

BCA SEM – I
Skill Enhancement Compulsory Course (SECC)
Environmental Studies
CODE: US01SBCA21 (T)

UNIT 1: INTRODUCTION TO ENVIRONMENTAL STUDIES

- Definition, Scope and importance of Environmental Studies
- Multidisciplinary nature of environmental studies
- Component of Environment: Atmosphere, Hydrosphere, Lithosphere, Biosphere
- Biogeochemical cycles: Carbon cycle and Nitrogen cycle
- Concept of sustainability and sustainable development.

ENVIRONMENTAL STUDIES

Environment literally means Surrounding in which we are living. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component like animals, plants or non-living component like soil, air water.

Environmental Protection Act (1986) defined “Environment as the sum total of water, air and land, their interrelationship among themselves and with the human beings, other living beings and property.”

Ecology and Scope of Ecological Studies:

Ecology is that part of environmental studies in which we study about organisms, plants and animals and their relationship or interdependence on other living and nonliving environment.

The term 'Ecology' is derived from Greek word 'Oekologue' which is composed of two words:

(a) 'Oekos' means surrounding

(b) 'Logos' means study on a whole ecology means 'Study of surrounding'

The scope of ecological study includes:

1. It deals with the study of flow of energy and materials in the environment.
2. It deals with the study of nature and its function.
3. It deals with the exchange of various materials between the biotic and abiotic components of environment. E.g., Biogeochemical cycles.

Meaning Of Environmental Studies:

Environmental studies are the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

SCOPE AND IMPORTANCE OF ENVIRONMENTAL STUDIES

The disciplines included in environmental education are environmental sciences, environmental engineering and environmental management.

(a) Environmental Science:

It deals with the scientific study of environmental system (air, water, soil and land), the inherent or induced changes on organisms and the environmental damages incurred as a result of human interaction with the environment.

(b) Environmental Engineering:

It deals with the study of technical processes involved in the protection of environment from the potentially deleterious effects of human activity and improving the environmental quality for the health and well beings of humans.

(c) Environmental Management:

It promotes due regard for physical, social and economic environment of the enterprise or projects. It encourages planned investment at the start of the production chain rather than forced investment in cleaning up at the end.

It generally covers the areas as environment and enterprise objectives, scope, and structure of the environment, interaction of nature, society and the enterprise, environment impact assessment, economics of pollution, prevention, environmental management standards etc.

The importance of environmental studies are as follows:

1. To clarify modern environmental concept like how to conserve biodiversity.
2. To know the more sustainable way of living.
3. To use natural resources more efficiently.
4. To know the behaviour of organism under natural conditions.
5. To know the interrelationship between organisms in populations and communities.
6. To aware and educate people regarding environmental issues and problems at local, national and international levels.

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Because, the environment is complex and actually made up of many different environments, including natural, constructed and cultural environments, environmental studies is the inter disciplinary examination of how biology, geology, politics policy studies, law, geology, religion engineering, chemistry

and economics combine to inform the consideration of humanity's effects on the natural world.

This subject educates the students to appreciate the complexity of environmental issues and citizens and experts in many fields. By studying environmental science, students may develop a breadth of the interdisciplinary and methodological knowledge in the environmental fields that enables them to facilitate the definition and solution of environmental problems.

It is essentially a multidisciplinary approach and its components include Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health Sciences, Anthropology, Economics, Statistics and Philosophy. It is essentially a multidisciplinary approach.

