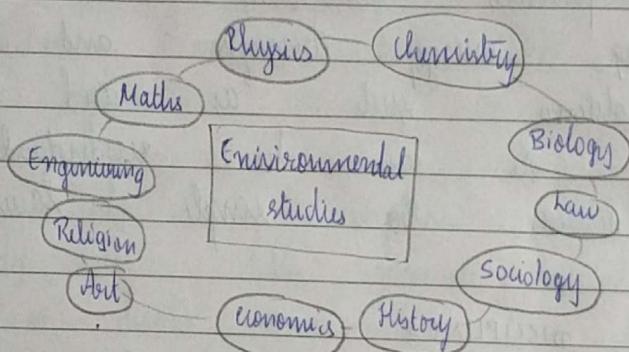


## UNIT - 1

Environmental eng. has been defined as the branch of eng. that is concerned with protecting the environment from the potentially deleterious effects of human activities, protecting human population from the effects of adverse environmental factors & improving environmental quality for human health and well being.

### MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES



EVS is a multi disciplinary program in nature since it includes all disciplines such as social sciences, humanities, commerce, etc. and it is created to promote the study of our natural surroundings to minimize the degradation of those surroundings and the social and political tools needed to pursue and improve the environment.

French word "Environs" means environs or surround.

### BIOLOGICAL SCIENCES

- (i) They help in understanding the biotic (living) components of the environment and their interactions with each other and abiotic (non-living) components.
- (ii) They form an important component of environmental science & it is impossible to study the environment without acquiring knowledge of the organism living in it.

### PHYSICAL SCIENCES

- (i) They help in understanding the changes and processes involving the abiotic components including energy transfer and nutrient cycling.
- (ii) Problems such as acid rain, ozone layer depletion etc. can be understood properly if one knows the simple laws of chemistry.

### OTHER DISCIPLINES

- (i) Social sciences enable human beings to relate and understand the implications of environment in human welfare.
- (ii) Geography is an area of study relevant to any one who is concerned with the relationship between society and environment.
- (iii) The clear knowledge of all the sciences is required to understand the problems related to the environment & to find solutions for the same.

SCOPE OF EVS

- 1) Ecosystem studies & function.
- 2) Environmental pollution control.
- 3) Environmental management.
- 4) Industry
- 5) Research & development
- 6) Social development
- 7) Environmental journalism.
- 8) Environmentalists.
- 9) Natural resource conservation.

The opportunities in this field are immense not only for scientists but also for engineers, biologists and environmental journalists. Environmental science can be applied in the following spheres.

- 1) The study of ecosystems mainly consists of the study of the processes that link the living or biotic components to the non-living or abiotic components.
- 2) With the knowledge of EVS, one can suggest methods to control pollution and manage waste effectively.
- 3) There are several independent environmental consultants working with the central and state pollution control boards. Thus consultants offer advice related to environmental problems & their solutions.
- 4) Environmental scientists work towards maintaining ecological balance, conservation of

biodiversity and preservation of natural resources.  
Rapid industrialisation is increasingly degrading the environment.

- 5) With the increase in public awareness regarding environmental issues, there is tremendous scope for research & development in the field.
- 6) Non government organisation (NGO) help in creating awareness regarding the protection of environment. They also work towards disseminating information & bringing about changes in political policies that adversely affect the environment.
- 7) Environmentalists analyse the causes & effects of environmental issues locally or globally & help in devising ways to combat the problems.
- 8) Apart from providing immovable resources, natural assets such as forest contribute towards maintaining a balanced environment. Thus, management & maintenance of forest & wild life is an important task under natural resource conservation.
- 9) There is an increasing demand for people who can report on environmental issues to generate awareness among people.

