ENVIRONMENTAL GEOGRAPHY -18MAG14E

Syllabus, Unit – I: Environmental Geography: Nature and Scope – Role of Geography – Man and Environment relationship – Changing nature of the Concepts: Determinism – Possibilism – Neo-Determinism – Ecology – Biogeochemical cycle - Sedimentary and Gaseous cycles.

Environmental geography

Environmental geography is the branch of geography that describes the spatial aspects of interactions between humans and the natural world. It requires an understanding of the dynamics of climatology, hydrology, biogeography, geology and geomorphology, as well as the ways in which human societies conceptualize the environment.

Environmental geography prepares students for careers in environmental planning, design, and restoration, as well as in environmental assessment and monitoring, resource management, natural areas preservation, and outdoor and environmental education. Students completing the program will develop competencies in a broad array of subjects spanning the natural and social sciences, as well as complementary analytical techniques.

Meaning of environment

- The term environment has been derived from a French word "Environ" means to surround.
- Environmental geography refers to both biotic and abiotic factors, which includes plants, animals, mountains, rocks, etc...
- Environment regulates the life of the organisms including human beings. Human beings interact with the environment more vigorously than other living beings.
- Ordinarily environment refers to the materials and forces that surrounds the living organism

Definition of Environment

The surroundings or conditions in which a person, animal, or plant lives or operates is called environment.

According to P. Gisbert "Environment is anything immediately surrounding an object and exerting a direct influence on it"

According to E. J. Ross "Environment is an external force which influences us"

The environment by which man is surrounded and affected may include natural, artificial, social, biological and psychological factors.

Nature of Environmental Geography

- Environmental geography is the study of systematic description of different components of environment and interactions of man with these components.
- It is the basically the study of total environment of the earth as a living planet having both physical and biotic components.
- The fundamental study unit of environmental Geography is the life layer of the earth having atmospheric, lithospheric and hydrospheric components, which is responsible for the support of all types of life.
- This life supporting layer is very commonly known as biosphere, is characterized by the operation of several physical and biological processes., mutual interaction and

interdependence of abiotic and biotic components of the biospheric ecosystem, production and consumption of ecological resources, various positive and negative responses of interactions between different components of the environment resulting into stability or instability of biospheric ecosystem at different levels.

- Environmental degradation and pollution arising out of increasing pressure of economic and technological man on the environment and man's renewed efforts and struggle to stabilize the disturbed ecosystem, to conserve and manage the ecological resources and the ameliorate environmental degradation and pollution through different pollution control and abatement programmes.
- There are certain basic principles which govern the basic aspects of environmental studies viz. natural processes, both physical and biological in the life supporting layer (biosphere) and relationships between man and environment and man and environmental processes , integrated functional unit of the biotic and abiotic components of the environment (ecosystem), functioning of ecosystem, ecological evolution and succession, climatic changes and ecological modification.

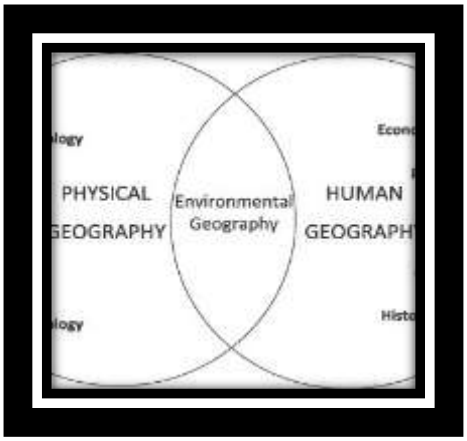
Environmental system or ecosystem is the fundamental ecological unit for the study of the environmental study: The planet earth is the only living planet that has atmosphere, environment and living organisms including plants, animals and microorganisms. Since the environment is both physical and biological concept, it encompasses both the non-living (abiotic) and living (biotic) components of the planet earth. Environment is the comprehensive term which in general refers to surroundings .The earth is the only known planet having different kinds of life forms where in there are complex sets of interrelationships between the physical and biological components. Various linkages between physical and biological components at different levels maintain the unity of the biospheric ecosystem.

Integrated geography (also referred to as integrative geography, environmental geography or human–environment geography) is the branch of geography that describes and explains the spatial aspects of interactions between human individuals or societies and their natural environment.