COMPONENT OF ENVIRONMENT: ATMOSPHERE, HYDROSPHERE, LITHOSPHERE, BIOSPHERE

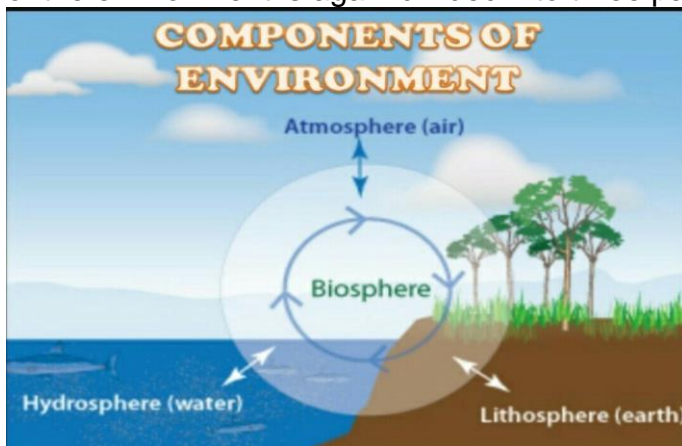
The environment is defined as the whole physical and biological system surrounding man and other organisms along with various factors influencing them. The factors are soil, air, water, light, temperature etc. These are called Abiotic factors. Besides the abiotic factors, the environment is very much influenced by biotic factors which include all forms of life like plants, animals, microorganisms etc.

Man is thus an inseparable part of the environment. Man and Environment have very close relationship with each other. The social life of man is affected by environment. This is the reason for various types of social and cultural activities around the world. The hilly people have different life styles than people in the plain area. Similarly people around the world differ in their food, cloth, festivals etc. All these are influenced by the factors around him.

The environment has three important constituents. These are:

- (a) Physical
- (b) Biological
- (c) Social

(a) The Physical Constituent of environment includes soil, water, air, climate, temperature, light etc. These are also called abiotic constituents of the environment. This part of the environment mainly determines the type of the habitat or living conditions of the human population. This physical constituent of the environment is again divided into three parts.



These are:

- (i) Atmosphere (gas)
- (ii) Hydrosphere (liquid)
- (iii) Lithosphere (solid)

These three parts represent the three important states of matter constituting the environment. This physical component of environment only consists of non-living things like air, water and soil. All these nonliving things influence much to all living organisms including man. Water and temperature are the most important abiotic components affecting living beings. Larger proportion of body's weight is due to water.

(I) Atmosphere

- I. The atmosphere is the protective blanket of gases which is surrounding the earth. It protects the earth from the hostile environment of outer space.
- II. It absorbs IR radiations emitted by the sun and reemitted from the earth and thus controls the temperature of the earth.
- III. It allows transmission of significant amounts of radiation only in the regions of 300 – 2500 nm (near UV, visible, and near IR) and 0.01 – 40 meters (radio waves), i.e. It filters tissue damaging UV radiation below 300 nm.
- IV. It acts as a source for CO₂ for plant photosynthesis and O₂ for respiration
- V. It acts as a source for nitrogen for nitrogen fixing bacteria and ammonia producing plants.
- VI. The atmosphere transports water from ocean to land.

2. Hydrosphere

It includes all types of water resources such as oceans, seas, rivers, lakes, streams, reservoirs, glaciers and ground waters. The distribution of earth's water supply is shown in figure-1.1.

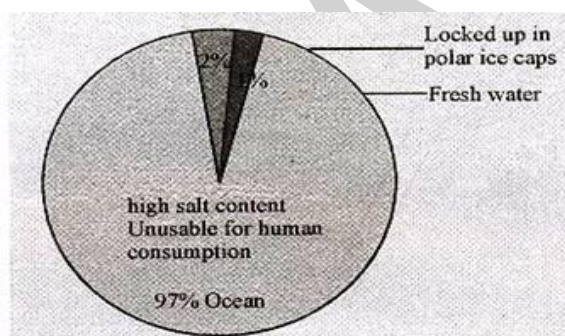


Figure 1.1

As can be seen, only 1 % of the total water supply is available as fresh water in the form of rivers, lakes, streams and ground water for human consumption and other uses.

The extent of the use of available fresh water for various purposes is shown in the following figure -1.2.

