**RKDF University, Bhopal**
**Open Distance Learning (ODL) Material**

**Faculty of Commerce**
**Semester –I**
**Subject- Environmental Education**

| Units | Topic | Marks |
|---|---|---|
| I | **Environment and Natural Resources:**<br>-Multidisciplinary nature, Scope and Importance of Environment<br>- Components of Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere.<br>Brief account of Natural Resources and associated problems: Land Resource, Water Resource, Energy Resource<br>-Concept of Sustainability and Sustainable Development<br>Biome, Ecosystem and Biodiversity: | 20 |
| II | -Major Biomes: Tropical, Temperate, Forest, Grassland, Desert, Tundra, Wetland, Estuarine and Marine<br>-Ecosystem: Structure function and type their Preservation & Restoration<br>-Biodiversity and its conservation practices | 20 |
| III | **Environmental pollution, Management and Social Issues**:<br>-Pollution: Types, Control measures, Management and associated problems.<br>-Environmental Law and Legislation: Protection and conservation Acts.<br>-International Agreement & Programme.<br>Environmental Movements, communication and public awareness programme.<br>-National and international organizational related to environment conservation and monitoring.-Role of information technology in environment and human health. | 20 |
| IV | **Ecosystem**-What is an ecosystem? Structure: food chains, food webs and function of ecosystem: Energy flow in an ecosystem, nutrient cycle and ecological succession, Ecological Interactions. | 20 |
| V | **Environmental Management**: Policies & Practices-Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Green Politics, Earth Hour, Green Option Technologies. Environmental communication and public awareness, Role of National Green Tribunal. | 20 |

## UNIT -I

## INTRODUCTION

The word environment is derived from the French word ‘environment’ which means to ‘encircle or surround’. · Thus our environment can be defined as “the Social, Cultural and Physical conditions that surround, affect and influence the survival, growth and development of people, animals and plants”

This broad definition includes the natural world and the technological environment as well as the cultural and social contexts that shape human lives. It includes all factors (living and nonliving) that affect an individual organism or population at any point in the life cycle; set of circumstances surrounding a particular occurrence and all the things that surrounds us.

**SEGMENTS OF ENVIRONMENT**

Environment consists of four segments.

1. Atmosphere- Blanket of gases surrounding the earth.
2. Hydrosphere- Various water bodies present on the earth.
3. Lithosphere- Contains various types of soils and rocks on the earth.
4. Biosphere- Composed of all living organisms and their interactions withthe environment.

**MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES**

- The Environment studies is a multi-disciplinary science because it comprises
- various branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc.
- It is the science of physical phenomena in the environment. It studies about the sources, reactions, transport, effect and fate of physical and biological species in the air, water, soil and the effect of from human activity upon these.
- As the environment is complex and actually made up of many different environments like natural, constructed and cultural environments,

environmental studies is inter disciplinary in nature including the study of biology, geology, politics, policy studies, law, religion engineering, chemistry and economics to understand the 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.

**SCOPE OF ENVIRONMENTAL STUDIES**

- Environmental studies as a subject has a wide scope. It includes a large number of areas and aspects, which may be summarized as follows:
- Natural resources- their conservation and management
- Ecology and Biodiversity
- These are the basic aspects of environmental studies which have a direct relevance to every section of society. Several career options have emerged in these fields that are broadly categorized as:
- Research and development in environment:
- Skilled environmental scientists have an important role to play in examining various environmental problems in a scientific manner and carry out R&D activities for developing cleaner technologies and promoting sustainable development.

**Green advocacy:**

- With increasing emphasis on implementing various Acts and Laws related to environment, need for environmental lawyers has emerged, who should be able to plead the cases related to water, air, forest, wildlife, pollution and control etc.

**Green marketing:**

- While ensuring the quality of products with ISO mark, now there is an increasing emphasis on marketing goods that are environment friendly. Such products have Eco mark or ISO 14000 certification. Environmental auditors and environmental managers would be in great demand in the coming years.

**GREEN MEDIA**

- Environmental awareness can be spread amongst masses through mass media like television, radio, newspaper, magazine, hoardings, advertisements etc., for which environmentally educated persons are required.

**IMPORTANCE OF ENVIRONMENTAL STUDIES**

- The importance of environmental studies is that, the current trend of environmental degradation can be reversed if people of educated communities are organized, empowered and experts are involved in sustainable development.
- Environmental factors greatly influence every organism and their activities.
- At present a great number of environmental issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. These issues are studied besides giving effective suggestions in the environment studies.
- The environment studies enlighten us, about the importance of protection andconservation of our natural resources, indiscriminate release of pollution into the environment etc.

**ENVIRONMENT STUDIES HAVE BECOME SIGNIFICANT FOR THE FOLLOWING REASONS:**

1. **Environment Issues being of International Importance:**

It has been well recognized that environment issues like global warming, ozone depletion, acid rain, marine pollution and loss of biodiversity are not merely national issues but are global issues and hence must be tackled with international efforts and cooperation.

Problems Cropped in

2. **The Wake of Development:**

Development, in its wake gave birth to Urbanization, Industrial Growth, Transportation Systems, Agriculture and Housing etc. However, it has become phased out in the developed world. The North, to cleanse their own environment has, fact fully, managed to move ‘dirty’ factories to South. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Evidently such a path is neither practicable nor desirable, even if developing world follows that.

3. **Explosively Increase in Pollution:**

World census reflects that one in every seven persons in this plant lives in India. Evidently with 16 per cent of the world's population and only 2.4 per cent of its land area, there is a heavy pressure on the natural resources including land. Agricultural experts have recognized soils health problems like deficiency of micronutrients and organic matter, soil salinity and damage of soil structure.

4. **Need For Wise Planning of Development:**

Our survival and sustenance depend. Resources withdraw; processing and use of the product have all to be synchronized with the ecological cycles in any plan of development. Our actions should be planned ecologically for the sustenance of the environment and development.

