OPSC STUDY: Forestry Optional

FORESTRY Optional Questions + Model Answers : (Free Sample)

Selective for Forestry Optional :

- **Questions + Model Answers (Covers all 20 Units with selective questions and model answers)**
- **Approximately : 180 Questions with Model ANSWERS**

: Maintain INTRO-BODY-CONCLUSION format when possible
: Use Heading and Subheading for answer clarity (better presentation and understanding)
: Stick to the Keywords (what the question demands?)
: Use Maps / diagrams/ flowcharts to enhance the quality of content.
: You must practice writing in timely and economical manner

- 10 Marks: 150 words
- 20 Marks: 250 -300 words
- 60 Marks: approx. 6 pages or 1000 words

: Use paragraph style of writing instead of bullet form
: Note: The model answers may exceed the word limit sometime. Thus, whenever you are writing you can shorten the answers through writing crisp answers (eliminating detailed explanation). Otherwise, you can use map, diagram or chart to explain the same answers in short.

1. Define "locality factor" and discuss the different locality factors? Describe how the growth of the tree is affected by light? (20 marks)

Ans-

As one moves from one locality to another, one can easily discern the change in the nature andcomposition of forests borne on such localities. Forests in Darjeeling hills are different from those in the lateritic tracts of south-west Bengal. Again, forests in the plains of north Bengal will be altogether different from the estuarine forests in the Sundarbans down in the south. That is, with change in locality, the nature of forests changes. Such changes manifest in flora and fauna, and their characteristic features like species, relative abundance of species, composition of vegetation in different stories, ground vegetation etc. This happens because forests and its biota (flora and fauna) in a particular locality are governed by the climate, soil, topography and biotic factors prevailing in that locality. In other words, it is not a matter of chance that a forest of a specific nature and composition gets established in a locality or site, rather forest of a locality is the result of complex influence of the climatic, edaphic, topographic, and biotic factors of the locality.

The factors of the locality are thus defined as the effective climatic, edaphic, topographic and biotic conditions of a site, which influence the vegetation of the locality. These factors are also referred to as site or habitat factors. Factors of locality are broadly classified into four categories, namely,

1. Climatic factors
2. Topographic factors
3. Edaphic factors, and
4. Biotic factors

The site factors interact among themselves to yield the inputs like light, heat, water, nutrientsetc. that are directly available and used by the plants.

Light

Light is an important locality factor as it has the following effects on trees and other vegetations

1. **Chlorophyll formation-** Light is an essential factor responsible for chlorophyll formation.
2. **Functioning of stomata**- Light influences the opening and closing of stomata, thus effecting respiration andphotosynthesis.
3. **Photosynthesis**- Photosynthesis, the process by which plants produce food, cannot takeplace in absence of light. Plants actually use only a small part of the total light falling onthe leaves. The leaf allows only a portion of incident light to be absorbed; and most of the light energy absorbed is used up in raising leaf's temperature and is lost as heat or consumed in transpiration. Since Chlorophyll is green, green foliage reflects a higher percentage of green lights than the blue- violet or the longer yellow- red wavelengths.

Thus the blue- violet and the yellow – red coloured light get absorbed instead of being reflected, and have relatively greater influence on photosynthesis.

4. **Growth**-The most obvious importance of light to forest vegetation lies in the dependence of tree-growth on Photosynthesis and latter's dependence, in turn, on light. The influence of light on tree growth depends on the wavelength, duration and intensity.
    a. The wavelength or colour of the light influences the height and shape of the plants.
    b. Duration of light or the length of exposure to day light influences the growth of plants. The response of plants to the timing of light and darkness, called Photoperiodism, is a biological clock enabling plants to adjust their metabolism to certain seasonal fluctuations. Photoperiod

largely controls the entrance into dormancy of many woody plants. Photoperiod is particularly important in higher altitudes where seasonal differences are very much pronounced.

c. Before we describe effect of intensity of light, let us define a couple of terms. Light Irradiance is the amount of radiation received per unit area in the visible spectral brand. The Light Compensation point is the light intensity at which carbon gain from photosynthesis equals carbon loss from respiration. When the irradiance is increased above the compensation point, photosynthesis is increased proportionately. It has been observed by scientists that in the range of 1 to 15 % of full sunlight, photosynthesis is directly proportional to irradiance, if other factors are favourable. The increase in photosynthesis will continue until other factors combine to bring growth to halt. At very high irradiance, factors like high respiration, water deficit causing stomatal closing, and over-accumulation of photosynthate may result in decreased photosynthesis.

5. **Form and quality of trees** – Growing axes of trees elongate mainly between sunset andsunrise in low irradiation. That is why trees growing in shade are usually taller than those of the same age growing in open provided other growth factors are not restricted.Light also influences the form of trees. In congested forest crop, lower branches of treesdie and fall off due to deficiency of light caused by upper story resulting in long clear boles. Continued competition for space restricts development of crown and tends to produce stem of more cylindrical shape. Exposure to light favours formation of relativelylarge crown and consequently, rapid growth. That is why, towards the end of rotation, forests are opened up to allow the selected trees to put on rapid diameter growth.
6. **Species stratification, size and structure of Leaves** – The intensity of light in a typical forest varies widely along vertical heights from top canopy to forest floor. The top canopy receives the full light. However, the intensity of incident light reduces as light gets filtered down through the canopies and foliage. Ultimately, light that reaches forestfloor is of very low intensity. This variation of light intensity down the heights results instratification of species in different canopies, according to requirement of light. Light also affects the size and structure of leaves. In typical forest trees, shade leaves are thinner, and less deeply lobed. Shade leaves have a larger surface per unit weight and fewer stomata than comparable sun leaves off the same tree.

