environmental awareness provides the understanding and competence to recognize environmental resources and interdependence between physical and biological components of the environment for the growth and development. The areas and content of environmental awareness have been enumerated in the following para.

In order to help children grow in knowledge, skill and values, attitudes and awareness relevant to environments, teacher is expected to be not only dispenser of information and knowledge, but also manages to teaching and learning situation. The ways of classroom organization have also to be drastically changed. For the purpose of profitably utilizing the time and taking care of the interests of children, teacher should resort to group activities and bear with a certain amount of active involvement and talking in the classroom. Therefore the concept of discipline in the classroom has also to be changed. This necessarily means that the education officers and other supervisory staff engaged in supervision of classroom activities must also be oriented towards the environmental approach to teaching learning strategies in the classroom.

They should look for the positive development in the children rather than acquisition of bookish information.

The environment and the experiences of the children outside the school, vary from place to place, consequently the activities provided them in the school by teachers would also vary so that knowledge, attitude, skill and commitment can be built on the solid foundation of experience the child draws from the environment.

The way each child experiences the environment is unique. Growing up, learning and gaining insight within his/her own environment is most natural for a child, and each child accomplishes it in his/her own way, accommodating to thousands of impression. This natural quality of children is a good basis, but not the essence of environmental education.

Environmental education comes into being when this development, which for every child occurs so naturally, and as a matter of course, is consciously and positively influenced, secured, encouraged, enriched and arranged by responsible adults who belong to the child's own environment and who thus become part of the interactions between the child and the environment.

Needless to stress that school teachers assume a very important place among the adults in this education, and that their responsibility is extremely great. The way teachers act can be enriching to the child, or it may have adverse effect. In either case the effect is life long.

Good teaching is a diversified professional activity, meant to help children to discover their own potential, and it must show continuity to permit them to develop it and build upon it.

In environmental education children must progress in knowledge, organization, discipline, and self reliance through an active and affective involvement with the world around them. But the object of this cannot be “the whole world”. The whole big world is far too large for children to comprehend, but with proper guidance they can learn to care for “their world”. The environment in all its complexity presents itself to the child through manageable, comprehensible and approachable details. The complexity of the interrelationship between and among various living and non-living resources of environment is reduced enough to be comprehensible to a child, and it will invariably lead to new insight.

Children who participate in the changes in their environment and who learn to recognize the relationship of cause and effect, and who begin to understand the interdependence and interaction, including themselves, cannot fail to perceive that they, too, play a role in these interactions, when their interactions become more conscious, more organized, more scientific, they acquire a growing insight into how the environment, to which they belong, can be profoundly influenced by their actions. They also begin to understand how the environment affects their own actions and lives.

Environmental education is not a matter of telling the children about it. It is necessary to use the unique environment of every child as a source of information as a ground for learning, a mine of wisdom. Only then can we expect children to accept responsibility for the earth they share with others. When this feeling of responsibility becomes ingrained in their personality, they will be able to carry it into adult life, when they face environmental problems.

1.12 DEVELOPMENT OF ENVIRONMENTAL KNOWLEDGE AND ENVIRONMENTAL ATTITUDES

Environmental knowledge is defined as the factual information possessed by a student about environmental issues. Facts and events in the content areas of ecological concepts, pollution, wild life, natural resources, population and persons and organizations are involved in the environmental movement.

The influence of environmental knowledge on environmental attitude has been the focus of study and discussion (Marcinkowski, 1988; Muttaqui, 1981; Yount, 1988; Mann, 1983).

It is true that much of the damage caused to the planet is due to man's ignorance of how to deal with nature. At one time the focus of socio-scientific discussion on science, technology and man was how best to use science and technology in the service of man and how best to tap and utilize natural resources. Today the focus of discussion is how best to utilize science and technology without endangering the planet, and how best to conserve the remaining resources for our grand children.

Following are some knowledge objectives of environmental education, the understanding of which are essential for change in environmental attitude.

1. The earth has finite resources. All life depends on how successfully human beings can learn to harmonize their use of the earth's resources with natural communities and ecosystems.
2. Due to increase in transport and communication planet earth is more like a spaceship than the planet it once was, and is more vulnerable to destruction.

