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FORESTRY

TOOL KIT SERIES

MPPSC

Madhva Pradesh

STATE FOREST SERVICE

2026

Detailed Syllabus Based study material + **Linkage of Concepts with PYQs** + **Infused with Infographics & Maps**

Module - 1

- Silviculture
- Locality factors
- Tree crop morphology
- Forest Succession
- Forest types in India
- Forest Regeneration
- Forest Nursery
- Vegetative propagation
- Plantation & Maintenance works
- Tending operations
- Commercial Forestry
- Mangroves & Cold desert
- Important Indian tree species

MPPSC STATE FOREST SERVICE 2023


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Comprehensive Forestry Course + CIGP


Rank – 3

Jyoti Thakur

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Rank – 4

Shivam Gautam

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Rank – 5

Nitin Patel

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Ankur Gupta

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Rank – 8

Deependra Lodhi

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Kapil Chauhan

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Rank – 10

Alok Kumar Jhariya

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Tarun Chouhan

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Rank - 12

Raghvendra Thakur

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11 Out of 12 Total Selections in

Assistant Conservator of Forest (ACF) 2023

108 Out of 126 Total Selections in

Range Forest Officer (RFO) 2023


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Rank – 2

Pushpendra Singh Ahirwar

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Jitendra Kumar Verma

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Pradeep Jatav

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Abhishek Barodiya

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Rank - 24

Golu Goyal

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Rank - 25

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SILVICULTURE

(Principles & Practices)

MODULE – 1

EDITION : 2026

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SYLLABUS

Unit	Syllabus
1	**SILVICULTURE** : Definitions, terminology, objective of forestry, ◈ Role of forest (productive, protective and ameliorative), ◈ Influence of forest on environment, ◈ Forest types of India and M.P., ◈ Reasons for declining forest, ◈ Classification of forest, ◈ Silvics and silviculture. ◈ Forest regeneration ◈ Some commercially important trees (botanical name and family) examples *Teak, Shisham, Sal, Babul, Harra, Bahera, Amla, Tendu, Palash, Arjun, Khair, Mahua.*
4	Role of forest in soil and water conservation.

Module - 1

CONTENTS

CHAPTER 0

PREVIOUS YEAR QUESTIONS

MPPSC FOREST SERVICE (MAIN) EXAMINATION 2011

SILVICULTURE

1. Silviculture is defined as

(a) Study of the life history of trees
(b) Science and art of cultivating forest crops
(c) Conserving and managing forest
(d) Study of trees in relationship to environment

2. ***Rainfall***, ***Temperature***, ***Light***, ***Wind*** and ***Humidity*** are

(a) Climate factors
(b) Edaphic factors
(c) Biotic factors
(d) Topographic factors

3. Tropical moist deciduous ***Light Demander*** tree species is

(a) *Populas ciliata*
(b) *Shorea robusta*
(c) *Toona ciliata*
(d) *Syzygium cumini*

4. Accumulation of organic matter in the forest is more in

(a) Temperate forest
(b) Tropical forest
(c) Alpine forest
(d) Coastal forest

5. A ***Hygrometer*** is an apparatus for measuring

(a) Soil moisture
(b) Leaf water potential
(c) Relative humidity
(d) Wind velocity

6. In the ***Nitrogen Cycle***, which of the following plays an important role?

(a) Rhizopus
(b) Mucor
(c) Nitrobacter
(d) Spirogyra

7. Which shows the ***Symbiotic Relationship***?

(a) Rhizobium
(b) Azotobacter
(c) Clostridium
(d) Nitrosomonas

8. ***Rhizobium*** is a

(a) Bacteria
(b) Fungi
(c) Lichen
(d) Algae

9. Which of the following non-leguminous tree species fixes nitrogen?

(a) Embilica officinalis
(b) Acacia nilotica
(c) Casuarina equisitifolia
(d) Mangifera indica

10. Plants that grow upon other plants but do not absorb food from them are called

(a) Parasites
(b) Epiphytes
(c) Saprophytes
(d) Symbionts

11. One of the most important ***Epiphytes*** in the forest

(a) Tinospora cordifolia
(b) Santalum album
(c) Cuscuta reflexa
(d) Loranthus longiflorus

12. Woody outgrowth on the bole or branch of a tree often caused by an accumulation of dormant buds is

(a) Burr
(b) Bulbil
(c) Brittle
(d) Buttress

13. Having male and female flowers on separate plants is termed as

(a) Monoecious
(b) Dioecious
(c) Cross-pollinated
(d) Autogamy

14. The number of fruits available for harvesting is known as

(a) Fruit setting
(b) Fruit retention
(c) Fruit stock
(d) None of these

15. A plant whose normal habitat is neither very wet nor very dry is

(a) Xerophyte
(b) Hygrophyte
(c) Epiphyte
(d) Mesophyte

16. Plants which can grow on salty soils are

(a) Thalophytes
(b) Lithophytes
(c) Heliophytes
(d) Halophytes

17. ***Halophytes*** are found in

(a) Desert
(b) Coastal region
(c) Mountains
(d) Humid region

(b) Dalbergia sissoo
(c) Azadirachta indica
(d) Leucaena leucocephala

64. Dalbergia sissoo is a

(a) Large deciduous tree
(b) A tree of mangrove forest
(c) Evergreen tree
(d) A tree of temperate forest