**NEED FOR PUBLIC AWARENESS**

1. **Growing Population:** A population of over thousands of millions is growing at 2.11 per cent every year. Over 17 million people are added each year. It puts considerable pressure on its natural resources and reduces the gains of development. Hence, the greatest challenge before us is to limit the population growth. Although population control does automatically lead to development, yet the development leads to a decrease in population growth rates.

2. **Poverty:** India has often been described a rich land with poor people. The poverty and environmental degradation are mixed with one another. The vast majority of our people are directly dependent on the nature resources of the country for their basic needs of food, fuel shelter and fodder. About 40% of our people are still below the poverty line.

3. **Environment degradation** has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenge of poverty and the challenge of environment degradation are two facets of the same challenge.

4. **Agricultural Growth:** The people must be made familiar with the methodsto sustain and increase agricultural growth without damaging the environment. High yielding varieties have caused soil salinity and damage to physical structure ofsoil.

5. **Need to Increase Ground water:** It is essential of rationalizing the use of groundwater. Factors like community wastes, industrial effluents, chemical fertilizers and pesticides have polluted our surface water and affected quality of the groundwater. It is essential to restore the water quality of our rivers and other water bodies. Suitable

strategies for conservation of water, provision of safe drinking water and keeping water bodies clean should be developed.

**INSTITUTIONS IN ENVIRONMENT**

Managing natural resources require efficient institutions at all levels i.e. local, national, regional and global. Among the large number of institutions that deal with environmental protection and conservation, a few well-known organization include government organizations like the BSI and ZSI, and NGOs like the BNHS, WWF-1, *etc*.

- **· The Bombay Natural History Society (BNHS), Mumbai**
- **· World Wide fund for nature- India (WWF-1), New Delhi**
- **· Centre or science and environment (CSE), New Delhi**
- **· C.P.R Environmental Education Centre, Madras**
- **· Centre for Environment Education (CEE)**
- **· Bharati Vidyapeeth University, Institute of Environment Education &Research, Pune**
- **· The Salim Ali Center for Ornithology and Natural History (SACON)**
  **· Wildlife Institute of India (WII), Dehradhun**
- **· Zoological survey of India (ZSI)**
- **· The madras Crocodile Bank Trust (MCBT)**
- **· Botanical Survey of India (BSI)**

**NATURAL RESOURCES**

- Natural resources can be defined as 'variety of goods and services provided by nature which are necessary for our day-to-day lives'.· Eg: Plants, animals and microbes (living or biotic part), Air, water, soil, minerals, climate and solar energy (non- living or abiotic part).
- They are essential for the fulfillment of physiological, social, economic and cultural needs at the individual and community levels.

## UNIT -II

## MAJOR BIOMES

### THERMAL POLLUTION:

Thermal pollution is generally defined as the discharge of heated water into aquatic biomes. But thermal pollution also covers releases of colder than normal water into the aquatic biomes. The general effect is to raise or lower the temperature of the aquatic biome in ways that kill off life that is sensitive to higher temperatures. If the heated water from industrial operations contains chemicals or radiation that is toxic to life in aquatic biomes, then the problem is compounded.

### CAUSES

The most common human, or anthropogenic, causes of thermal pollution are coolant release from power production and manufacturing plants, urban runoff from storm drains that carry surface runoff from roads and warmer surfaces, and releases of colder than normal water from reservoirs into rivers and waterways.

In the industrial area, petroleum refineries, pulp/paper mills, chemical plants, steel mills and smelters are the big contributors to thermal heat pollution.

Natural causes include geothermal and volcanic activity, either under the oceans and seas or from above ground lava flow. Lightning strikes can also introduce massive amounts of heat, and the natural progress of warmer currents into colder biomes occurs.

### EFFECT

The effects of thermal pollution include damage to larvae and eggs of fish in rivers where there is a limited tolerance for temperature change. The other effects are on the biodiversity of aquatic biomes due to killing off of some species that are not resistant to temperature change, which disrupts the balance of the food and light chains for plants, fish, bacteria, and microscopic life forms. Fish and macroinvertibrates are most susceptible to temperature changes, as they have the most limited tolerance for sudden excessive heat and cold.

Heat affects the metabolic rate and enzymatic activity of aquatic animals, leading to more eating, which can upset the balance in food availability.

Dissolved oxygen and other chemical changes to the structure of the water are another effect of heat thermal pollution. The heat tends to decrease the amount of dissolved oxygen in the water. Another effect is that living entities attempt to migrate when their

environment is untenable. The increased migration of life forms to areas that had a perfect balance can create a fight for limited resources, once the population increases.

**PREVENTION**

What can be done about anthropogenic thermal pollution? There are cooling ponds and towers that store and transition the water to more acceptable temperatures before release. There is also recycling of the heated water to direct it to areas where heat is needed.

Following are the means to reduce thermal pollution:

Theoretically, when efficiency of any heat engine is equal to 1.0 then it will convert 100% of heat energy to mechanical energy. So there will be no loss of heat to the environment. This is practically impossible. Rather, we should aim at maximizing the efficiency of heat engines (steam, IC, nuclear etc.) so that heat loss is minimum.

Reduce mechanical friction in any rotating parts.

Avoid consuming energy more than necessity. Burn less coal, oil or gas.

Promote use of more nuclear energy because it will not generate Carbon di oxide.

One of the major cause of Global warming is increasing concentration of Carbon di oxide, leading to more greenhouse effect. On the other hand, green plants have got the capacity to absorb Carbon di oxide. In the photo synthesis plants take water, sunlight and carbon di oxide to produce their food.

**NUCLEAR POLLUTION:**

The environmental impact of nuclear power results from the nuclear fuel cycle, operation, and the effects of nuclear accidents.

The routine health risks and greenhouse gas emissions from nuclear fission power are small relative to those associated with coal, but there are "catastrophic risks"[1] such as the possibility of over-heated fuel releasing massive quantities of fission products to the environment. The public is sensitive to these risks and there has been considerable public opposition to nuclear power. The 1979 Three Mile Island accident and 1986 Chernobyl disaster, along with high construction costs, ended the rapid growth of global nuclear power capacity.