IMPORTANCE OF EVS

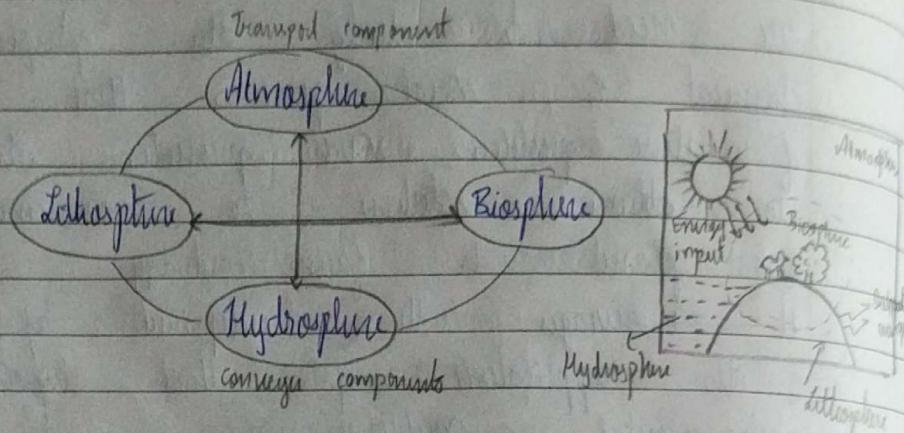
The study of the structure & function of the environment is essential for sustainable development of all living organisms on earth.

EVS is important because of the following reasons:

- (i) To understand the current environmental problems, we need to study the physical, biological, chemical & social processes that form the basis of these problems. EVS provides the skills necessary to attain solution to environmental problems on our planet which is facing today.
- (ii) It encourages the development & application of these principles to solve environmental problems.
- (iii) EVS helps to maintain ecological balance by providing a basic operating knowledge of environmental systems & processes.
- (iv) It examines the scientific basis for environmental & social concerns about our present energy needs, global climate change, toxic emissions & waste disposal.
- (v) EVS helps to achieve sustainable development & understand the relationships b/w the development & the environment.
- (vi) This discipline helps to educate people regarding their duties towards environmental protection.
- (vii) EVS is helpful in environmental management.
- (viii) EVS applies economic methods & concepts to issues of the environment, environmental policies, analysis & management.
- (ix) EVS also aims to protect biodiversity. Growth in population of human beings & the resulting increase in material consumption & technological development have increased the rate of degradation of the environment.

- (x) The concepts from EVS can be applied to the study of agriculture & the design of sustainable production systems

### COMPONENTS OF ENVIRONMENT & THEIR INTERACTION



#### LITHOSPHERE

- It is a solid shell of inorganic materials on earth composed of soil particles & underlying rocks upto a depth of 50 km
- It is the soil mantle that wraps the core of the earth.
- Soil supplies nutrients to plants & is one of the most important ecological factor called "edaphic" factor
- The soil layer is referred to as the pedosphere. It is a mixture of inorganic & organic soil matter, air, water & microorganisms

#### ATMOSPHERE

- Troposphere
- Stratosphere → ozone layer
- Mesosphere
- Ionosphere → Thermosphere
- Exosphere → outer space

BIOSPHERE Atmosphere + Hydrosphere + lithosphere = Biosphere.

- (i) It thin shell of organic matter on earth comprising all living things.
- (ii) It occupies least volume of all spheres. But it is the cause of the majority of flow of matter through nature.
- (iii) Life sustaining resources like air, food & water are radium from the biosphere.
- (iv) Waste products in gaseous, liquid & solid forms are discharged.

### ECOLOGY

It is the study of the interrelationships between plants & animals that live in a particular physical environment.

The main objective of the study of ecology is to apply the knowledge gained from ecological study to safeguard against disaster caused by

- (i) uncontrolled interference with natural population.
- (ii) unchecked felling of trees.
- (iii) environmental pollution.

### ECOLOGICAL SYSTEM (ECOSYSTEM)

An ecosystem is defined as the natural functional ecological unit comprising of living organisms (biotic) & non living (abiotic component & physiochemical) environment that interact to form a stable self supporting system.

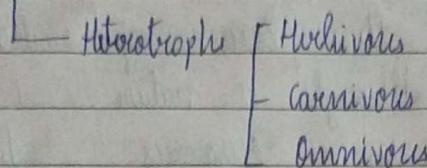
Eg: Pond, grass land, forest.

### TYPES OF ECOSYSTEM

- 1) Natural ecosystem Eg: lake, forest
- 2) Artificial used for Eg: agricultural land, constructed wet land, treatment of municipal sewage.

