1)PREFER FIVE MEASURES OF DEFORESTATION AND

2)OVER EXPLOITATION OF FOREST RESOURCES

answer for these two questions:

Forest resources :Uses of Forests

Commercial uses:

- Man depends heavily on a larger number of plant and animal products from forests for his daily needs.
- The chief product that forests supply is wood, which is used as fuel, raw material for various industries as pulp, paper, newsprint, board, timber for furniture items, other uses as in packing articles, matches, sports goods etc.
- Indian forests also supply minor products like gums, resins, dyes, tannins, fibers, etc.
- Many of the plants are utilized in preparing medicines and drugs; Total worth of which is estimated to be more than $300 billion per year.
- Many forests lands are used for mining, agriculture, grazing, and recreation and for development of dams.

Ecological uses:

The ecological services provided by our forests may be summed up as follows:

- Production of Oxygen: The main green house gas carbon di oxide is absorbed by the forests as a raw material for photo synthesis. Thus forest canopy acts as a sink for carbon di oxide thereby reducing the problem of global warming caused by green house gas CO2.
- Wild life habitat: Forests are the homes of millions of wild animals and plants. About 7 million species are found in the tropical forests alone.
- Regulation of hydrological Cycle: Forested watersheds act like giant sponges, absorbing the rainfall, slowing down the runoff. They control climate through transpiration of water and seed clouding.
- Soil Conservation: Forests bind the soil particles tightly in their roots and prevent soil erosion. They also act as wind breakers.
- Pollution moderators: Forests can absorb many toxic gases and can help in keeping the air pure and in preventing noise pollution.

Over Exploitation of Forests:

- Man depends heavily on forests for food, medicine, shelter, wood and fuel.
- With growing civilization the demands for raw material like timber, pulp, minerals, fuel wood etc. shot up resulting in large scale logging, mining, road-building and clearing of forests.

- Our forests contribute substantially to the national economy.The international timber trade alone is worth over US $ 40 billion per year.
- The devasting effects of deforestation in India include soil, water and wind erosion, estimated to cost over 16,400 crores every year.

Deforestation:

- Deforestation means destruction of forests.
- The total forests area of the world in 1900 was estimated to be 7,000 million hectares which was reduced to 2890 million ha in 1975 fell down to just 2,300 million ha by 2000.
- Deforestation rate is relatively less in temperature countries, but it is very alarming in tropical countries.
- Deforestation is a continuous process in India where about 1.3 hectares of forest land has been lost.
- The per capita availability of forest in India is 0.08 hectares per person which is much lower than the world average of 0.8 hectares. The presence of waste land is a sign of deforestation in India.

Causes of Deforestation:

Major causes of deforestation are listed below:

a) Development projects

b) Shifting cultivation

c) Fuel requirements

d) Construction of dams

e) Growing food needs

Consequences of deforestation:

Some of the effects of deforestation are listed below:

a) Effect on climate

1. Global warming

2. Less rainfall

3. Hot climate and others.

b) Effect on biodiversity

1. Loss of medicinal plants

2. Loss of timber, fuel wood and others.

c) Effect on resources

1. Loss of land resource

2. Loss of soil fertility

3. Soil erosion

4. Drastic changes in biogeochemical cycles

d) Effect on economy

1. Increase in medicinal values

2. Demand of industrial products and others

e) Effect on food

1. Loss of fruit production

2. Loss of root based foods

3)MORDERN AGRICULTURE AND OVER GRAZING:

Modern Agriculture:

Modern agriculture refers to high-input, technology-driven farming methods that use hybrid seeds, chemical fertilizers, pesticides, and advanced irrigation systems to increase crop yields and efficiency.

- The practice encourages **monoculture** (cultivation of single crop varieties over large areas), which increases susceptibility to pests and diseases; a disease outbreak can have devastating consequences due to uniform crop conditions.
- Heavy dependence on **chemical fertilizers** creates micronutrient imbalances (such as zinc deficiency), as seen in regions like Punjab and Haryana, negatively impacting soil productivity.
- **Nitrate pollution** from nitrogenous fertilizers seeps into groundwater. High nitrate concentrations (above 25 mg/L) can cause "Blue Baby Syndrome" (methaemoglobinemia) in infants, posing serious health risks.
- Runoff of fertilizers into water bodies leads to **eutrophication**, causing excess algal blooms and depletion of dissolved oxygen, thereby harming aquatic life.
- Use of **pesticides** has resulted in resistance among pests (“super pests”), harm to non-target beneficial organisms, and **biological magnification**—the build-up of toxic substances through food chains.

