Environmental Science

INTERNAL ASSESSMENT - MERCY CHANCE ASSIGNMENT

Submitted by:

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G-23

ASSIGNMENT NO1

Discuss the various components of the environment and explain how they interact with each other.

Environment is the total sum of living and non-living components and events surrounding an organism. It is the summation of both living (biotic) and non-living (abiotic) components.

Biotic Factors: These are living components of the environment, including plants, animals, fungi, and bacteria. Based on their role in the environment the biotic components can be classified into three types. These are:

1. Producers: Also called autotrophs are organisms that are capable of making their food themselves. Green plants, grasses, mosses, etc are autotrophic components. Producers have a green pigment called chlorophyll that traps the energy of sunlight to convert carbon dioxide and water into carbohydrates by releasing oxygen into the atmosphere. The chemical energy stored by the producers is partly used by them for their growth and survival while the remaining is stored for use at other trophic levels.

2. Consumers: Also called heterotrophs are directly or indirectly dependent on autotrophs for their energy/food requirements. Depending on their food habits consumers are divided as:

i) Herbivores- Also called primary producers, these are consumers who eat plants for their energy and nutrients. Example- Cow, Deer, Goat.

ii) Carnivores- Also called secondary consumers, feed on herbivores and may also consume other carnivores. Example- Lion, Hyena, Cheetah, Giant Panda, etc. iii) Omnivores- Those organisms that eat both plants and animals are omnivores.

3. Decomposers: These are heterotrophic organisms that break down complex compounds into simple products that are utilized by producers or by decomposers themselves. These are called microconsumers as well. Example- Bacteria and Fungi.

Abiotic Factors: Non-living components such as temperature, sunlight, soil, water pH, and nutrients. They may be classified as:

i) Climatic factors- Solar radiation, temperature, wind, water current, rainfall, etc.

ii) Physical factors- Light, fire, pressure, etc.

iii) Chemical factors- Acidity, salinity, inorganic nutrients, gases, minerals, etc. The abiotic factors exhibit diurnal, nocturnal, seasonal, and annual changes. These have a strong influence on the structure, distribution, behavior, and interrelationships of organisms in an environment.

The interactions between these components are as follows:

Climate Regulation: The atmosphere and oceans regulate global climate through processes like the greenhouse effect, ocean currents, and atmospheric circulation. Changes in one of the many components can impact others.

Habitat: Interactions between biotic and abiotic factors define habitats (specific environments where organisms live) and ecological roles (roles organisms play in their environment).

Human Impact: Human activities alter environmental components through pollution, deforestation, and climate change.

Nutrient Cycling: Nutrients like carbon, nitrogen, and phosphorus cycle through the environment via interactions between the atmosphere, lithosphere, hydrosphere, and biosphere. For example, carbon dioxide from the atmosphere is absorbed by plants during photosynthesis and released back during respiration.

Energy Flow: Energy from the sun enters ecosystems and flows through food webs via producers, consumers, and decomposers. This connects biotic and abiotic components.

Water Cycle: Evaporation from oceans and land surfaces, condensation into clouds, and precipitation sustain terrestrial and aquatic environments.

ASSIGNMENT NO2

Evaluate the importance of sustainable development and discuss the key strategies for achieving it in the context of modern industrial practices.

Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It can also be said as a way of organizing the society by which it can exist for a long duration without compromising on the availability of resources for future generations. For sustainable development, factors such as preserving the environment and natural resources along with maintaining social and economic equality need to be followed. It also helps ensure environmental conservation by promoting practices that minimize resource wastage, pollution, and habitat destruction. In industries, this means using technologies and processes that reduce environmental impact, such as renewable energy sources, efficient use of water and materials, and waste reduction through various economic principles. By preserving ecosystems and biodiversity, it maintains the essential services that the environment provides, such as clean air, water, and fertile soil, which are crucial for human well-being and other crucial activities. Using the available resources judiciously and working towards maintaining the ecological balance. To prevent degradation of the environment and emphasize protecting the environment. To prevent overexploitation of resources. Economic Growth: For creating an economy that is sustainable and growing in the right direction. Protecting the Environment: This objective focuses on the contribution by humans towards protecting and enhancing the natural environment, by minimizing pollution and waste, and also working towards reducing the global carbon footprint. Social Inclusion: This objective focuses on providing the facility housing for future generations and assisting in creating healthy, strong, and vibrant global communities.