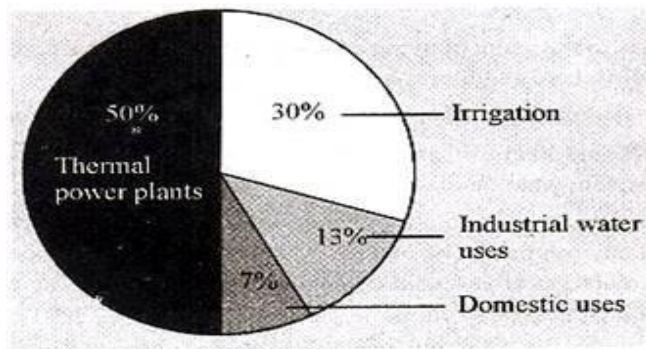
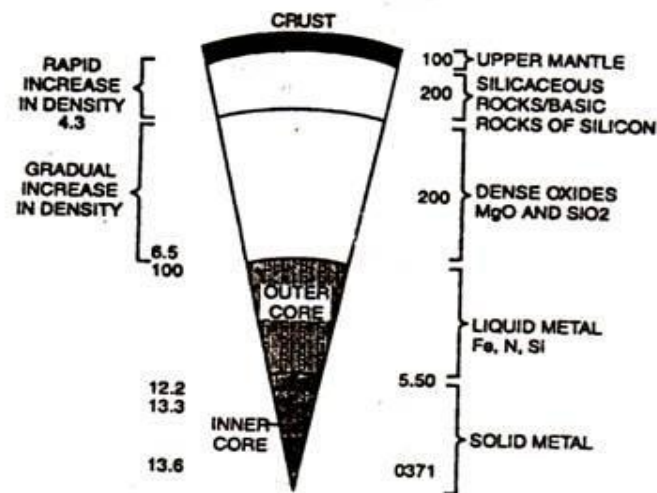


Figure 1.2. Major use of fresh water

The major problem with global water supply is its non-uniform distribution, since people in areas with low precipitation often consume more than people in regions with more rainfall.

3. Lithosphere

- I. The earth is divided into layers as shown in figure-1.3



- II. The lithosphere consists of upper mantle and the crust.
- III. The crust is the earth's outer skin that is accessible to human. The crust consists of rocks and soil of which the latter is the important part of lithosphere.

4. Biosphere

The biosphere refers to the realm of living organisms and their interactions with the environment (VIZ: atmosphere, hydrosphere and lithosphere)

- The biosphere is very large and complex and is divided into smaller units called ecosystems.
- Plants, animals and microorganisms which live in a definite zone along with physical factors such as soil, water and air constitute an ecosystem.
- Within each ecosystems there are dynamic inter relationships between living forms and their physical environment. The natural cycles operate in a balanced manner providing a continuous circulation of essential constituents necessary for life and this stabilizes and sustains the life processes on earth.
- These inter relationships manifest as natural cycles, (hydrologic cycle, oxygen cycle, nitrogen cycle, and phosphorous cycle and Sulphur cycle).
- The shape of the earth is very close to that of an oblate spheroid, a sphere flattened along the axis from pole to pole.

BIOGEOCHEMICAL CYCLES: CARBON CYCLE AND NITROGEN CYCLE

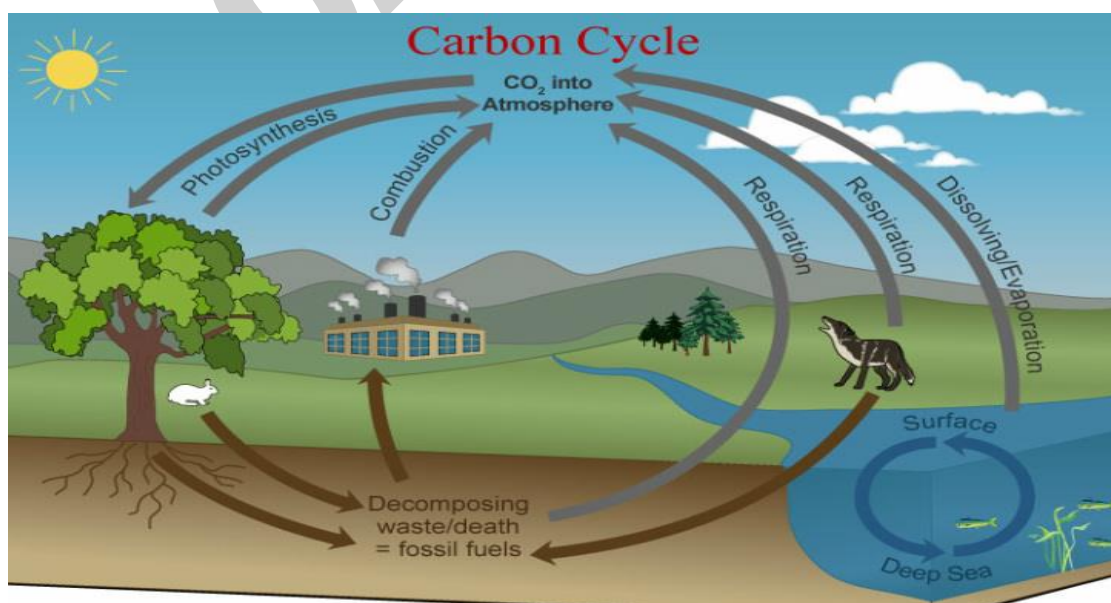
Producers are the only living component of the ecosystem which is capable of converting the solar energy into chemical energy of food. This is done by process called Photosynthesis in which producers utilizes the basic inorganic nutrient form their non-living environment.

