SREE SIDDAGANGA COLLEGE
OF ARTS, SCIENCE and COMMERCE
B.H. ROAD, TUMKUR

(AFFILIATED TO TUMKUR UNIVERSITY)

BOTANY PAPER-II

STUDY MATERIAL

UNIT-1 (2 Hr)

Introduction and Scope of Ecology

The branch of Biology that deals with the study of interrelationships and interdependence between biotic and Abiotic factors in an environment is called "Ecology or "Environmental biology".

In 1886 German Zoologist Ernst Haekal coined the term 'Ecology'. It is derived from Greek words where 'Oikos 'means 'home'. And 'logos' means 'to study'. Odum Defines Ecology as "The study of structure and function of nature".

The term 'Environment is derived from French word where 'Environer' means 'to encircle 'or 'to surround'. "The study of interactions of man with the living and non living components of environment and interdisciplinary field study is referred as "Environmental studies".

SCOPE OF ECOLOGY

1. Study of Ecology provides knowledge for proper maintenance of natural resources.
2. It helps to understand the harmful effects of pollution, need for its control.
3. It provides knowledge about population, their interactions with environment. And necessity of maintenance of delicate balance between living and none living components of nature.
4. It provides Knowledge on Biodiversity, their types, reasons of depletion, their importance and methods of conservation.
5. It helps to take suitable steps to prevent the extinction of species and protect endangered (Species towards extinction) and endemic (Species restricted to a particular geographical region) species.
6. It gives knowledge about the need for sustainable development.
7. It helps to understand process of evolution.
8. It helps to discover new sources of food and energy.
9. It provides the importance of following laws of nature, Values, natural balance, management and Coexistence.
10. It helps in finding jobs as Environmental officers, research scientists, and clean technology entrepneurers.

2 marks questions

1. What is Ecology?
2. What is meant by Environment?

5 marks Questions

1. Write a note on Scope of Ecology.
2. Mention the importance of Environmental studies.

UNIT-2 (10 Hrs)

Ecological factors-Climatic factors-light,Temperature, Wind, Precipitation and Atmospheric humidity. Edaphic factors-Soil factors- Soil Profile, Types of Soil, soil Humus, Soil water, Soil PH, Soil organisms and Soil temperature. Biotic factors- Positive and Negative interrractions.

INTRODUCTION

The branch of Biology that deals with the study of interrelationship between the organisms and their environment is called 'Ecology or Environmental Biology'.

SUB- DIVISIONS OF ECOLOGY

Ecology includes 2 Sub-divisions. They are I) Aut Ecology II) Syn ecology.

I. AUT ECOLOGY : Study of an individual or individuals belonging to same species in relation to their environment is called ' Aut ecology'. Individuals of same species constitute'population'. Study of population in terms of Growth and reproduction is called 'Population ecology'.

II. SYN ECOLOGY: Study of individuals of different species in relation to their environment is called 'Syn ecology'. It includes following types: -

a) Habitat ecology b) Community ecology c)Ecosystem Ecology.

a) Habitat ecology : Study of individuals of different species in relation to their habitat such as fresh water, marine , Grass land , Forest etc are called ' Habitat ecology'.

b) Community ecology: Population of different species in a common habitat is called 'Community '. Study of members of community in relation to their environment is called 'Community ecology'.

c) Ecosystem ecology : A biotic and Biotic components in an area interact and constitutes an 'Ecosystem.' Study Biotic communities in relation to their environment is called 'Ecosystem ecology'.

ECOLOGICAL FACTORS

The environmental conditions which bring about adaptations in organisms are called 'Ecological factors'. They are classified into 2 groups 1. A biotic factors or Physical factors. 2. Biotic factors.

A] ABIOTIC FACTORS OR PHYSICAL FACTORS The non-living components of the environment constitute an abiotic factors. It includes 2 types 1) Climatic factors 2) Edaphic factors.

[I] CLIMATIC FACTORS

Factors of the atmosphere such as Precipitation, Light, Temperature, Humidity, and Wind constitute Climatic factors. The proportion of these factors in a given locality at a particular time is called 'Climate'. It varies from region to region.

WATER:- Water is an important ecological factor in plant's life. It is an universal solvent. In nature it is found in 3 forms. They are Precipitation, Atmospheric moisture, soil moisture.

1. PRECIPITATION (Rainfall) :-

Precipitation is the chief source of soil moisture. Clouds consist of water vapors which condense and precipitate out of the atmosphere. This is known as 'Precipitation'. It occurs in various forms as follows: -

Drizzle: minute droplets floating in air.

Rain: Large drops of water. It is the main source of water for plants.

Snow: Moisture in solid state. It is injurious to plants because it breaks tender shoot, branches, flowers fruits, but melting of snow is the source of water to soil.

Dew/ Frost: Formed due to condensation of moisture on objects.

Hail: Balls of Ice. It causes damage to aerial parts of the plants.

Rain is the main source of soil water, it is caused by monsoon. Amount of Annual rain fall decides the type of vegetation. In India vegetation is diversified.

Evergreen forest: - Above 80" throughout year.

Deciduous forest: Annual rainfall between 40- 80".

Grass land – Annual rainfall between 40 -20". **Desert** : Annual rainfall below 20".

2. ATMOSPHERIC MOISTURE[HUMIDITY]

Water is present in the atmosphere in **invisible** form called **Humidity**. Actual amount of water vapor or moisture in the atmosphere is called 'Absolute humidity'. Percentage of moisture present at a particular temperature is called' Relative Humidity '. It is measured with the help of **Psychomotor**. Moisture in **visible form** is called **Fog or Cloud**. These are formed by cooling of air to a temperature below its dew point.**Clouds** are formed due to upward movement of air from land towards cooler sides of atmosphere. **Fog** is caused due to cooling of air at or near land surface .

At higher atmospheric humidity rate of transpiration is slow. At low humidity rate of transpiration it is high. Humidity is the chief source of water for Orchids.

3. TEMPERATURE

Plants require definite range of temperature to perform physiological activities. Generally temperature range of 26 to 32 C is suitable for many plants. Based on tolerance to heat plants are classified as follows: -

a) Megatherms :- These plants require high range of temperature ie.,40 C . Ex: Xerophytes.
b) Mesotherms: These plants require neither high or low range of temperature ie.,20 C to 40 C .
c) Microtherms:- These plants require very low temperature ie., 0 to 20 C .
d)Hekisthotherms:- These plants require extreme low temp..Ex: Alpine vegetation, bacteria.

"Some plants require low temperature for flowering. Cold treatment of plants to induce early flowering is called '**Thermoperiodism**'.It is also called '**Vernalisation** '. Lysenko used the term Vernalization".

4. LIGHT

Light is an ecological factor that affects the distribution of plants. Radiant energy released from sun on reaching earth surface constitute light. It is essential for development of Chlorophyll, Photosynthesis, opening and closing of stomata, growth, flowering etc.
Based on quantity& intensity of light requirement ,plants are ecologically classified into 2 types.
I) Heliophytes: Plants growing best in full sun light.
II) Sciophytes: Plants growing best in low light intensity. Length of the daily light period to which plants are exposed has effect on the vegetative growth as well as flowering of the plants. The influence of light on the flowering process in plants is called 'Photoperiodism'. Based on their light requirement for flowering, plants are classified into 3 types:-
I] Short day plants:- Plants which flower when day length is short(Between 12- 14 hours) are called' Short day plants'. Ex: - Aster, Dhalia, Tobacco,Chrysanthimum, Datura, Salvia.
2] Long day plants : Plants which flower when day length is length is long are called' Long day p lants'.Ex: Potato, Wheat, Spinach, Radish.
3] Day neutral plants:- Plants in which flowering is not affected by length of the day are called 'Day neutral plants'. Ex: Pea, Tomato, Balsam,Sunflower, Cucumis, maize.

5. WIND

Air in motion is called 'Wind'. It is an important ecological factor of the atmosphere. It brings about many physical, physiological and anatomical effects on plants.
PHYSICAL EFFECTS
1.Breakage and uprooting:- High velocity of wind may cause breakage of living branches of trees and even sometimes uproot trees.
2. Deformation:- Strong wind from constant direction may cause permanent alteration in form and position of shoot.Ex: Trees growing on ridges and along coast.
3. Lodging:-Violent wind cause flattening of shoots. Ex:Grass, maize, wheat, sugarcane.
4. Abrasion:- Wind carry particals of soil or Ice which act as strong abrasive force, by which buds and other parts of the plants may get eroded.Ex: Crops grown in sandy soil.
5. Erosion and deposition:- Wind removes top layer of the soil exposing roots of plants. areas

where additional soil is deposited become unsuitable for plants growing there.
6. Salt spray:- Strong wind along sea coast carry salts of water which have injurious effect for plants growing there.

PHYSIOLOGICAL AND ANATOMICAL EFFECTS OF WIND

1.Compression of wood: - Wind deformation in tree boles develops dense, reddish type of xylem called 'Compression wood' on the compression side. Or in herbs it may stimulate collenchyma formation in wind deformed side.
2. Desiccation:- Strong wind cause an increase in rate of evaporation and transpiration. Thus suffer from desiccation. Plants with crowded branches escape such damage.
3. Dwarfing:- Plants growing under the influence of drying winds suffer from dehydration,loss of turgidity. Their organs become dwarfed.Ex: trees on sea coast, Artic and Alpine timber lines.

[II] EDAPHIC FACTOR

Part of earth's crust that supports living organisms, particularly plants is called 'Soil'. It is formed by weathering of rock. It is composed of Mineral matter, Soil water, Soil air, Soil organisms, Horizons etc.

1.MINERAL MATTER

weathering of rock results in mineral particles , which varies in size . depending on their size , mineral particles are of following types:-

NAME OF PARTICLE	DIAMETER (mm)
Clay	Less than 0.002
Silt	0.002 to 0.020
Fine sand	0.020 to 0.200
Coarse sand	0.200 to 2.000
Fine gravel	2.000 to 5.000
Coarse gravel	Above 5000

Soil texture is determined by relative proportion of mineral particles of different sizes present in the soil. Based on this soil is classified into following types:- **a) Sandy soil:**- This type of soil has 85% coarse particles , 15% of Clay,or silt.It has good aeration ,poor water holding capacity.It supports growth of Xerophytes.it is called Physically dry soil. **b) Loam soil:**- This type of soil has 50% of sand, 50% of clay or silt and humus. It has good aeration, good water holding capacity, rich in organic nutrients and best for growth of all kinds of plants .**c)Clay soil**:- This type of soil has more percentage of clay than sand. It has good water holding capacity, poor aeration.It is suitable for crop plants and vegetables. **d) Silt soil:-** This type of soil has moderate amount of

silt and clay. It has good aeration, good water holding capacity. It supports all types of vegetation.

2 .ORGANIC MATTER [SOIL HUMUS]

Decomposed dead plants , Animals and their excreta in the soil constitutes soil humus. It is a source of mineral nutrients, which binds soil particles into aggregate structure increasing water infiltration, aeration and water holding capacity. All organic debris fallen recently to the ground is called 'Litter'. Just beneath litter is partly decomposed organic matter called 'Duff'. The amount and chemical nature of litter depend upon the type of vegetation. Based on chemical and biological status it is classified into 2 types. They are Mull humus and MOR humus.

1) Mull humus:-It is porous, loose mass composed of mixture of humus with mineral soil. PH is 5, rich in microbial activity, earth worms are plenty.

2) Mor humus:- It is non porous humus with very low organic matter content, present like a carpet on the top of mineral soil. PH is less than 4. Decomposition is slow, earth worms are absent. Vegetation is dominated by mosses, Ericaceae.

In Grasslands organic matter is is formed by roots as aerial shoots are grazed. In Aquatic plants salts are absorbed from mud, rich in nitrogen.

3. SOIL SOLUTION

Soil solution is water present in the soil with dissolved necessary minerals like carbonates, sulphates, nitrates, chlorides, and organic salts like calcium, magnesium, sodium, potassium, etc. The chemical nature of solution depends on the nature of parent matter through which water has percolated.

Based on the PH value of soil solution soil can be grouped into 3 types:-

a) Acidic soil:- Acidic soil has PH value is less than 7. It is less in calcium. Plants growing in acidic soil are called 'Calciphobus ' or' calciphytes'. Ex: Cotton, Jowar, Maize, Grond nut.

b)Alkaline soil:- Acidic soil has PH more than 7. Plants growing in alkaline soil are called 'Calciphilous'. It is physiologically dry soil, supports growth of halophytes few mosses, ferns etc.

c) Neutral soil:-Neutral soil has PH 7. It is composed of moderate proportions of acids and bases. It supports growth of all kinds of plants.

Soil borne diseases such as root rot of cotton; root rot of tobacco, potato scab can be controlled by lowering PH of the soil. Diseases of potato tubers, Club root of crucifers can be controlled by increasing the PH values.

4. SOIL AIR

Spaces between soil particles are known as Pore spaces. These are occupied by soil solution and gases. Space between the soil particles consists of air .it constitutes soil air. gases present are similar to those present in the atmosphere. But it has less oxygen and more carbon di oxide.

Soil air is essential for growth of root, seed germination, and microbial activities. Poor aeration suppress root hair development and reduce rate of absorption of water and mineral salts.

5. SOIL MOISTURE [SOIL WATER]

Main source of water for plants is atmospheric precipitation. Water content in the soil is called 'Soil water'. It is present in 3 forms. They are as follows: -

1) Hygroscopic water:- Water present over tightly held soil particles is called Hygroscopic water. It is not easily available for plants.

2) Capillary water:- Water present between soil particles in the form of capillaries is called Capillary water. It is suitable for growth of plants.

3) Gravitational water :- Water that moves down wards through moist soil in response to gravity and reach water table. Is called 'Gravitational water'. The water in deep saturated zone of soil is called 'Gravitational water', the upper surface of this is called 'Water table'. It is not available for plants.

In sandy soil, particles are larger with larger pore spaces which are unable to hold more water, much water percolates to deeper layers due to gravitational attraction. Thus water is not available for plants. Such soil is called **'Physically dry soil'**. In some soil, although water is present in great amount, due to high degree of salinity it is rarely used by plants. Such soil with salinity is called 'Physiologically **dry soil'.**

Total amount of water present in the soil is called **Holard.** Amount of water absorbed by plants is called **Chresard.** Water which is not absorbed by plants is called **Echard.**

Based on water content of the soil, ecologically plants are classified into 3 types. They are :-

a) Hydrophytes: - Plants adapted to aquatic environment.

b) Xerophytes: - Plants adopted to grow in dry lands where water content in soil is low.

C) Mesophytes [Terrestrial] Plants adopted to grow in normal water conditions ie., soil which has neither excess nor deficiency of water.

6. SOIL TEMPERATURE

Solar radiation is the main source of temperature. Microbial activity also generates heat which contributes to soil temperature. Soil temp. Affects physiological activities like rate of absorption of water and solutes, growth, seed germination etc. Low temperature influence dwarfness.

7. SOIL ORGANISMS

The organisms inhabit soil, playing a vital role in the growth of plants are called 'Soil organisms'. Ex: Flora (Plants) includes Bacteria, Fungi, Actinomycetes, and Algae. Fauna (Animals) includes Protozoa, Nematodes, Mites, Insects, Earth worm, Rats etc.

Soil organisms play important role in the life of plants .Their chief roles are as follows:-

1) Soil microbes like saprophytic bacteria and fungi bring about decay and decomposition of

organic matter .Thus increase soil fertility.

2) In poorly aerated soil chemical products of decomposition like toxins as aldehydes, Vanillin etc. are very harmful to higher plants. Soil organisms show antagonistic effects among themselves.

3) Some bacteria and fungi secrete growth promoting substances, such as Indole acetic acid.

4) Some bacteria and Blue green algae fix atmospheric nitrogen and maintain soil fertility.

Ex: Bacteria such as Azatobacter , Clostridium , Rhizobium, Blue green algae such as Nostoc, Anabaena, Oscillatoria etc.

5) Soil inhabiting fungi enter roots of higher plants. These are called Micorrhiza. They provide growth factors to it.

6) Some Blue green algae and bacteria produce mucilaginous excretions which help in binding soil grains into aggregates.

7) Rodents, worms, insects bring about soil mixing; burrowing worms make passages which increase soil aeration resulting in water penetration and root elongation.

8) Some fungi and worms may also cause injuries and infections to root.

SOIL PROFILE

Soil layer horizontal to the surface is called 'Soil Horizon'. The superimposed horizons constitutes **'Soil profile'.** Smallest volume of soil which gives the total picture of all horizons is called '**Pedon'.**

Fig:

Soil profile differs in their physical, chemical, biotic characteristics .all horizons are not always present in each profile. The soil profile consists of 4 main horizons. They are :-

1) 'A' Horizon: - It is the topmost layer . This has mineral matter with humus, clay, Aluminium organic colloids this horizon is sub-divided into sub layers **A A A A** from upwards to downwards. It is well developed in Forests and absent in grasslands.

A region: - It is well developed in forests, consisting of fresh leaf material and other organic detritus which has not undergone decomposition. **A region: - It is below A region.** It contains

organic matter in variable state of decomposition called **'Duff'. A layer :-** It is dark, as organic debris is mixed with the mineral matter from overlying humus. **A Layer:-**It is light colored with maximum leaching and without chemicals. A A are called' **mineral soil' or 'Solum'**.

2)'B' Horizon :- This is below A horizon. It is coarse textured; deep colored, mineral matter has Aluminium, Iron with rich clay. This zone has maximum collection of materials.

A and **B** horizons **together constitutes 'Top soil'**.

3) 'C' Horizon:- This is also known as **'Sub –soil'.** It is thick, consists of large masses of weathered mineral matter.