Strategies:

- Affordable and Clean Energy: A well-established energy system supports all sectors: from businesses, medicine and education to agriculture, infrastructure, communications and high technology. For many decades, fossil fuels such as coal, oil or gas have been major sources of electricity production, but burning carbon fuels produces large amounts of greenhouse gases which cause climate change and have

harmful impacts on people's well-being and the environment. This affects everyone, not just a few. Moreover, global electricity use is rising rapidly. In a nutshell, without a stable electricity supply, countries will not be able to power their economies.

-Economic Growth: Providing youth the best opportunity to transition to a decent job calls for investing in education and training of the highest possible quality, providing youth with skills that match labor market demands, and giving them access to social protection and basic services regardless of their contract type, as well as leveling the playing field so that all aspiring youth can attain productive employment regardless of their gender, income level or socio-economic background. Governments can work to build dynamic, sustainable, innovative, and people-centered economies, promoting youth employment and women's economic empowerment, in particular, and decent work for all.

-Industries, Innovation and Infrastructure: Inclusive and sustainable industrialization, together with innovation and infrastructure, can unleash dynamic and competitive economic forces that generate employment and income. They play a key role in introducing and promoting new technologies, facilitating international trade and enabling the efficient use of resources. The growth of new industries means improvement in the standard of living for many of us. If industries pursue sustainability, this approach will have a positive effect on the environment.

ASSIGNMENT NO3

Describe the structure and function of an ecosystem. Provide examples of different types of ecosystems and explain their unique characteristics.

As defined by Eugene Odom, Any unit that includes all of the organisms (ie: the "community") in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity, and material cycles (i.e.exchange of materials between living and nonliving parts) within the system is an ecosystem. A more refined definition would be: An ecosystem is a natural system consisting of all plants, animals, and microorganisms (biotic factors) in an area functioning together with all the non-living physical (abiotic) factors of the environment.
Structure: The ecosystem can be divided into two components:
1: Biotic Components 2: Abiotic Components
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Types of ecosystems:
1. Natural Ecosystem- A natural ecosystem is developed and governed by nature. These are capable of operating and maintaining themselves without any major interference by man. The following are the two types of natural ecosystems based on their habitat. Terrestrial- forests, grasslands, and deserts Aquatic- freshwater, marine, and estuarine.
2. Artificial Ecosystem-An artificial ecosystem is created and maintained by man for his different needs. Some of the artificial ecosystems are reservoirs, artificial lakes, croplands, townships, and cities.
3. Incomplete Ecosystems- An ecosystem that does not contain all basic components (Abiotic substances, Producers, Consumers, and Decomposers) is known as an incomplete ecosystem. Some incomplete ecosystems are - abysmal depths in the sea/ocean and caves which lack producers but contain abiotic substances, consumers, and decomposers.

ASSIGNMENT NO4

Analyze the relationship between energy consumption and environmental impact. Discuss the role of renewable energy sources in mitigating environmental degradation.

Energy is an essential input for industrial development. Energy is produced from commercial sources like coal, and petroleum hydroelectric schemes as well as from non-commercial sources like cow dung, fuel wood, and agricultural waste.
Excessive utilization of coal and oil for the generation of electricity leads to multiple problems like Global warming and acid rain. Tension in Gulf countries increases because they are the major petroleum-supplying countries. Nuclear power plants come with the risk of radiation leakage which result in diseases like cancer and the birth of crippled children.
Renewable energy is energy from renewable natural resources that are replenished on a human timescale. These resources have a cycle hence they are non-exhaustible e.g. solar energy, wind energy, hydroelectricity Biogas, Petro cropping, Petro-plantation, thermal energy, and Tidal energy.