Definition Of Environmental Geography

"Environmental geography is the study of characteristic features of various components of the Environment, the interactions between and among the components in a geo-ecosystem in terms of ecosystem of varying spatial and temporal scales"

According to Savindra Singh, Environmental geography is "The study of spatial attributes of interrelationships between living organisms and natural environment in general and between technologically advanced 'economic man' and his natural environment in particular in temporal and spatial framework"



Main scopes of environmental geography

- Geo-ecosystem or simply ecosystem as study unit.
- The functioning of ecosystem including circulation of energy and matter and ecosystem productivity.
- Temporal changes in ecosystem
- Spatial ecological changes
- Global environmental problem.
- Environmental hazards disasters.
- Man and environmental processes.
- Environmental degradation and pollution.
- Environmental management.

Importance of Environment Geography

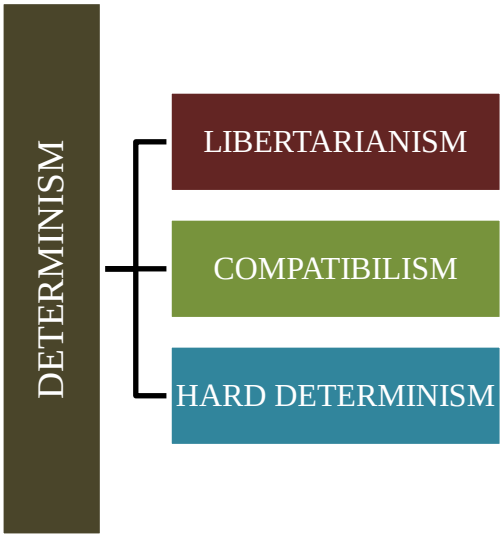
- Environment geography is multi-disciplinary in nature.

- It is related to other disciplines like- life science, physical science, ecology, economics, biology, chemistry, public administration etc.
- It's concerned with the spatial attributes of all the phenomena related to the environment.
- Studies the various biomes and human influences.
- Deals with the pattern of biodiversity at the global, national and local level.
- Studies the spatial pattern of physical and anthropogenic degradation of environment.
- Studies cause- effect, severity, management and mitigation of various environment issues like Climate change, global warming, ozone depletion, habitat loss, bio-diversity loss, pollution etc.
- Includes the notion of sustainable development, environment education, planning, conservation and management.

Geography is a way of thinking, of asking questions, of observing and appreciating the Earth. Geography gives us the tools we need to move about in the world, to make wise decisions about our environment, and to relate more meaningfully to people from other lands and cultures.

Environment is everything that is around us. It can be living (biotic) or non-living (abiotic) things. It includes physical, chemical and other natural forces. ... In the environment there are different interactions between animals, plants, soil, water, and other living and non-living things.

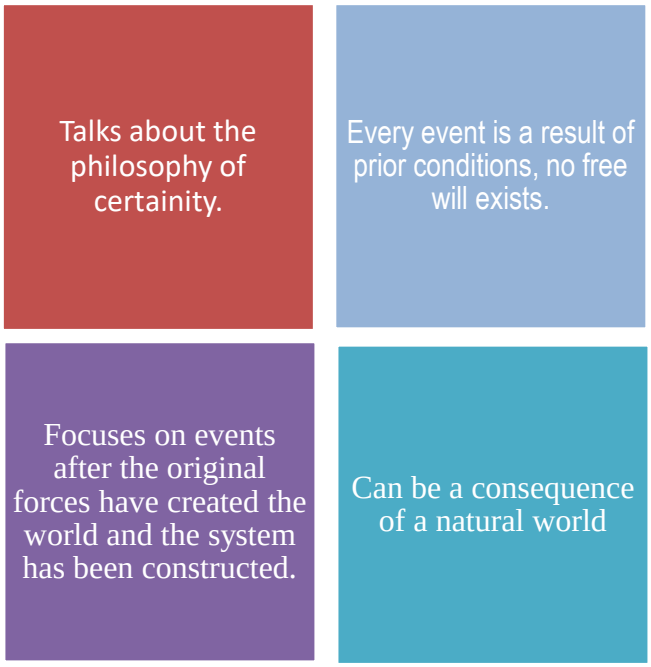
DETERMINISM



- Determinism or environmental determinism is based on the tenet of 'earth made man' and pays more attention on the complete control of physical environment and man and his activities.
- It refers to the idea that everything in human life is caused by the inevitability of natural environment.

- Many determinists like Hippocrates, Aristotle, Strabo gave their earlier views on determinism.
- Determinism is the belief that your future is fixed or determined by what you have genetically inherited or by your social environment and experience
- The concept stresses the influence of environment on man and his activities and treats man subordinate to nature.
- Friedrich Ratzel and E.C. Semple were the main propagators of environmental determinism. He argued that 'Similar location lead to similar mode of life'.
- Friedrich Ratzel, a German geographer of nineteenth century was the founder of human geography. He stressed upon the influence of the physical environment on man as the end product of evolution.
- Ratzel's approach was influenced by the theory that the physical environment played an active role in the evolution of life forms on the earth's surface.