- Over-irrigation leads to **water logging** and **soil salinity**, particularly problematic in states like Punjab, Haryana, and Rajasthan, reducing crop yields and requiring remedial measures such as sub-surface drainage and bio-drainage.

Overgrazing:

Overgrazing occurs when livestock graze beyond the carrying capacity of grasslands, resulting in excessive removal of vegetation and severe land degradation.

- **Land degradation:** Overgrazing strips away grass cover and humus, leading to poor, compacted soils that are less fertile and more prone to drought and erosion.
- **Soil erosion:** Grasses anchor the soil through their roots. Their removal leaves soil loose and vulnerable to erosion by wind and water, further decreasing productivity.
- Loss of **useful species:** Valuable forage grasses are replaced by thorny, less nutritious varieties such as Parthenium and Xanthium, which do not protect soil effectively, thereby worsening erosion and diminishing livestock productivity.
- In severely overgrazed areas, livestock yield decreases, biodiversity declines, and barren wastelands form, requiring restoration and sustainable management practices to recover ecosystem health.

4) METHODS OF BIODIVERSITY AND CONSERVATION

Methods of Biodiversity

Biodiversity can be understood at different levels depending on how organisms are grouped or classified. The main methods of biodiversity are:

1. Genetic Diversity

- Variation in genes within a species. Includes differences in DNA sequences, traits, or inherited characteristics.
- Example: Different breeds of dogs, varieties of rice, or resistance to diseases in plants.

2. Species Diversity

- Variety of species within a particular region or ecosystem.Includes the number of species (richness) and how evenly individuals are distributed (evenness).
- Example: Forests containing mammals, birds, insects, and plants.

3. Ecosystem Diversity

- Variety of ecosystems in a region or globally.Includes different habitats, ecological processes, and interactions between organisms.

- Example: Deserts, wetlands, coral reefs, and tropical rainforests.

4. Functional Diversity (Optional Advanced Concept)

- Differences in how species perform roles in the ecosystem.Related to the interactions between organisms and their environment.
- Example: Pollinators, decomposers, and predators fulfilling different ecosystem roles.

5. Phylogenetic Diversity (Optional Advanced Concept)

- Diversity based on evolutionary relationships between organisms.Helps understand how species evolved and their genetic links.

Methods of Conservation of Biodiversity:

Biodiversity conservation aims to protect species, habitats, and ecosystems from extinction or degradation. The main methods are:

1. In-Situ Conservation (On-Site Conservation)

Protecting species and ecosystems in their natural environment.

Key approaches:

- **National Parks** – Areas where wildlife and plants are protected.
- **Wildlife Sanctuaries** – Focus on safeguarding specific species and their habitats.
- **Biosphere Reserves** – Larger areas with ecological importance where sustainable use is encouraged.
- **Sacred Groves** – Forests conserved by local communities due to cultural or religious beliefs.
- **Marine Protected Areas** – Conserving marine biodiversity.

Examples:

- Jim Corbett National Park (India)
- Sundarbans (Mangrove ecosystem)

2. Ex-Situ Conservation (Off-Site Conservation)

Preserving species outside their natural habitat.

Key approaches:

- **Botanical Gardens** – Cultivating rare plants.
- **Seed Banks** – Storing seeds for future regeneration.

- **Gene Banks** – Preserving genetic material of species.
- **Zoos and Aquariums** – Breeding endangered animals.
- **Cryopreservation** – Freezing cells or embryos for long-term storage.

Examples:

- Svalbard Global Seed Vault
- Arignar Anna Zoological Park (Chennai)

3. Community-Based Conservation

Encouraging local participation in conservation efforts.

Key approaches:

- Sustainable harvesting of resources. Education and awareness programs.
- Joint management of forests and wetlands.

4. Legal and Policy Measures

Laws and regulations help prevent illegal hunting, deforestation, and habitat destruction.

Important laws and treaties:

- **Wildlife Protection Act (India, 1972)**
- **Forest Conservation Act (India, 1980)**
- **Convention on Biological Diversity (CBD)**
- **CITES (Convention on International Trade in Endangered Species)**

5. Ecotourism and Education

Promoting awareness and economic benefits while preserving ecosystems.

