Module 1

ENVIRONMENTAL STUDIES

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UNIT 1:

The Multidisciplinary Nature of Environmental Studies

Why should we study state of an environment ?

- For information that clarifies modern environmental concepts such as the needs to
  - conserve biodiversity
  - lead more sustainable lifestyles
  - use resources more equitably
- To change the way in which we view our own environment by a practical approach based on observation and self learning
- To create a concern for our environment that will trigger pro-environmental action, including activities we can do in our daily life to protect it

Environmental Studies ?

.Deals with every issue that affects an organism living on the earth.

.Applied science – seeks practical answers to making human civilization sustainable on the earth's finite resources.

.Multidisciplinary approach

.Components : Biology, Geology, Chemistry, Physics, Engineering, Sociology, Health Sciences, Anthropology, Economics, Statistics and Philosophy.

Scope and importance

.Our surroundings were originally a natural landscape such as a forest, a river, a mountain, a desert, or a combination of these elements.

.Most of us live in heavily modified landscapes in villages, towns or cities

.But still dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder, and fish

Web of Life ?

.We use water – drink and other activities

.We breath air

.We use resources to make food

.We depend on community of plants and animals – forms the web

.We are part of it !

From the past

.Our dependence on nature is so great that we cannot continue to live without protecting the earth's environmental resources.

.Most traditions refer to our environment as 'Mother Nature' and most traditional societies have learned that respecting nature is vital for their livelihoods.

.Led to many cultural practices that helped traditional societies protect and preserve their natural resources.

.Respect for nature and all living creatures is not new to India.

Went wrong somewhere

.Over the past 200 years – modern societies began to believe that easy answers to the question of producing more resources could be provided by means of technological innovations.

.Growing more food by using fertilizers and pesticides

.Developing better strains of domestic animals and crops

.Irrigating farmland through mega dams and developing industry

.Led to rapid economic growth

.The ill effects of this type of development, led to environmental degradation.

.Industrial development and intensive agriculture uses up large amounts of natural resources such as water, minerals, petroleum products, wood, etc.

.Non-renewable resources, such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations.

.Renewable resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as regrowth or rainfall.

.But these too will be depleted if we continue to use them faster than nature can replace them

More problems !

- Misuse of natural resources
- Pollute the environment
  - Water pollution : causes gastro-intestinal diseases
  - Air pollution : causes respiratory problems
  - Industries : Solid, liquid and gaseous pollutants are emitted
  - Use of plastics

What to do ?

.Take it up as our own responsibility and don't just leave it with government

.Use resources in a way that sustains over in longer term – sustainable development

.Understand the values of nature

- Productive value
- Aesthetic value
- Option value

.Create awareness campaigns through various media

Institutions for environment

- Bombay Natural History Society (BNHS), Mumbai
  - influence on wildlife policy building, research, popular publications and peoples action have been unique features
  - 'Save the Silent Valley' campaign
- World Wide Fund for Nature (WWF-I), New Delhi
  - Nature Clubs of India program for school children
- Center for Science and Environment (CSE),New Delhi
  - organising campaigns, holding workshops and conferences, and producing environment related publications
- CPR Environmental Education Centre, Madras
- Centre for Environment Education (CEE), Ahmedabad
- Bharati Vidyapeeth Institute of Environment Education and Research (BVIEER),Pune
  - Institute has a PhD, a Masters and Bachelors program in Environmental Sciences
  - Research on Biodiversity Conservation

- Uttarkhand Seva Nidhi (UKSN), Almora
- Kalpavriksh, Pune
- Salim Ali Center for Ornithology and Natural History (SACON), Coimbatore
  - Dr. Salim Ali's dream to support a group of committed conservation scientists on a permanent basis
- Wildlife Institute of India (WII), Dehradun
  - significant publication has been 'Planning A Wildlife Protected Area Network for India'
- Botanical Survey of India (BSI)
  - Conducts surveys of plant resources
- Zoological Survey of India (ZSI)
  - Has the largest collection of 'Type specimens' in Asia

UNIT 2:

Natural Resources

Introduction

- Natural resources
  - Abiotic – air, water, soil, minerals, along with the climate and solar energy
  - Biotic – living parts of nature consists of plants and animals, including microbes
  - Interactions between the abiotic aspects of nature and specific living organisms together form ecosystems

Earth's resources and man

- Atmosphere
  - Protective shell over the Earth
  - Provides oxygen and other gaseous necessities
- Hydrosphere
  - Region containg water bodies
- Lithosphere
  - Region containing soil, rocks, nutrients
- Biosphere
  - Layer of Earth where life can exist

- The spheres are related via different processes

Non-renewable resources

.minerals that have been formed in the lithosphere over millions of years

.once used, remain on earth in a different form and, unless recycled, become waste material

.include fossil fuels such as oil and coal

.If used at the present rate, it will be soon used up

Renewable resources

.natural resource which can replenish with the passage of time

.Fresh water, forest, fish

.if the rate at which the resource is consumed exceeds its renewal rate, renewal and sustainability will not be ensured

.Renewable energy – Solar enery, windpower, hydropower, Geothermal energy

Forest Resources

.India should ideally have 33% land under forests but now only 12% forests !