DETERMINISM



POSSIBILISM

- The term 'Possibilism' was first used by French scholar Lucien Febvre who observed "man is a geographic agent and not the least.
- The emergence of possibilism as a reaction to German environmentalism which focuses on the role of man as a geographic agent and a modifier of physical environment.
- The concept of man-environment relationship was developed by French geographer Vidal de la Blache and his followers including Brunhes.

- With socio-cultural and technological development people move from a state of necessity to a state of freedom. They create possibilities with the resources obtained from the environment. This approach of human geography is known as 'possibilism'.
- Febvre said that, "The true and only geographical problem is that of utilization of possibilities. There are no necessities but everywhere possibilities.
- The philosophy of possibilism is the belief that people are not just the products of their environment or just pawns of natural environment.
- Eg; man has brought changes to the environment by increasing its capacity to meet his largely increased needs and demands. (the visible and common examples are industrial revolution, agricultural advancement, technological revolution.

NEODETERMINISM

- The concept of Neo-Determinism was put forward by Griffith Taylor-a leading Australian Geographer.
- He opined that people might attempt whatever they wished with regard to their environment, but in long term, nature's plan would ensure that the environment won the battle and forced a compramise out of its human occupants.
- He says that man is able to accelerate, slow or stop the progress of a country's (region) development. But h should not, if he is wise, depart from directions as indicated by natural environment. He (man) is like the traffic controller in a large city who alters the rate but not the direction of the progress.
- He used the term "STOP AND GO" Determinsism as his philosophy very vivdly explained by the role of a traffic controller.
- Griffith Taylor introduced the concept of 'stop and go determinism' or neodeterminism which reflects the middle way between the ideas of environmental determinism and possibilism.
- Man is not a quite free agent but he can conquer nature by obeying it.

ECOLOGY

Ecology is a branch of science, including human science, population, community, ecosystem, and biosphere. Ecology is the study of organisms, the environment and how the organisms interact with each other and their environment. It is studied at various levels, such as organism, population, community, biosphere, and ecosystem. Ecologist's primary goal is to improve their understanding of life processes, adaptations and habitats, interactions and biodiversity of organisms. Let us have a detailed look at the ecology notes provided here and explore the concept of ecology.

BIOTIC AND ABIOTIC FACTORS

The main aim of ecology is to understand the distribution of biotic and abiotic factors of living things in the environment. The biotic and abiotic factors include the living and non-living factors and their interaction with the environment. Biotic components are living factors of an ecosystem. Abiotic components are non-living chemical and physical factors of an ecosystem. These components could be acquired from the atmosphere, lithosphere, and hydrosphere. A few examples of abiotic components include sunlight, soil, air, moisture

minerals, and more. Living organisms are grouped into biotic components, whereas non-living components like sunlight, water, topography are listed under abiotic components. Examples of biotic components include bacteria, animals, birds, fungi, plants, etc.

TYPES OF ECOLOGY

Ecology can be classified into different types. The different types of ecology are given below:

Global ecology

It deals with interactions among earth's ecosystems, land, atmosphere, and oceans. It helps to understand the large-scale interactions and their influence on the planet.

Landscape Ecology

It deals with the exchange of energy, materials, organisms, and other products of ecosystems. Landscape ecology throws light on the role of human impacts on the landscape structures and functions.

Ecosystem Ecology

It deals with the entire ecosystem, including the study of living and non-living components and their relationship with the environment. This science research how ecosystems work, their interactions, etc.

Community Ecology

It deals with how community structure is modified by interactions among living organisms. Ecology community is made up of two or more populations of different species living in a particular geographic area.

Population Ecology

It deals with factors that alter and impact the genetic composition and the size of the population of organisms. Ecologists are interested in fluctuations in the size of a population, the growth of a population and any other interactions with the population.

In biology, a population can be defined as a set of individuals of the same species living in a given place at a given time. Births and immigration are the main factors that increase the population and death and emigration are the main factors that decrease the population.

Population ecology examines the population distribution and density. Population density is the number of individuals in a given volume or area. This helps in determining whether a particular species is in endanger or its number is to be controlled and resources to be replenished.

Organismal Ecology

Organismal ecology is the study of an individual organism's behavior, morphology, physiology, etc. in response to environmental challenges. It looks at how individual organisms interact with biotic and abiotic components. Ecologists research how organisms are adapted to these non-living and living components of their surroundings.