4) 'D' Horizon:- This is the lowest horizon of soil profile composed of un weathered rock.

Relationship among organisms of Biotic community

Individuals in a population interact which may be beneficial to both interacting organisms or beneficial to only one partner and harmful to one or both the interacting organisms. Beneficial interactions are called 'Positive 'and harmful interactions are called 'negative 'interactions'.

A]POSITIVE INTERACTIONS

The interactions between organisms where both the interacting organisms or only one interacting organism is benefited without harming other is called **' positive interaction'.** These include 1)Mutualism 2) Commensalism 3) Cooperation.

1) Mutualism:- Mutualism is a type of positive interaction where both the interacting organisms and mutually benefited . Ex: **1. Lichens:**In Lichens Algae and Fungi are in close permanent, obligatory contact where Algae synthesize food and supply to fungi, Fungi provides shelter for algae. **2. Nitrogen fixers:** Rhizobium bacteria lives in roots of leguminous plants fix gaseous nitrogen, makes it available to plant and obtain food from legume plant. Blue green algae such as Nostoc , Anabaena in corolloid root of Cycas.**3. Mycorrhizae**: Fungi form mycorrhizal structure inside roots of orchids and members of Ericaceae and outside surface of Pines, oaks and help in absorption of water, minerals or provide harmones.4. Dispersal of fruits and seeds: Fruits are eaten by birds and animals. Seeds in them are dropped at various places.**4.Pollination:** Bees**, moths**, butterflies derive food from nectar or other plant product and in return bring about pollination. **5. Algae Zoochlorellae** live in outer tissue of sponges, Coelenterates, Molluscs. Algae produce nitrogenous compounds beneficial to host and in exchange they obtain materials released by metabolism of host.

2)Commesalism:- Commensalism is a type of positive interaction where only one partner is benefited and other is neither benefited nor harmed. Ex:**1. Lianas**: These are woody climbers rooted in the ground , maintain erectness of their stem by climbing on other trees.**2. Epiphytes:** These are not rooted in the ground. They grows perched on other plants, use other plants only for support but not for food and water. ex: Orchids.

3) Myrmicophily[Protocooperation]: It is a primitive type of co operation between an Ant and

plants. Ants live in association with plants, gets food & shelter from it. In return they protect plants from external agencies.ex: Association between Ants and trees such as mango, Acacia.

B] Negative interaction

The interactions between organisms where both the interacting organisms or only one interacting organism is harmed is called **' Negaitive interaction'.** These includes following types:
1)Antibiosis 2) Competition 3) Parasitism

1) Antibiosis:-Antibiosis is a type of negative interaction where one interacting organism is benefited & the other is neither benefited nor harmed. Ex:

a) Many members of Actinomycetes fungi, number of lichens produce substances inhabits molds and bacteria.

b) Algae Chlorella vulgaris in cultures inhibits growth of Diatom**.**

c) Blue green algae Mycrocystis produce toxins hydroxyl amine which causes death of microbes

d)Juglans produce toxin in the soil that affects herbs.

e)Bitter almond produces potassium cyanide that inhibits germination of poppy seeds.

2) Competition :-Competition is a type of Negative interaction where both the interacting organisms are harmed. Ex:

a)In ecosystem individuals of the same species or different species compete for space, light, food etc. for their survival.

b)In soil Fung, high degree of competition saprophytic ability is shown.(For colonization on dead substrates).

3) Parasitism:- Parasitism is a type of negative interaction in which one of the interacting organism is benefited and other is harmed.

a)Cuscuta is a total parasite on green plants. It sucks food, water from host plants through haustoria.

b) Some Bacteria live parasites in plants, animals and human beings. Ex; Citrus canker, Mango leaf spot. They cause diseases to the host.

C)Fungi such as Albugo, Puccinia, and Cercospora etc.live as parasites on economically important crops, causing diseases bring about heavy loss.

[III] BIOTIC FACTORS

Organisms live together influencing directly or indirectly each other's life in terms of growth, reproduction, nutrition. Such interactions results in Pollination, dispersal of fruits and seeds, grazing, symbiosis, parasitism etc. Influence of life forms on vegetation is called 'Biotic factors'. Role of Biotic factors is divided into Role of plants, Animals, Micro organisms, Human beings.

1.ROLE OF PLANTS The vegetation in an environment is influenced by Biotic factors like other plants. Plants belonging to the same species or other species, plants of one community over other community compete with each other for their survival. Ex: Herbs, shrubs, trees, Climbers grow together in a forest. They compete for light, space, water and minerals.

A] Effects of trees: In a forest, tall trees are profusely branched, forms canopy which prevents sun light to fall on to the forest floor. This results in inhibitory effect on growth of Heliophytes(Light loving plants). And encourages the growth of Sciophytes (Shade loving plants). Like Bryophytes and Pteridophytes.

B] Effects of climbers: Climbers are weak stemmed plants which need support of other plants to grow erect. These may pull down branches or plant and destroy them. Ex:
In Forests Root climbers like pothas .Betel, Alocasia develops adventitious roots which clasp the supporting plant to get sun light. In Tendril climbers, Tendrils are thin, long, coiled, wiry structures which help to climb. Ex: passion flower, Antigonon .In Woody climbers, Stem are woody, twine around the stem of supporting tree and reach the canopy .EX: Lianas.

C] Effect of parasites: Parasites lead heterotrophic mode of Nutrition. They develop button shaped structure called Haustoria which penetrates into the host, reach the vascular bundles, absorb nourishment from it and ultimately destroy the host. Ex: Bacteria, Fungi, Flowering plants like Striga, Santalum,Cuscuta , Viscum.

D] Effect of New species: - The new species in their earlier stages of development in a new locality face many problems due to change in climatic and edaphic factors. When once they adjust, become dominant, destroy other prior existing plants. Later whole locality will be covered by new species.Ex: Lantana, Parthenium, Eicchornia, Acacia produces toxic substances which kill surrounding plants.

E] Effect of Symbionts:- some plans grow in or on the surface of other plants .From this association both the partners are mutually benefited. Ex: In **Lichens** Algae & Fungi are in close permanent, obligatory contact where Algae synthesize food and supply to fungi, Fungi provides shelter for algae. **Nitrogen fixers:** Rhizobium bacteria lives in root nodules of leguminous plants fix gaseous nitrogen, makes it available to plant ,it obtain food from legume plant. Blue green algae such as Nostoc,Anabaena in corolloid root of Cycas. **Mycorrhizae**: Fungi form Mycorrhizal structure inside roots of orchids and outside surface of Pines, oaks help in absorption of water, minerals or provide harmones.

2. ROLE OF ANIMALS : The interaction of animals with plants is of following types :-

A] Grazing animals: Eating of grass is called 'grazing'. Continuous grazing by these animals converts the vegetation field into a barren area. If it is unchecked, it leads to formation of Desert called 'Desertification'.Ex: Domesticate animals like cattle, sheep, goat, Cow .B] B]

B]Browsing animals:- Eating of tender branches of plants is called 'Browsing'. They not only

destroy plants but also kill small herbs, creepers, by hooves and paws .Ex: Sheep, Goat, Ass Horse, and Cow. They lay huge quantity of dung and destroy dung hating plants (Caprophillos plants). Unrestricted browsing within a short period convert forest into scrubby jungle with thorny plants like canthium, Acacia, Zizipus, cacti etc.

C] Insects and worms feed on parts of plant, obstruct their development or cause diseases to the plants & destroy them.

D] Pollination by insects and animals: Insects while feeding on nectar bring about cross pollination .Flowers of orchids, Salvia are modified to attract insects. Some flowers emit fragrance, some flowers are variously colored to attract particular insect. Some animals also facilitate cross pollination.

E] Dispersal of fruits and seeds: Dispersal of fruits, seeds by animals is responsible for easy spreading and even distribution, and increase of vegetation on this planet.

F]Carnivorous plants: Some plants growing in marshy area suffer from deficiency of nitrogen. Such plants fulfill their nitrogen requirement by depending on insects. These are called 'Insectivorous or Carnivorous plants'.

G] Myrmicophily: It is a type of protocoperation between Ants and plants, where Ants live in association with plants, get food and shelter from it, in turn they protect plant from external agencies.

3. ROLE OF MICRO ORGANISMS:- Micro organisms play very +ve and –ve role in plant life:-

A] Positive role: Saprophytic Fungi & bacteria bring about decay,decomposition of dead bodies, clean earth surface , enrich soil with nutrients.Symbiotic Blue green algae likeNostoc,scytonema etc, and Bacteria such as Azatobacter, Clostridium fix molecular Nitrogen and enrich soil. Fungi live in association with higher plants, helps in water absorption and provide growth hormones.

B] Negative role: Denitrifying bacteria by Denitrification decreases nitrogen content of soil. Parasitic Bacteria and Fungi lives in body of other living organisms, cause diseases to them. Ex: Cholera, Typhoid, Citrus canker, and Kole roga, Rust, Leaf spot etc.

4. ROLE OF HUMAN BEINGS:- Role of human beings on vegetation is both useful and harmful but harmful effects are more than useful.

A] Harmful effects;- Increasing urbanization , Civilization, industrialization has negative effect on vegetation as it leads to indiscriminate felling of trees, over exploitation, of natural resources, pollution and climate change. Cutting of Trees not only destroy Twiners but also destroy Epiphytes, Climbers, Sciophytes, Insects, Animals and Birds which feed on fruits.
It leads to the disappearance of particular species. Irresponsible human activities may cause

forest fire leading to destroy of fauna and Flora of that area. Progressive civilization and increase in urbanization leads to exploitation of plant wealth ,creates imbalance in an ecosystem, promote soil erosion , disturb humidity , Climate which leads to disappearance of rare species.

B] Beneficial aspects: - Lay farming, A forestation, Reforestation activity of Human being is responsible for conversion of barren area into vegetation field or forest. Plant breeding experiments in crop plants by man has resulted in good yielding, disease resistance varieties, protection of endangered species, Conserve Biodiversity. Construction of dams has made increased cultivated land and production of new species. Domestication and distribution of economically important ,commertial plants has beneficial role.

QUESTIONS **2 marks**

1. What is Aut ecology and Syn ecology?
2. Define photoperiodism .
3. What is meant by Thermoperiodism?
4. Differentiate between Heliophytes and Sciophytes.
5. What is Velamen? Mention its significance.
6. What is Myrmicophily?
7. What is Antibiosis and Symbiosis?
8. Define Mor and Mull humus.
9. What is Grazing and Browsing?
10. What is Vernalization?

5 marks

1. Describe Light & wind as climatic factor or Precipitation& Temperature as Climatic factor.
2. Explain soil profile.
3. Give an account of any two edaphic factors.
4. Describe positive interaction.
5. Describe Negative interaction.
6. Give an account on biotic factors.

10 Marks

1. Give an account on any 4 Climatic factors.
2. Describe Edaphic factors.
3. Explain biotic factors.

UNIT:3 (10 Hrs)

Ecosystem- Concepts, Components, Study of Marine ,Grassland and Forest Ecosystem, Food chain, Food web, Ecological pyramids, Production and Productivity,(Primary and secondary), **Biologeo chemical cycles**- Carbon, Nitrogen, Phosphorous

ECOSYSTEM

Introduction A Biotic community lives in an environment which provides materials , energy requirements and forms an interacting system called " Ecosystem". The term Ecosystem was introduced by A.G. Tansley in 1935.

An **Ecosystem can be defined** as **"A Structural and Functional unit of Biosphere consisting of living organisms and their environment both interacting and exchanging materials between them". An ecosystem can be distinguished into 2 types. They are:-**

1) Natural ecosystem 2) Artificial ecosystem.

Ecosystem

I] Natural **2] Artificial**

A] Aquatic **B] Terrestrial** Ex**: Cropland**

1] Fresh water **2]Marine** Ex: **Forest ,Desert** **Dams**

a)Lentic **b) Lotic** Ex**: Ocean,Esturies** **Grassland**

Ex**:Pond, Lake** **River**

STRUCTURAL COMPONENTS OF AN ECOSYSTEM

An Ecosystem consists of 2 components. They are: -I] A Biotic component II] Biotic component.

I] A Biotic components :-

The Non living elements of an Environment constitute Abiotic component.They are as follows:-

a) Climatic factors:- It includes light, temperature, Precipitation, Humidity, Wind etc.

b) In organic substances:- It includes carbon, Hydrogen, Nitrogen, oxygen, Phosphorus, Sulphur, Carbon dioxide Magnesium, Boron etc.

c) Organic substance: - It includes Carbohydrates, Proteins, and Lipids.

II] Biotic components:-

The living organisms like Plants, Animals, Micro organisms of an environment constitutes Biotic components. These are classified into 3 groups Such as Producers, consumers, Decomposers.

1] PRODUCERS: - Producers are Autotrophs .Ex: Green plants. Chlorophyll present in green

plants converts solar energy into chemical energy to prepare organic food using carbon dioxide and water during photosynthesis. Such plants are called 'Autotrophs'. These occupy first Trophic level. **[T].**
various steps through which energy flow in an ecosystem are called ' Trophic level'.

2] CONSUMERS:-Consumers are 'Heterotrophs'. I.e., these depend on producers for their food. These are of 3 types. They are Primary, Secondary, tertiary.
A) Primary consumers:- Animals which feed on green plants are called 'Primary consumers'. These are herbivores, occupy second trophic leve**[T**]Ex: Cow Sheep,deer,Elephant,Rabbit etc.
B) Secondary consumers :- Animals which feed on Green plants &primary consumers are called 'secondary consumers'. These are Carnivores, occupy third trophic level**.[T]**Ex:Cat,Fox,Bird,Frog
C) Tertiary consumers:- The animals which feed on Primary consumers and Secondary consumers are called 'Tertiary consumers'. These are strictly Carnivores, cannot be preyed further, occupy forth trophic level **[T].** Ex: Lion, Tiger, Eagle etc.

3]DECOMPOSERS:-Decomposers are Saprophytes ,They obtain their food by decomposing dead bodies of producers, consumers. These occupy fifth trophic level [T] & often called' Micro consumers' as they are microscopic OR Reducers as they decompose and remove dead bodies.
Ex:- Saprophytic Bactria, Fungi.

PLANTS

I] AUTOTROPHS	**II] HETEROTROPHS**
Green plants which synthesize	Non green plants which are not able to synthesise food.
Food by photosynthesis	**a) Parasite:** These obtain food from other living organisms.
	b) Saprophyte: Obtain food from dead bodies.

TERRESTRIAL ECOSYSTEM

Ecosystem developed on land is called as 'Terrestrial Ecosystem' Depending upon the type of land it is classified into 3 types.They are

1) Forest Ecosystem 2) Grassland Ecosystem 3) Desert Ecosystem

GRASSLAND ECOSYSTEM

Grassland ecosystem is a type of terrestrial ecosystem developed in areas with annual rainfall between 10 to 40 ". It covers 19% of the earth's surface. It is composed of Biotic and abiotic components.

I .Abiotic factors :- All nonliving components of an ecosystem constitute abiotic factors. Ex : Light, Temperature, Rainfall, soil air, soil water, soil humus, minerals.etc.

II. Biotic factors: All living components of an ecosystem constitute biotic factors.

1) PRODUCERS: - Producers are Autotrophs .Ex: Green plants. Ex: Dicanthium,Desmodium, Cynodon, Elephant grass, Bamboo's etc. Few herbs such as Primula, Fritillaria, Iris,

2] CONSUMERS:-Consumers are 'Heterotrophs'. I.e., these depend on producers for their food. These are of 3 types. They are Primary, Secondary, tertiary.

A) Primary consumers:- Animals which feed on green plants are called 'Primary consumers'. These are herbivores, occupy second trophic leve**[T]**Ex:Grass hopper, Deer, Rabbit, Bison, Mouse etc.

B) Secondary consumers :- Animals which feed on Green plants and primary consumers are called 'secondary consumers'. These are Carnivores, occupy third trophic level**.[T]**Ex: Frog, Lizard, Wild dogs, Snake, Bird. Etc.

C) Tertiary consumers:- The animals which feed on Primary consumers and Secondary consumers are called 'Tertiary consumers'. These are strictly Carnivores, cannot be preyed further, occupy forth trophic level **[T].** Ex: Wolf, Eagle, Hawk etc.

3]DECOMPOSERS:-Decomposers are Saprophytes ,These obtain their food by decomposing dead bodies of producers, consumers. These occupy fifth trophic level [T] these are often called Micro consumers as they are microscopic. And also as Reducers as they decompose and remove dead bodies. Ex:- Saprophytic Bactria, Fungi.

FOREST ECOSYSTEM

Forest ecosystem is a Terrestrial Ecosystem. In India it occupies 19% of the total land area .major forest found in India are as follows:-

1. Tropical Rain forest: - Tropical Rain forest is developed in regions with Annual Rainfall above 180cms, it is found in silent valley, Western Ghats, Andaman and Nicobar islands.

2. Tropical deciduous Forest: Tropical deciduous Forest: - Tropical deciduous forest is developed in regions with Annual Rainfall is between 15-150.It is found in Bandipur , Bannerughatta forests.

I) Abiotic factor: - This forest characterized by daily rain, High Humidity, High temperature, Black, Porous humus rich soil.

II) **Biotic factor**:- The living organisms like Plants, Animals, Micro organisms of an environment constitutes Biotic components. These are classified into 3 groups Such as Producers, consumers, Decomposers.

I) **Producers: -** Producers are Autotrophs .Ex: Green plants. Chlorophyll present in green plants converts solar energy into chemical energy to prepare organic food using carbon dioxide and water during photosynthesis. Such plants are called 'Autotrophs' T

Top storey is composed of Evergreen trees which grow to 40-50 mts. height, middle storey consists of trees with 20-40 mts height. Lower storey is composed of plants with 10-20 mts height. On ground are masses and Sciophytes.

