Q.1. (c) Differentiate between food chain and food web with example. (2.5)

Ans. A food chain is a single series of organisms in which each plant or animal depends on the organism above or below it. As an example, a food chain might consist of garden plants, such as lettuce and carrots, fed upon by rabbits which, in turn, are fed upon by owls which, in turn, are fed upon by hawks. A food chain is largely a theoretical idea and probably seldom, if ever, exists in the real world. It is a useful concept, however as it helps ecologists understand how specific plants and animals are dependent upon

one another. The feeding relationships of organisms in the real world is almost always more complex than suggested by a food chain. For that reason, the term food web is more accurate than is food chain.

EXAMPLE:

THE SUN provides food for GRASS

The GRASS is eaten by a GRASSHOPPER

The GRASSHOPPER is eaten by a FROG

The FROG is eaten by a SNAKE

The SNAKE is eaten by a HAWK.

A food web differs from a food chain in that it includes all the organisms w feeding habits are related in some way or another to those of other organisms. I example above, small animals other than rabbits feed on lettuce and carrots an turn, those animals are fed upon by a variety of larger animals.

Food webs are organized into three main categories, depending on the kin organisms they contain. These three categories are known as trophic levels. The primary trophic levels are those that consist of (1) Producers, (2) Consumers, a Decomposers

EXAMPLE:

TREES produce ACORNS which act as food for many MICE and INSECTS.

Because there are many MICE, WEASELS and SNAKES have food.

The insects and the acorns also attract BIRDS, SKUNKS, and OPOSSUMS

With the SKUNKS, OPPOSUMS, WEASELS and MICE around, HAWKS, F and OWLS can find food.

They are all connected! Like a spiders web, if one part is removed, it can aff whole web.

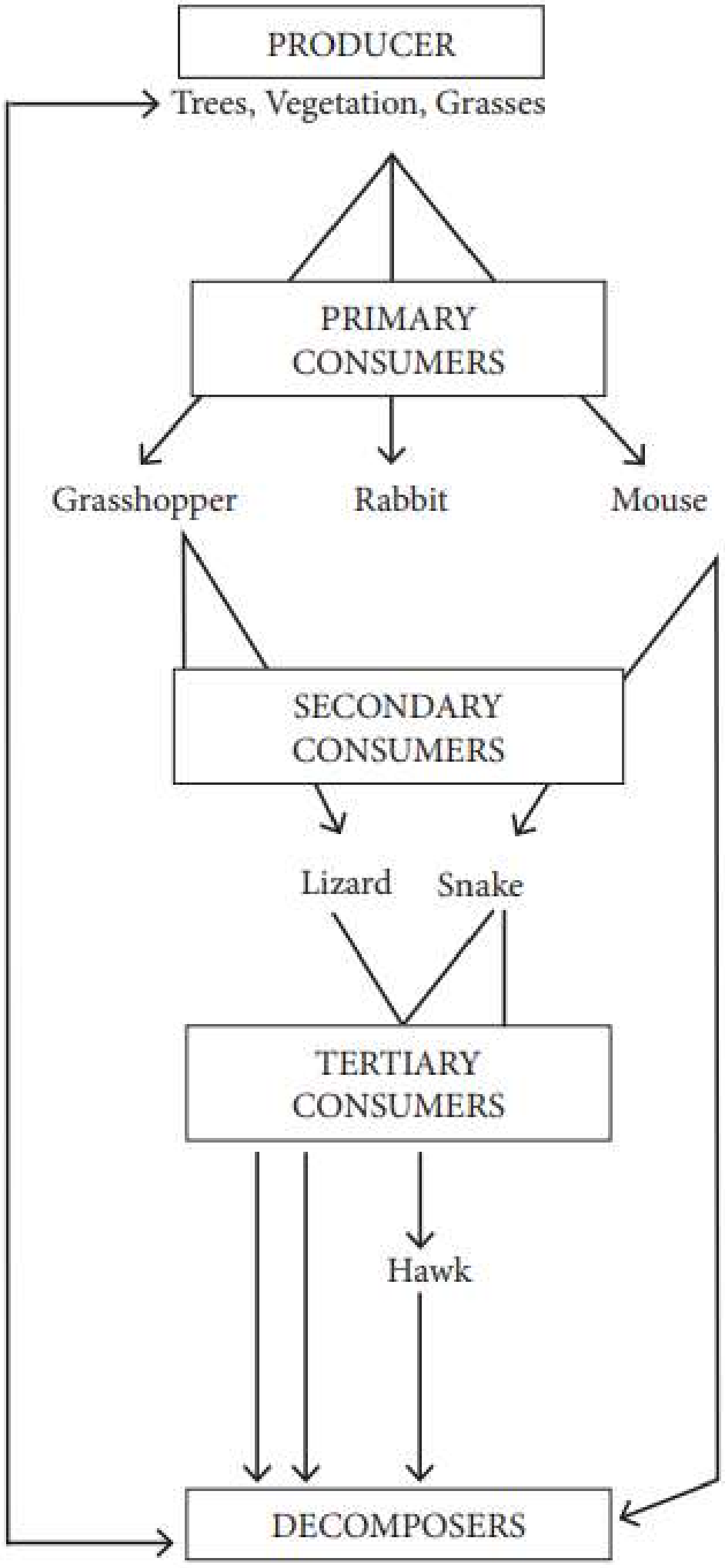


Figure 3.3 Simple Food Web of a Grassland Ecosystem

3.4.3 Food Chains and Food Webs

As already discussed, in the ecosystem only green plants contain chlorophyll with the help of which they can convert solar energy to food which is being taken by different heterotrophs. Heterotrophs cannot produce food for themselves. Herbivores, carnivores, and decomposers are collectively known as heterotrophs. The food which is produced by an autotroph is eaten by herbivores (cows, goats, horses, rabbits and so on) which are eaten by small carnivores which in turn become food for bigger carnivores and the process continues.

Ultimately after the life cycle, the dead organism is decomposed by different decomposers (bacteria, fungi, microbes etc.) as shown in Fig. 3.2.

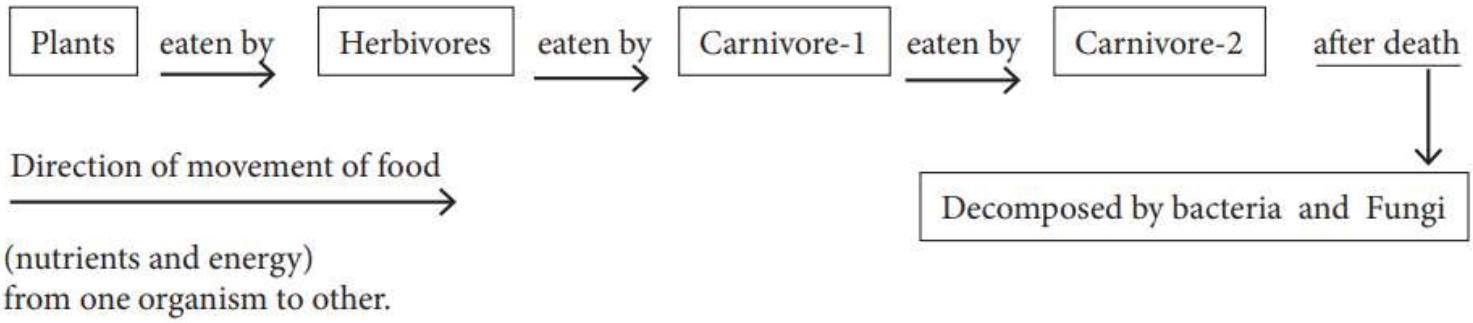


Figure 3.2 Flow Chart Showing the Movement of Food and Energy in a Food Chain

This sequence of organisms which feed on one another for their survival is known as the food chain. In a food chain, the links are known as trophic levels (food level). The plants are producers and form trophic level-1, the herbivores are primary consumers and form trophic level-2, the small carnivores are secondary consumers and form trophic level–3 and the big carnivores are tertiary consumers and form trophic level-4. They are also called top carnivores.

The food chain in the ecosystem helps to maintain:

(i) The biodiversity of nature.

(ii) The feeding relationship of nature.

(iii) Flow of energy of the ecosystem.

(iv) Passage of nutrients from one organism to another.

The only demerit of a food chain is that along with nutrients it also transports toxic substances from one organism to another which finally results in biomagnification. In the ecosystem, a number of food chains operate simultaneously. These food chains are inter-linked with one another to form a food web. For example, a plant may be food for any herbivore or carnivore such as human beings. A herbivore again becomes food for carnivore-1 or is directly eaten by the top carnivore. For example, a mouse feeding on food grains becomes food for a snake which is eaten by a hawk. The mouse can be directly eaten by a hawk. In this way, the inter-related complex food chain forms a food web. A food web constitutes a number of alternative paths for energy flow and provides greater stability to the ecosystem. A food web of a grassland ecosystem is shown in Fig. 3.3.

Pyramid of Numbers: This pyramid deals with the relationship between the number of primary producers and consumers (herbivore and carnivore) of different orders. Depending on the nature of the food chain, in the present ecosystem the pyramid of numbers may be upright or inverted. For example, in a grassland ecosystem, the number of grasses (producer) is always high followed by primary consumers (herbivores like rabbits and grasshoppers) that are less, the secondary consumers (carnivores like snakes and lizards) that are lesser and finally the top carnivore, in this case hawks, which are the least in number. So the pyramid is upright in this case as shown in Fig. 3.4.

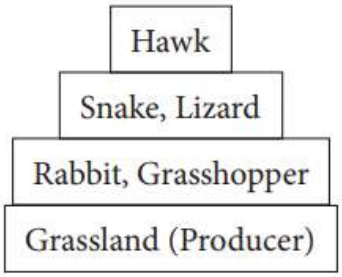


Figure 3.4 Pyramid of Numbers (Grassland)

On the other hand, in a forest ecosystem, the producers are big trees on the fruits of which birds and other primary herbivores depend. Thus, the number of primary consumers (birds and monkeys) is always greater than the number of producers (big fruit-bearing trees). Again the number of secondary consumers (carnivores such as snakes and lizards) is less than primary consumers and obviously the number of top (tertiary) carnivores (lions and tigers) is the least. Thus, the shape of the pyramid looks as shown in Fig. 3.5.

Q.1. (*d*) Define and explain in-situ and ex- situ biodiversity conserva

Ans. Ex-Situ Conservation: Ex-situ conservation is the preservation of comp of biological diversity outside their natural habitats. This involves conserva genetic resources, as well as wild and cultivated or species, and draws on a divers of techniques and facilities. Such strategies include establishment of botanical g zoos, conservation strands and gene, pollen seed, seedling, tissue culture an banks.

In-situ Conservation: In-situ conservation is on site conservation conservation of genetic resources in natural populations of plant or animal s such as forest genetic resources in natural populations of tree species. It process of protecting an endangered plant or animal species in its natural h either by protecting or cleaning up the habitat itself, or by defending the from predators.

It is applied to conservation of agricultural biodiversity in agro forestry by f especially those using unconventional farming practices. In-situ conservati done by declaring area as protected area.

In India following types of natural habitats are being maintai

1. National parks
2. Wildlife sanctuaries
3. Biosphere reserves

INDIA has over 600 protected areas, which includes over 90 national park 500 animal sanctuaries and 15 biosphere reserves.

4.6 Conservation of Biodiversity

Conservation of biodiversity is aimed at the protection, preservation, management or restoration of natural resources such as the forests and their flora, fauna, and water. Thus, biodiversity conservation includes:

(i) Protection of all critically endangered, endangered, vulnerable, rare and other species of life present in the ecosystem.

(ii) Preservation of all varieties of old and new flora, fauna and microbes.

(iii) Protection and preservation of critical habitats, unique ecosystems.

(iv) Regulation of international trade in wildlife.

(v) Reduction of pollution.

(vi) Increase in public awareness.

Conserving biodiversity becomes a problem when there is lack of resources and a need to use the land for human activities. The term hotspot is used to define regions of high conservation priority with their biodiversity richness and high endemism and a high threat.

Conservation efforts are often focused on a single species. This is called 'keystone species' because the idea of conserving one species over others is more appealing. For example, conservation of tigers over say Zayante band-winged grasshoppers is not only more appealing and convincing, but it also attracts more resources, which can be used for the conservation of an endangered habitat.

However, the process of conservation can be broadly divided into two types:

(i) **In-situ Conservation:** In this type of conservation, the natural process and its interaction with the habitat as well as with all the elements of biodiversity are conserved. The establishment of protected areas such as national parks, sanctuaries and biosphere reserves is an example of in-situ conservation.

(ii) **Ex-situ Conservation:** In case of complete degradation of a habitat, in-situ conservation is not possible, as the endangered species need special care. In such cases, the endangered species is removed from the area and kept under total human supervision in places such as zoos, botanical gardens and seed banks. This is called ex-situ conservation.

4.6.1 In-situ Conservation

The basic principle of in-situ conservation is the protection and management of components of biological diversity through a network of protected areas in their natural habitat. In this method, the total ecosystem is

protected by eliminating the factors that are harmful to the existence of the species concerned. Not only, do the endangered species benefit from this, but all the constituent species present in that ecosystem benefit as well. In-situ conservation is a cheap, convenient and natural way of conservation. The species are allowed to grow in their own natural habitat with the conservationists playing a supportive role. As the species grow in their natural habitat, they face natural calamities such as rain, floods, droughts and snow, and thereby evolve into better-adapted forms. For this reason, the wild species are more resistant to the prevailing environmental conditions than the domesticated or hybrid varieties.