Individual species are related to various adaptations like physiological adaptation, morphological adaptation, and behavioral adaptation.

Molecular Ecology

The study of ecology focuses on the production of proteins and how these proteins affect the organisms and their environment. This happens at the molecular level.

DNA forms the proteins that interact with each other and the environment. These interactions give rise to some complex organisms.

PRINCIPLES OF ECOLOGY

(i) Principle-1:

With an increase in distance between the organisms of a given trophic level and the initial source of energy, the probability of the organisms to depend exclusively on the preceding trophic level for energy decreases.

(ii) Principle-2:

The relative loss of energy due to respiration is progressively greater to higher trophic levels because the species at higher trophic levels being relatively larger in size have to move and work for getting food and therefore more energy is lost due to respiration.

(iii) Principle-3:

Species at progressively higher trophic levels appear to be progressively more efficient in using their available food supply, because increased activity by predators increases their chances of encountering suitable prey species, and in general predators are less specific than their prey in food preference.

(iv) Principle-4:

Higher trophic levels tend to be less discrete than the lower ones because the organisms at progressively higher trophic levels receive energy from more than one source and are generalists in their feeding habit and they are more efficient in using their available food.

(v) Principle-5:

Food-chains tend to be reasonably short. Four vertical links is a common maximum because loss of energy is progressively higher for higher trophic levels and species at higher levels tend to be less discrete.

Biogeochemical

The term biogeochemical is derived from “bio” meaning biosphere, “geo” meaning the geological components and “chemical” meaning the elements that move through a cycle.
The matter on Earth is conserved and present in the form of atoms. Since matter can neither be created nor destroyed, it is recycled in the earth’s system in various forms.
The earth obtains energy from the sun which is radiated back as heat, rest all other elements are present in a closed system. The major elements include:

- Carbon
- Hydrogen
- Nitrogen
- Oxygen
- Phosphorus
- Sulphur

These elements are recycled through the biotic and abiotic components of the ecosystem. The atmosphere, hydrosphere and lithosphere are the abiotic components of the ecosystem.

Types of Biogeochemical Cycles

Biogeochemical cycles are basically divided into two types:

Gaseous cycles – Includes Carbon, Oxygen, Nitrogen, and the Water cycle.

Sedimentary cycles – Includes Sulphur, Phosphorus, Rock cycle, etc.

Sedimentary Cycles

Sedimentary cycles are the ones in which the reservoir is the Earth's crust. Sedimentary cycles include those of phosphorus, sulphur, iron, calcium, and other more-earthbound elements.

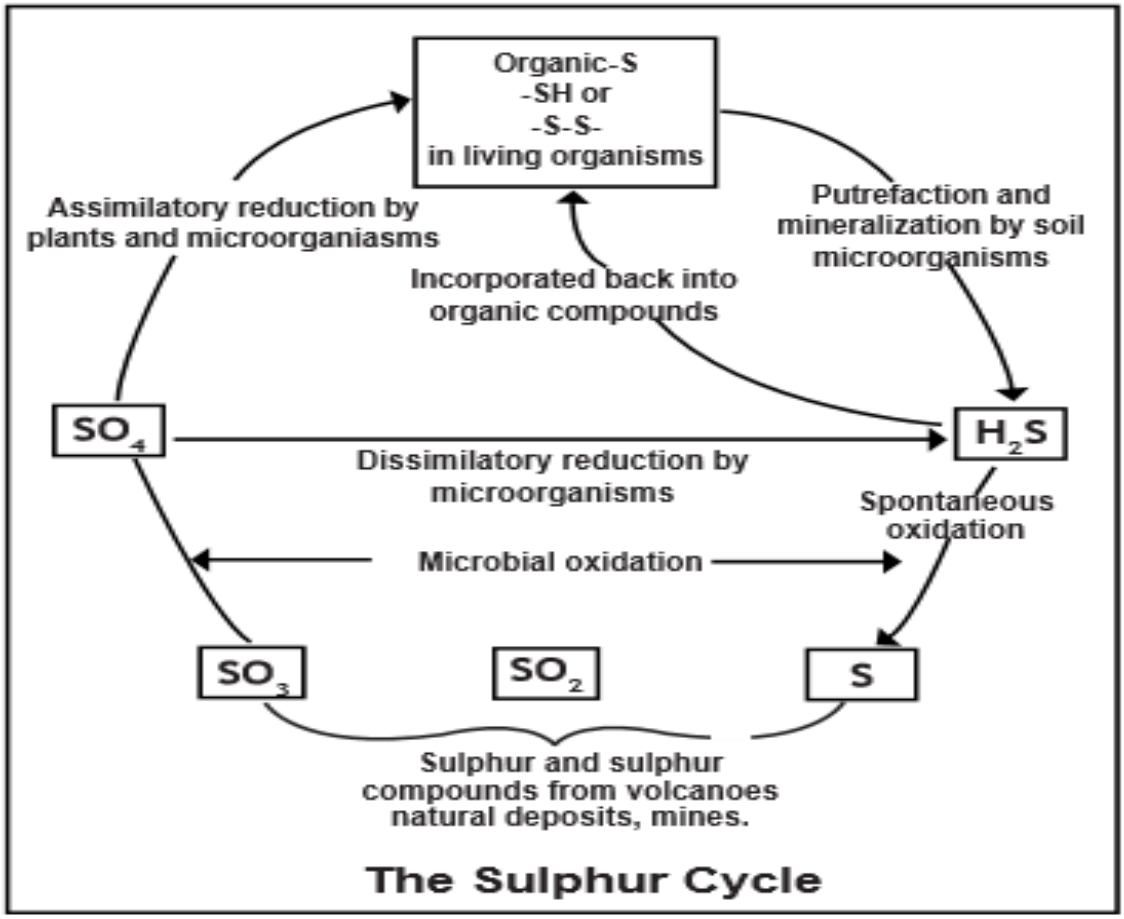
1. Sulphur cycle
2. Phosphorus cycle
3.