.Forest functions :

- .Watershed protection
- .Atmospheric regulation
- .Erosion control
  - .Holding soil (by preventing rain from directly washing soil away)
- .Land Bank
  - .Maintenance of soil nutrients and structure
- .Local use(Consumptive use)
- .Market use(Productive use)

.Problems :

- .Timber extraction and deforestation
- .Mining
- .Contruction of dams

Water resources

.World depends on a limited quantity of fresh water
.Water covers 70% of the earth's surface but only 3% of this is fresh water
.At a global level, 70% for agriculture, 25% for industry and 5% for domestic use
.Problems :
- Over utilization and pollution of surface and ground water
- Excessive construction of dams

.Bad Effects :
- Global climate change
- Floods and drought

.Sustainable water management necessary

Mineral Resources

.naturally occurring substance of definite chemical composition and identifiable physical properties

.formed over a period of millions of years in the earth's crust

.Stages in mining operations :

- Prospecting
- Exploration
- Development
- Exploitation

.Mining – main source of environmental degradation

.Side-effects of mining :

- Depletion of available land due to mining
- Land pollution, water and air pollution
- conversion of land to industry

Food resources

.Our food – entirely from agriculture, animal husbandry and fishing

.World food problems :

- ·Food production lags behind population growing level
- ·fertile soils are being exploited faster than they can recuperate
- ·Fish resources are getting exhausted
- ·great disparities in the availability of nutritious food
- ·shortage of cultivable productive land.

.Better agricultural practices required

Energy resources

- found on our planet in a variety of forms :
  - immediately useful to do work
  - require a process of transformation
- Non-renewable energy
  - non-renewable resources must be ignited
  - Consist of the mineral based hydrocarbon fuels coal, oil and natural gas – fossil fuels
  - Burning emits carbon dioxide, oxides of sulphur, nitrogen causing lung diseases
  - Oil spills cause for water pollution

- Renewable energy
  - use resources that are constantly replaced and are usually less polluting
  - Hydroelectric Power
  - Solar Energy
  - Tidal and Wave Power
  - Geothermal Energy
  - Nuclear Power
- Energy Conservation
  - shift to alternate energy use and renewable energy sources
  - Develop mini dams to generate electricity
  - Biomass can be converted into biogas or liquid fuels ie. ethanol and methanol

Land resources

.Hills, valleys, plains, river basins and wetlands include different resource generating areas that the people living in them depend on

.If utilized carefully it can be considered a renewable resource

.Problems faced :

- Land Degradation
- Soil Erosion

UNIT 3:

Ecosystems

Ecosystem

.The living community of plants and animals in any area together with the non-living components of the environment such as soil, air and water, constitute the ecosystem

.Based on geographical features and climatic conditions

.Types :

- Terrestrial / Land-based ecosystem
- Aquatic ecosystem

.Different levels :

- Global level : Biosphere
- Sub-global level : bio-geographical realms
- National or State level : bio-geographic regions

Structural aspects

.Inorganic aspects – C, N, CO2, H2O

.Organic compounds – Protein, Carbohydrates, Lipids – link abiotic to biotic aspects.

.Climatic regimes – Temperature, Moisture, Light & Topography

.Producers – Plants

.Macro consumers – Phagotrophs – Large animals

.Micro consumers – Saprotrophs, absorbers – fungi.

Functional aspects

- Energy Cycles
- Food Chains
- Diversity-interlinkages between organisms
- Nutrient cycles-biogeochemical cycles
- Evolution

Producers, Consumers and Decomposers

- Producers
  - Plants : manufacture their food by using energy from the sun
  - In forest : communities of plant life
  - In sea : tiny algal forms to large seaweed
- Consumers
  - Primary consumers : herbivorous - live on the producers
  - Secondary consumers : carnivorous - live on the herbivorous animals
- Decomposers or detrivores
  - break down dead organic material into smaller particles and finally into simpler substances that are used by plants as nutrition
  - consists of small animals like worms, insects, bacteria and fungi

Energy Flow

.functions of the ecosystem are related to the growth and regeneration of its plant and animal species