## COMPONENTS OF ECOSYSTEM

1) Biotic component - Autotrophs

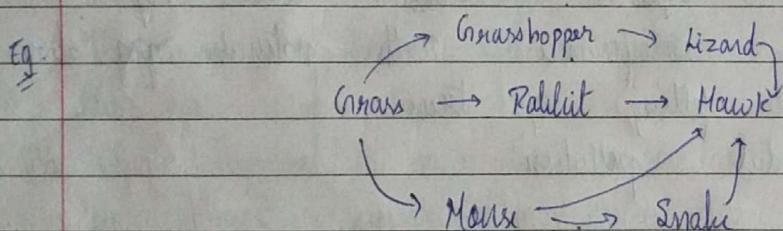


2) Abiotic component - physical conditions like pressure, Temperature, humidity, etc.

### FOOD CHAIN & FOOD WEB

Eg: Grass → grasshopper → Frog → Snake → Hawk

### FOOD WEB



Simple chain of eating & being eaten away  
is food chain

The transfer of energy from the producer either through herbivores, carnivores or through decomposition in a connectedness or linkage of organisms dependent for their existence on other organisms in the next trophic level

### FOOD WEB

In a given ecosystem various food chains are linked together & interact with each other to form a complex network called food web.

SIGNIFICANCE OF FOOD CHAIN & FOOD WEB

- Food chain in understanding feeding relationships b/w organisms in any ecosystem.
- It helps in appraising the energy flow mechanism within the ecosystem.
- Helps in understanding the movement of toxic substances in the ecosystem & the problem of biological magnification/biomagnification.

STRUCTURE OF AN ECOSYSTEM

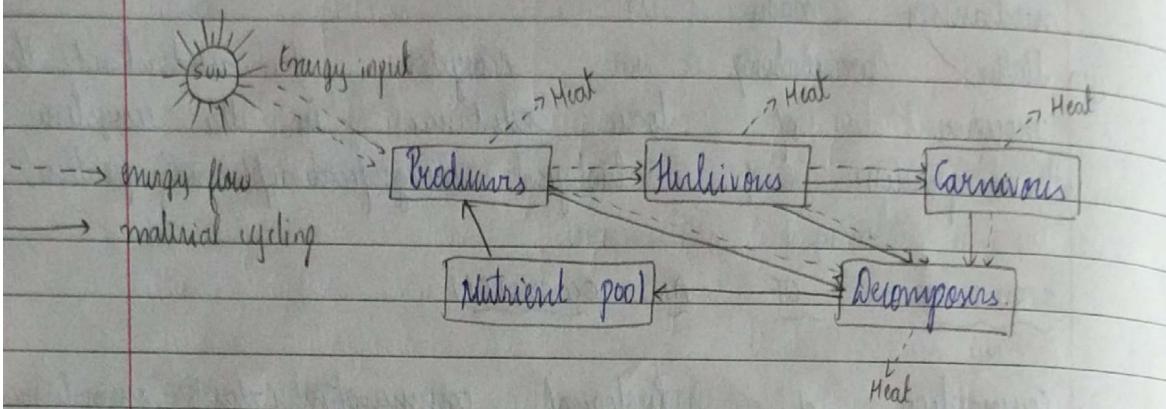
- Composition of biological community (plants, animals, micro-organisms), distribution of in space, trophic status.
- Quantity distribution & cycling of abiotic material like macro & micro nutrients, water, trace elements, etc.
- Range or gradient conditions such as temperature, rainfall, light, wind, relative humidity, etc.

FUNCTIONS OF ECOSYSTEM

- It regulates flow rates of biological energy including production & respiration rates.
- It regulates flow rates of materials in form of material cycles.
- It fixes limit & tolerance for each organism in an ecosystem.
- It regulates species diversity.
- It regulates modification of environment because the environment is modified by the organisms according to their needs.
- It controls alteration of anyone component.

Biotic component of ecosystem is called as functional kingdom in nature.