Sulphur Cycle:

Sulphur is one of the components that make up proteins and vitamins. Proteins consist of amino acids that contain sulphur atoms. Plants absorb sulphur when it is dissolved in water. Animals consume these plants, so that they take up enough sulphur to maintain their health. The sulphur reservoir is in the soil and sediments where it is locked in organic (coal, oil and peat) and inorganic deposits (pyrite rock and sulphur rock) in the form of sulphates, sulphides and organic sulphur. It is released by weathering of rocks, erosional runoff and decomposition of organic matter and is carried to terrestrial and aquatic ecosystems in salt solution

Sulphur can also be found in the atmosphere. It enters the atmosphere through both natural and human sources. Natural resources can be for instance- combustion of fossil fuels (coal, diesel etc.), volcanic eruptions, bacterial processes, evaporation from water, or decaying organisms. When sulphur enters the atmosphere through human activity, this is mainly a consequence of industrial processes where sulphur dioxide, SO_2 and Hydrogen Sulphide, H_2S gases are emitted on a wide scale.

When Sulphur Dioxide enters the atmosphere it will react with oxygen to produce sulphur trioxide gas, S03 or with other chemicals in the atmosphere, to produce sulphur salts. Sulphur dioxide may also react with water to produce sulphuric acid, H_2SO_4. All these particle will settle back onto earth, or react with rain and fall back into earth as acid deposition. The particle will then be absorbed by plants again and are released back into the atmosphere, so that sulphur cycle will start over again. And the sulphur bound in living organism is carried back to the soil, to the bottom of ponds and lakes and seas through excretion and decomposition of dead organic material.



