AR – 7886

B.Sc. (Second Semester) Examination, 2013
FORESTRY
Paper-II : Forest Ecology, Biodiversity & Conservation
Time : Three hours
Maximum Marks : 60

Model answer

Dr. Anindita Bhattacharya
Department of Forestry, Wildlife & Environmental Sciences
Guru Ghasidas Vishwavidyalaya
Bilaspur, Chhattisgarh

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Note : Section-A is compulsory. Attempt any four questions from Section-B

Section: A

1. Multiple Choice Questions **[20×1]**

(i) The rhythmic occurrence of processes taking place within the organisms

(a) Ecotone (b) Environmental complex

(c) Biological clock(√) (d) All of the above

Ans : Biological Clock

(ii) What is studied in the functional aspect of the ecosystem?

(a) Biological regulation (√) (b) The range of conditions of existence

(c) Either a or b (d) None

Ans: Biological regulation

(iii) The amount of inorganic substances present at any given time in an ecosystem is known as

(a) Abiotic component (b) Biogeochemical cycle

(c) Standing state (√) (d) All of the above

Ans: Standing state

(iv) The amount of living material, present in a component population at any time is known as

(a) Standing crop (√) (b) Standing state

(c) Biotic component (d) Both a & c

Ans: Standing crop

(v) The phenomena which contribute to major flow of hydrological cycle are

(a) Evaporation (b) Precipitation

(c) Radiation (d) Both a & b (√)

Ans: Evaporation and Precipitation

(vi) *Thiobacillus thiooxidans* converts sulphur into

(a) Sulphate (b) Hydrogen sulphide

(c) Sulphuric acid (√) (d) Sulphur dioxide

Ans: Sulphuric acid

(vii) The idea of number of links of food chain is put forth by

(a) Elton (√) (b) Odum

(c) Reiter (d) None

Ans. : Elton

(viii) Visible spectrum consists of how much percent of solar radiation?

(a) 20 (b) 30

(c) 40 (d) 50 (√)

Ans: 50

(ix) Ecological efficiencies is the ratio of

(a) Energy flow (√) (b) Nutrient flow

(c) Both a & b (d) Either a or b

Ans: Energy flow

(x) Fluctuations that are observed in population are

(a) Flat (b) Cyclic

(b) Irruptive (d) All of the above (√)

Ans : All of the above

(xi) Declining population experiences which type of age pyramid?

(a) Triangle shape (b) Bell shape

(c) Urn shape (√) (d) Stair shape

Ans: Urn shape

(xii) Economic density is the density per unit

(a) Total space (b) Habitat space (√)

(c) Either a or b (d) None

Ans: Habitat space

(xiii) Ecological natality is also called as

(a) Fertility rate (√) (b) Fecundity rate

(c) Realized rate (d) Potential rate

Ans: Fertility rate

(xiv) Dominance is a

(a) Analytical character (b) Synthetic character

(c) Quantitative character (d) Both a & b (√)

Ans: Both analytical and synthetic character

(xv) The mechanism of the modification of the environment through the influence of living organism is

(a) Autogenic succession (b) Allogenic succession

(c) Reaction (d) Both a & c (√)

Ans: Both Autogenic succession and Reaction

(xvi) The term biodiversity was coined by

(a) Walter G. Rosen (√) (b) Wilson

(c) Paine (d) Howe

Ans: Walter G. Rosen

(xvii) Mace and Lande have proposed species conservation categories which are of

(a) 2 types (b) 3 types (√)

(c) 4 types (d) 5 types

Ans : 3 types

(xviii) Mace and Lande have proposed the classification for conservation categories on the basis of

(a) Probability of extinction (√) (b) Percentage of extinction

(c) Time in years (d) None

Ans.: Probability of extinction

(xix) Reed-swamp stage of hydrosere is also known as

(a) Amphibious stage (√) (b) Aqueous stage

(c) Compensation stage (c) None

Ans: Amphibious stage

(xx) How many zones are there in a National Park?

(a) One (b) Two (√)

(c) Three (d) Four

Ans: Two.

Section : B (Attempt any four questions) (1x10)

Q 2. Give a comparative account of grassland and pond ecosystem

Ans :

The living organism interact with non-living environment in an orderly self-sufficient manner is known as ecosystem.

