



Module - 1

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INDIAN FOREST SERVICE
TOOLKIT**

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64 Out of **147** Total
Selections in

Indian Forest Service (IFoS) 2023

SILVICULTURE

Paper – 1 | Section – A



EDITION : 2024

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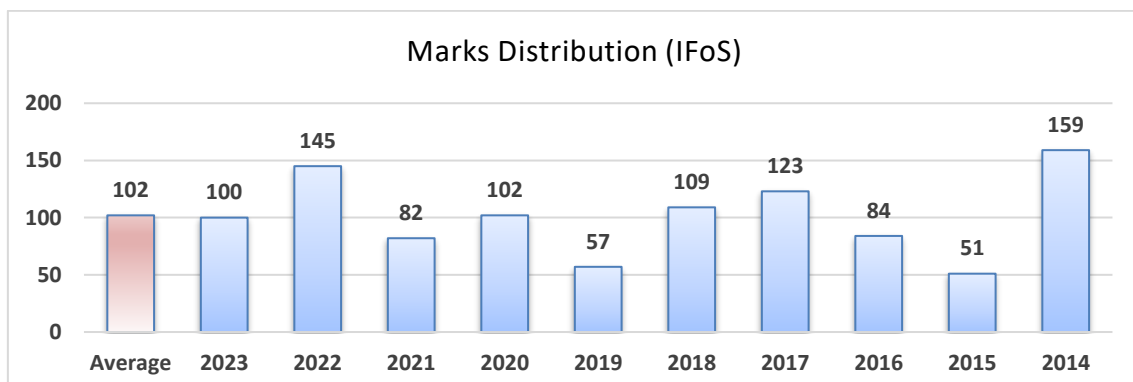
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SYLLABUS

<p>Indian Forest Service (IFoS) [Paper 1 Section A]</p>	<p>General Silvicultural Principles : Ecological and physiological factors influencing vegetation, natural and artificial regeneration of forests; methods of propagation, grafting techniques; site factors; nursery and planting techniques. Nursery beds, polybags, and maintenance, water budgeting, grading and hardening of seedlings; special approaches; establishment and tending.</p>
<p>Odisha PSC Civil Service (Main) Examination [Paper 1 Part A]</p>	<p>Effect of Locality Factors : (a) <i>Climatic factors</i> - Light, temperature, frost, precipitation, dew, humidity, wind; (b) <i>Physiographic factors</i> - altitude, aspect, topography, microclimate, (c) <i>Edaphic factors</i> - geology and soil, geology and forests, soil conditions; (d) <i>Biotic factors</i>.</p> <p>Forest classification and Distribution : (a) Basis for classification, criteria for delineating forest types in India and Odisha, distribution of forest types. (b) <i>Botanical areas</i> : Principal sub-groups, forest types, and their distribution. Brief description of groups and types, Biodiversity and its preservation, Mangrove forest.</p> <p>Forest Regeneration : <i>Natural regeneration</i> : by vegetative parts, by seeds, ecological requirements for natural regeneration, operations to be carried out for natural regeneration. Natural regeneration practice for important species and types – Moist Sal forest, Teak forest, Bamboo forest, Dry deciduous forest, Moist deciduous forest, Evergreen forest. <i>Artificial regeneration</i> : factors affecting, choice between artificial and natural regeneration, choice of species, choice between sowing and planting. <i>Introduction of exotics</i> : procedure for artificial regeneration, seed collection, and storage, <i>nursery operation</i>, planting out, maintenance of plantation, the role of in-vitro culture in regeneration.</p> <p>Tending operations and Forest growth : Weeding, cleaning, thinning, thinning types, methods of thinning, factors affecting thinning, thinning in important species, thinning in irregular crops, mixed plantations and coppice crops, improvement felling, girdling, pruning, Climber cutting. <i>Tree growth</i> : height growth. Growth in diameter, increment, growth in quality, rate of growth, crop growth.</p> <p>[Paper – 1 Part – B]</p> <p>Forest Influences : (a) Forest and climate - precipitation, temperature, shelterbelt and windbreak effect, humidity frost, snow fall, evapotranspiration. (c) Forest and hydrological cycle - Forest and interception, Forest and infiltration, forest and runoff, forest and erosion, forest and flood, forest and water yield, forest and avalanche, forest and animals; forest and biodiversity conservation, forest recreation, forest and population. (d) Plant succession : stages of succession, climax formation.</p>

MODULE – 1

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INDIAN FOREST SERVICE (IFoS) PYQs [2010 to 2023]

2023	<ul style="list-style-type: none"> • The shoot portion of seedlings of some tree species like Sal and Sandal, under natural regeneration, keeps on drying year after year but the roots remain alive. Discuss [8 M] • Calculate the quantity of seeds (kg) required to establish a teak plantation over an area of 10 ha. [8 M] • What is frost hole? How does frost affect regeneration? [8 M]. • Write the botanical names of three tree species each of [8 M] <ol style="list-style-type: none"> (a) Non-coppicers, (b) Poor coppicers, (c) Good (fair) coppicers and (d) Strong coppicers. • Describe the seed collection and storage methods of the following tree species [15 M]. <ol style="list-style-type: none"> (i) <i>Santalum album</i> (ii) <i>Chukrasia tabularis</i> (iii) <i>Cedrus deodara</i> (iv) <i>Azadirachta indica</i> (v) <i>Dalbergia latifolia</i> • Write the factors which affect the natural regeneration of Sal (<i>Shorea robusta</i>). Discuss the procedure to obtain natural regeneration of moist Sal forests [15 M]. • Explain the following [15 M]. <ol style="list-style-type: none"> (a) Lignotuber (b) Root sucker (c) Vermiculite (d) Buttresses (e) Ortet and Ramet • Discuss the significance of exotics in tree improvement. Name four exotic tree species [Linked Q 8 M] • How does moisture influence the soil formation and growth of vegetation? [Linked Q 8 M] • What are biofertilizers ? Enlist the factors associated with the mycorrhizal development in trees. Discuss the types of mycorrhizae [15 M].
2022	<ul style="list-style-type: none"> • Explain the techniques for upgradation and hardening of nursery seedlings of <i>Lagerstroemia lanceolata</i> [8 M] • Discuss the significance of bamboo flowering [8 M] • How are nurseries classified in India? What is a clonal nursery? Explain the nursery technique for <i>Casuarina equisetifolia</i> [15 M] • What is precision silviculture? Explain the silvicultural techniques for the following. [15] – <ol style="list-style-type: none"> (a) Dalbergia Sissoo, (b) Eucalyptus tereticornis • Explain the silvicultural practices that help in the modification of site factors in forestry [15 M]

	<ul style="list-style-type: none"> • Differentiate between thinning cycle and thinning intensity. Why is thinning essential for the management of <i>forest stand</i>? Describe the merits and demerits of French thinning [15 M] • What is <i>root : shoot cutting</i>? Write the names of five tree species which are propagated by this method [10 M] • How do <i>sacred groves</i> help in conservation of biodiversity? [8 M] • Explain the <i>role of mycorrhizae</i> in plant growth and development of forest trees [10 M] • What are the <i>biotic and abiotic stresses</i> on trees? Explain the responses of trees to these stresses [8 M]. • Describe the <i>adverse climatic factors</i> causing damage to forests [15 M]. • What are commensalism, Amensalism, Mutualism and symbiosis? Write the function of an ecosystem [10 M] • “Success of commercial forest plantations depends on site-specific and strategic planning” Justify the statement [8 M]
2021	<ul style="list-style-type: none"> • What factors are considered important while <i>choosing a species</i> under avenue plantation? [8 M] • Are <i>non-native</i> tree species an option or a threat in forest ecosystem / Plantation under climate change? [8 M] • Do the trees of same species have different response to <i>light conditions</i> at different ages ? [8 M]. • What do you mean by <i>tending</i> operations? Enumerate various tending operations carried out in forest crops. Discuss improvement felling [15 M]. • Why is <i>grading</i> operation of nursery seedlings essential for successful forest plantations? [10 M]. • How are <i>forest sites</i> classified on the basis of vegetation? [10 M]. • What is <i>Site Quality Index</i> ? How does it differ from fractional site quality ? Explain any one method used for developing site quality classes with the help of neat diagram [15 M]. • What is meant by <i>climax</i> in ecological succession? Give an example and describe types of ecological succession [8 M].
2020	<ul style="list-style-type: none"> • Define <i>silviculture</i>. Relate the applications of silvicultural to different branches of forestry [8 M]. • Frost resistance in trees depends on the internal and external factors. Explain [8 M]. • Write the adaptive characteristics of plant species of <i>cold desert</i> [8 M]. • Describe the methods of <i>artificial regeneration</i> of <i>Tamarindus indica</i> [8 M]. • Describe the following terms [10 M] (a) Dominant, (b) Dominated, (c) Crop height, (d) Top height, (e) Hardening • Write down the pre-sowing seed treatments for the following tree species [15 M] [<i>Linked Q</i>]. (a) <i>Tectona grandis</i>, (b) <i>Santalum album</i>, (c) <i>Dalbergia sissoo</i>, (d) <i>Albizia lebbek</i>, (e) <i>Acacia nilotica</i>. • What are the different factors governing the successful <i>introduction of an exotic tree</i>