Less global warming: Human activity is overloading our atmosphere with carbon dioxide and other global warming emissions. These gases act like a blanket, trapping heat. The result is a web of significant and harmful impacts, from stronger, more frequent storms, to drought, sea level rise, and extinction.

Improved public health: The air and water pollution emitted by coal and natural gas plants is linked with breathing problems, neurological damage, heart attacks, cancer, premature death, and a host of other serious problems.

Inexhaustible energy: Strong winds, sunny skies, abundant plant matter, heat from the earth, and fastmoving water can each provide a vast and constantly replenished supply of energy.

Jobs and other economic benefits: Compared with fossil fuel technologies, which are typically mechanized and capital intensive, the renewable energy industry is more labor intensive. Solar panels need humans to install them; wind farms need technicians for maintenance. This means that, on average, more jobs are created for each unit of electricity generated from renewable sources than from fossil fuels.

Stable energy prices: Renewable energy is providing affordable electricity across the country right now, and can help stabilize energy prices in the future.

Reliability and resilience: Wind and solar are less prone to large-scale failure because they are distributed and modular. Distributed systems are spread out over a large geographical area, so a severe weather event in one location will not cut off power to an entire region. Modular systems are composed of numerous individual wind turbines or solar arrays. Even if some of the equipment in the system is damaged, the rest can typically continue to operate.

Renewable energy technologies use resources straight from the environment to generate power. These energy sources include sunshine, wind, tides, and biomass. Renewable resources won't run out, which cannot be said for many types of fossil fuels – as we use fossil fuel resources, they will be increasingly difficult to obtain, likely driving up both the cost and environmental impact of extraction. Renewable energy systems usually require less overall maintenance than generators that use traditional fuel sources. This is because generating technology like solar panels and wind turbines either have few or no moving parts and don't rely on flammable, combustible fuel sources to operate. Fewer maintenance requirements translate to more time and money saved.

ASSIGNMENT NO5

Explain the ecological importance of reservoir ecosystems. Discuss the potential environmental impacts of large reservoir projects and how these impacts can be managed.

A Reservoir may be defined as a large expense of impounded water created by putting across a stream or a river an earthen stone masonry concrete bundh or dam. People build reservoirs because the amount of water in a river varies over time. During very rainy times or when mountain snow is melting, the water in a river rises and sometimes overflows its banks. By limiting the amount of water allowed to continue downriver, reservoirs help control flooding. During droughts or extended dry periods, the water level in a river may be very low. Under these conditions, more water is released from the reservoir so farmers can water their crops, and homes and businesses can function normally. Reservoirs serve other purposes. They are used for boating, fishing, and other forms of recreation. Some of the dams that create reservoirs are used to generate electricity.

Environmental Impacts of Reservoirs: The construction of a reservoir often involves flooding a large area to create a large body of water. This can lead to the degradation of aquatic and terrestrial environments, loss of biodiversity, and disruption of natural water flows. Reservoirs can also cause downstream water pollution since the water in the reservoir is often stagnant with a low oxygen level. The construction of dams can also lead to increased sedimentation downstream.

Social Impacts of Reservoirs: The construction of reservoirs often leads to the displacement of many people from their homes since the area that will be flooded must be cleared. This can lead to several social problems, such as loss of livelihood, poverty, and disruption of communities.

Economic Impacts of Reservoirs: The construction of reservoirs is a costly undertaking that requires significant financial investment. Furthermore, maintaining a reservoir and its associated facilities can be costly due to the need for regular monitoring and repairs. There is also the potential for economic losses due to water leakage or inadequate water management.
The gradual transformation from a riverine to a lacustrine ecosystem gives rise to the intrinsic ecosystem which groups as a result of an artificial system. Due to the reservoirs are useful in several ways they may often pose' great hazards. To meet their needs men go to any extent and thus tend to often overlook the negative aspects of things whether the construction of dams is a concern often such steps are taken which may turn out to be great hazards for the future i.e. often dams are built in the earthquake zone areas while often large of fertile agriculture land are lost and large human population displaced. If we take care of that negative point keep in mind that the reservoir may remain the temple of modern India. In this program thus we find in the reservoir a fascinating phenomenon quite like nature's own healing powers that a river when suddenly stopped on its way developed a completely different ecosystem effecting a gradual transformation from a lotic to a lentic ecosystem.