Kinds of ecosystem

(A) Natural: These are operated by themselves under natural conditions without any major interference by man. based on kinds of habitat these are divided as

(i) Terrestrial (Forest, grassland, desert etc.)

(ii) Aquatic : (i) Freshwater: (I) Lotic: Running water bodies like stream, river etc.

(II) Lentic : Standing water body eg. pond, sea etc.

(B) Anthropogenic ecosystem : Man made ecosystem like agriculture, aquaculture

Grassland and pond are the examples of two different ecosystems, first one is terrestrial and the other one is aquatic. The following differences could be observed in these ecosystems:

Grassland	Pond
I. Definition: An area, such as a prairie or meadow, of grass or grass like vegetation.	A shallow water standing body
2. Habitat: Terrestrial	Aquatic
3. Components (i) Abiotic material : Soil, organic components such as protein, lipids & climatic factor like temperature, rainfall	(i) Water, protein, carbohydrate, wind, water current etc.
(ii) Biotic component: (a) Producers Herbaceous plant	(a) Phytoplankton
(b) Consumer: Insect, cattle, sheep	(b) Zooplankton, small fish, big fish
(c) Decomposer Bacteria, fungi etc. present in soil	(c) Bacteria, fungi etc. present in water
4. Succession Succession follows the trend of lithosere	Succession follows the trend of hydrosere
5. Material cycling : Soil based	Water based
6. Eg: Grass→Deer→Lion	Eg.Phytoplankton→Zooplankton→Fish→Crane
7. Water currents are not found	7. Water current are found
8. Oxygen is freely available in the air	8. Dissolved oxygen is found.
9. Water & temperature are the limiting factor	9. Water & temperature are not limiting factor
10. Flora and fauna includes grasses, deer etc	10. Lilies, lotus, water snake, snails etc. are found.
11. Communities exhibit stratification namely, subterranean, floor, herbs and shrub	11. Zonation is found namely littoral, limnetic and profundal zone.

Q 3. What do you mean by edaphic nutrient cycle? Explain nitrogen cycle. How this cycle is disturbed by human activities?

Ans2- The movement of nutrient is possible by different chemical cycles, what we call as biogeochemical cycles that keep on passing the nutrient back and forth between organisms and their environment. Biogeochemical cycles are of two types: (a) **Gaseous cycles :** the elements have a main reservoir in the gaseous phase and (b)**Sedimentary cycle:** They are usually found in soil and sediments.

Inorganic nutrient are of two types: (i) **Macronutrient:** C, H and O (Gaseous cycle) and P and K (Edaphic/Sedimentary cycle) (ii) **Micronutrient:** Cu, Fe, Co etc. have edaphic cycle. So the nutrients that are cycled through sedimentary phase or through soil are called edaphic nutrient cycle.

Nitrogen cycle: This cycle is included in gaseous cycle but it also covers some edaphic phase.

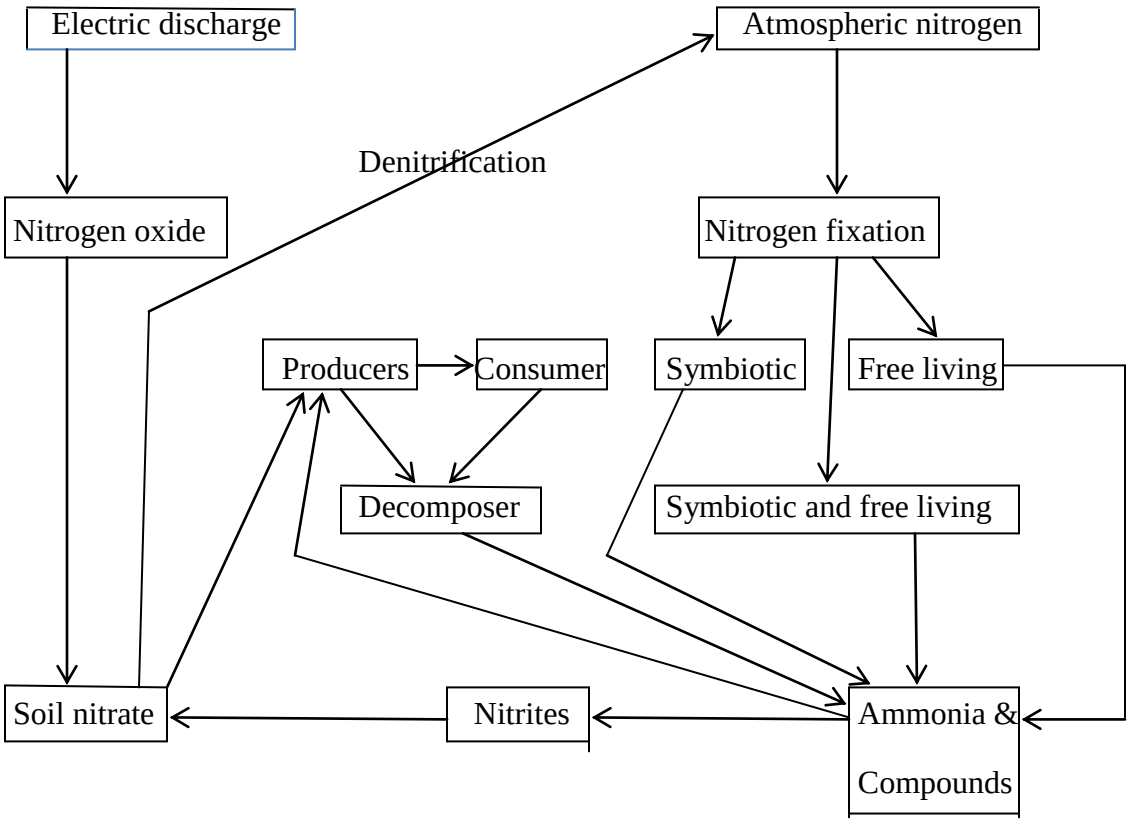
Importance:

(1). Important structural component of cell.

(2) Important constituent of genetic material and protein.

(3) Necessary for plant growth.

Nitrogen cycle:



Methods:

(1)**Ammonification:** Organic matter of plant and animal origin is decomposed by microorganisms in the soil and ammonia and amino acids are released. The microorganisms responsible for ammonification are *Bacillus* and actinomycetes.

(2)**Nitrification:** The conversion of ammonia/nitrogen into nitrate is called nitrification. The conversion is done by two methods: (i) Non-biological methods: (a) Industrial fixation (b) Electrochemical method: Thunderstorm and lightning : It is estimated that about 35 $mg/m^2/yr$ of nitrogen is converted into nitrate by this method. (ii) Biological method: (a) Symbiotic bacteria: *Rhizobium* sp. are important to note.(b) Free living: Azotobacter, Clostridium are important species here.

Bacteria such as *Nitrosomonas* first convert the ammonia into nitrites. *Nictrobacter* covert nitrite into nitrate that is available to the plants. The energy released during this process is utilized in carbon assimilation by bacteria.

(3)**Denitrification:** The reduction of nitrates to nitrogen, ammonia or some other oxides also occurs in soil under anaerobic conditions. *Bacillus* and *Pseudomonas* are responsible for this.

Impact of human activities on nitrogen cycle

(a) **Population explosion:** Due to increasing human needs and greed, population is increasing at an alarming rate generating more pressure on vital resources of earth

(b) **Deforestation :** If plants will not be there, then whole food chain will be affected. Litter will decrease; less will be ammonification and nitrification. Large amount of nitrogen stored in soil and plant is released into the troposphere by destruction of forest and wetland.

(c) **Industrialization:** Burning of fuel either in industry, household or by vehicles releases a huge amount of nitrogen oxides into the atmosphere which is returned back into the earth in form of acid rain.

(d) **Agricultural activities:** Action of inorganic bacteria on animal wastes and inorganic fertilizers releases N_2O which warm the atmosphere and deplete ozone layer. Nitogen fertilizer contaminates the surface and underground water causing blue baby syndrome in children.

Q 4. Mention about the different kinds of food chain in different habitats and ecosystem. Discuss the methods to study the food chain.

Ans :

Autotrophs convert solar energy into chemical energy stored in food material. The transfer of food energy by a process of eating and being eaten from producers to successive levels of consumer is called as food chain.

Types of food chain

(a) On the basis of habitat:

(i) **Terrestrial :** This type of food chain operate at grassland, forest, agricultural land etc which belong to terrestrial habitat.

Eg: In Indian pasture following type of food chain operates

Cynodon dactylon (Grass)→*Melanoplus differentialis* (grasshopper)→*Bufo melanostictus* (toad)→*Zamenis mucosus* (snake)→ *Pavo cristatus* (Peacock)

(ii) **Aquatic :** This type of food chain operate in water bodies.