Light requirement of species

Light required by a species for growth and establishment varies from species to

species. Based on tolerance to light intensity, species are classified into following categories –

1. **Light Demander** – requires abundant light for its bestdevelopment
2. **Shade bearer** – is capable of persisting and developing undershade
3. **Shade demander** – requires, at least in its early stage, some shade for normaldevelopment.

In practice, however, all species cannot be categorized rigidly under the above classification, because plants may respond to light intensity differently under different growing conditions, and at different stages of growth. For example, *Shorea robusta* (Sal), known to be light demander, requires shade at the early (seedling) stage. However, based on broad observation, some examples of classifications are givenbelow.

Light Demander - *Bombax ceiba* (Simul), *Terminalia alata* (Pacasaj),Eucalyptus etc.

Shade bearer – *Quercus dilatata* (Katus), *Cupressus torulosa*, *Toona celiata* (Toon), *Pongamia pinnata* (Karanj), *Schima wallichii* (Chilauni)etc.

Shade demander – *Taxus baccata, Xylia dolabriformis* (Lohakath),

Mallotus philippinensis (Sindure), *Litsea glutinosa* (Leda) etc.

1. Explain how the biotic factor affects the growth of the plant in forest. (20 marks)

Ans-

The biotic factors include the influence of living organisms, both plants and animals upon the vegetation. Any activity of the living organism which may cause marked effects upon vegetation in any way is referred to as biotic effect.

The biotic effect may be both direct and indirect. It may be beneficial to the plants in some respects but detrimental in other respects.

The plants live together in a community and influence one another. In the forest there are many plant communities, such as trees, shrubs, herbs, mosses, lichens. These communities interact with one another and adjust according to environmental conditions. Trees cast their shadow on many shade-loving plants which grow around or beneath them. The micro-organisms, such as bacteria, algae, fungi, and viruses affect the life of plants of a given area in many ways.

Besides these, the decomposition of dead parts of plant bodies causes significant addition of organic compounds and humus to soil. In this way, vegetation modifies the habitat to a considerable extent. Similarly, animals which are in close association with plants also affect the plant life in one or several ways. Many animals use plants as their food and for shelter as well. Besides animals, the man is most significant agent for modifying the vegetation.

The biotic effects modifying the vegetation can be discussed in the following heads:
(1) Interactions between the plants and local animals and man.

(2) Interaction among plants growing in a community.

(3) Interaction between plants and soil micro-organisms.

1. Interaction between Plants and Local Animals and Man:
These can be described under the following heads:
(i) Effects of grazing and browsing by animals.

(ii) Role of animals in the pollination.

(iii) Role of animals in the dispersal of seeds and fruits.

(iv) Insects and carnivorous plants.

(v) Effects of human activities on vegetation.

(vi) Myremecophily.

(vii) Miscellaneous effects.

(i) Effects of grazing and browsing:

Grazing means eating away of un-harvested herbs as forage by animals , as for example, eating away of grasses by goats whereas browsing refers to a similar use of shrubs or trees by animals , as for example, eating away of leaves and small twigs of Neem by camels.

The animals destroy a large part of Vegetation by grazing and browsing. Some animals prefer to graze and browse on some particular plant species they show selective grazing and browsing, e.g., sheep normally prefer forbs, horses and cattle prefer grasses and goats and deer prefer woody and leafy Parts of plant. Small annual plants become uprooted and disappear after being grazed. In browsing, taller plants such as trees and shrubs are little affected.

Various other effects of grazing and browsing are summarized briefly in the following points:

(a) The grazing and browsing adversely affect the aeration of soil and make it compact and hard and finally render the soil unfit for the growth of trees and shrubs. Forests open to cattle are changed first into shrubby vegetation's and finally into grasslands. Excessive grazing and browsing may thus change the pattern of vegetation and finally lead the area to develop into desert.

(b) The grazing and browsing reduce greatly the frequency of photosynthetic organs (leaves and apical green parts of stem) and thus curtail the assimilation.

(c) The grazing and browsing reduce the vegetation from the surface of earth to a considerable extent and thus expose the soil for erosion.

(d) The most important effect of grazing and browsing is the trampling. In the trampling complete destruction of small and weak annual herbs is caused by the hoofs, paws and feet of animals, but the shrubs and trees are little affected. Usually trampled area becomes inhabited by special type of plants which can withstand the mechanical effect of trampling. These plants propagate vegetatively and are not dependent upon the seed for their propagation.

(e) In grazed pasture and meadows, dung avoiding (coprophobic) plants disappear giving place for the colonization of non-coprophilous vegetation.

(ii) Role of animals in pollination:

A large number of plants depend on insects, birds and a number of animals for their pollination. These plants develop coloured flowers. The flowers possess scents, nectar, sap, edible pollens and many other characteristic structures for attracting insects towards them. Insects, birds and other pollinators visit the flowers in search of honey and edible pollens. Flowers in the families Rosaceae, Compositae, Leguminosae, Rutaceae, Umbelliferae, Euphorbiaceae, Cruciferae, Ranunculaceae are pollinated by insects.

Some plants are specialized in their pollination by particular type of animals, for example, Rafflesia is pollinated by elephants and birds, bilipped flowers of Salvia are pollinated by bees, entomophilous flowers of orchids, Ficus and Calotropis are pollinated characteristically by insects.

It is observed that different types of flowers and their pollinators generally live together in the same biotic communities and affect each other's life.

Besides insects, birds, bats and some other animals, man too is taking active part in pollinating artificially one plant with the pollen of some other plant species. The artificial pollination is being used by man for the production of high yielding and disease resistant plant varieties.

(iii) Role of animals in the dispersal of fruits and seeds:

Many animals, such as birds, bats, monkeys, act as important agents for disseminating the seeds, fruits and spores and thus they play important role in the migration of plants. The seeds of many plants are very hard. Such seeds along with fleshy parts of fruits are swallowed by animals. While passing through the elementary canals of animals hard seeds are not affected by digestive juices.