.The linked processes are depicted as the various cycles

.Water Cycle

- Rain water – to ground, rivers and sea – absorbed by plants from ground – water transpired from leaves and evoparates – evaporates also from water bodies – form clouds – come back as rain

.Carbon Cycle

- Plants use CO2 during photosynthesis – becomes carbohydrates – animals use this – release CO2 during respiration – return carbon to soil by excretion and when they die

.Oxygen Cycle

- Taken up by plants and animals for respiration – released by plants during photosynthesis

.Nitrogen Cycle

- Nitrogen fixing bacteria decompose dead and add nitrates to soil – plants absorb this for photsynthesis – herbivores consume plants – carnivores

.Energy Cycle

- Sunlight used by plants for photosynthesis – used by consumers – decomposers
- Can be depicted by 'food/energy pyramid'

Ecological succession

- process through which ecosystems tend to change over a period of time
- can be related to seasonal environmental changes
- Developmental stages in the ecosystem
  - pioneer stage
  - series of changes known as serel stages
  - climax stage
- Example – pond ecosystem
  - dry terrestrial habitat
  - early colonisation stage by small aquatic species after the monsoon
  - mature aquatic ecosystem
  - reverts back to its dry stage in summer : aquatic life remains dormant

Food Chains, Food Webs and Ecological Pyramids

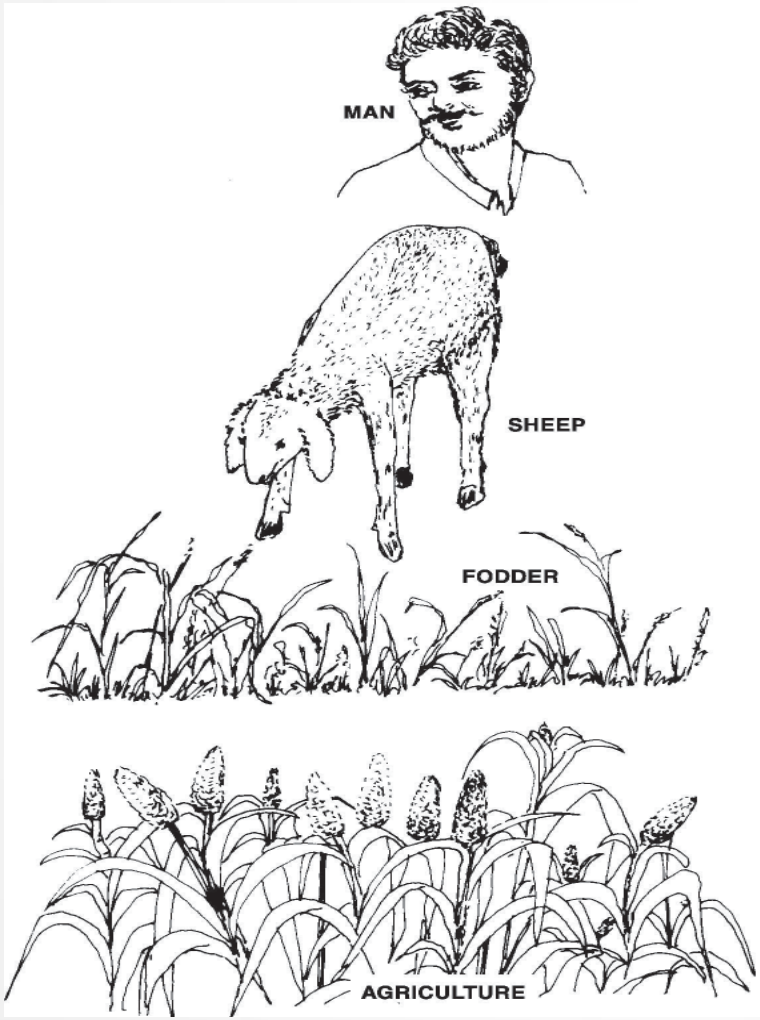
.transfer of energy from the source in plants through a series of organisms by eating and being eaten constitutes food chains