Key approaches:

- Responsible tourism. Environmental education in schools and communities.

5)FOOD CHAIN AND FOOD WEB:

Food Chains

- ✓ The sequence of eating and being eaten in an ecosystem is known as food chain.
- ✓ All organisms, living or dead, are potential food for some other organism and thus, there is essentially no waste in the functioning of a natural ecosystem.
- ✓ A caterpillar eats a plant leaf, a sparrow eats the caterpillar, a cat or a hawk eats the sparrow and when they all die, they are all consumed by microorganism like bacteria or fungi (decomposers) which break down the organic matter and convert it into simple inorganic substances that can again be used by the plants-the primary producers.
- ✓ Some common examples of simple food chains are:
  - o **Grass → grasshopper→ Frog → Snake →Hawk (Grassland ecosystem)**
  - o **Phytoplanktons → water fleas → small fish → Tuna (Pond ecosystem)**
  - o **Lichens → reindeer → Man (Arctic tundra)**
- ✓ Each organism in the ecosystem is assigned a feeding level or trophic level depending on its nutritional status.
- ✓ Thus, in the grassland food chain, grasshopper occupies the I trophic level, frog the II and snake and hawk occupy the III and the IV trophic levels, respectively.

In nature, we come across two major types of food chains:

1. **Grazing food chain:** It starts with green plants (primary producers) and culminates in carnivores. Example: Grass→ Rabbit→ Fox
2. **Detritus food chain:** It starts with dead organic matter which the detritivores and decomposers consume. Partially decomposed dead organic matter and even the decomposers are consumed by detritivores and their predators.
   Examples: Leaf litter→ algae→ crabs→ small carnivorous fish→ large carnivorous fish (Mangrove ecosystem)
   Dead organic matter→ fungi→ bacteria (Forest ecosystem)

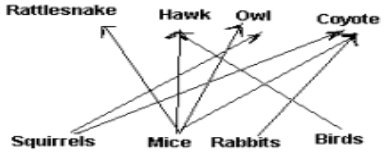
Both the food chains occur together in natural ecosystems, but grazing food chain usually predominates.

Food Web

- Food web is a network of food chains where different types of organisms are connected at different trophic level, so that there are a number of options of eating and being eaten at each trophic level.
- In a tropical region, the ecosystems are much more complex.
- They have rich species diversity and therefore, the food webs are much more complex.
- Food webs give greater stability to the ecosystem.
- In a linear food chain, if one species becomes extinct or one species suffers then the species in the subsequent trophic levels are also affected.

- In a food web, on the other hand, there are a number of options available at each trophic level.
- So if one species is affected, it does not affect other trophic levels so seriously.

For Example: Hawk eats both mice and birds. Coyote eats mice, rabbits and birds.



Significance of food chains and food webs:

- Food chains and food webs play a very significant role in the ecosystem because the two most important functions of energy flow and nutrient cycling take place through them.
- They help maintain the ecological balance.
- Food chains show a unique property of biological magnification of some chemicals.

6)IN-SITU AND EX - SITU

Conservation of Biodiversity

The enormous value of biodiversity due to their genetic, commercial, medical, esthetic, ecological and optional importance emphasizes the need to conserve biodiversity.

There are two approaches of biodiversity conservation:

(a) In situ conservation (within habitat): This is achieved by protection of wild flora and fauna in nature itself. E.g. Biosphere Reserves, National Parks, Sanctuaries, Reserve Forests etc.

(b) Ex situ conservation (outside habitats): This is done by establishment of gene banks, seed banks, zoos, botanical gardens, culture collections etc.

In Situ conservation:

At present in our country we have:

- ★ 7 major Biosphere reserves,
- ★ 80 National Parks,
- ★ 420 wild-life sanctuaries and
- ★ 120 Botanical gardens
- ★ They totally cover 4% of the geographic area.

The Biosphere Reserves conserve some representative ecosystems as a whole for long-term in situ conservation. In India we have:

- ✓ Nanda Devi (U.P.),
- ✓ Nokrek (Meghalaya),
- ✓ Manas (Assam),
- ✓ Sunderbans (West Bengal),
- ✓ Gulf of Mannar (Tamil Nadu),
- ✓ Nilgiri (Karnataka, Kerala, Tamil Nadu),
- ✓ Great Nicobars and Similipal (Orrisa)

A National Park is an area dedicated for the conservation of wildlife along with its environment. It is also meant for enjoyment through tourism but without impairing the environment. Grazing of domestic animals, all private rights and forestry activities are prohibited within a National Park. Each National Park usually aims at conservation specifically of some particular species of wildlife along with others.