However, the main disadvantage of in-situ conservation is that it requires a large area for the complete protection of biodiversity. This implies a restriction of human activity and a greater overlap or interaction of wildlife with local residents near a reserve forest. People living on the outskirts of a natural reserve depend on the forest for their livelihood. At present there are 7,000 protected areas, parks, sanctuaries and natural reserves in the world, covering more than 650 million hectares of the earth's surface, which is about 5 per cent of the total global land area.

National Parks and Sanctuaries

These are small reserves for the protection and conservation of a few species in their habitat. A national park has a well-defined boundary. Sanctuaries do not have a well-defined boundary and tourists are allowed inside a sanctuary.

Natural Reserve or Biosphere Reserve

These are large, protected areas where the entire biotic spectrum of the climatic zone is preserved. These have boundaries properly identified by legislation. Exploitive human activity or tourists are allowed only up to the outskirts of these reserves areas, which are also scientifically managed.

Project Tiger

The tiger is the finest symbol of earth's natural heritage but tiger sightings these days are very rare in India because of poaching. Tiger poaching is a recurrent problem in countries such as, India, Bangladesh, Bhutan, Cambodia, China, North Korea, Indonesia, Laos, Malaysia, Nepal, Myanmar and Thailand. Almost all the body parts of a tiger are traded for huge amounts of money. Many believe that tigers have healing powers. They believe that tiger bones cure rheumatism, muscular weakness, back pain and enhance longevity. Tiger skins can fetch $1,50,000, the soup made from its penis is said to increase one's sexual prowess, the whiskers are potent poisons, tiger brain is used to treat acne, tiger tail mixed with soaps cures skin diseases and pills made from its eyes purportedly calms convulsions. Thus a tiger is considered equivalent to a big bag full of money.

Some species of this big cat are already extinct while others are endangered or close to extinction. According to the WWF, tigers are hunted primarily for the use of their body parts in Chinese medicine; these patented Chinese medicines have a huge demand in Asia. Tigers are also poached for souvenirs such as, their skin and mounted heads.

Efforts are being made to preserve this magnificent predator from extinction. Former Indian Prime Minister, the Late Indira Gandhi, launched Project Tiger in 1972, for the conservation and upliftment of the tiger population in India. At present, India has 27 tiger reserves, which extend from the high Himalayan region to the mangrove swamps of the Sundarbans and the thorny scrubs of Rajasthan. Of these 27 tiger reserves, Manas National Park of Assam has been declared a World Heritage Site by UNESCO. Table 4.7 gives a detailed list of the tiger reserves in India. However, more wildlife conservation laws and greater awareness among people are still required for the success of Project Tiger.

4.6.2 Ex-situ Conservation

Due to the degradation and fragmentation of habitat, a large number of species are on the verge of becoming extinct. Ex-situ conservation aims at protecting and preserving such endangered species in zoos, nurseries and laboratories. Breeding plants and animals under human care is the strategy employed by ex-situ conservation. Although, earlier it was not practiced for wildlife conservation today with the advancement of science and technology the practice has emerged as a well-defined technology for the purpose. The following are the two main steps for ex-situ conservation:

(i) Identification of the species to be conserved.

(ii) The selection of method to be followed for its ex-situ conservation.

(i) **Identification of the Species to be conserved:** Those species that are at the maximum risk of extinction are chosen for preservation. The life cycle of the species, its degree of specialization, rich location, dispersal ability, adult survival and atrophic status are studied for the final selection.

(ii) **Methods for Ex-situ Conservation:** From the study on the selected species, the method for its growth, reproduction and survival under ex-situ conservation is decided. The various methods adopted for ex-situ conservation of the critically endangered species are as follows:

(a) *Long-Term Captive Breeding*: If the species is being pushed into extinction due to habitat loss or by some adverse external conditions then they are removed from their natural habitat for long-term captive breeding. Captive breeding can increase their population and help the species to survive. Thereafter, as most of these species cannot survive in their wild habitat they are kept in zoos and botanical gardens under proper care.

(b) *Short-Term Propagation and Release*: If the population of a particular species decreases suddenly due to some temporary setback then it is removed from its natural habitat, maintained with ex-situ conservation methods, bred and later released into their natural habitat. Ex-situ crocodile conservation is an example of this method.

(c) *Animal Translocation*: If the population of a particular species decreases suddenly then some animals of the same species are brought from a similar habitat and released in the less populated area. For example, if the number of male tigers decreases in habitat number one, then male tigers of the same species are brought from some other area and released in this habitat so as to increase the tiger population here. However, the capture, transfer and release of wildlife from one area to another require maintenance of the species in captivity for a short period.

(d) *Animal Reintroduction*: When an animal becomes extinct from its natural habitat, attempts are made to reintroduce the species there. For this, newborn animals bred in captivity or animals caught in infancy and kept in captivity for some time then they are selected and released into the habitat from where the original population has disappeared. It is important to rehabilitate the reintroduced species or they too may suffer the same fate as the original species. For this purpose, proper maintenance of the natural habitat and constant observation of the reintroduced species is very important. These days radio collars are used for observation.

The capture, transfer and release of animals from one locality to another is difficult, so special drugs are administered to the target animal from a distance to immobilize the animal. Special emphasis is laid on the nutrition and health care of the animals by administering preventive medicines and systematic vaccinations to them.

Biosphere Reserves of India

Biosphere reserves are protected areas of representative ecosystems of terrestrial as well as coastal areas. They are internationally recognized under the Man and the Biosphere (MAB) Programme initiated by UNESCO in 1971. A biosphere reserve is aimed at:

(i) In-situ conservation of biodiversity of natural and semi-natural ecosystems and landscapes.

(ii) Contribution to sustainable economic development of the human population living within and around the biosphere reserve.

(iii) Providing facilities for long-term ecological studies, environmental education, training, and research and monitoring.

Thus, these reserves could serve as a referral system for monitoring and evaluating changes in the natural ecosystem. A biosphere reserve is classified into three zones:

Core Zone: This zone is meant for the conservation of biological diversity and is securely protected. Non-destructive research work and low-impact activities like education and ecotourism can be conducted here.

Buffer zone: This zone surrounds the core zone and is used for cooperative activities such as environmental education, recreation, basic and applied research and so on.

Transition area: It surrounds the buffer zone and may be used for agricultural activities, settlement of local communities, NGOs', cultural groups and by other stakeholders for economic interests and sustainable development of the area's resources.

Globally, 425 biosphere reserves have already been established in 95 different countries since 1979.

The Government of India constituted a panel of experts in 1979, to identify potential areas of biosphere reserves under the MAB Programme of UNESCO. The experts identified 14 sites to be declared as biosphere reserves. Of them, 13 sites were declared biosphere reserves in 2005 and later Achanakmar-Amarkantak was declared the 14th biosphere reserve of India. Table 4.8 lists the biosphere reserves of India that have been declared till date.

Q.1. (e) What is soil erosion ? Briefly explain different soil conservation methods. **(2.5)**

Ans. Soil erosion is the washing or blowing away (by water or wind) of the top layer of soil (dirt).Soil erosion is one form of soil degradation. The erosion of soil is a naturally occurring process on all land. The agents of soil erosion are water and wind, each contributing a significant amount of soil loss each year. Soil erosion may be a slow process that continues relatively unnoticed, or it may occur at an alarming rate causing serious loss of topsoil. The loss of soil from farmland may be reflected in reduced crop production potential, lower surface water quality and damaged drainage networks.

While erosion is a natural process, human activities have increased by 10-40 times the rate at which erosion is occurring globally. Excessive (or accelerated) erosion causes both "on-site" and "off-site" problems. On-site impacts include decreases in agricultural productivity and (on natural landscapes) ecological collapse, both because of loss of the nutrient-rich upper soil layers. In some cases, the eventual end result is desertification. Off-site effects include sedimentation of waterways and eutrophication of water bodies, as well as sediment-related damage to roads and houses. Water and wind erosion are the two primary causes of land degradation; combined, they are responsible for about 84% of the global extent of degraded land, making excessive erosion one of the most significant environmental problems world-wide.

Different method of soil conservation

1. Afforestation: It means growing the forest over culturable wasteland.

2. Reforestation: Growing the forest again over the lands where they were existing and was destroyed due to fires, overgrazing, and excessive cutting. Reforestation checks water logging, floods, soil erosion and increase productivity of land.

3. Providing surface cover: The easiest way to protect the land surface from soil erosion is of leave crop residue on the land after harvesting.

4. Mulching: Here also protective cover of organic matter and plants like stalks, cotton stalks, tobacco stalks etc. are used which reduce evaporation, help in retaining soil moisture and reduce soil erosion.

5. Changing Ground Topography on Downhill's: Running water erodes the hill soil and carries the soil along with it. This can be minimized by following alternation in ground topography:

(a) Strip farming: Different kinds of crops are planted in alternate strip along the contour.

(b) Terracing: In this arrangement, the earth is shaped in the form of levelled terraces to hold soil and water. The terrace edges are planted with such plant species which anchor the soil.

(c) Contour ploughing: In this arrangement, the ploughing of land is done across the hill and not in up and down style.

6. Leaching: In salt affected land, the salinity can be minimized by leaching them with more water.

7. Changing agricultural practices: Like mixed cropping, crop rotation and cropping of plants are adopted to improve soil fertility.

8. Ecological Succession: This refers to the natural development or redevelopment of an ecosystem which help in reclaiming the minerally deficient soil of wasteland.

Soil Erosion

Soil erosion is one of the outcomes of land degradation caused both by natural processes as well as human activities. The continuous eroding away of the earth's crust by the forces of weather is known as soil erosion. Normal geological erosion is very slow and it tends to bring the earth's surface to a uniform level. When this soil erosion is accelerated due to different human activities it is called artificial or accelerated erosion. Deforestation and overgrazing are the most prominent causes of soil erosion. Depending upon the factors causing it, erosion is classified as wind erosion, gully erosion, water erosion, coastal erosion and so on.

Soil erosion is the washing or wearing away of the topmost layer of soil. By this process not only is the productivity of the eroded land destroyed but when the top soil run-off lands on top of other productive soil, it destroys the productive soil as well.

However, soil erosion can be prevented by using remedial measures. Wind erosion can be prevented by planting trees to break the wind force. Trees can also check soil erosion by holding together the soil particles. Water erosion can be checked by terracing, contour cultivation or through strip cropping.

Overgrazing

The increase in livestock population with simultaneous decrease in grazing land has resulted in the overexploitation of natural resources. India supports about 85 per cent of the world's total livestock such as buffaloes, cattle, goats and sheep, with only 1/40th of the total land area of the world at its disposal. The result is overgrazing on fallow, uncultivated forestlands. This uncontrolled grazing removes the ground vegetation, causing soil erosion and gradual depletion of soil organisms which turn the land to wasteland.

Soil conservation through a planned growth of fodder and grasslands on the outskirts of dense forests and wastelands can check soil erosion and simultaneously solve the problem of overgrazing.

Mining Activities

With the advancement of science and technology, our underground resources are now excavated through mining activities. For this usually, the two principles of opencast mining and underground mining are followed. In opencast mining, the underground resources are excavated directly by removing the topsoil and other strata. As a result, the total area gets destroyed and loses its productivity. In underground mining, the minerals are mined through tunnels. When the mine is abandoned after mining, the whole area collapses into a big depression and becomes a wasteland.

Q.2. (a) Discuss the process of Ecological Succession. **(4)**

Ans. Ecological succession is the gradual process by which ecosystems change and evelop over time. Nothing remains the same and habitats are constantly changing.

• The species living in a particular place gradually change over time as does th physical and chemical environment within that area.

• Succession takes place because through the processes of living, growing an reproducing, organisms interact with and affect the environment within an area gradually changing it.

• Each species is adapted to thrive and compete best against other species unde a very specific set of environmental conditions. If these conditions change, then th existing species will be outcompeted by a different set of species which are bette adapted to the new conditions.

• Change in the plant species present in an area is one of the driving forces behin changes in animal species. This is because each plant species will have associate animal species which feed on it. The presence of these herbivore species will the dictate which particular carnivores are present.

• Succession occurs on many different timescales, ranging from a few days t hundreds of years.

There are two main types of succession, primary and secondary.

Primary succession is the series of community changes which occur on an entire new habitat which has never been colonized before. For example, a newly quarried ro face or sand dunes.

Secondary succession is the series of community changes which take place on previously colonized, but disturbed or damaged habitat. For example, after felling tre in a woodland, land clearance or a fire.

3.4.6 Succession and Evolution of the Ecosystem

The conversion of a pond to a deciduous forest through various stages such as the development of mesic community, terrestrial community, scrubland and so on or generation and growth of different biospecies in an exposed parent rock are examples of evolution and succession in an ecosystem. So, ecological succession can be defined as a change of community over time, with modification of the physical environment.

Ecological succession is a two-step process. First, with the modification of the physical environment one community, mainly autotrophs, tries to survive in the most unfavourable environment, such as an open rock, sand dunes, or an aquatic system.

Evolution of a biospecies for the first time in a sterile area is known as primary succession. The first community is always autotrophic and is usually known as the pioneer community as its evolution occurs in a purely inorganic environment. The continuance of the life cycles of the pioneer community makes the environment rich in organic matter which helps the succession of the second community. As a lot of organic matter is available (sewage bed, organic waste), the secondary succession is mainly heterotrophic.

