COURSE: MSc Part -II

PAPER – XII (2nd)

TOPIC- Environmental Biology

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Topic-4

Explain, how human activities have caused major threat to biodiversity. Explain in a systematic manner.

Human activities are causing major changes in biological communities worldwide, and these changes can harm biodiversity and ecosystem function. Ecosystem function is important for supporting plant and animal communities, and ensuring the long-term survival of human populations.

The main threats facing biodiversity globally are: destruction, degradation and fragmentation of habitats reduction of individual survival and reproductive rates through exploitation, pollution and introduction of alien species.

1. Habitat Loss and Fragmentation:

A habitat is the place where a plant or animal naturally lives. Habitat loss is identified as main threat to 85% of all species described as threatened or endangered. Factors responsible for this are deforestation, fire and over-use and urbanization.

2 Deforestation is a direct cause of extinction and loss of biodiversity. An estimated 18 million acres of forest are lost each year, due in part to logging and other human practices, destroying the ecosystems on which many species depend. Tropical rainforests in particular, such as the Amazon, hold a high percentage of the world's known species, yet the regions themselves are in decline due to humans. Some of the major causes of deforestation are:

A) Agricultural Expansion

The conversion of forests into agricultural plantations is a major cause of deforestation. The increase in global demand for commodities, such as palm oil and soybeans, are driving industrial-scale producers to clear forests at an alarming rate

B) Livestock Ranching

Forest clearing for livestock ranching is another contributor of deforestation. Since 1990, Brazil, a top exporter of beef, has lost an area of forest that is three-fourths the size of Texas. A strong global demand for beef, supported by governments such as in Brazil, is expanding this kind of deforestation.

C) Logging

Logging, including illegal logging, is a driver of deforestation.

D) Infrastructure Expansion

Road Construction

Road construction can lead to deforestation by providing an entryway to previously remote land. The 5,404-km Interoceanic Highway, which runs from Brazil to Peru, is a concern for conservationists as the road cuts a strip through the biodiverse Amazon rainforest. The road expansions often lead to logging and illegal logging, where opportunists slash down trees without permission from authorities. The cleared land then attracts an influx of settlers and disturbs the peace that once reigned the small villages.

E) Overpopulation

Our planet once housed an estimated maximum of 15 million people in prehistory. It now sustains a whopping 7 billion and counting. With overpopulation, there is an increase in global needs and wants, leading to expansion and deforestation. The planet's forests are being devastated at an even rate with population growth.

2. Over-exploitation for Commercialization:

Over-exploitation of resources has coasted more environmental degradation than earning. For example; shrimp farming in India, Thailand, Ecuador and Indonesia results in Wetland destruction, pollution of coastal waters and degradation of coastal fisheries. Scientific studies have concluded that cost of environmental degradation resulting from shrimp farming was costing more than the earning through shrimp exports.

3. Invasive Species:

Invasive species are 'alien' or 'exotic' species which are introduced accidentally or intentionally by human. These species become established in their new environment and spread unchecked, threatening the local biodiversity. These invasive alien species have been identified as the second greatest threat to biodiversity after habitat loss.

4. Pollution:

Pollution is a major threat to biodiversity, and one of the most difficult problems to overcome; Pollutants do not recognize international boundaries. For example, agricultural run-off, which contains a variety of fertilizers and pesticides, may seep into ground water and rivers before ending up in the ocean. Atmospheric pollutants drift with prevailing air currents and are deposited far from their original source.For example, acid rain, which is typically caused by the burning of fossil fuels, can acidify smaller bodies of water and soil, negatively affecting the species that live there by changing breeding and feeding habits.

5. Global Climate Change:

Climate change is the recent rapid warming of the earth due in large part to the burning of fossil fuels which is creating too much carbon in the atmosphere. Rainforests have been studied for their role as a carbon sink, absorbing copious amounts of this greenhouse gas emission. And yet, we are rapidly eliminating the rain forests. When we do this, we are losing an invaluable resource.

Mature forests act as a carbon sink, storing carbon in wood, leaves and the soil. When the forest is cleared, that carbon is released. Deforestation accounts for nearly 20 percent of greenhouse gas emissions and is second only to burning fossil fuels as a contributor to climate change. In fact, deforestation contributes more greenhouse gas emissions than the world's entire transport sector. Species suffer because of anthropogenic climate change. The effects of climate change on some creatures is already profound. Animals are no longer able to live in their natural habitats because they are too warm or the water has risen too high are migrating simply to stay alive. The problem is that living creatures in their natural habitat are part of a natural ecosystem that is balanced and interdependent. An oft-cited simple example is that birds rely on caterpillars for food. Caterpillars rely on new growth leaves for food.

There are many variables in a balanced ecosystem. The recent phenomenon of rapid climate change due to anthropogenic activity can fatally interrupt this synchrony at any level. It is a simple fact that creatures have not had the time to adapt.

Another scenario is that the plants the caterpillars rely upon may no longer be able to survive in their natural habitat due to global warming. As we saw above with the fungus garden ants, some species rely upon a single food source. Coral reefs, often called "the rain forests of the sea" due to the rich biological diversity living in these ecosystems are dying from the rising ocean temperatures and acidification. Coral reefs are home to one quarter of all marine species.Many climatologists believe that the greenhouse effect is likely to raise world temperatures by about 2°C by 2030, meaning that sea levels will rise by around 30-50 cm by this time. Global warming, coupled with human population growth and accelerating rates of resource use will bring further losses in biological diversity. Vast areas of the world will be inundated causing loss of human life as well as ecosystems.

6. Population Growth and Over-consumption:

From a population of one billion at the beginning of the 19th century, our species now numbers more than six billion people. Such rapid population growth has meant a rapid growth in the exploitation of natural resources— water, foods and minerals. Although there is evidence that our population growth rate is beginning to slow down, it is clear that the exploitation of natural resources is currently not sustainable. Added to this is the fact that 25 per cent of the population consumes about 75 per cent of the world's natural resources. This problem of over-consumption is one part of the broader issue of unsustainable use.

7. Illegal Wildlife Trade:

The international trade in wild plants and animals is enormous. Live animals are taken for the pet trade, or their parts exported for medicines or food. Plants are also taken from the wild for their horticultural or medicinal value.

8. Species extinction:

Extinction is a natural process. The geological record indicates that many hundreds of thousands of plant and animal species have disappeared over the eras as they have failed to adapt to changing conditions. Recent findings however indicate that the current rate of species extinction is at least a hundred to a thousand times higher than the natural rate.

Topic-5

POLLUTION

Pollution is the introduction of contaminants into the natural environment that cause adverse change. Pollution can take the form of chemical substances or energy, such as noise, heat or light. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. Air pollution is defined as all destructive effects of any sources which contribute to the pollution of the atmosphere and/or deterioration of the ecosystem. Air pollution is caused by both human interventions and/or natural phenomena. It is made up of many kinds of pollutants including materials in solid, liquid, and gas phases. PSI is a guideline for reporting air quality which was first introduced by Thom and Ott in 1974. Hence, it would provide a method of comparing the relative contribution of each pollutant to total risk. The calculation of PSI is based on the concentration of five major air pollutants including particulate matters (PMs), sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), and ozone (O3) in the air. According to Johnson et al., "air quality index (AQI) is defined as a measure of the condition of air relative to the requirements of one or more biotic species or to any human need."[22] AQI is divided into ranges, in which they are numbered, and each range is marked with color codes. It provides a number from healthy standard level of zero to a very hazardous level of above 300 to indicate the level of health risk associated with air quality There are 7 types of Pollution:

1. Air Pollution.

2. Water Pollution.

3. Soil Pollution.

4. Light Pollution.

5. Noise Pollution.

6. Radioactive Pollution.

7. Environmental Pollution.

1. Air Pollution: Types of Pollutant of Air

Particle pollutants

Particle pollutants are major parts of air pollutants. In a simple definition, they are a mixture of particles found in the air. Particle pollution which is more known as PM is linked with most of pulmonary and cardiac-associated morbidity and mortality.

Long-term exposure to current ambient PM concentrations may lead to a marked reduction in life expectancy. The increase of cardiopulmonary and lung cancer mortality are the main reasons for the reduction in life expectancy. Reduced lung functions in children and adults leading to asthmatic bronchitis and chronic obstructive pulmonary disease (COPD) are also serious diseases which induce lower quality of life and reduced life expectancy. Strong evidence on the effect of long-term exposure to PM on cardiovascular and cardiopulmonary mortality come from cohort studies

Ground-level ozone

O_3 with the chemical formula of O_3 is a colorless gas which is the major constituent of the atmosphere. It is found both at the ground level and in the upper regions of the atmosphere which is called troposphere. Ground-level ozone (GLO) is produced as a result of chemical reaction between oxides of nitrogen and VOCs emitted from natural sources and/or due to human activities. GLO is believed to have a plausible association with increased risk of respiratory diseases, particularly asthma. O_3 induces a variety of toxic effects in humans and experimental animals at concentrations that occur in many urban areas

Carbon monoxide

CO is a colorless and odorless gas, which is produced by fossil fuel, particularly when combustion is not appropriate, as in burning coal and wood. The affinity of CO to hemoglobin (as an oxygen carrier in the body) is about 250 times greater than that of oxygen. Depending on CO concentration and length of exposure, mild to severe poisoning may occur. Symptoms of CO poisoning may include headache, dizziness, weakness, nausea, vomiting, and finally loss of consciousness. The symptoms are very similar to those of other illnesses, such as food poisoning or viral infections.