Some major National Parks of our country are enlisted in the Table 2 below:

Table 2 Some important National parks in India

Name of National Park	**State**	**Important Wildlife**
Kaziranga	Assam	One horned Rhino
Gir National Park	Gujarat	Indian Lion
Bandipur	Karnataka	Elephant
Periyar	Kerala	Elephant, Tiger
Sariska	Rajasthan	Tiger

Wildlife sanctuaries are also protected areas where killing, hunting, shooting or capturing of wildlife is prohibited except under the control of highest authority. Some major wildlife sanctuaries of our country are shown in table 3.

Table 3 Some Important Wildlife Sanctuaries of India

Name of Sanctuary	State	Major Wild Life
Ghana Bird Sanctuary	Rajasthan	3oo species of birds (including migratory)
Sultanpur Bird Sanctuary	Haryana	Migratory birds
Mudamalai Wildlife Sanctuary	Tamil Nadu	Tiger, elephant, Leopard
Vedanthangal Bird Sanctuary	Tamil Nadu	Water birds
Wild Ass Sanctuary	Gujarat	Wild ass, wolf, nilgai, chinkara

For plants, there is one gene sanctuary for Citrus (Lemon family) and one for pitcher plant (an insect eating plant) in Northeast India.

Ex Situ Conservation:

This type of conservation is mainly done for conservation of crop varieties. In India, we have the following important gene bank/seed bank facilities:

(i) National Bureau of Plant Genetic Resources (NBPGR) is located in New Delhi. Here agricultural and horticultural crops and their wild relatives are preserved by cryo-preservation of seeds, pollen etc. by using liquid nitrogen at a temperature as low as – 196 degree Celsious. Varieties of rice, turnip, radish, tomato, onion, carrot, chilli, tobacco etc. have been preserved successfully in liquid nitrogen for several years without losing seed viability.

(ii) National Bureau of Animal Genetic Resources (NBAGR) located at Karnal, Haryana. It preserves the semen of domesticated bovine animals.

(iii) National Facility for Plant Tissue Culture Repository (NFPTCR) for the development of a facility of conservation of varieties of crop plants/trees by tissue culture. This facility has been created within the NBPGR.

For the protection and conservation of certain animals, there have been specific projects in our country e.g. Project Tiger, Girl Lion Project, Crocodile Breeding Project, Project Elephant, Snow Leopard Project etc.

7)ECOLOGICAL PRAMIDS:

Ecological Pyramids

Graphic representation of trophic structure and function of an ecosystem, starting with producers at the base and successive trophic levels forming the apex is known as an ecological pyramid.

Ecological pyramids are of three types:

I. **Pyramid of numbers**:
   a. It represents the number of individual organisms at each trophic level.
   b. We may have upright or inverted pyramid of numbers, depending upon the type of ecosystem and food chain as shown in Fig.1
   c. A grassland ecosystem (Fig. 1) and a pond ecosystem show an upright pyramid of numbers.
   d. The producers in the grasslands are grasses and that in a pond are phytoplankton (algae etc.), which are small in size and very large in number.
   e. So the producers form a broad base.
   f. The herbivores in grassland are insects while tertiary carnivores are hawks or other birds which are gradually less and less in number and hence the pyramid apex becomes gradually narrower forming an upright pyramid.

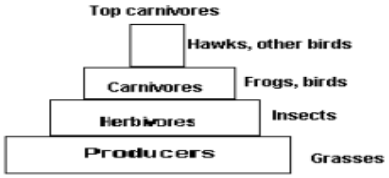


Fig: 1. Grassland ecosystem

II. **Pyramid of biomass:**
   a. It is based upon the total biomass (dry matter) at each trophic level in a food chain.
   b. The pyramid of biomass can also be upright or inverted. Fig.2. show pyramids of biomass in an aquatic ecosystem.
   c. The pond ecosystem shows an inverted pyramid of biomass (Fig. 2).
   d. The total biomass of producers (phytoplanktons) is much less as compared to herbivores (zooplanktons, insects), carnivores (Small fish) and tertiary carnivores (big fish). Thus the pyramid takes an inverted shape with narrow base and broad apex.