The succession process continues till a stable community is developed. The transitional series of communities which develop during succession are called seres or seral stages while the stable community that develops finally is called climax community which is mostly a deciduous forest. Series of different physical environments are depicted in Table 3.2.

Table 3.2 Evolution of Biospecies

Physical Environment	Biospecies
Aquatic system	Hydrach succession or Hydrosere
Exposed parent rock	Xosere
Dry sand (Desert)	Psammosere
Saline land	Halosere

The major terrestrial communities are different types of forests namely, moist tropical forest, montane subtropical forest, montane temperate forest, rain forest, deciduous forest, coniferous forest and so on. The major aquatic communities are inland water bodies, oceans, estuaries and so on.

Both terrestrial and aquatic communities show abundant biodiversity, depending on the variation of the environment. In an aquatic system, biodiversity depends on the variation of salinity of waters.

Q.2. (*b*) 'The flow of energy is one way and continuous in Ecosystem. Justi

Ans. The flow of energy is one way and continuous in an ecosystem: Ener flow is the amount of energy that moves through a food chain. The largest source energy for an ecosystem is the sun. Energy and nutrients are passed around through food chain, when one organism eats another organism. Any energy remaining in a d organism is consumed by decomposers. An example of energy flow in an ecosyst would begin with the autotrophs that take energy from the sun. Herbivores then feed the autotrophs and change the energy from the plant into energy that they can u Carnivores subsequently feed on the herbivores and, finally, other carnivores prey the carnivores.

In each case, energy is passed on from one trophic level to the next trophic level each time some energy is lost as heat into the environment. This is due to the fact t each organism must use some energy that they received from other organisms in or to survive. The top consumer of a food chain will be the organism that receives the l amount of energy.

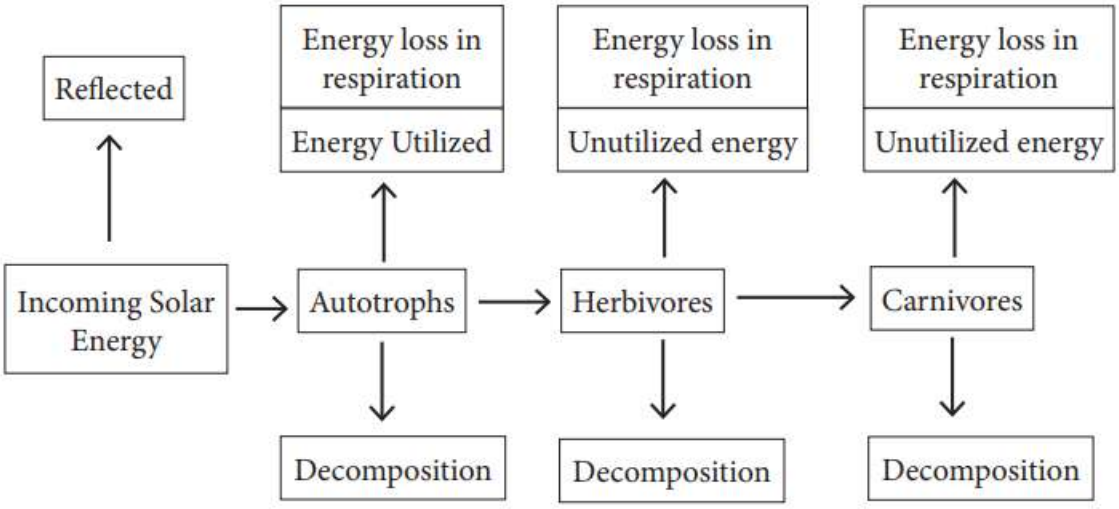


Figure 3.10 Flow of Energy in an Ecosystem

The dissipation of energy during its transmission from one trophic level to another is in agreement with the second law of thermodynamics which states that 'Processes occur spontaneously only if the sum total of the entropy of the system and its surrounding increases.' In other words, processes involving energy transformation will occur spontaneously if energy degradation takes place from a non-random to a random form of heat energy. From Fig. 3.10 it can be inferred that:

(i) Flow of energy is unidirectional. The solar energy trapped by an autotroph cannot revert to solar input.

(ii) Energy passes from herbivore to carnivore not vice versa.

(iii) Due to this unidirectional energy flow, the ecosystem can maintain its entity and prevent the collapse of the system (as shown in Fig. 3.11).

Thus, in an ecosystem there is:

(i) Transfer of materials by cycling in a food chain without any loss of nutrients.

(ii) Unidirectional flow of energy with its dissipation to the surroundings.

(iii) As the amount of energy available to the top carnivores is extremely small, organisms nearer the producers get more. Thus, a shorter food chain will support more numbers as shown in Fig. 3.12.

Q.2. (c) What are the major threats to Biodiversity . Explain giving real examples.

Ans. Some of the main threats to biodiversity are:

1. Human Activities and Loss of Habitat,
2. Deforestation,
3. Desertification,
4. Marine Environment,
5. Increasing Wildlife Trade and
6. Climate Change.

1. Human Activities and Loss of Habitat: Human activities are causing a loss of biological diversity among animals and plants globally estimated at 50 to 100 times the average rate of species loss in the absence of human activities. Two most popular species in rich biomes are tropical forests and coral reefs. Decreased biodiversity also interferes with essential ecological services such as pollination, maintenance of soil fertility, flood controls, water purification, assimilation of wastes and the cycling of carbon and other nutrients.

2. Deforestation: Current projections suggest that demand for wood will roughly double over the next 50 years, which will make increasing use of sustainable forest practices more difficult. In addition to threats to biodiversity and potential shortages in the supply of forest products, the degradation of forests represents an enormous potential source of green house gas emissions.

3. Desertification: Desertification and deforestation are the main causes of biodiversity loss. Both processes are decisively influenced by the extension of agriculture. The direct cost of deforestation is reflected in the loss of valuable plants and animal species. Desertification process is the result of poor land management which can be aggravated by climatic variations.

4. Marine Environment: In coastal areas, where human activities are concentrated, pollution, over-exploitation of resources, development of critical habitats such as wetlands, and mangroves, and water-flow from poor land-use practices have led to drastic reductions in near shore fisheries production and aquatic biodiversity

5. Climate Change: As climate warms, species will migrate towards higher latitudes and altitudes in both hemisphere. The increase in the amount of CO_2 in the air affects the physiological functioning of plant and species composition. Moreover, aquatic ecosystems, particularly coral reefs, mangrove swamps, and coastal wetlands, are vulnerable to changes in climate.

3. Overexploitation: Overhunting, overfishing and over-harvesting contribute greatly to the loss of biodiversity, killing off numerous species over the past several hundred years. Poaching and other forms of hunting for profit increase the risk of extinction; the extinction of an apex predator — or, a predator at the top of a food chain — can result in catastrophic consequences for ecosystems.

4.3 Threats to Biodiversity

The human drive for 'development', has led him to exploit more natural resources than are actually needed to improve the living conditions. This is responsible for endangering other species of the biosphere. These human actions are beginning to threaten biodiversity. The human urge to transform habitats and exterminate rivals and competitors has led to a lot of harm being caused to all ecosystems and species. Some of the major threats to biodiversity are:

(i) loss/degradation of habitat,
(ii) overexploitation of resources,
(iii) pollution,
(iv) extinction of species due to aggressive non-native species and
(v) global environmental changes.

4.3.1 Degradation of Habitat

A habitat is where every living being finds food, water and shelter to survive and a safe place to reproduce and bring up their offspring. So, loss of habitat is actually the greatest threat to the world. As per a global study by IUCN in 2000, 89 per cent of all threatened birds, 83 per cent of all threatened mammals and 91 per cent of all threatened plants have already been affected by loss or degradation of habitat. This can be caused by natural disasters like flood, fire, hurricanes and erosion. The human need for wood, minerals and water (dams) could also be responsible for this loss. Air and water pollution along with global climate changes also affects sensitive species.

Deforestation for agriculture (*jhum* cultivation), clearing of land for developmental work, overgrazing and so on, are also responsible for fragmenting habitats into small, isolated, scattered populations that are vulnerable to inbreeding, depression, high infant-mortality and susceptible to environmental stochasticity and possible extinction.

Changes in forest composition, quality and habitat-type, lead to a decline in primary food species for wildlife and eventually to loss of habitat. However, statistics show agricultural practices as one of the major causes of loss of habitat.

4.3.2 Overexploitation of Resources

Unlimited extraction (through mining, fishing, logging, harvesting and poaching) and development work (human settlement, industry and associated infrastructure) are the major factors that contribute to the overexploitation of resources. As a result of this overexploitation, tigers, giant pandas, black rhinoceros, musk deer, cod and several whale species are on the verge of extinction.

4.3.3 Pollution

Loss of biodiversity due to pollution is very common these days. When we pollute nature with the waste generated by us, only the biodegradable waste gets broken down slowly and gets recycled. But the non-biodegradable or less biodegradable waste remains in the environment and enters our food chain. This waste travels through the food webs, gets biomagnified and reaches the tissues of all living species. These wastes are very toxic and sometimes their toxicity increases with time. A very common example of this is the organic pesticide DDT which affects all types of birds (peacocks, hawks, kites, and so on). Therefore, pollution in various forms is responsible for global climatic changes and for the extinction of most of the species till date.

4.3.4 Extinction of Species due to Aggressive Non-native Species

Despite its importance, this aspect is often overlooked particularly in island areas. When two or more species are inter-dependent or a particular species has strong links with another, the Domino Effect takes place causing extinction of the weaker species. It is the reported cause of extinction of almost 50 per cent species on islands all over the world since 1600 AD.

4.3.5 Global Environmental Change

Scientists feel that 35 per cent of the world's existing terrestrial habitat may face extinction due to global warming. Global warming is a result of the accumulation of Greenhouse gases. It causes the global environment

to change and leads to the extinction of many species which fail to adapt and acclimatize to the changing environmental conditions.

However, poverty, macro-economic policies, international trade factors, policy failures, poor environmental laws or weak enforcement of the same, unsustainable developmental projects and a lack of local control over resources as well as population pressure are some of the underlying causes of biodiversity loss. Increase in the collection of fuel wood, fodder and grazing of animals belonging to local communities also take a toll on the forest and its biodiversity.

4.4 Threats to Indian Biodiversity

With 7.31 per cent species of fauna and 10.78 per cent floral species in the world, India is very rich in biodiversity. It has 89,451 animal species and several floral species, one-third of which are endemic to the country. These species are concentrated in the North East, Western Ghats, North West Himalayas, Lakshadweep and the Andaman and Nicobar Islands. But today, this rich biodiversity is under severe threat because of:

(i) loss/degradation of habitat due to agriculture, extraction,

(ii) fragmentation and overexploitation of resources,

(iii) poaching and international trade of wild species and products,

(iv) economic and social causes such as poverty, government policies, environmental laws and enforcement, population pressure and unsustainable development projects and

(v) deforestation due to the collection of fuel wood, fodder, overgrazing and agriculture.

Hunting and poaching alone are responsible for bringing to the verge of extinction as much as 37 per cent of the birds, 34 per cent of the mammals and 8 per cent of the plants, in addition to many reptiles and fishes. In fact, some animals such as tigers are more in demand than others which leads them to be poached more often.

Islands are particularly susceptible to invasion by alien species. This poses a serious threat to 30 per cent of the birds and 15 per cent of the plant species.

pollutant when emitted by human industrial activities.

Q.3. (*a*) Explain how human activities have increased vulnerability to drought. Write about different types of drought. (4)

Ans. Human activities that can help trigger droughts include:

• Widespread cutting down of trees for fuel reduces the soil's ability to hold water drying out the ground, triggering *desertification* and leading to drought.

Of all human activities that have a direct or indirect impact on natural hazards, deforestation is by far the most significant. Deforestation is the removal or destruction of forest cover of an area. One of the major functions of a forest is to maintain the humidity level in the atmosphere. Lack of trees translates to the lack of root fibers that hold the topsoil. In the event of a drought, the topsoil flakes and gets blown by the wind, leading to severe dust storms.

• Constructing a dam on a large river may help provide electricity and water to irrigate farmland near the reservoir. However, it may also cause drought downstream by severely reducing the flow of water.

• Human activity like construction of roads can have a major impact on vulnerability of a mountain slope.