This material is finally transformed into biomass of the producers which is then transferred to the consumer population and ultimately returned to the environment with the help of reducers or decomposers. This cyclic exchange of material between the living organisms and their non-living environment is called Biogeochemical Cycle.

CARBON CYCLE:

The carbon found in organic compounds is indicated in both the abiotic and biotic parts of the ecosystem. Carbon is a building block of both plant and animal tissues. In the atmosphere, carbon occurs as carbon dioxide (CO_2). In the presence of sunlight, plants take up carbon dioxide from the atmosphere through their leaves. The plants combine carbon dioxide with water, which is absorbed by their roots from the soil. In the presence of sunlight they are able to form carbohydrates that contain carbon. This process is known as photosynthesis. Plants use this complex mechanism for their growth and development. In this process, plants release oxygen into the atmosphere on which animals depend for their respiration. The plants help in regulating and monitoring the percentage of oxygen and carbon dioxide in the Earth's atmosphere. All of mankind depends on the oxygen generated through this cycle. It also keeps the CO_2 at acceptable levels.

Herbivores feed on plant materials, which is used by them for energy and for their growth. Both plants and animals release carbon dioxide during respiration. They also return fixed carbon to the soil in the waste they excrete. When plants and animals die, they return their carbon to the soil. These processes complete the carbon cycle.



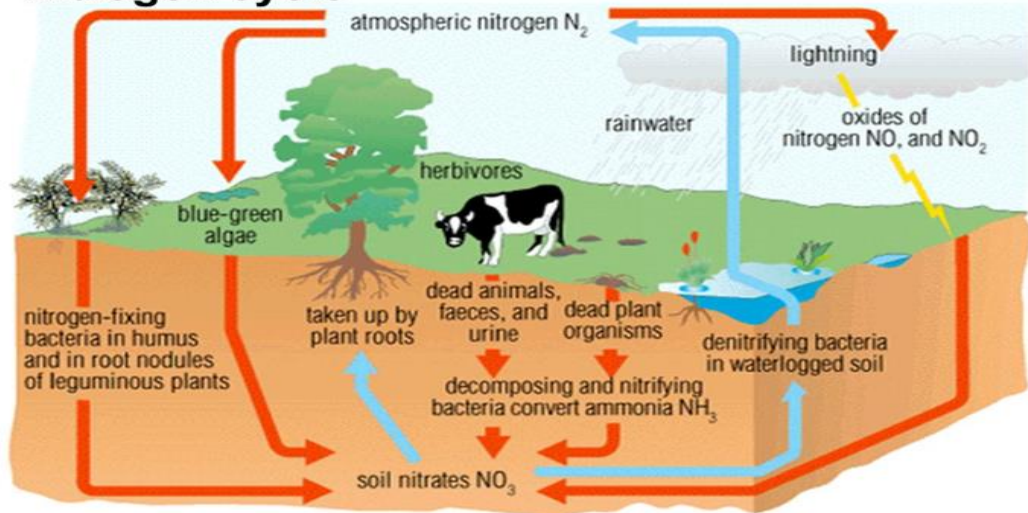
1. Carbon enters into the living world in the form of carbon dioxide through the process of photosynthesis as carbohydrates.
2. This organic compounds (food) are then passed from the producers to the consumers (herbivores & carnivores)
3. This carbon finally returned back to the surrounding medium by the process of respiration or decomposition of dead bodies of plant and animals by decomposers.
4. Carbon is also recycled during burning of fossil fuels.