2) Consumers: - Consumers are 'Heterotrophs'. I.e., these depend on producers for their food. These are of 3 types. They are Primary, Secondary, tertiary.

A) Primary Consumer:- Animals which feed on green plants are called 'Primary consumers'. These are herbivores, occupy second trophic levehese are Bison, Deer, Elephant, and Rabbit.

B) Secondary consumer: - Animals which feed on Green plants &primary consumers are called 'secondary consumers'. These are Carnivores; occupy third trophic level Fox, wild dog, Frog.

C) Tertiary consumer: - **:-** The animals which feed on Primary consumers and Secondary consumers are called 'Tertiary consumers'. These are strictly Carnivores, cannot be preyed further, occupy forth trophic level Lion, Tiger, Cheetah.

3) Decomposer: - Decomposers are Saprophytes ,They obtain their food by decomposing dead bodies of producers, consumers. These occupy fifth trophic level [T] & often called' Micro consumers' as they are microscopic OR Reducers as they decompose and remove dead bodies. Ex:- Saprophytic Bactria, Fungi.

MARINE SYSTEM

Marine ecosystem includes salt water mass of seas and oceans that covers 70.8% of the earth's surface. Based on their depth ocean is classified into 4 zones.

a) Littoral zone: It is the shore line between land and ocean. This zone possesses plenty of

nutrients, subjected to extremes of physical turbulence, waves, fluctuations of temperature and light intensities.

b) Neritic zone:- It is the zone of shallow water with the depth ranging from 200mts.it constitutes 7.5% of the total area of sea. It is the best fishing water zone.

C) Pelagic zone:- It is zone of open sea with the depth of more than 200 mts. poor in nutrient content. It constitutes 90% of total area of the sea. It is poor in nutrients.

d) Benthic zone:- It is the zone that extend from edge of continental shelf to the deepest trenches and crevices of ocean floor. It does not receive light, dissolved oxygen is low, dominant organisms are heterotrophs.

Abiotic factors

The factors that influence marine life are light, temperature, Pressure of 1 atmosphere at the surface to 1000 atmosphere at depth, Salinity due to chlorides, sulphates, carbonates, bicarbonates and bromides of sodium, calcium, magnesium, potassium. Tides afnd currents.

II. Biotic factors

Sea biota is not abundant but, contains well marked diversity. It includes Producers, Consumers, and Decomposers.

1) PRODUCERS: - Producers are Autotrophs .Ex: Green plants. Ex: Planktonic Diatoms, and Dinoflagellates, Green algae, Brown algae, Red algae.

2] CONSUMERS:-Consumers are 'Heterotrophs'. I.e., these depend on producers for their food. These are of 3 types. They are Primary, Secondary, tertiary.

A) Primary consumers:- Animals which feed on green plants are called 'Primary consumers'. These are herbivores, occupy second trophic leve**[T**]Ex: Crustaceans, Molluscs, Fish.

B) Secondary consumers :- Animals which feed on Green plants and primary consumers are called 'secondary consumers'. These are Carnivores, occupy third trophic level**.[T]** Ex: Carnivorous fishes (Herring , shad).

C) Tertiary consumers:- The animals which feed on Primary consumers and Secondary consumers are called 'Tertiary consumers'. These are strictly Carnivores, cannot be preyed further, occupy forth trophic level **[T].** Ex: Fishes like Cod, Haddock.

3]DECOMPOSERS:-Decomposers are Saprophytes ,These obtain their food by decomposing dead bodies of producers, consumers. These occupy fifth trophic level [T] these are often called Micro consumers as they are microscopic. And also as Reducers as they decompose and remove dead bodies. Ex: - Saprophytic Bactria,

FOOD CHAIN

Flow of food energy from producers through series of organisms with repeated eating and being eaten by others is called '**Food chain'**. Less number of links in food chain more will be available energy.

Types of Food chain:-

There are 3 types of food chain. They are:-

1. Grazing food chain
2. Parasitic food chain
3. Detritous food chain

I). Grazing food chain: - (predators food chain)

In Grazing food chain there is flow of Energy in the form of food from green plants to primary, secondary and tertiary consumer.

Ex:-**1] Food chain in Grassland Ecosystem**

Producer-→Primary consumer-→Secondary consumer--→ Tertiary consumer→Quaternary con

Grass-----→Grasshopper--------→Frog----------→Snake----------→Howk

2. Food chain in Forest Ecosystem:-

Higher plants-------→Deer, Elephant------→Lion, Tiger

3. Food chain in Aquatic Ecosystem:-

Phytoplanktons----------→Zooplanktons----------→Small fish----------→Large fish

II) Parasitic food chain

In parasitic food chain there is flow of Energy from plants through consumers to parasites.It is a shorter Food chain.

Ex: - Tree fruits→ Tree birds→ Ticks and Mites.

Grass----------→Sheep----------→Liver fluke.

III) Detritus food chain: -

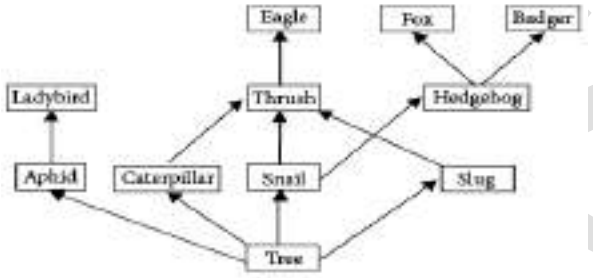
In Detritus food chain there is flow of Food Energy from plants to Detritus made up of dead organic matter to micro organisms, then to Detrivores(crabs) and their predators(fishes)

Ex:- Mangroove leaves----→ Detritus----→ Microorganisms------→Crabs-------→Fishes

FOOD WEB

Net work of food chains which are interconnected at different trophic levels to form complex web is called "Food web". **OR** An interlocking of food chain is called as 'Food web'. An n organism may be eaten by number of different organisms due to diverse food habit of consumber.Thus food chains are interlocked.

Food web operates according to taste, Food preferences of organisms and Availability of the food source, Food web opens several alternate path ways food energy, it allows an organism to obtain food from more than one type of organism at lower tropic level. This helps in keeping different organisms under check. If a link in food chain or Food web is disturbed, Ecosystem will



be imbalanced.

Ex:-In an area if all frogs are killed, its prey insects will increases, its predator Snakes decrease due to unavailability food. If number of Snakes decreases number of rat will increase.

SIGNIFICANCE OF FOOD CHAIN AND FOOD WEB

1. In an Ecosystem food chain indicate the pattern of flow of food energy through different trophic levels. Whenever energy flow s from one to another link about 80 to 90% of the energy is lost.
2. Availability of energy is more in food chain with less number of links. And available energy will be less in food chain with more links.
3. It maintains Ecological balance. Because each trophic level controls population of the previous trophic level and is control by next trophic level.Ex: frogs control population of Grasshoppers and Snakes control population of Frogs.
4. Producers from first link for all food chain, they have to be protected for survival of other organisms.
5. Each link in food chain is important. If one link is lost, it leads to the loss of entire food chain and organisms involved in it.
6. Organisms' will have options to get food from other links due to food web.

ECOLOGICAL PYRAMID

The graphic representation of the structure and functions of various trophic levels of organisms is called "Ecological pyramid". producers forms the base , while successive trophic levels forms the steps one above the other and top carnivores form tip of the pyramid. It was devised by British ecologist charls Elton

TYPES OF ECOLOGICAL PYRAMID

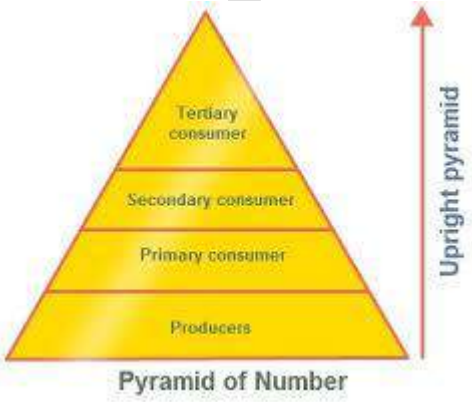
Ecological pyramid is of 3 types .they are 1) Pyramid of Number, 2) pyramid of Biomass, 3) Pyramid of energy.

1. **Pyramid of number**; - Graphic representation of structure and function of various trophic levels of food chain in terms of numbers of organisms is called "Pyramid of Numbers". **OR** graphic representation of number pf individuals per unit at various trophic levels is called "Pyramid of Number". It denotes the relationship between population and density of organisms in food chain.

   In a Grassland ecosystem and pond ecosystem , pyramid of Number is upright, with largest number of producers at the base, supporting less number of primary consumer, lesser numbers of secondary consumers and least number of tertiary consumers at the apex of pyramid.

   In parasitic food chain, the pyramid of number is inverted. Ex: Single large tree is a producer at the base. Primary consumers like fruit eating birds, insects are more in number. Secondary consumers like Ectoparasites are biggest in number.

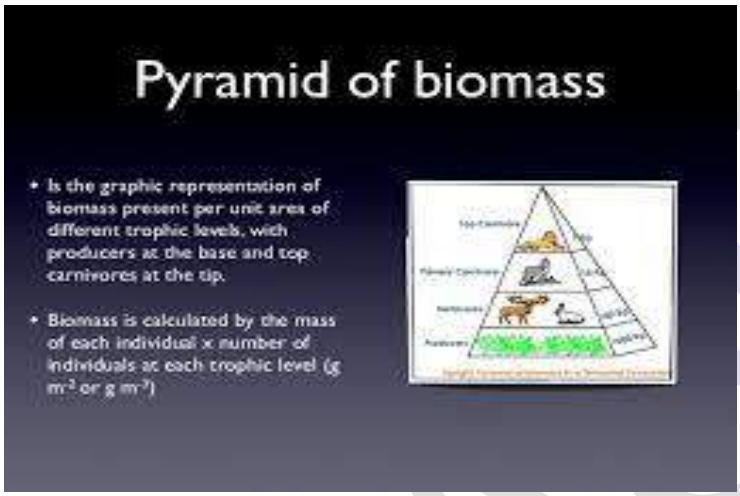
   In Forest Ecosystem pyramid of number is inverted, the large trees form producers and their number is less, number of consumers like insects, birds will be more. Further number of carnivores like Lizards, snakes will be less; further number of top carnivores will be least like hawks.



2. **Pyramid of Biomass:-** The graphic representation of the structure and function of various trophic levels of food chain in term of Biomass is called " Pyramid of Biomass". OR

Graphic representation of total organic matter per unit area of different trophic levels is called "Pyramid of Bio mass".

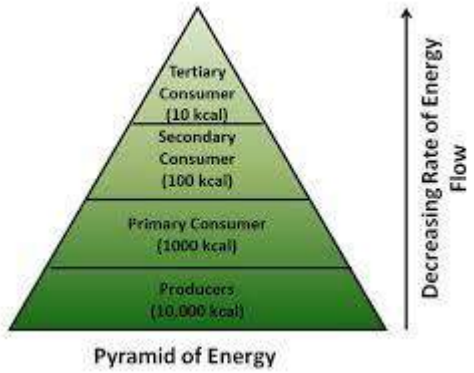
In Forest or Grass land ecosystem pyramid of biomass is upright. Producers like Trees and grasses from huge biomass, primary consumers form less biomass than producers, Biomass of further trophic level reduces gradually. Hence it is upright.



3. **Pyramid of Energy**:- the graphic representation of the structure and function of various trophic level of food chain in terms of flow of energy is called ' Pyramids of energy'.OR

   The graphic representation of rate of energy flow at successive trophic levels in an ecosystem is called as 'Pyramid of energy".

   Producers occupy the base of the Pyramid with largest amount of energy, availability of energy decreases at higher levels because there is loss of energy of about 80% to 90% at each trophic level .and only 10 % of energy passes from one trophic level to another.



Pyramid of Energy

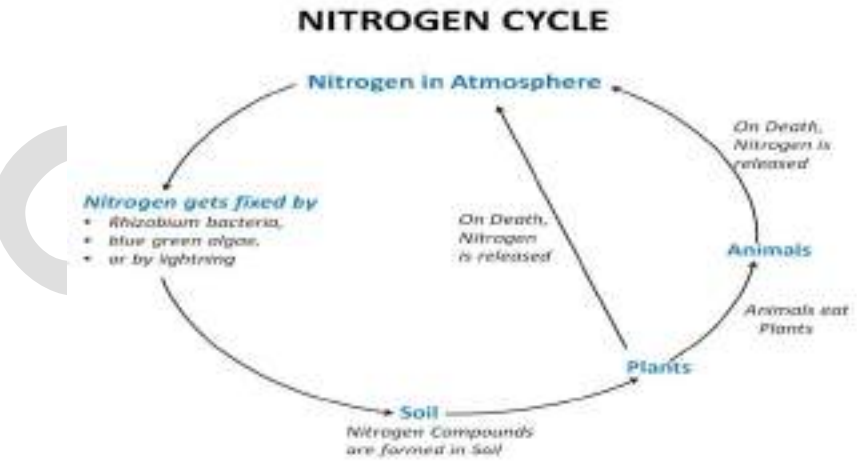
SIGNIFICANCE OF ECLOGICAL PYRAMIDS:

1. The graphic representation of the structure and function of various trophic levels. Any change in the in this may result in collapse of pyramid and thereby entire ecosystem.
2. Producers form the base of pyramid. This indicated the importance of producers. More the number of producers and Biomass stronger will be the ecosystem.
3. Flow of energy in an ecosystem is unidirectional and fallows Law of Thermodynamics.

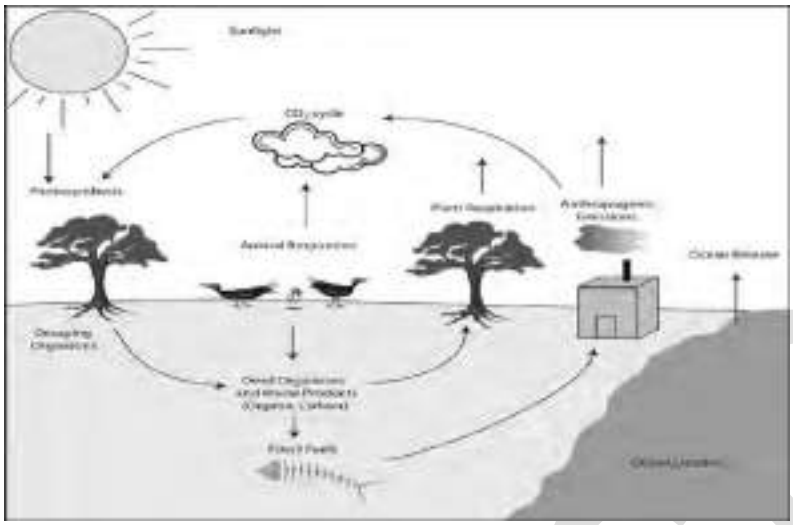
NITROGEN CYCLE: The cyclic movement of Nitrogen between organic and inorganic form to maintain its balance in nature is called" Nitrogen cycle".

Nitrogen cycle involves fallowing steps:-

1. Air is a reservoir for nitrogen. It is made available for plants during lightning and rain fall by physical means and through soil microbes by biological nitrogen fixation.
2. Nitrates are utilized by green plants to synthesise nutrients. [proteins].
3. Animals feed on plants, Nutrients are passed to animals. These excrete nitrogenous wastes. These are converted into Nitrites by Ammonification.
4. Dead bodies of plants and Animals are decomposed into nitrogenous wastes.
5. Nitrites are converted into nitrates by nitrification.
6. Nitrates are converted into gaseous nitrogen by denitrification[bacteria pseudomonas denitrificans , Thiobacillus bring about Denitrification].
7. Gaseous Nitrogen is made available for plants through nitrogen fixation by physical and biological methods.Thus Nitrogen cycle goes on continuously in nature.



Carbon cycle.



The atmospheric carbon dioxide is virtually the only source of carbon which is the basic constituent of all the organic compounds.

This gas is used by all plants in photosynthesis and the end products (organic substances) of this complex process are used in two ways.

One fraction is used in the construction of more living matter. The carbon and oxygen so supplied by CO_2 remain in living matter until death.

Decay subsequently returns CO_2 to the atmosphere, and this completes one possible carbon cycle. Another fraction of the organic substances is used as fuel in respiration by both plants and animals.

This process releases CO_2 as a by-product. Such CO_2 may now be used in photosynthesis again, or it may return to the environment, completing the second possible carbon cycle . Thus, photosynthesis and respiration are the two major processes that drive the global Carbon Cycle, with CO_2 as the main vehicle of flux between atmosphere, hydrosphere and biota.

The CO_2 content of the atmosphere is replenished not only through biological oxidation (respiration), but also through non-living combustion i.e., forest fires and burning of industrial fuels release CO_2 into the air. Occasionally volcanic eruptions also add CO_2 to the atmosphere.

It is clear that terrestrial plants utilize atmospheric CO_2 as their carbon source for photosynthesis, whereas aquatic plants use hydrosphere carbon i.e., dissolved carbonates.

These two sub-cycles are linked by CO_2 exchanges between the atmosphere and ocean as follows:-

$$\text{Atmospheric } CO_2 \longleftrightarrow \text{dissolved } CO_2$$

$$CO_2 + H_2 \longleftrightarrow H_2CO_3 \text{(Carbonic acid)}$$

The carbon is also found in freshwater bodies and oceans as bicarbonate resulting from weathering (Carbonation) of calcium – rich rocks.

$$CO_2 + H_2O + CaCO_3 \longleftrightarrow CaH_2(CO_3)_2$$

Thus, oceans are considered as great reservoirs of CO_2.