Eg.: Following type of food chain operate Indian river:

Scenedesmus boligues (phytoplankton)→*Brachionus falcatus* (zooplankton)→ *Amblypharyngodon* sp. (small fish)→*Wallago attu* (large fish)→ *Homo sapien* (man)

(b) On the basis of ecosystem:

(i) **Grazing food chain:** Cattle and rodents are the main grazers in grassland, while zooplanktons are the main grazers in a pond or lake. Up to 50% of the net primary production is grazed on by these animals in their respective ecosystems and the remaining 50% goes to the decomposer organisms as dead organic matter. Therefore, in these ecosystems, the food chain is herbivore based and herbivore are considered important consumers. This is called as grazing food chain.

(ii) **Detritus or decomposer food chain:** In a forest ecosystem, the dominant primary consumers are insects, which usually consume less than 10% of the net primary production. The rest 90% is consumed later as dead plant material by the small detritus feeding animals such as earthworms and microorganisms like bacteria etc. This is called as detritus food chain.

(iii) **Parasitic food chain:** This type of food chain operates in every ecosystem. This involves host parasite-hyperparasite links.

Significance of food chain

(i) It helps to understand feeding relationship and interaction between organisms in any ecosystem.

(ii) It helps to understand the energy flow mechanism

(iii) It helps to understand the material circulation

(iv) It helps to understand the problem of biomagnification.

Method to study the food chain

(i) **Gut content analysis:** In this method the alimentary canals of animals are opened and undigested food material are taken and identified.

(ii) **Use of radioactive isotope:** The use of radioactive isotopes like phosphorus-32 in food items and then following their movements and detecting them by a GM counter is followed here.

(iii) **Precipitin test**: Dempster used this test to study the predators of the broom beetle, *Phytodecta olivacea*. He used caged rabbits which were inoculated with cell-free extracts of the broom beetle. Then 50 ml of blood is withdrawn from them, blood cell and lipids are removed and the resulting serum sterilized, dried and stored in the refrigerator. Then predators of broom beetle were collected, crusted on a filter paper and dried in phosphorus pentoxide. Then it was extracted in normal saline, centrifuged and a clear supernatant is used for testing. Then 0.2 ml of both the extracts are taken. The presence of broom beetle in the gut of the predator was shown by the formation of white precipitate.

Q 5. With suitable instances explain population interaction.

Ans :

A population is generally a group of individuals of a particular species occupying a particular area at a specific time. Two type of population are there:

(a) **Monospecific population:** It is the population of the individuals of only one species.

(b) **Polyspecific population:** It is the population of individuals of more than one species. It is generally referred as community.

Population interacts with each other in various ways. These are of two types

(1) **Interspecific:** This is the interaction between various different species. This is of two types:
   (a) Positive: Commensalism and symbiosis
   (b) Negative: Parasitism and predation

(2) **Intraspecific:** this is the interaction between the individuals of the same species.

Interspecific interaction

(1) **Parasitism :** It is the interaction between two different species, a parasite and a host. On the basis of living organism it is of two types (a) Plant parasite (b) Animal parasite

On the basis of habitation it is of two types: (a) Ectoparasite: Lice & ticks (b) Endoparasite: Malarial parasite and body worms.

(2) **Predation:** GF Gause conducted experiment on two ciliated protozoa, *Paramoecium caudatum* and *Didinium nasutum*. *D. Nasutum* is a predator of Paramoecium. First five Paramecia were taken in a small test tube containing oat medium in which bacteria grow. Two days later, three Didinia were introduced into the test tube. After three and four days, Paramoecium (prey) and Didinium (predator) were extinct. In another experiment, refugees were introduced for Paramecia to hide. Then prey and predator were introduced simultaneously. Now the prey population increases and predator population extincted.

(3) Competition :

(a) Gause studied the growth pattern of two species of paramecium (*P. aurelia* and *P. caudatum*) were cultured together and separately. Each species has sigmoid growth pattern when grown independently. When grown together, the growth patterns were sigmoid in the first week but later there was a gradual increase of P. aurelia. This is called as competition exclusion principle.

(b) Thomas Park study on grain beetles, *Tribolium confusum* and *Tribolium castaneum* under different environmental condition and agreed with competition exclusion principle.