	<p>species? [10 M].</p> <ul style="list-style-type: none"> • What are Orthodox and Recalcitrant seeds? Give five examples for each of these categories of seeds [10 M]. • How does slope aspect impact forest stand characteristics and soil properties? [10 M]. • What are the structural and functional changes that occur in a forest ecosystem during succession? [15 M].
2019	<ul style="list-style-type: none"> • Write <i>scientific names of four major tree species</i> in each of southern Tropical Semi-evergreen Forest and Northern Tropical Wet-Evergreen Forest [8 M]. • Explain the <i>modern nursery techniques</i> for the production of quality planting stock [8 M]. • Discuss the factors which influence the <i>choice between natural and artificial regeneration</i> [8 M]. • What are the <i>different types of grafting</i>? Explain 'Cleft Grafting' with neat sketches [8 M]. • Draw a schematic diagram showing <i>altitudinal zonation of forest vegetation</i> [10 M]. • Explain different <i>grades of thinning</i>. Discuss in brief the thinning practices adopted for teak plantations [15 M].
2018	<ul style="list-style-type: none"> • Justify that the study of <i>Silvics</i> is essential for the successful afforestation program in India [8 M]. • Explain different <i>kinds of thinning</i> and its application in the forest [8 M] • Explain the <i>Eco-physiological factors</i> that are more concerned to the silviculturist [15 M] • Can 'climate change' changed the period of <i>phenology</i>? share with examples [10 M] • Write in detail about the <i>influence of parent rock</i> in the <i>distribution of tree species</i> [8 M]. • Write the problem and prospects of <i>exotic tree species</i> in India with suitable examples [15] • Enlist different <i>types of nurseries</i> and write different types of nursery beds used in a nursery [7.5 M] • Enlist different <i>types of containers</i> used in a forest nursery and explain different methods of seed sowing followed in a nursery [7.5 M] • What is succession and <i>climax</i>? Give the causes of forest succession [10 M] • Write the soil-water relationship of any forest area. Describe the influence of water table in the growth and development of tree species [10 M] • What is <i>hydrology</i>? Describe the role of hydrology in the planning and management of watershed development. Do tree species improve the infiltration rate, soil temperature, water level, and hydrological cycle? Justify with few examples [10 M] • Write in brief on the criteria of selection of tree for resistance to adverse environments for high-quality timber production [<i>Linked Q</i> : 8 M]
2017	<ul style="list-style-type: none"> • Give four examples of uses of <i>Pollarding</i> in Indian forestry [8 M]. • Enlist four groups of <i>forest types</i> under the moist tropical forest as per the Champion and Seth classification of forest types [8 M]. • Name the <i>method of thinning</i> that best promotes genetic improvement of the regular stand besides controlling density. Give reasons in support of your answer [8 M].

	<ul style="list-style-type: none"> • Calculate the number of <i>seeds required</i> to raise a 20-hectare plantation with 4 m x 4 m spacing and an extra plant in the centre of each square. Plant percent of the species is 75% [8 M]. • Enlist the advantages and disadvantages of <i>vegetative propagation</i>. What future do you foresee for it in forestry? [10 M]. • Some rural communities are opposed to Chir-pine and advocate removal of Chir-pine and its replacement with broadleaved multipurpose trees. What is your reaction to this matter? [10]. • Regulation of <i>solar radiation</i> given a powerful tool to the forester justify [10 M]. • What is <i>Sub-Climax</i>? Explain its importance in the context of Indian forestry [10 M]. • Discuss in detail the kind of <i>Mycorrhiza</i> and the benefits derived by plant from them [8 M] • Why <i>Site-Specific Planning</i> is essential for forest management? Explain different Components of site-specific management [8 M]. • Describe the <i>effect of thinning</i> on volume increment [10 M]. • Define succession. Explain different types of succession in detail, citing suitable examples. Discuss various theories of succession [15 M]. • Explain the classification of <i>forest types</i> in India by Champion and Seth. Enlist major forest types and their group [10 M].
2016	<ul style="list-style-type: none"> • Comment on '<i>Forest has moderating influences</i> on soil and air temperature' [8 M]. • Describe the important <i>objectives of thinning</i>. Differentiating crown thinning from ordinary thinning. Write grades of ordinary thinning [8 M]. • Write the importance of soil organic matter in the forest. How is <i>calculation of number of seedlings</i> carried under Line, square, Triangular, and Quincunx methods of planting? [20 M] • Write in detail the term <i>girdling</i> and <i>pruning</i>. Write scientific names of five trees/Shrubs each for the cold desert and mangrove forest [20 m 1/3 Q]. • Discuss the reasons for widespread use of <i>exotics</i> for plantations and specific advantages of exotics over native species [8 M] • Explain the role of forests in environmental conservation [10 M]. • Justify the statement "Forest substantially check soil erosion and control run-off" [8 M]. • How are the forest classified in India? Discuss its significance in forest management [10 M ½ Q]. • Enumerate the classification of tropical dry deciduous forests given by Champion and Seth (1964). Mention two species for each forest type [10 M].
2015	<ul style="list-style-type: none"> • Comment upon the <i>dieback</i> (dying back) phenomenon in <i>Shorea robusta</i>. Is it a problem or a adaptation? [8 M]. • Describe the methods of pre-sowing treatment of seeds for raising Nursery [10 M] • How can a forest with <i>shade bearer</i> and <i>light demander tree species</i> be managed under <i>uniform shelterwood system</i>? [10 M 1/3 Q] • Explain the term <i>Hardening off</i>. What are the internal factors affecting forest resistance? [10 M].