ASSIGNMENT NO6

Describe the process of energy flow in an ecosystem. Use diagrams to illustrate the trophic levels and the concept of the energy pyramid.

Energy flows and matter recycles in ecosystems, with the Sun as the primary energy source. Plants, as primary producers, convert sunlight into energy-storing biomolecules. Consumers, like animals, obtain energy by eating plants or other animals. Decomposers break down dead organisms, recycling matter and nutrients. Energy is conserved but often released as heat, while matter constantly cycles through the ecosystem. Water, Salt, Minerals, and Gases are the matter whereas light, temperature, and energybound chemicals serve as different forms of energy.
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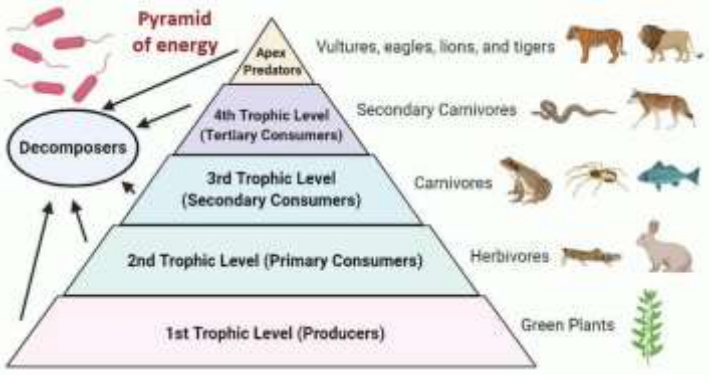
Green plants have chlorophyll that traps the sun's energy. Only chlorophyll has the property to convert solar energy into chemical energy. During this conversion rearrangement of molecules of water and carbon dioxide takes place to produce oxygen and sugar. This is known as photosynthesis. Every organism may be a member of more than one food chain and in this way; the organism can serve as a link between various food chains. All these overlapping and the shortcuts in a biotic community make a food web. The food chain and the food web maintain a delicate equilibrium in nature. Any disturbance in a food chain or the organisms of the food chain may disturb the whole ecosystem.



ASSIGNMENT NO7

Define ecological succession and explain its stages. Discuss the importance of food webs in maintaining ecological balance.

Ecologoical Succession can be defined as the Development of different communities of living organisms one after the other over the same area over time.

The stages of ecological succesion are:

Nudation, Invasion, Migration, Competition/Reaction, Stabilization/Climax

Nudation: It is the basic process of succession and here formation of bare area takes place. There are many reasons responsible for bare area formation like landslides, soil erosion, flooding, long and continuous drought, volcanic eruption, deposition, fire, and diseases.

Invasion: Plants and animals from surrounding areas reach the bare area, establish there, and aggregate by way of reproduction.

Migration: The seeds, spores, and other offsprings of organisms reach the bare area by the agency of air, water, and animals.

Competition/Reaction: Migrated plant species try to establish themselves in new areas by the way of germination of seed, seedling growth, vegetative growth, flowering, and fruiting.

Stabilization/Climax: Plant species that are successful in fruiting establish there, while unsuccessful species disappear. The successful establishment of species in bare areas is called Ecesis.