(c) On the Galapagos Island, Charles Darwin observed the niche separation of 14 species of finches. Six were ground feeders and fed on seeds while eight were adapted to perching on trees and feeding on insects found under barks.

(d) Ramakrishnan and Gupta studied on *Argemone mexicana* and *Argemone ochroleuca* and found that Argemone Mexicana dominates in mixed population.

Intraspecific interaction

Completion also occurs among individuals of the same species for space, nutrients, reproduction and so on, if these are in short supply. This is termed as intraspecific competition. Crowding results in competition which may affect mortality, life expectancy and so on. This has been found in black-tail deer and water fleas.

Q 6. Mention about the characters that are used to express community characteristics.

Ans: A group of several species living together with mutual tolerance and beneficial interaction in a natural area is known as a community. Community has certain characteristics like species diversity, growth forms and structure, dominance, succession etc. Some characters or parameters are required to study these characteristics. Characters to study the community are of two types: (I) Analytical character : These are generally expressed in 5-point scale (II) Synthetic character : These are actually computed from analytical character.

(I). Analytical character: (A). Quantitative character:

(1) Frequency: Frequency is the number of sampling units in which a particular species occur. It is calculated with the help of quadrat, transect and point method.

$$\text{Frequency} = \frac{\text{No. of sampling unit in which the species occurred}}{\text{Total No. of Sampling unit studied}} \times 100$$

(2) Density : Density represents the numerical strength of a species in the community. The number of individuals of the species in any unit area is its density.

$$\text{Density} = \frac{\text{Total no. individuals of the species in all the sampling units}}{\text{Total number of sampling unit studied}}$$

(3) Abundance : This is the number of individuals of any species per sampling unit of occurrence. It is calculated as:

$$\text{Abundance} : \frac{\text{Total no. of individuals of the species in all the sampling units}}{\text{Total no. of sampling unit studied}}$$

(4) Cover : Cover is the area of the ground occupied by the above ground parts of the plants

(5) Basal area refers to the ground actually penetrated by the stem.

(6) Dominance : Daubenmire considered dominance as an analytical character

(B) Qualitative characters :

(1) Physiognomy : This is the general appearance of vegetation as determined by the growth form of dominant species

(2) Phenology : It is the scientific study of seasonal change.

(3) Stratification : It is the way in which plants of different species are arranged in different vertical layers.

(4) Adundance : It is of 5 types: Very rare, rare, common, frequent and very much frequent.

(5) Sociability : It denoted the proximity of plants to one another. Braun-Blanket used 5 groups: (i)S_1: Plants found separately (ii) S_2:A group of 4-6 plants at a place (iii)S_3: Many smaller scattered group at one place (iv) S_4: Several bigger groups of many plants at one place. (v) S_5 : A large group occupying larger area.

(6) Vitality : This is the capacity of normal growth and reproduction. Daubenmire gave vitality groups as follows:

(i)V_1 : Plants whose seedlings die (ii)V_2 : Seedlings grow, but unable to reproduce (iii) V_3 : Reproduce only vegetatively (iv) V_4: Reproduce sexually, but uncommon (v) V_5: Reproduce sexually and grow regularly.

(7) Life-form : It is the sum of adaptation of the plant to climate.

(II) Synthetic character:

(1) Presence and constance: This is the extent of occurrence of individuals of a particular species in the community. These are of following types:

(i) Rare: Present in 1-20% of the sampling units

(ii). Seldom present : Present in 21-40% of the sampling unit

(iii) Often present : Present in 41-60% of the sampling units

(iv) Mostly present : Present in 61-80% of the sampling unit

(v) Constantly present : present in 81-100% of sampling units

(2) Fidelity : It is the degree with which a species is restricted in distribution to one kind of community. It had 5 classes:

(i). Fidelity 1: Plants appearing accidentally.

(ii) Fidelity 2 : Indifferent plants, may occur in any community.

(iii) Fidelity 3 : Occur in many communities, but predominant in one

(iv) Fidelity 4: Present in one community but may occur in other community as well Also called as selective.

(v) Fidelity 5 : Occur only in one particular community and not in others. Also called as exclusives.