When the animals leave faecal matter, the uninjured seeds present in it germinate. Passing of seeds through the digestive tracts sometimes facilitates their germination in certain cases. The seeds of tomato, tobacco, guava and many other plants are dispersed in this way.

The hairy, spiny, hooked and sticky fruits and seeds of some plants get entangled with the bodies of birds and other animals and with the clothes of man and are brought to distant places. When the animals clean their bodies at some places the seeds are dropped there. Seeds and fruits of Xanthium, Andropogon, Plumbago, Aegle marmelos are dispersed in this way. Ants are good agents for transporting oily seeds and small grains of cereals.

(iv) Insects and Carnivorous plants:

Semi-autotrophic insectivorous plants, as for example, pitcher plant, Drosera, Aldrovanda, Dionaea, bladderwort, etc., grow in the habitats which are deficient in nitrogenous compounds. These plants have some specialized organs and mechanisms for trapping and assimilating the preys.

Pitcher plants have leaf pitchers containing liquid and enzymes inside. When the insects are trapped down in the pitcher they are digested and assimilated by it. In Drosera spathulate leaves are covered with sensitive glandular hairs which shine in the sunlight and attract insects and small flies. When the insects are entangled in the glandular hairs of leaves, digestive enzymes are secreted immediately which kill and digest the bodies of insects. The digested parts of insects are absorbed by the surface cells of the leaves.

(v) Effects of human activities on vegetation:

Man affects vegetation in the following ways:

(a) By cutting, felling and replanting the forest trees.

(b) Cultivation:

Besides the old methods of cultivation, man has adopted a number of advanced methods for cultivation of plants. Cutting, budding, grafting and other methods used by man are proved beneficial for certain plants. Now at various research stations men are performing cross breeding experiments to evolve new varieties of plants that give high yields and are disease resistant. In cultivation, the destruction of weeds by man

eliminates the competition among the plants. Proper spacing of plants during cultivation also checks the competition among them for food.

(c) Fire:
Fire is a biological factor rather than a physical factor because it is mostly caused by man's activity. Lightning initiated fires have destroyed plants and animals since their early appearance on earth. In some countries, especially America and Africa, a lot of work has been done on the effects of fire on different ecosystems. A large body of information has developed on the effects of fire on grasslands and forests as well as on the use of fire in land management.

The branch of ecology which deals with the effects of fire on ecosystem is called "Fire ecology" or Ecopyrology. Plants having ability to withstand fire with little or no damage are referred to as Pyropliytes. A number of pyrophytes are known to occur in Siwalik hills. Important examples of pyrophytes are Cochlospermum religiosa, Combretum nanum, Grewia sapida etc. These small plants are supposed to have become permanently dwarf by annual jungle fires. Pyrophytes are mostly woody plants with thick bark.

Fires caused by man's activity are responsible for complete destruction of vegetation at certain places resulting in temporary or permanent alterations in the characters of vegetation's. In some parts of tropics and subtropics, especially in Africa, the burning of grassland has been a regular practice for the last many centuries.

Generally, in fires the aerial parts of plants are destroyed completely but their roots, rhizomes or other underground parts may sometimes remain unaffected which under favourable conditions may grow and produce new plants. Fire generally makes the area suitable for the growth of grasses and thus improves the quality of forage. Post-bum plants are preferred by herbivores. Animals grazing on burnt grasslands are found to gain weight more rapidly than those grazing on un-bunt grasslands. Fire removes harmful plant and animal parasites and pests.

Litter accumulations physically prevent the healthy production and growth of some plant species in grassland. Fire not only removes the choking litter accumulation but also reduces the organic debris to ash. It affects the productivity by stimulating both the above and below ground growth, increases flowering in forbs and seed production in grasses, increases certain species like legupies and improves nutrient contents of the grassland species.

Burning in normal course does not affect the grassland soils adversely and generally improves them. Mineral salts of calcium, magnesium, potassium and phosphorus increase with burning. Excessive burning may reduce the humus content and the fertility of the soil. Soil acidity increases and erosion is accelerated. Annual burning coupled with continuous heavy-grazing will have detrimental effects on the health of grassland.

(d) Man also clears the vegetation for making houses, roads, etc.

(e) In ancient times many human invasions took place in India which caused great destruction of vegetation. Alexander (330 B.C.), Muslim invasion after 850 A.D. Gori and Gaznavi, and Rajput invasions destroyed dense forests and converted them into deserts. Mohenjo-Daro and Harappa are examples which are supposed to have become deserted as a result of human invasions. The excavations of Mohenjo-Daro and Harappa indicate that shrubby plants were abundant in the desert areas of Punjab and Sindh.

(vi) Myremecophily:

Sometimes ants take their abode or shelter on some trees such as Mango, Litchi, Jamun, South American Acacia (Acacia sphaerocephala) (Fig. 2.18) and so on. These ants act as body guards of the plants against any disturbing agent. In lieu of this defence, the plants provide food and shelter to these ants. This phenomenon is known as myremecophily.

(vii) Miscellaneous effects:

The animals also affect the plant life in many other ways. Some animals, as for example, barkeater, rodents may kill a large number of trees. Juice sucking insects, woodpeckers, bud eating birds, sparrow, squirrel and other animals cause great harm to the vegetation. Elephants detach the branches of the trees and sometimes uproot the gigantic trees. The insects, birds, squirrels, mice and rodents eat abundant seeds. Some animals eat and destroy seeds at the sowing time. Fishes, ducks and other aquatic animals depend upon aquatic plants for food and shelter.

2. Interaction among Plants Growing in a Community:

Various plants in a community react with one another in several ways for:

(i) Water,

(ii) Essential minerals and organic compounds, and

(iii) Light and air.

The taller plants modify the habitat for the plants growing around and underneath them by casting shadow, protecting them from injuries by strong wind, by increasing the atmospheric humidity, and by determining the humus content of the soil.