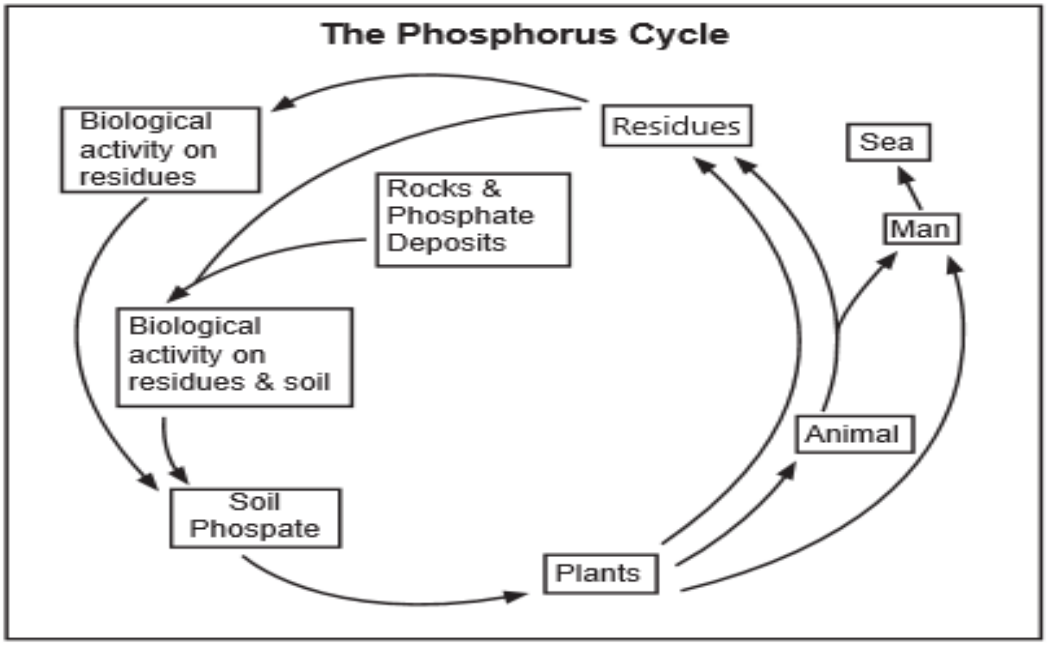
A typical Sulphur cycle

Phosphorous cycle:

Phosphorous is the second most important substance in the biosphere which is most essential for the growth of organisms because it limits production in the biospheric ecosystem. Phosphorous is the short supply as it is found in phosphate rocks which are restricted to very limited areas over the globe. Phosphorous is such a chemical element which has a very small quantity in the form of dust and salt which are carriedas salt spray from the sea or blown as dust from the areas of phosphate deposits and active mines.

The phosphorus cycle is the nutrient cycle which characterises the transport and chemical transformation of phosphorus through the lithosphere, hydrosphere and biosphere. Unlike many other biogeochemical cycles, the atmosphere does not play a significant role in the movement of phosphorus, since phosphorus and phosphorus-based compounds are typically solids at the normal ranges of temperature and pressure found on Earth. Therefore,

most of the phosphorus remains within rock, sediments, sand, and the ocean floor, with a fraction in living biomass. Phosphorus plays a central role in aquatic ecosystems and water quality. Unlike carbon and nitrogen, which come primarily from the atmosphere, phosphorus occurs in large amounts as a mineral in phosphate rocks and enters the cycle from erosion and mining activities. This is the nutrient considered to be the main cause of excessive growth of rooted and free-floating microscopic plants (phytoplankton) in lakes [Eutrophication]. The main storage for phosphorus is in the earth's crust. On land phosphorus is usually found in the form of phosphates. Phosphorus moves among trophic levels in an ecosystem by plant growth, herbivores and carnivores



A typical Phosphorus cycle

Gaseous Cycle

The term gaseous cycle refers to the transfer and transformation of gasses between various biogeochemical reservoirs, lithosphere, hydrosphere, atmosphere, and biosphere. An understanding of the interactions between the reservoirs is essential to any assessment of gaseous geochemical .Gaseous cycles include those of nitrogen, oxygen, carbon, and water; sedimentary cycles include those of iron, calcium, phosphorus, Sulphur and other more-earthbound elements.

Gaseous cycles include those of nitrogen, oxygen, carbon and water cycle.

Nitrogen Cycle

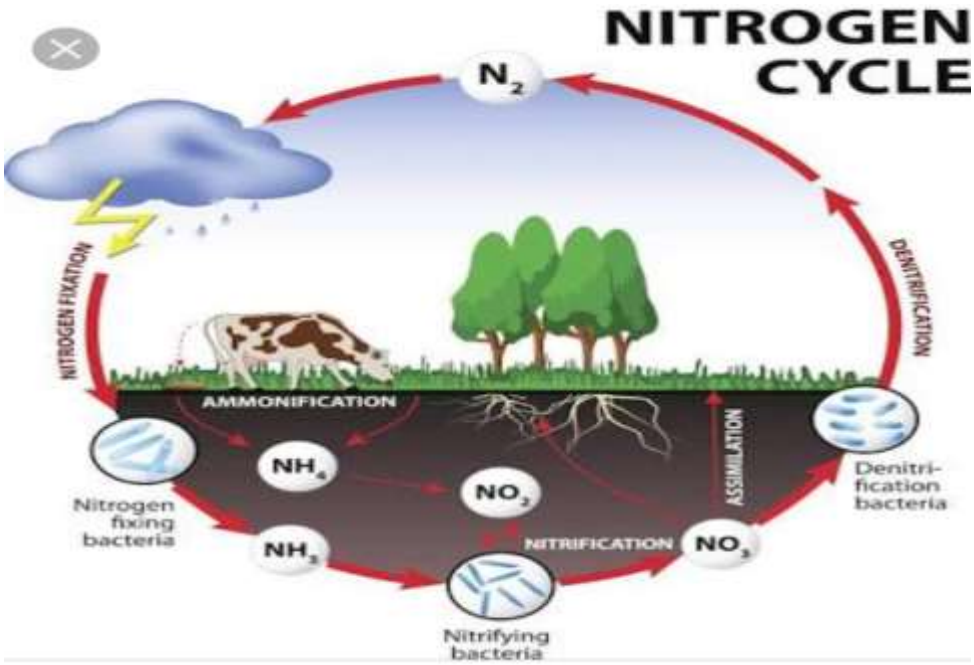
The nitrogen cycle is a repeating cycle of processes during which nitrogen moves through both living and non-living things: the atmosphere, soil, water, plants, animals and bacteria. In order to move through the different parts of the cycle, nitrogen much change forms. Nitrogen is a crucially important component for all life. ... It is an important part of many cells and processes such as amino acids, proteins and even our DNA. It is also needed to make chlorophyll in plants, which is used in photosynthesis to make their food.