65. Eucalyptus is a genus of

(a) Africa
(b) Australia
(c) Indigenous tree of India
(d) China

MPPSC FOREST SERVICE (MAIN) EXAMINATION 2014-15

SILVICULTURE

66. On the basis of mean annual and mean January temperature and occurrence of frost and snow. The following temperature zone has been recognized

(a) Tropical, subtropical, temperate & alpine
(b) Moist tropical, dry tropical, subtropical & temperate
(c) Subtropical, sub montane, sub temperate & alpine
(d) Arid Zone

67. Type of colour develop when leaves are about to fall

(a) Green
(b) Red
(c) Yellow
(d) Black

68. Which of the following tree fixes nitrogen through Frankia

(a) *Acacia nilotica*
(b) *Dalbergia sissoo*
(c) *Casuarina equisetifolia*
(d) *Cedrus deodara*

69. A plant from the time the young tree reaches 1 m height till the lower branches begin to fall is called

(a) Pole
(b) Seedling
(c) Sapling
(d) Tree

70. Plant from germination to the stage that a young tree has a few leaves is called

(a) Seedling
(b) Pole
(c) Sapling
(d) Recruit

71. Seasonal change in the development of foliage, flowering and fruiting is referred to as

(a) Physiology
(b) Phenology
(c) Cytology
(d) Ecology

72. Lignotubers are found in

(a) Eucalyptus
(b) Teak
(c) Casuarina
(d) Acacia

73. Buttressing is common in

(a) *Acacia nilotica*
(b) *Terminalia myriocarpa*
(c) *Dalbergia sisoo*
(d) *Shorea robusta*

74. Which species shows fluting tendency

(a) Tectona grandis
(b) Azadirachta indica
(c) Shorea robusta
(d) Bamboo

75. A crop density of 0.8 – 0.99 in a forest is given for

(a) Closed forest
(b) Open forest
(c) Dense forest
(d) Thin forest

76. D_1 symbol is known for

(a) Dominated tree
(b) Suppressed trees
(c) Co-dominant trees
(d) Pre-dominant tree

77. **K symbol** is symbolic of

(a) Suppressed trees
(b) Dominated trees
(c) Diseased trees
(d) Dead or Moribund trees

78. Tolerance model of succession was proposed by

(a) Gleason
(b) Conell & Slatyer
(c) Elements
(d) Engler

79. Successional changes brought about by environmental factor is called

(a) Autogenic
(b) Allogenic
(c) Autotrophic
(d) heterotrophic

80. Champion & Seth have classified the forest of India into the following major group

(a) 6
(b) 4
(c) 5
(d) 7

81. Champion & Seth have classified forest type of India into

(a) 15 type of group
(b) 17 type of group
(c) 16 type of group
(d) 18 type of group

82. Wet evergreen vegetation are found in the region where rainfall is

(a) Below 500 mm
(b) 500 – 900 mm
(c) 900 – 2400 mm
(d) 2500 mm or more

83. Which tree of the following is non-coppice

(a) Acacia catechu
(b) Cedrus deodara
(c) Dalbergia sissoo
(d) Shorea robusta

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MPPSC FOREST SERVICE (MAIN) EXAMINATION 2019 (+Re-exam)

SILVICULTURE

103. Climax species means [MPPSC Forest Service (Main) 2019, Science & Tech]

(a) Endangered organism
(b) Extinct organism
(c) Organism thriving in the last stage of succession
(d) None of the above

104. Which of the following forests are found along the Western side of the Western Ghats? [MPPSC Forest Service (Main) 2019, GS Re-exam]

(a) Tropical evergreen forests
(b) Tropical moist deciduous forests
(c) Tropical semi-evergreen forests
(d) Dry tropical forests

MPPSC FOREST SERVICE (MAIN) EXAMINATION 2020

SILVICULTURE

105. Normal dates of withdrawal of south-west monsoon in Madhya Pradesh is

(a) 25 October
(b) 1 November
(c) 10 October
(d) 10 November

106. What do you understand by 'Chiropterophily'?

(a) Pollination by insects
(b) Pollination by snails
(c) Pollination by air
(d) Pollination by bats

107. Tropical evergreen forests of western Ghat are found on which of the following heights?

(a) 450 – 1300 m
(b) 600 – 1800 m
(c) 500 – 1400 m
(d) 300 – 1200 m

MANGROVES & COLD DESERTS

IMPORTANT INDIAN TREE SPECIES

108. The botanical name of Teak is

(a) Acacia nilotica
(b) Prosopis cineraria
(c) Tectona grandis
(d) Shorea robusta

109. Scientific name of khair is

(a) Bauhinia purpurea
(b) Acacia arabica
(c) Acacia catechu
(d) Morus alba

110. Scientific name of Sal is

(a) Dalbergia sissoo
(b) Eugenia jambolana
(c) Terminalia tomentosa
(d) Shorea robusta