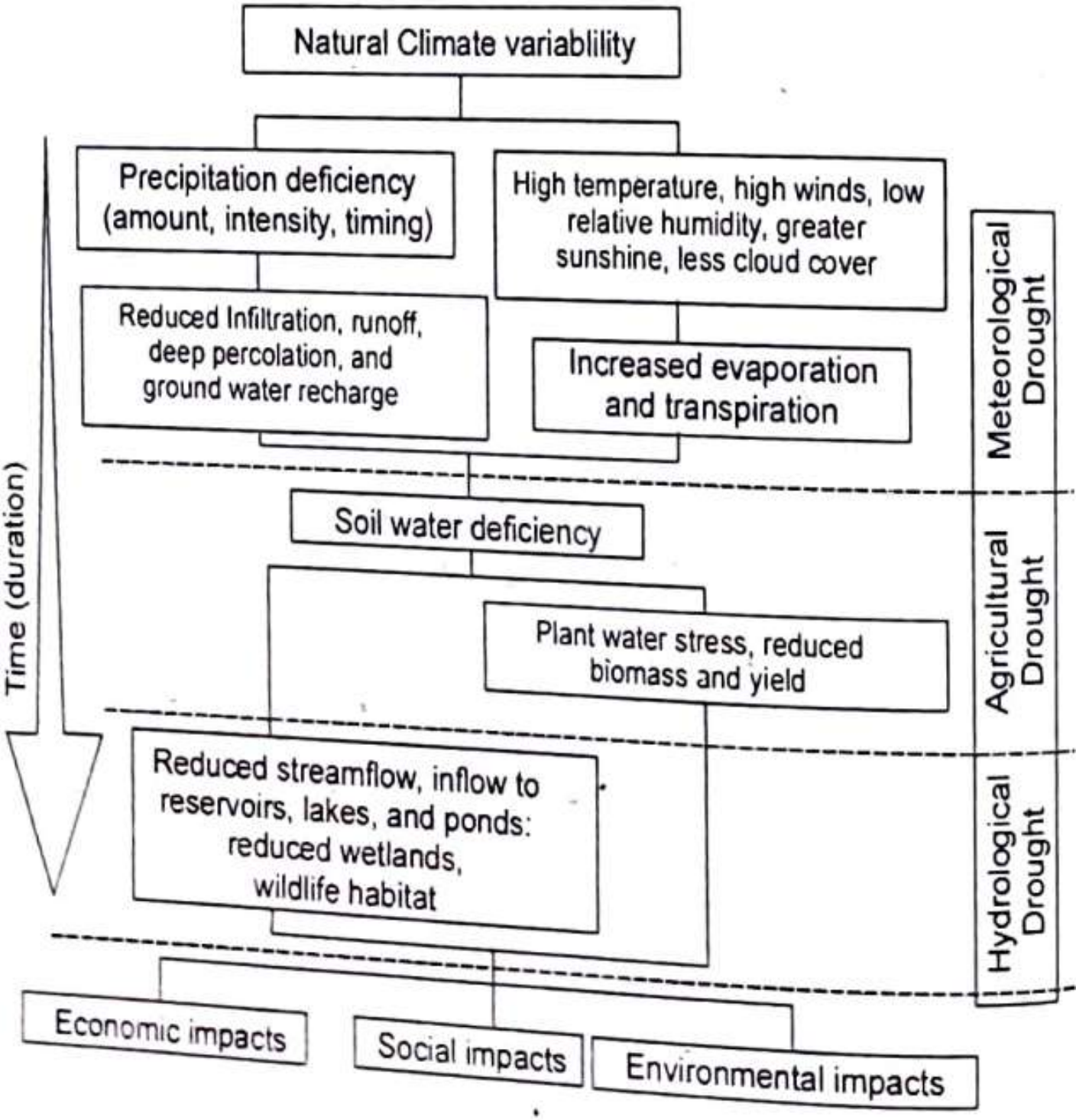
• Another type of mass movement that is seen in plain areas is subsiden Subsidence is vertical sinking of materials. In many unplanned cities, the city sprawled into areas not covered by municipal water distribution network indiscriminate ground water usage through bore wells have severely depleted wa tables. regions like the Raniganj – Jharia coal belt in India, improper mining excavati and inappropriate filling of excavated tunnels have led to widespread subsidence

TYPES OF DROUGHT

Meteorological drought: This kind is usually determined by the general lac moisture in the weather such as lack of precipitation, and the play of other weat conditions such as dry winds, high temperatures and so on. It is expressed in relatio the *average* conditions of the region over a long period of time. It is usually an indic of potential water crisis if the condition is prolonged. Meteorological drought can be and end immediately.

Agricultural drought: This is when atmospheric moisture is reduced to the ex that soil moisture is affected. Here, crops and animals are affected a evapotranspiration is also affected. It is often the signs one sees when a meteorolog drought is at play, but not before a hydrological drought.

Hydrological drought: This is when there is a deficiency of surface water ground water supply in a region, often as a result of less precipitation, excess reliance on surface water for farming, energy and other needs. Hydrological drou does not usually occur at the same time as meteorological drought. In a way, decline in the quantity and quality of surface and sub-surface water is the effec meteorological drought.


Natural Climate variablility
Precipitation deficiency (amount, intensity, timing)
High temperature, high winds, low relative humidity, greater sunshine, less cloud cover
Reduced Infiltration, runoff, deep percolation, and ground water recharge
Increased evaporation and transpiration
Soil water deficiency
Plant water stress, reduced biomass and yield
Reduced streamflow, inflow to reservoirs, lakes, and ponds: reduced wetlands, wildlife habitat
Economic impacts
Social impacts
Environmental impacts
Time (duration)
Meteorological Drought
Agricultural Drought
Hydrological Drought

Q.3. (*b*) How can we harness energy from ocean ? Explain different metho

Ans. The two main forms of energy associated with our oceans are: Ti power and wave power - born of the same source, but different in how they turn ener into electricity.

Tidal Power: Tidal power coverts the energy of tides into electricity utilizing t rise and fall of the ocean tides. The stronger the tide, either in water level height or ti current velocities, the greater the potential for tidal electricity generation.

Tidal power can be classified into two main types; Tidal Stream Systems and Barrag

• Barrages are similar to hydro-electric dams but are placed in an estuary bay river mouth, where they act as barriers that create artificial tidal lagoons. When wa levels outside the lagoon changes relative to water levels inside, turbines in the barra are able to produce electrical power. There are only three such structures in the wor the Rance River in France, Canada's Bay of Fundy, and Kislaya Guba, Russia.

• Tidal stream systems make use of the kinetic energy of moving water to pow turbines. This technology simply relies on individual turbines which are placed in t water column; moored to be suspended, floating or anchored to the ocean floor. As t tide flows in or out, electrical energy is produced as water moves through the turbi

Wave Power: Ocean surface waves are also a considerable source of energy potent but energy that is not as restricted in terms of location as tidal energy systems. Typica wave energy is captured using buoys which generate mechanical energy as they oscill vertically from wave motion.

• Terminator devices extend perpendicular to the direction of wave travel a capture or reflect the power of the wave. Water enters through a subsurface opening i a chamber with air trapped above it and wave action causes the captured water colu to move up and down like a piston to force the air though an opening connected t turbine.

• A point absorber is a floating structure with components that move relative to each other due to wave action (e.g., a floating buoy inside a fixed cylinder). The relative motion is used to drive electromechanical or hydraulic energy converters.

• Attenuators are long multi-segment floating structures oriented parallel to the direction of the waves. The differing heights of waves along the length of the device causes flexing where the segments connect, and this flexing is connected to hydraulic pumps or other converters.

• Overtopping devices have reservoirs that are filled by incoming waves to levels above the average surrounding ocean. The water is then released, and gravity causes it to fall back toward the ocean surface. The energy of the falling water is used to turn hydro turbines.

Ocean Thermal Energy Conversion (OTEC) is a process that can produce electricity by using the temperature difference between deep cold ocean water and warm tropical surface waters. OTEC plants pump large quantities of deep cold seawater and surface seawater to run a power cycle and produce electricity. OTEC is firm power (24/7), a clean energy source, environmentally sustainable and capable of providing massive levels of energy.

Ocean (Tidal) Energy: In some countries, tidal energy is also used to rotate turbines and generate electricity. The energy derived from the rise and fall of the sea tide is converted into electricity in small, tide-driven turbines at sea shores. France was the first country to construct a major tidal electricity generation plant.

In India, places like the Gulf of Kutch, Cambay and Sundarbans are exploited for the most prospective tidal energy harnessing sites. Sea shores near Lakshadweep and the Andaman and Nicobar Islands are also found to be most suitable for the generation of electricity from the ocean. At both these places, cold water is available at a depth of 1,000 mm near the shore. In fact, a one MW plant for Lakshadweep Island has already been designed.

Tidal power potential of 9,000 MW has been identified in India. In Ocean Thermal Energy Conversion (OTEC) and wave energy, the temperature difference between warm, surface sea water (28–30°C) and cold, deep sea water (5–7°C) at 800 to 1,000 m depth in tropical waters is utilized to drive turbines to generate electricity. A floating OTEC plant can generate electricity even in the middle of the sea for offshore mining operations and so on.

Q.3. (c) Write down the negative impacts of timber extraction from forests. (2)

Ans. Wood used for engineering purposes like building houses, making furniture is called timber.

The major effects of timber extraction on forest and tribal people include:

- Poor logging results in a degraded forest.
- Floods may be intensified by cutting of trees or upstream watersheds.
- Loss of biodiversity.
- Climatic changes such as lower precipitation.
- New logging roads permit shifting cultivators to gain access to logged areas and fell the remaining trees.
- It results in forest fragmentation which promotes loss of biodiversity because some species of plants and animals require large continuous areas of similar habitat to survive.
- Exploitation of tribal people by the contractors.
- Soil erosion especially on slopes occurs extensively.
- Sedimentation of irrigation systems, floods may be intensified by cutting of trees on upstream.
- Scientific research documenting the impact of timber extraction indicate that it has resulted in fragmentation of the remaining forest, as well as decrease in biodiversity
- Loss of non-timber products and loss of long-term forest productivity on the site affect the subsistence economy of the forest dwellers.

2.3.1 Timber Extraction

Timber extraction results in deforestation and in the fragmentation of the last remaining forests. It harms valuable species of trees, birds and wild animals. In spite of this, it is sometimes necessary to extract timber, so as to meet the needs of a developing country. During the extraction of timber, cutting, felling and handling should be done selectively, carefully and in a planned manner, in order to save the remaining forests and biodiversity. The United Nations Food and Agriculture Organization (UNFAO) has framed certain guidelines for the same.

Timber extraction can be classified as follows:

(i) Clear felling;

(ii) Selective logging;

(iii) Mechanized logging;

(iv) Handlogging and

(v) Reduced-impact logging.

Clear felling generally means the complete destruction of native forest, modifying it by harvesting commercial trees to create an even aged group and removing non-commercial trees, if required. Now, industrial timber logging is being done through clear felling all over the world.

In selective logging, only large individual trees of a few economically marketable species are harvested. The other trees are left untouched till the next harvesting. Although in selective logging only three to 10 of the tallest trees are targeted per hectare, the damage done may be as high as 50 per cent of the total forest areas because of the need to create access routes, dragging cut trees on the forest floor and lack of planning.

In mechanized logging, heavy machineries are used to pull, lift and transport the trees. This process can be used in clear felling or selective logging operations.

Local people use handlogging for non-commercial felling of timber or clearing of forests for agriculture. This labour-intensive, non-mechanized means involves the felling of trees by hand-held chain saws and then transporting the logs manually. This method is used in peat swamp forests which are regularly water logged and where heavy machinery movement is not possible.

Reduced-impact logging is now a common feature in industrialized nations where environmental damage can be minimized through the selection of site-sensitive techniques of harvesting and logging.

Q.4. (*a*) Explain genetic diversity, species diversity and ecosystem diversity.

(3)

Ans. "Biodiversity" is often defined as the variety of all forms of life, from genes to species, through to the broad scale of ecosystems

Biological diversity includes 3 hierarchical levels.

Genetic diversity: It refers to the variation of genes within a species. The genetic diversity enables a population to adapt to its environment and to respond to natural selection. The amount of genetic variation is the basis of speciation. Genetic diversity within a species often increases with environmental variability.

Species diversity: Species are distinct units of diversity each playing a specific role in the ecosystem. Species diversity refers to the variety of species within a region. In nature, both the number and kind of species, as well as the number of individuals per species vary, leading to greater diversity.

Community and ecosystem diversity: Diversity at the level of community and ecosystem exists along 3 levels. It could be within-community diversity (alpha diversity), between-communities diversity (beta diversity) or diversity of the habitats over the total landscape or geographical area (gamma diversity).

(3)

Genetic Diversity

When there is a variation of genes within the same species (single population) and also among geographically separated populations it is called genetic variation. It is responsible not only for the difference in characteristics but also for the adaptation of organisms to a particular habitat or environment. Within the same species, while some individuals are taller than others, some have brown or blue eyes.

A change in external as well as internal factors is responsible for genetic variations. The species that is spread out over a large area interbreeds thereby spreading its genes but the species that is confined to a small area, has a low, very localized gene flow.

According to an estimate, there are 10,000,000,000 different genes distributed all over the biosphere though all of them do not make similar contributions towards genetic diversity.

Species Diversity

This diversity provides a quantitative idea of the number of species and the variety of species present in a particular ecosystem. Table 4.1 gives us the number of various life forms (species) described so far on earth.

Table 4.1 Species Diversity in the Biosphere

Sl. No.	Life Forms (Species)	No. Described
1	Virus	1,000
2	Bacteria	3,060
3	Cyanobacteria	1,700
4	Fungi	28,983
5	Algae	26,900
6	Lichens	18,000
7	Bryophytes	16,000
8	Pteridophytes	11,299
9	Gymnosperms	929
10	Dicotyledons	1,70, 000
11	Monocotyledons	50,000
12	Invertebrates	9,89,761
13	Mammals	4,000
14	Other vertebrates	48,853
15	Other forms	27,400

So far there are approximately 13.92 million species on earth and the expected number is about 25–30 million, with tropical and sub-tropical parts contributing around 70 per cent of the global biodiversity. Presently, about 3,000 scientists are engaged in exploring and identifying these life forms.