	<ul style="list-style-type: none"> • Explain How the <i>Latitude</i> influences the forest types of the earth [10 M]. • Explain the necessity of <i>grading of seedlings</i> before plantation [10 M].
2014	<ul style="list-style-type: none"> • <i>Mixed forest stand</i> offers complete utilization of land, Comment [8 M]. • Discuss in detail the evolution of the concept of plant succession [20 m]. • Explain the following – (a) Orthodox and recalcitrant seeds [5 M]. (b) <i>Elite thinning</i> are often difficult to execute [5 M]. • What do you mean by <i>plantation schedule</i>? give in detail the factors which decide the success of plantation program [10 M] • Explain the importance of soil and air temperature on the growth of forest trees [10 M] • Explain the survival strategies of the following group of plants [20 M] - (a) Halophytes, (b) Phraetophytes (c) Xerophytes (d) Succulent. • Discuss the <i>natural regeneration</i> in soil, give steps recommended for ensuring its successful regeneration [8 M]. • Why does height of a tree consider a better criterion for a <i>site selection</i> than its diameter? Discuss [5 M] • How is <i>site quality</i> important in timber production? Discuss the methods used to measure the site quality [15 M]. • Explain the <i>importance of snow</i> in regeneration of <i>Cedrus deodara</i> [5 M]. • Difference b/w - (1) <i>Ectomycorrhizae</i> and <i>Endomycorrhizae</i> [4 M]. (2) <i>Exogenous dormancy</i>, and <i>endogenous dormancy</i> [4 M]. • Discuss in detail the objective of <i>artificial regeneration</i> [10 M]. • Describe the characteristics and structure of an <i>even-aged stand</i> [10 M]. • <i>Exotics</i> have potential, do you agree or disagree. Justify your response [5 M]. • What is <i>stand density</i>? How spacing is used to control stand density? Discuss [15 M].
2013	<ul style="list-style-type: none"> • Enumerate the factors which decide the <i>choice of species</i> for plantation [8 M]. • Configuration of the land surface has an impact on local climatic conditions and wind movement, which in turn have a bearing on forest." Comment [8 M]. • Explain the evolution of the concept of plant succession [8 M]. • Explain the role of <i>thinning</i> in forestry. What are the different methods of thinning followed in regular crops? Discuss in detail crown thinning [20 M]. • Explain various factors affecting the choice between <i>natural regeneration</i> and <i>artificial regeneration</i> with reasoning [10 M]. • Based on objectives, what are the different classifications of the <i>forestry</i> ? [10 M]. • Large-scale mortality has been noticed in <i>Dalbergia sissoo</i> and <i>Acacia nilotica</i> What could be the possible reasons for this mortality? (10) • Discuss the <i>mechanism of drought resistance</i>, <i>drought tolerance</i>, and <i>drought avoidance</i> in plants [10 M].

2013	<ul style="list-style-type: none"> Describe flora and distribution of group: Type 14/C₂ East Himalayan sub-alpine birch fir forests [10 M]. Write a note on 'role of micro-organism and rhizobium in amelioration of forest soils [10 M]. Describe the operational use of <i>vegetative propagation</i> in tree improvement [10 M].
2012	<ul style="list-style-type: none"> Comment critically on the following – <ol style="list-style-type: none"> Failure of forest plantations (5 m). Recycling of nutrients in Natural Forest (5) Basis of <i>forest classification</i> and why there is a need for such classification (5). How <i>snow</i> affects the forest vegetation? (5m) Importance of plant succession in Forestry practices (5 m). Reasons of <i>dying Dalbergia sissoo</i> (5m). Briefly discuss the - <i>Canopy architecture</i> in forestry (4m). Differentiate between – (1) Growth and development of trees, (2) <i>Ectomycorrhizae</i> and <i>Endomycorrhizae</i> (5 × 2 = 10 m). What are the ecological aspects for Selecting the tree species? Discuss [8 M]. <i>Gregarious flowering</i> is an indicator of drought in the area.' Do you agree with this statement ? (4 m). Differentiate clearly between natural and artificial regeneration of forest, describe the manner in which natural regeneration of Teak, Sal and Deodars takes places (16 m). Discuss the <i>role of forest</i> in interception, surface runoff, Infiltration of rainfall, regulation of stem flow, and maintaining Soil fertility (5m). Do forests influence the rainfall ? If so, how? (5 m). Discuss in detail the protective role of national forests in India (10 m). Comments upon - <i>Exotics</i> in Indian Forestry (5m). Highlight the salient features of – (1) <i>Aerial seeding</i> (2) <i>Stump planting</i> (2x3=6). Describe flora and distribution of Group : 16 C₁ of Champion & Seth's Forest Type [8 M]. Describe the altitudinal variations in flora of Eastern and Western Himalayas through a schematic diagram [10 M]. What are the major ecological consideration in Afforestation (5 m). List the pioneers flora of sand dunes under – (i) on dunes, (ii) Spread out sand, and (iii) Stabilized dunes (5m)
2011	<ul style="list-style-type: none"> Why are <i>locality factors</i> considered important for any silvicultural operation? (10 m). Explain the <i>role of fire</i> in the silviculture of <i>Shorea robusta</i> [10 M]. How do we calculate the seed requirement of a species while raising nursery? Also explain the method of calculating the number of plants required per hectare for plantation (10m). Explain the following points in relation to <i>nursery management</i> – (1) Site selection and layout, (2) Soil working, (3) Methods of raising nursery stock, (4) Plant protection measures, (5) <i>Nursery register</i>. (4 × 5 = 20 m)

	<ul style="list-style-type: none"> Differentiate between (5 × 2 = 10 m). <ul style="list-style-type: none"> (a) Exogenous <i>dormancy</i> and endogenous dormancy (b) Artificial regeneration and Natural <i>regeneration</i> Differentiate between <i>ectomycorrhizae</i> and endomycorrhizae with respect to structure and function [10 M]. Give <i>legal definition of forests</i> in India. Write about the major groups of forest types of India [10 M]. Describe the initial causes of secondary succession. Write various seral stages of succession leading to the development of <i>Shorea robusta</i> forests [10 M]. Describe the tangible and intangible <i>benefits of forests</i> [10 M]. <i>Linked</i> : Define a <i>forest type</i>. Discuss the different forest types found along with tidal swamp forests with their species composition. Give a note on how <i>Rhizophora racemosa</i> is managed in the mangrove forest of Sundarbans (3 + 12 + 5 = 20 m).
2010	<ul style="list-style-type: none"> Why do forest plantations fail? cite relevant examples (5 m). What are the different <i>types of containers</i> used in raising forest nurseries? List their advantages and disadvantages (5 m). Explain the role of <i>growth regulators in rooting of cuttings</i> (5 m). Briefly discuss <i>low-temperature injuries</i> in forest trees (5 m). What do you understand by the term <i>locality factors</i>? How these affect the decision of plantations undertaken by the silviculturist? [10 M]. Why is LAI important in deciding the productivity of forest trees? Explain the concept of optimum LAI and how it varies with the type of forest and climate [10 M]. Differentiate between the – (i) <i>Site quality</i> and <i>site index</i>, (ii) <i>Gregarious flowering</i> and sporadic flowering in bamboo (4 × 2 = 8). Comment on following – (a) <i>Pure stand</i> of forest result incomplete utilization of the site, (b) Plantation forestry has high production potential but low conservation value (5 × 2 = 10 m). Distinguish between "<i>Tending operations</i>" and "<i>Cultural operations</i>" in forestry [10 M]. Write short notes on – (a) <i>Canopy architecture</i>, (b) Radiation absorption and energy balance in forest, (c) Seed coating and pelleting, (d) <i>Nutrient cycling</i> in natural forest (5 × 4 = 20 m). Write on tree species for smoke and dust pollution control (5 m). What morphological, Anatomical, and physiological features are suited in <i>Xerophytic plants</i> [10 M].

FOREST FORESTRY & SILVICULTURE

1.1 INTRODUCTION

The term *Forest* has its roots in early medieval European society. The increasing population and the rise of new kingdoms and serfdoms, based on the heavy exploitation of natural resources, caused a severe loss of natural vegetation (that we called in India - *Jungles*) to meet their increasing demands for food, fodder, fuel, and timber. The shrinking areas of natural vegetation created a shortage of fuelwood and timber in their ruling regions. As a result, they began designating parts of the land, usually unproductive and located at the boundaries of village territories, for growing tree crops, which became known as *Woodlands* or *Forests*, to produce the required resources.

- ✎ *Forest* term derived from a *latin* word *foris* which means *outside of village boundary*.

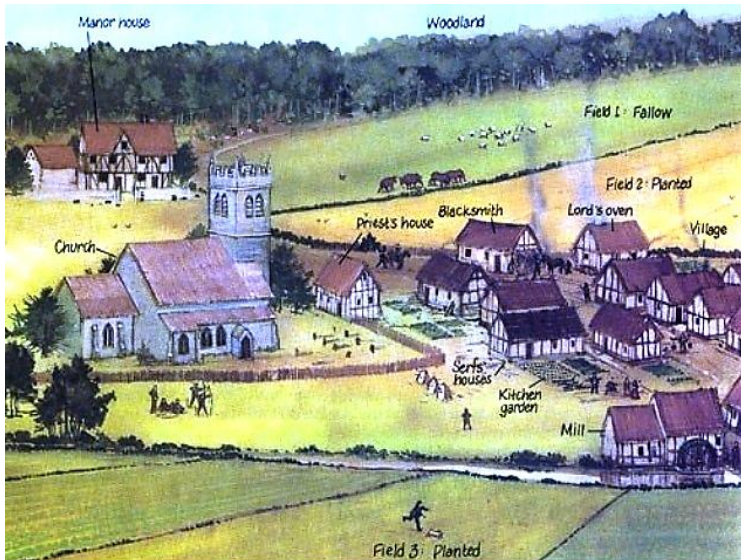


Figure 1.1 : A medieval European village

► DEFINITION

- Forest is an *area set aside* for the *production of timber* and other forest produce or to get other *indirect benefits* from it [Technical definition].