ENERGY FLOW & MATERIAL CYCLING



- (i) Autotrophic plants have the ability to change radiant energy by photosynthesis.
- (ii) Part of the energy is consumed by autotrophs during respiration, growth, etc.
- (iii) Remaining chemical energy is used for body building of plant.
- (iv) Inorganic chemicals are excreted out which becomes nutrients again used by plants continuing nutrient cycling.
- (v) Consumers obtain organic compounds used in body building & energy used for growth & maintenance.
- (vi) The nutrient cycling continues as long as light supplied.
- (vii) Energy is lost as heat at various stages & it is unidirectional flow.

## CONCEPT OF SUSTAINABLE DEVELOPMENT

- (i) The development that meets the needs of present without compromising the ability of future generations to meet their own needs.
- (ii) In the sustainable approach its based on human goals & understanding the long term impact of our activities on the environment.
- (iii) The objectives of sustainable development are-
  - (i) control of population growth.
  - (ii) minimisation of waste
  - (iii) conserve natural resources like air, water, food, soil, land, etc.
  - (iv) conservation of energy resources.
  - (v) Place more emphasis on waste reduction & pollution prevention.
  - (vi) Reuse, reduce & recycle matter from the waste generated.
  - (vii) Minimize the use of virgin materials
  - (viii) Make the things that last longer & the remanufacturing
  - (ix) Design a product that can withstand wear, stress & degradation
  - (x) Accountability & responsibility of economic decision makers.

## BALANCED ECOSYSTEM

- (i) The stable ecosystem represents a dynamic balance among numerous factors of biotic potential & environment resistance
- (ii) Altering any one factor will alter the balance & may put the system into a state of change
- (iii)

## FACTORS RESPONSIBLE FOR BALANCED ECOSYSTEM

- (i) Balance b/w predators & prey
- (ii) Balance b/w vegetation, herbivores & carnivores
- (iii) Balance b/w competing species & balance with alien factors.
- (iv) In an ecosystem the biological cycling of matter is maintained by 3 groups namely producers, consumers & decomposers.
- (v) Decomposers are fungi & bacteria that decompose the organic matter of producers & consumers into inorganic substances that can be reused as food by the producers. Thus the decomposers are the recyclers of the biosphere.
- (vi) Nature is capable of sustaining the producer, consumer, decomposer cycle indefinitely with the sun as the energy source.

## BIODIVERSITY OR BIOLOGICAL DIVERSITY

Biodiversity refers to number, variety & variations of living organisms & ecosystems. The term includes all the terrestrial, marine & other aquatic organisms. It covers diversity within species, b/w species & variation among ecosystems. It is concerned with complex ecological interrelationships of species. It is the earth's life support system & is a precondition to human survival.

### TYPES

- (i) Species
- (ii) Genus
- (iii) Ecosystem

SPECIESBIODIVERSITY

It refers to the variety of species within the region. It is much easier to count the no. of species at any given sample site. It is the most straight forward & in many ways the most convenient & useful measure of biodiversity.

GENETICDIVERSITY

(i) It refers to the variation of genes within the species. The genes found in organisms can form enormous number of combinations each of which gives rise to some variations.

(ii) Difference b/w individual organisms have two causes.

a) Variation in the genetic material

b) Variation caused by environmental influence on each individual organisms

(iii) When the genes within the same species show diff. versions due to new combination, it is called genetic variability.

ECOSYSTEMDIVERSITY

(i) It is a variety of habitat found in an area.

(ii) It refers to variety of forests, deserts, grass land, aquatic systems, etc. that occurs in an area.

(iii) The ecosystem also shows variation w.r.t physical parameters like moisture, temp., altitude, precipitation (rain, snow, mist, dew). Thus there occur tremendous diversity within the ecosystem.

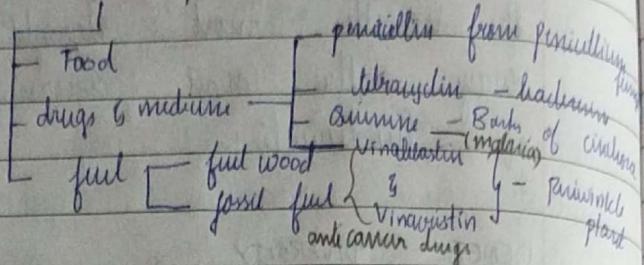
(iv) Diversity of ecosystems is assessed in terms of the diversity of species.