Species diversity is the most basic way to keep an account of biodiversity as it includes all forms of life from micro-organisms such as viruses and bacteria to multi-cellular kingdoms of plants, animals, and fungi.

Ecosystem Diversity

A broader scale of biodiversity depicts the differences between different habitats, ecological processes, and the ecosystem in which the species exist. Based on the physical structure and species composition, the ecosystem can be divided into:

(i) Terrestrial Ecosystems such as forests, grasslands, deserts and so on.

(ii) Aquatic Ecosystems: These are of two types:

  (a) Freshwater, consisting of lotic and lentic.

  (b) Marine, consisting of oceans and estuaries.

(iii) Artificial or Man-made Ecosystem consisting of lakes, croplands and so on.

Q.4. (b) Write a short note on Green Fuel. (3)

Ans. Green Fuel

• Green fuel is also known as bio fuel and is now being promoted as a substitute for the usual fossil fuels that are used to power our vehicles, generators etc.

• Bio fuel is a type of fuel that is made by distilling plant and animal materials and are said to be less polluting and environmentally friendlier that the popular fossil fuel.

• There are many types of green fuels that are now available and some of the popular ones are Ethanol and bio diesel.

• These fuels are made from plants and animals and there is a new source for green fuel that is currently being researched and that is algae.

E85 is the abbreviation that is used for a fuel blend that is made up of 85% denatured ethanol fuel and the remaining 15% is made of gasoline or any other hydrocarbon. Ethanol fuel is produced by using starch and sugar producing crops like corn and sugarcane. These crops are put through a fermenting process that produced ethanol.

TYPES OF GREEN FUEL

1. HYDROGEN: UNLIKE fossil fuels, hydrogen is in abundance. In fact, hydrogen makes up 75% of the universe we live in, so there's no danger of it running out any time soon. There are many advantages to running a hydrogen-powered car

2. BIODIESEL: BIODIESEL is a clean-burning renewable fuel made using a chemical process that converts natural vegetable oils and fats into a non-toxic and renewable form of energy. It is used as a replacement for standard diesel, but it can also be blended with diesel fuel in any proportion. Green diesel and biodiesel are some of many other forms of liquid biofuels that may be produced from vegetable or animal fats. All are mainly used for vehicle locomotion as they burn cleanly, are easily portable and contain high amounts of energy, thus making them compatible with combustion engines.

3. Liquefied Petroleum Gas (LPG): LPG is cleaner, cheaper and greener than regular fuel

4. Compressed Natural Gas (CNG): COMPRESSED natural gas (CNG) is a low-carbon fuel that can be used as an alternative to petrol or diesel. It's made from the same type of gas that is used for heating and cooking in the home. CNG burns far cleaner than conventional fuels and there is no shortage of the gas across the world.

5. ETHANOL: ETHANOL is an alternative to petrol and can be combined with regular unleaded fuel in any concentration, up to 100% pure ethanol. ETHANOL is made from fermentation of any sugar or starch from which alcohol may be made. It can also be produced from cellulosic combustion of bagasse and similarly inedible waste products or non-food energy crops.

Q.4. (c) Discuss conflicts/case studies over equitable sharing of river water: **(4)**

Ans. The **sharing of waters** of the Cauvery river has been the source of a serious nflict between the two **states** of Tamil Nadu and Karnataka. The genesis of this

conflict rests in two agreements in 1892 and 1924 between the erstwhile Madra Presidency and Princely State of Mysore. The 802 kilometres (498 mi) Cauvery rive has 44,000 km^2 basin area in Tamil Nadu and 32,000 km^2 basin area in Karnataka The inflow from Karnataka is 425 TMC ft whereas that from Tamil Nadu is 252 TMC . Tamil Nadu too had become heavily dependent on the river after they developed million of agricultural land around the river. They argued that the livelihood of farmers woul be affected if there was a change in the distribution of water.

The river dispute has attracted some of the most extreme protests and *dharnas*. I 1986, a farmer's association from Tanjavur, Tamil Nadu moved the Supreme Court (SC and demanded that a tribunal be formed for the adjudication for the Cauvery wate dispute. The next few years saw enough rain for the states to not create an uproar. I 1993, Tamil Nadu Chief Minister Jayalalithaa went on a sudden fast at the MG memorial in Chennai. She demanded Tamil Nadu's share of water as stipulated by th interim order.

In 1995, Karnataka received very little rainfall and hence could not obey th interim order. Tamil Nadu, on the other hand, approached the SC demanding relea of 30 tmcft of water.

On 12 September, the SC ordered Karnataka to release 12,000 cusecs of water day to Tamil Nadu until 20 September. That means Karnataka will end up releasi more water to its neighbour.

Indus Water Dispute between India and Pakistan: The dispute started with the Partition in 1947 when the Indus water basin was divided between India and Pakistan. Pakistan disputed India's share of irrigation water from the Indus river. The dispute ended in 1960 when the Indus Water Agreement was signed by the two countries after 12 years of World Bank-led negotiations.

Ganga Water Dispute between India and Bangladesh: This dispute too, started with the Partition in 1947 between India and East Pakistan (present Bangladesh). In 1962, India built and operated the Farakka Barrage 40 km away from the Indo-Bangladesh border for navigability of the Calcutta Port. This resulted in the escalation of the dispute regarding allocation of the flow of the Ganga River and its tributaries between India and Bangladesh and in the development of a rational plan for an integrated watershed development, including supplementation of the flow of the Ganga. During the long conflict, short term agreements were reached in 1977, 1982, and 1985 that temporarily settled the dispute between 1977 and 1982, and 1982 to 1984 and 1985 to 1988. In December 1996, a 30-year treaty was signed between the two riparian based on the 1985 accord to help reduce the regional tensions.

Cauvery Water Dispute: The Cauvery river is one of the most contentious sources of water in Southern India. Its watershed is divided between Karnataka (former princely state of Mysore) and Tamil Nadu (former Madras Presidency). Although Tamil Nadu does not control any of the Cauvery head waters, it is in possession of two of its tributaries, Bhavana and Moyar. Similar to the other divided watersheds (Mekong in Southeast Asia and Colorado in Western United States) there is peace in times of good rains.

The Cauvery Water Dispute has been a serious issue since 1974 when a 50-year-old agreement, signed in 1924 between Madras Presidency and Mysore State expired, compounding a century-old dispute over the vital interests of farmers in Tamil Nadu and Karnataka. According to Karnataka, the 1924 agreement entailed a discontinuation of the water supply to Tamil Nadu after 50 years. In 1991, the Supreme Court reassigned a tribunal to settle the dispute. The tribunal gave the decision that Karnataka must release 205 TMC of water from the Cauvery reservoirs to Tamil Nadu on a monthly basis. Karnataka declined to implement the order, arguing that if more than 100 TMC of water is released to Tamil Nadu, it would cause distress to its people.

Yamuna Water Dispute: The sharing of the waters of the Yamuna river between the three states of Uttar Pradesh, Delhi and Haryana comes with its own share of conflicts. The case was earlier referred to the Supreme Court for intervention and solution. When that failed, the recent political intervention resolved the issue. The Chief Ministers of the three states and the Central Government held conferences and resolved the issue.

Krishna–Godavari Water Dispute: This dispute was mainly about the inter-state utilization of untapped surplus water between the states of Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh and Orissa. After failed negotiations, the dispute was resolved by a tribunal judge who ordered equitable apportioning of water. The Krishna Tribunal reached its decision in 1973 and the verdict was published in 1976, while the Godavari Tribunal commenced hearing in 1974 and gave its final verdict in 1979. Meanwhile, the states continued negotiations among themselves and reached agreements on all disputed issues and the tribunal only endorsed the same.

Ravi–Beas Water Dispute: The present Ravi–Beas Water Dispute between Punjab and Haryana started in 1966 when Haryana became a separate state with a part of east Punjab. Ravi, Beas, Sutlej and Yamuna flow through both the states and the two states are highly dependant on irrigated agriculture. The two states disputed over the allocation of water. This resulted in an agreement in 1976 which Punjab has been disputing till now. A new agreement was made in 1981. Later, a tribunal was formed in 1986 to resolve the issue. The verdict of the tribunal has not yet been published or implemented.

Q. 1. Attempt any five of the following:

Q. 1. (a) State the objectives of the environmental studies. **(2)**

Ans. Objectives and Guiding Principles of Environmental Studies:

According to UNESCO (1971), the objectives of environmental studies are:

(a) Creating the awareness about environmental problems among people.

(b) Imparting basic knowledge about the environment and its allied problems.

(c) Developing an attitude of concern for the environment.

(d) Motivating public to participate in environment protection and environment improvement.

(e) Acquiring skills to help the concerned individuals in identifying and solving environmental problems.

(f) Striving to attain harmony with Nature.

Q.1. (b) Write short note on ecological succession.

Ans. Refer Q. 2. (c) of End Term 2017.

Q. 1. (c) What are the hotspots of biodiversity?

(2)

A biodiversity hotspot is a biogeographic region that is both a significant reservoir f biodiversity and is threatened with destruction.

The term biodiversity hotspot specifically refers to 25 biologically rich areas around he world that have lost at least 70 percent of their original habitat.

The remaining natural habitat in these biodiversity hotspots amounts to just 1.4 ercent of the land surface of the planet, yet supports nearly 60 percent of the world's lant, bird, mammal, reptile, and amphibian species.

List of Biodiversity Hotspots

- **North and Central America:** California Floristic Province, Madrean pine-oak oodlands, Mesoamerica
- **The Caribbean:** Caribbean Islands
- **South America:** Atlantic Forest, Cerrado, Chilean Winter Rainfall-Valdivian orests, Tumbes-Chocó-Magdalena, Tropical Andes
- **Europe:** Mediterranean Basin
- **Africa:** Cape Floristic Region, Coastal Forests of Eastern Africa, Eastern fromontane, Guinean Forests of West Africa; Horn of Africa; Madagascar and the Indian cean Islands; Maputaland-Pondoland-Albany; Succulent Karoo
- **Central Asia:** Mountains of Central Asia;
- **South Asia:** Eastern

Albany; Succulent Karoo and the Indian

- **Central Asia:** Mountains of Central Asia;
- **South Asia:** Eastern Himalaya, Nepal; Indo-Burma, India and Myanmar; Western Ghats, India; Sri Lanka
- **South East Asia and Asia-Pacific:** East Melanesian Islands; New Caledonia; New Zealand; Philippines; Polynesia-Micronesia; Southwest Australia; Sundaland; Wallacea;

- **East Asia:** Japan; Mountains of Southwest China
- **West Asia:** Caucasus; Irano-Anatolian

4.1.4 Hotspots in Diversity

According to British ecologist Norman Myers, certain ecosystems despite their small size account for a high percentage of global biodiversity. Many of these areas also suffer from logging, overexploitation of land due to excessive agriculture, hunting and climatic changes. Myers was the first to devise the concept of biodiversity hotspots so as to identify these areas and preserve the endemic species there.

Biodiversity hotspots are environmental emergency rooms (store houses) of the earth. They are biologically rich areas with a large percentage of endemic species. For example, a terrestrial biodiversity hotspot is based on plant diversity that has:

(i) At least 0.5 per cent or 1,500 of the world's 3, 00,000 species of green plants

(ii) Has lost 70 per cent of its primary vegetation.

Coral reefs and multiple taxa (species of coral, snails, lobster and fishes) signify marine hotspots. Most hotspots are found in tropical and sub-tropical areas because warm, moist tropical environments are conducive to the growth and reproduction of the species present there. Species and ecosystem diversity varies with altitude and depth. For instance, the mountainous environment (orobiome) is vertically divided into montana, alpine and nival ecosystems and diversity in the aquatic ecosystem (both marine and freshwater) species decreases as we go deeper. Biodiversity also tends to increase from the Poles to the Equator.

Keeping in mind Myers' definition of hotspots, biologists have identified areas of high endemism with species richness and labelled them as hotspots. Hotspots are defined as the localized concentration of biodiversity, and are in need of sincere conservation action. Conservation International has identified 25 terrestrial biodiversity hotspots around the world for conservation.

The identified hotspots around the world are:

Keeping in mind Myers' definition of hotspots, biologists have identified areas of high endemism with species richness and labelled them as hotspots. Hotspots are defined as the localized concentration of biodiversity, and are in need of sincere conservation action. Conservation International has identified 25 terrestrial biodiversity hotspots around the world for conservation.

The identified hotspots around the world are:

(i) Tropical Andes,
(ii) Meso-American forests,
(iii) Caribbean,
(iv) Brazil's Atlantic forests,
(v) Choco Darien/Western Ecuador,
(vi) Brazil's Cerrado,
(vii) Central Chile,
(viii) California Floristic Province,
(ix) Madagascar,
(x) Eastern Arc and coastal forests of Tanzania/Kenya,
(xi) Western African forest,
(xii) Cape Floristic Province (South Africa),
(xiii) Succulent Karoo,
(xiv) Mediterranean Basin,
(xv) Caucasus,
(xvi) Sunderland,
(xvii) Wallace (Eastern Indonesia),
(xviii) Philippines,
(xix) Indo-Burma (Eastern Himalayas),
(xx) South-Central China,
(xxi) Western Ghats of India and the Island of Sri Lanka,
(xxii) South-West Australia,
(xxiii) New Caledonia,
(xxiv) New Zealand and

(xxv) Polynesia and Micronesia Island complex including Hawaii.