3. The economic benefit created by a technology at the local level is not the only criterion which can be used to assess its value. It is equally important to assess its global influence on the planet.
4. Science and technology can be used for not only economic growth but also for improving the physical and mental health of individuals as well as civic hygiene and sanitation.
5. Economic growth may improve the standard of living, but it may not improve the quality of life, which is a better index of the well being of a community.
6. Man, though biologically superior, is not the most important species on earth, because all species play an equally important role in maintaining the life support system of the earth.
7. Man is the only organism who consciously modifies his environment. Naturally he is solely responsible for maintaining the quality of life on this planet.
8. Continued contact with nature and an appreciation of the beauty of nature are essential to man's spiritual and emotional well being.
9. The effects of ecological destruction need not be permanent, and can be reverted if the community acts fast. Prolonged indifference to an ecologically disturbed area can make it permanently inhospitable.
10. It takes millions of years for a species to evolve, but it can be exterminated in a very short time.
11. The extermination of a species of plant or animal is permanent and irrevocable.
12. the cost of repairing ecological damage is much less if the extent of damage is less. Prevention or early intervention is better than cure.

13. Technological progress is not incompatible with environment. Conservation provides man with spiritual and emotional benefits, technology provides material benefits.
14. Man's survival depends on the natural life support system of the planet and other species of plants and animals in these life support systems with which he is directly or indirectly related.
15. The environmental crisis can be averted only if people all over the world unite, and cooperate to protect the environment.

1.13 PURPOSES OF ENVIRONMENTAL EDUCATION

According to a Chinese proverb, "If you are thinking one year ahead, plant rice; if you are thinking ten years ahead, plant trees; and if you are thinking hundred years ahead, educate the people".

The philosophy behind the above Chinese proverb, when taken in its totality, is environmentally very comprehensive and holistic. It takes care of many of our needs such as food, fodder, fertilizer; fiber, medicine and shelter, and above all, it help to remove ignorance and irrationality.

The philosophy of environmental education asserts that man is an integral and inseparable component of the ecosystem. Within the system, his culture, values, scientific and technical knowledge and his association and arrangements are the elements through which he interacts with the biotic and abiotic environment. It need to be clearly understood that we cohabit the world with other living organisms. For this, an understanding of the use of available resources by man and also the impact of his activities on the ecosystem is necessary. Such an understanding could be made

possible only through an education system which clearly explains causes of ecosystem functioning and its conservation and management. The environmental education therefore has the following purposes:

- Providing factual information to students which will lead to their understanding the intricate system of ecological balance and the position of man in it.
- Developing a concern and respect for environment.
- Informing people as to how they can play an effective role in protecting the environment by demanding changes in laws and enforcement systems.

The role of environmental education at college and university level in particular, should be to provide the highest level of manpower for managing, protecting, preserving and improving our environment.

This is a critical input to any worthwhile development and socio-economic change. Given good teachers and students, good training and motivation will follow, thus helping the students in pursuits to create a suitable environment for human existence, survival and progress and the sustainable growth and development of the country.

The concept of environmental education is related to the problem of human survival and survival of the planet.

Environmental education is that instrument of social change which could influence people of all ages and all walks of life with the purpose of instilling in them the ability to appreciate the natural laws by which this planet is governed, as well as

the skills attitudes and values they need to use for protecting this planet as well as life forms inhabiting it.

Environmental Education Operates in the Following Four Ways

1. By influencing the legal system so that it can introduce rules, policies, regulations which are implemented to harmonize the lives of individuals with principles of environmental conservation.
2. By influencing the educational system (and the public) so that the youth of today learn the principles of environmental stewardship, and develop suitable skills, attitude and values thereof.
3. By influencing science and technology, scientists and technologists, with the object of posing environmental problems evaluating various solutions and making scientists aware of the necessity to develop environmental friendly technologies.
4. By creating a society which appreciates the importance of leading a simpler non-materialistic life which would make less demands on resources.

1.14 SUGGESTED ACTIVITIES

Keeping in view the objectives of environmental education, the following activities can be undertaken by students and teachers in schools.