Phosphorous cycle.

Basic source and the great reservoir of phosphorus are the rocks or other deposits which have been formed in the past geological ages. These are gradually eroding, releasing phosphates to ecosystems. But much phosphate escapes into the sea where part of it is deposited in the shallow sediments and part of it is lost to the deep sediments.

The means of returning phosphorus to the cycle are inadequate to compensate for the loss.

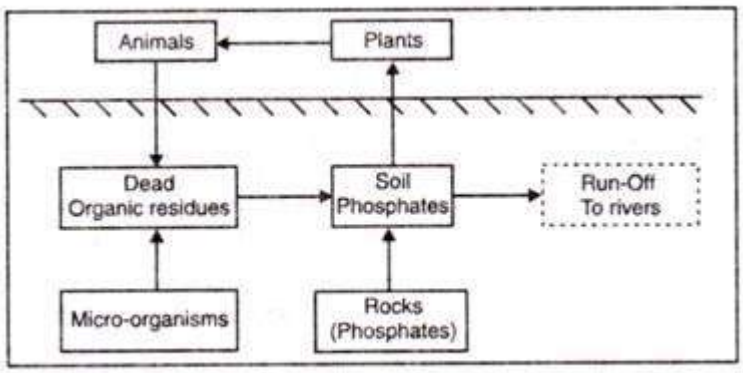


Fig. 5.10. The Phosphorus cycle on land.

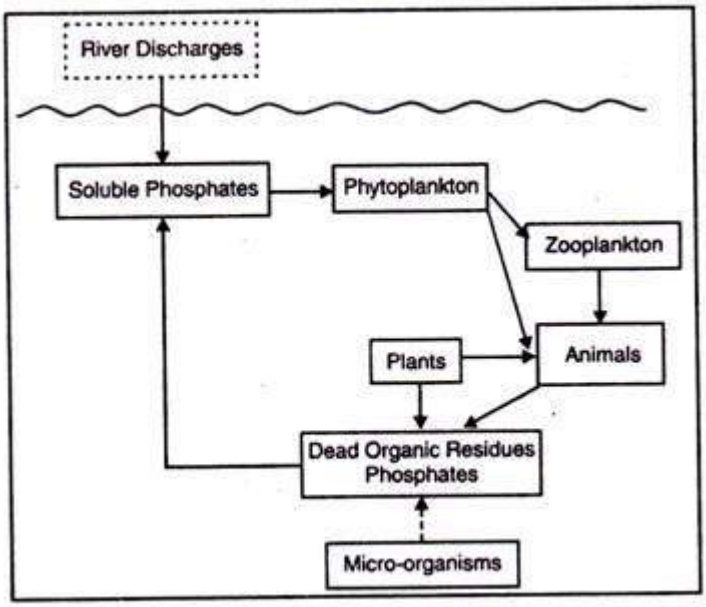


Fig. 5.11. The Phosphorus cycle in water.

Much phosphate becomes lost to this central cycle by physical processes, such as sedimentation, which take it out of the reach of upwelling and major water circulation. Biological process, such as the formation of teeth and bone.

The fish and marine birds are also important in phosphorus cycle. The latter have apparently played an important role in returning phosphorus to the cycle.Although man harvests a lot of marine fish about 60,000 tons of elementary phosphorus per year is returned in this manner, compared with one to two million tons of phosphate rocks which are mined and most of which are washed away and lost.

For their nutrition plants absorb water dissolved inorganic phosphates from the soil either as di-hydrogen phosphate (H_2PO_4) or as hydrogenphosphate (HPO_4) and convert these into organic phosphate.The latter is transferred to animal consumers and decomposers.
Decomposers return phosphorus to the soil as the phosphate ion. Phosphate absorbed from the soil is returned to it in dead plant and animal organic residues, which are converted to humus by the action of soil microorganisms. Much of the phosphate in the soil is fixed or adsorbed on to soil particles but some is lost through leaching out into watercourses.

In fresh water, the floating algae or phytoplankton rapidly absorb soluble inorganic phosphates and convert them into organophosphates .Algae provide food for zooplankton which in turn are consumed by other animals. All plants and animals eventually die and in due time their organic

remains or debris decay through the action of microorganisms, and phosphates are released into the water for recycling. In aquatic plants, phosphorus, limits plant growth.

Certain specialized fungi play an important role in phosphorus cycle. plant species have mycorrhizae (fungus roots), a mutualistic relationship between a non-pathogenic fungus and living plant root cells These mycorrhizae play an important role in soil nutrient cycling.

Natural phosphate cycle can be very much affected by pollution. Agricultural fertilizers containing superphosphate or triple superphosphate which are now frequently used in the fields; and sewage, even after treatment, contains phosphates derived from excreta and detergents.

These phosphates can eventually reach freshwater streams and rivers through the land run-off and effluent discharge. Phosphate pollution of rivers and lakes has caused excessive growth of algae, which depletes the dissolved oxygen content of water and disrupts the natural food chains.

2 marks questions

1. What is an Ecosystem? Mention its types. **2.** What is Lentic and Lotic Ecosystem?
   3. List components of Ecosystem**. 4.** What is Food chain and Food Web?
   5. What is an ecological pyramid? Mention its types. **6.** What is Bio geo chemical cycle?

5 marks questions

1. Describe components of Ecosystem**.**
2. Explain grassland Ecosystem/ Marine Ecosystem.
3. Explain forest ecosystem**. 4.** Describe Food chain.
   5. Explain Pyramid of Number/ energy.
   6. Describe Nitrogen cycle phosphorous cycle.

10 marks questions

1. Explain concept of Ecosystem with reference to Grassland.
2. Give an account of Ecological Pyramid.

UNIT: 4 (14 Hrs)

Ecological Adoptations- Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites. **Ecological Succession** - Definition, Process of Succession, Xerosere and Hydrosere. **Polluiton**- A brief account on Air, water and Soil. Global issues- Green house effect, Ozone depletion, nuclear winter, Solid waste management.

ECOLOGICAL ADOPTATIONS

Change in structure of plant parts to survive in the existing environmental condition is called Ecological Adaptation. Based on the habitat they grow they are classified into 3 ecological groups such as 1) Hydrophytes, 2) Xerophytes, 3) Halophytes etc.

HYDROPHYTES:-Plants which grow in water or soil covered with water are called Hydrophytes. They are classified into 4 types as follows:-

1. **Free floating hydrophytes**: -These plants float freely on the surface of water and remain in contact with air and water but not soil. Ex: Azolla, Pistia,Eichhornia, Jussiea etc.
2. **Rooted floating hydrophytes**: These plants are rooted in the soil at the bottom of water, but leaves have long petioles which makes them float on the surface of water.Ex: Nymphaea, Nelumbo,Trapa.etc.
3. **Submerged hydrophytes**:-These plants are floating, completely submerged in water but not rooted in soil.Ex: Hydrilla, Nepenthes.
4. **Emergent hydrophytes**:- These plants are partially submerged in water ,rooted in soil and partially exposed to air on surface ofwater.Ex: Sagittaria,Ranunculus,,Polygonum.

Adaptations in Hydrophytes

Various types of hydrophytes (Free floating, Rooted floating, submerged, emergent hydrophytes) may differ from each other on which they grow in the nature, but shows similar morphological and Anatomical adaptations. They are as follows:-

Morphological (External) Adaptations in Hydrophytes

1. Roots may be absent as in Wolffia or poorly developed as in Hydrilla or well developed with root caps as in Ranunculus.
2. Root hair is absent or poorly developed.
3. In some plants like Eichhornia root caps are replaced by “Root Pockets”.
4. In jussiaea aerial, floating, spindle shaped roots which help in floating are developed.
5. Stem In free floating forms are thick, short, spongy as in Hydrilla and long, slender, flexible in submerged forms.
6. Vegetative reproduction takes place by runners, Stolon, Offset or Tubers.
7. Leaves are flat, large with their surface coated with wax, and petioles are long, flexible,with mucilage as in Nymphaea or swollen ,spongy as in Eichhornia.

Anatomical (Internal) Adaptations in Hydrophytes

1. Cuticle is absent or poorly developed.
2. Epidermis is single layered, in leaf of submerged forms stomata are absent, in floating forms they are present only in upper epidermis.
3. Cortex is well developed with Aerenchyma.Vascular tissues are poorly developed, and lack bundle sheath.4. Mechanical tissues are generally absent.

XEROPHYTES

The plants that grow in dry habitats (area where the availability of water is less) is called' Xerophytes'.On the basis of their morphology, physiology and life cycle pattern Xerophytes are classified into 3 types. They are:-

1. **Ephemeral annuals (Draught evaders or draught escapers) :-**These xerophytes are annuals, complete their life cycle within a short period, of 6-8 weeks, avoid dry season and not with stand dry seasons. Ex: Argemone.
2. **Sacculents:** - These plants are having fleshy root, stem and root which store water during brief rainy season.Ex: Opuntia, Aloe, Bryophyllum, and Yucca.
3. **Non succulent perennials**:-These are true xerophytes because they possess number of Morphological, anatomical, Physiologicalcharacteristicsto withstand critical dry conditions.Ex: Acacia, Calotropis, Zizipus, Nerium, casurina.

Ecological Adaptations in xerophytes Plants growing in habitat with high temperature, Scarcity of water, and high rate of transpiration show adaptations both externally and internally as follows:- **Morphological(External) Adaptations.**

1. Root system is very well developed with extensive branches, Root hairs & root caps.
2. Stem is stunted, woody, dry, hard, covered with bark.
3. In some plants like Opuntia stem becomes fleshy, green, leaf like called Phylloclade, In Asparagus it branched with one internode called Cladode.
4. Leaves are reduced small scales in Asparagus,or modified to spines as in Opuntiato check transpiration. Leaf surface is glazed to reflect light and heat.

Anatomical(Internal) Adaptations

1. Root may be fleshy to store water as in Asparagus.
2. Cuticle is thick; Epidermis is well developed with thick wall& sunken stomata.
3. Hypodermis is several layered, and sclerenchymatous.
4. Vascular bundles are well developed, heavily lignified with several layered bundle sheath. Mechanical tissues and Bark are well developed.
5. Oil and Resins are often present.

6. In non-succulent xerophytes leaves become rolled so that stomata are hidden and reduce rate of transpiration.

Halophytes

The plants that grows in physiologically dry saline habitat are called 'Halophytes'. Saline soil have high concentration of salts of Sodium chloride, magnesium chloride and magnesium sulphate.

Types of Halophytes: warming in1909 classified Halophytic communities into 4 types. They are

1.Lithophylous: The plants that grow on saline surface of rock are called 'Lithophylous'**.**

2.Psammophilous: The plants that grow on saline sandy soil are called Psamophilous**.**

3.Pleophilous: The plants that grows on saline mud i.e., waterlogged saline soil.

4.Helophilous: The plants that grow on swampy soil are called Helophilous. It includes salt desert and Littoral forest (mangroove).

Adaptations in hydrophytes:- Plants growing in saline habitat shows following adaptations;

1. Plant s shows stunted growth with thick, leathery leaves and may develop stilt roots.
2. Rhizophora, Sonneratia develop special roots called Pneumatophores which grows vertically above soil, develop pores called 'lenticels' on its surface which helps in respiration .These are also called Respiratory roots are Breathing roots.
3. The seeds of these plants germinate when they are still attached to the mother plant .This is called 'Vivipery'.
4. Cork is several layered, cells of cortex and pith are filled with oil and Tannin, and walls are lignified.
5. In leaf Epidermis has thick cuticle and cells with calcium oxalate crystals. Stomata are sunken, only in lower epidermis. Mesophyll is well differentiated.

Epiphytes

The plants which grow perched on other plants are called '**Epiphytes'.** They are Autotrophic, do not have food relation with plants on which they grow; they absorb water from rain or moisture in the air.

Epiphytes grow abundantly in dense Tropical rain forest, eastern and western Himalayas. Epiphytic flora range from Thallophytic plants to flowering plants. Epiphytic lower plants are Lichens, Mosses and Ferns. Flowering Epiphytes are Vanda (Orchidaceae), Pothas (Araceae) Dischidia(Asclepiadaceae). Epiphytes develop 2 types of roots. They are :-

1) Clasping Roots:-These roots fix the plant firmly to the bark of the tree.

2)Hanging Roots:-These roots are long , thick, shiny, hang freely in air, have many layered spongy tissue called **'Velamen'**outside epidermis . These cells are dead, have holes in their walls and absorb water from rain or humid air like a sponge. They also absorb water and

minerals from wet soil collected in tree fork. Next to Vela men is thick walled supersized cells called' **Exodermis'.** Some cells in this layer are thin walled called passage cells. These cells permit passage of water from Vela men to cortex.

Adaptations in Epiphytes :-Epiphytes shows Xerophytic characteristics to cut down water loss during dry weather . They are:-

1. Leaves are thick and sacculent.Ex: vanilla.
2. Many layered Epidermis.EX: Ficus rametacea(Moraceae).
3. Leaves are reduced or absent.EX: Polyrrhiza. or cuticle is thick with sunken stomata.
4. Shed their leaves during dry weather.

PARASITES

The plants which derive food from other plants to which they are attached are called **Parasites.**

Parasitic adaptations:

I] Based on Nutritional requrements:- Based on this aspect Parasites are classified into 2 types. They are: - Holoparasite and Partial parasite. **a) Holoparasites :-**The parasite which entirely depend for its food upon host plant to which it is attached is called Holoparasite. Holoparasites develops adventitious roots called Haustoria which penetrates into the host, establishes contact with conducting elements absorb water and inorganic salts from Xylem and food from Phloem. Ex: Cusccuta, Lathraea. **b) Partial Parasite:-**The parasite which is partially dependent upon the plant to which it is attached is called Partial parasite. It develops haustoria that establish contact with the Xylem of host, absorb water and inorganic salts from it. These contain chlorophyll & can prepare their food. . EX: Viscum , Loranthus.

II] Based on part of host plant on which it develops:- Based on this aspect parasites are classified into 2 types. They are Stem parasite and Root parasite. **a) Stem parasite** :- The parasite which depends on the stem of other plant for its nourishment is called ' Stem parasite'. Ex: Cuscuta. **b) Root parasite:-** The parasite which grow on roots of other plant for nourishment is called is called ' Root parasite'. Ex: Striga grows on root of Sugar cane, Orobranchae grows on root of crop plants, and Santalum album (Sandal wood) is a partial root parasite. Its root develops haustoria which enter roots of neighboring plants.

Ectoparasite and Endoparasite : - These parasites obtain food from their host and cause diseases to them**.** The parasite which grow on the green plants are called ' **Ectoparasite'.**
The parasites which grow inside the green plants are called '**Endoparasite**'. Ex:-Bacteria, Fungi.

ECOLOGICAL SUCCESSION:

The plant community in an area is in equilibrium with the environment .The environment constantly changes due to interaction with the plants or due to inherent reasons. As a result existing plant community disappears and another community is established. It is a natural process by which the same locality becomes colonized by different communities of plants.

Definition: Successive colonization of an area by different plant communities till relatively stable community is established.

TYPES OF SUCCESSION: Based on the area on which plant succession takes place and organisms involved plant succession has been classified into 2 types. They are:

1.Primary succession: Succession that begins in a barren area which was not previously occupied by any vegetation is called Primary succession. The plants that begin the colonization are called 'Pioneers'.

2.Secondary succession: Succession that begins in an area which was previously occupied by vegetation, but destroyed due to environmental factors is called 'secondary succession'.

The factors may be climatic such as Draught; Wind, Snow, Fire Floods etc. or Biotic factors such as Grazing by animals, diseases caused due to pathogens fungi, Bacteria. Changes in land area by human activities. or Physiographic factors such as soil erosion, emergence of new land surface and submergence of existing land by natural calamities etc.

PROCESS OF SUCCESSION: The process of succession can be classified into 2 types .They are

1) Autotrophic succession: It is characterized by early and continued dominance of green plants. Energy flow is maintained indefinitely. Ex: Hydro sere, Xerosere.

2) Heterotrophic succession: It is characterized by early dominance of heterotrophs such as bacteria, fungi and animals. The process of Primary autotrophic succession involves following sequential steps: - **Nudation, Migration, Ecesis, Aggregation, Competition and reaction, Stabilization**.

1.Nudation:- A bare area may develop due several factors such as erosion, deposition, land slide.

2.Migration :- The seeds ,spores , propagules are of plants are carried by air , water, animals, man to the bare area. This is called Migration.

3 Ecesis:-The germination, growth, development, reproduction of migrated seeds and propogules results in their establishment in bare area.

4. Aggregation:-Successful growth and reproduction lead to increase in number of individual's .This is called Aggregation. Time to time new species continue to reach new area and establish .This is called Invasion.

5. Competition and co-action:- Aggregation of large number of species in limited area results in competition for nutrition,space,etc.Individuals affect each other .This is called Co-action.

6.Reaction:- Colonizers bring about changes in soil, water, temperature etc. which becomes unsuitable for existing community and it will be replaced by another community. This is called reaction.

7. Stabilization(Climax):-Changes in the environmental factors results in characteristic vegetation in which becomes more or less established for a longer period of time and is not replaced .