A recent global study conducted over four years, by nearly 400 scientists and other experts has identified nine new hotspots; bringing the total to 34. These new hotspots are home to 75 per cent of the world's most threatened mammals, birds and amphibians. Originally, these hotspots covered 16 per cent of the earth's surface which has now reduced to 2.3 per cent due to human encroachment and habitat destruction.

The nine new hotspots are:

(i) East Melanesian Island,

(ii) Madrean Pine-Oak Woodland on the US-Mexico border,

(iii) Japan,

(iv) Horn of Africa,

(v) Irano-Anatolian region of Iran and Turkey,

(vi) Mountains of Central Asia,

(vii) Maputaland-Pondoland-Albany in southern Africa (parts of Mozambique, South Africa and Swaziland),

(viii) Himalayan region and

(ix) Eastern Afro-Montana along the eastern edge of Africa from Saudi Arabia to Zimbabwe.

However, World Wildlife Fund (WWF) replaced the biodiversity concept that Myers had devised in 1977 with the 'Global 200' Strategy in 1998. Global 200 expands the conservation priorities to 233 eco-regions, comprising 19 terrestrial, freshwater and marine major habitats thereby covering major biodiversities of the planet.

Q.1. (d) What are the consequences of drought?

Ans. Consequences of drought:

- In times of drought, the lack of water can often cause a decline in crop yields, a thus a reduction in income for farmers
- Drought can result in insect infestations and plant diseases,
- Increased erosion, habitat and landscape degradation
- Decrease in air quality and that of what water is present, as well as an increa risk of fire because of drier vegetation.
- Plant and animal species can suffer tremendously, and over time desertificat can happen with an extreme lack of moisture.
- Droughts have social impacts that can cause disputes between users of availa water, inequalities in water distribution between wealthy and poor, disparities in ar in need of disaster relief, and a decline in health.

Q.1.(e) Discuss the importance of forest.

Ans. Importance of forests

Atmospheric regulation:

- Absorption of solar heat during evapo-transpiration
- Maintaining carbon dioxide levels for plant growth
- Maintaining the local climatic conditions

Water shed production:

- Reducing the rate of surface run-off of water
- Preventing flash floods and soil erosion
- Producing prolonged gradual run off and thus safeguarding against drough

Erosion control: Holding soil by preventing rain from directly washing away.

Land bank: Maintaining soil nutrients and structure

Local use (consumptive use):

- Food: gathering plants, fishing, hunting from the forest
- Fodder for cattle
- Fuel wood and charcoal for cooking and heating
- Poles for building homes especially in rural and wilderness areas
- Timber for household articles and construction
- Fiber for weaving baskets, ropes, nets, string etc.
- Sericulture for silk
- Apiculture or rearing bees for honey
- Medicinal plants for traditional medicines

Market use (Productive use)

- Most of the above forest products are sold as a source of income for suppor the livelihoods of forest-dwelling people
- Minor forest produce like fuel wood, fruit, gum, fiber etc., which are collected sold in local markets as a source of income for forest dwellers
- Major timber extraction for construction, industrial uses, paper pulp etc.

Function	Types of Benefits
Centre of biodiversity	• Forests provide home to unique plants, animals and wildlife.
Watershed protection	• Forests reduce the pace of surface run-off of water and thus encourage its percolation. • They stop soil erosion and prevent flash floods. • They help in preventing droughts through prolonged, gradual run-off.

Function	Types of Benefits
Clean water	• Trees cleanse the ground because their root system filters water and clears toxins and impurities. • Trees facilitate storing of clean water and maintain the availability of water during summer, when it is most needed.
Land erosion control	• Forests hold soil by preventing rain from directly washing away soil. • They reinforce soil to avoid landslides in mountainous areas. • They maintain soil nutrients and structures.
Clean air	• Trees absorb solar energy and cool and refresh the air we breathe. • Theymaintain local climatic conditions. • They absorb carbon dioxide and harmful pollutants and release oxygen into the atmosphere.
Economic benefits	• Timber production and other wood-based industries constitute an important part of the national economy. • Forests supply wood for fuel. • They supply fodder for cattle. • Trees provide fibres for weaving baskets, ropes, nets, strings and so on. • Sericulture for silk, apiculture for honey and pollinating crops, medicinal plants for medicines are economically beneficial.

	others. • They provide foods, fruits, nuts, flowers, fish and meat. • Forests facilitate ecotourism.
Environment benefits	• Trees provide clean air. • They provide clean water. • They prevent global climate change through absorption of carbon dioxide, a leading Greenhouse gas, to produce wood and leaf matter, known as carbon sequestration. • They help in controlling soil erosion. • They absorb noise and reduce stress. • They provide an aesthetic place for mental peace and healing qualities. • They help in controlling climate and heat island effects resulting from city environments. • Forests also help in global recycling of water, carbon and nitrogen.

The overexploitation of forest resources has resulted in a serious threat to mankind. This was the cause of heated discussions at the Earth Summit in June 1972 at Rio de Janeiro on the topic of global transition to sustainable forest management. Forest cover all over the world is depleting fast, thus endangering rare varieties of plants, wildlife and other natural resources. India itself is losing about 15 lakh hectares of good forest land annually, which is estimated to be equivalent to the country's total consumption of oil, coal and electricity.

Q.1.(f) Discuss the ocean thermal energy.

Ans. Refer Q. 5. (b) of End Term Examination 2018.

Q.2. (a) "The need for public awareness about environment is of vital importance." Discuss. **(3)**

Ans. If we have to improve the **environment**, public awareness is the primary requirement. There are a number of ways in which we can spread awareness and educate the public how to protect the environment.

i. Running awareness campaigns

ii. Providing environmental education at the school level

iii. Regulating environmental legal rights and responsibilities

iv. Spreading awareness via the media

v. Encouraging public participation

Today, these initiatives are being undertaken by the government, the media, as well as by schools at a considerable level. The government plays an important role in creating public awareness. The 'Environmental Education, Awareness and Training' programme of the Government of India aims at developing public knowledge and skills to protect the environment.

Q. 2. (b) Explain ecological pyramid. Discuss the nutrients and energy flow in an ecosystem. **(4)**

Ans. Ecological pyramid:

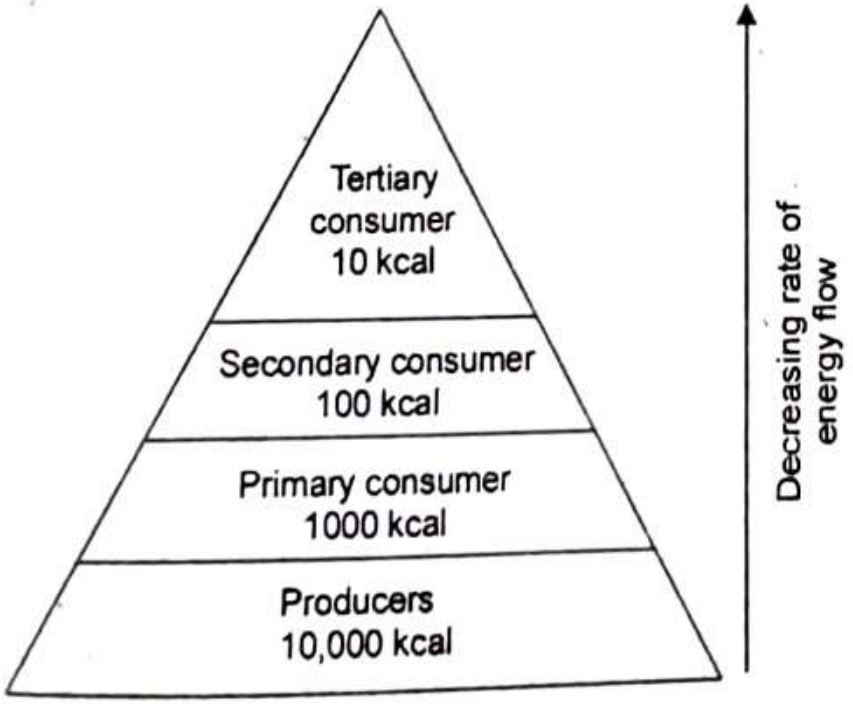
There are 3 types of ecological pyramids as described as follows:

• Pyramid of energy • Pyramid of numbers • Pyramid of biomass.

Pyramid of Energy:

The pyramid of energy or the energy pyramid describes the overall nature of the ecosystem. During the flow of energy from organism to other, there is considerable loss of energy in the form of heat. The primary producers like the autotrophs there is more amount of energy available. The least energy is available in the tertiary consumers. Thus, shorter food chain has more amount of energy available even at the highest trophic level.

- The energy pyramid always upright and vertical.
- This pyramid shows the flow of energy at different trophic levels.
- It depicts the energy is minimum as the highest trophic level and is maximum at the lowest trophic level.
- At each trophic level, there is successive loss of energy in the form of heat and respiration, etc.



Pyramid of Energy

Pyramid of Numbers: The pyramid of numbers depicts the relationship in terms of the number of producers, herbivores and the carnivores at their successive trophic levels. There is a decrease in the number of individuals from the lower to the higher trophic levels. The number pyramid varies from ecosystem to ecosystem. There are three of pyramid of numbers:

- Upright pyramid of number
- Partly upright pyramid of number and
- Inverted pyramid of number.

Inverted pyramid of number.

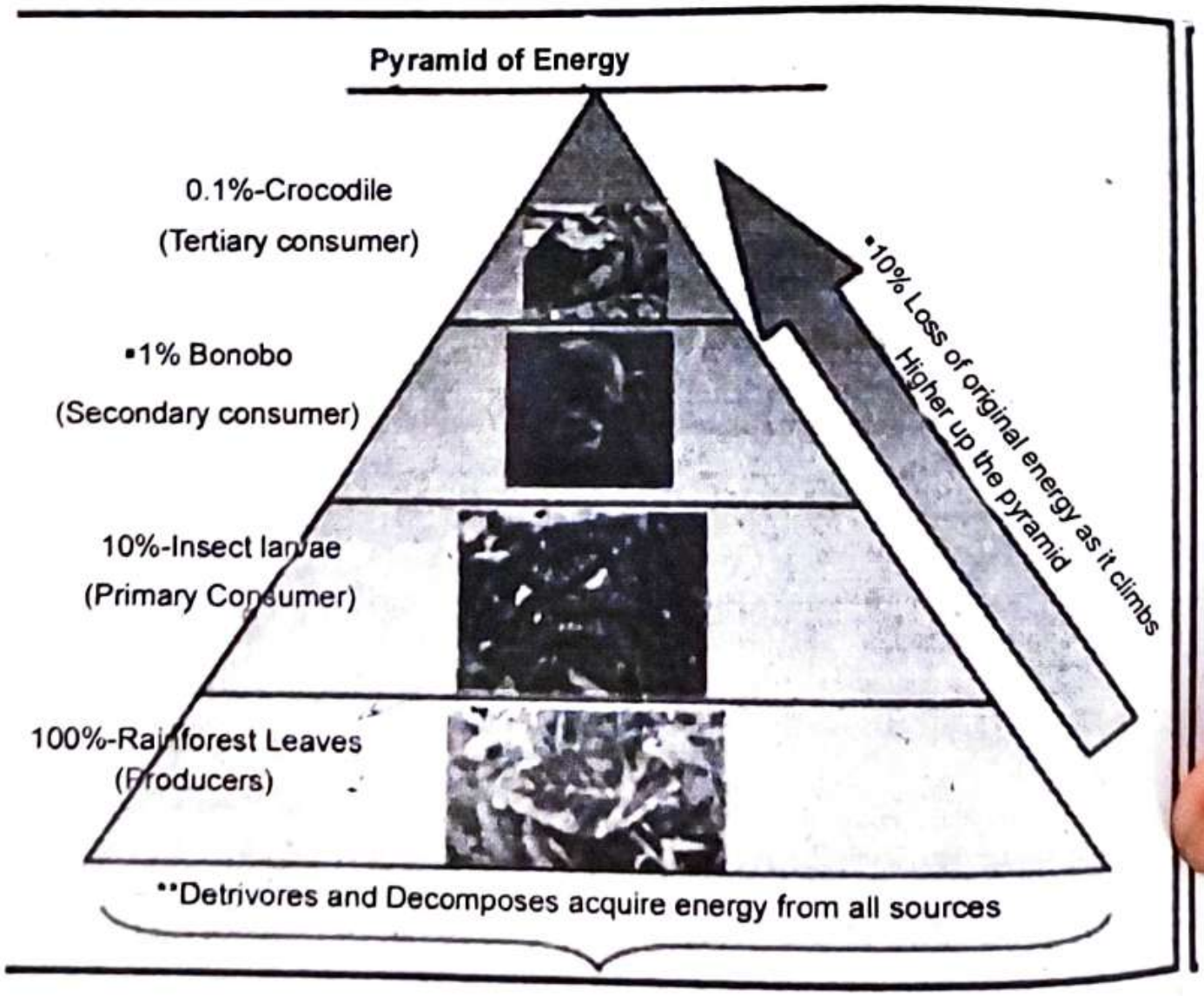
Pyramid of Biomass: The pyramid of biomass is more fundamental, they represent the quantitative relationships of the standing crops. In this pyramid there is a gradual decrease in the biomass from the producers to the higher trophic levels. The biomass here the net organisms collected from each feeding level and are then dried and weighed. This dry weight is the biomass and it represents the amount of energy available in the form of organic matter of the organisms. In this pyramid the net dry weight is plotted to that of the producers, herbivores, carnivores, etc.