Sulfur dioxide

SO_2 is a colorless, highly reactive gas, which is considered as an important air pollutant. It is mostly emitted from fossil fuel consumption, natural volcanic activities, and industrial processes. SO_2 is very harmful for plant life, animal, and human health. People with lung disease, children, older people, and those who are more exposed to SO_2 are at higher risk of the skin and lung diseases.Residents of industrialized regions encountered with SO_2 even at lower concentrations (<1 ppm) in the polluted ambient air might experience a high level of bronchitis.

Nitrogen oxide

Nitrogen oxides are important ambient air pollutants which may increase the risk of respiratory infections. They are mainly emitted from motor engines and thus are traffic-related air pollutants. They are deep lung irritants that can induce pulmonary edema if been inhaled at high levels. They are generally less toxic than O_3, but NO_2 can pose clear toxicological problems. Exposures at 2.0–5.0 ppm have been shown to affect T-lymphocytes, particularly CD8+ cells and natural killer cells that play an important role in host defenses against virusesCoughing and wheezing are the most common complication of nitrogen oxides toxicity, but the eyes, nose or throat irritations, headache, dyspnea, chest pain, diaphoresis, fever, bronchospasm, and pulmonary edema may also occur.

Lead

Pb or plumb is a toxic heavy metal that is widely used in different industries. Pb pollution may result from both indoor and outdoor sources. It is emitted from motor engines, particularly with those using petrol containing Pb tetraethyl. Smelters and battery plants, as well as irrigation water wells and wastewaters, are other emission sources of the Pb into the environment. Fetuses and children are highly susceptible to even low doses of Pb. Pb accumulates in the body in blood, bone, and soft tissue. Because it is not readily excreted, Pb can also affect the kidneys, liver, nervous system, and the other organs.. Pb is a powerful neurotoxicant, especially for infants and children as the high-risk groups. Mental retardation, learning disabilities, impairment of memory, hyperactivity, and antisocial behaviors are of adverse effects of Pb in childhood. Therefore, it is very important to reduce the Pb level of ambient air.Abdominal pain, anemia, aggression, constipation, headaches, irritability, loss of concentration and memory, reduced sensations, and sleep disorders are the most common symptoms of Pb poisoning. Exposure to Pb is manifested with numerous problems, such as high blood pressure, infertility, digestive and renal dysfunctions, and muscle and joint pain.

Other air pollutants

Other major air pollutants that are classified as carcinogen and mutagen compounds and are thought to be responsible for incidence and progression of cancer in human include VOCs such as benzene, toluene, ethylbenzene, and xylene, PAHs such as acenaphthene, acenaphthylene, anthracene, and benzopyrene, and other organic pollutants such as dioxins, which are unwanted chemical pollutants that almost totally produced by industrial processes and human activity.

Various agents of Air pollution

a) The burning of fossil fuels. Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles are one the major cause of air pollution. ...

b) Agricultural activities. ...

c) Exhaust from factories and industries. ...

d) Mining operations. ...

e) Indoor air pollution.

Causes of Air Pollution

-Particulate Matter. Air pollution is characterised by the presence of particulate matter in the air of the atmosphere.

-Poisonous Gas. ...

-Emission from Vehicles. ...

-Combustion of Fossil Fuels. ...

-Pollution From Air Conditioners. ...

-Dust & Dirt. ...

-Household Pollution. ...

-Pollution from Natural Events.

Method to reduce Air Pollution

1. Understand Where Air Pollution comes From- To identify the pollution causing agent.

2. Reduce Use of Automobiles: to minimize the use of Automobiles.

3. Plant More Plants: To plant more trees

4. Go Solar – More use of Solar power

5. Get the Lead Out- Lead free fuel should be used.

WATER POLLUTION

Causes of water pollution

Water is uniquely vulnerable to pollution. Known as a “universal solvent,” water is able to dissolve more substances than any other liquid on earth. It’s also why water is so easily polluted. Toxic substances from farms, towns, and factories readily dissolve into and mix with it, causing water pollution.

Various source of water pollution are:

a) Industrial waste.

b) Sewage and wastewater.

c)Mining activities.

d)Marine dumping.

e) Accidental oil leakage.

f) The burning of fossil fuels.

g) Chemical fertilizers and pesticides.

f) Leakage from sewer lines.

Effect of water pollution on human health

Infectious diseases can be spread through contaminated water. Some of these water-borne diseases are Typhoid, Cholera, Paratyphoid Fever, Dysentery, Jaundice, Amoebiasis and Malaria. Chemicals in the water also have negative effects on our health. It can result into following disease:

Respiratory diseases.

Cardiovascular damage.

Fatigue, headaches and anxiety.

Irritation of the eyes, nose and throat.

Damage to reproductive organs.

Harm to the liver, spleen and blood.

Nervous system damage.

Besides above-mentioned disease Human health is affected by the direct damage of plants and animal nutrition. Water pollutants are killing sea weeds, mollusks, marine birds, fishes, crustaceans and other sea organisms that serve as food for human. Insecticides like DDT concentration is increasing along the food chain.

How can we stop water pollution?

There is no easy way to solve water pollution; if there were, it wouldn't be so much of a problem. Broadly speaking, there are three different things that can help to tackle the problem—education, laws, and economics—and they work together as a team.

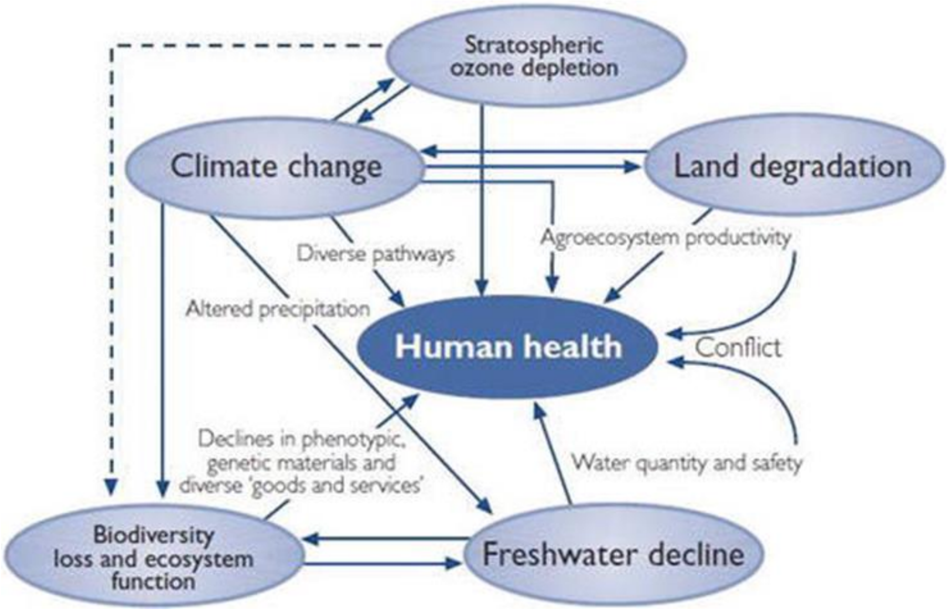
Education- This can be done by creating awareness. NGO can be assigned this job

Laws

One of the biggest problems with water pollution is its transboundary nature. Many rivers cross countries, while seas span whole continents. Pollution discharged by factories in one country with poor environmental standards can cause problems in neighboring nations, even when they have tougher laws and higher standards. Environmental laws can make it tougher for people to pollute, but to be really effective they have to operate across national and international borders. This is why we have international laws governing the oceans, such as the 1982 UN Convention on the Law of the Sea (signed by over 120 nations), the 1972 London (Dumping) Convention, the 1978 MARPOL International Convention for the Prevention of Pollution from Ships, and the 1998 OSPAR Convention for the Protection of the Marine Environment of the North East Atlantic. The European Union has water-protection laws (known as directives) that apply to all of its member states. They include the 1976 Bathing Water Directive (updated 2006), which seeks to ensure the quality of the waters that people use for recreation. Most countries also have their own water pollution laws. In the United States, for example, there is the 1972 Clean Water Act and the 1974 Safe Drinking Water Act.

Economics

Most environmental experts agree that the best way to tackle pollution is through something called the polluter pays principle. This means that whoever causes pollution should have to pay to clean it up, one way or another.