.Interlocked pattern of food chains – food web

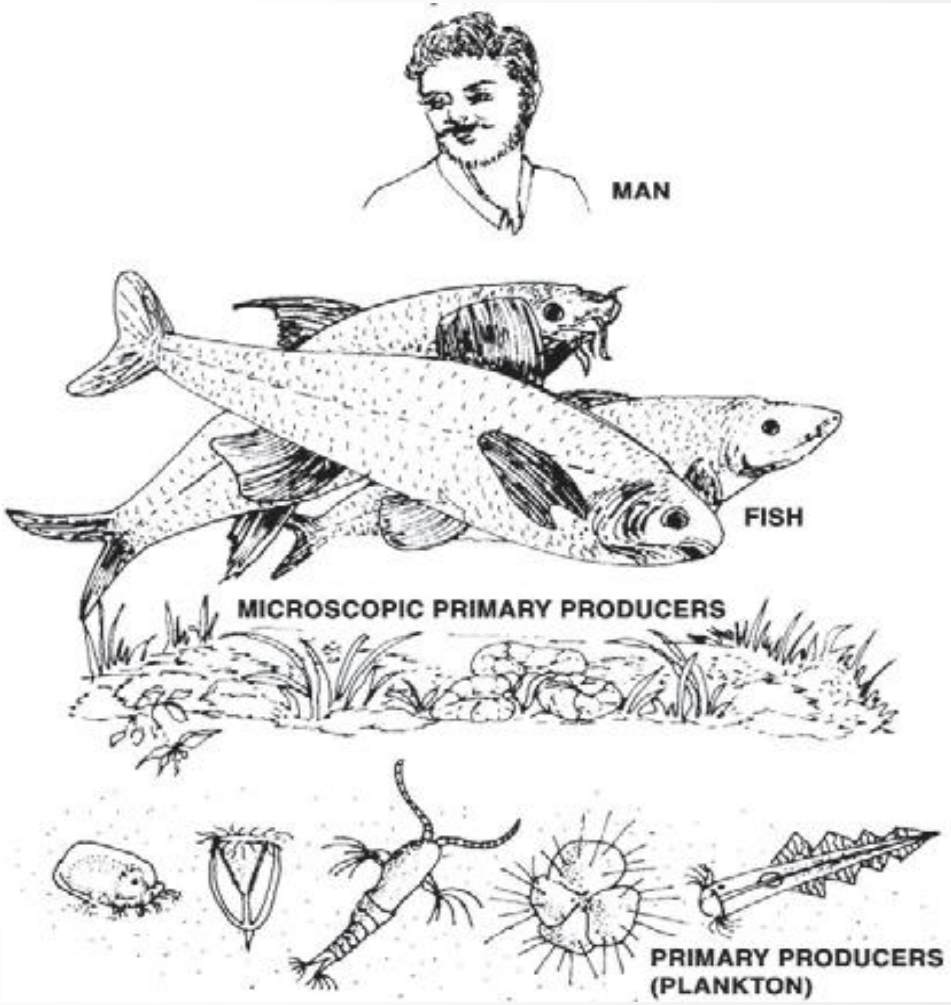
.Each step of the food web – trophic level.

.Trophic levels together form the ecological pyramid.

Terrestrial Food Pyramid



Aquatic Food Pyramid



Types of ecosystem

- Terrestrial Ecosystems
  - Forest
  - Grassland
  - Semi arid areas
  - Deserts
  - Mountains
  - Islands
- Aquatic Ecosystems
  - Pond
  - Lake
  - Wetland
  - River
  - Delta
  - Marine

Forest Ecosystem

- Two parts :
  - Non-biotic : Geography of a region, soil, amount of rainfall, temperature
  - Biotic : plants and animals form communities that are specific to each forest type
- Forests in India :
  - Coniferous forests
    - In Himalayan mountain region
  - Broadleaved forests
    - evergreen forests, deciduous forests, thorn forests, and mangrove forests

Grasslands

.vegetation is mainly formed by grasses and small annual plants

.cover areas where rainfall is usually low and/or the soil depth and quality is poor

.Grassland types in India :

- ·Himalayan pasture belt : extends upto the snowline
- ·Terai : patches of tall grasslands interspersed with a Sal forest ecosystem
- ·Semi-arid plains of Western India, Central India and the Deccan : covered by grassland tracts with patches of thorn forest
- ·Shola grasslands : consist of patches on hillslopes along with the Shola forests on the Western Ghats, Nilgiri and Annamalai ranges

.Threats : Overgrazing and urbanization

Desert Ecosystem

.Climate in these vast tracts is extremely dry

.areas covered with sparse grasses and a few shrubs, which grow if it rains

.Examples in India :

- Thar Desert
- Great and Little Rann of Kutch are highly specialised arid ecosystems

.Indian wolf, desert cat, desert fox and birds such as the Great Indian Bustard and the Florican

Aquatic Ecosytem

.constitute the marine environments of the seas and the fresh water systems in lakes, rivers, ponds and wetlands

.Classification :

- stagnant ecosystems
- running water ecosystems

.Classification based on salinity level :

- Freshwater
- Brackish
- Marine

.Uses for man :

- Water
- Fish and other products

.Threats :

- Water pollution from sewage, fertilizers