NITROGEN CYCLE:

Carnivores feed on herbivores that, in turn, feed on plants. When animals defecate, this waste materials is broken down by worms and insects, mostly beetles and ants. These small 'soil animals' break the waste materials into smaller bits on which microscopic bacteria and fungi can act. This material is thus broken down further into nutrients that plants can absorb and use for their growth. In this manner, nutrients are recycled back from animals to plants. Similarly, the bodies of dead animals are also broken down into nutrients that are used by the plants for their growth. Thus, the nitrogen cycle, on which life is depends, is completed.

The nitrogen-fixing bacteria and fungi in the soil give this important elements to plants, which absorb it as nitrates. These nitrates are a part of the plant's metabolism, which help in forming new plant proteins. This used by the animals that feed on the plants. The nitrogen is then transferred to the carnivores when they feed on the herbivores. So, our lives are closely interlinked to soil animals, fungi and even the bacteria in the soil. When we think of food webs, we usually think of the large mammals and other forms of life. But we need to understand that it is the unseen small animals, plants and microscopic forms of life that are of great value for the functioning of the ecosystem.

Nitrogen cycle

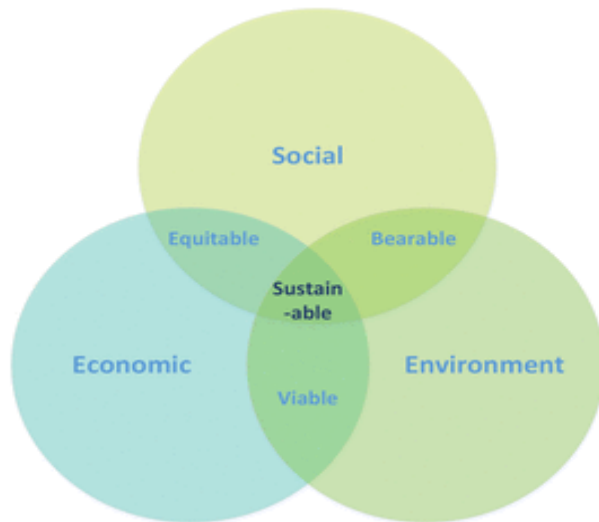


1. Nitrogen is present in the atmosphere in its elemental form and as such it cannot be utilized by living organisms.
2. This elemental form of nitrogen is converted into a combined state with elements like H, C, O by certain bacteria so that it can be readily used by plants.
3. Nitrogen is continuously entering into the air by the action of microorganisms like denitrifying bacteria and is finally returned back to the cycle through the action of lightning and electrification.

CONCEPT OF SUSTAINABILITY

The word sustainability is derived from the Latin *sustinere* (*tenere*, to hold; *sus*, up). The way in which sustainability is used nowadays is based on the English term “sustainability,” which is an expression of the possibility of a certain matter to be supported. Sustainability is seen as a paradigm for thinking about the future in which environmental, societal, and economic considerations are balanced in the pursuit of an improved quality of life. The ideals and principles behind it lay on broad concepts such as intergenerational equity, gender equity, social tolerance, poverty alleviation,

environmental preservation and restoration, natural resource conservation, and building just and peaceful societies.



So to achieve true sustainability we need to balance economic, social and environmental sustainability factors in equal harmony. These may be defined as:

- **Environmental Sustainability:** Environmental sustainability means that we are living within the means of our natural resources. To live in true environmental sustainability we need to ensure that we are consuming our natural resources, such as materials, energy fuels, land, water etc., at a sustainable rate. Some resources are more abundant than others and therefore we need to consider material scarcity, the damage to environment from extraction of these materials and if the resource can be kept within Circular Economy principles. Environmental sustainability should not be confused with full sustainability, which also need to balance economic and social factors.
- **Economic Sustainability:** Economic sustainability requires that a business or country uses its resources efficiently and responsibly so that it can operate in a sustainable manner to consistently produce an operational profit. Without an operational profit a business cannot sustain its activities. Without acting responsibly and using its resources efficiently a company will not be able to sustain its activities in the long term.