**Waste streams**

Nuclear power has at least four waste streams that may harm the environment:

- they create spent nuclear fuel at the reactor site (including plutonium waste)
- they produce tailings at uranium mines and mills
- during operation they routinely release small amounts of radioactive isotopes
- during accidents they can release large quantities of dangerous radioactive materials

**Radioactive waste High-level waste**

Around 20–30 tons of high-level waste are produced per year per nuclear reactor. The world's nuclear fleet creates about 10,000 metric tons of high-level spent nuclear fuel each year. Several methods have been suggested for final disposal of high-level waste, including deep burial in stable geological structures, transmutation, and removal to space. So far, none of these methods have been implemented. There is an "international consensus on the advisability of storing nuclear waste in deep underground repositories", but no country in the world has yet opened such a site There are some 65,000 tons of nuclear waste now in temporary storage throughout the U.S., but in 2009, President Obama "halted work on a permanent repository at Yucca Mountain in Nevada, following years of controversy and legal wrangling".

**Other waste**

Moderate amounts of low-level waste are produced through chemical and volume control system (CVCS). This includes gas, liquid, and solid waste produced through the process of purifying the water through evaporation. Liquid waste is reprocessed continuously, and gas waste is filtered, compressed, stored to allow decay, diluted, and then discharged. The rate at which this is allowed is regulated and studies must prove that such discharge does not violate dose limits to a member of the public (see radioactive effluent emissions).

**DISASTER MANAGEMENT**

'Disaster management can be defined as the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters.

Any disaster can interrupt essential services, such as the provision of health care, electricity, water, sewage/garbage removal, transportation and communications. The interruption can seriously affect the health, social and economic networks of local communities and countries. Disasters have a major and long-lasting impact on people long after the immediate effect has been mitigated. Poorly planned relief activities can have a significant negative impact not only on the disaster.

## DISASTER PREVENTION

These are activities designed to provide permanent protection from disasters. Not all disasters, particularly natural disasters, can be prevented, but the risk of loss of life and injury can be mitigated with good evacuation plans, environmental planning and design standards. In January 2005, 168 Governments adopted a 10-year global plan for natural disaster risk reduction called the Hyogo Framework. It offers guiding principles, priorities for action, and practical means for achieving disaster resilience for vulnerable communities.

## DISASTER PREPAREDNESS

These activities are designed to minimize loss of life and damage – for example by removing people and property from a threatened location and by facilitating timely and effective rescue, relief and rehabilitation. Preparedness is the main way of reducing the impact of disasters. Community-based preparedness and management should be a high priority in physical therapy practice management.

## FLOODS

A flood is an overflow of water that submerges land.The European Union (EU) Floods Directive defines a flood as a covering by water of land not normally covered by water.[2] In the sense of "flowing water", the word may also be applied to the inflow of the tide. Flooding may result from the volume of water within a body of water, such as a river or lake, which overflows or breaks levees, with the result that some of the water escapes its usual boundaries or may be due to accumulation of rainwater on saturated ground in an area flood.

While the size of a lake or other body of water will vary with seasonal changes in precipitation and snow melt, it is not a significant flood unless such escapes of water endanger land areas used by man like a village, city or other inhabited area.

## EARTHQUAKE

An earthquake (also known as a quake, tremor or temblor) is the result of a sudden release of energy in the Earth's crust that creates seismic waves. The seismicity, seismism or seismic activity of an area refers to the frequency, type and size of earthquakes experienced over a period of time. Earthquakes are measured using observations from seismometers. The moment magnitude is the most common scale on which earthquakes larger than approximately 5 are reported for the entire globe. The more numerous earthquakes smaller than magnitude 5 reported by national seismological observatories are measured mostly on the local magnitude scale, also referred to as the Richter scale. These two scales are numerically similar over their range of validity. Magnitude 3 or lower earthquakes are mostly almost imperceptible and magnitude 7 and over potentially causes serious damage over large areas, depending on their depth. The largest earthquakes in historic times have been of magnitude slightly over 9, although there is no limit to the possible magnitude. The most recent large earthquake of magnitude 9.0 or larger was a 9.0 magnitude earthquake in Japan in 2011 (as of March 2011), and it was the largest Japanese earthquake since records began. Intensity of shaking is measured on the modified Marcella scale. The shallower an earthquake, the more damage to structures it causes, all else being equal.

## LANDSLIDES AND AVALANCHES

Earthquakes, along with severe storms, volcanic activity, and coastal wave attack, and wildfires, can produce slope instability leading to landslides, a major geological hazard. Landslide danger may persist while emergency personnel are attempting rescue.

## UNIT -III

## ENVIRONMENTAL POLLUTION

### ENVIRONMENTAL POLLUTION

WHAT IS POLLUTION

Pollution is the introduction of harmful substances or products into the environment

We will be examining 3 main parts of pollution

- Water Pollution
- Air Pollution
- Land Pollution

### WATER POLLUTION:

CAUSES

Factors that contribute to water pollution can be categorized into two different groups

- Point sources
- Non-point sources
- Point sources are the easiest to identify and control
- Non point sources are ambiguously defined and harder to control

### POINT SOURCES

Some point sources of water pollution include

- Waste products from factories
- Waste from sewage system
- Waste from power plants
- Waste from underground coalmines
- Waste from oil wells

They are called point sources because they are direct sources of water pollution and can be reduced and monitored

### NON-POINT SOURCES

The term non-point source encompasses a large range of sources such as:

- when rain or snow moves through the ground and picks up pollutants as it moves towards a major body of water
- the runoff of fertilizers from farm animals and crop land