(3). Dominance : Here important value index (IVI) is calculated.

$$\text{Relative density} = \frac{\text{Density of species} \times 100}{\text{Total density of all species}}$$

$$\text{Relative frequency} = \frac{\text{Frequency of the species} \times 100}{\text{Total frequency of all the species}}$$

$$\text{Relative dominance} = \frac{\text{Dominance (cover) of the species} \times 100}{\text{Total dominance (cover) of all the species}}$$

Now these three values are added to get IVI.

(III) Other synthetic characters:
Dominance index, diversity index, similarity index are also calculated.

Q 7. Write a brief note on island biogeography.

Definitions

For biogeographical purposes, an "island" is any area of suitable habitat surrounded by an expanse of unsuitable habitat. While this may be a traditional island—a mass of land surrounded

by water—the term may also be applied to many untraditional "islands", such as the peaks of mountains, isolated springs in the desert, or expanses of grassland surrounded by highways or housing tracts. Additionally, what is an island for one organism may not be an island for another: some organisms located on mountaintops may also be found in the valleys, while others may be restricted to the peaks.

Theory

The theory of island biogeography proposes that the number of species found on an undisturbed island is determined by immigration and extinction. And further, that the isolated populations may follow different evolutionary routes, as shown by Darwin's observation of finches in the Galapagos Islands. Immigration and emigration are affected by the distance of an island from a source of colonists. Usually this source is the mainland, but it can also be other islands. Islands that are more isolated are less likely to receive immigrants than islands that are less isolated.

The rate of extinction once a species manages to colonize an island is affected by island size (area effect or the species-area curve). Larger islands contain larger habitat areas and opportunities for more different varieties of habitat. Larger habitat size reduces the probability of extinction due to chance events. Habitat heterogeneity increases the number of species that will be successful after immigration. Over time, the countervailing forces of extinction and immigration result in an equilibrium level of species richness.

Modifications

In addition to having an effect on immigration rates, isolation can also affect extinction rates. Populations on islands that are less isolated are less likely to go extinct because individuals from the source population and other islands can immigrate and “rescue” the population from extinction (rescue effect).

In addition to having an effect on extinction, island size can also affect immigration rates. Species may actively target larger islands for their greater number of resources and available niches; or, larger islands may accumulate more species by chance just because they are larger.

Influencing factors

Total number of reptilian and amphibian species on seven small and large islands in the West Indies

- Degree of isolation (distance to nearest neighbour, and mainland)
- Length of isolation (time)
- Size of island (larger area usually facilitates greater diversity)
- The habitat suitability which includes:
    - Climate (tropical versus arctic, humid versus arid, etc.)
    - Initial plant and animal composition if previously attached to a larger land mass (e.g. marsupials, primates)
    - The current species composition
- Location relative to ocean currents (influences nutrient, fish, bird, and seed flow patterns)
- Serendipity (the impacts of chance arrivals)
- Human activity

Historical record

The theory can be studied through the fossils, which provide a record of life on Earth. 300 million years ago, Europe and North America lay on the equator and were covered by steamy tropical rainforests. Climate change devastated these tropical rainforests during the Carboniferous Period and as the climate grew drier, rainforests fragmented. Shrunken islands of forest were uninhabitable for amphibians but were well suited to reptiles, which became more diverse and even varied their diet in the rapidly changing environment; this event triggered an evolutionary burst among reptiles.

Applications in conservation biology

Within a few years of the publishing of the theory its potential application to the field of conservation biology had been realised and was being vigorously debated in ecological circles.[4] The idea that reserves and national parks formed islands inside human-altered landscapes (habitat fragmentation), and that these reserves could lose species as they 'relaxed towards equilibrium' (that is they would lose species as they achieved their new equilibrium number,

known as ecosystem decay) caused a great deal of concern. This is particularly true when conserving larger species which tend to have larger ranges.

Island biogeography theory also led to the development of habitat corridors as a conservation tool to increase connectivity between habitat islands. Habitat corridors can increase the movement of species between parks and reserves and therefore increase the number of species that can be supported, but they can also allow for the spread of disease and pathogens between populations, complicating the simple proscription of connectivity being good for biodiversity.

In species diversity, island biogeography most describes allopatric speciation. Allopatric speciation is where new gene pools arise out of natural selection in isolated gene pools. Island Biogeography is also useful in considering sympatric speciation, the idea of different species arising from one ancestral species in the same area. Interbreeding between the two differently adapted species would prevent speciation, but in some species, sympatric speciation appears to have occurred.

Q 8. What is the magnitude of biodiversity? How biodiversity could be assessed through various indices?