HYDROSERE:

The plant succession that begins in water is called 'Hydro sere' .The steps are well studied in ponds, pools or lakes. They are:-

1) **Phytoplankton stage, 2) submerged stage3) Floating stage, 4) Reed-swamp stage, 5) sedge meadow stage6), Wood land stage, 7) Forest stage.**

1) **Phytoplankton stage:** Microscopic, free floating plants are called Phytoplankton's. These constitute pioneers of Hydro sere. Some Blue green algae, like Nostoc, Scytonema, Spirulina, green algae like chlamydomonas, Volvox, Spirogyra etc. Golden brown algae Diatoms, bacteria are first organisms to colonize in the primitive medium. The soil is very much reduced with a PH value of more than 5. They multiply and grow for some time. The accumulated dead bodies of these mix with silt eroded by rain decrease the depth of the pond. Now this habitat favors growth of submerged plants.

2) **Submerged stage :**-The new habitat will be little shallow ,where light penetrates easily and favors' growth of rooted submerged hydrophytes like Hydrilla, Vllisnaria,Elodia, Utricularia,Myriophyllum etc.
These plants further build up substratum as a result of their death and decay.water level decreases, pond become shallower.New habitat is now suitable for growth of floating plants.
3) **Floating stage :**-The new habitat become still shallower .It is suitable for growth of rooted floating plants such as Nelumbo,Nymphaea,Trapa,Monochoria,etc.and also free floating plants such as Azolla, Lemna,Wolfia, Pistia etc.
These plants colonize the habitat with their rhizome. The water level becomes much

decreased. The decomposing organic matter further builds up substratum making pond shallower. Floating plants disappear from the area.

4) **Reed swamp stage:**- The new habitat is now suitable for the development of Amphibious plants such as Typha, Sagittaria, Scirpus,Phragmitis etc. These plants have well developed rhizome that form dense vegetation decreasing water level, become unsuitable for amphibious plants.
5) **Sedge –meadow stage:-** The new marshy habitat is suitable for members of Cyperaceae and graminae such as Carex, Juncus,Cuprus, Eleocharis . They form dense mat like vegetation towards center. High rate of transpiration, exposure of mud to air, addition of nutrients makes marshy vegetation to disappear gradually.
6) **Wood land stage;**-Soil becomes drier, area become invaded by terrestrial plants namely shrubs such as salix, Cornusetc, trees such as Poplus, Almus. Accumulation of humus with rich flora of micro organisms favors arrival of new tree species.
7) **Forest stage (Climax stage):**- The growth of pioneers of Forest community depends on local climatic factors. In tropical climate with heavy rainfall, favors tropical rain forest. In temperate region mixed forest of Acer, Ulmus ,Quresdevelops.In regions with moderate rainfall, tropical deciduous forest establishes. Forest canopy do not allow light rays to penetrate and favours Sciophytes(shade loving plants).Heliophytes (Sun loving plants) adopt epiphytic life. Thus, Climax community is established which interact with the environment, remain stable for longer period.

XEROSERE OR XERARCH :

Successive colonization of plants in an area with minimum moisture is called **Xerosere or Xerarch.** It can be classified into 3 types' namely :-

1)Lithosere :- Colonisation of plants on rocks .

2) Psammosere:-Colonisation on sand.

3)Halosere:- Colonization in saline soil or saline water.

Lithosere: Lithosere is a type of Xerosere , originating on bare rock surface, where the original substratum is deficient in water, lacks organic matter with minerals in disintegrated unweathered state**.** Various stages of Lithosere and their plant species are as follows:-**Crustose lichen stage, Foliose lichen stage, moss stage, Herbs stage, shrub stage, forest stage.**

1 .Crustose lichen stage: -Crustose lichens are pioneers of Litho sere.(xerosere).Ex;Rhizocarpon, Rhinodina, lecanora grows there. They produce some acids which bring weathering of rocks. The dead organic matter of lichen mix with small particles of rock. These habitats become suitable for foliose lichen.

2. Foliose lichen stage: In this new habitat foliose lichen such as Parmelia, Dermatocarpon grows. These have leaf like thallus, fixed to substratum with hair like rhizinae which bring weathering of rock by

lichenic acids. They are able to absorb and retain moisture, accumulate dust particles mix with humus, results in development of soil. Thus habitat is suitable for mosses.

3.Moss stage:- In the new habitat Mosses such as Polytrichum, Tortula, Grimmia grows .They are erect , prevent sunlight reaching substratum leading to lichen disappearance. Due to their death and decay there is further addition of organic matter and thickness of soil layer increases.

4.Herb stage:-The changed habitat favors growth of herbaceous rooted grasses such as Poa, Solidago,Festua ,aristidia . Their growth, death and accumulation of humus in soil with further weathering of rock xeric condition decreases favors shrubs.

5 .Shrub stage:-The new habitat is suitable for shrubs such as Rhus, Phytocarpus .They over shadows herbs, soil is enriched with dense shrubs, microbes, with increased humidity, water holding capacity which supports forest vegetation.

6.Forest stage:-The new habitat support xeric trees. Gradual further weathering of rock, increase humus content favors mesophytic vegetation. Thus finally complex forest establishes which remain stable and maintain balanced ecosystem.

ENVIRONMENTAL POLLUTION

An undesirable change in physical, chemical or Biological characteristics of Air, water and land that affect life forms and create imbalance in the nature. It is a serious problem which is manmade. It can be also be natural caused by volcanic eruption, emission of natural gases, floods, forest fire, Cosmic rays etc. The substances which cause pollution are called 'Pollutants'. They can be classified into 2 types as Biodegradable and non- biodegradable.

1) Biodegradable pollutant :- The substances which are **degraded by the activity of Microbes** are called 'Bio-degradable pollutant'.Ex:Organic substances, Sewage, Paper etc.

2) Non-degradable pollutant:- The substances which **never degrade by the activity of Microbes** are called 'Non-biodegradable pollutant'.Ex: Glass, DDT, BHC,Mercury.

Types of pollution ;- There are several kinds of pollution . Major types are Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal and radioactive pollution.

I] AIR POLLUTION

An undesirable change in physical, chemical or Biological character of air which are harmful to life forms and environment is' Air pollution'.

Air pollutants are Exhaust gases like carbon monoxide, Sulphur oxides, Nitrogen oxides, Hydrocarbons, Hydrogen sulphides, smoke dust, radioactive isotopes, pollen grains, Microbes .

Causes: Exhaust gases

1. Combustion of fossil fuels like petrol, Diesel, used in Automobiles release toxic gases like carbon monoxide, Sulphur dioxide, Hydrocarbons.

2. Cement, Iron and Steel, Graphite industries release smoke and dust. Oil refineries, chemical industries release carbon di oxide, CO, sulphur dioxide, etc. Fibers from textile industries.

3. Burning of plastic produce poly chlorinated biphenyl.
4. Agriculture burning, Forest fire, Domestic fuel, burning of urban wastes release smoke.
5. Ionizing radiations from atom bomb, reactor, and explosion release radioactive pollutants.

Effects:-

1. Carbon monoxide combines with hemoglobin of blood, form caboxy hemoglobin which reduce oxygen carrying capacity in blood, inhaling cause nervous disorder.
2. Sulphur dioxide cause sore throat and eye irritation. In plants it inhibits metabolic activities, and cause chlorosis**.**
3. Sulphur dioxide and Nitrogen oxide oxidize to Sulphuric acid and nitric acid .These dissolve in rain water and reach ground as **'Acid rain'.** It has corrosive effect on buildings, metals, marbles, makes water bodies acidic, which is not tolerable by planktons. Molluscs.
4. Hydrocarbon cause cancer .Tobacco smoke contain 'Benzopyrene' which cause lung cancer.
5.Nitrogen oxides in sun light combine with gaseous hydrocarbon to form photochemical oxidants PAN. (Peroxy acyl nitrate). These with dust and fog form smog (Smoke +fog). It causes eye irritation and bronchial disorders. In plants it causes Silvering, Bronzing, and Necrosis**.**
6.Chlorofluro carbon (CFC) used in refrigerators, aerosols deplete Ozone layer . It exposes earth to increase ultra violet radiations which cause mutation, Skin cancer.
7. Green house gases like Carbon di oxide, Methane, CFcs, increase in atmosphere lead to rise in global temperature, by 2 to 3 c. This is called 'Green house effect'. (Global warming). It change the rain fall pattern, cause melting of Glacier, Polar ice cap. Which cause flooding of low lying plains and coastal cities.
8. Fly ash, Metal dust cause head ache, Dizziness, loss of appetite, weakness.
9. Inhale of dust in cotton ,mine and Flour industries workers suffer from 'Pneumoconiosis', inhale of dust by workers in stone grinding industry suffer from' Silicosis', inhale of Asbestos dust by workers in asbestos industries suffer from' Asbestosis'.
10. Spores, pollen grains, Bacteria in air cause Allergy or Hay fever**.**

CONTROL MEASURES

Air pollution can be controlled by educating people to develop sense of ecological conscience by adopting fallowing methods: -
1. Use of compressed natural gas in Automobiles.
2. Use of Solar energy and wind energy.
3. Use of filters, Scrubbers, Collectors. Electrostatic precipitators in industries
4. Use of catalytic converter filter in Vehicles to convert nitrous oxide to Nitrogen.
5. The unburnt hydrocarbon in auto emission can be reduced by use of efficient engines.
6. Industrial areas are to be shifted away from populated areas and installation of tall chimneys.
7. Promote Afforestation.

II] WATER POLLUTION

Undesirable change in physical, chemical or biological characteristics of water that destroys aquatic life and threatens terrestrial life is called 'Water pollution'.

CAUSES: -

1. Domestic sewage: - Domestic sewage from residential areas, hotel contain organic wastes, Animal wastes, fecal matter, food residues, cleaning agents, detergents. It reaches ponds, pools, lakes through drainage and pollutes water.

2.Industrial wastes:- Waste water from paper industries, Sugar mills, metallurgical industry, food processing plants contain suspended solids, heavy metals like Nitrates, Phosphates.

3. Agricultural sources Excess of pesticides used to eradicate pests:- contain chemicals such as chlorinated Hydrocarbon, metallic salts etc . wash away in rain water, reach water body and pollute it. Artificial fertilizers used to get high yields contain Nitrogen, Phosphorous, Sulphur, Potassium etc. through agricultural runoff reaches water body and pollute it**.**

4. Oil spill:- Crude oil leaked into water body . During transport, loading and unloading at harbor or accidents pollute water.

5. Radioactive isotopes reach water body through rain and cause pollution.

6. Water used for cooling operation in industries release hot water into ponds, pools & affect life forms.

EFFECTS OF WATER POLLUTION

1. On human health: -a) Water polluted with sewage contains Virus, Bacteria that cause cholera, Typhoid, dysentery. **b)** Consumption of mercury contaminated fish cause Minamata disease (Crippling deformity).**c)** Cadmium contaminated water cause Itai Itai disease.

d) Lead contaminated water cause Anemia, loss of muscle power.

2.On Aquqtic system:- Organic and inorganic substances in water decrease dissolved oxygen content of water . The demand for oxygen increases. This is called 'Biological oxygen demand'.

3. Eutrophication:-The process of Nutrient enrichment of water leads to species diversity in water body. It is called 'Eutrophication'.

4.Biological magnification:- Accumulation of Non-degradable pollutants increasing concentration in tissues of living organisms along food chain is called ' Biological magnification' EX: Regular spray of DDT for few years to check Mosquito population in an island in USA declined fish eating birds, if human eat such fish it cause cancer.

5. Ground water pollution:- Ground water get contaminated due to seepage from agricultural runoff or industrial waste. a) Excess of Fluoride in drinking water cause teeth deformity, hardening of bones. b) Excess of nitrates in drinking water cause Blue baby syndrome in infants.

CONTROL MEASURES

1. Industrial effluents are to be suitably treated, made harmless and then release to the water body.
2. Minimize use of pesticides and artificial fertilizers.
3. Hot water released from cooling operations should be cooled before its discharge.
4. Oil spills can be cleaned with the help of bregoli**. (Saw dust)** byproduct of paper mills**.**
5. Water hyacinth absorbs toxic chemicals, heavy metals and purifies it**.**
6. Sewage is suitably treated by removal of larger, suspended particles by sedimentation, bacterial decomposition, and chemical oxidation.

SOIL POLLUTION

An Undesirable change in physical, chemical and biological characteristics of soil that affect the life forms and reduces its productivity is called 'Soil pollution'.

Causes:- 1.Industrial wastes:- It includes toxic chemicals like lead, copper, Zinc, Cadmium etc.
2. Pesticides sprayed to plants may reach soil in powder form or along with rain water.
3.Fertilizers contain various salts which increase salt concentration in the soil, decrease useful bacteria and reduce productivity**.**
4. Discarded materials like glass, leather, metals, concrete, synthetic yarn, and solid wastes.
5.Radioactive wastes released from mining, nuclear power plants alter composition of soil.

EFFECTS OF SOIL POLLUTION

1. Pesticides in the soil reduce useful microbes and decrease fertility of the soil.
2. Chemical fertilizers kill bacteria, increase salt concentration& reduce the productivity of soil
3. Excreta contain pathogens that cause diseases in life forms.
4. Radioactive wastes affect normal metabolic activities of plants and animals in the soil.

CONTROL MEASURES

1. Minimize use of chemical fertilizers by use of Biofertilizers.
2. Reduce use of pesticides by adopting biological pest control.
3. Animal refuse and agricultural waste can be utilized for production of bio gas.
4. Dumping of solid waste in transfer stations constructed at various points in cities.
5. Improvement of mining technique to avoid mine dust.
6. Ban of toxic non degradable chemicals like DDT, BHC.
6. Separation of biodegradable and non bio degradable wastes before dumping.
7. Recycling of non degradable wastes.

SOUND POLLUTION [NOISE POLLUTION]

Sound is a normal feature of life which is means of communication and entertainment. Loud unpleasant sound that causes discomfort is called 'noise'. Release of noise in the atmosphere is called 'Noise pollution'. The unit of sound level is decibel (db).the intensity of normal conversation varies between 35 to 60 db.

Sources:- 1. Industries like textile mills, Engineering works, printing press.
2. Domestic gadgets like mixer, fans, and air conditioners.
3. Entertaining equipments like TV, radio, record player etc.
4. Vehicles, Crackers, Construction works, stone crushers etc.

EFFECTS

1. Sudden loud noise or prolonged exposure to noise of 80db or more may damage ear drum.
2. Noise above 120db cause hormonal imbalance, increase heart beat rate, constriction of blood vessel, cholesterol level, blood pressure.
3. Noise cause anxiety. Detracts attention, emotional disturbance, and upset mood.
4. In animals it may damage heart, brain and liver.

CONTROL MEASURES

1.Replace noisy machines by sound proof installed machines**.**
2. Proper lubrication and machine maintainence.
3. Installation of decibel meter in industry.
4. Fixed intensity of sound in fixed hours of day for use of loud speakers**.**
5. Silence zones around hospitals, educational institutions and residential areas.

GLOBAL ISSUES

Human activities like pollution, Industrialization, extensive deforestation, results in the increase of carbon-di-oxide, depletion of ozone, shortage of potable water ,etc. All these leads to global scale environmental changes that affect life forms in Biosphere. Some of the Global warming, green house effect, Ozone layer depletion, acid rain.

Climate change: The average weather conditions and Variations in specific geographical region over along period of time (About 30 years) is called “Climate change”.

The inter governmental Panel on climate change has observed the earth’s temperature increase considerably which may cause periodic draught, famine, floods at unexpected places. This damage agriculture and other productive activities of mankind. Effect of Climate change is represented as follows:-

Climate change
Temperature change
Sea level rise
Precipitation change
Draughts and floods

Adaptation

----------→

Adoptation

Impact on Human and Natural system

Food and water resources
Ecosystem and Biodiversity
Human settlements
Human health

Emission and concentration
Green house gases
Aerosols

Socio economic development paths

Economic growth
Technology Population
Governance

GLOBAL WARMING AND GREEN HOUSE EFFECT

Warming of the earth's troposphere due to blanketing effect of high carbon di oxide , methane and other gases in the Stratosphere is called ' Global warming'. OR
[The increase in the Global mean temperature due to increase in the concentration of carbon di oxide, Methane and other gases is called 'Global Warming'.]

Green house Effect:-

CONCEPT

The gaseous mantle around the Globe allows solar radiations to enter earth which absorbs it and radiates back infrared and heat waves.
Green house gases form blanket in the Stratosphere. It checks back passage of infra red and heat waves from earth crust to space and keep the Global warm. The phenomenon is similar to Green house where Glass panels of the green house allows light, controls the heat from escaping and keep the plants warm to live in water . This is known as **"Green house effect'**.

CAUSES

1. Increase in carbon di oxide concentration due to burning of fossil fuels, Deforestation constitutes 60% of Global warming.
   2. Increase in Methane concentration due to anaerobic decomposition of organic matter contributes 20%.
   3. Increase in Chloro fluro carbon used in refrigerators, Air conditioners, solvents leak to atmosphere contributes 14%.
   4. Increase in N2 O concentration in the atmosphere contributes 14%.
   5. in 20 century Global mean temperature has increased by 0.6 C.

EFFECTS

1. Extreme heat waves due to Global warming cause death of life forms.Ex: In 2003 deaths in Europe were 20,000. In India it was 1000**.**

2. It may decline Artic polar ice cap. This raises the sea level resulting in floods which would destroy coastal countries.

3. It brings about disruption of habitat like Coral reefs, Alpine meadows, resulting in extinction of many species of plants and animals.

4. Colder places welcome positive effects of Global warming i.e. Warm temperature.

5.Increase in temperature increases Plant diseases and pests which decreases crop production.

Control measures

1. Global warming can be controlled by afforestation as plants use carbon di oxide for Photosynthesis.

2. Limited use of Nitrogen fertilizers in Agriculture which reduces N2O **.**

3. Limited use of chloro fluro carbon and developing alternative source for it.

4. Limited use of Fossil fuel and use of alternative source like solar energy and wind.

OZONE LAYER DEPLETION

Ozone is a form of Oxygen present in Stratosphere (between 20 to 26 km above sea level). It protects life forms from ultra violet radiation of Sun.