Chapter Outline

- 1.1 Forest
- 1.2 Forest Classification
- 1.3 Forestry
- 1.4 Silviculture
- 1.5 Role of Forest
- 1.6 Forestry development through ages
- 1.7 Important terminology
 - 🌿 Silvology
 - 🌿 Sacred Groves
 - 🌿 Precision Silviculture
- 1.8 Exercise

- Forest is an *uncultivated land* occupied by *natural vegetation* with a closed or partially *closed canopy*, which *provides shelter to the wildlife* [Ecological definition].
- Forest is any land area that has been *declared as a 'forest'* under any *central* or *state*, or *local laws* (i.e., by Tribal council) [Legal definition]

1.2 FOREST CLASSIFICATION

Forests are classified into various categories to –

- Provide a *standardized system for identifying, describing, and mapping* different types of forests based on their characteristics, such as tree species composition, canopy structure, and ecological function. This information can be used in decision making process related with *conservation, management, administration, research, land-use planning and record-keeping*.
- Identifying the *areas of high biodiversity* or *ecological significance* for conservation and sustainable management.
- *Developing sustainable management plans* : By understanding the characteristics of different forest types, managers can develop plans that are tailored to the specific needs of the forest ecosystem.

Forest may be classified on the basis of –

- [A] Age
- [B] Regeneration
- [C] Composition
- [D] Ownership
- [E] Function
- [F] Legality
- [G] Growing stock
- [H] Density of Forest cover
- [I] Ecological or Ecosystem-based

► FOREST TYPES, BASED ON AGE

- **Even Aged or Regular Forest** : a forest (stand) consisting of trees of approximately the same age. For management point of view, *differences up to 25 % of the rotation age may be allowed in the case where a stand is not harvested for 100 or more years.* While Nature never produced even-aged forest, but man can through plantation works, i.e., Nilambur teak plantation (1842). [in short, an actual *even-aged forest must be a man-made forest*].
- **Un-Even Aged or Irregular Forest** : Forest stand consisting of trees of all ages. The range of difference is usually more than 20 years and, in the case of long rotation crops, more than 25 % of rotation age. A



Previous year Questions

IFoS 2022 : What is the purpose of classifying forests ? How are the forests classified for silvicultural management? (8 m)

IFoS 2012 : Basis of forest classification and why there is need for such classification (5 m).

✿ What are the bases for the classification of forests? Why there is need of their classification? Write the type groups of tropical forests and their distribution and species of the area [OPSC ACF 2019-20 | 20 m].

✿ What are the objectives of forest classification ? Classify forests on the basis of different criteria used with definition of each class [Arunachal PSC Civil (Main) 2017-18 | 20 m].

✿ Write down the classification of forests on the basis of age, regeneration, composition and growing stock [OPSC Civil (Main) 2020-21 | 10 m]

✿ Discuss classification of forests based on age, composition, object of management, ownership and legal status [OPSC Civil (Main) 2016 | 20 m].

natural forest shows this composition, *i.e.*, the Satpura forest.

► **METHOD OF REGENERATION**

- **High Forest** : A forest with a closed or partially closed canopy *regenerated by seeds*. It is also known as a “Seedling Forest”
- **Coppice Forest** : A forest *regenerated by some vegetative* methods like *coppice, root suckers, ratoons*, etc., is called a coppice forest. It is also known as a “Low Forest”

It can also be classified as

- **Natural Forest** : When regeneration is obtained by natural means, *i.e.*, *virgin Forest*
- **Man-Made Forest or Plantation** : When regeneration obtains by Artificial means.

Virgin Forest

A natural forest in its natural state (without any human intervention)

- ✿ Differentiate between - High Forest and Coppice Forest [**Himachal PSC Civil (Main) 2015 | 5 m**]
- ✿ Write short notes - (a) High Forest (b) Low Forest [**Uttarakhand PSC (RFO) 2012 | 20 m**].

► **COMPOSITION OF FOREST VEGETATION (FLORISTIC COMPOSITION)**

- **Pure Forest** : A forest composed of almost entirely by one species, or at least *not less than 80 %*. It is also called a Pure crop.
- **Mixed Forest** : A forest composed of trees of two or more species intermingled in the same canopy. Mixed forests may be further divided into -
 - **Principal species** – (a) The species *first in importance* in a mixed stand, either by frequency, volume, or silvicultural value. (b) The species to which the silviculture of a mixed forest is primarily directed.
 - **Accessory species** – a useful species of *less value* than the principal species, which assists in the growth of later.
 - **Auxiliary species** – A species of *inferior quality* or size, of relatively little silvicultural value or importance [*syn.* Secondary species, Subsidiary species].

► **CLASSIFICATION BASED ON OWNERSHIP**

- **Govt Owned Forest** : Forest owned and managed by the state. 96 % forest area of India comes under this category.
- **Communal Forest** : A forest owned and managed by a community such as a village, tribal authority, or local government for their wellbeing [*syn.* Community forest].
- **Private Forest** : A forest owned and managed by industry, *i.e.*, BILT paper mill.
- **Panchayat Forest** : forest whose management is vested in a village panchayat for administration and management purposes, *i.e.*, *Lalwan* community reserve, Punjab.

► **CLASSIFICATION BASED ON FUNCTION OR OBJECTIVES OF MANAGEMENT**

- **National Forest Policy (1952)** : classified forests into four categories based on their purpose of management, *i.e.*, Protection forest, National forest, Village forest, and Tree land.

- Started Indian Forest Services (1867) = *Foundation of Forest administration*.
- Famous books : The forest flora of North-west and Central India (1874), Forest Entomology (1882), Indian trees (1906).

1866 : Changa-manga fuelwood plantation was established to gather fuel and resources for the engines employed in the North-Western railway networks [Now in Punjab, Pakistan].

1875 : 1st copy of Indian forester journal issued by Baden Powell and Dr. Schlich

1878 : Forest school at Dehradun started

1879 : Elephant Preservation Act passed

1881 : Brandis retired from the service, and **William Schlich** became the 2nd Inspector General of the Forest

1885 : Training of Indian forest officers started at *Cooper's Hill, England*.

1890 : **Dr. John Augustus Voelker** (German) was a consulting chemist of the Royal Agricultural Society of England. At the request of the Government of India starts, a study on the problems of Indian agriculture. In 1893, he presented his report "*Improvement of Indian Agriculture*" with a dedicated chapter on forests (Chapter 8, titled "Wood"), which laid down the foundation of the **forest policy of 1894**.

✍ The First Forest policy of India came in = **1894**

1898 : **Vedanthangal** declared as the first wildlife sanctuary in India

1906 : The *Imperial Forest Research Institute*, also known as the *Forest Research Institute* (FRI), was established in 1906 (Dehradun). It initially started functioning from the **Imperial Forest School** building and then from 1914 to 1929 from a building at Chandbagh (now known as Doon Public School). In 1929 its own commenced building was inaugurated.

1927 : Indian forest act

1936 : The 1st *national park of India* was set up in the Himalayan foothills, known as "Hailey" (Corbet) National Park

AFTER INDEPENDENCE [UNDER 5-YEAR PLANS]

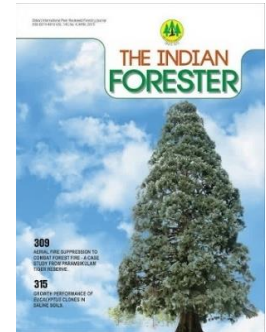
1948 : Central Board of Forestry was set-up

1949 : **M. D. Chaturvedi** — First Indian Inspector General of Forest (IGF)

1950 : **Van Mahotsav** is an annual pan-Indian **tree planting festival** launched in 1950 by K. M. Munshi, the then Union Minister for Agriculture and Food, to create enthusiasm in the populace's mind for the conservation of forests and planting of trees. It is observed in the **1st week of July**.