**AIR POLLUTION:**

CAUSES

- One of the main causes of air pollution is the release of carbon dioxide into the atmosphere, this happens because of Deforestation and fossil fuel burning
- Sulfur dioxide is another air polluter and is released into the atmosphere by the burning of sulfur containing compounds of fossil fuels. Sulfur oxides are very dangerous to humans at a high concentration. Sulfur in the atmosphere is responsible for acid rain
- Chlorofluorocarbons (CFCs) also contribute to air pollution by reducing the amount of ozone the stratosphere. CFCs come from a variety of places such as:
- the burning of plastic foam items
- leaking refrigerator equipment
- Spray cans

**LAND POLLUTION:**

CAUSES

Four Main causes of land pollution

- Construction
- Agriculture
- Domestic waste
- Industrial Waste

CONSTRUCTION

- Buildings take up resources and land, the trees are chopped down and used to make buildings

- Takes away from places for animals and other organisms to live

AGRICULTURE

- As there are more and more people inhabiting the earth, food is in higher demand and so forests are chopped down and turned into farmland
- In addition, herbicides, pesticides, artificial fertilizers, animal manure (poop) are washed into the soil and pollute it

DOMESTIC WASTE

- Tons of domestic waste is dumped every day. Some waste from homes, offices and industries can be recycled or burnt in incinerators

INDUSTRIAL WASTE

- Plastics factories, chemical plants, oil refineries, nuclear waste disposal activity, large animal farms, coal-fired power plants, metals production factories and other heavy industry all contribute to land pollution

CONSEQUENCES

- Land pollution exterminates wild life
- Acid rain kills trees and other plants
- The vegetation that provides food and shelter is destroyed
- Land pollution can seriously disrupt the balance of nature, and, in extreme cases, can cause human fatalities
- Pesticides can damage crops; kill vegetation; and poison birds, animals, and fish. Most pesticides kill or damage life forms other than those intended. For example, pesticides used in an effort to control or destroy undesirable vegetation and insects often destroy birds and small animals. Some life forms develop immunity to pesticides used to destroy them.

**WAYS TO STOP POLLUTION**

- You can help to reduce global air pollution and climate change by:
- Driving a car that gets at least 35 mpg
- Walking, biking, and using public transportation

- Using CFL bulbs over incandescent bulbs
- Buying only energy efficient appliances
- Recycling newspaper, aluminum, and others
- Planting trees!
- Avoid purchasing products that contain CFCs

**NOISE POLLUTION:**

The word noise is derived from the Latin word nausea meaning seasickness. Like its root meaning, noise has a negative effect to human health and well-being. Noise resulting from road traffic, jet planes, jet skis, garbage trucks, construction equipment, manufacturing processes, lawn mowers, leaf blowers, and boom boxes, to name a few, are among the audible litter that are routinely broadcast into the air (Noise, Noise Pollution and Clearinghouse). They interfere with sleep, concentration, communication, and recreation. The potential health effects of noise pollution are numerous, pervasive, persistent, and medically and socially significant. Health problems related to noise include hearing loss, stress, high blood pressure, sleep loss, distraction and lost productivity, and a general reduction in the quality of life and opportunities for tranquility. Noise is among the most pervasive pollutants today, Its more severe and widespread than ever before, and it will continue to increase in magnitude and severity because of population growth, urbanization, and the associated growth in the use of increasingly powerful, varied, and highly mobile sources of noise. However, strategies such as noise mitigation and its three distinct methods: control, path control and receptor shielding (Noise Mitigation) can reduce environmental noise.

**PREVENTION**

Follow the below given steps for controlling and preventing noise pollution.

- Control of Noise pollution at Source
- Noise producing industries, railway stations, aerodrome, etc. should be located far away from the residential areas.
- We should play various music systems such as stereos, television, etc. at low volume.
- We should not use loud speakers during night. Even during time they should be used

at low volumes.

- Various machines should be well maintained so that they produce less sound.
- It is observed that certain persons blow horns of their vehicles unnecessarily, or remove silencers of the exhaust pipes of vehicles. Such practices produce lot of noise and should be avoided.

Laws should be framed so that the persons producing unnecessary noise are punished.

**THERMAL POLLUTION:**

Thermal pollution is generally defined as the discharge of heated water into aquatic biomes. But thermal pollution also covers releases of colder than normal water into the aquatic biomes. The general effect is to raise or lower the temperature of the aquatic biome in ways that kill off life that is sensitive to higher temperatures. If the heated water from industrial operations contains chemicals or radiation that is toxic to life in aquatic biomes, then the problem is compounded.

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**OTHER WASTE**

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Solid waste can be disposed of simply by placing it where it will not be disturbed for a few years. There are three low-level waste disposal sites in the United States in South Carolina, Utah, and Washington. Solid waste from the CVCS is combined with solid radiate that comes from handling materials before it is buried off-site.

## UNIT -IV

## ECOSYSTEM

### WHAT IS AN ECOSYSTEM?

An ecosystem is a community of living organisms, along with their physical environment, interacting as a system. This includes plants, animals, and microorganisms, as well as the air, water, soil, and sunlight that make up their habitat. Ecosystems can be large, such as a rainforest or a coral reef, or small, such as a pond or a backyard garden. They can also be natural, like a forest or a desert, or human-made, like a farm or a garden.

Ecosystems are complex systems with many interconnected parts, each playing a unique role in maintaining the balance and health of the overall system. Within an ecosystem, there are various interactions between organisms, such as competition for resources, predation, and symbiosis. These interactions contribute to the overall stability and resilience of the ecosystem.

One of the key features of ecosystems is the flow of energy and nutrients through the system. Producers, such as plants, use sunlight to convert carbon dioxide and water into food through the process of photosynthesis. Consumers, such as animals, feed on producers or other consumers to obtain energy and nutrients. Decomposers, such as bacteria and fungi, break down dead plant and animal matter, returning nutrients to the soil for the cycle to begin again.

Ecosystems provide a wide range of services that are essential for human well-being. These ecosystem services include providing food, clean water, clean air, pollination of crops, and climate regulation. Ecosystems also have intrinsic value, as they support biodiversity and provide habitats for a wide variety of species.