There are two types of pyramid of biomass, they are:

- Upright pyramid of biomass and
- Inverted pyramid of biomass.

ENERGY FLOW IN ECOSYSTEM

ENERGY FLOW IN ECOSYSTEM



1. The energy starts with the sun

2. Plants produce metabolic energy via photosynthesis, wherein approximately 10% of their energy is stored in their tissues, available for consumption by a grazing herbivore. The rest of the solar energy was used by the plant in its own metabolism, lost as heat or lost as waste.

3. Of that 10% that an herbivore eats, only 10% of that is stored in its tissues to be eaten by a carnivore. Just like the plant, the other 90% of its metabolic energy is used up by the herbivore in functioning, excreting waste, and heat loss.

4. This continues up the pyramid with each subsequent carnivore only inheriting 10% of the previous level's energy.

5. By the time that the original solar energy hits the top of the pyramid, as little as 0.1% of the energy is consumed by the top predator; the rest is lost to metabolic activities.

6. Decomposers, such as bacteria, worms, and fungi, obtain the little amount of energy remaining in the tissues of dead plants and animals.

Naturient Flow of Ecosystem

Organisms that need to consume other organisms to obtain their energy are called **consumers** or **heterotrophs**. Animals, humans, fungi and bacteria are all consumers. They obtain their nutrients and energy by eating other organisms.

There are different types of consumers. There are primary consumers, known as **herbivores** that eat plants and are often eaten by other animals and there are secondary consumers, or **carnivores** that eat the herbivores. The consumers that are able to eat both plants and animals are known as **omnivores** while animals that eat only dead animals are called **scavengers**. Bacteria and fungi that return nutrients to the soil when they decompose dead animals and plants are called **decomposers**. The interaction between producers and primary and secondary and possibly tertiary consumers keeps an ecosystem healthy.

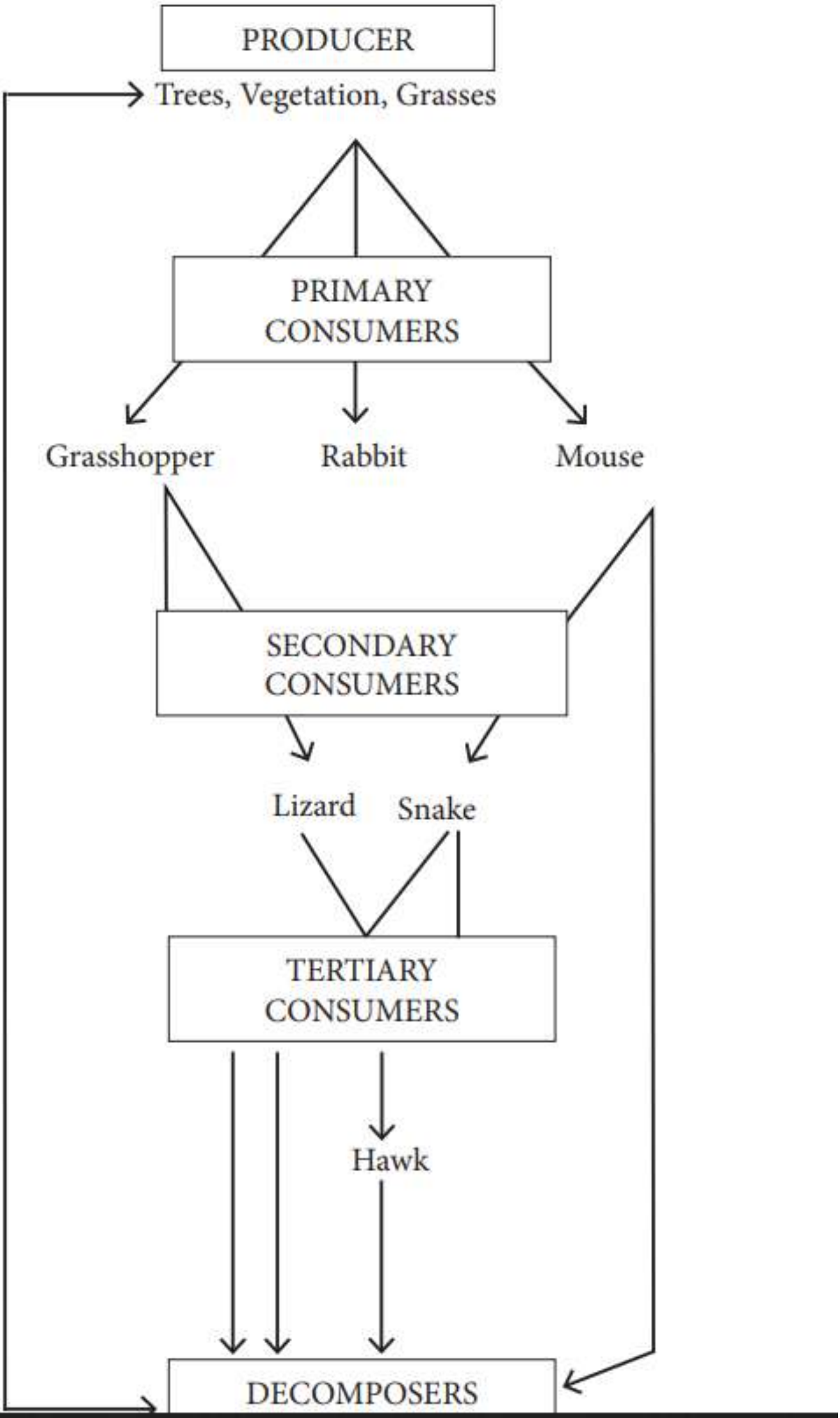
Ecological Pyramids

In 1927, scientist Charles Elton observed that the number of animals present at the top of the trophic level is much less compared to the number of animals present at the base of the food chain. He also plotted his findings on a graph to get a pyramid-like structure. He called this pyramid the Eltonian Pyramid after his name. It is also known as the ecological pyramid. Thus, an ecological pyramid is the graphical representation of the trophic structure (the position of organisms in the food chain) and function at successive trophic levels. The base of the pyramid consists of the food producer level. The successive levels make the tiers, with the top carnivores forming the apex. These ecological pyramids are of three types:

(i) Pyramid of numbers.

(ii) Pyramid of biomass.

(iii) Pyramid of energy.


PRODUCER
Trees, Vegetation, Grasses
PRIMARY CONSUMERS
Grasshopper
Rabbit
Mouse
SECONDARY CONSUMERS
Lizard
Snake
TERTIARY CONSUMERS
Hawk
DECOMPOSERS

Pyramid of Numbers: This pyramid deals with the relationship between the number of primary producers and consumers (herbivore and carnivore) of different orders. Depending on the nature of the food chain, in the present ecosystem the pyramid of numbers may be upright or inverted. For example, in a grassland ecosystem, the number of grasses (producer) is always high followed by primary consumers (herbivores like rabbits and grasshoppers) that are less, the secondary consumers (carnivores like snakes and lizards) that are lesser and finally the top carnivore, in this case hawks, which are the least in number. So the pyramid is upright in this case as shown in Fig. 3.4.

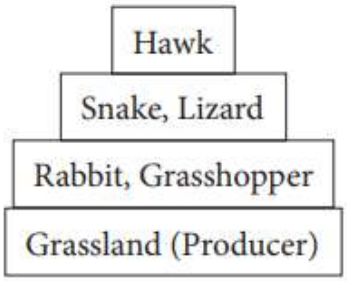


Figure 3.4 Pyramid of Numbers (Grassland)

On the other hand, in a forest ecosystem, the producers are big trees on the fruits of which birds and other primary herbivores depend. Thus, the number of primary consumers (birds and monkeys) is always greater than the number of producers (big fruit-bearing trees). Again the number of secondary consumers (carnivores such as snakes and lizards) is less than primary consumers and obviously the number of top (tertiary) carnivores (lions and tigers) is the least. Thus, the shape of the pyramid looks as shown in Fig. 3.5.

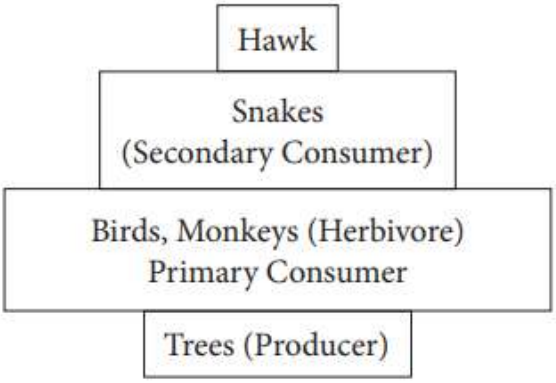


Figure 3.5 Pyramid of Numbers (Forest Ecosystem)

In case of a parasitic food chain the pyramids are always inverted. This is because a single plant (producer) supports a large number of herbivores (primary consumers). These, in turn, support a large number of parasites. Thus, the ecological pyramid, in this case, is always inverted as shown in Figure 3.6.

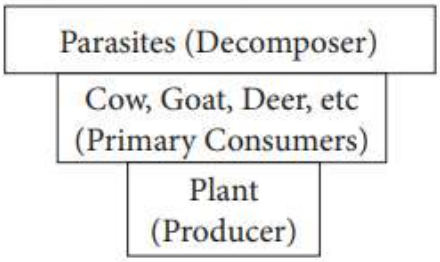


Figure 3.6 Pyramid of Numbers (Parasitic food chain)

As it is very difficult to count the exact number of all organisms, the pyramid of numbers cannot give a true picture of the trophic structure for an ecosystem. They generally vary with different communities having different types of food chains in the same ecosystem.

Pyramid of Biomass: In this concept, the individual in each trophic level is weighed instead of being counted. Thus, in a pyramid of biomass the total weight of each trophic level is represented. For most of the ecosystems on land (for example, forest and grassland), the biomass of producers is large (the base of the pyramid) and it gradually decreases with each successive layer resulting in an upright pyramid as shown in Fig. 3.7.

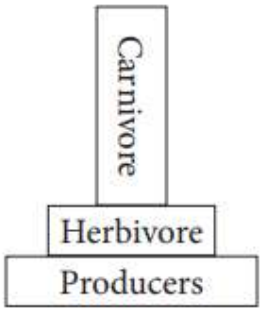


Figure 3.7 Pyramid of Biomass (g.dry – wt/Unit area) on Land (Forest, Grassland)

In the case of a pond ecosystem, the producers are tiny phytoplanktons which grow and reproduce rapidly. These phytoplanktons are consumed as fast as they reproduce (only survivors). In this case, the biomass of the consumer at any instant is more than the producer biomass. Thus, in the case of a pond or any aquatic ecosystem, the pyramid of biomass has an inverted shape as shown in Fig. 3.8.

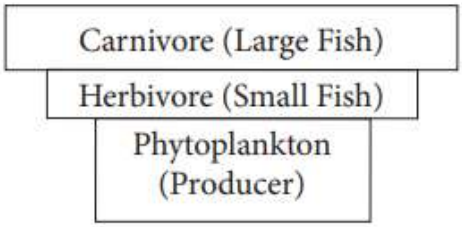


Figure 3.8 Pyramid of Biomass of an Aquatic Ecosystem

Pyramid of Energy: The pyramid of energy actually depicts the rate at which the food mass is passed through the food chain. It is based on the actual amount of energy that individuals take in, how much is burnt up in the metabolism, how much remains in the waste products and how much they store in the body tissue; this is a reflection of the laws of thermodynamics. Thus, the energy pyramid gives the best picture of the overall nature of the ecosystem. The actual amount of energy content in successive trophic levels from the producer to various consumers decreases. Hence, the shape of energy pyramid is always upright.

For example, a forest ecosystem receives 1,000 calories of sunlight in a day of which about 100 calories are stored in the plant. When any herbivore (primary consumer such as a deer or a goat) eats the plant, it receives 100 calories. But after its expenditure, its own metabolism lets it store 10 calories of energy. Thus, any carnivore (secondary consumer) eating the above herbivore will receive 10 calories. It can store one calorie of energy after its expenditure for metabolism. Thus, the energy pyramid looks as shown in Fig. 3.9.

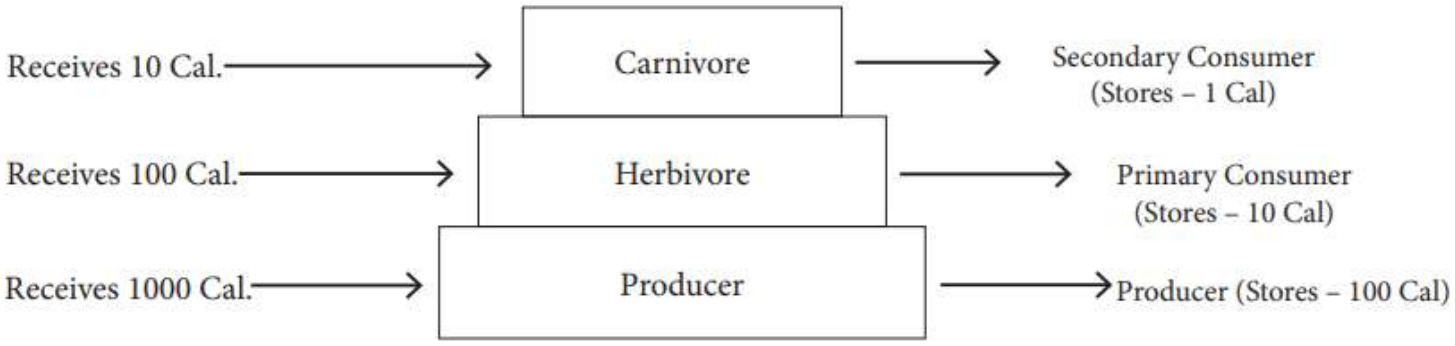


Figure 3.9 Pyramid of Energy in an Ecosystem

Q. 2. (c) Discuss the various approaches for conservation of biodiversity. **(3)**

Ans. There are two basic approaches towards conservation of bio diversity:

1. In situ conservation
2. Ex situ conservation

(1) In situ conservation: In-situ approaches include methods and tools that protect species, genetic varieties and habitats in the wild. It is a favourable approach amongst ecologists and conservationists to protect habitats and ecosystems.