Objectives

- Provide fuel
- Increase the production of fruits and add to the potential food resources of the country.
- Help creation of shelter-belts around agricultural fields to increase their productivity.



LOCALITY FACTORS

2.1 LOCALITY FACTORS

SITE or **LOCATION** is an area where you want to carry out plantation or management work.

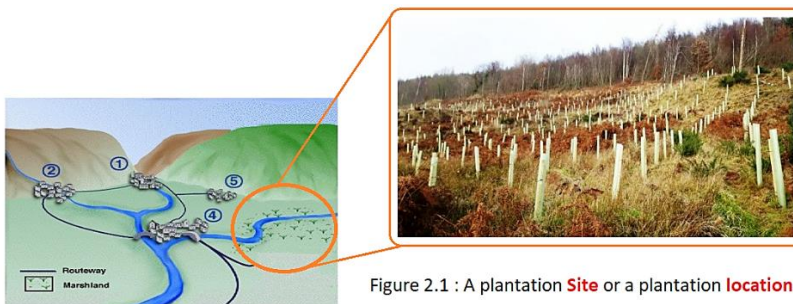


Figure 2.1 : A plantation **Site** or a plantation **location**

SITE FACTORS

The sum of all effective climatic, edaphic, topographic, and biotic conditions of a particular area under which a plant community lives. This means, Site factors are all biotic and abiotic factors of an area that interact and influence vegetation occurrence, distribution, and growth.

► Site factors are also known as *locality factors* or *habitat factors*.

These factors are –

1. Climatic factors : Solar radiation, rainfall, Wind speed, air temperature, etc.
2. Edaphic factors : Soil organic matter, soil texture, soil structure, mycorrhiza, waterlogging, salinity, etc.
3. Topographic or Physiographic factors : Mountains arrangement, Altitude, latitude, slope, aspects, exposure, etc.
4. Biotic factors : insects/pests attacks, invasion of exotics, grazing and browsing by wild and domestic animals, Human interference.

Chapter Outline

- 2.1 Locality Factors
- 2.2 Why are these factors important?
- 2.3 Site Quality
 - Quality classification
 - Site quality Index
 - Site index curve
- 2.4 Importance of Site Quality
- 2.5 PYQs

IFoS 2018 : Explain the Eco-physiological factors that are more concerned to Silviculturist (15 m).

IFoS 2011 : Why are locality factors considered important for any silvicultural operation? (10 m).

IFoS 2010 : What do you understand by the term locality factors ? how these affect the decision of plantations undertaking by the Silviculturist ? (10 m).

✿ Define the term locality factors. How do these factors affect the decision of plantation undertaken by a forester [Mizoram PSC Civil (mains) 2018 | 10 m]

✿ What are all the biotic and abiotic factors, responsible for tree/forest growth? Discuss [Himachal PSC ACF (Main) 2017] 15 m]

CLIMATIC FACTORS

Climate is the average weather prevalent in any locality that influences our forest vegetation, *i.e.*, light, atmospheric temperature, pressure & humidity, wind, etc.

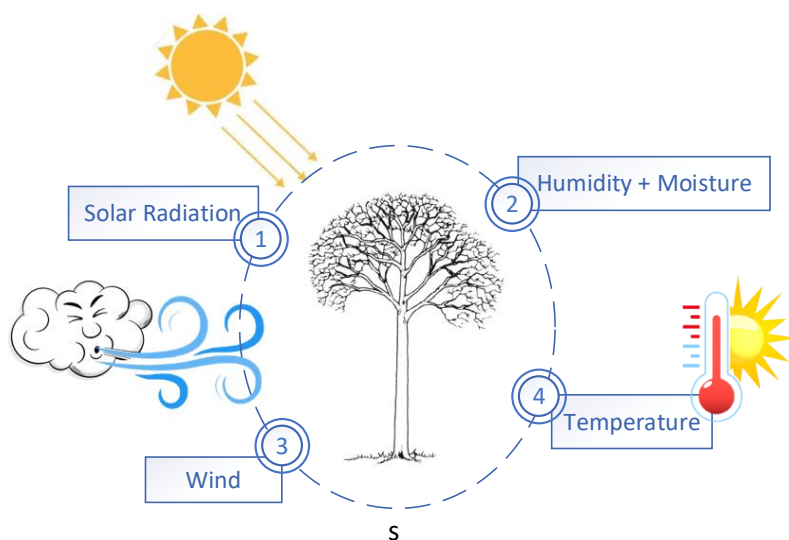


Figure 3.1 : Climatic factors

3.1 SOLAR RADIATION

Solar radiation is the primary source of energy for photosynthesis. Factors such as quality, intensity, and duration of light affect the vegetation or indirectly the entire forest ecosystem.

IMPORTANCE OF SOLAR RADIATION

Plants depend upon solar radiation not only to synthesize food but also to regulate many other metabolic reactions. Such as –

- *Essential for basic metabolic reactions* such as photosynthesis, transpiration, and opening & closing of the photoactive stomata.
- Light is essential for the *synthesis of chlorophyll molecules*. The absence of light for more prolonged periods results in the degeneration of Chlorophyll molecules, and leaves become yellow; this phenomenon is called *Etiolation*.
- Intense *light increases the transpiration rate*, which leads to

Chapter Outline

3.1 Solar radiation

- ✿ Importance
- ✿ Light Increment
- ✿ Species behaviour toward light

3.2 Temperature

- ✿ Importance of Temperature
- ✿ Types of Frost; Frost resistance & Species behaviour
- ✿ Snow, its beneficial & harmful effects

3.3 Wind

- ✿ Beneficial & harmful effects

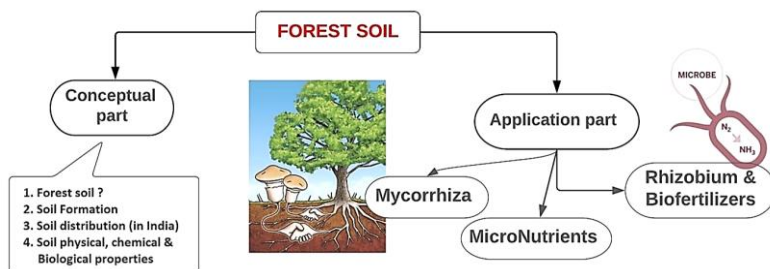
3.4 Moisture

- ✿ Types of precipitation
- ✿ Source of Moisture
- ✿ Importance of water
- ✿ Water-logging / Flood
- ✿ Drought
- ✿ Water tapper, Saver and Storer plants

3.5 PYQs/Exercise

EDAPHIC FACTORS

Edaphic factors are the ecologically influenced characteristics of the soil brought about by its physical and chemical characteristics. These include soil texture, structure, soil water, temperature, porosity, salinity, pH, Electrical conductivity, etc.



4.1 CONCEPTUAL PART

- **Soil** : the uppermost weathered layer of the earth's crust.
- **Forest Soil** : A portion of the earth's surface serves as a medium for the growth and sustenance of forest vegetation.

[Remaining parts such as soil formation, type, distribution, classification, properties, and conservation practices are a part of Soil Science, and, are required to be studied separately at a superficial level under different Sub-head 'Forest Soil'].

4.2 MYCORRHIZA

Mycorrhiza is the *symbiotic** relationship between *fungi and higher plants* (*Myco* = *Fungi* + *Rhiza* = *Rhizome* = *Roots*). Mycorrhizal fungi are composed of fine, tubular filaments called *Hyphae* (singular *hypha*). The mass of hyphae that forms the fungus body is called *Mycelium* (plural *Mycelia*).