However, ecosystems around the world are facing numerous threats, including habitat destruction, pollution, climate change, and overexploitation of natural resources. These threats can disrupt the delicate balance of ecosystems, leading to declines in species diversity, loss of ecosystem services, and even ecosystem collapse. It is therefore important to protect and conserve ecosystems to ensure the health and sustainability of our planet.

To learn more about ecosystems, you can explore the following resources:

- National Geographic: Ecosystems - This article provides a comprehensive overview of ecosystems, including different types of ecosystems, their components, and their importance.
- The Encyclopedia of Earth: Ecosystem - This resource offers in-depth information on ecosystems, including ecosystem functions, services, and threats.
- World Wildlife Fund: Habitat and Ecosystems - This website provides information on the importance of preserving habitats and ecosystems for biodiversity conservation.
- Ecosystem Services Partnership - This organization focuses

**STRUCTURE: FOOD CHAINS, FOOD WEBS AND FUNCTION OF ECOSYSTEM**

In the natural world, all living organisms rely on each other for survival, forming intricate connections through food chains and food webs. These interconnected relationships play a crucial role in maintaining the balance and function of ecosystems. In this article, we will explore the concepts of food chains, food webs, and the function of ecosystems, and their importance in maintaining the health and stability of our planet's biodiversity.

**FOOD CHAINS**

A food chain is a linear sequence of organisms, where each organism serves as a source of food for the next. In a typical food chain, energy flows from one organism to another as they consume and are consumed by other organisms. The primary source of energy in a food chain is the sun, which is captured by green plants through photosynthesis. These plants are known as producers because they produce their own food by converting sunlight into energy.

The next trophic level in a food chain consists of primary consumers, such as herbivores that feed on plants. These herbivores are in turn consumed by secondary consumers, which are often carnivores or omnivores. The energy from one trophic level is transferred to the next through the consumption of organisms, creating a flow of energy through the ecosystem.

At the top of the food chain are apex predators, which have no natural predators and are at the highest trophic level. Apex predators play a crucial role in maintaining the balance of ecosystems by controlling the populations of other organisms.

## FOOD WEBS

While a food chain represents a simple linear sequence of trophic interactions, a food web is a complex network of interconnected food chains within an ecosystem. In a food web, multiple organisms are connected through various feeding relationships, creating a more accurate representation of the flow of energy through an ecosystem.

A food web illustrates the interconnectedness of different species within an ecosystem and highlights the importance of biodiversity in maintaining the stability of the ecosystem. Each organism in a food web plays a specific role in the ecosystem, and changes in one population can have ripple effects throughout the entire food web.

For example, if a predator at the top of the food web experiences a decline in population size, it can lead to an increase in the population of its prey, which in turn can affect the populations of other organisms within the ecosystem. These interconnected relationships demonstrate the interdependence of species within an ecosystem and the importance of maintaining balance for the health of the entire ecosystem.

## FUNCTION OF ECOSYSTEMS

The function of ecosystems refers to the roles and interactions of living organisms within a specific environment. Ecosystems play a crucial role in maintaining balance and stability in the natural world, providing essential services and resources to support life on Earth. Understanding the functions of ecosystems is essential for conservation and sustainable management of natural resources.

- **Ecosystems** are complex and dynamic systems that involve a wide range of living organisms, such as plants, animals, and microorganisms, as well as non-living components like soil, water, and air. These components interact with each other in intricate ways, forming a web of relationships that sustains life within the ecosystem. The functions of ecosystems can be broadly classified into several categories:
- **Nutrient cycling:** One of the key functions of ecosystems is the cycling of nutrients through the system. Nutrients like carbon, nitrogen, phosphorus, and sulfur are essential for the growth and development of living organisms. Plants absorb nutrients from the soil, which are then passed on to herbivores that eat the plants, and then to carnivores that eat the herbivores. When organisms die, their

bodies decompose, releasing nutrients back into the soil for use by other organisms. This cycle of nutrient flow is essential for maintaining the health and productivity of the ecosystem.

- **Energy flow:** Ecosystems rely on the flow of energy from one organism to another. Producers (plants) convert sunlight into energy through photosynthesis, which is then passed on to herbivores and carnivores through the food chain. As energy is transferred from one trophic level to another, some of it is lost as heat, limiting the efficiency of energy transfer within the ecosystem. Understanding energy flows within ecosystems is important for predicting how changes in one part of the system can impact the rest of the ecosystem.
- **Habitat provision:** Ecosystems provide a range of habitats for living organisms to thrive. Different species have specific habitat requirements, such as temperature, moisture, and food availability. Ecosystems provide a variety of niches that support a diverse range of species, each playing a unique role within the ecosystem. Habitat provision is crucial for maintaining biodiversity and ensuring the resilience of ecosystems in the face of environmental changes.
- **Water regulation:** Ecosystems help regulate the water cycle by storing and releasing water, reducing the risk of floods and droughts. Wetlands, forests, and other ecosystems act as natural sponges, absorbing excess water during heavy rains and slowly releasing it back into the environment.

**ENERGY FLOW IN AN ECOSYSTEM**

Energy flow in an ecosystem refers to the movement of energy through various organisms in a specific environment. This flow typically begins with producers, such as plants, that convert sunlight into usable energy through photosynthesis. This energy is then passed on to primary consumers (herbivores), secondary consumers (carnivores), and so on, forming a food chain.

The concept of energy flow in an ecosystem can be simplified into two main components: producers and consumers. Producers, such as plants, algae, and some bacteria, are able to convert sunlight into energy through the process of photosynthesis. This energy is then transferred to consumers, such as animals, fungi, and other organisms, through the consumption of plant material or other consumers.

Energy flow in an ecosystem can be represented by a food chain or a food web. A

food chain is a linear representation of the flow of energy from one organism to another, starting with producers at the base and moving up the chain to consumers at higher trophic levels. A food web, on the other hand, is a more complex representation of the interconnected relationships between multiple organisms within an ecosystem.