1. Conducting seminars, essay and elocution competition on environmental issues.
2. Releasing of bulleting on environmental issues.
3. Writing slogans on environment in public places.
4. Conducting cleanliness drives with the help of local organizations.
5. Making efforts to clean open drains, to facilitate smooth flow of rain water, etc.

6. Helping the people to adopt modern methods of sanitation and help them get government help for the same.
7. Destroying the weeds like Parthenium and Eupatorium from playgrounds, school campus and residential areas.
8. Highlighting the importance of clean water, clean air and earth.
9. Discussing the effects of pesticides, synthetic fertilizers, explosives, etc.
10. Playing street dramas on environmental issues.
11. Observing plants, flowers, birds and animals with a view to recognizing them.
12. Discriminating between colors, sizes of plants and flowers by their names.
13. Observing the behavior of birds, animals and their nests and habitats.
14. Visiting museums, sanctuaries, wild forests, zoological and botanical parks, etc.
15. Setting up of herbarium, aquarium, vivarium, etc.
16. Visiting sea shores, river banks, fire stations, etc.
17. Visiting historical monuments and studying the effects of environmental pollution on them.
18. Observing meadows, agricultural farms, woodlands, sand dunes, etc.
19. Involving in model-making, arts-works and craft activities, competitions, survey, field trips, demonstration, campaigns, etc.
20. Action programmes – raising school gardens, nurseries, fish tanks, developing school ponds, ecosystem, cleaning school campus, school beautification, fencing the school campus with bushes and bamboos, developing drainage around the school for preventing water stagnation, etc.

21. Creative expressions performing street plays/staging environmental dramas, puppet shows, etc.
22. Observing specific environmental programmes conducted in the community and surroundings.
23. Formation of eco-clubs in schools.
24. Letter-writing to authorities to take steps for cleaner environment.
25. Developing audio-visual materials on environmental issues.

Chapter Three

KEY CHARACTERISTICS OF ENVIRONMENTAL EDUCATION

According to NAAEE (North American Association of Environmental Education) guidelines for excellence, six key characteristics are defined for environmental education materials which are as in the followings:

1- Key Characteristic #1

Fairness and Accuracy: Environmental Education materials should be fair and accurate in describing environmental problems, issues, and conditions, and in reflecting the diversity of perspectives on them.

1.1) Factual accuracy: Environmental education materials should reflect sound theories and well-documented facts about subjects and issues.

What to look for?

- Sources of factual information are clearly referenced.
- Data are drawn from current and identified sources of information. (Knowing source of information can aid in judging its trustworthiness or identifying possible bias.)
- Factual information is presented in language appropriate for education rather than for propagandizing.
- Information comes from primary sources, which provide context, documentation, and explanation rather than from reviews or newspaper articles that simply provide bits and pieces of arguments or evidence.
- A range of experts in the appropriate fields reviewed the materials or participated in their development in another way. The materials provide a

list of the people involved in development and review, and their areas of expertise.

- 1.2) Balanced presentation of differing viewpoints and theories:** where there are differences of opinion or competing scientific explanations, the range of perspectives should be presented in a balanced way.

What to look for?

- Proponents of differing viewpoints reviewed the materials or helped develop them in another way. The materials list the people involved in development and review, and their organizational affiliation.
- Opinions or policies of an agency or organization are clearly identified as such.
- Scientifically and socially credible positions and explanations are covered thoroughly, while other positions are also mentioned. (Balanced presentation does not mean giving equal time and space to every opinion or perspective, but treating major positions fairly.)
- Materials communicate areas of consensus among scientists or other experts.

- 1.3) Openness to inquiry:** Materials should encourage learners to explore different perspectives and form their own opinions.

What to look for?

- Educators are given tools to use in helping learners to form and express opinions about competing theories.
- Exercises are suggested for helping learners explore personal and societal values and conflicting points of view within the context of the issue.
- Materials promote an atmosphere of respect for different opinions and openness to new ideas.

- There are exercises that encourage learners to understand the opinions of their peers.
- Materials suggest projects that involve learners in collecting and analyzing their own data and comparing those data to similar data from other places.
- Activities encourage learners to become discerning readers and observers of media coverage of environmental matters.