TYPES OF MYCORRHIZAE

- ▷ **ECTO-MYCORRHIZA** : under this, fungal mycelium formed a thick sheath or *Mantel** around the lateral roots, and some mycelia penetrated between the cortical cells (Figure 6.2). The cortical cells themselves are not penetrated by the fungal hyphae but instead are surrounded by a network of hyphae called the

Chapter Outline

4.1 Soil – Conceptual part

4.2 Mycorrhiza

- ✿ Ecto
- ✿ Endo
- ✿ Ecto-Endo
- ✿ Importance

4.3 Biofertilizers

- ✿ Classification

4.4 Soil Nutrients

- ✿ Macro
- ✿ Micro

4.5 Nutrients cycling

- ✿ Internal NC
- ✿ External NC

4.6 Influence of Parent rocks on the distribution of species

4.7 Exercise

PHYSIOGRAPHIC FACTORS

The factors concerned with topography or physical features of an area are called **topographic** or **Physiographic** factors, including height, the direction of slope, and slopes' steepness. The topographic factors are also called *indirect factors* as they influence the growth and development of forest vegetation by bringing variations in climatic factors.

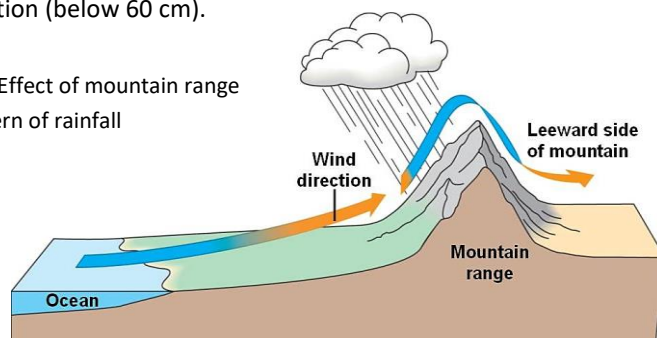
These factors are -

- Configuration or arrangement of the land surface, *i.e.*, hills & valleys
- Altitude
- Latitude
- Slopes
- Aspect & Exposure

5.1 CONFIGURATION OF LAND SURFACE

The arrangement of hills and valleys affects the local climate by affecting *Rainfall Patterns*^①, *Temperature*^②, *Solar Radiation*^③, and *Soil Profile Depth*^④. It would also affect *wind direction*, which is essential for pollination and seed dispersal in conifers. Himalayan valleys are cooler in winter, and pool frost is common, whereas, in summer, adjoining hills make the valley extremely hot. The soil in valleys is deeper, more prosperous and productive, and has dense vegetation growth. For example, **the Inner Himalayas** received very low precipitation (below 60 cm).

Figure 5.1 : Effect of mountain range on the pattern of rainfall



Chapter Outline

- 5.1 Configuration of land surface
- 5.2 Altitude
 - ✿ Effect
 - ✿ Zonation
- 5.3 Latitude
- 5.4 Slopes
- 5.5 Aspect & Exposure
- 5.6 Exercise

BIOTIC FACTORS

Biotic factors are living agencies that affect the growth and development of vegetation individually. Climatic, Edaphic, and Physiographic factors affect the entire crop, whereas Biotic factors may affect individually (Sal heartwood borer) and collectively.

Typically, a plant or a plant species interacts with other plant species, various wild animals, and humans in various ways, both positively and negatively.

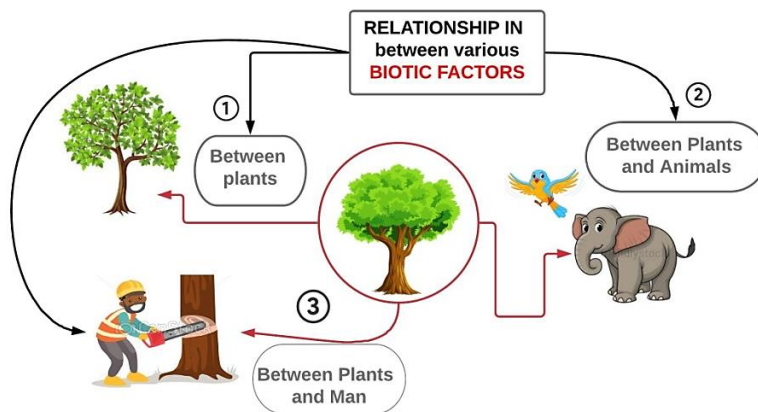


Figure 6.1 : Relationship between various biotic factors.

6.1 RELATIONSHIP BETWEEN PLANTS OF VARIOUS SPECIES

Where one plant species affects the growth, development, and distribution of other plant species through the mechanism of -

- **Competitive** relationship : plants fight with each other for light, moisture, space, and Nutrition. So, only a healthy and Vigour plant can survive.
- **Symbiotic** relationship : here, plants help each other survive under stressful conditions, *i.e.*, Mycorrhiza and Rhizobium.
- **Parasitic** relationship : when one species depends upon another for food and protection, *i.e.*, Sandalwood is a partial root parasite and usually takes water and nutrients from the other host plants.

Chapter Outline

6.1 Relationship between plants of various species

- Competition
- Symbiosis
- Parasitic
- Epiphytes
- Climbers
- Commensalism
- Amensalism
- Helotism

6.2 Relationship between Plants and Animals

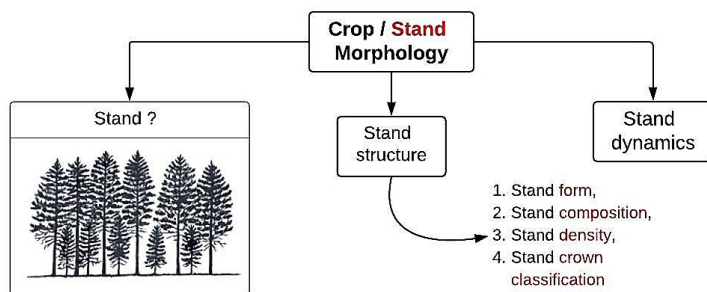
- Insectivorous Plants

6.3 Relationship between plants and man

6.4 Exercise

TREE'S STRUCTURE & GROWTH FORMS

Morphology means the science of form, especially studying the outer form (structure), inner structure, and development of their parts. **Crop morphology** means studying the outer form of forest crops and their development.



9.1 STAND ?

The **stand** concept has long been central to the practice of Silviculture and has traditionally been defined as *a group of trees that are relatively homogenous in composition, age-class distribution, and structure growing on a site of uniform quality*. Stands, as defined in this context, have served as the primary unit of forest management around the globe with the stand-by-stand application of silvicultural treatments for achieving a sustainable yield of produce.

Stand v/s Forest

A forest is a collection of stands. Remember that a stand is a unit of silvicultural interest. Forester's practice silvicultural operations on stands, but not on forests. It is not an ecological management unit.

9.2 STAND STRUCTURE

Stand Structure refers to the *overall look* of a forest stand. It is the *horizontal and vertical distribution of components* of a stand, including the height, diameter, crown layers and stems of trees,

Chapter Outline

9.1 Stand?

9.2 Stand structure

- ✿ Stand Forms
- ✿ Stand composition

9.3 Stand density

9.4 Stand Crown

classification

FORESTRY SUCCESSION

Succession is the process of replacing one set of biotic communities by another set of more advanced and different natural biotic community.

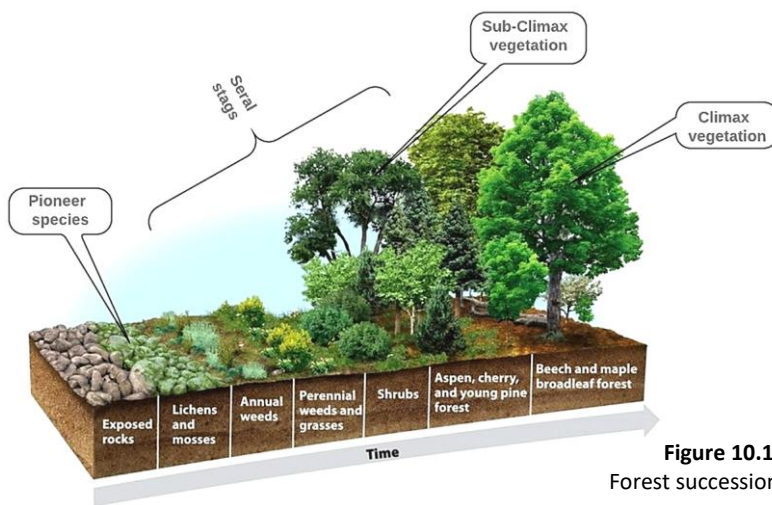


Figure 10.1 : Forest succession.