(a) Biosphere reserves: Out of 425 biosphere reserves in the world, 14 are in India. Hot spots are the areas / regions of high endemism and very high levels of species richness. There are 34 hot spots in the world, of which three are in India; namely Western Ghats and Sri Lanka, Indo-Burma and Himalaya.

(b) National parks and wildlife sanctuaries: India has 90 nationals parks and 448 wildlife sanctuaries.

Sacred groves: These are forest patches which were venerated and given total protection. It includes a number of rare, endangered and endemic species. Ex. Western Ghats, Khasi and Jaintia Hills in Meghalaya

(2) Ex situ conservation: Ex-situ approaches include methods that remove plants, animals and microbial species and genetic varieties from their environment. These are popular amongst agriculturalists and species-orientated biologists, and helps the maintenance of samples of species.

India has 35 botanical gardens and 275 zoological parks. By using Cryopreservation (-196o C) technique, sperms, eggs, animal cells, tissues and embryos can be stored for long period. Plants are propagated by using tissue culture methods called micropropagation.

Q. 3. (a) Discuss the consequences of over-exploitation of mineral resources. (3)

(a) Mining is hazardous occupation:

1. This occupation involves several health risk dust produced during mining operation are injurious to health and cause lung diseases.

2. Extraction of some toxic or radioactive minerals leads to life threatening hazards.

3. Dynamite explosion during mining is very risky as fumes produced are extremely poisonous.

4. Underground mining is more hazardous than surface mining as there are more chances if accidents like roof falls, flooding and inadequate ventilation etc.

Increasing demand for high grade minerals has compelled miners to carry out more extraction of minerals, which require more energy sources and produce large amount of waste materials.

(b) Wastage of upper soil layer and vegetation:

Surface mining results in the complete destruction of upper soil layer and vegetation. After extraction, the wastes are dumped in an area which destroys the total surface and vegetation.

(c) Environmental problems:

Over exploitation of mineral resources resulted in many environmental problems like:

1. Conversion of productive land into mining and industrial areas.
2. Mining and extraction process are one of the sources of air, water and land pollution.
3. Mining involves huge consumption of energy resources like coal, petroleum, natural gas etc. which are in-turn non renewable sources of energy.
4. Surface mining directly degrades the fertile soil surface thus effect ecology and climate if that particular area.

Increasing demand for high grade minerals has compelled miners to carry out more extraction of minerals, which require more energy sources and produce large amount of waste materials.

(d) Wastage of upper soil layer and vegetation:

Surface mining results in the complete destruction of upper soil layer and vegetation. After extraction, the wastes are dumped in an area which destroys the total surface and vegetation.

(e) Environmental problems:

Over exploitation of mineral resources resulted in many environmental problems like:

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2. Mining and extraction process are one of the sources of air, water and land pollution.
3. Mining involves huge consumption of energy resources like coal, petroleum, natural gas etc. which are in-turn non renewable sources of energy.

Q.3. (b) What are the negative impacts of modern agriculture on environment? (3)

Ans. Refer Q. 4. (a) of End Term Examination 2017.

2.6.3 Effects of Modern Agriculture

The effects of modern agriculture, as discussed in world food problems and elsewhere, are not very good. The adverse impacts are:

(i) Soil pollution;
(ii) Contamination of water;
(iii) Water scarcity;
(iv) Global climate change;
(v) Water-logging;
(vi) Soil salinity and
(vii) Loss of genetic diversity.

Soil pollution can be traced to wind or water erosion of exposed top soil, compacting of soil, depletion of organic matter in the soil, loss of water retention capacity, reduction in biological activity, salination of soil, accumulation of irrigation water in irrigated farming area due to poor absorption or poor drainage and desertification due to overgrazing.

The use of pesticides and chemical fertilizers results in water contamination. Water is becoming increasingly scarce due to its overuse for irrigation and increase in domestic and industrial requirements.

Deforestation and loss of vegetation cover are the consequences of modern agriculture. This may cause climatic change in the area. Overirrigation and agriculture cause water-logging and salinity. Water-logging is caused by the excessive use of water in a land, mostly clayish land, due to overirrigation. The surplus water in the overirrigated land evaporates, resulting in an increase in the salt content in the soil which leads to a loss of crop productivity. Modern agricultural practices have also resulted in a serious loss of genetic variety of crops.

Fertilizer Pesticide Problems

The problems that arise from the usage of fertilizers and pesticides are commonly known. However, this has been discussed in the context of soil pollution in Unit-V.

Water-logging and Soil Salinity

Water-logging and soil salinity, as mentioned earlier, are caused by overirrigation.

When there is water-logging due to excessive rainwater, irrigation, flood in clay-type soil or in soil containing an impermeable layer of clay, plants decay because their roots cannot get enough oxygen to breathe and grow. Soil salinity is also due to overirrigation. When crops are over irrigated surplus water evaporates and the dissolved salts are left behind in the soil thereby increasing the salinity of both the soil and the remaining water. Increased soil salinity affects water intake by plants and thus their productivity. The effects are most evident in fruits, followed by vegetables and then crops.

(i) Shifting cultivation

Ans. Shifting cultivation that means the shifting of the land from the other place for the cultivation purpose. In that there is the there is the change of the place is take

place that means if there is the cultivation of the land is get reduced then by shifting it we can increase this.

In the different region of the country there is the one and unique features of the shifting of the land in the India. In the purpose of the minor and major variation these have featured in the two distinct patterns that are the (i) settled farming on the permanent and developed land in the plains and valley areas and (ii) tribal agricultural practices.

The shifting of the cultivation is also known as its famous word that is 'Jhumming', that name is give because the cultivation land can be on the slopes of the hills or it is called as the Jhum that is available in the area of the hills. This region is used by the peoples of the India that are in the region of the hills.

That is being used in the region of the hill areas of that is the North-Eastern Region, Sikkim, Bihar, Orissa, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, Kerala, Karnataka and Maharashtra.

Advantages of Shifting Cultivation:

- The best advantage of the shifting of the cultivation or the land on the hills side that is to provide the very easy and very fast method of the preparation of the land for the agriculture.
- The waste material of the field that is the bush and the weeds can be removed easily and that can be burn easily and can be obtaining the beneficial things for the cultivation
- In this shifting cultivation the growth of the crops will start fast and in the sometimes only it will get ready for the harvest.
- In this shifting of the cultivation there is no any fear or the danger for the flood and the animals which destroy the crops. On the hills there are the streams of the mountain which provide the water to the crops easily on the regular and normal rate.

Disadvantage of Shifting Cultivation:

- The most and the important disadvantage of the shifting cultivation is that to cut the Forrest and the trees that are helpful for the soil erosion and that is very helpful for the nature.
- By this there can be the heavy erosion of the soil is get affected and by this the revers that are in the in the plain and low laying areas like the Brahmaputra and Barak get flooded in the time of the heavy rain fall.
- By the shifting cultivation there is the loss of the 22 percent of the soil that is on the top of the soil and full with the fertility. This creates the serious problem in the economic rate of the peoples

Q.3.(c)(ii) Water logging and salinity

Ans. Salinisation is a process that results in an increased concentration of soluble salts in soil and water. Of these salts, sodium chloride, or table salt, is the most common. Salinity is the state of soils that have a high concentration of such salts. *Primary salinisation* is when salts accumulate in the soil and groundwater of an area over a long period of time due to natural processes.

Impacts of salinity

High soil salinity adversely affects plant growth of both native and introduced crop and pasture species. This is due to the toxicity of the salt ions, as well as the general osmotic effect of the soil around the roots of the plant, which reduces the ability of the plant to absorb water from the soil.

Increased salinity poses a significant threat to the health and wellbeing of many ecosystems, and to biodiversity as a whole. It can destroy remnant vegetation, leading to the disappearance of animal species that are dependent upon this vegetation for habitat.

High salinity not only makes the soil chemically toxic for plants, but it also affects the soil's physical properties.

Saline soils are also prone to erosion as a result of the death of vegetation that would otherwise have stabilised them.

Water logging

The waterlogging may be defined as rendering the soil unproductive and infertile due to excessive moisture and creation of anaerobic conditions.

Causes of water logging: They are as fallows

(i) Inadequate drainage of over-land run-off increases the rate of percolation and in turn helps in raising the water table.

(ii) The water from rivers may infiltrate into the soil.

(iii) Seepage of water from earthen canals also adds significant quantity of water to the underground reservoir continuously.

(iv) Sometimes subsoil does not permit free flow of subsoil water which may accentuate the process of raising the water table.

Adverse Effect of Water Logging

1. Depletion of oxygen in root zone and increase of CO_2 due to water logging. An aerobic condition adversely affects micro-organisms while harmful organisms proliferate and restrict the plant growth.

2. Physical or chemical and biological activities in the soil are disturbed due to low temp as a result of water logging. Thus pest and diseases infestation problem arises.

3. Water logging makes field operations difficult on impossible.

4. The adverse effects of water logging get accelerated when the capillary water brings salts from lower horizon of soil or they are present in the ground water used for irrigation.

5. Water logging adversely affect the soil water plant relationship there by creating ecological imbalance.

6. Secondary salinization caused by the salts which are brought up from lower horizon strict the uptake of moisture and nutrients in the plant roots and create toxic effect in the root system.

Q. 4. (a) What are major causes and consequences of deforestation? (4)

Ans. Causes of Deforestation

1. Agricultural Activities: Due to overgrowing demand for food products, huge amount of tress are fell down to grow crops and for cattle gazing.

2. Logging: Apart from this, wood based industries like paper, match-sticks, furniture etc also need a substantial amount of wood supply. Wood is used as fuel both

directly and indirectly, therefore trees are chopped for supplies. Firewood and charcoal are examples of wood being used as fuel. Some of these industries thrive on illegal wood cutting and felling of trees.

3. Urbanization: Further on order to gain access to these forests, the construction of roads are undertaken; here again trees are chopped to create roads. Overpopulation too directly affects forest covers, as with the expansion of cities more land is needed to establish housing and settlements. Therefore forest land is reclaimed.

4. Desertification of land: Some of the other factors that lead to deforestation are also part natural and part anthropogenic like Desertification of land. It occurs due to land abuse making it unfit for growth of trees.

5. Mining: Oil and coal mining require considerable amount of forest land. Apart from this, roads and highways have to be built to make way for trucks and other equipment. The waste that comes out from mining pollutes the environment and affects the nearby species.

6. Forest Fires: Hundreds of trees are lost each year due to forest fires in various portions of the world. This happens due to extreme warm summers and milder winters. Fires, whether causes by man or nature results in huge loss of forest cover.

Consequences of Deforestation:

1. Food problems: The soil in many deforested areas in also unsuitable for supporting annual crops.

2. Exposing soil to heat and rain: Heavy rainfall and high sunlight quickly damage the topsoil in clearings of the tropical rain forests.

3. Flooding: Deforestation can results to watersheds that are no logger able to sustain and regulate water flows from rivers to steams. Trees are highly effective in absorbing water quantities, keeping the amount of water in watersheds to a manageable level.

4. Displacement of indigenous communities: Some indigenous people's may of life and survival are threatened by the loss of forests. Fewer trees results an in secure future for forests workers.

5. Climate change: Deforestation can cause the climate to become extreme in nature. It increases CO_2 concentration in atmosphere and contributes to global warming.

7. Economic loss: The occurrence and strength of floods and droughts affecting the economy. It also leads to loss of future markets for ecotonism

8. Health issues: The stress of environmental change may make some species more susceptible to the effect of insects, pollution and disease

Q. 4. (b) Discuss the consumptives and productive values of biodiversity.

Ans. The direct values are of two types (1) Consumptive use value and (2) Productive use value.

1. Consumptive use value: These are the direct use values where the biodiversity products can be harvested and consumed directly. Example: Food, fuel and drugs. These goods are consumed locally and do no figure in national and international market.

(a) Food:

(i) Plants: The most fundamental value of biological resources particularly plants is providing food. Basically three crops i.e. wheat, maize and rice constitute more than two third of the food requirement all over the world.

(ii) Fish: Through the development of aquaculture, techniques, fish and fish products have become the largest source of protein in the world.

(b) Fuel: Since ages forests have provided wood which is used as a fuel. Moreover fossil fuels like coal, petroleum, natural gas are also product of biodiversity which are directly consumed by humans.

(c) Drugs and medicines: The traditional medical practice like ayurveda utilizes