1.4) Reflection of diversity.

Different cultures, races, genders, social groups, age, etc., are included with respect and equity.

What to look for?

- Materials contain descriptions and illustrations that depict people of various races, ethnic groups in a respectful and equitable manner.
- Where such variety is appropriate, the content and illustrations depict rural, suburban, and urban settings.
- If the material is designed for nationwide use, the content and illustrations reflect geographic differences appropriately.
- Experts in multicultural education and members of historically under-represented groups, such as women and people of color, have been involved in the development and review process.
- Readings and additional resources that present concepts and perspectives from different cultures are offered.

2. Key Characteristic # 2 Depth

Environmental education materials should foster awareness of the natural and built environment, and understanding of environmental concepts, conditions, and issues, and an awareness of the feelings, values, attitudes, and perceptions at the heart of environmental issues, as appropriate for different developmental levels.

- 2.1) Awareness.** Materials should acknowledge that feelings, experiences, and attitudes shape environmental perceptions and issues.

What to look for?

- As appropriate for the developmental level, opportunities are provided for learners to explore the world around them.
- Activities provide opportunities for experiences that increase learners' awareness of the natural and built environments.
- Materials help learners understand the interdependence of all life forms, including humans (i.e., dependence of human life on the resources of the planet and on healthful environment).
- Exercises and activities encourage students to identify and express their own positions regarding environmental issues.

- 2.2) Focus on concepts.** Rather than presenting a series of facts, materials should use unifying themes and important concepts.

What to look for?

- Concepts from environmental science fields such as ecology, earth science, chemistry, conservation biology, etc., are presented, as appropriate for the intended developmental level.
- Concepts from social science fields such as economics, anthropology, sociology, history, and political science are presented, as appropriate for the intended developmental level.
- Facts are presented- and vocabulary words introduced and defined in context and support of the important concepts.
- Ideas are presented logically and are connected throughout the materials, emphasizing a depth of understanding rather than encyclopedia breadth.

- Materials include a clearly articulated conceptual framework that states the concepts to be learned and relates them to each other.

2.3) Concepts in context. Environmental concepts should be set in a context that includes social and economic as well as ecological aspects.

What to look for?

- Environmental issues are explained in terms of specific concepts.
- Historical, ethical, cultural, geographical, economic, and sociopolitical relationships are addressed, as appropriate.
- Learners are offered opportunities to examine multiple perspectives on the issues and to gain an understanding of the complexity of issues, as appropriate for their developmental level.
- Further investigations help learners probe more deeply into the ecological, social, and economic aspects of issues, and their interrelationships.
- Concepts are introduced through experiences relevant to learners' lives.
- Materials help learners to make connections among the concepts.
- Learning is based on students constructing knowledge through research, discussion, and application to gain conceptual understanding.

2.4) Attention to different scales. Environmental issues should be explored using a variety of scales as appropriate, such as short to long time spans, localized to global effects, and local to international community levels.

What to look for?

- Materials consider communities of different scales. These scales include the local, regional, national, and global levels.
- Local, regional, continental, and global geographic scales are used to help learners understand that issues can be important, widespread and complex.

- Materials examine issues over a variety of temporal scales so that short-term and long-term problems, actions, and impacts are clear.

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Key characteristic #3

EMPHASIS ON SKILLS BUILDING

Environmental education material should build lifelong skills that enable learners to address environmental issues.

3.1) Critical and creative thinking. Learners should be challenged to use and improve their critical thinking and creative skills.

What to look for?

- Materials offer learners opportunities to practice critical thinking processes such as problem definition, forming hypothesis, collecting and organizing information, analyzing information, synthesizing, drawing conclusions, formulating possible solutions, and identifying opportunities for action.
- Materials provide learners with opportunities to practice creative thinking processes such as modeling, using metaphors and analogies, and formulating questions.
- Learners challenged to use higher level thinking processes such as identifying bias, inferring, relating, applying, and reflecting.
- Materials provide guidance for judging the validity of various sources of information, and learners are encouraged to apply these guidelines.
- Learners are given opportunities to practice skills individually and in groups.