## VALUES OF BIODIVERSITY

(i) Direct Eg: food

(ii) Indirect Eg: precipitation

Under direct value, consumption values



## PRODUCTIVE VALUES

- (i) These are commercially valuable values where the product is marketed & sold.
- (ii) These may include the animal products like stinks from elephants, musk from musk deer, silk from silkworm, wool from sheep etc which are traded in the market.
- (iii) Many industries are dependent upon the productive use values of biodiversity
  - a) Paper industry
  - b) Textile industry
  - c) Leather industry
  - d) plywood industry

## SOCIAL VALUES

These are the values associated with the social life, cast customs, religion & psycho-spiritual aspect of people.

## ETHICAL VALUES

(i) They are also known as intrinsic values.

It involves ethical values like "All life must be preserved". It is based on the concept of "Karma", let him?

(ii) Ethical values means that we may or may not be a species, but knowing the very fact that the species

exist in nature gives us pleasure.

### AESTHETIC VALUES

Great aesthetic value is attached to biodiversity. People spend a lot of time & money to visit wilderness areas where they can enjoy the aesthetic value of biodiversity & this type of tourism is known as ecotourism.

### OPTION VALUES

- (i) These values include the potentials of biodiversity that are presently unknown & need to be explored.
- (ii) Option value is the value of knowing that there are biological resources existing on this biosphere that may one day prove to be an efficient option for something important in the future.
- (iii) The biodiversity is like a precious gift of nature granted to us.

### ECOSYSTEM SERVICE VALUES

It refers to the services provided by the ecosystem like prevention of soil erosion, prevention of floods, maintenance of soil fertility, cycling of nutrients, fixation of nitrogen, cycling of water, pollutant absorption & reduction of the threat of global warming.

## BIODIVERSITY LOSSES

- (i) Deforestation or forest
  - (ii) Overexploitation of biomass
  - (iii) Overgrazing - livestock
  - (iv) Urbanization
  - (v) Shift cultivation
  - (vi) Industrialisation
  - (vii) Illegal trade -犀牛, 马来象, 狐猴 of 马达加斯加
  - (viii) Soil degradation & soil erosion
  - (ix) Droughts & famines
  - (x) Desertification
  - (xi) Natural calamities - flood, volcano eruptions

## THREATS TO BIODIVERSITY

- (i) Biodiversity is the variety of variations occurring in nature which has sustained the harmonious existence of life on earth

(ii) The components of this diversity are so interdependent that any change in the system leads to a major imbalance and threatens the main ecological cycle

## i) Loss of habitat

- a) Natural forests & grasslands were the natural homes of 1000s of species which perished due to loss of their natural habitat
  - b) Habitat loss is caused by agricultural activities, hunting & extraction, development of human settlements, industry and associated infrastructure
  - c) The wet lands are also destroyed due to draining, filling & pollution thereby causing huge biodiversity loss.

(iii) Poaching, hunting & fishing

- Poaching of endangered wildlife is encouraged due to their high price in international market.
- Overhunting is responsible for depletion or extinction of many species.
- Hunting of species for <sup>human</sup> consumption will exhaust the entire population.
- Fish stocks have been depleted ~~by~~ by overhunting in many parts of the world.

(iv) Fragmentation

- In addition to habitat loss, a serious problem is habitat fragmentation. The reduction of habitat into smaller & smaller more scattered patches.
- Fragmentation reduces biodiversity because many species require large territories to exist.
- Fragmentation also divides populations into isolated groups.

(v) Man-wildlife conflicts

- Rapidly growing human population interferes with wildlife creating man-wildlife conflicts. It is an issue of survival for both.
- Domestic cattle compete with the wild animals for grass & water.
- Agriculture is especially in the temperate highlands, hill areas, slopes encroach in wildlife area.
- Many tourists in the wildlife area disturb by transport, hunting & construction of resorts.
- The glamour for products obtained from wildlife such as skin, horn, tusk, etc.