Ozone is a variant of oxygen. UV radiation from sun causes photodissociation of Ozone into O2 and O. But these recombine to form O3. Ozone is constantly being made by the action of sun light on oxygen .This dissipitates the energy of UV rays as heat. There is equilibrium between O3 formation and destructions leading to steady state of concentration of ozone layer.

The concentration of Ozone changes with season. It is highest in spring season (Feb- April). Lowest during fall season. (July- Oct). The thickness of Ozone if condensed averages 0.29 cm above equator and may exceed 0.40 cm above poles at the end of winter. The decline in spring time Ozone layer thickness is called Ozone layer hole**.** It was fist recorded in 1985 by farmer

over Antartica.

During 1956-1970 in Antarctica Spring time Ozone was between 280 to 325Dobson units. In 1979 it was decline to 225 Du. In 1985 to 136 Du. in 1994 it was declined to 94 Du.

CAUSES FOR OZONE DEPLETION

1.Chloro fluro carbon used in Air conditioners, Aerosols, Refrigerators destroy Ozone layer.

2. Combustion of Fossil fuels and Organic matter.

3. Excessive use of Nitrogenous fertilizers**.** **4.** Nuclear tests.

5. Sulphate aerosols emitted through volcanic eruptions.

EFFECTS

1. Rise in skin cancer in human beings.

2. Damage to eyes causing cataract.

3. Reduces functioning of Immune system**.**

4. In phytoplankton's it inhibits Photosynthesis**.**

5. Reduce fish productivity. 6. Plants exposed to UV rays shows reduction in growth and chlorophyll content.

CONTROL MEASURES

1. Ban of Chlorofluro carbon [Banned in Australia or USA].

2. Use of Alternatives to CFS's.

3. Carbon tetrachloride used in dry Cleaning, Methyl bromide used as insecticide has to be banned as they are found to be ozone depleting.

4. Create awareness .Every every year September 16 is observed as world ozone day**.**

5. International agreement, Montreal protocol was signed by 30 countries which limit production and use of Ozone depleting substance.

ACID RAIN

The phenomenon in which rainfall has PH less than 5.6 is called 'Acid rain'. Increase in concentration of C O ,S O, N O gases in the atmosphere combine with moisture to form acids and fall out of the atmosphere, deposits on the earth in 2 forms namely Wet and Dry.

A] Wet deposition:- It is the acidic water that reaches the earth through rain, fog, snow .

B] Dry deposition:- These are acidic gases and particles that reaches the earth by wind blow and deposits on buildings , cars, trees. It can be washed from rain storms.

CAUSES

1. Acid rain is formed when oxides of Nitrogen, Sulphur and Carbon dioxide combine with moisture in the atmosphere resulting in Nitric acid, Sulphuric acid and Carbonic acid respectively.

2. Automobiles are the main source of Nitrogen emissions, factories are source of sulphur, combustion of fossil fuels is the source of carbon dioxide emission.

EFFECTS

1. Acid rain cause leaves to lose cuticle, thus expose plants to infections**.**

2. Deforestation of leaves, reduce rate of photosynthesis. (It tends to release toxic substances such as Aluminium from nutrients which prevent use of Nutrients by plants).

3. It acidifies fresh water resources and cause death of aquatic organisms like Molluscs, Planktons and fishes.

4 It damages Marble, Lime stone, Sand stone, metals, Paints, Textiles, Carvings & monuments.5. In human beings it causes respiratory problems .6. It kills soil microbes leading to loss of fertility and bio diversity.

CONTROL MEASURES

1. Use of alternative energy sources like solar, wind, geo thermal energy.

2 .Increase in vegetation cover.

3. Use of catalytic converter in vehicles which convert Nitrogen oxide into Nitrogen.

NUCLEAR WINTER

The winter cold and low temperature condition on the earth due to nuclear or atom bombs explosion is called 'Nuclear winter'.

Nuclear winter is a hypothetical global climatic condition that is predicted to be possible outcome of nuclear war. The concept of Nuclear winter was first introduced in 1983 through **TTAPS study**.ie,. Scientists **T**urco**, T**oon, **A**uckerman, **P**ollack, Carl **S**agan.

CONCEPT

After Nuclear bomb explosion huge fumes of smoke, soot and dust would be produced. This form thick black cloud at height of 15 km from the surface of the earth. This layer prevents entry of 90% of the solar radiation and results in fall of temperature by 20 to 25 C causing peculiar type of cold condition as in winter. This is called 'Nuclear winter'.

EFFECTS OF NUCLEAR WINTER

Effects of Nuclear winter would be as follows:-

1. Nuclear explosions would ignite uncontrolled fire over cities and forests within their range.
2. It would interrupt plant photosynthesis and destroy earth's vegetation.
3. It would cause death of animals and human beings.

4. This could lead to destruction of industrial, medical transportation, infrastructure along with food supplies.

CONTROL MEASURES:

1. Imposition of Ban on use of Nuclear weapons. (It is estimated that USA, Russia, China, Pakistan, England, Germany, India etc, have 10,000 mega tons of Nuclear weapons which have ability to destroy earth several times. Hence proliferation of Nuclear weapons is dangerous).

SOLID WASTE MANAGAMENT

INTRODUCTION;-

Increase in Population and civilization has led to the formation of solid substances which are of no use called "Solid waste". Each person generates 200 to 500 gms of Solid waste per day.

TYPES OF SOLID WASTE:-

Depending upon the source Solid wastes is classified as follows:-

2. **Domestic Waste:-** Unused food stuff, Broken glass, Leather , old paper, Old cloths, Plastic bags, Ash , empty metal boxes constitutes Domestic wastes.
3. **Road side waste:-** Fallen leaves, flower branches, fruits, Excreta of animals thrown out substances constitute Road side wastes.
4. **Market and industrial waste:-** Packing materials, rotten fruits, vegetables, empty shells of eggs , plastic bags, defective parts of machine, metal scrap, constitutes market wastes.
5. **Hospital waste:-** Unused and expired dated medicines, tablet cover, Bandage cloth, used syringes, fluid bottles, pipes etc constitutes Hospital wastes.
6. **Building waste:-**Concrete, cement, broken bricks, furniture's etc constitutes Building wastes.

CLASSIFICATION OF SOLID WASTE

Solid waste can be classified into 2 types as follows:-

1. **Bio- degradable Waste: -** Solid waste which undergoes decay and decomposition by the action of saprophytic Bacteria and Fungi are called Bio degradable waste. Ex: Food stuff, cloths, paper, leaves.
2. **Non-degradable Waste:-**Solid waste which cannot be degraded by Bacteria and fungi are called Non – degradable waste. Ex:- Plastic, Glass, Porcelin, Metal.

EFFECTS OF SOLID WASTE;

1. Heap of Solid waste emit fowling smell during decomposition, provide place for Pathogenic microbes which cause diseases such as Cholera, dysentery, Cholera etc. and affects Aesthetic beauty of the place.
2. Unused food is packed in plastic bags and thrown out. Cattles eat it along with food that leads to the death.
3. Burning of wastes releases gases which release carcinogenic gases. Dust and Smoke may cause Asthma, and respiratory problems.
4. Leaching of solid wastes causes soil pollution and water pollution.

METHODS OF SOLID WASTE MANAGEMENT:-

Safe disposal of segregated solid waste to Safe place is known as " Solid waste management". It includes following methods;-

1. Separation of Solid waste into **a) Dry waste** such as Paper, plastic, Metal, Rubber, Cloth. This type of waste should be given for recycling for production of useful substances.
   b) Wet waste such as unused food, Kitchen waste. This undergoes decomposition, from compost used for plants, good quality manure for vermiculture.
   C) Toxic waste such as expired Medicines, Battery shells, Paints, infected cotton, injection tubes. This waste has to be safely disposed far away from water source and burnt in safe places.
2. Building waste and industrial waste can be disposed in land fill sites.
3. Waste has to be disposed in places away from human habitation with concrete base.
4. Adopt Eco friendly life styles to reduce amount of solid waste.

2 marks Questions

1. What is Haustoria? Mention its significance.
2. What is meant by Vivipery? Where do you find it?
3. Mention green house gases.
4. What is Global warming? Mention any 2 effects.
5. What is Biomagnification? Mention its effects.

6. Mention types of solid wastes.
7. What is Eutrophication? List its effects.
8. Write 4 adoptations of Halophytes.
9. What is velamen? Mention its significance.
10. What is Pneumatophore? Mention its function.
11. What is ecological Succession? Mention its types.
12. What is nuclear winter? Mention its effects.

5 marks questions

1. Give an account of adaptations In Hydrophytes.
2. Describe Morphological and anatomical adaptations in Xerophytes.
3. Explain parasitic adaptations.
4. Explain process of Ecological Succession
5. Give an account of Soil Pollution.
6. Write a note on Solid waste management.
7. What is Acid rain? Write note on its causes, effects control measures.

10 mark questions

1. Describe process of Hydrosere.
2. Explain succession on barren rock(Xerosere)
3. What is Air pollution? Explain causes, effects and control measures of Air pollution.
4. Give an account of causes , effects and control measures of water pollution

BOTANY II SEMESTER CBCS **K.S.Gitanjali.SSCASC TUMKUR**

UNIT:5 (10 Hrs)

Plant biodiversity- Definition, types, Values of Biodiversity, conservation- Soil conservation, Social forestry, Hot spots, endangered species, Red data book. Phytogeography- Phytgeographical regions of India, Vegetational types of Karnataka.

INTRODUCTION

Diversity of life forms i.e. Microbes, plants, Animals and human beings found on all parts of world are called Bio diversity. The term 'Biodiversity was coined by Rosen and Walter in 1985.It refers to difference present within the members of species which is due to differences in genes.

TYPES OF PLANT BIO DIVERSITY

Plant biodiversity can be classified into 3 types. They are as follows:-

7. **Genetic diversity:-**The Variation in genes within species is called "Genetic diversity". It is basis for speciation. It has key role in maintenance of diversity at species and community level.
   A species having more genetic diversity can adapt better to the changed environmental conditions. A species with lower diversity takes time to adapt to changed environment and more susceptible to diseases. Ex: Genetically similar crops developed by scientists are more prone to fungal diseases or insect attacks than the wild varieties which have better genetic diversity.
8. **Species diversity:-The Variety of species present with in a region is called "Species Diversity".** Every species has a specific role in an ecosystem. It forms a link in the food chain.
   Species diversity is measured by its richness.ie,. Number of species per unit area. The number of species increases with the area of site. Greater the species number, greater is the diversity.
   The species that are important in determining the ability of large number of other species to persist in ecosystem is called "Keystone species". If Keystone species is lost from an area, numerous other species from an area are lost.Ex: Ficus bengalensis (Banyan tree) is a keystone species because many insects, birds depend on it for survival.
9. **Ecosystem diversity:-The different kind of ecosystems present in a region is referred as "Ecosystem diversity".** It is of 2 type's namely Aquatic ecosystem and Terrestrial ecosystem.
   Ecosystem diversity has 3 types, namely
   1) Alpha diversity:-The diversity of organisms sharing the same habitat is known as "Alpha diversity". In a habitat combination of species richness and evenness represent alpha diversity. It changes with change in habitat or community.
   2) Beta diversity: - The rate of replacement of species along a gradient of habitat is known as "Beta diversity". Environmental gradients like altitude, moisture, etc results in differences in species composition.

3) Gamma diversity: - The diversity of habitats over the total landscape or geographical area is known as "gamma diversity". Number of ecosystems present in a region is a measure of diversity.

VALUE OF BIODIVERSITY

In 1900 Mc Neely has classified Economic Values of Biodiversity as follows:-

4. **Consumption Value:- Consumptive uses include the products that can be harvested and consumed like Food, Drugs, fiber etc.**
   a) **As Food;-** Human beings depend on only Rice , Wheat, Corn and Potato for food. About 80,000 edible plant species have been reported from wild. The forest is store house of wild varieties of agricultural crops. These unutilized species may have more Nutritional values than the current utilized species. These wild varieties are potential sources of genetic material to obtain desired trait such as high yield, Disease resistant etc.
   b) **Druga and Medicines:**-75% of the world population depends on plants or plant extracts for medicine. 30% of the medicines are of plant origin. In Ayurvedic system use of medicinal plants is popular. Ex; Neem, Tulsi, Aloe vera etc. Substances with therapeutic properties are obtained from plants are as follows:-

Sl. No	Medicine	Plant	Curable disease
1	Morphine	Papaver	Analgesic
2	Quinine	Cincona	Malaria
3	Penicillin	Penicillium	Antibiotic

5. **Productive Value**: - Products of commercial value are manufactured utilizing Biodiversity.
   a) Furniture; Furniture's like Chairs, Tables, Doors, Windows ,Cots etc are made from Teak, Acacia, cane and Jack wood.
   b) Fuel: - In Rural areas plants are sources of fire wood. Fossil fuels like Petrol, charcoal, Diesel derived from plants.
   c) Scent Products: - Plants like jasmine, Sandal, champak ,Rose are sources of Perfume.
   d) Fibers: - Cotton yield hard, elongated fibers used in Textile industries. Jute, Coconut, Agave, etc yield fibers used in Coir industry in the manufacture of Carpets, Bags, and Ropes etc.
   e) Dye; - Different parts of plants like Flower, Leaf, Bark, Seeds and animals yield Dye.

6. **Social Value:-**Biodiversity has cultural and religious beliefs. Some plants and Animals are recognized as symbol of National pride and cultural heritage and national pride. Ex: Oscimum(Tulsi), Lotus, . Eagle Marmelose. (Bilva patrae) are believed to be Sacred plants. Cow, Peacock, Elephant, Lion, Tiger, Snake are to be considered sacred and worshipped.

Neem (Baevu) Peepul(Aralei), are restored to inculcate the religious sentiments and sense of reverence towards tree. Sacred Forest are traditionally conserved patches of Forests dedicated to local deity.

7. **Ethical Value:-**Recent research shows close link between Ecological system and Ethical system. It puts, moral principles to preserve, protect Biodiversity.
8. **AestheticValue:-** Biodiversity has great Aesthetic value. Roses, cornation flowers, orchids, colorful wings of birds, majesty of Lions, and Elephants are permanent source of joy and happiness. It provides good deal of fun, recreation, Eco tourism bird watching, wild life watching, Pet keeping, Gardening etc.
9. **Optional Value:-**Biodiversity has potential of becoming important in future as source of useful genes, or as food. Any plant or animal may provide product or service in future of man.
10. **Ecosystem services:-**Biodiversity is essential to keep natural cycles going and make itself sustain unit A) Biodiversity maintain gaseous composition of atmosphere. B) Soil formation and Protection) Climate control by Forest ecosystem and ocean ecosystem. C) Nutrient cycling. E) Conservation and Purification of water.

CONSERVATION OF BIODIVERSITY

"Management of Biosphere, so that it gives maximum benefit to the present generation maintaining its potential to meet needs of future generation" is called conservation ecology. There are 2 strategies of Bio- diversity conservation .They are as follows:-

IN-SITU CONSERVATION : Conservation of endangered species in its natural habitat by eliminating factors which are harmful to their existence is called "IN-SITU conservation". It is done by setting National park, Sanctuaries, Bio sphere reserves etc.

1.National park :- National park is a protected habitat meant to maintain Bio diversity through legal and effective method. Here Hunting, grazing, fire wood collection, Timber harvesting, habitat manipulation, Private ownership is not permitted. Tourist activity is permitted on outskirts, but not in interior. In India there are 89 National parks. Some of them are as follows:-

National park	Location	Animals found
Bannerghatta	Karnataka	Elephant, Tiger, Crocodile
Khaziranga	Sibsagar, Assam	One hirned Rhinoceros, Ring tailed fishing eagle, Tiger, Bison, Wild Buffalow
Rajiv Gandhi	Nagarahole , karnataka	Tiger, Flying sqirril

Corbett	Nainital, Uttarnchal	Sloth bear, Tiger, Panther, Elephant.

2.Santuries:- Sanctuary is a protected area reserved for only animals. In Sanctuaries harvesting of timber, collection of minor forest products, private ownership is allowed, provided they do not affect animals. In India there are 492 wild sanctuaries.

Santuary	**Location**	**Aniamls found**
Bhandra	Chikkamagalur Karnataka	Elephant, Leopard
Annamalai	Coimbatore, Tamil nadu	Tiger, Elephant, spotted deer, Wild dog
Nagarjun sagar	Andra pradesh	Panther, Wild beer, Samber, Tiger

3.Biophere reserves :- Biosphere reserves are Scientifically managed , special category of protected areas where people are part of the system. In 1975 UNESCO formulated this concept. Here attention is given to research and conservation of gene pool. In India there are 13 Biosphere reserves. They are as follows :-Nanda Devi Biosphere reserve(Uttar Pradesh), Sunder bans(West Bengal), Nilgiri (Tamil nadu, Kerala, Karnataka), Manas (Assam), Nackik(Meghalaya) Munnar Khari (Tamil nadu) , Great Nicobar and Pimptilal (Orissa).

Advantages of IN-SITU conservation

1. IN –SITU conservation reduces cost of maintenance.
2. Protect large number of Fauna and Flora.
3. Storm, Draught, Rain, Snow, Fire, and Pathogen play major role provides opportunity for organisms to evolve into better adopted forms.

EX-SITU CONSERVATION :-Conservation of Bio diversity at places away from their Natural habitat under controlled condition is called EX-SITU conservation. Ex**:** Zoo, Nurseries, Botanical gardens etc.