In an ecosystem, energy is constantly being transferred and lost at each trophic level. This loss of energy occurs through a variety of processes, including respiration, waste production, and heat generation. As a result, each trophic level in an ecosystem typically contains less energy than the one below it, leading to the pyramid of energy flow that is often depicted in ecological diagrams.

One important concept related to energy flow in an ecosystem is the idea of trophic levels. Trophic levels are hierarchical levels within a food chain or food web that represent the position of an organism in the energy flow of the ecosystem. Producers occupy the first trophic level, followed by primary consumers (herbivores) at the second trophic level, secondary consumers (carnivores) at the third trophic level, and so on. Each trophic level is defined by the source of energy that organisms at that level consume, with higher trophic levels consuming organisms from lower trophic levels.

There are also other important factors that influence energy flow in an ecosystem, such as nutrient cycling, predation, competition, and environmental factors. Nutrient cycling is the process by which nutrients such as carbon, nitrogen, and phosphorus are recycled within an ecosystem, allowing for the continual replenishment of essential nutrients for plant growth and other biological processes. Predation involves the consumption of one organism by another.

**NUTRIENT CYCLE AND ECOLOGICAL SUCCESSION**

Nutrient cycling is the movement and exchange of organic and inorganic matter back into the production of living matter. These nutrients include carbon, nitrogen, phosphorus, sulfur, and other elements essential for life. The nutrient cycle involves a series of processes such as nutrient uptake by plants, decomposition of organic matter, nutrient release back into the environment, and nutrient recycling through biotic and abiotic components of ecosystems.

The nutrient cycle is crucial for the functioning of ecosystems as it ensures a

continuous supply of nutrients necessary for the survival of living organisms. Different organisms play specific roles in the nutrient cycle. For example, decomposers such as bacteria and fungi break down organic matter into simpler compounds, releasing nutrients that can be taken up by plants.

Ecological succession, on the other hand, refers to the gradual and predictable changes in species composition and community structure over time in an ecosystem. It occurs in response to environmental disturbances or changes, such as fires, floods, or human activities. Ecological succession can be primary, where a new habitat is colonized for the first time, or secondary, where an existing community is disturbed and recovers over time.

Primary succession typically starts with bare rock or land devoid of soil, and pioneer species such as lichens and mosses begin to colonize the area. Over time, more complex plant species establish themselves, leading to a climax community that is in equilibrium with the environment. Secondary succession occurs in areas where the existing community has been disturbed but some soil remains, allowing for faster recolonization by plants and other organisms.

Both nutrient cycling and ecological succession are interconnected processes that shape the structure and function of ecosystems. Nutrient availability influences the rate and direction of ecological succession, as different species have varying nutrient requirements and impact nutrient cycling in different ways.

In conclusion, understanding nutrient cycles and ecological succession is vital for ecosystem management and conservation efforts. By studying these processes, ecologists can better predict how ecosystems will respond to environmental changes and human interventions.

## ECOLOGICAL INTERACTIONS

Ecological interactions are the relationships between various organisms in an ecosystem. These interactions play a crucial role in maintaining the balance and stability of the ecosystem. There are several types of ecological interactions, including competition, predation, herbivory, mutualism, commensalism, and parasitism.

Competition is a common ecological interaction where two or more organisms compete for the same limited resources, such as food, water, or territory. This

competition can lead to the exclusion of certain species or the development of niche specialization to reduce competition.

Predation is another important ecological interaction where one organism, the predator, hunts and consumes another organism, the prey. Predation plays a vital role in regulating the population of prey species and can influence the structure of entire ecosystems.

Herbivore is the consumption of plant material by herbivores. Herbivores play a significant role in shaping plant communities by controlling plant growth and distribution. They can also influence the abundance and distribution of other organisms in the ecosystem.

Mutualism is a type of ecological interaction where both species benefit from the relationship. For example, pollination is a mutualistic interaction between plants and pollinators, such as bees or birds. Both species benefit from the exchange of resources in mutualistic relationships.

Commensalism is a relationship where one organism benefits from the association, while the other is neither harmed nor benefited. An example of commensalism is epiphytic plants that grow on trees and use them for support without causing harm.

Parasitism is an ecological interaction where one organism, the parasite, benefits at the expense of another organism, the host. Parasites can cause harm to the host and influence their behavior and health. Parasitism is a widespread interaction in nature, with various parasites affecting different organisms.

Ecological interactions are interconnected, and changes in one interaction can have cascading effects on the entire ecosystem. For example, the loss of a key predator can lead to an increase in prey populations, which can then impact plant communities and other species in the ecosystem.

Understanding ecological interactions is essential for conservation and ecosystem management. By studying these relationships, scientists can predict how changes in one species or behavior can affect the entire ecosystem. Conservation efforts often focus on preserving key species that play critical roles in ecological interactions to maintain ecosystem stability.

In conclusion, ecological interactions are the relationships between organisms in an

ecosystem that shape the structure and function of natural communities.

## UNIT -V
## ENVIRONMENTAL MANAGEMENT

### ENVIRONMENTAL MANAGEMENT: POLICIES & PRACTICES

Environmental management refers to the processes and policies put in place by organizations or governments to mitigate the impact of human activities on the environment. These practices are designed to promote sustainability, reduce pollution, conserve resources, and protect ecosystems for future generations.