Food Web is a net or Web-like trophic inter-relationship. The food web provides stability to the Ecosystem as the number of organisms is controlled through a network in which one organism consumes the other. The food chain keeps the ecology in check. Food chains depict the conditions in which a producer or customer is lost as a result of an incident. Entire communities can be wiped out. As a result, food chains assist scientists in learning more about ecosystems and ensuring that they remain balanced. Every plant and animal species, large or small, relies on the existence of another plant or animal species

to some extent. Bees obtaining pollen from flowers, plants photosynthesis, or lions devouring the deer are all possibilities. The ecosystem's balance will be disrupted if a single point is lost. Plants are the cornerstone of food webs. Plants are the cornerstone of all ecosystems and food chains, and food webs are useful tools for recognizing this. Photosynthesizing plants provide us with the first product of the food chain, which is sustenance. Plants provide us with food, oxygen for survival and reproduction, clothing, and even furniture, as well as a plethora of other essentials for long-term sustainability. Plants also help to reduce greenhouse gas emissions and provide homes for a variety of creatures. As a result, it is critical to comprehend the ecology of the environment in terms of plants. Natural Selection. Food webs aid in the comprehension of natural selection by illustrating the species hierarchy, with carnivorous, omnivorous, and tertiary organisms at the top of all food chains. It is a pattern of eating based on inherent survival traits and instincts that represents the physical and behavioral adaptations of plants and animals. Food scarcities caused by overhunting, poaching, global warming, and habitat degradation destabilize populations, leading to extinction, according to food webs. The circulation of energy and nutrients. The movement of energy, nutrients, and organic compounds through an ecosystem is described by a food chain. Plants are at the bottom of the food chain, producing energy, which is then passed on to higher-level species like herbivores. After that, energy is transmitted from one to the other when carnivores eat herbivores.

ASSIGNMENT NO8

Compare and contrast the causes, effects, and control measures of air pollution, water pollution, soil pollution, and noise pollution. Provide case studies for each type.

Water Pollution: water pollution is the release of substances into subsurface groundwater or lakes, streams, rivers, estuaries, and oceans to the point that the substances interfere with the beneficial use of the water or with the natural functioning of ecosystems.

Causes:

- Agricultural: Around the world, agriculture is the leading cause of water degradation. In the United States, it is the top source of contamination in rivers and streams, the second-biggest source in wetlands, and the third main source in lakes.
- Sewage and Wastewater: It comes from our sinks, showers, and toilets and commercial, industrial, and agricultural activities. The term also includes polluted rainwater, which occurs when rainfall carries road salts, oil, grease, chemicals, and debris from impermeable surfaces into our waterways. - Oil Spills: nearly half of the estimated 1 million tons of oil that makes its way into marine environments each year comes not from tanker spills but from land-based sources such as factories, farms, and cities. Oil is also naturally released from under the ocean floor through fractures known as seeps.

One Case Study is the decommissioned Hanford nuclear weapons production site in Washington, where the cleanup of 56 million gallons of radioactive waste is expected to cost more than $100 billion and last through 2060.

Effects:

- Eutrophication: Eutrophication is one of the processes that is taking place mainly because of the pollution caused by human beings in water quality. The addition of nitrate, the addition of phosphorous, and the addition of chlorides, are deteriorating the water quality, not only the surface water body but also groundwater.
- Effect on human health - Human health may be affected by consuming polluted water for drinking and personal hygiene purposes or using it for agriculture industries recreation or living in close visiting of the polluted water body.
- Effect on aquatic Flora and Fauna. The inorganic and organic pollutants in water affect aquatic vegetation adversely. These may favor the growth and reproduction of some species while on the other hand, these may prove lethal to many other species. Thus pollutants are responsible for the reduction of

species diversity in the system which is a negative sign for the ecosystem. In many causes toxic effects of chemicals were found to be responsible for vanishing the flora and fauna of the aquatic system.
Control:
The most important and effective solution for environmental pollution control lies in social awareness and public participation. Waste containing radioactive substances should be treated separately using a dewatering procedure. Solids or brine should be disposed of with special care. Sewage and industrial effluents should be properly treated through physical, chemical, and biological processes to minimize pollution load before release in the water body. Industrial plants should follow recycling operations. The catchment and feeders of the rivers, lakes ponds, and streams should be regularly monitored these should not carry pollutants.