Topic-6

Biogeochemical Cycle

The flow of chemical elements and compounds between living organisms and the physical environment is called as Biogeochemical cycle. Chemicals absorbed or ingested by organisms are passed through the food chain and returned to the soil, air, and water by such mechanisms as respiration, excretion, and decomposition. As an element moves through this cycle, it often forms compounds with other elements as a result of metabolic processes in living tissues and of natural reactions in the atmosphere, hydrosphere, or lithosphere. These chemical elements cycles are:

a) Carbon cycle.

b) Nitrogen cycle.

c)Nutrient cycle.

d)oxygen cycle.

e) Phosphorus cycle.

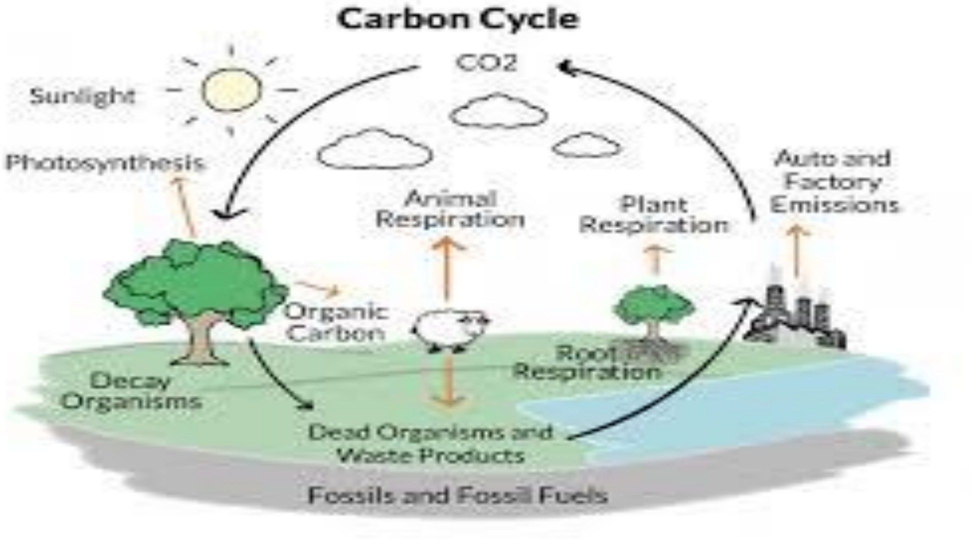
f) Sulfur cycle.

g) Rock cycle.

h) Water cycle.

1. Carbon cycle

Carbon enters the atmosphere as carbon dioxide from respiration (breathing) and combustion (burning). Carbon dioxide is absorbed by producers (life forms that make their own food e.g. plants) to make carbohydrates in photosynthesis . These producers then put off oxygen.Animals feed on the plants. Thus passing the carbon compounds along the food chain. Most of the carbon these animals consume however is exhaled as carbon dioxide. This is through the process of respiration. The animals and plants then eventually die.The dead organisms (dead animals and plants) are eaten by decomposers in the ground. The carbon that was in their bodies is then returned to the atmosphere as carbon dioxide. In some circumstances the process of decomposition is prevented. The decomposed plants and animals may then be available as fossil fuel in the future for combustion.



Nitrogen: Various steps of Nitrogen cycle has been explained below

1) Nitrogen Fixation

In the process of nitrogen fixation, bacteria turn nitrogen gas from the atmosphere into ammonia.These nitrogen-fixing bacteria, often called "diazotrophs," have an enzyme called "nitrogenase" which combines nitrogen atoms with hydrogen atoms. Ammonia is a nitrogen compound that can dissolve in water, and is easier for other organisms' enzymes to interact with. The enzyme nitrogenase can only function when oxygen isn't present. As a result, organisms that use it have had to develop oxygen-free compartments in which to perform their nitrogen fixation! Examples of such nitrogen-free compartment are the Rhizobium nodules found in the roots of nitrogen-fixing legume plants. The hard casing of these nodules keeps oxygen out of the pockets where Rhizobium bacteria do their valuable work of converting nitrogen gas into ammonia.

2) Nitrification

In nitrification, a host of soil bacteria participate in turning ammonia into nitrate – the form of nitrogen that can be used by plants and animals. This requires two steps, performed by two different types of bacteria.First, soil bacteria such as Nitrosomonas or Nitrococcus convert ammonia into nitrogen dioxide. Then another type of soil bacterium, called Nitrobacter, adds a third oxygen atom to create nitrate. These bacteria don't convert ammonia for plants and animals out of the goodness of their hearts. Rather, they are "chemotrophs" who obtain their energy from volatile chemicals. By metabolizing nitrogen along with oxygen, they obtain energy to power their own life processes.The process can be thought of as a rough (and much less efficient) analog to the cellular respiration performed by animals, which extract energy from carbon-hydrogen bonds and use oxygen as the electron acceptor, yielding carbon dioxide at the end of the process.

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3) Assimilation

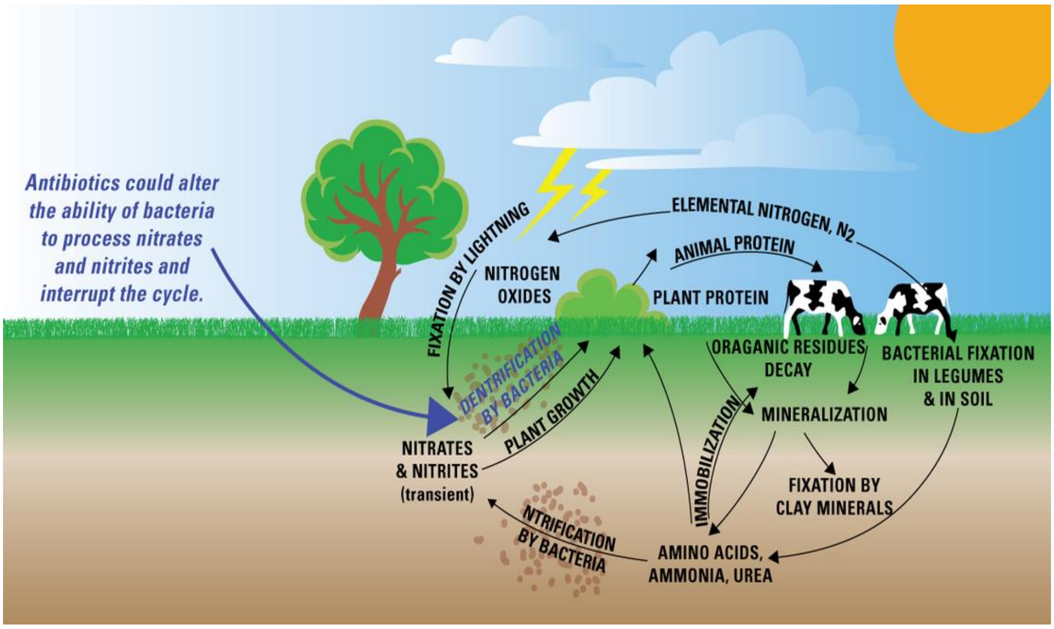
In nitrogen assimilation, plants finally consume the nitrates made by soil bacteria and use them to make nucleotides, amino acids, and other vital chemicals for life. Plants take up nitrates through their roots and use them to make amino acids and nucleic acids from scratch. Animals that eat the plants are then able to use these amino acids and nucleic acids in their own cells.

4) Ammonification

A process called “ammonification” is performed by soil bacteria which decompose dead plants and animals. During the process, these decomposers break down amino acids and nucleic acids into nitrates and ammonia and release those compounds back into the soil.There, the ammonia may be taken up again by plants and nitrifying bacteria. Alternatively, the ammonia may be converted back into atmospheric nitrogen through the process of denitrification.