The 1st species that encroach and start to grow (establish themselves) in a new area is called = the *Colonizer* or *Pioneer* species. *Sere* or *Seral Stages* (sometimes used term *Consolidation Phase* in a loose sense) are the intermediate stages during which plant communities grow and improve soil conditions and gradually change themselves into another more progressive community.

- And the last, *Climax Stage* - A mature, final and stable community that maintains itself for an extended period in equilibrium with that particular environmental condition.
- The development and movement of vegetation from one stage to another stage (*i.e.*, grassland to tree land) are called = *Succession*.

10.1 PROCESS OF SUCCESSION

- **Nudation** : the process of development of a bare area (barren land), it may be due to erosion (Soil/water), Volcanic eruption, forest fire, erosion, and deposition etc.
- **Invasion** or **Migration** : migration of seeds & spores of

Chapter Outline

10.1 Process of Succession

10.2 Types of Succession

10.3 Causes of Succession

10.4 Examples of various types of Succession

- ✦ Mt. Temperate forest
- ✦ Riverain forest
- ✦ Estuarine succession
- ✦ Sand dunes

10.5 Theories

- ✦ Mono-climax theory
- ✦ Poly-climax theory
- ✦ Climax pattern hypothesis
- ✦ Information theory
- ✦ Mosaic theory

✦ With every stage in succession complexity and diversity increase.

✦ When COLONIZER starts growing on barren land where there no residue of previous Organic matter is called *Primary Succession* . If it starts growing on previously availed Organic Matter, called – *Secondary Succession*).

FOREST TYPES

The forest type is a forest category defined with reference to its geographic allocation, climatic and edaphic features, composition, and condition. **Champion and Seth** defined it as 'A unit of vegetation which possesses (broad) characteristics in physiognomy structure sufficiently pronounced to permit its differentiation from other such units.

▷ **Definition** : Forest type is the categorization of forest vegetation with particular reference to their physiognomic characters, structures, geographical allocation, and specific edapho-climatic conditions; that permit us to differentiate this vegetation.

▷ **NEEDS OF SUCH CLASSIFICATION?**

With only 2.4% of the world's land area, India accounts for 7 % of the world's recorded species. This tremendous biodiversity and ecosystems with extensive geographical and local variations creating issues during conservation, management, and understanding the mechanism and dynamics of the natural ecosystem, especially with the emerging challenge of climate change.

- It helps us understand our forest, its composition, and species-specific variations to comprehend species dynamics with changing environment and forest management.
- It helps to understand how climatic, edaphic, topographic, and biotic factors affect forest vegetation; and how they are responsible for its distribution, composition, and complexity of our forest ecosystem.
- Our 10.8 % tribal population lives in these areas. We depend upon it for food, fodder, medicinal plants, water resources, and cultural values. That directly or indirectly play a role at the grass-root level.

Chapter Outline

Sclerophyll is a type of vegetation that is adapted to long periods of dryness and heat.

IFoS 2016 : How are the forest classified in India ? Discuss its *significance in forest management* (10 m).

IFoS 2012 : Comment critically on – The *Basis of forest classification* and *why there is need for such classification* (5).

✿ How are the forest types defined? Which factors limit the distribution of forest types in terrestrial environment ? What are the objectives of classifying the forest types? Name the four forest types occurring in Gujarat [GPSC RFO (Main) 2020-21 | 10m]

✿ What are the bases for the classification of forests? *Why is there need for their classification?* Write the type groups of tropical forests and give their distribution and the species of the area [OPSC (ACF) 2019-20 | 20 m].

ARTIFICIAL REGENERATION

The renewal of a forest crop by sowing, planting or other artificial means is called *artificial regeneration* (synonyms = *plantation*). It includes both (i) reforestation and (ii) afforestation. *Reforestation* is the restocking of a felled or cleared forest by artificial means. *Afforestation* is the establishment of a forest by artificial means on a non-forest area (the area from which forest vegetation has been absent).

13.1 OBJECTIVES OF ARTIFICIAL REGENERATION

- **Supplement natural regeneration** : Natural regeneration is a slow and challenging process, and often it does not give adequate and uniform stocking over the area. We cannot rely only upon it; we have to supplement it by artificial means. The natural regeneration in Sal-bearing moist deciduous forests in Uttar Pradesh has always been a problem; fir and spruce forests in Himachal Pradesh are also facing the same issue.
- **Replacing Natural Regeneration** by artificial means : Due to an increase in the biotic pressure, natural regeneration in several areas is lacking, slow, and uncertain. Therefore, it is necessary to regenerate that area with the help of artificial means to speed up the regeneration process (Remember, here we do not just supplement the natural regeneration process. We actually remove the majority of natural seedlings and replace them with plantation).
- **Restocking & revegetate** (Reforestation) our degraded and overexploited forest. That was damaged due to heavy biotic pressure. We already have a target of *26 million hectares* of degraded land that should be reforested by *2030*.
- **Reclamation & Afforestation of Wastelands**, abandoned mining areas, and industrial dumping grounds.
- **Increasing Proportion of Valuable Species** : called - *Forest enrichment****, it also helps in making forest fire-resistant by planting evergreen trees.

Chapter Outline

- 13.1 Objectives of AR
- 13.2 AR v/s NR
- 13.3 Factors affecting plantation activities
 - ✿ Russian poplar
- 13.4 Plantation organization
- 13.5 Plantation schedule
- 13.6 Success of Plantation
- 13.7 Advantages of plantation
- 13.8 Exercise

IFoS 2014 : Discuss in detail the objectives of artificial regeneration [10 m]

FOREST NURSERY

A Forest nursery is an area where plants are growing for transplanting for use as stocks for vegetative reproduction (*i.e.*, budding, grafting).

Seedlings are young plants obtained from seed sowing. These young plants can be about one meter in height. **Transplants** are seedlings that have transferred from one bed to another to make the seedlings suitable for planting. Seedlings, transplants, and other planting material, *i.e.*, rooted cuttings etc., together are generally called **planting stock**.

16.1 REQUIREMENTS OF NURSERY?

Artificial regeneration of forests and afforestation of wastelands is carried out either by sowing seeds directly in the field or/and planting nursery-raised seedlings, stumps, cuttings, etc. The easiest and cheapest method of artificial regeneration of forests and afforestation of wastelands is to sow the seeds of desired species directly in the field and tend them to grow after the seeds have germinated. Artificial regeneration by seed sowing has not shown the desired results in the case of several species due to several problems. Planting of Nursery-raised seedlings, stumps, cuttings, rhizomes, etc., offers several advantages over seed sowing. These advantages are as follows

- Several species are **initially slow-grown**. If seeds of these species are sown in the field, the seedlings are most likely to be swamped by weeds and **killed by intense competition**. The nursery-raised seedlings are better equipped to compete with weeds and tolerate adverse site factors, therefore, better success is ensured in planting nursery-raised seedlings.
- Several species **do not seed every year** and produce good quality seeds during a good seed year only. So, we can produce seedlings in the Nursery by collecting seeds through the years.
- Several species, when grown by direct sowing, are not

Chapter Outline

- 16.1 Requirements of nursery
- 16.2 Types of Nurseries
- 16.3 Establishment of a permanent nursery
- 16.4 Seed bed or Nursery bed
- 16.5 Planting stock
- 16.6 Use of Containers for raising seedlings
- 16.7 Stump preparation
- 16.8 Grading of planting material
- 16.9 Nursery Journal
- 16.10 Nursery Callender
- 16.11 Nursery register
- 16.12 Exercise

SOWING & PLANTING

18.1 SITE SELECTION

The selection of a site is one of the vital considerations in the success of the plantation program. If the plantation is raised in a regeneration area or under a CAMPA plantation, the area is generally known.