The nitrogen cycle is the biogeochemical cycle by which nitrogen is converted into multiple chemical forms as it circulates atmosphere terrestrial and. Marine ecosystem .The conversion of nitrogen can be carried out through both biological and physical processes. Important processes in the nitrogen cycle include fixation, ammonification ,nitrification, and denitrification. The majority of Earth's atmosphere (78%) is nitrogen making it the largest source of nitrogen. However, atmospheric nitrogen has limited availability for biological use, leading to a scarcity of usable nitrogen in many types of ecosystems.

The Earth's atmosphere is 78% nitrogen gas or N_2. Even though there is so much nitrogen in the air, there is very little in the Earth's crust. It can be found in some fairly rare minerals such as saltpeter. Nitrogen can also be found in all living organisms on Earth including plants and animals.

Nitrogen can also be produced on a large scale by burning carbon or hydrocarbons in air and separating the resulting carbon dioxide and water from the residual nitrogen. On a small scale, pure nitrogen is made by heating barium acid.

Nitrogen is an inert gas — meaning it doesn't chemically react with other gases — and it isn't toxic. But breathing pure nitrogen is deadly. That's because the gas displaces oxygen in the lungs. Unconsciousness can occur within one or two breaths, according to the U.S. Chemical Safety and Hazard Investigation Board.



Carbon Cycle

The carbon cycle describes the process in which carbon atoms continually travel from the atmosphere to the Earth and then back into the atmosphere. Since our planet and its atmosphere form a closed environment, the amount of carbon in this system does not change.

Photosynthesis, Decomposition, Respiration and Combustion are the 4 steps of Carbon cycle. Carbon cycles from the atmosphere into plants and living things. For example, carbon is a pollutant in the atmosphere as carbon dioxide. Carbon cycles from the atmosphere into plants and living things. For example, carbon is a pollutant in the atmosphere as carbon dioxide. Over millions of years, carbon can get re-purposed into hydrocarbons. This is the long term carbon cycle.

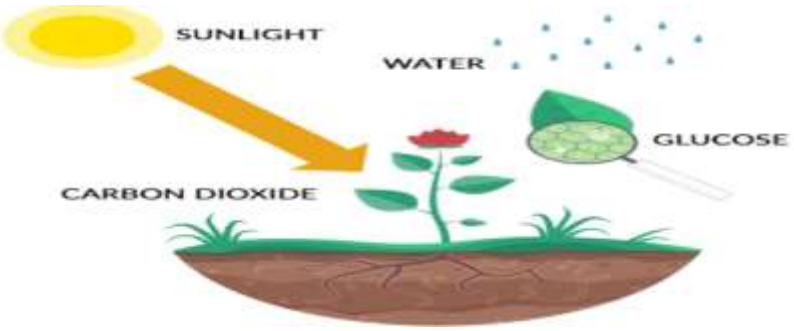
So, carbon takes up various forms: glucose in plants, carbon dioxide in the air and hydrocarbons like coal.But today, we'll talk about the short-term carbon cycle that just takes days, months or years for carbon to cycle through the environment.

Photosynthesis

Plants pull in carbon dioxide out of the air through photosynthesis. Even Carbon dioxide makes less than 1%in the atmosphere, it plays a major role for living things.

With CO_2 and H_2O in the atmosphere, photosynthesis produce sugar like glucose. This is the plant material that plants synthesize on their own.

If you have the right conditions, this process can repeat for centuries. Not only does photosynthesis pulls carbon dioxide out of the atmosphere, but it's fuels all living things as a source of energy.