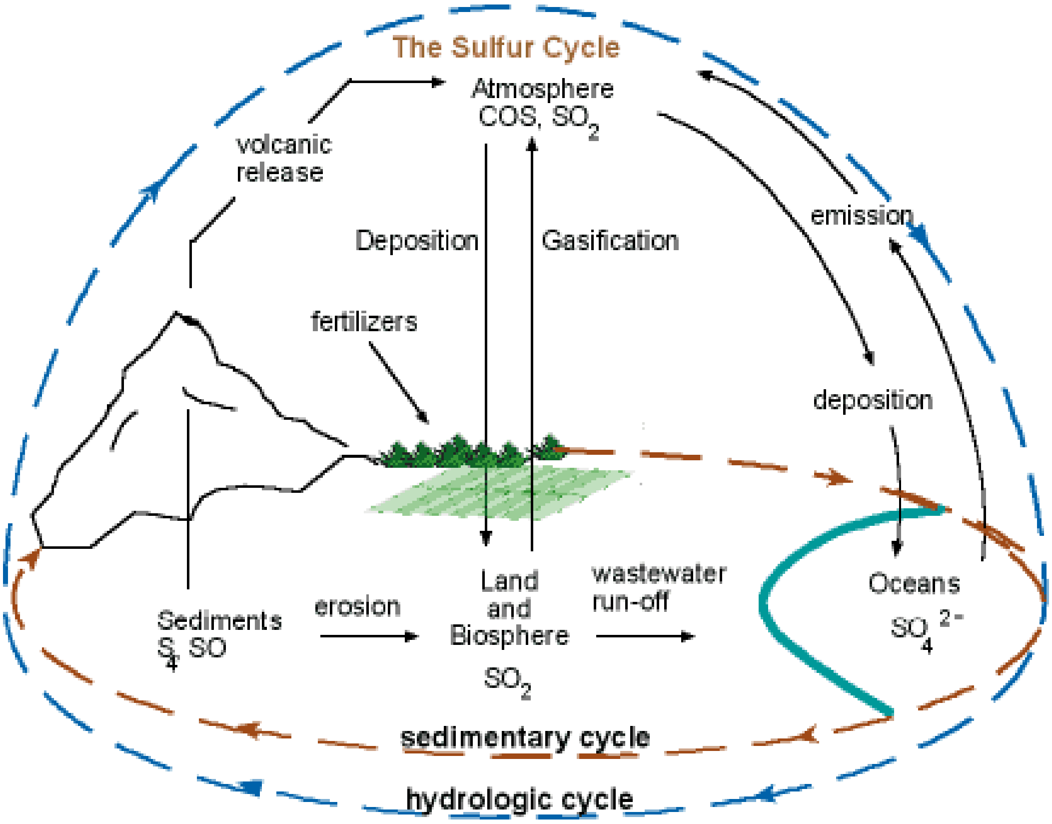
5) Denitrification

In the final step of the nitrogen cycle, anaerobic bacteria can turn nitrates back into nitrogen gas. This process, like the process of turning nitrogen gas into ammonia, must happen in the absence of oxygen. As such it often occurs deep in the soil, or in wet environments where mud and muck keep oxygen at bay.In some ecosystems, this denitrification is a valuable process to prevent nitrogen compounds in the soil from building up to dangerous levels.



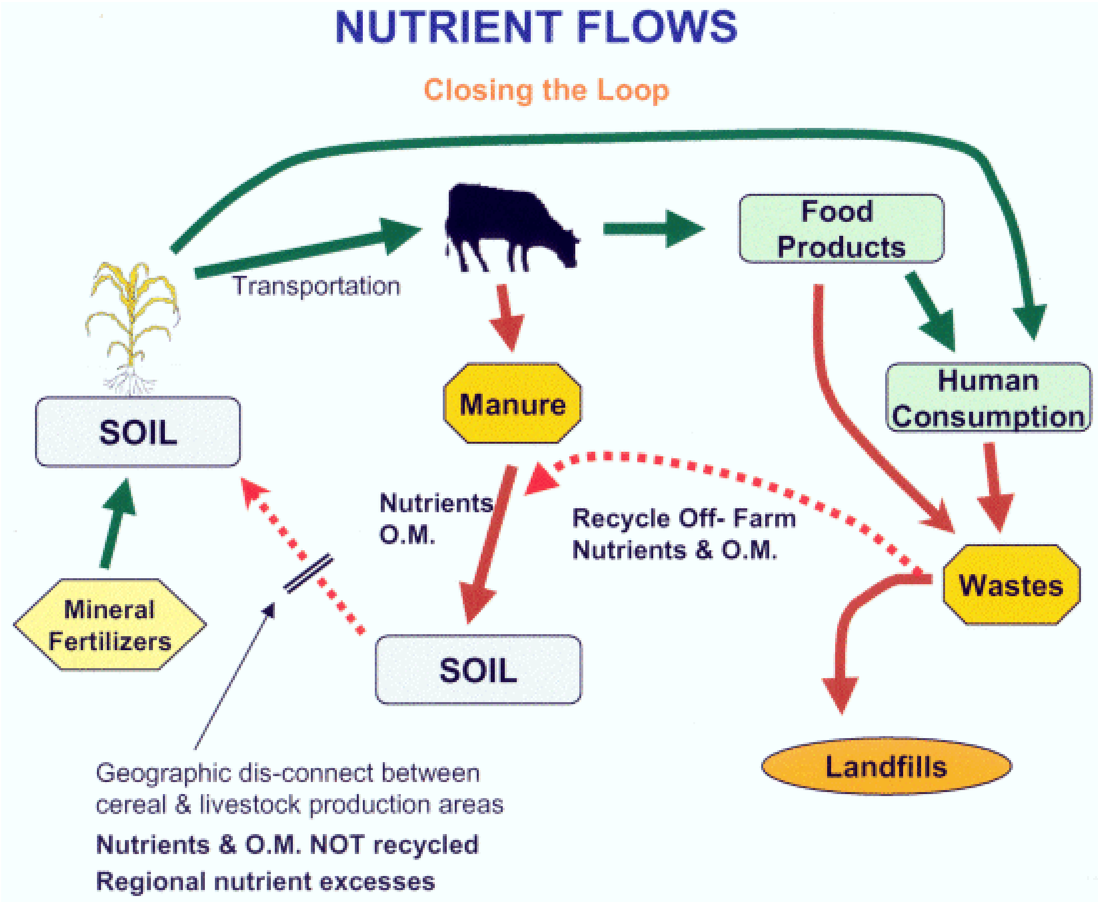
Sulphur cycle

Sulfur cycle, circulation of sulfur in various forms through nature. Sulfur occurs in all living matter as a component of certain amino acids. It is abundant in the soil in proteins and, through a series of microbial transformations, ends up as sulfates usable by plants. Sulfur-containing proteins are degraded into their constituent amino acids by the action of a variety of soil organisms. The sulfur of the amino acids is converted to hydrogen sulfide (H2S) by another series of soil microbes. In the presence of oxygen, H2S is converted to sulfur and then to sulfate by sulfur bacteria. Eventually the sulfate becomes H2S.Hydrogen sulfide rapidly oxidizes to gases that dissolve in water to form sulfurous and sulfuric acids. These compounds contribute in large part to the “acid rain” that can kill sensitive aquatic organisms and damage marble monuments and stone buildings.



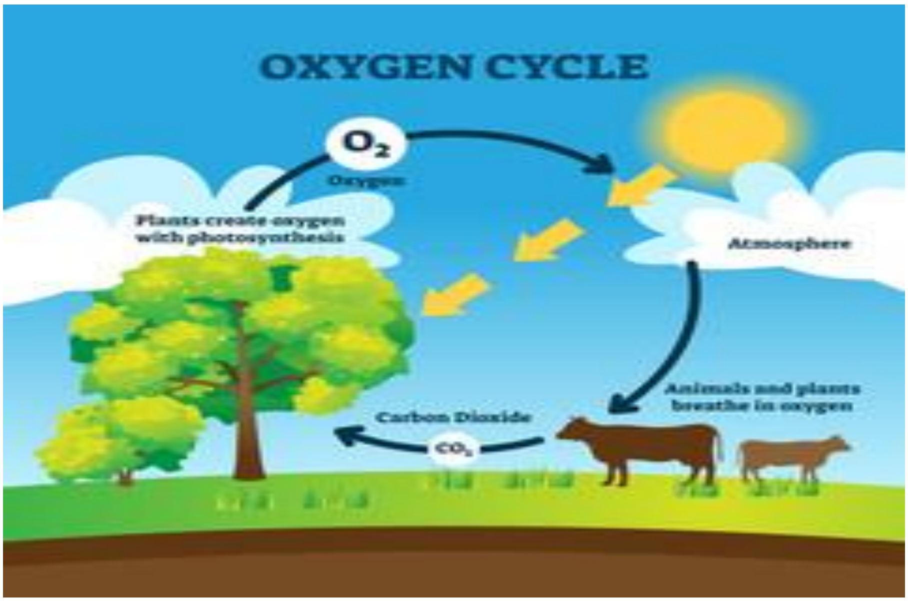
Nutrient cycle

Every living thing needs nutrients, this give our bodies energy and help our cells function. Nutrients move between living things, into the Earth, and into the atmosphere. This process is called a nutrient cycle. Things we need to survive like carbon-containing compounds such as sugar, micronutrients like nitrogen, phosphorus, and sulfur, and water, move through living things and our environment. Today we're going to look at the nutrient cycle for each of these important compounds.



Oxygen cycle

Oxygen cycle, circulation of oxygen in various forms through nature. Free in the air and dissolved in water, oxygen is second only to nitrogen in abundance among uncombined elements in the atmosphere. Plants and animals use oxygen to respire and return it to the air and water as carbon dioxide (CO_2). CO_2 is then taken up by algae and terrestrial green plants and converted into carbohydrates during the process of photosynthesis, oxygen being a by-product. The waters of the world are the main oxygen generators of the biosphere; their algae are estimated to replace about 90 percent of all oxygen used. Oxygen is involved to some degree in all the other biogeochemical cycles. For example, over time, detritus from living organisms transfers oxygen-containing compounds such as calcium carbonates into the lithosphere.