- 3.2) Applying skills to issues.** Students should learn to arrive at their own conclusions about what needs to be done based on thorough research and study, rather than being taught that a certain course of action is best.

What to look for?

- Materials help students learn to identify, define, and evaluate issues on the basis of evidence and different perspectives. Ethical and value considerations are included.
- Materials provide a list of organizations and other resources that learners can use to explore the issue on their own, as appropriate for their developmental level. This list should include groups and resources with various perspectives.
- There are opportunities to use different methods of evaluating environmental issues and their potential solutions, as appropriate for the intended age level. These methods may include risk analysis, cost/benefit analysis, ethical analysis, environmental impact analysis, analysis of cumulative effects, different kinds of economic analyses, social impact analysis, etc.
- Materials help learners understand the strengths, weaknesses, and biases of these different means of evaluating an issue.
- Learners develop their own solutions to issues.
- Environmental issues are presented with a range of possible solutions as well as information about how the problems are currently being addressed. Materials compel learners to consider the implications of different approaches.

- 3.3) Action skills.** Learners should gain basic skills needed to participate in resolving environmental issues.

What to look for?

- Materials give learners an opportunity to learn basic skills for addressing environmental issues, as appropriate for the intended age level. These skills may include defining an issue, determining if action is warranted, identifying others involved in the issue, selecting appropriate action strategies and understanding their likely consequences, creating an action plan, evaluating an action plan, implementing an action plan, and evaluating results.
- Learners hone their ability to forecast and to plan for the long term.
- Learners are provided with opportunities to develop a variety of citizenship skills, including participation in the political or regulatory process, consumer action, using the media, and community service.
- Materials and activities help students sharpen basic laboratory and field skill such as experimental design, observation, data collection, and data analysis.
- Materials facilitates student learning of basic skills of applied science, including environmental monitoring, evaluating others' research, and setting up an independent research proposal.
- Learners use various forms of technology that help them develop and apply their skills. These technologies might include computers and electronic communication networks, data gathering equipment, video equipment, etc.

KEY CHARACTERISTIC #4 ACTION ORIENTATION

Environmental education materials should promote civic responsibility, encouraging learners to use their knowledge, personal skills, and assessments of environmental problems and issues as a basis for environmental problem solving and action.

4.1) Sense of personal stake and responsibility.

Materials should help learners to examine the possible consequences of their behaviors on the environment and evaluate choices they can make which may help resolve environmental issues.

What to look for?

- Materials promote intergenerational and global responsibility, linking historical and current actions with future and distant consequences.
- Learners are provided with opportunities to reflect on the effects of their actions and to sort out their opinions about what, if anything, they should do differently.
- Materials contain examples of people of different ages, races, genders, cultures, and education and income levels who have made a difference by taking responsible action.
- Materials convey the idea that many individual actions have cumulative effects, both in creating and addressing environmental issues.

4.2) Self-efficacy. Materials should aim to strengthen learners' perception of their ability to influence the outcome of a situation.

What to look for:

- Materials challenge learners to apply their thinking and act on their conclusions.
- Materials include a variety of individual and community strategies for citizen involvement and provide learners with opportunities to practice these strategies through projects they generate individually in their school or in the larger community.
- There are examples of successful individual and collective actions. Learners are encouraged to examine what made these actions

successful. (where actions were not successful, students are encouraged to examine the reason for failure.)

- Learners are encouraged to share and celebrate the results of their actions with peers and other interested people.

KEY CHARACTERISTIC # 5

INSTRUCTIONAL SOUNDNESS

Environmental education materials should rely on instructional techniques that create an effective learning environment.

- 5.1) Learner -centered instruction.** When appropriate, learning should be based on learner interest and on the learner's ability to construct knowledge to gain conceptual understanding.

What to look for?

- Activities allow learners to build from previous knowledge and lead toward further learning.
- Learners gain understanding through research, discussion, application, and practical experiences.
- Instruction assists learners in undertaking their own inquiry.
- Where appropriate, activities and projects use learner question and concerns as a starting point.
- Materials facilitate learner participation in planning and assessing learning. Materials promote learner reflection on the process and content of learning.