The two main problems of interaction among plants are:

(a) Maximum absorption of water from the atmosphere and from the bark surface of the supporting plant and

(b) Maximum economy in the water consumption. These plants develop two types of roots, namely the aerial and clinging roots.

The aerial roots are thick and have special thin walled porous absorptive tissue, the 'velamen' on their surface. These roots absorb rain water and moisture from the atmosphere. The clinging roots fix the epiphytes on the surface of supporting plants. Because the epiphytes are autotrophic, they do not affect the supporting plants to any considerable extent.

(iii) Effects of parasitic plants. Some plants are heterotrophic and are dependent on other plants for their food requirements. They are called parasites.

These are of the following two types:
(i) Ectoparasites (external parasite); and

(ii) Endoparasites (internal parasites).

The endoparasites are more destructive than the ectoparasites. Because the parasites take their food from host plants, they check the growth and ultimately cause the death of their hosts. Cuscuta, Loranthus, Orobanche, Rafflesia, and sandal wood tree (Santalum album) are important parasitic angiosperms which may grow either on roots or on stems and sometime even on the leaves of the higher plants. The parasites may be either obligate or facultative.

Cuscuta is an obligate stem parasite on Acacia, Zizyphus and a number of other angiospermic plants. Loranthus is a partial stem parasite on mango. Orobanche grows very commonly on the roots of crucifers and solanaceous plants as obligate roots parasite. Other important parasites are Rafflesia on the roots of Vitis Viscum album on coniferous trees. Striga, one of the smallest angiospermic parasites grows on the grasses. Arceuthobium minutissimum, an interesting smallest parasitic dicot, is an obligate stem parasite of Pinus excelsa.

3. Interaction between Plants and Microorganisms:
Various kinds of bacteria, protozoa, algae, fungi, worms, nematodes and other soil microbes act as important agents which alter the physical and chemical properties of the soils and increase or decrease their fertility. These changes in the soil properties have great impact on the nature and growth of vegetation.

Very often soil microbes, such as nematodes, bacteria and fungi cause many diseases in the underground parts of plants. Viruses too cause several mosaic and other diseases in many plants, as for example, the curling of tomato leaves, mosaic patterns in papaya and lady's finger (bhindi), bean mosaic, tobacco mosaic, etc. Some microbes secrete growth stimulating substances in the soil which induce the growth of plants.

Besides above effects, the soil microorganisms show symbiotic activities and many soil fungi form mycorrhizal association with the roots of higher plants.

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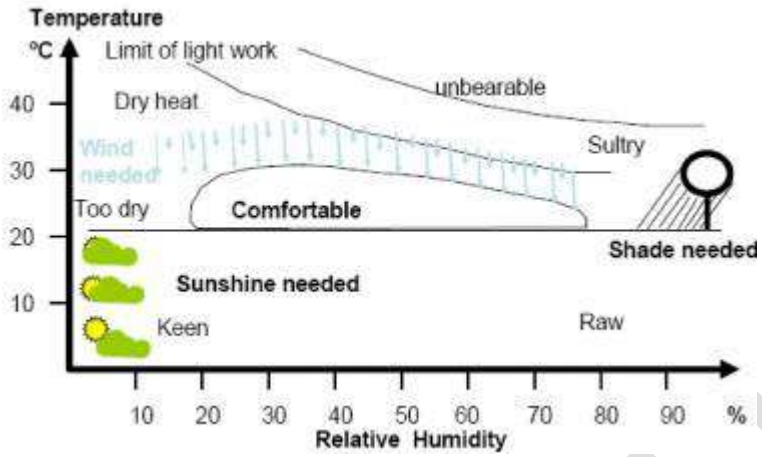
B. Bioclimate

A climate, as it influences, and is influenced by, biological organisms. A climate or climatic zone considered or defined in relation to living organisms and their distribution is known as Bioclimate.

Various climate factors influence the vegetation collectively but not individually or separately. Thus the vegetation of a place is result of various climatic factors acting together.
The variables like annual mean temperature (Temp) and annual precipitation (Prec), as these are key drivers of ecosystem processes, vegetation structure , and species richness .



While affecting vegetation collectively, these factors modify the influence of each other to certain extent. Therefore, each climatic factor has to be modified or adjusted in such a way that it may describe the influence of collective complex climatic factors on plant life. The climate defined by these modified or adjusted climatic factors is called bioclimate. For example, the total rainfall of a place has certain effect on vegetation. But the effect of rainfall is modified by number of rainy days. A certain amount of total rainfall with a larger number of rainy days will result in a different vegetation than the same total rainfall and number of rainy days. The effect of total rainfall and number of rainy days is further modified by the amount of evaporation taking place in that locality. Therefore, in order to describe the correct effect of rainfall as a climatic factor, the total rainfall will have to be modified by the number of rainy days and evaporation.

1. What do you mean by forestry? What are the main objectives of forest classification? Classify forest on different basis.

Answer-

Forestry is defined as the theory and practice of all that constitutes the creation, conservation and scientific management of forests and the utilization of their resources. It is an applied science which is concerned with not only the raising or cultivation of forest crops but their protection, perpetuation, mensuration, management, valuation and finance as well utilization of the forest products for the service of the nation. In favourable localities, this science is applied to get maximum return and so it is called intensive forestry which is defined as the practice of forestry with the object of obtaining the maximum in volume and quality of products per unit are through the application of the best techniques of silviculture and management. When forestry is practiced to achieve more than one purpose, it is called

multiple-use forestry which is defined as the practice of forestry for the simultaneous use of a forest are for two or more purposes, often in some measure conflicting, e.g., the production of wood with forest grazing and/or wildlife conservation.