- **Social Sustainability:** Social sustainability is the ability of society, or any social system, to persistently achieve a good social well-being. Achieving social sustainability ensures that the social well-being of a country, an organisation, or a community can be maintained in the long term.

Taking these three pillars of sustainability further if we only achieve two out of three pillars then we end up with:

- **Social + Economic Sustainability = Equitable**
- **Social + Environmental Sustainability = Bearable**
- **Economic + Environmental Sustainability = Viable**

Only through balancing economic + social + environmental can we achieve true sustainability and a truly circular economy.

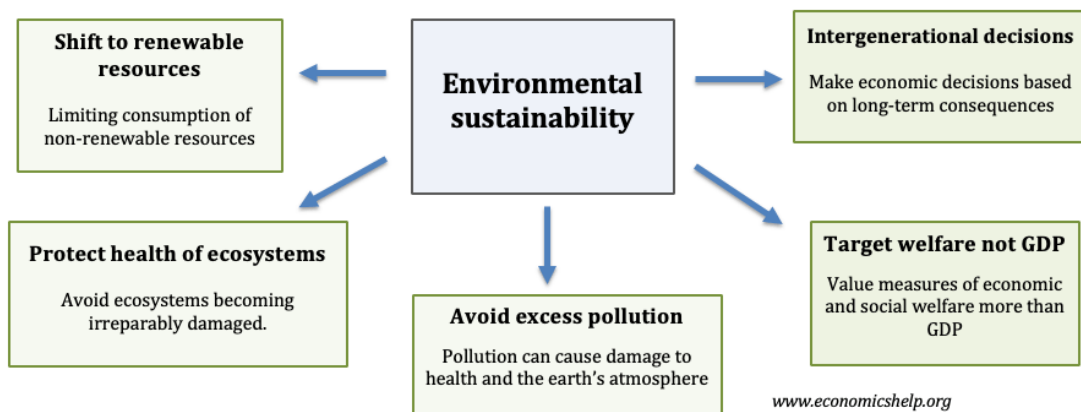
CONCEPT OF SUSTAINABLE DEVELOPMENT

‘Sustainable Development’ is by no means a new concept for Indians. The Indian literature dating back to the ‘Vedic’ times has a number of references in respect of sustainable use of water, forest, animals, land and many other living resources. The rapid growth of the industries all over the world has helped realize the importance of sustainable development.

According to Brundtland, “Sustainable development is the development that meets the needs of the present without compromising the needs of the future generations to meet their own needs.”

According to Pearce Makandia and Barbier, “Sustainable development involves devising a social and economic system, which ensures that these goals are sustained; i.e. that real incomes raise, that education standards increase, that the health of the nation improves, that the general quality of life is advanced.”

Environmental sustainability is concerned with whether environmental resources will be protected and maintained for future generations.



Environmental sustainability is concerned with issues such as:

- **Long-term health of ecosystems.** Protecting the long-term productivity and health of resources to meet future economic and social needs, e.g. protecting food supplies, farmland and fishing stocks.
- **Intergenerational decision making.** When taking economic decisions, we should focus on implications for future generations, and not just the present moment. For example, burning coal gives a short-term benefit of cheaper energy, but the extra pollution imposes costs on future generations.
- **Renewable resources:** Diversifying into energy sources that do not rely on non-renewable resources. For example, solar and wind power.
- **Prevent the consequences of man-made global warming.** Policies to ensure the environment of the planet does not deteriorate to a point where future generations face water shortages, extreme weather events, excess temperature. – All factors that could make living in parts of the world very difficult if not possible.
- **Protection of species diversity and ecological structure.** Sometimes medicines require elements within specific plant species. If some species go extinct, it limits future technological innovation.
- **Treating environmental resources as if they have intrinsic rights and value.** In other words, we shouldn't just rely on a monetary value, i.e. we should

protect rainforests because they deserve to be protected rather than using a cost-benefit analysis of whether we gain financially from protecting rainforests.

- **Targeting social welfare/happiness** and environmental sustainability above crude measures of progress such as GDP.

BCA SEM-I