- 5.2) Different ways of learning.** Materials should offer opportunities for different modes of teaching and learning.

What to look for?

- Materials encourage educators to experiment with a range of instructional methods to reach learners with a variety of learning styles. These techniques may include research, experimentation, observation, lecture, discussion, creative expression, field studies, role playing, independent work, cooperative learning, cross-age teaching, etc.
- Important concepts are conveyed in several ways (visual, auditory, tactile, etc.) so that all students can understand them.
- Materials and activities are developmentally appropriate for the designated grade, yet sensitive to individual differences in educational experiences and learning mode.
- Opportunities are provided for students to learn from expression and experience – for example, using music, art, poetry, and the community in learning activities.
- Diverse sensory involvement is a criterion for selecting learning activities.
- Learners are challenged to develop their multiple intelligences.
- Learning is accessible to students with limited English proficiency.

5.3) Connection to learners' everyday lives. Materials should present information and ideas in a way that is relevant to learners.

What to look for:

- Concepts to be taught are related directly to students' experiences.
- Case studies and examples are relevant to the learner. If the material is designed for use in a specific area of the country, the content and illustrations are appropriate for that area.
- Instructional materials are easy for students to use and understand. Materials reflect cultural, gender, and age differences.

- Materials provide for continuing involvement throughout the year by the learner, both at home and at school. Means for involving learners' families or care givers are suggested.

5.4) Expanded learning Environment. Students should learn in environment that extend beyond the boundaries of the classroom.

What to look for:

- Students learn in a diverse environment which includes the school yard, laboratory, field settings, community, and other settings beyond the classroom.
- Learners share their knowledge and their work with others.
- Materials use examples that reflect real-world experiences.
- Materials suggest partnerships with local civic organizations, businesses, religious communities, or governments to explore a local issue.
- Partnership with local universities, colleges, or technical schools to allow learners to participate in research, environmental monitoring, creative projects, etc.
- Materials suggest linkage to informal experiential, and service learning opportunities in the community.
- Lists of written materials and other resources for further study are included.

5.5) Interdisciplinary. The materials should recognize the interdisciplinary nature of environmental education.

What to look for:

- Materials clearly list the subject disciplines integrated into each lesson or lessons, suggest tie-ins with other subject areas, such as the

science disciplines, social studies, math, geography, English, arts, physical education, occupational education, etc.

- The material helps develop skills useful in other subject areas, such as reading comprehension, math, writing, and map reading and analysis.
- Where appropriate, materials are keyed to national standards for other disciplines or standards adopted by the school district or state.

5.6) Goals and objectives. Goals and objectives for the materials should be clearly spelled out.

What to look for:

- Goals and objectives for learner outcome are clearly stated.
- Instructional methods are appropriate to the guide's goals.
- Objectives should be in keeping with goals and objectives of general education.

5.7) Appropriateness for specific learning. Claims about the material's appropriateness for the targeted grade level(s) and the implementation of the activity should be consistent with the experience of educators.

What to look for:

- The content is appropriate (level and language) for the target grade levels. The examples, terminology, and comparisons used are within the probable vocabulary and experience of students.
- Lesson-related activities can be accomplished in the time specified, with resources provided or easily available.
- Experiments and activities are relevant, accurate, predictable, and suitable for the target grade levels. Materials include suggestions for appropriate variations and extensions.

- Activities are efficient. The amount of time required is consistent with the importance of what is to be learned.
- Environmental responsibility is modeled in the design, underlying philosophy, and suggested activities of the lessons and materials.

5.8) Assessment. A variety of means for assessing learner progress should be included in the materials.

What to look for:

- Materials state expected learners outcomes and provide examples of how to use specific performance-based assessments such as portfolios. Open-ended questions, group or independent research, or other appropriate projects to indicate mastery.
- Learners are tied to the goals and objectives of the materials.
- Means of assessing learner's baseline understandings, skills, and concepts at the beginning of each lesson are included.
- Materials use current and appropriate educational assessment techniques.
- Suggested assessment techniques are practical and efficient.
- Assessment is on-going and tied to student learning.
- Expectations are made clear to students at the onset of an activity.
- Students assess their own and other students' work.