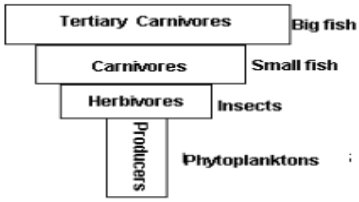


Fig:2 Pyramid of biomass in pond

III. **Pyramid of Energy**:
   a. The amount of energy present at each trophic level is considered for this type of pyramid of energy gives the best representation of the tropic relationships and it is always upright.
   b. There is a sharp decline in energy level of each successive trophic level as we move from producers to top carnivores. Therefore, the pyramid of energy is always upright as shown in Fig.3.

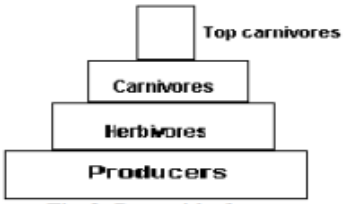


Fig:3. Pyramid of energy

8)ECOSYSTEM BY EXPLAINING FUNCTION OF COMPONENTS:

Introduction

An **ecosystem** is a functional unit where living organisms (plants, animals, and microorganisms) interact with each other and with non-living components like soil, water, air, and climate. These interactions maintain a balance in nature by supporting life processes and regulating the environment.

The ecosystem is mainly composed of **biotic (living)** and **abiotic (non-living)** components. Each plays an important role in maintaining the flow of energy, cycling of nutrients, and survival of species.

1. Abiotic Components (Non-living elements)

Abiotic factors create the physical environment that supports living organisms.

- **Sunlight** – Provides energy required by producers to perform photosynthesis.
- **Water** – Essential for metabolic activities, nutrient transport, and temperature regulation.
- **Air** – Supplies oxygen for respiration and carbon dioxide for photosynthesis.
- **Soil** – Offers minerals and nutrients necessary for plant growth.
- **Temperature and Climate** – Controls biological processes, species distribution, and ecosystem productivity.

Function:
Abiotic components create favorable conditions for living organisms, influence their growth, reproduction, and survival, and regulate ecosystem processes.

2. Biotic Components (Living elements)

The biotic components are classified into **producers, consumers, and decomposers**, all of which are interdependent.

a) Producers (Autotrophs)

Example: Plants, algae, and some bacteria.

Function:

Use sunlight to convert carbon dioxide and water into glucose through photosynthesis. Form the base of the food chain and supply energy to consumers.

b) Consumers (Heterotrophs)

- Organisms that depend on producers or other consumers for food.

Types of consumers:

1. **Primary consumers** – Herbivores that feed on plants (e.g., deer, rabbits).
2. **Secondary consumers** – Carnivores that feed on herbivores (e.g., snakes, frogs).
3. **Tertiary consumers** – Top predators that feed on secondary consumers (e.g., eagles, tigers).

Function:

Transfer energy from producers to higher trophic levels. Maintain ecological balance by controlling the population of other organisms.

c) Decomposers (Detritivores)

Example: Fungi, bacteria, earthworms.

Function:

Break down dead plants, animals, and waste material. Release nutrients back into the soil, making them available for producers. Help in nutrient recycling and sustaining the ecosystem.

3. Interaction Between Components

The ecosystem functions smoothly because of continuous interactions between abiotic and biotic components.

➤ **Energy Flow**

- Sunlight → Producers → Primary consumers → Secondary consumers → Tertiary consumers → Decomposers → Soil nutrients → Producers again.

➤ **Nutrient Cycling**

- Decomposers return essential elements like nitrogen and phosphorus to the soil, enabling plant growth and sustaining life.

➤ **Population Control**

- Predators keep the population of prey under control, preventing overgrazing and depletion of resources.

➤ **Adaptation**

- Organisms adapt to environmental changes, ensuring the ecosystem remains stable and functional.

4. Importance of Ecosystem Functions

- Maintains biodiversity and supports life.Ensures availability of resources like food, water, and oxygen.
- Helps regulate climate and purify air and water.Supports agriculture, medicine, and economy through ecosystem services.

Conclusion:

Ecosystems are complex networks of living and non-living components that work together to sustain life on Earth. The abiotic factors create a supportive environment, while producers, consumers, and decomposers interact to maintain energy flow and nutrient cycling. Understanding these functions is essential for protecting and preserving biodiversity for future generations.