1. **Zoo and Botanical gardens :-** Endangered species are captured and maintained in Zoo and Botanical gardens. Animals are allowed to breed in captivity. Ex: Long tailed Macaca found in Western ghats is hunted for tasty flesh and medicinal value. Their number has decreased .Now they are introduced to various Zoos.
2. **Animal translocation:-**Animals' translocation involves transfer of animals from one locality to another when their number increase beyond capacity of habitat or if it becomes nuisance to human life, health and property. Ex: Golden Lion tamarins a squirrel sized monkey endemic to forest of Rio de Janerio was translocated to safer place.

3. **Animal reintroduction:-** Animal reintroduction involves release of animals into an area from where they are disappeared or caught in infancy, grown in captivity. It is practiced

when species is a victim of pet trade or hunted for its product or threatened to disease, natural disaster. Ex; Bison, eagle, Owl, White tailed eagle.

4. **Gene or Germplasm bank:-** Genetic resource is present in seed, bud, tissue is called Germplasm. Storage of germplasm of wild and cultivated or domestic animals at low temperature in frozen state is called 'Cryopreservation'. By this method germplasm can be stored for longer duration.

SIGNIFICANCE OF BIODIVERSITY

1. Conservation of old relatives of crop plants provides breeders with ready source of genetic material.
2. Plants and Animals conserved in Zoo, Botanical garden etc. can be used to restore degraded land. Restock depleted population.

CONSERVATION ECOLOGY

Conservation ecology deals with the preservation of natural resources to maintain balance in an ecosystem. Natural resources can be classified into 2 types.

1. Non–Renewable resources: Natural resources which cannot be restored against their loss are called' Renewable resources'.Ex:-Coal, Uranium, Bauxite, Gold, Petroleum products

2. Renewable resources: Natural resources which can be restored against their loss are called 'Renewable resources'. Ex: Soil, Water, forest, Wild life.

OVER EXPLOITATION OF NATURAL RESOURCES

In recent decades man has achieved progress in scientific, industrial, technological field. But he has ignored, tried to control & dominate the nature by it's over exploitation ignoring the basic principles that govern the ecosystem. Thus delicate balance is disturbed & altered.

CAUSES:- man made causes for over exploitation are as follows:-

1. Urbanisation:- Natural increase in population and immigration results in scarcity of space for housing , Agriculture, inadequate food etc. This leads to urbanization which is a consequence of industrialization.

2. Expansion of Agriculture: - Population growth, demand for increased food production, modern methods of agriculture leads to the destruction of forest.

3. Deforestation;- Deforestation is due to developmental activities of human for food, fodder and fuel.

4. Mining activity: - Excavation of Non-renewable resource for economic purpose sets major ecological problem.

5. Poaching: - Hunting and indiscriminate poaching of wild animals for their skin, horn, ivory,

nail etc. is responsible for extinction of wild life.

6. Pollution:- Human activities cause undesirable change in air, water, soil, alter its composition and harmful effect.

EFFECTS OVER EXPLOITATION OF NATURAL RESOURCES

1. Urbanization, expansion of agricultural land leads to deforestation& depletion in natural resources.

2. Deforestation leads to Global warming, Soil erosion, Floods, desertification, low rainfall**.**

3. Air pollution bring about Ozone layer depletion, Smog , Acid rain, Water pollution cause diseases, mutation, Biomagnifications.

4. Soil pollution destroys microbes by toxic chemicals decrease fertility.

5. Poaching reslts in extinction of wild species.

CONTROL MEASURES Natural resources can be preserved by following methods:-

1. Restrictions are to be imposed against use of Non renewable resources.

2. Alternative source are to be find out for fast depleting Non-renewable resource.

3. Planned utilization with provision for regeneration.

4. Use of solar energy, wind energy instead of fossil fuel.

SOIL EROSION

Soil is the top most layer of earth crust formed of weathered rock and organic debries. It supports life forms. The term 'Soil' is derived from Latin where 'Solum' means 'Earthy material'.

The removal of fertile top most layer of the soil resulting in disturbed soil structure is called 'Soil erosion'. It may be caused by natural factors such as wind, water and with human intervention through deforestation, modern agricultural methods.

Types of soil erosion The process of soil erosion can be classified into 4 types. They are: -

I. Geological erosion:- Geological is a natural process in the geological activity of the earth. There is equilibrium between soil erosion and soil formation.

II. Accelerated erosion: - The rapid soil erosion by wind or water when soil is denuded of vegetation is called Accelerated erosion.

A) Wind erosion: - Removal of soil particles by wind in the form dust or heavier particles by surface creep when an area is denuded of vegetation is called' wind erosion'.

B) Water erosion:- Removal of soil by water is called Water erosion. It takes place in various forms as follows: -

1. Sheet erosion :- The process of removal of uniform layer of soil in barren area during heavy rain fall is known as' Sheet erosion'.

2. Rill erosion: - The process of removal of soil forming finger shaped depressions by runoff water is called 'Rill erosion'.

3. Gulley erosion:- The process of removal of wide and deeper channels by rills is known as 'Gulley erosion'.

4. Land slide or Slip erosion:- The process of sliding of section of soil down the hills during heavy rainfall is called ' Slip erosion or Land slide'.

5. Stream bank erosion: - The process of erosion of bank of the river by waves or floods is called Stream bank erosion.

EFFECTS OF SOIL EROSION

1) Soil erosion results in loss of top fertile soil**.**

2) On hill slopes it destroys vegetation.

3) It leads to reduced productivity of soil**.**

4) Siltation at the bottom of water body reduces water storage capacity**.**

5) Sand particles carried by wind het deposited over adjacent crop lands, ponds, pools, lakes which increases aridity and gives to desert conditions.

SOIL CONSERVATION

Prevention of soil erosion to maintain soil fertility is called 'Soil conservation'. The term 'conservation' is derived from latin where 'Con' means 'together' and 'serve' means 'guard'. In India it is supervised by Central soil conservation board.

TYPES OF SOIL CONSERVATION

Soil conservation is classified into 2 types. They are: -

I. Biological methods: Soil conservation by plants and its organic materials is called 'Biological soil conservation'. **II. Mechanical methods:** Soil conservation by other methods to increase water holding capacity, decrease velocity of runoff is called' Mechanical soil conservation'.

I. Biological methods: -

Soil conservation by plants and its organic materials is called 'Biological soil conservation' .They are grouped into 2 types. They are **A**] **Agronomic methods. B] Agrostological methods.**

A] AGRONOMIC METHODS OF SOIL CONSERVATION

It includes crop rotation, Mixed cropping, Mulching, Tilling, Contour farming, Strip cropping,

1) Crop rotation:- The process of growing 2different types of crops alternately in the same land to replace lost minerals and organic matter . It conserves soil, helps to break plant diseases and insect cycle. EX: - Growing Cereals and legumes**.**

2. Mixed cropping: - The process of growing 2 different crops in the same land at the same time. Ex; Banana crop with Areca and Coconut. Millet with Black gram and pigeon pea.

3. Mulching:- The process of covering the soil with grasses , leaves, crop residues, litter etc. It helps to retain moisture, decrease runoff, increases humification.

4. Tilling:- The process of tilling the land removes weeds, increases water percolation , water holding capacity and conservation of Soil.

5. Contour farming: - The processes of ploughing land at right angle to the slope where plants are grown on ridges which check excess of runoff water and conserve soil.

6. Strip cropping: - The process of dividing the land into alternate bands of tilled and untilled strips and growing crops in the tilled strips along the slopes checks soil erosion.

B] AGROSTROLOGICAL METHODS OF SOIL CONSERVATION

It includes Lay forming and a forestation and Reforestation).

1. Ley forming: - Cultivation of grass in heavily eroded area along with legumes is called ley forming. It checks soil erosion, enrich soil makes soil productive.

2. Aforestation and Reforestation:-Growing of trees for the first time in tree less region is called' Aforestation'. Growing of trees in areas which was previously occupied by trees but destroyed due to Fire, Flood or over grazing is called 'Reforestation'.

II MECHANICAL METHODS OF SOIL CONSERVATION

Soil conservation by Mechanical or Engineering methods to increase water holding capacity, decrease velocity of runoff is called' Mechanical soil conservation'. It includes Basin listing, Sub-soiling, Terracing, trenching, Bank protection.

1. Basin listing:- In basin listing small basins are made with the help of Basin listers . It holds water and stabilizes downward moving water.

2. Sub- soiling:- In Sub-soiling large soil particles are broken into fine particles with sub soiler to increase absorption.

3. Terracing: - In terracing along the steep hills series of platforms are made like steps of a stair case to check runoff and to decrease velocity of wind. vegetation is grown on these platforms.

4. Contour trenching: - In Trenching series of small, shallow pits are dug across the slope. These hold water; above trenches tree seedlings are grown.

5. Bank protection:- In bank protection banks of rivers and channels are constructed with concrete and stones to protect them.

6.Contour bunding:- In contour bunding small bunds are built up on the edges of field to check sheet erosion and retain moisture.

SOCIAL FORESTRY :-

_Planned development of useful plants to fulfill essential needs of human being is called 'Agriculture'. Agriculture has reached essential output due to Agro technology & advancement in use of fertilizers, crop physiology, pest control and genetic engineering.

EFFECTS:-

1. Small land holders, land less agricultural labourers migrate to cities & are forced to live in slums.**2** Infrastructure of cities cannot cope up with influx and results in overcrowding**.**
3. Disturb social balance in human society.

Benefits of Social forestry

Land surface with dense mat of trees is called 'Forest'. Its products meet large number of human requirements. They are:

1**.** Wood as Timber, fuel and Char coal. **2**. Wood pulp in paper mills, rayon.
3. Gums, resins, Tannin, Camphor. **4**. Fibers for cordage.
5. Leaves in lunch, plates, Bee dies, Cigarettes. **6.** Edible fruits**.**
7. Forests maintain ecological balance, climate, prevent soil erosion, landslides, attract rain bearing clouds.
Indiscriminate felling of trees, over grazing leads to soil erosion, disturb ecological balance, reduces rainfall.

CONSERVATION OF FOREST :

Forest can be conserved by following methods: -
1. A forestation: - Growing of tree seedlings for the first time in the tree less region is called ' 'Aforestation '.
2. Sylviculture:- Planned development of forest is called ' Sylviculture'. It includes natural regeneration and thinning. **In natural regeneration** ecological conditions prevailing in the forest are studied, altered to regenerate and establish requires species. **In thinning** to avoid competition and to promote proper growth some plants are removed from overcrowded areas. Cleaning, weeding, climber cutting is also practiced**.**
3. Social forestry:- Cultivation of trees in village common land is called ' Social forestry'. The species selected for this purpose should not demand too much nutrition, should grow fast. The wood could be used in the manufacture of Agricultural implements, carts, etc. and as fire wood
4. Establishment of grazing grounds :-In village, common land is used for cultivation of species which provide food for cattle's. It prevents and protects the forests from indiscriminate grazing.

Forest wealth is protected by ecologists in Bedthi Karnataka. Silent valley in kerala.Nelambur in Kerala has maintained teak plantation. In Madhya Pradesh mixed forest with teak and Bamboos are maintained.

HOT SPOTS: "The Hot spots are richest and most threatened reservoirs of plant and Animal life on earth. In1998 Norman Myers developed Hot spot concept to designate priority areas for determining for IN-SITU conservation.

Criteria for determining hot spots are as follows:-

1. An area should contain 1500 endemic species or 0.5 endemic species of the world.
2. Threat of habitat loss is above 70%.
   Over the world 25 Hot spots have been identified. These occupy 1.4 5 of earths land area. 20 % of population lives in Hot spots.

HOT SPOTS OF INDIA : Among 25 Hot spots of the world 2 Hot spots are found in India. They are:-1) Western Ghats and 2) Eastern Himalayas.

1. **Western Ghats:** - Western Ghats lies parallel to Western coast, Indian peninsula for 1600 km, spread over in Maharashtra, Karnataka, Tamilnadu and Kerala.

It has 490 Taxa of which 308 are endemic .Ex: Rowolfia serpentine, (Sarpagandha), GArcinia, Loris, Macaca silensus. The 2 centers of Biological diversity are: -
1) Agastyamalai hills and silent valley. 2) Amambalam reserve.

2. **Eastern Himalayas**:- Eastern Himalayas extend to North eastern India, Bhutan, Deep and Semi isolated valleys are present here. Due tp rich diversity of flowering plants it is referd as "Cradle of Speciation". It is represented by 63%, mammals 60%, Birds 2, Endemic Lizard genera, 35 endemic Reptile species, 2 Turtle, 65 Amphibians of which 20 are endemic.

ENDANGERED SPECIES OF INDIA

The uncultivated plants and undomesticated animals in their natural habitat are referred as wild life. Wild life has suffered from Human activities Like Industrialization, Urbanization, deforestation, construction of reservoir, dams etc various species have become extinct.

A species is considered to be extinct when no member of the species is alive anywhere in the world. Wild life biologists have classified wild life that is facing possible extinction into 3 groups. They are 10 Endangered. 2) Threatened. 3) Rare.

1. Endangered species:- A taxon is considered as Endagered when its number is very low,the habitat is reduced or damaged,that they are in danger of extinction near Future.

In India, At present Among animals 150 species of birds,are considered to be endangered. Some of them are as follows:-

Endagered plants :- orchid species,Sandal wood,Sango paln,Sarpagandha,Pitcher plant,Rhododendron.

Mammals :- Tiger,india Lion,Indian wolf,Sloth bear, Red fox,Dugong,Golden cat,Striped hyena.

Reptiles:- Crocodile,Indian rock python,golden sea,Turtile,Tortoise.

Birds: - Peacock,Pelicon,Horn bill,Siberian white crane,spotted owl.

Primates:- Lion tailed Macaca,Capped monkey,Golden monkey,Nilagiri longur.
IUCN (International union for conservation of Nahure and Nahural Resources) maintain 'Red data Book' which provides recorded of plants and animals which are in danger.

2) Threatened species:- A Taxon is considered to be threatened or vulnerable when it's number is decreasing and are likely to become extinct with medium term future

3) Rare :- A Taxon is considered to be Rare when a Taxon live in small population localized with in restricted geographical area.Human activities do not endanger or threat it but they are at risk.

RED DATA BOOK

The species whose number is at critically low level and whose habitats are drastically reduced or damaged that they are in danger of extinction is called endangered species.

IUCN (International union for conservation of Nature and Natural Resources) founded in 1964 is the world's comprehensive inventory of global conservation of status and biological specimens. It publishes a book called" Red Data Book "It contains a list of threatened species in groups of 3 categories. A pink page publishes critically endangered species, green pages are used for species that were endangered, but now have recovered. Ex:- Lepidagathis barber, lepidaganthis diffusa of karnataka has entered to red list. Madhuka tree(Madhuka insignis) ,Pink headed duck, grass pink orchid.

Criteria considered for entry in Red data book;- 1) Reduction in population > 90% over last 10 years.2) population size , number less than 50 mature individuals 3) Qualitative analysis showing probability of extinction in wild in at least 50 % in the 10 years. 4) It is therefore considered to be facing an extremely high risk of extinction in wild.

India in 2014 had 973 species entered in red data book. In 2015 it has added 15 species. Thus India has 988 species on red list as of 2015.

Phytogeography

vegetational types of Karnataka.

Karnataka has a geographical area of 19.18 million hectare constituting 5.83 of the total area of the country. The state can be divided into 2 regions namely, malnad (Hilly) region and maiden (plain) region. The rain fall varies from 450mm in drier northeastern plateau to 3,200 mm in the Western Ghats. Summer and Winter temperatures vary from 26 c 35 c respectively. Some important crops of the state are Coffee, Rice, Jower, Millet, Ground nut, Sesame oil seeds.The vegetation of Karnataka is varied due to varied climatic and varied edaphic factors. According to the forest survey of India report of 2001, the forest area is 38, 724, 00 ha which constitutes 20.2% of the geographical area of the state. The Reserve forest constitutes 73.8%, protected forest 10.2% and unclassed forest 16%. The state ranks fourth among al the states and union territories n respect of area under tree cover.It has 5 major forest types situated in a belt running from north to south starting from Belgaum and ending in Mysore. Major forest types are:-

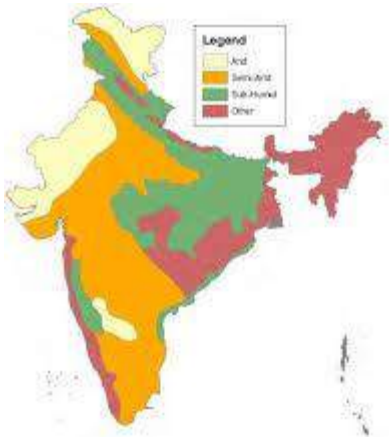
1. **Tropical wet evergreen forest**: - It is seen in areas with Temperature of 10-32 C, Annual Rainfall -2000 to6000mm& Altitude of 75to870m.Distibuted in Udupi, Belgaum,Hassan, North Karnataka etc

2. **Tropical semi evergreen forest**:- - It is seen in areas with Temperature of 5C -33 C, Annual Rainfall 2500 to5000mm &Altitude of 65-1607m. Kodagu ,dakshina kannada, Hassan,Shimoga.
3. **Tropical moist deciduous forest**- It is seen in areas with Temperature of 18-37 C, Annual Rainfall 625-2500mm&Altitude of125-2100m. Distributed in Uttarakannada ,Shimoga Chikkamagalur, Mysore. Mandya,Bandipuretc.
4. **Tropical Dry deciduous forest :-** - It is seen in areas with Temperature of 10-35 C, Annual Rainfall 600-300 mm&Altitude of600-1800m.Disributed in Kolar, Chamarajnagar,Devarayana durga,Bannerghatta,Chikkamagalur.
5. **Tropical Thorn forest :-** - It is seen in areas with Temperature of 7-42 C, Annual Rainfall - 350to450mm, altitude 500 to1100m. Distributed in Bijapur Bellary ,Chitradurga ,Dharwad etc.