The main objective of forest classification is to provide care, protection and to study about different aspect of forest vegetation, wildlife habitat, and how it link to the different aspect of society. On basis of objective forest is classified into different types-

a) Protection forestry – Protection forestry is the practice of forestry with the primary object of (1) protecting lands whether those upon which the forest is situated or those at a distance from it, against wind and water erosion, (2) conserving water supplies for human consumption, fish culture, etc., (3) reducing hazards from flood damage to human life and property and (4) amelioration of adverse climatic effects.

b) Commercial forestry – Commercial forestry is the practice of forestry with the object of producing timber and other forest products as a business enterprise. A specialized aspect of commercial forestry is to meet the requirement of a particular industry and in that case it is called industrial forestry which is defined as the practice of forestry to sustain a given industrial enterprise, such as a saw mill, pulp mill, chemical plant or a combination of these.

c) Social forestry – Social forestry is the practice of forestry on lands outside the conventional forest area for the benefit of the rural and urban communities. Supply of fuel wood to divert cow dung from village hearths to village fields, small timber for rural housing and agricultural implements, fodder for the cattle of the rural population living far away from the forest areas, protection of agriculture by creation of diverse ecosystem and arresting wind and water erosion and creation of recreational forests for the benefit of the rural as well as urban population are the basic economic and cultural needs of the community without which there can be no improvement in the conditions of their living. The application of forestry technology to achieve this social objective is known as social forestry.

Classification of Forests

i) **Classification based on method of regeneration** – Forests can be regenerated either from seed or from vegetative parts; those which are regenerated from seed are called high forests and those regenerated by some vegetative method are called coppice forests.

ii) **Classification based on age –** Even in plantation raised in a particular year, all the trees are not of the same year because casualities are replaced in the second and third years. Thus forests having all trees of the same age, are usually not found. Therefore forests are classified on the basis of age into even-aged or regular forest and uneven-aged or irregular forest. Even-aged or regular forest is defined as a forest composed of even-aged woods. The term even-aged used in this definition is applied to a stand consisting of trees of approximately the same age. Differences upto 25% of the rotation age may be allowed in cases where a stand is not harvested for 100 years or more. Uneven-aged or irregular forest is defined as a forest composed of trees of markedly different ages. The term uneven-aged is applied to crops in which individual stems vary widely in age, the range of difference being usually more than 20 years and, in the case of long rotation crops, more than 25% of the rotation. Such a forest is called selection forest when all or nearly all age gradations or age classes are present.

iii) **Classification based on composition** – A forest may have only one species or more than one species. On the basis of the number of species present, the forest is classified into pure or mixed forest. Pure forest is defined as a forest composed of almost entirely of one species,

usually to the extent of not less than 80%. It is also called pure crop or pure stand. Mixed forest, on the other hand, is defined as a forest composed of trees of two or more species intermingled in the same canopy; in practice, and by convention, atleast 20% of the canopy must consist of species other than the principal one. The species composing the mixture may be distinguished as principal, accessory and auxillary. Principal species is defined as the species first in importance in a mixed stand either by frequency, volume or silvicultural value or the species to which the silviculture of a mixed forest is primarily directed. Accessory species is defined as a useful species of less value than the principal species, which assists in the growth of the latter and influence to a smaller degree the method of treatment. Auxillary species is defined as a species of inferior quality or size, of relatively little silvicultural value or importance, associated with the principal species. It is also referred to as secondary species or subsidiary species.

iv) **Classification based on objects of management** – On the basis of objects of management, forests are classified into production forest, protection forest, farm forest, fuel forest, recreation forest, etc. Production forest is a forest managed primarily for its produce. It is also sometimes referred to as national forest, i.e., a forest which is maintained and managed to meet the needs of the defence, communications, industry, and other general purposes of public importance. Protection forest is defined as an area wholly or partly covered with woody growth, managed primarily to regulate stream flow, prevent erosion, hold shifting sand or to exert any other beneficial influence. Farm forest is a forest raised on farms and its adjoining area either as individual scattered trees or a collection of trees to meet the requirement of fuel and fodder of the farmers and to have a beneficial influence on agriculture. Fuel forest is a forest raised on village wasteland to supply fuel, small timber, fodder, etc., to the village communities living far away from government forest. Recreational forest is a forest which is managed only to meet the recreational needs of the urban and rural population.

v) **Classification based on ownership and legal status** – On the basis of ownership, forests are classified into state forest, communal forest and panchayat forest. State forest is a forest owned by state. Communal forest is a forest owned and generally managed by a community such as a village, town, tribal authority or local government, the members of which share in the produce or proceeds. Panchayat forest is any forest where management is vested in a village panchayat (i.e., a body of men elected by the villagers from among themselves for specific administrative or other purposes pertaining to the village). The state forests are further classified into reserved forest, protected forest and village forest on the basis of their legal status. A reserved forest is an area so constituted under the Indian Forest Act or other forest law. A protected forest is an area subject to limited degree of protection under the provisions of Chapter IV of the Indian Forest Act. A village forest is a state forest assigned to a village community under the provisions of the Indian Forest Act.

vi) **Classification on the basis of growing stock** – On the basis of growing stock, the forests are classified into normal and abnormal forest. Normal forest is defined as a forest which for a given site and given objects of management, is ideally constituted as regards growing stock, age class distribution and increment and from which the annual or periodic removal of produce equal to the increment can be continued indefinitely without endangering future yields. Such a forest by reason of its normalcy in these respects serves as a standard of comparison, for sustained yield management. Abnormal forest is a forest in which, as compared to an acceptable standard, the quantity of material in the growing stock is in

deficit or in excess or in which the relative proportions of the age or size classes are defective.

2. What do you mean by forest fire? Its types, causes and effect of forest fire. What are the preventive measures? (20 marks)

Answer-

Next to deforestation forest fire causes the most severe damage to the forests. One single uncontrolled fire can destroy the forest wealth which foresters have toiled over years to establish. Although fire is clearly a disturbance that disrupts the development of the existing stand, fire is a natural factor in the forest ecosystem, and its effects have been incorporated in species' adaptations and ecosystem dynamics.