KEY CHARACTERISTIC #6

USABILITY

Environmental education materials should be well designed and easy to use.

4.3) Clarity and logic. The overall structure (purpose, direction, and logic of presentation) should be clear to educators and learners.

What to look for:

- Materials are clearly and engagingly written. Main concepts are well articulated. Examples in the text are appropriate to the content and easily understood.
- Instructions for educators are clear and concise.
- The following information is included in a straightforward manner:
 - Intended audience/ grade level;
 - Instructional setting and optimal number of learners;
 - Process skills addressed (i.e., observing communicating, comparing, ordering, categorizing, relating, inferring, applying)
 - Equipment needed'
 - Safety precautions and clean up if appropriate;
 - Time needed for activity;
 - Instructions for conducting the activity; and
 - Pre- and post-activities, such as suggestions for enrichment activities, if appropriate.
- Background information for the educator is adequate and accurate, and there is a listing of additional resources.
- Materials are organized sequentially and in an easy-to-use fashion.
- Lab and field work, and other activities, are clearly linked to related content material.

4.4) Easy to use. Materials should be inviting and easy to use.

- **What to look for?**

The layout of materials is interesting and appealing for educators and learners.

- Illustrations, photographs, maps, graphs, and charts are useful, clear, and easy to read.

- The material is easy for educators to keep and use.
- Masters for student handouts and overhead transparencies are easily duplicated.
- Copyright is spelled out or permission to copy is granted.
- Where appropriate, materials are available in electronic form such as computer file, CDROM, or over the internet.

4.5) Long-lived. Materials should have a life span that extends beyond one use.

What to look for:

- Materials include information on where replacements, updates, equipment, and special supplies can be obtained.
- Equipment and materials are listed, reasonably accessible, inexpensive, and simple to use.
- Student materials are sufficiently supplied. Consumable instructional materials are of good quality and sufficient quantity to support the objectives.
- None consumable materials can be reused by another educator.

4.6) Adaptable. Materials should be adaptable to a range of learning situations.

What to look for:

- Suggestions are provided for adapting lessons and activities for learners from particular or cultural backgrounds.
- Materials are available in more than one language, if appropriate.
- Where appropriate, the materials suggest easy adaptations for different environments, such as indoor and outdoor environments. Formal and informal settings, large and small classes, mixed-level classes, or rural, suburban, and urban settings.

- There are suggestions for finding low-cost or no-cost alternatives for the equipment and materials needed.
- Materials provide suggestions for adaptations for students with special learning needs, language needs, and physical needs.
- Materials offer ideas for adapting to different grade levels.

4.7) Accompanied by instruction and support. Additional support and instruction should be provided to meet educators' needed.

What to look for?

- Professional development programs are accessible to educators in your area.
- Continuing technical support for educators is provided (for example, a toll-free telephone number or a list of local or regional points of contact for questions about the materials).
- Instructional programs provide follow-up activities or evaluations and help develop a network of practitioners.
- Materials include lists of essential resource and supporting materials, such as agency contacts, references to videos, information on computer database, etc.

4.8) Make substantiated claims. Materials should accomplish what they claim to accomplish.

What to look for:

- Claims of learning outcomes are substantiated by systemic evaluation rather than merely by letters of endorsement and anecdotal comments from users.
- Materials were field tested under conditions similar to their intended use and evaluated in terms of stated goals and objectives prior to wide scale implementation.

- If materials are part of a larger program, the program provides for continuous feedback and modification once it is underway.
- Educators who work in the settings in which the material is intended to be used participated on the development team or reviewed drafts of materials.
- Experts in learning theory, evaluation, and other appropriate educational disciplines were involved on the development team or reviewed drafts of materials.

4.9) Fit with national, state, or local. Environmental education materials should fit within national, state, or local standards or curricula. (Also see guideline #5.5 for other ideas about fitting local curricula.)

What to look for:

- Materials have been or could be easily correlated with national, state, or local requirements or learning objectives.
- Materials can be readily integrated into established curricula.