Ans:

Biodiversity is a Greek word, bios= life and diversity= forms. The term biodiversity was coined by Walter G. Rosen in 1985. According to U.S. Office of Technology Assessment (1987), biological diversity is the variety and variability among living organisms and the ecological complexes in which they occur. Basically biodiversity includes all the flora, fauna and microorganisms inhabiting the earth. There are three level of biodiversity:

(1) Genetic diversity : It includes the genetic variation within the species

(2) Species diversity : It includes full range of species starting from microorganisms to the multi-cellular kingdom of the earth

(3) Ecosystem diversity : It includes variation in the biological communities in which species live, the ecosystem in which the community exist and the interactions among these levels.

Magnitude of Biodiversity

Global biodiversity (Gibbs, 2001)

Major taxonomic group	Number of identified species
Higher plants	2,70,000
Algae	40,000
Fungi	72,000
Bacteria including cyanobacteria	4,000
Viruses	1,550
Mammals	4,650
Birds	9,700
Reptiles	7,150
Fish	26,950
Amphibians	4,780
Insects	10,25,000
Crustaceans	43,000
Molluscs	70,000
Nematodes and other worms	25,000
Protozoa	40,000
Others	1,10,000

Biodiversity of India - Plants

Species	Data
Bacteria	850
Fungi	23,000
Algae	2,500
Bryophytes	2,564
Pteridophytes	1,022
Gymnosperms	64
Angiosperms	15,000/ 17,500
Total :	45,000/ 47,500

Biodiversity of India - Animals

Species	Data
Insects	57,525
Lower group	9,214
Molluscs	5,042
Fish	2,546

Birds	1,228
Echinoderms	765
Reptiles	428
Amphibia	204
Mammals	372
Protochordates	116
Hemichordates	12

Measuring biodiversity

Biodiversity could be measured by different indices which are as follows

(1) Shannon diversity index

$\overline{H} = -\sum(n_i/N) \log_e (n_i/N)$

Where, n_i= numder/biomass/energy flow for each

N= Total number in that community.

(2) Simpson's index of dominance

$D=\sum(n_i/N)^2$

(3) Similarity index : Czechanovski (1913) had developed this index

$S=100\times((2C/(a+b))$

Where, a= no. of species in one site

b= no. of species in another site

c =no. of species common to both sites

S= Czechanovski's similarity index

(4) Evenness index

$E=\overline{H}/S$

Where, S= No. of species

$\overline{H}$= Shannon index

Importance of Biodiversity

(a) Sources of food

(b) Sources of fats and oil: Soya bean, Coconut etc.

(c) Fibers : Cotton, flax etc.

(d) Drug and medicines : For diabetes, ring worms etc.

(e) Aesthetic value : Ecotourism, wildlife etc. are rewards of aesthetic value.

(f) Cultural value : Ficus (Pipal) like species are worshipped in India.

(g) Ecosystem services : Pollination, nutrient cycling, soil conservation, protection of climate, providing oxygen are important to note.

Threats of biodiversity : Biodiversity is declining continuously due to the following reasons:

(i) Habitat loss and fragmentation

(ii) Deforestation

(iii) Human population explosion

(iv) Pollution

(iv) Over-exploitation

(v) Intensive agriculture

(vi) Introduction of exotic species

(vii) Industrialization

(viii) Political and socio-economic reasons

Conservation of biodiversity

(a) In-situ conservation : It is concerned with protection and management of important component of biological diversity through a network of protected area like (i) National Park – these are maintained by the government. Inside the national park, cultivation, grazing, forestry and habitat manipulation are not allowed (ii) Sanctuary- these are the land areas with/ without lake where wild animals can take refuse without being hunted and disturbed (iii) Biosphere Reserve- These are multi-purpose protected area which are meant for preserving genetic diversity in the representative ecosystem by protecting wildlife, tribals and domesticated plants or animals.

(b) Ex-situ conservation : It is the conservation of selected rare plants and animals in places outside their national habitat. Important areas are sea bank, cryopreservation technique, botanical gardens and zoos.

(c) Removal of exotic species – Exotic species that have become a pest should be removed for protection of native biodiversity.

(d) Legal provision: The Wild Life (Protection) Act, 1972, Forest Protection Act, Ramsar Convention (wetland) and CITES could be used legally to protect the biodiversity.