Phosphorus cycle

Phosphorus Cycle Steps

The phosphorus cycle is a slow process, which involves five key steps, as shown in the diagram below and described as follows:

Weathering

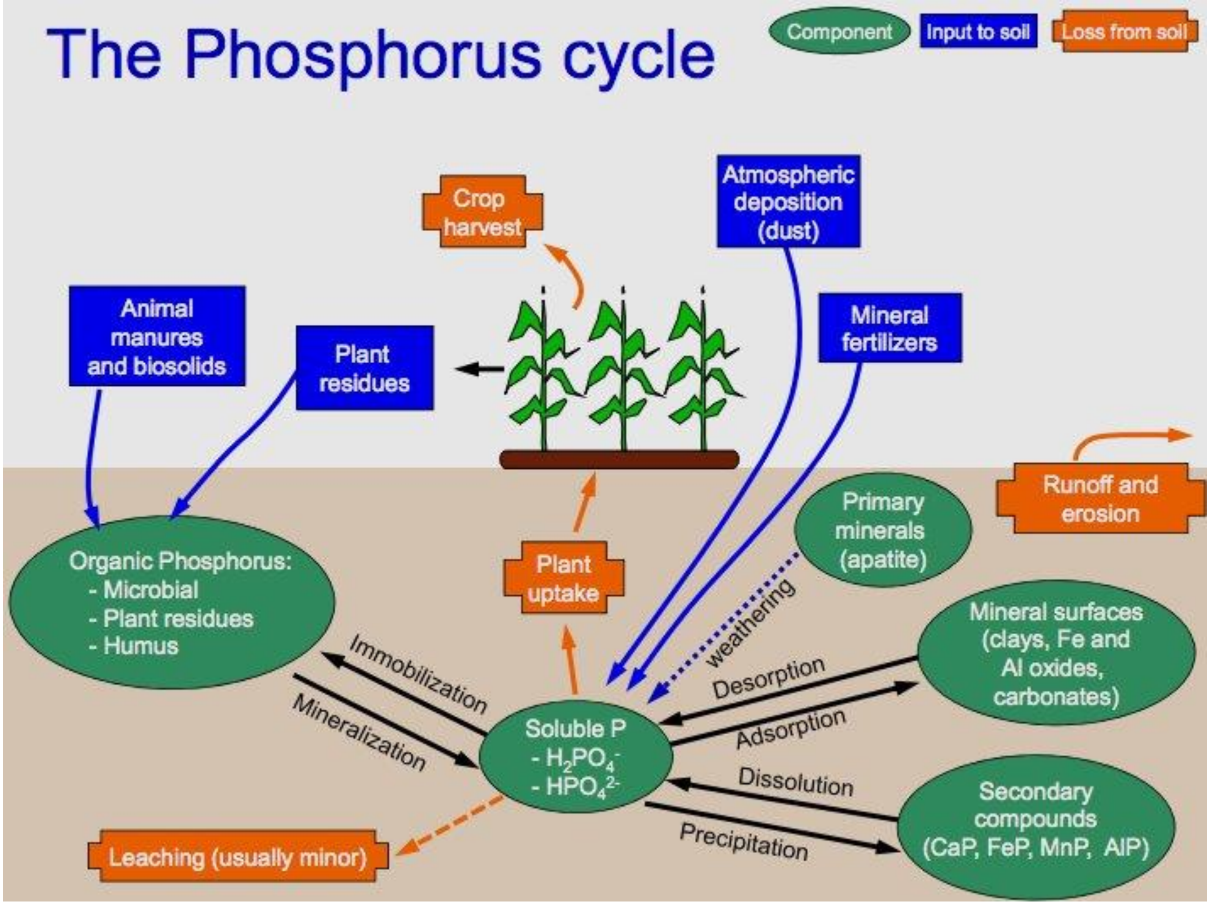
Since the main source of phosphorus is found in rocks, the first step of the phosphorus cycle involves the extraction of phosphorus from the rocks by weathering. Weather events, such as rain and other sources of erosion, result in phosphorus being washed into the soil.

Absorption by Plants and Animals

Once in the soil, plants, fungi, and microorganisms are able to absorb phosphorus and grow. In addition, phosphorus can also be washed into the local water systems. Plants can also directly absorb phosphorus from the water and grow. In addition to plants, animals also obtain phosphorus from drinking water and eating plants.

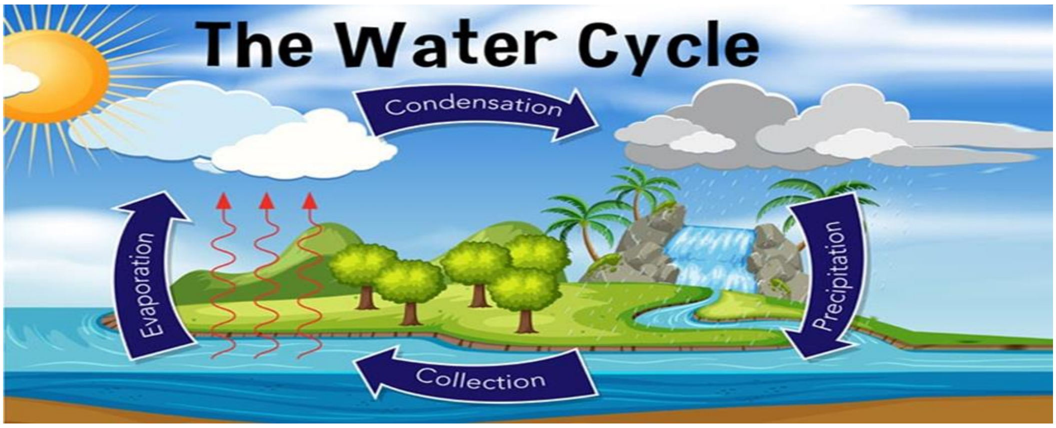
Return to the Environment via Decomposition

When plants and animals die, decomposition results in the return of phosphorus back to the environment via the water or soil. Plants and animals in these environments can then use this phosphorus, and step 2 of the cycle is repeated.



Water cycle

Water cycle, also called hydrologic cycle, cycle that involves the continuous circulation of water in the Earth-atmosphere system. Of the many processes involved in the water cycle, the most important are evaporation, transpiration, condensation, precipitation, and runoff. Although the total amount of water within the cycle remains essentially constant, its distribution among the various Processes is continually changing.



Topic-7

Ecological pyramid

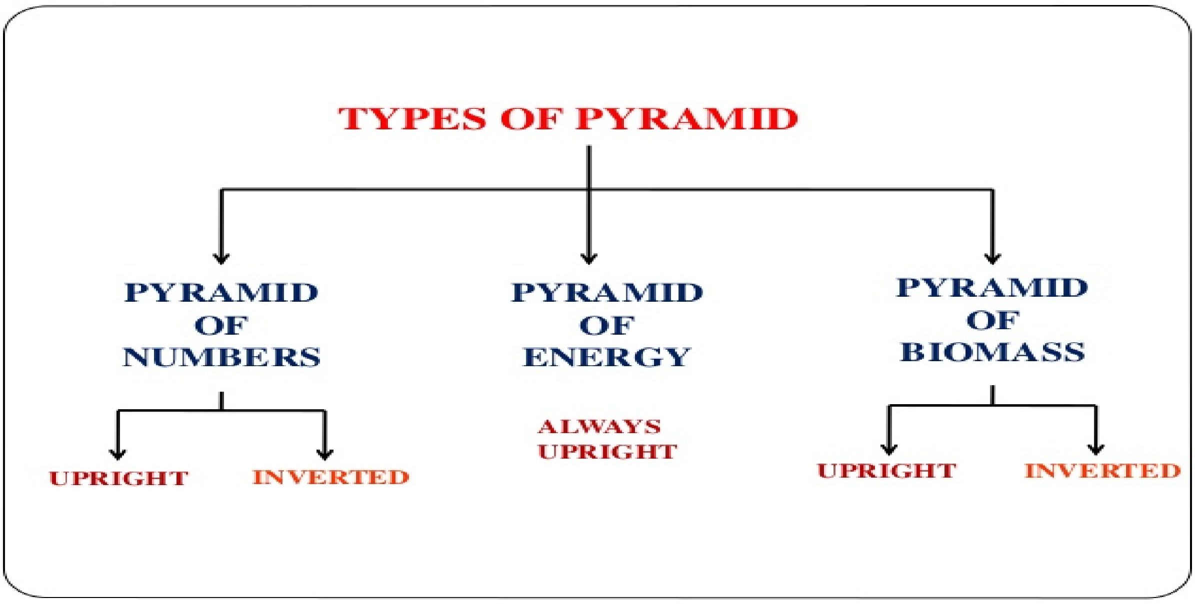
An ecological pyramid is a graphical representation of the relationship between different organisms in an ecosystem. Each of the bars that make up the pyramid represents a different trophic level, and their order, which is based on who eats whom, represents the flow of energy. Energy moves up the pyramid, starting with the primary producers, or autotrophs, such as plants and algae at the very bottom, followed by the primary consumers, which feed on these plants, then secondary consumers, which feed on the primary consumers, and so on. The height of the bars should all be the same, but the width of each bar is based on the quantity of the aspect being measured.