Types of forest fires

According to the level at which they occur, forest fires are of the following types-

Ground fire – it burns the ground cover only, i.e. the carpet of herbs and low shrubs which cover the soil.

Surface fire – It burns not only the ground cover but also the undergrowth. This is the most common type; it consumes litter, killing aboveground parts of herbs and shrubs, and typically scorching the trees. Surface fire is very sensitive to wind speed. It tends to kill young trees of all species and most of the trees of less resistant species of all sizes .

Crown fire – It spreads through the crowns of trees and consumes all or part of upper branches and foliages. This usually occurs in coniferous forests.

Causes of forest fires

Broadly, there are two causes of forest fires, namely,

(1) natural and

(2) man-made, that is, fires caused by humans.

Natural Causes – The natural causes that prompt fire are lightning, rolling stones or rubbing of dry bamboos. The major among these causes is the lightning. Between 70 and 100 lightning flashes are estimated to occur every second worldwide, but not all strike the ground. In our country the number of fires that may be caused by all the three natural causes are not more than 5 % of the total number of fires caused in a year.

Fires caused by humans – Throughout the world humans have been the most significant causes of fires. About 95% of fires in this country are caused by man (L S Khanna, 1998). Fires caused by humans may be due to carelessness or could be a deliberate action.

Accidental fires due to carelessness may be caused by any of the following incidents –

I. Leaving fire burning after cooking in forest camps;

II. Throwing burning match stick or bidi or cigarette;

III. Throwing torch wood by the travelers at night;

IV. Burning of fields or grass lands adjoining to forests;

V. Accidental spread of fires while burning fire lines

Deliberate or intentional fires are caused normally in the following cases –

1. Burning the undergrowth to collect minor forest produce;
2. Inducing new shoots of grass by burning the dry grass;
3. Scaring away wild animals from the villages in the forest fringe;
4. Destroying or charring the stumps of illicitly-felled trees.

Effect on forests

Forest fires cause the following damage to forests.

I. Damage to plants – The ground flora of shrubs and herbs and the undergrowth are most vulnerable to surface fire, which is most common. Trees, in the upper storey, however, depending on species and age, suffer in varying proportion due to forest fire. The species which have thick corky bark are less prone to damage than those with thin bark. The broad-leaved species are less affected by forest fire than the conifers.

II. Damage to regeneration – Forest fire causes enormous damage to regeneration of plants and young plantations. Even a ground or surface fire of moderate intensitycantotallydestroytheregeneration.If the species concerned are good coppicer, and their root stock does not get destroyed, regeneration can appear again, but still the vigour of growth gets retarded.

III. Damage to soil – Fire bares the forest soil to eroding agents like sun, wind and rain. Soil erosion thus gets enhanced. Forest fire also depletes organic matter and nitrogen reserve. Fire also makes the soil more compact and impervious.

IV. Damage to productive potential – Fire reduces the productive potential or capacity of forests. Repeated fires may change the type of forests, for example, an evergreen forest may turn into a deciduous forest of poorer quality. Owing to natural adaptive character of the plants, valuable species may be replaced by inferior fire-hardy species. Fires also adversely affect the crop density and yield. Thus on repeated occurrence of fires, forest yield suffers both in terms of quality and quantity.

V. Damage to conservation potential – Even as ground and surface fire burns down the ground flora and undergrowth, there is considerable increase in the runoff. As a result, the capacity of forest to conserve soil and ground water is reduced. The streams passing through forested watershed witness sudden spurt in channel flow, if the watershed is burnt. Studies have revealed that stream flow from a watershed with protected ground vegetation is more uniform and steady than from a watershed whose soil and protective cover has been damaged.

VI. Damage to wild animals – Forrest fire destroys the eggs and young ones of wild animals. Sometimes the bigger animals also become victims of fire. Fire thus inflicts an enormous damage to wild animals and the biological diversity of forest.

4. Explain the similarities and different between softwood and hard wood with suitable example

Hardwood does not necessarily refer to a wood that is hard and dense. Similarly, softwood is not necessarily a soft or less dense wood. Let us see how they differ from each other!

Hardwood:

Hardwood is the wood that is obtained from angiosperms (flowering plants) such as evergreen trees especially with broad-leaves and deciduous trees which shed leaves annually. The seeds of angiosperms are enclosed in the ovary which later develops into a fruit. They usually grow at a slower pace and are far bigger in size. It is believed that black ironwood is one of the hardest woods known to the mankind.

Hardwood trees have xylem with vessels to carry or transport water throughout the tree. The cell walls of these xylem vessels are lined with lignin which is an extremely hard material, responsible for the hardness of the tree. The main advantage of hardwood is that they are more durable than softwoods.

Some of the species of hardwood trees commonly found in Europe and USA are willow, maple, sassafras, olive tree, walnut, cherry, ash, alder, birch, cottonwood, elm etc.

Softwood:

Softwood is the wood that is obtained from gymnosperms like pines, larches, spruces etc. These trees produce naked seeds which mean their seeds are not enclosed in an ovary or any other protective covering like an ovary. These trees have needle-shaped leaves and generally grow fast than hardwood trees. More than 70% timber is obtained from softwood which makes it four times more common than hardwood.

Softwood is cheaper than hardwood so sometimes it is used as a substitute for hardwood. It is also lighter and easier to cut to produce planks with different shapes. Generally, the softwood is light-colored and has less distinct grain and is very knotty. The knots are circles which result from the branches of the trunk.