Noise Pollution: Noise Pollution is an unwanted sound that interferes with communication, work, rest, recreation, or sleep. Causes:

- Vehicles, aircraft, trains, and other forms of transportation
- Industrial machines, construction work, and maintenance
- Loud music, loudspeakers, crackers, and events
- Domestic appliances, generators, lawn care, and alarm systems
- Storms, rainfalls, and thunder
- Insufficient urban planning and overcrowding

One case study is noise reduction efforts in Tokyo, Japan, involving sound insulation and stricter noise regulations to improve urban living conditions. Effects:

- Human Body: The cardiovascular system is affected by disturbed blood flow, disturbed pulse rate, disturbed heartbeat beat, and disturbed BP.
- Wildlife: Zoo animals like deer, lions, and rabbits become dull and inactive and their health deteriorates.

Control:
Using electric or battery operated devices in place of petrol or diesel operated devices. Choosing machine/equipment that produces less noise. Conducting noise operations in open or away from residential areas. Keeping industrial areas away from residential areas. Keeping the noise-producing equipment at a distance. Using silencing devices in noise-producing equipment.

ASSIGNMENT NO9

Discuss the causes and consequences of global warming, ozone layer depletion, and nuclear hazards. Propose potential solutions for each issue.

Global Warming:

Causes and Consequences: It results from the increase in greenhouse gas emissions, such as carbon dioxide, methane, and nitrous oxide, due to human activities like burning fossil fuels, deforestation, and industrial processes.

- Rising temperatures: Leading to heatwaves, melting polar ice caps, and rising sea levels.
- Extreme weather events: Increased frequency and intensity of hurricanes, droughts, floods, and wildfires.

- Disruption of ecosystems: Threatening biodiversity, disrupting habitats, and altering migration patterns of species.
- Impact on agriculture: Changes in precipitation patterns affects crop yields and food security.
- Impact on Health: Increased incidences of heat-related illnesses, vector-borne diseases, and respiratory problems.

Solution:
Using renewable energy. Use renewable energy like solar, wind, hydroelectric, and geothermal energy to reduce reliance on fossil fuels. Energy efficiency. Improve energy efficiency in industries, buildings, and transportation. Afforestation and reforestation on land. Planting trees to absorb CO2 and restore degraded ecosystems.

Ozone Layer Depletion:

Causes and Consequences: Ozone layer depletion is mainly caused by human-made chemicals called ozone-depleting substances, such as chlorofluorocarbons (CFCs), halons, and methyl bromide.

- Increased UV radiation: Harmful UV-B and UV-C radiation reaching the Earth's surface, leading to skin cancer, cataracts, and suppressed immune systems in humans and animals.
- Impact on ecosystems: Damage to marine phytoplankton, coral reefs, and terrestrial plant life.
- Climate change implications: Influence on atmospheric circulation and climate patterns.

Solutions:

Research and innovation. Develop technologies to monitor ozone levels and advance ozone-friendly alternatives in refrigeration and fire extinguishing systems. Public awareness: Educate the public about the risks of UV radiation and promote sun-safe behaviors.

Nuclear Hazards:

Causes and Conequences: Nuclear hazards stem from accidents, radioactive waste disposal, and weapons testing. Accidents like Chornobyl and Fukushima have highlighted the dangers of radioactive contamination and the potential for widespread environmental and health impacts.

- Radiation exposure: Leading to acute and long-term health effects such as cancer, genetic mutations, and birth defects.
- Environmental contamination: Radioactive materials entering soil, water, and food chains, affecting ecosystems and biodiversity.
- Social and economic impacts: Displacement of communities, loss of livelihoods, and long-term psychological effects on affected populations.

Solutions:

Safety regulations. Strengthen nuclear safety standards and emergency preparedness measures to prevent accidents and mitigate their consequences. Waste management: Develop secure storage and disposal methods for radioactive waste to minimize environmental and health risks. Using renewable energy: Use renewable energy like solar, wind, hydroelectric, and geothermal energy to reduce reliance on fossil fuels. International Cooperation: Promote international cooperation to reduce nuclear wars.