The ecological pyramids may be of following three kinds.

Pyramid of Number: It depicts the number of individual organisms at different trophic levels of food chain. ...

Pyramid of Biomass: The biomass of the members of the food chain present at any one time forms the pyramid of the biomass. ...

Pyramid of Energy



Pyramid of Numbers

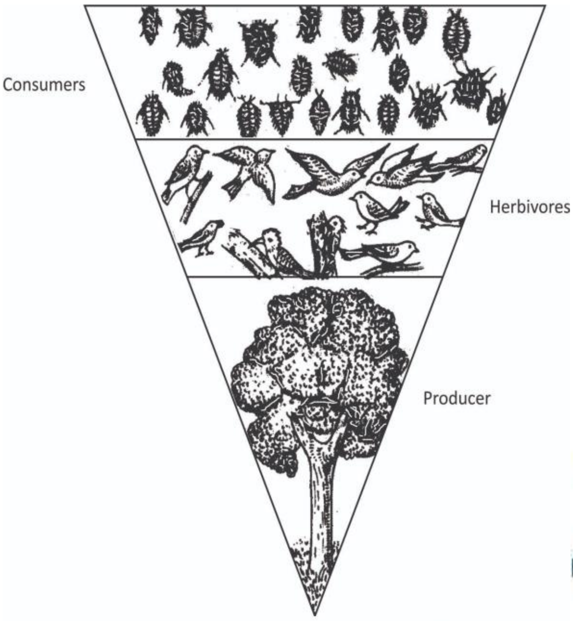
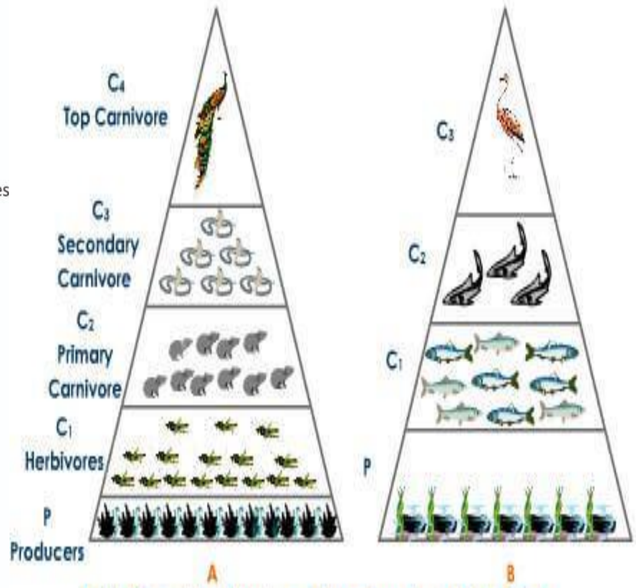
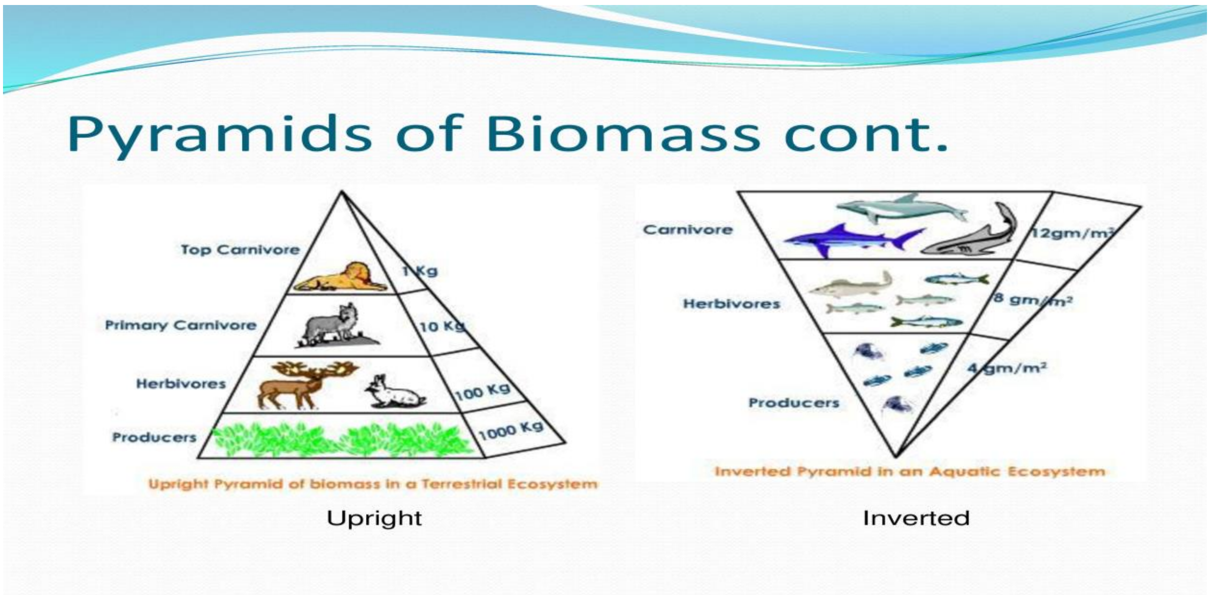


Fig. : Inverted pyramid of numbers in a tree (Parasitic) ecosystem



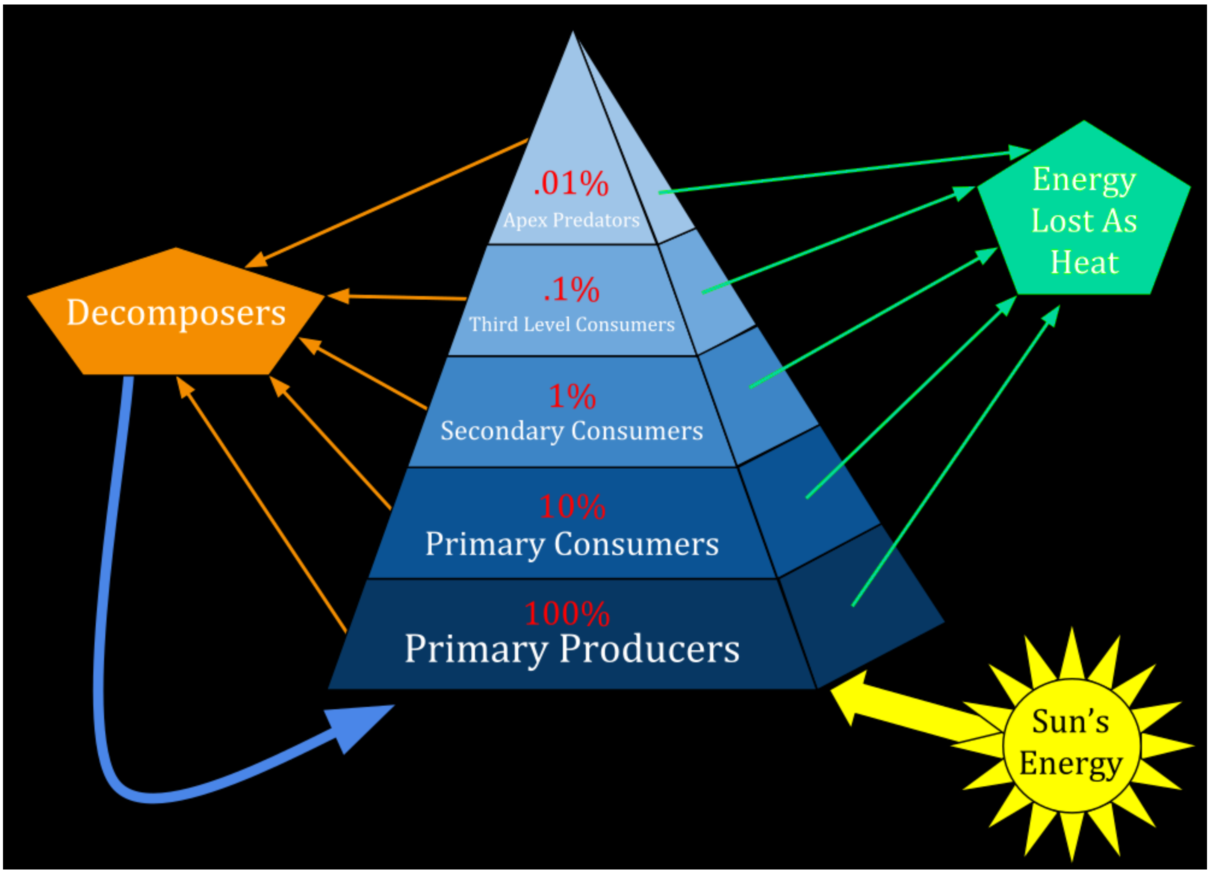
Upright Pyramids of Numbers. (A) In a Grass Land (B) In a Pond

Pyramid of Biomass



Pyramid of Energy

Always upright



Topic-8

Threatened categories of plants

The IUCN Red List of Threatened Species™ is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of quantitative criteria to evaluate the extinction risk of thousands of species. These criteria are relevant to most species and all regions of the world. With its strong scientific base, The IUCN Red List is recognized as the most authoritative guide to the status of biological diversity.