Plantation sites are usually of four types - (a) degraded forest areas, where soil conditions are generally poor, and soil erosion is rampant, (b) wastelands where sites have one or several limiting factors, (c) forest area where the plantation is to be established either due to absence of natural regeneration or replacement of existing crop and (iv) plantation work along the rail, road, canal sides and agroforestry plantation in agricultural lands.

In most cases, the following points must be taken into consideration in the selection of a site :

- The sites for the plantation, as far as possible, should be easily approachable. If the site is not approachable, there are problems in the transport of planting stock, plantation work, weeding, and other operations. There is a problem in the disposal of produce also.
- There must be enough area for undertaking plantation for several years. It facilitates supervision and protection.
- The site selected should be such that it is easy to obtain participation and involvement of the local population.

Chapter Outline

18.1 Site selection, including planting survey

18.2 Site Preparation

✿ Soil working

✿ Staking

18.3 Seed sowing

✿ Direct sowing

✿ Hydro

✿ Aerial

18.4 Planting-out : When ?

/Size/Age, Method,

Spacing, Planting pattern

18.5 General Rules of Planting

18.6 Plantation journal

18.7 Exercise

Site Selection

Site allotted by the Govt.



Green Highway Corridor



CAMPA Forest

TENDING OPERATION

WHAT DO YOU MEAN BY TENDING OR TENDING OPERATION?

From the establishment of the regeneration and subsequent growth to the harvesting, several operations are carried out at different stages of growth in order to provide a healthy environment for their growth. These operations are called tending operations –

- Weeding,
- Cleaning,
- Thinning & improvement felling
- Climber cutting
- Pruning
- Girdling of unwanted growths.

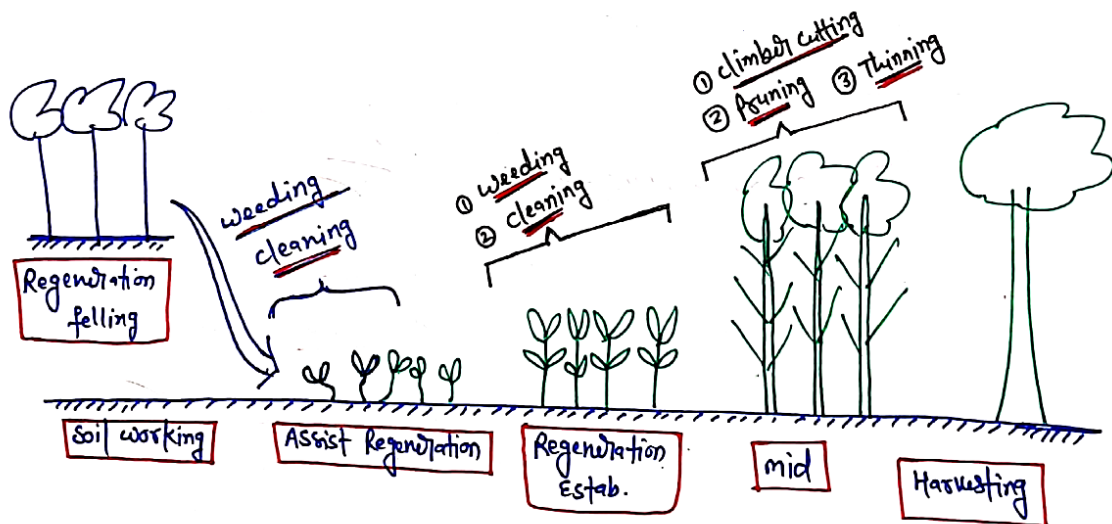
IFoS 2021 : What do you mean by **tending** operations?

Enumerate various tending operations carried out in forest crops. Discuss improvement felling (15 m).

✿ Explain briefly the tending operations carried out in a forest [UKPSC (ACF) 2018].

✿ Explain different types of tending operations used in forestry [MPPSC (ACF) 2017| 20 m].

✿ What do you understand by tending? Write in detail about various tending operations in forest trees. How are tending operations different from cultural operations [Himachal PSC Civil (Main) 2017| 20 m].



CULTURAL OPERATION ?

The operation, as a rule not directly remunerative, undertaken to assist or complete existing regeneration, to promote the proper development of the crop or to minimize the after-effects of felling damage. It, therefore, includes subsidiary felling, weeding, cleaning, unremunerative

IFoS 2011 : Short notes on – cultural operation (5 m).

IFoS 2010 : Distinguish between 'Tending operation' and Cultural operation in Forestry (10 m) [Also in, Arunachal PSC civil (Main) 2015-16; Odisha PSC Civil (Main) 2018].

- ▶ **Non-commercial Plantation** : This produces fuel wood, fodder and timber for domestic use + Rehabilitate Westland + Soil and water conservation + creation of extra carbon sink + Forest enrichment.

Poplar : Not Popular Anymore

Since the government has not regulated a Minimum Support Price for poplar wood, merchants have reduced prices in Yamuna Nagar, India's timber hub, affecting the income of farmers

There are several reasons attributed to the decline of poplar prices in Yamuna Nagar, India's major timber hub. The local timber traders and merchants say that for poplar, the government has not set up any Minimum Support Price (MSP), unlike wheat and sugarcane. Due to a lack of alternatives to sell poplar produce, the plywood manufacturers arbitrarily decide the rates to maximise their profits, since they are the major buyers of timber, and thus dominate the timber trade in the region.

The president of the Manakpur Timber Association in Yamuna Nagar says there are other reasons behind the fall of poplar prices—non-issuance of new licenses since 2002 to establish new units for peeling and saw-milling. This has constrained the scope of timber trade in the region, with plywood industries having the upper hand in decision-making regarding the prices.

Moreover, plywood factories have started using Chinese-made peeling machines, which can peel much thinner logs, unlike the traditional ones. This way the rotation period of pulpwood tree species has been shortened—poplar trees' rotation period has decreased from 7-8 years to 3-4 years, resulting in oversupply, thereby affecting the prices.

There are no government sawmills or factories in the region and this has discouraged competition and farmers have been left with the existing buyers



21.5 ENERGY PLANTATION or ENERGY CROPS

- ▶ **Definition** : Energy plantation means the "*growing of select trees and shrub species for production of fuel wood or vegetable oil*" to fulfil the emerging demand-supply gap of clean energy as well as to keep in check the CO₂ emission.

- ▶ **Species** : *Acacia nilotica, Jatropha curcas, Pongamia pinnata* etc.

- ▶ **Importance**

- Energy security
- fulfil demand-supply gap and reduce dependency on imported coal & crude oil

Which are *harvestable in a comparably shorter time*. The fuel wood may be used either directly in wood-burning stoves or processed into methanol, ethanol and producer gas.

- ▶ **NEEDS/SIGNIFICANCE**

✿ Define energy plantation. Write, in detail, about the coppice system and its use in forest-based industries [OPSC Forest Service (Main) 2019-20 | 20 m]



3

Anuradha Mishra



5

Ajay Gupta



6

Shobhit Joshi



11

Dinesh Jangid



17

Yash Dhoble



19

Udayan Subbudhi



23

Akarsh B.B.



24

Swarnadipta
Rakshit



26

Senthilkumar V



30

Suchet Balkal

35 Out of **149** Total Selections in

Indian Forest Service (IFoS) 2022



6

Ayush Krishna



9

Vinod Jakhar



10

Gurleen Kaur



11

Apoorv Dixit



30

Mohammed Abdul
Rawoof Shaik



32

Shinde Sandeep
Karbhari



35

Chandra Kumar
Agrawal



42

Anshul Tiwari



52

Vikas Yadav



57

Subburaj G

21 Out of **108** Total Selections in

Indian Forest Service (IFoS) 2022



1

Ashish Vijaywar



2

Ankit Kumar Jain



3

Sachindra
Singh Tomar



4

Shubham Soni



6

Rahul Chouhan

05 Out of **06** Total Selections in

Assistant Conservator of Forest (ACF)

MPPSC State Forest Service 2020