Phytogeographical regions of India.

Clark, Chategeri, Clader, Hooker were main phytogeographeres worked for phytogeographical studies of India. To study Flora of India, It is classified into 9 Phytogeographical regions. They are namely: **Western Himalayas, Eastern Himalayas, Indus plain, Assam region, Gangetic plain, Central India, Malabar region, Deccan plateau, Andaman region**

1. **Western Himalayas: -** This region includes North and south Kashmir, Part of Punjab, This region is dry with less rainfall, more Snow. Vegetation shows 3 Zonations. They are Sub tropical, temperate and Alpine. **In Sub-**tropical Zone rainfall is 80 to 200 cms, summer is dry, and winter is cold with frost. Snow does not occur, vegetation contains continuous belt of Shorea Robusta forest and xerophytic plants.**In Temperate zone** Annual rainfall 100 cm, winters are cold with snow. Vegetation contains Coniferous forests of Pinus, Quercus, Taxus,Cedrus. **In Alpine zone** Annual rainfall is low, Area remains covered with snow. In major part of the year. Source of water is melting of snow. Wind blows in high speed. Vegetation contains Timber line forest of Betula, Abies, Pyrus etc. meadows of sedum are found.



Eastern Himalayas :-This region extends from Sikkim to Arunachal Pradesh. It receives high rainfall, low snow fall, high temperature.In this region Vegetation is abundant, varied, divided into Tropical, Temperate and alpine zone.In Tropical zone evergreen forest are found. In Temperate zone Coniferous forests are found, in alpine zone forests and herbs are found.

2. **Indus plain:-** This region includes Plains of Punjab, Gujarat and Rajasthan. In Desert area rainfall is between 5 to 12 cms, in moist area between 50- 75 cms. This region is represented by Date palm, Acacia, Capparis

3. **Gangetic plain**:-This region includes Uttar Pradesh, Bihar, West Bengal, and Part of Orissa. It is the most fertile region. Based on Vegetation types it is divided into 3 sub divisions like **Upper gangetic plain c**onsists of Forest of Shorea Robusta.**Lower gangetic plain** consists of Cocas, Calamus, and Areca.

   Sunder Ban region barders Bay of Bengal, Common plants are Xylia Xylocara, Elephant grass, Avecinia.

4. **Assam region:-** This region includes Valleys of Brahmaptra and Sub-himlayan regions of Assam. In this region Annual rainfall is above 200 cms. It include large number of hills, plains, Rivers & marshes. Chirapungi in kasha hills receive annual rainfall of 10 to 800 cms. It is the rainiest spot of world. In this region vegetation is luxuriant with evergreen forests, Pine forests.

5. **Central India:-** This region includes Madhya Pradesh, part of Gujarat and Orissa. It is represented by mixed deciduous forests and Thorny forests. Common plants are Teak, Rose wood, Bauhinia, Madhuca indica etc.

6. **Malabar region:-**This region includes west coasts of India from Kanyakumari to Gujarat. It consists of series of hills called Western Ghats with annual rainfall of 200 to 300 cms. This region has rich vegetation of evergreen forests, semi evergreen forests, deciduous forests, Mangroves.

7. **Deccan plateau:-** This region includes part of Gujarat, Madhya Pradesh, Andra Pradesh Bihar, Tamilnadu, Karnataka.In this region topography is uneven. It has fertile plain, dry rocks, Wet hills, and Sandy area with average rainfall of 100cms.This region is represented by deciduous forests, mangroves'. Common plants are Acacia, Casuarina, Capparis, Terminalia, Hardwickikia, Shorea, etc.
8. **Andaman region**: - This region includes group of several islands of Andaman and Nicobar. This region receives heavy rainfall and is represented by evergreen and mangroves, coral reefs, Grasses etc.

2 marks questions

1. What is bio diversity? Mention its types.
2. What are Endemic species? Give example.
3. What is significance of Biodiversity conservation?
4. Mention any 4 values of Biodiversity.
5. What is IN-SITU and EX -SITU conservation.
6. Mention significance of Social forestry.
7. What is Biodiversity conservation? Mention its types.
8. What are endangered species? Give example.
9. What is Red data book? Mention its significance.
10. Mention biological methods of soil conservation.
11. What is meant by Aforestation and Reforestation?
12. Mention vegetaional types of India.
13. What is soil erosion? Mention its effects.

5 marks questions

1. Explain Types of Biodiversity.
2. Give an account of Soil erosion.
3. Describe biological methods of soil conservation.
4. Write Mechanical methods of Soil conservation.
5. Benefits of soil conservation
6. Describe social forestry.
7. Explain soil erosion.
8. Explain mechanical methods of Soil conservation.

10 marks questions

1. Explain Values of Biodiversity.

2. Give an account of IN-SITU and EX-SITU conservation. /Biodiversity conservation.
3. Give an account of method of soil conservation.
4. Give an account of Vegetation of Karnataka.
5. Give an account of Vegetation of India

Unit-6 : Plant pathology – Introduction and classification of plant diseases based on pathogens.

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1 Phytophthora areca andP.infeston.

Koleroga of Arecanut

The disease is caused by fungal pathogen it is also called fruit rot. It is most common in rainy season during the month of june - september.**Causal organism** : *Phytophthora arecae*

Symptoms :-

1. The symptoms are first infected on nuts. The infected nuts are discolored and covered with a white fungal mycelium.
2. Infected nuts shows water- soaked area towards base, Which results in loss of green color.
3. The pericarp of the nut Shrivelled and seed kernel gets destroyed.
4. The infection may even spread to the crown of the tree and the plant dries up and it leads to wither such condition is called crown rot.

Control measures :-

1. By spraying Bordeaux mixture of 1% before mansoon and pre- mansoon.
2. By removing, destroying and burning the infected diseased nuts to prevent the spread of disease.
3. Spraying of 0.25% perenox is also effective.

Late blight of potato

It is a most serious fungal disease in potatoes. It spreads rapidly in the winter especially in January.

Causal organism : *Phytophthora infestans*

Symptoms :-

1. Small water-soaked, light brown patches appear on the leaf.
2. In humid and cloudy weather, the patches(lesions) enlarge in size and become black rounded with concentric markings.
3. A white growth of fungus arises on the lower surface of the infected leaf.

4. Appearance of rusty Brown patches on the infected tubers and later they rot.

Control measures :-

1. The seed tubers should be obtained from diseased free area.
2. By close examination infected tubers should be rejected and healthy tubers should be selected for planting.
3. Dusting the foliages with copper-lime in the early morning is a promising method. Foliar spray with 1% Bordeaux mixture, perenox, Blitox-50 helps to control the disease.
4. Growing disease resistant varieties will help us to control the disease. Kufri swarna, Kufri kuber etc. are resistant to late blight disease.

2.Grain smut of sorghum

This is seed borne disease. smut disease of jowar is most common in Karnataka, Andra Pradesh and Tamilnadu.

Causal organism :-*Sphacelotheca sorghi*

Symptoms-

1. The fungus infects only at the time of grain formation in the ear.
2. The fungal mycelium get converted into spores replacing the ovary with sorus.
3. The smut sori are larger than the normal grains. They are oval to cylindrical, broad and dirty grey in color.

Control measures :-

1. Collection of seeds for cultivation from smutted plants should be strictly avoided.
2. Seed dressing with 0.5% formalin for two hours or with 0.5-3% $CuSo_4$ for 3-5 minutes, before sowing them in the field.
3. Treating seeds with sulphur dust before sowing.
4. By removing, destroying and burning the infected plants.
5. Growing disease resistant varieties like SPV 115, CJH-5, Nandyal etc.

3. Blast disease of Rice

The disease is most destructive and reported from all the rice growing countries of the world. In India, this disease is more commonly found in southern rice growing areas.

Causal organism :- ***Pyricularia oryzae***

Symptoms :-

1. The fungi attacks all the aerial parts of the plant.
2. The characteristic, isolated, necrotic lesions with water-soaked appearance are formed on the leaf blades.
3. Symptoms on the leaves appears as spindle shaped spot, Bluish-green in the centre, and remains surrounded by brown zones.

4. When the neck of the panicle is infected at the base it becomes blackened and shriveled. Hence this stage is black neck or neck blast or rotten neck disease.
5. In case of severe attack the entire field presents a blasted or burnt appearance.

Control measures :-

1. The seeds obtained from disease free crops are used for raising the crop.
2. The most economic method is cultivation of resistant, high yielding varieties. Ex:- TKM-1, CO 30.etc.
3. By spraying Bordeaux mixture has been proved quite effective against neck and node infection.
4. By treating seeds with copper fungicides and organomercuriales.
5. The plant debris should be collected and destroyed.

4. Red rot of sugarcane

It is a fungal disease, appears after rainy season.

Causal organism *:- Colletotrichum falcatum*

Symptoms:-

1. The first symptom of red rot is the discolouration of young leavesin the field.
2. The cane starts shriveling, the rind shrinks and becomes longitudinally wrinkled.
3. The stem shows longitudinal red streaks crossed by white patches.
4. As the disease advances, the entire stem rotsand central tissues become soft with large cavities filled grayish mycelium.
5. At the final stage,acervuli appear on the wrinkled areas of the canes.

Control measures:-

1. Healthy, disease free setts are planted in the plant.
2. By dipping the cut ends of seed setts in1% Bordeaux mixture.
3. The diseased leaves and canes should be collected from the field and destroyed by burning.
4. By growing disease resistant varieties.
5. Crop rotation in every two or three years keeps the pathogen in control in the fields.

5. Citrus canker

It is a bacterial disease produces lesions and cankers on citrus plants.

Causal organism :-***Xanthomonas citri***

Symptoms :-

1. The disease first appears as a yellow spot on the lower surface of young leaves.
2. The lesions becomes raised and turn brown in color.

3. All green parts and maturing fruits become more or less covered with brown scabby spots surrounded by dark brown glossy margins.

Control measures :-

1. By removing the infected branches.
2. Spraying the plants with 1% Bordeaux mixture.
3. Disease free nursery stock should be planted.
4. Disease resistant varieties should be cultivated.
5. Spraying the suspension of Neem cake at t 1Kg in 20liters of water.
6. Spraying of antibiotics like streptomycin

It is a fungal disease, appears in important commercial crop Coffee plants.

7. Coffee rust

CLASS: Basidiomycetes ORDER:Uredinales FAMILY: Pucciniaceae

Causal organism: - **Hamelia Vastatrix.**

Symptoms:-

1. Disease is restricted to leaves, and rarely on berries. Yellowish spots appear on ventral surface of leaves.
2. Yellowish spots enlarges, develop brown patches on upper surface of leaves due to production of orange colored uredospores.
3. As diseases advances leaves dry up, becomes dark brown and leaves drop off.

Control measures: - Coffee rust can be controlled by following methods:-

1. By dipping the cut ends of seedlings in Boradeaux mixture.
2. Destroy of Diseased leaves by burning.
3. By growing disease resistant varieties.
4. Rotation of crops after 2 to 3 years.

Biopesticides :

Biopesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals

Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Microbial pesticides consist of a microorganism (e.g., a bacterium, fungus, virus or protozoan) as the active ingredient. Microbial pesticides can control many different kinds of pests.

- Biopesticides are usually inherently less toxic than conventional pesticides.
- Biopesticides generally affect only the target pest and closely related organisms, conventional pesticides that may affect organisms such as birds, insects and mammals.
- Biopesticides often are effective in very small quantities and often decompose quickly, resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides.
- When used as a component of Integrated Pest Management (IPM) programs, biopesticides can greatly reduce the use of conventional pesticides, while crop yields remain high.

Neem biopesticide: Biopesticides are a good alternative to the synthetic pesticide. Both leaves and fruit of neem plant are known to have bitter taste having fungicidal, insecticidal and nematicidal properties

Pest and disease control

Neem is a key ingredient in non-pesticidal management (NPM), providing a natural alternative to synthetic pesticides. Neem seeds are ground into powder that is soaked overnight in water and sprayed onto the crop.

To be effective, it must be applied repeatedly, at least every ten days.

Neem does not directly kill insects on the crop. It acts as an anti-feedant, repellent, and egg-laying deterrent and thus protect the crop from damage.

The insects starve and die within a few days.

Neem also suppresses the hatching of pest insects from their eggs.

Neem-based fertilizeres have been effective against the pest southern armyworm.

Neem cake is often sold as a fertilizer.[19]

Neem oil has been shown to avert termite attack as an ecofriendly and economical agent.[20]

Neem oil is a vegetable oil pressed from the fruits and seeds of the neem (*Azadirachta indica*), an evergreen tree which is endemic to the Indian subcontinent and has been introduced to many other areas in the tropics. It is the most important of the commercially available products of neem for organic farming and medicines.

BENEFITS OF NEEM PESTICIDES

Neem based pesticide is suited for mixing with other synthetic pesticides and infact enhances their action.

No other synthetic pesticides need to be used it reducing the pollution load. Neem consists of several compounds hence development of resistance is impossible.

Neem doesn't destroy natural predators and parasites of pest thereby allowing these natural enemies to keep a check on the pest population. Neem also has systemic action

and seedlings can absorb and accumulate the neem compounds to make the whole plant pest resistant.

Neem has a broad spectrum of action active on more than 200 species of pest.

Neem is harmless to non-target organisms like pollinators, honeybees, mammals and other vegetables

neem compounds, especially Azadirachtin entered in the body of insect larvae, and suppressed and the larvae and ultimately died.

The neem compound produces something similar to vomiting sensation; because of this sensation the insect does not feed on the neem treated surface

The neem oil also reduces pest not by allowing the female to deposit eggs on stored grains and after treatment the insect will not feed on them.

Trichoderma

Trichoderma is a very effective biological mean for plant disease management especially the siol born

It is a free living fungus which is common in soil and root ecosystem .It is highly interactive in root, soil and foliar environment

General Characteristics

- Conidiophores are highly branched and thus difficult to define or measure, loosely or compactly tufted, often formed in distinct concentric rings or borne along the scant aerial hyphae.
- Main branches of the conidiophores produce lateral side branches that may be paired or not.
- The branches may rebranch, with the secondary branches often paired and longest secondary branches being closest to the main axis.
- All primary and secondary branches arise at or near 90° with respect to the main axis.
- Conidia typically appear dry but in some species they may be held in drops of clear green or yellow liquid.
- Conidia of most species are ellipsoidal,
- Chlamydospores may be produced by all species, but not all species produce chlamydospores. Chlamydospores are typically unicellular subglobose and terminate short hyphae.

Benefits of Trichoderma

1. **Disease Control:** Trichoderma is a potent biocontrol agent and used extensively for soil born diseases. It has been used successfully against pathogenic fungi
2. **Plant Growth Promoter:** Trichoderma strains solubilize phosphates and micronutrients. The application of Trichoderma strains with plants increases the number of deep roots, thereby increasing the plant's ability to resist drought.
3. **Biochemical Elicitors of Disease:** Trichoderma strains are known to induce resistance in plants. Three classes of compounds that are produced by Trichoderma and induce resistance in plants are now known. These compounds induce ethylene production, hypersensitive responses and other defense related reactions in plant cultivars.
4. **Transgenic Plants:** Introduction of endochitinase gene from Trichoderma into plants such as tobacco and potato plants has increased their resistance to fungal growth. Selected transgenic lines are highly tolerant to foliar pathogens as well as to the soil-borne pathogen.
5. **Bioremediation:** Trichoderma strains play an important role in the bioremediation of soil that are contaminated with pesticides and herbicides. They have the ability to degrade a wide range of insecticides: organochlorines, organophosphates and carbonates.

Biocontrol mechanisms of *Trichoderma:*

The Trichoderma may suppress the growth of the pathogen population in the rhizosphere through competition and thus reduce disease development. It produces antibiotics and toxins such as trichothecin and a sesquiterpine, Trichodermin, which have a direct effect on other organisms. The antagonist (*Trichoderma*) hyphae either grow along the host hyphae or coil around it and secrete different lytic enzymes such as chitinase, glucanase and pectinase that are involved in the process of mycoparasitism.

Trichoderma Enhances yield along with quality of produce. Boost germination rate. Increase in shoot & Root length Solubilizing various insoluble forms of Phosphates Augment Nitrogen fixing. Promote healthy growth in early stages of crop. Increase Dry matter Production substantially. Provide natural long term immunity to crops and soil.

Method of application:

1. **Seed treatment:** Mix 6 - 10 g of Trichoderma powder per Kg of seed before sowing.
2. **Nursery treatment:** Apply 10 - 25 g of Trichoderma powder per 100 m2 of nursery bed. Application of neem cake and FYM before treatment increases the efficacy.
3. **Cutting and seedling root dip:** Mix 10g of Trichoderma powder along with 100g of well rotten FYM per

liter of water and dip the cuttings and seedlings for 10 minutes before planting.

4. **Soil treatment:** Apply 5 Kg of Trichoderma powder per hector after turning of sun hemp or dhainch into the soil for green manuring. Or Mix 1kg of Trichoderma formulation in 100 kg of farmyard manure and cover it for 7 days with polythene. Sprinkle the heap with water intermittently. Turn the mixture in every 3-4 days interval and then broadcast in the field.
5. **Plant Treatment:** Drench the soil near stem region with 10g Trichoderma powder mixed in a liter of water.

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