The IUCN system uses a set of five quantitative criteria to assess the extinction risk of a given species. In general, these criteria consider:

The rate of population decline

The geographic range

Whether the species already possesses a small population size

Whether the species is very small or lives in a restricted area

Whether the results of a quantitative analysis indicate a high probability of extinction in the wild

After a given species has been thoroughly evaluated, it is placed into one of several categories. (The details of each have been condensed to highlight two or three of the category's most salient points below.) In addition, three of the categories (CR, EN, and VU) are contained within the broader notion of "threatened." The IUCN Red List of Threatened Species recognizes several categories of species status:

Extinct (EX), a designation applied to species in which the last individual has died or where systematic and time-appropriate surveys have been unable to log even a single individual

Extinct in the Wild (EW), a category containing those species whose members survive only in captivity or as artificially supported populations far outside their historical geographic range

Critically Endangered (CR), a category containing those species that possess an extremely high risk of extinction as a result of rapid population declines of 80 to more than 90 percent over the previous 10 years (or three generations), a current population size of fewer than 50 individuals, or other factors

Endangered (EN), a designation applied to species that possess a very high risk of extinction as a result of rapid population declines of 50 to more than 70 percent over the previous 10 years (or three generations), a current population size of fewer than 250 individuals, or other factors

Vulnerable (VU), a category containing those species that possess a very high risk of extinction as a result of rapid population declines of 30 to more than 50 percent over the previous 10 years (or three generations), a current population size of fewer than 1,000 individuals, or other factors

Near Threatened (NT), a designation applied to species that are close to becoming threatened or may meet the criteria for threatened status in the near future

Least Concern (LC), a category containing species that are pervasive and abundant after careful assessment

Data Deficient (DD), a condition applied to species in which the amount of available data related to its risk of extinction is lacking in some way. Consequently, a complete assessment cannot be performed. Thus, unlike the other categories in this list, this category does not describe the conservation status of a species

Not Evaluated (NE), a category used to include any of the nearly 1.9 million species described by science but not assessed by the IUCN

There is a long list of threatened species of plants some of which has been listed

Piperales Species

Peperomia abnormis

Piper cordulatum

Campanulales

Burmeistera refracta

Campanula alata

Campanula bohemica

Theales

There are 45 species and two varieties in Theales assessed as near threatened.

Theaceae

Adinandra angulata

Adinandra forbesii

Adinandra integerrima

Adinandra parvifolia

Balthasaria schliebenii

Camellia costata

Camellia hengchunensis

Camellia indochinensis

Camellia longissima

Camellia melliana

Camellia parvimuricata

Camellia pilosperma

Camellia subintegra

Camellia tuberculata

Freziera friedrichsthailana

Freziera longipes

Freziera tomentosa

Pyrenaria pahangensis

Ternstroemia evenia

Ternstroemia maclellandiana

Visnea mocanera

Actinidiaceae

Saurauia adenodonta

Saurauia laxiflora

Saurauia lehmannii

Saurauia magnifica

Saurauia mahmudii

Saurauia malayana

Saurauia rubens

Saurauia schultzeorum

Topic-9

Green House effect

The origins of the term greenhouse effect are unclear. French mathematician Joseph Fourier is sometimes given credit as the first person to coin the term greenhouse effect based on his conclusion in 1824 that Earth's atmosphere functioned similarly to a "hotbox"—that is, a heliothermometer (an insulated wooden box whose lid was made of transparent glass) developed by Swiss physicist Horace Bénédict de Saussure, which prevented cool air from mixing with warm air. Fourier, however, neither used the term greenhouse effect nor credited atmospheric gases with keeping Earth warm. Swedish physicist and physical chemist Svante Arrhenius is credited with the origins of the term in 1896, with the publication of the first plausible climate model that explained how gases in Earth's atmosphere trap heat. Arrhenius first refers to this "hot-house theory" of the atmosphere—which would be known later as the greenhouse effect—in his work Worlds in the Making (1903).

greenhouse effect

The greenhouse effect is caused by the atmospheric accumulation of gases such as carbon dioxide and methane, which contain some of the heat emitted from Earth's surface.

The atmosphere allows most of the visible light from the Sun to pass through and reach Earth's surface. As Earth's surface is heated by sunlight, it radiates part of this energy back toward space as infrared radiation. This radiation, unlike visible light, tends to be absorbed by the greenhouse gases in the atmosphere, raising its temperature. The heated atmosphere in turn radiates infrared radiation back toward Earth's surface. (Despite its name, the greenhouse effect is different from the warming in a greenhouse, where panes of glass transmit visible sunlight but hold heat inside the building by trapping warmed air.)

Without the heating caused by the greenhouse effect, Earth's average surface temperature would be only about −18 °C (0 °F). On Venus the very high concentration of carbon dioxide in the atmosphere causes an extreme greenhouse effect resulting in surface temperatures as high as 450 °C (840 °F).

Although the greenhouse effect is a naturally occurring phenomenon, it is possible that the effect could be intensified by the emission of greenhouse gases into the atmosphere as the result of human activity. From the beginning of the Industrial Revolution through the end of the 20th century, the amount of carbon dioxide in the atmosphere increased by roughly 30 percent and the amount of methane more than doubled. A number of scientists have predicted that human-related increases in atmospheric carbon dioxide and other greenhouse gases could lead by the end of the 21st century to an increase in the global average temperature of 3–4 °C (5.4–7.2 °F) relative to the 1986–2005 average. This global warming could alter Earth's climates and thereby produce new patterns and extremes of drought and rainfall and possibly disrupt food production in certain regions.

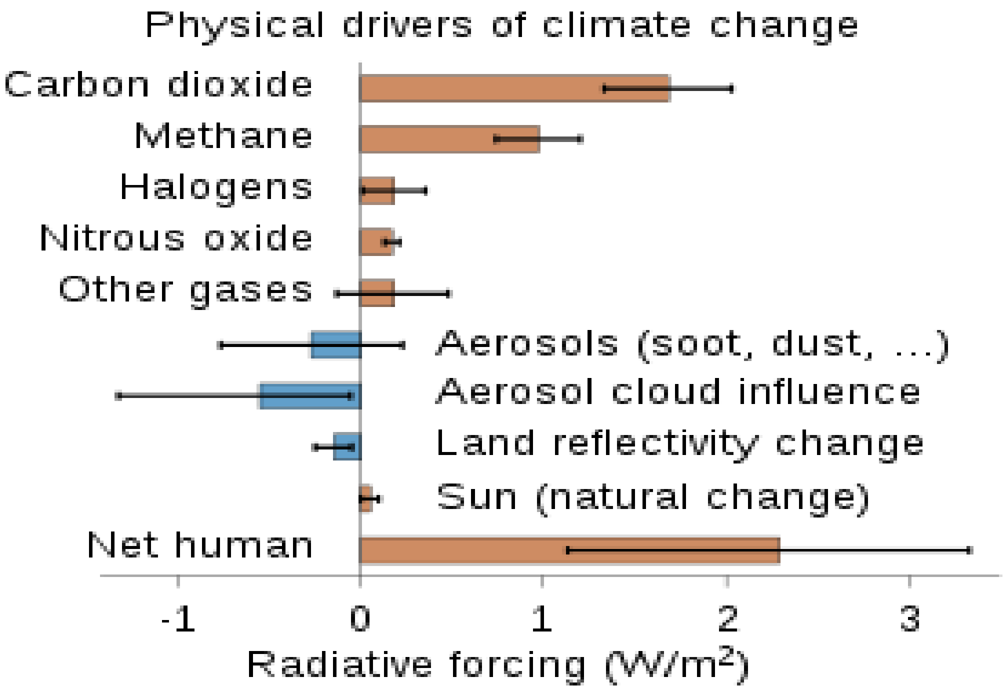
Some of the greenhouse gases are:

Carbon dioxide (CO_2): Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials, and also as a result of certain chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

Methane (CH4): Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

Nitrous oxide (N2O): Nitrous oxide is emitted during agricultural and industrial activities, combustion of fossil fuels and solid waste, as well as during treatment of wastewater.

Fluorinated gases: Hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases ("High GWP gases"



Topic-10

Acid rain

Acid rain is a result of air pollution. When any type of fuel is burnt, lots of different chemicals are produced. The smoke that comes from a fire or the fumes that come out of a car exhaust don't just contain the sooty grey particles that you can see - they also contains lots of invisible gases that can be even more harmful to our environment.Power stations, factories and cars all burn fuels and therefore they all produce polluting gases. Some of these gases (especially nitrogen oxides and sulphur dioxide) react with the tiny droplets of water in clouds to form sulphuric and nitric acids. The rain from these clouds then falls as very weak acid - which is why it is known as "acid rain".