Based on the above information, some of the key differences between hardwood and softwood are as follows:

Hardwood	Softwood
Hardwood trees belong to angiosperms (flowering plants).	Softwood trees belong to gymnosperms (trees that produce naked seeds).
It is hard, dense, and heavier than softwood. It does not split or break easily and not easier to cut using cutting tools.	It is lighter and less dense than hardwood. It tends to split more easily and easier to cut with cutting tools.
More wastage as hardwood trees don't grow straight.	Less wastage as softwood trees tend to grow straight.
It is more expensive than softwood.	It is generally less expensive than hardwood.
Hardwood trees grow at a slow pace as compared to softwood trees.	These trees grow fast as compared to hardwood trees.
Common examples: willow, maple, teak, walnut etc.	Common examples: pine, cedar, larches, cypresses, spruces etc.
It is more resistant to fire.	It is less resistant to fire.
It is used to produce highly-durable and high-quality furniture, deck, flooring etc.	It has a wide range of applications such as windows, doors, medium-density fiberboard, paper etc.

These trees have xylem with vessels to transport water throughout the tree.	These trees lack vessels and have medullary rays and tracheids to transport water throughout the tree.

a) What is nursery? Mention about classification of forest nursery. Explain about the role of nursery in increasing forest cover of the country.

Answer-

Nursery, place where plants are grown for transplanting, for use as stock for budding and grafting, or for sale. Commercial nurseries produce and distribute woody and herbaceous plants, including ornamental trees, shrubs, and bulb crops. While most nursery-grown plants are ornamental, the nursery business also includes fruit plants and certain perennialvegetables used in home gardens (e.g., asparagus, rhubarb). Some nurseries are kept for the propagation of native plants for ecological restoration. Greenhouses may be used for tender plants or to keep production going year round, but nurseries most commonly consist of shaded or exposed areas outside. Plants are commonly cultivated from seed or from cuttings and are often grown in pots or other temporary containers.

Classification of Forest Nurseries:

A. On the Basis of Area Size:

Based on size of area, forest nurseries are classified into:

i. Small Nursery:

Nurseries with an area of less than 3 ha

ii. Medium Nursery:

Nurseries with an area of 3-10 ha

iii. Large Nursery:

Nurseries with an area of more than 10 ha

B. On the Basis of Irrigation Facility:

Based on the water availability, forest nurseries are classified into:

i. Dry Nursery:

It is a nursery that is maintained without any irrigation or other artificial watering.

ii. Wet Nursery:

It is a nursery that is maintained by irrigation or other artificial watering during the dry periods.

C. On the Basis of Planting Stock:

Based on the planting stocks produced, forest nurseries are classified into:

i. Bareroot Nursery:

In bareroot nursery, plants grow directly in the nursery soil and the roots are separated from the soil at the time of lifting. The lifted planting stock is further handled and planted without soil surrounding the roots.

ii. Container Nursery:

In container nursery, plants are grown with roots in a growing medium held in a container. Roots of lifted plants are covered by the adhering growing medium.

D. On the Basis of Size of Seedlings:

Based on the seedling size, forest nurseries are classified into:

i. Seedling Nursery:

A nursery which has only seedling beds i.e., in which seedlings only are raised, no transplanting being done is called seedling nursery.

ii. Transplant Nursery:

A nursery which has only transplant beds, in which seedlings are transplanted for preparation for forest planting, is called transplant nursery.

In general, separate seedling and transplant nurseries are seldom made.

E. On the Basis of Ownership:

Based on ownership, forest nurseries are classified into:

i. Institutional Nurseries:

They are commonly established, operated and maintained by research institutions, academic institutions, corporations and international organizations. They are permanent in nature but may be larger, medium or small, based on purpose.

ii. Government Nurseries:

They are established and operated by national or local government to support reforestation and community tree planting programmes. They are large in size and are permanent in nature.

iii. Industrial Nurseries:

They are commonly established and operated by large integrated wood based industries. They are large in size with high production capacities and permanent in nature. Seedling production complies with rigid quality standards or specifications.

iv. Project Nurseries:

They are established and managed by projects and non-governmental organizations (NGOs) or development organizations to promote tree planting culture within target communities. The intended lifespan of project nurseries is usually 3-5 years, but may continue for longer periods.

v. Community Nurseries:

They are established by communities to support tree planting programmes for social benefits.

vi. Group Nurseries:

They are also established to build technical and leadership capacities of group members and expand the number of species and quality of germplasm available to group members.

vii. Individual Nurseries:

They are also known as household nurseries or backyard nurseries and are generally established and managed by individual farmer or household. These nurseries are usually initiated to produce seedlings for planting on operator's personal farms. The house compound or farmland provides the planting sites. They are normally small in size.

F. On the Basis of Duration of the Use:

Based on the duration of their use, forest nurseries are classified into:

i. Temporary Nursery:

It is a nursery that is maintained for supplying stock for a short period after which it is abandoned. Normally, it is constructed in the plantation area and usually small in size. It is suitable for hilly regions.

ii. Permanent Nursery:

It is a nursery that is maintained for supplying nursery plants for a long time on a permanent basis. It is intended to meet the requirements of one or more ranges and it is relatively larger in extent.

Nursery management represents the greatest concentration of technology and investment in the forest growth cycle. On an area basis, any effect on subsequent seedling or tree growth brought by nursery decisions and investment is multiplied many fold. This extraordinary leverage given to nursery manager's decisions not only makes those decisions the focus of land manager's attention but also provides an unusual opportunity for using research to improve productivity.

Furthermore, because the nursery production cycle is short relative to many other forestry operations, the impacts of nursery manager's decisions usually can be quickly seen and the effects of new research information applied to nursery operations can be rapidly evaluated.

The National Action Plan on Climate Change (NAPCC) and Green India Mission aim at afforestation of 6 million hectares of degraded forest lands and expanding forest cover from 23 to 33 per cent of India's territory. The plantation forestry programmes viz. afforestation, reforestation and reclamation forestry, which focus on increasing productivity of forest, necessitates for production of quality planting stocks.

These large scale plantation programmes require huge quantity of elite planting materials supplied through forest nurseries across the country. The forest nurseries thus play an important role in meeting the national objective of keeping 1/3rd of the country's geographical area under forest.