Here is an outline of the topics that can be covered in a detailed discussion on environmental management policies and practices:

- Introduction to Environmental Management

Definition and importance of environmental management

Historical background and evolution of environmental management

Goals and objectives of environmental management

- Environmental Management Systems (EMS)

Overview of EMS standards such as ISO 14001

Components of an EMS (policy, planning, implementation, monitoring, review, and improvement)

Benefits of implementing an EMS

- Environmental Policy

Development of environmental policies

Key elements of an environmental policy

Importance of a strong environmental policy for organizations

- Environmental Impact Assessment (EIA)

Purpose and process of conducting an EIA

Key considerations in an EIA

Role of EIA in decision-making and project planning

- Pollution Prevention and Control

Strategies for pollution prevention

Technologies for pollution control

Regulatory frameworks for pollution prevention and control

- Sustainable Resource Management

Principles of sustainable resource management

Sustainable practices in water, energy, and waste management

Importance of resource efficiency for environmental sustainability

- Biodiversity Conservation

Importance of biodiversity conservation

Strategies for biodiversity conservation

Role of protected areas and wildlife reserves

- Climate Change Mitigation

Impact of climate change on the environment

Mitigation strategies to reduce greenhouse gas emissions

Policies and agreements to address climate change (e.g., Paris Agreement)

- Corporate Social Responsibility (CSR) and Environmental Management

**Link between CSR and environmental management**

- Role of businesses in promoting environmental sustainability
- Examples of successful CSR initiatives related to environmental management
- Environmental Legislation and Compliance
- Overview of environmental laws and regulations
- Compliance requirements for organizations
- Consequences of non-compliance with environmental regulations

**ROLE OF INDIAN AND OTHER RELIGIONS AND CULTURES IN ENVIRONMENTAL CONSERVATION:**

The role of Indian and other religions and cultures in environmental conservation is a complex and multifaceted topic that has gained increasing attention in recent years. Many indigenous and traditional belief systems around the world have long recognized the interconnectedness of humans and the natural world, and have developed practices and rituals that promote environmental stewardship and sustainability. In these belief systems, the earth is often seen as a living, sacred entity, and humans are seen as caretakers with a responsibility to protect and preserve the natural environment.

In India, for example, Hinduism, Buddhism, Jainism, and Sikhism all have teachings and practices that emphasize the importance of living in harmony with nature. The concept of dharma, or duty, is central to these traditions, and includes a responsibility to care for the earth and all its inhabitants. Many Hindu texts and scriptures, such as the Vedas and the Upanishads, contain passages that extol the virtues of environmental preservation and sustainable living. Similarly, in Buddhism, the concept of interconnectedness (dependent origination) and the principle of non-harming (ahimsa) are central to the teachings, which promote compassion for all living beings and a respect for the natural world.

In addition to the Indian religions, many other cultures and belief systems around the world also have strong connections to the natural environment and have developed practices and rituals that promote environmental conservation. For example, indigenous communities in North and South America, Africa, and Asia have traditional ecological knowledge that has been passed down through generations and informs their sustainable use of natural resources.

The role of these religions and cultures in environmental conservation can be seen in a variety of ways, including the preservation of sacred natural sites, the development of sustainable farming and fishing practices, and the promotion of environmental education and awareness. In recent years, there has been a growing recognition of the potential for these belief systems to contribute to global efforts to address environmental challenges, including climate change, deforestation, and biodiversity loss.

In conclusion, the role of Indian and other religions and cultures in environmental conservation is an important and underappreciated aspect of the broader movement

towards sustainability and environmental stewardship. By drawing on the wisdom and practices of these traditions, and by engaging with indigenous and traditional communities.

**GREEN POLITICS:**

Green politics is a political ideology that aims to create an ecologically sustainable society rooted in environmentalism, social justice, nonviolence, and grassroots democracy. It often advocates for policies and practices that prioritize the protection of the environment, promote renewable energy sources, and combat climate change.

Some key principles of Green politics include:

- **Sustainability:** Ensuring that the needs of current generations are met without compromising the ability of future generations to meet their own needs.
- **Social justice:** Addressing issues of inequality and ensuring that all individuals have access to basic needs such as healthcare, education, and a clean environment.
- **Grassroots Democracy:** Empowering individuals and communities to participate in decision-making processes and have a voice in shaping policy.
- **Non-Violence**: Promoting peaceful solutions to conflicts and advocating for the abolition of war and violence.

**EARTH HOUR:**

Earth Hour is an annual event that is organized by the World Wildlife Fund (WWF) where individuals, communities, and businesses around the world are encouraged to turn off non-essential lights for one hour. This symbolic gesture is meant to raise awareness about the impact of climate change and the need to take action to protect our planet.

The first Earth Hour took place in Sydney, Australia in 2007, where 2.2 million individuals and 2,000 businesses participated by turning off their lights for one hour. Since then, Earth Hour has grown into a global movement with millions of people in over 180 countries participating each year.

The main goal of Earth Hour is to raise awareness about the threats of climate change and to inspire people to take action to reduce their carbon footprint and protect the environment. By turning off non-essential lights for just one hour, participants are sending a powerful message that they care about the planet and are willing to take

steps to address climate change.

In addition to individuals and communities participating in Earth Hour by turning off their lights, many businesses and organizations also join in by hosting events and initiatives to show their support for the environment. For example, some cities have organized candlelight dinners, concerts, and other activities to mark Earth Hour and raise awareness about sustainability.

Earth Hour has also inspired people to take action beyond the one-hour event. Many participants use Earth Hour as a starting point to make lasting changes in their daily lives, such as reducing energy consumption, using more sustainable products, and advocating for policies that protect the environment.

Overall, Earth Hour is a powerful symbol of global unity and commitment to protecting the planet. By participating in this event, individuals and communities can show their support for sustainability and inspire others to take action to address climate change.

## GREEN OPTION TECHNOLOGIES:

Green technology encompasses a wide area of scientific research, including energy, atmospheric science, agriculture, material science, and hydrology. Many green technologies aim to reduce emissions of carbon dioxide and other greenhouse gases in order to prevent climate change.

### 10 Examples of Green Technology:

- Emissions treatment.
- Waste-to-Energy.
- Recycling and waste management.
- Biofuels.
- Wastewater treatment.
- Solar energy.
- Wave and tidal energy.
- Eco Vehicles.

## ENVIRONMENTAL COMMUNICATION AND PUBLIC AWARENESS:

Environmental communication is a field that focuses on promoting awareness, understanding, and action on environmental issues. It involves using various communication strategies and channels to inform, educate, and engage individuals, communities, and organizations about environmental challenges such as climate change, pollution, deforestation, habitat destruction, and biodiversity loss. By raising awareness and fostering dialogue, environmental communication plays a crucial role in shaping public attitudes, behaviors, and policies related to the environment.