Decomposition

By mostly using sunlight, water and carbon dioxide, plants can grow. In turn, animals consume food for energy using O_2 and giving off CO_2. Alternatively, they die, decay and decompose repeating for millions of years. Decomposition is the process of breaking down plants. Over vast periods of time, layers of sediment build on each other. Because of the pressure and heat from within the Earth's crust, this generates fossil fuels. Much of this happened during the Carboniferous era. Anaerobic decomposition involves bacteria breaking down organic matter such as glucose into CO_2 and methane (CH_4). The nutrient cycle recycle inorganic and organic material s in soil through the process of decomposition. Then, it goes back again through the same process again.

Respiration

You and I are both made of carbon. We consume plants. But we also breathe in the air, which has carbon in the form of carbon dioxide. Animals rely on plants for food, energy and oxygen. Our cells require oxygen to break down the food we consume through Cellular respiration. Once consumed, carbon dioxide is released into the atmosphere because of cell respiration. In turn, this CO_2 produced from respiring cells can be used to photosynthesis again.

Combustion

Our cars use the energy released by burning fossil fuels. And carbon is also a pollutant as carbon dioxide.

- We extract fossil fuels; combustion involves burning them to release energy. But a by-product of combustion is that it releases carbon dioxide back into the atmosphere. And too much CO2 increases the greenhouse effect.
- And as we deplete our oil reserves adding CO_2 into the air daily, this affects the carbon cycle with an imbalance of oxygen and carbon. Carbon dioxide is one of the greenhouse gases contributing to climate change.
- Using sunlight, it creates a molecule called glucose ($C_6H_{12}O_6$) and sinks to bottom of the ocean. Humans discovered these fossil fuels beneath the ocean.

Oxygen Cycle

The oxygen cycle describes the various forms in which oxygen is found and how it moves through different reservoirs on Earth. It is one of the biogeochemical cycles.

- There are three major reservoirs of oxygen: the atmosphere, biosphere, and lithosphere. Some people also consider the hydrosphere, a subdivision of the biosphere, to be the fourth reservoir.
- The biosphere includes all living and non-living components on Earth. In the biosphere, oxygen is mostly found molecules, liquid water, and molecules dissolved in water, such as free oxygen and carbonic acids.
- In the atmosphere, the oxygen is mostly found as free O2 molecules released via photosynthesis. It also exists as ozone (O3), carbon dioxide (CO2), water vapour and sulfur or nitrogen oxides.
- The atmosphere is actually the smallest source of oxygen on Earth comprising only 0.35% of the Earth's total oxygen.
- In the atmosphere, a process called photolysis plays an important role. In this reaction, high-energy UV radiation from the sun breaks down atmospheric water and nitrous oxide, releasing free oxygen molecules into the atmosphere
- Oxygen can also cycle between the biosphere and lithosphere. Marine organisms in the biosphere create calcium carbonate shells which are full of oxygen. When the organism dies, the shell settles at the ocean floor. It eventually forms limestone sedimentary rock, becoming a part of the lithosphere. Likewise, oxygen can be cycled from the lithosphere back into the biosphere when organisms use minerals found in rock and then release oxygen from it.
- This free oxygen then recombines with existing O2 molecules to make O3 or ozone. This cycle is important because it helps to shield the Earth from the majority of harmful ultra violet radiation turning it to harmless heat before it reaches the Earth's surface.

Water Cycle

The cycle of processes by which water circulates between the earth and atmosphere, and land, involving precipitation as rain and snow, drainage in streams and rivers, and return to the atmosphere by evaporation and transpiration.

- The water cycle shows the continuous movement of water within the Earth and atmosphere. It is a complex system that includes many different processes. Liquid water evaporates into water vapor, condenses to form clouds, and precipitates back to earth in the form of rain. There are four main parts to the water cycle
- Evaporation, Convection
- Precipitation, Collection

Evaporation

Evaporation happens when a liquid substance becomes a gas. When water is heated, it evaporates. The molecules move and vibrate so quickly that they escape into the atmosphere as molecules of water vapor. Evaporation is a very important part of the water cycle

Convection

When a fluid, such as air or a liquid, is heated and then travels away from the source, it carries the thermal energy along. This type of heat transfer is called convection.

Precipitation

Precipitation is water released from clouds in the form of rain, freezing rain, sleet, snow, or hail. It is the primary connection in the water cycle that provides for the delivery of atmospheric water to the Earth. Most precipitation falls as rain.

Collection

This is when water that falls from the clouds as rain, snow, hail or sleet, collects in the oceans, rivers, lakes, streams. Most will infiltrate (soak into) the ground and will collect as underground water

---

Subject Name: Environmental Geography
Subject Code : 18MAG14E
Faculty : K Sumesh