(d) Explain about composite wood and different forms of composite wood. Define adhesive explain its types

Composite wood

Composite wood is a general term for built up bonded products, consisting either wholly of natural wood or of wood in combination with metals, plastics, etc. Various processes and methods have been developed, most of them in recent years in building larger pieces from relatively small pieces or in treating and modifying wood by means of pressure, heat and chemicals. These developments also help in utilizing waste wood and wood of inferior species.

Forms of composite wood:

I. Plywood
II. Laminated Wood
III. Core Boards
IV. Sandwich Boards
V. Fiber Boards
VI. Particle Boards

Plywood

- Plywood is the term applied to glued wood construction built of veneers in such a manner that the grain of each veneer is at right angle to that of the adjacent veneer in the assembly. This method is called the cross-bonded construction.
- The most significant advantage is the modification of strength properties to a maximum advantage.
- The outer plies in a plywood panel are called faces, or face and back and the centre ply or plies, the core.
- The core may consist of veneer, timber or various combinations of veneers and timber.
- Plywood is used for interior walls, exterior walls, floors, doors and fitments.

Laminated Wood

- Laminated wood may be defined as a built up product made of wood layers called laminae, all laid with their grain parallel and glued or otherwise fastened together.
- The laminae may vary as to species, number, size, shape and thickness.
- Glued laminated wood construction or the structural material resulting from glued lamination, is called glulam.
- It is used for furniture parts, cores of veneered panels, sports goods, aero plane hangars, auditoriums, exhibition halls, churches, green houses, gymnasia, theatres, warehouses, etc.

Core Boards

- A core board is a composite board built up of a core composed of strips of wood of various dimensions glued together or otherwise jointed together to form a slab, which is in turn glued between two or more outer veneers with the direction of the grain of the core strips running at right angles to that of the adjacent veneers.
- It is called a batten-board when the strips of wood are not more than 7.5cm wide, a block-board when the size is not more than 2.5cm and a lamin-board when each strip of wood has a thickness not more than 7mm.
- It is used for doors and partitions due to its low weight, better stability, good acoustic and heat insulation properties.

Sandwich Boards

- A sandwich board is a general term for built up boards having a core of light material, faced on both sides with a relatively thin layer of material having high strength properties.
- Sandwich construction are composites of different material bonded together into a unit, to achieve a combination desirable properties which are not attainable with the constituent themselves individually.
- The construction is also economical, since the relatively expensive facing material is used only in small quantities and the core materials are inexpensive.
- Sandwich construction finds application in aircraft components, motor boats, table tops, flush doors and containers.

Fiber Boards

- A fiberboard is a sheet of material made from fibers of wood. The wood is first defibrated or pulped and the fibers are then interfelted into a mat and consolidated by pressure and heat.
- Bonding agents and supplementary materials may be added at the felting stage to improve mechanical properties.
- Fiberboards are used as core material in core boards and sandwich boards.
- These are manufactured for the use as panels, insulating and cover material in buildings and for components of cabinets, cupboards.

Particle Board

- A particle board is a board or sheet constituted from fragments of wood and other ligno-cellulosic materials, bonded with organic binders with the help of one or more agents like heat, pressure, humidity, catalyst, etc.
- The difference between fiberboard and particleboard is that in the former the basic particle is essentially pulp made up of individual fibres or small clumps of fibres, while in the latter basic material consists of larger units in the form of chips, flakes, splinters, etc., that exhibit many of the characteristics of the original wood.
- They have adequate strength for interior applications in housing or furniture.

Adhesives

Adhesive is any substance applied to one surface, or both surfaces, of two separate items that binds them together and resists their separation. Adhesive may be used interchangeably with glue, cement, mucilage, or paste. The use of adhesives offers many advantages over binding techniques such as sewing, mechanical fastening, thermal bonding, etc. These include the ability to bind different materials together, to distribute stress more efficiently across the joint, the cost effectiveness of an easily mechanized process, an improvement in aesthetic design, and increased design flexibility.

Types of Adhesives

1) Phenol Formaldehyde : Phenol formaldehyde resins (PF) are synthetic polymers obtained by the reaction of phenol or substituted phenol with formaldehyde. Used as the basis for Bakelite, PFs were the first commercial synthetic resins (plastics). They have been widely used for the production of molded products including billiard balls, laboratory countertops, and as coatings and adhesives.

- These are used in manufacture of construction plywood and oriented strand board.
- Phenolic resins requires more time for bonding as compared to other adhesives and have boil proof bonds which helps them to withstand wet conditions.

2) Urea Formaldehyde : A thermosetting synthetic resin made by condensing urea with formaldehyde and used especially in wood-bonding adhesives, colored molded articles, and for finishes (as of textiles, paper, and metals).It requires less time for bonding, but its bond breaks under wet or moisture conditions.

3) Melanine Formaldehyde : It is a hard, thermosetting plastic material made from melamine and formaldehyde by polymerization.

- Melamine formaldehyde is used in plastic laminate, decorative laminates, paper coating, paper treating and overlay materials. Formaldehyde is more tightly bound in MF than it is in urea-formaldehyde, reducing emissions.
- PF resins are more expensive than PF resins and are used in combination with UF resins.

4)Polymeric methylene-di-isocyanate (PMDI) : It is used as an alternative to PF resins.

- It is more expensive and can tolerate higher moisture and temperature conditions.
- Its curing rate is higher and only disadvantage is that it causes chemical reaction while using in raw state.

5) Bio adhesive : Bio adhesives are natural polymeric materials that act as adhesives. The term is sometimes used more loosely to describe a glue formed synthetically from biological monomers such as sugars, or to mean a synthetic material designed to adhere to biological tissue.

- Organisms may secrete bio adhesives for use in attachment, construction and obstruction, as well as in predation and defense.