Environmental communication is a vital component of raising public awareness about environmental issues and encouraging action to protect the planet. It encompasses the use of various forms of communication, such as media campaigns, educational programs, community outreach initiatives, and advocacy efforts, to inform and engage individuals and communities in environmental conservation efforts.

One of the key goals of environmental communication is to increase public understanding of the complex interrelationships between human activities and the environment, and to promote sustainable behaviors that reduce negative impacts on natural ecosystems. By providing accurate and accessible information about environmental issues, communication efforts can empower individuals to make more informed decisions about their actions and lifestyles, and to take steps to reduce their environmental footprint.

Effective environmental communication also plays a crucial role in shaping public attitudes and perceptions towards environmental issues, influencing public policy decisions, and mobilizing support for environmental conservation efforts. By highlighting the importance of environmental protection and sustainability, communication efforts can inspire individuals to become more actively involved in environmental advocacy, volunteerism, and policy-making initiatives.

In recent years, advances in digital communication technologies and social media platforms have significantly expanded the reach and impact of environmental communication efforts. Social media platforms, in particular, have emerged as powerful tools for raising public awareness about environmental issues, mobilizing support for environmental causes, and fostering online communities of environmentally conscious individuals.

Many environmental organizations, advocacy groups, and government agencies now

utilize social media platforms to share information about environmental issues, promote sustainable practices, and engage with the public in meaningful dialogue about environmental conservation efforts. By leveraging the power of social media and other digital communication tools, environmental communicators can reach a wider audience, stimulate public debate, and catalyse collective action on environmental issues.

In addition to leveraging digital communication technologies, environmental communicators also use traditional media channels, such as television, radio, print publications, and public events, to disseminate information about environmental issues and engage with the public. By collaborating with journalists, media outlets, and other stakeholders, environmental communicators can amplify their messaging, cultivate media coverage of environmental issues, and raise public awareness about urgent environmental challenges.

Furthermore, environmental communication efforts often involve partnership-building and collaboration with a diverse range of stakeholders, including government agencies, non-profit organizations, businesses, educational institutions, and community groups. By forming strategic partnerships with key stakeholders, environmental communicators can amplify their messaging, leverage additional resources, and foster a more holistic approach to environmental conservation efforts.

Overall, environmental communication and public awareness play a critical role in addressing pressing environmental challenges, fostering sustainable behaviours.

Public awareness refers to the level of understanding and consciousness that individuals and communities have about environmental issues. It is essential for building support for environmental conservation and sustainable practices, as well as for holding policymakers and businesses accountable for their environmental impact. Public awareness campaigns, educational programs, media coverage, and advocacy efforts all contribute to increasing public awareness and mobilizing society to address environmental challenges.

Effective environmental communication and public awareness initiatives employ a mix of strategies, tools, and approaches to reach diverse audiences and achieve specific objectives. These may include:

- **Education and Outreach Programs**: Schools, universities, NGOs, and

government agencies often organize educational programs, workshops, seminars, and field trips to inform students and the public about environmental issues and solutions.

- **Media Campaigns**: Television, radio, print media, social media, and online platforms are used to disseminate information, raise awareness, and inspire action on environmental issues. Documentaries, news reports, infographics, and social media posts can all play a role in engaging the public.
- **Community Engagement**: Local communities are vital stakeholders in environmental conservation efforts. Engaging communities through town hall meetings, citizen science projects, community clean-ups, and grassroots campaigns can foster a sense of ownership and responsibility for environmental stewardship.
- **Partnerships and Collaborations**: Building partnerships with businesses, governments, non-profit organizations, and community groups can amplify the impact of environmental communication efforts. Collaborations allow for shared resources, expertise, and networks to reach broader audiences and achieve common goals.
- **Behavior Change Campaigns**: Encouraging individuals to adopt sustainable behaviors such as recycling, reducing energy consumption, using public transportation, and supporting environmentally-friendly products can contribute to positive environmental outcomes. Behavior change campaigns often use social norms, incentives, and persuasive messaging to motivate action.

**ROLE OF NATIONAL GREEN TRIBUNAL.:**

The National Green Tribunal (NGT) is a specialized environmental court in India established under the National Green Tribunal Act, 2010. It was set up with the objective of providing fast-track justice in environmental matters and ensuring better enforcement of environmental laws.

The role of the National Green Tribunal is multifaceted and critical in the protection and preservation of the environment in India. Some of the key functions and responsibilities of the NGT include:

- Adjudication of environmental disputes: The NGT has the power to hear and dispose of cases related to environmental violations, such as pollution, deforestation, waste management, and conservation of natural resources. It provides a forum for affected parties to seek redressal and justice in environmental matters.
- Enforcement of environmental laws: The NGT plays a crucial role in the enforcement of environmental laws and regulations in India. It has the authority to issue directions and orders for the strict implementation of environmental standards and guidelines, and to penalize violators of environmental norms.
- Monitoring of environmental projects: The NGT monitors the progress and compliance of environmental projects, such as industrial developments, infrastructure projects, and conservation initiatives. It ensures that these projects adhere to environmental norms and do not cause harm to the environment.
- Promotion of sustainable development: The NGT promotes sustainable development by balancing economic growth with environmental protection. It aims to ensure that development activities do not compromise the environment and the well-being of future generations.
- Public awareness and education: The NGT conducts awareness programs and educational initiatives to raise public consciousness about environmental issues and the importance of environmental conservation. It seeks to empower citizens to participate in environmental governance and decision-making processes.
- Expert advice and guidance: The NGT seeks the expertise and guidance of environmental scientists, experts, and professionals in resolving environmental disputes and making informed decisions on environmental matters. It relies on scientific evidence and data to make objective and fact-based judgments.

Overall, the National Green Tribunal plays a crucial role in safeguarding the environment and ensuring sustainable development in India. It serves as a vital institution for environmental governance and justice, and contributes to the protection of the country's natural resources and ecosystems.