Chemistry of acid rain

$SO2 + H2O \rightarrow H2SO4 \longleftrightarrow H+ + HSO4 \longleftrightarrow 2H+ + SO42$

$NO2 + H2O \rightarrow HNO3 \longleftrightarrow H+ + NO3$

Acidity is measured using a scale called the pH scale. This scale goes from 0 to 14. 0 is the most acidic and 14 is the most alkaline (opposite of acidic). Something with a pH value of 7, we call neutral, this means that it is neither acidic nor alkaline.Very strong acids will burn if they touch your skin and can even destroy metals. Acid rain is much, much weaker than this, never acidic enough to burn your skin.Rain is always slightly acidic because it mixes with naturally occurring oxides in the air. Unpolluted rain would have a pH value of between 5 and 6. When the air becomes more polluted with nitrogen oxides and sulphur dioxide the acidity can increase to a pH value of 4. Some rain has even been recorded as being pH2.

The Effects of Acid Rain

Acid rain can be carried great distances in the atmosphere, not just between countries but also from continent to continent. The acid can also take the form of snow, mists and dry dusts. The rain sometimes falls many miles from the source of pollution but wherever it falls it can have a serious effect on soil, trees, buildings and water.

Forests

It is thought that acid rain can cause trees to grow more slowly or even to die but scientists have found that it is not the only cause. The same amount of acid rain seems to have more effect in some areas than it does in others.

Acid rain can effect trees in several different ways, it may:

• dissolve and wash away the nutrients and minerals in the soil

which help the trees to grow.

• cause the release of harmful substances such as aluminium into the soil.

• wear away the waxy protective coating of leaves, damaging them and preventing them from being able to photosynthesise properly.

A combination of these effects weakens the trees which means that they can be more easily attacked by diseases and insects or injured by bad weather. It is not just trees that are affected by acid rain, other plants may also suffer.

Lakes and Rivers

It is in aquatic habitats that the effects of acid rain are most obvious. Acid rain runs off the land and ends up in streams, lakes and marshes - the rain also falls directly on these areas.

As the acidity of a lake increases, the water becomes clearer and the numbers of fish and other water animals decline. Some species of plant and animal are better able to survive in acidic water than others. Freshwater shrimps, snails, mussels are the most quickly affected by acidification followed by fish such as minnows, salmon and roach. The roe and fry (eggs and young) of the fish are the worst affected, the acidity of the water can cause deformity in young fish and can prevent eggs from hatching properly.The acidity of the water does not just affect species directly, it also causes toxic substances like aluminium to be released into the water from the soil, harming fish and other aquatic animals.

Buildings

Every type of material will become eroded sooner or later by the effects of the climate. Water, wind, ice and snow all help in the erosion process but unfortunately, acid rain can help to make this natural process even quicker. Statues, buildings, vehicles, pipes and cables can all suffer. The worst affected are things made from limestone or sandstone as these types of rock are particularly susceptible and can be affected by air pollution in gaseous form as well as by acid rain.

Topic-11

Ozone depletion

Ozone depletion, is gradual thinning of Earth's ozone layer in the upper atmosphere caused by the release of chemical compounds containing gaseous chlorine or bromine from industry and other human activities. The thinning is most pronounced in the polar regions, especially over Antarctica. Ozone depletion is a major environmental problem because it increases the amount of ultraviolet (UV) radiation that reaches Earth's surface, which increases the rate of skin cancer, eye cataracts, and genetic and immune system damage. The Montreal Protocol, ratified in 1987, was the first of several comprehensive international agreements enacted to halt the production and use of ozone-depleting chemicals. As a result of continued international cooperation on this issue, the ozone layer is expected to recover over time.

Causes of Ozone Layer Depletion

According to the studies done by the scientists the cause of the ozone layer depletion is human activity. All the activities are done by human beings. Through which the chemicals are made that contain chlorine or bromine. These are basically called ODS that stands for Ozone-Depleting Substance.The ozone layer depletion was observed by the researchers in the early 1970s. Furthermore, the ozone-depleting substances are said to be Eco-friendly and they are very popular for the last some decades and are still in use.These ozone depletion substances float and then reach the stratosphere. Therefore, the formation of chlorine and bromine takes place and these chemicals cause the depletion of the ozone layer at a very high speed.They are capable of breaking down the molecules of the ozone layer. One chlorine molecule has a capacity to breakdown thousands of molecules present in the ozone layer, therefore, it results in the depletion of the ozone layer.

Over the past 30 years humans have made progress in stopping damage to the ozone layer by curbing the use of certain chemicals. But more remains to be done to protect and restore the atmospheric shield that sits in the stratosphere about 9 to 18 miles (15 to 30 kilometers) above the Earth's surface.

Atmospheric ozone absorbs ultraviolet (UV) radiation from the sun, particularly harmful UVB-type rays. Exposure to UVB radiation is linked with increased risk of skin cancer and cataracts, as well as damage to plants and marine ecosystems. Atmospheric ozone is sometimes labeled as the "good" ozone, because of its protective role, and shouldn't be confused with tropospheric, or ground-level, "bad" ozone, a key component of air pollution that is linked with respiratory disease.

Ozone (O_3) is a highly reactive gas whose molecules are comprised of three oxygen atoms. Its concentration in the atmosphere naturally fluctuates depending on seasons and latitudes, but it generally was stable when global measurements began in 1957. Groundbreaking research in the 1970s and 1980s revealed signs of trouble.

In 1974, Mario Molina and Sherwood Rowland, two chemists at the University of California, Irvine, published an article in Nature detailing threats to the ozone layer from chlorofluorocarbon (CFC) gases. At the time, CFCs were commonly used in aerosol sprays and as coolants in many refrigerators. As they reach the stratosphere, the sun's UV rays break CFCs down into substances that include chlorine.The groundbreaking research—for which they were awarded the 1995 Nobel Prize in chemistry—concluded that the atmosphere had a “finite capacity for absorbing chlorine” atoms in the stratosphere.One atom of chlorine can destroy more than 100,000 ozone molecules, according to the U.S. Environmental Protection Agency, eradicating ozone much more quickly than it can be replaced.

The ozone layer’s status today

Recognition of the harmful effects of CFCs and other ozone-depleting substances led to the Montreal Protocol on Substances That Deplete the Ozone Layer in 1987, a landmark agreement to phase out those substances that has been ratified by all 197 UN member countries. Without the pact, the U.S. would have seen an additional 280 million cases of skin cancer, 1.5 million skin cancer deaths, and 45 million cataracts—and the world would be at least 25 percent hotter.More than 30 years after the Montreal Protocol, NASA scientists documented the first direct proof that Antarctic ozone is recovering because of the CFC phase-down: Ozone depletion in the region has declined 20 percent since 2005. And at the end of 2018, the United Nations confirmed in a scientific assessment that the ozone layer is recovering, projecting that it would heal completely in the (non-polar) Northern Hemisphere by the 2030s, followed by the Southern Hemisphere in the 2050s and polar regions by 2060.

Topic-12

Kinds of natural disaster

Natural disasters are large-scale geological or meteorological events that have the potential to cause loss of life or property. These types of disasters include:

Each can be quite powerful and cause severe damage to the environment and the people who live there.

1. Hurricane, Typhoons & Cyclones. A hurricane is a type of cyclone, which is a generic term for any powerful, rotating storm that originates in warm tropical oceans and creates strong winds and heavy rain. ... A weather system technically becomes a hurricane once it reaches wind speeds of 74 mph (before that, it's called a tropical storm
2. Earthquakes. ... An earthquake is the result of a sudden release of stored energy in the Earth's crust that creates seismic waves. ... At the Earth's surface, earthquakes may manifest themselves by a shaking or displacement of the ground. Sometimes, they cause tsunamis, which may lead to loss of life and destruction of property
3. Hurricanes, Typhoons, and Cyclones. The word hurricane comes from the Taino Native American word, hurucane, meaning evil spirit of the wind. ▪ The first time anyone flew into a hurricane happened in 1943 in the middle of World War II. ▪ A tropical storm is classified as a hurricane once winds goes up to 74 miles per hour or higher.
4. Tsunamis. A tsunami is a natural disaster which is a series of fast-moving waves in the ocean caused by powerful earthquakes, volcanic eruptions, landslides, or simply an asteroid or a meteor crash inside the ocean. A tsunami has a very long wavelength. It can be hundreds of kilometers long. Usually, a tsunami starts suddenly.
5. Floods. A flood is an overflow of water on normally dry ground. This is most commonly due to an overflowing river, a dam break, snowmelt, or heavy rainfall. Less commonly happening are tsunamis, storm surge, or coastal flooding.
6. Mudslides. A mudslide, also called a debris flow, is a type of fast-moving landslide that follows a channel, such as a river. A landslide, in turn, is simply when rock, earth, or other debris moves down a slope. ... Mudslides occur after water rapidly saturates the ground on a slope, such as during a heavy rainfall.
7. Avalanches. a large mass of snow, ice, earth, rock, or other material in swift motion down a mountainside or over a precipice. 2 : a sudden great or overwhelming rush or accumulation of something hit by an avalanche of paperwork.