MPPSC FOREST SERVICE (MAIN) EXAMINATION 2021

SILVICULTURE

111. When the regeneration of a forest is obtained from the seed, it is known as

(a) A high forest
(b) Coppice forest
(c) Private forest
(d) Protected forest

112. Establishment of a forest by artificial means on an area from which vegetation has always or long been absent is called

(a) Reforestation
(b) Afforestation
(c) Deforestation
(d) None of the above

113. Viability period of Neem (*Azadirachta indica*) seed is

(a) Up to two weeks
(b) Up to three months
(c) Up to four months
(d) Up to one year

INDIAN TREE SPECIES

114. Match the following

(a) Acacia catechu	Teak
(b) Diospyros melanoxylon	Khair
(c) Tectona grandis	Sal
(d) Shorea robusta	Tendu

[A]	(a) – (iii), (b) – (iv), (c) – (i), (d) – (ii)
[B]	(a) – (ii), (b) – (i), (c) – (iii), (d) – (iv)
[C]	(a) – (iv), (b) – (ii), (c) – (i), (d) – (iii)
[D]	(a) – (ii), (b) – (iv), (c) – (i), (d) – (iii)

MPPSC FOREST SERVICE (MAIN) EXAMINATION 2022

SILVICULTURE

115. The percentage of the incoming radiation from the sun reflected back to space by the earth is

(a) 10 %
(b) 20 %
(c) 30 %
(d) 40 %

116. Match the following terminologies with their **correct** definition

Pair – I

[A] Afforestation

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[B] Reforestation
[C] Forest Regeneration
[D] Deforestation

List – II

(1) Replanting of trees in an area where there was once a forest which was destroyed or damaged
(2) It refers to the destruction of forests for globalization, industrialization, urbanization or any other purpose.
(3) Planting or adding of trees in an area where there was never a forest or plantation.
(4) The act of renewing tree cover by establishing young trees naturally or artificially.

Match the pair

(a) [A] – 4, [B] – 1, [C] – 2, [D] – 3
(b) [A] – 3, [B] – 1, [C] – 4, [D] – 2
(c) [A] – 3, [B] – 2, [C] – 1, [D] – 4
(d) [A] – 4, [B] – 2, [C] – 3, [D] – 1

117. Trench layer" method is used for vegetative propagation of which type of trees?

(a) For flowering trees
(b) For fruit trees
(c) For decorative trees
(d) All of the above

118. How much area is required to plant 1600 trees as a spacing of 2.5 m x 2.5 m?

(a) 5.5 acre
(b) 2.5 acre
(c) 3.5 acre
(d) 4.5 acre

INDIAN TREE SPECIES

119. Match the following species with their families

Species Name	Family
(A) Madhuca indica	1. Fabaceae
(B) Tectona grandis	2. Dipterocarpaceae
(C) Shorea robusta	3. Sapotaceae
(D) Butea monosperma	4. Verbenaceae

(a) (A) – 4, (B) – 2, (C) – 1, (D) – 3
(b) (A) – 1, (B) – 2, (C) – 3, (D) – 4
(c) (A) – 3, (B) – 4, (C) – 2, (D) – 1
(d) (A) – 3, (B) – 4, (C) – 1, (D) – 2

120. Among the following, which tree does not play a significant role in fixing nitrogen in the soil

(a) *Pongamia pinnata*
(b) *Pithecellobium dulce*
(c) *Dalbergia sissoo*
(d) *Mangifera indica*

MPPSC FOREST SERVICE (MAIN) EXAMINATION 2023

SILVICULTURE

121. In the western part of Madhya Pradesh, rainfall is mostly received from

(a) Arabian Sea Monsoon Branch
(b) Bay of Bengal Monsoon Branch
(c) Tropical cyclones
(d) Winter showers

122. The interaction, in which one organism is benefited and the other is neither harmed nor benefited, is called

(a) Parasitism
(b) Camouflage
(c) Commensalism
(d) Competition

123. Photosynthetically Active Radiation (PAR) range is

(a) 360 nm-780 nm
(b) 280 nm-680 nm
(c) 400 nm-700 nm
(d) 360 nm-680 nm

124. Inarching is

(a) Budding method
(b) Grafting method
(c) Layering method
(d) Pruning method

125. Run-off coefficient of the forest areas having above average filtration rate and sandy or gravelly soil is

(a) 0.40
(b) 0.30
(c) 0.20
(d) 0.10

126. The example of a deciduous tree is

(a) Abies pindrow
(b) Pinus wallichiana
(c) Acacia catechu
(d) Cedrus deodara

127. Champions and Seth, 1935 has classified major group "tropical forest" into how many groups?

(a) 8
(b) 7
(c) 6
(d) 5

128. The practice of forestry with the object of developing or maintaining a forest of high scenic value is called

(a) Aesthetic Forestry
(b) Commercial Forestry
(c) Urban Forestry
(d) Social Forestry

129. The potential capacity of a seed to germinate is

(a) Viability
(b) Germinative energy
(c) Germinative capacity
(d) Dormancy

INDIAN TREE SPECIES

130. Name the common tree of Madhya Pradesh locally called 'Anjan' belonging to family Fabaceae often pollarded for deriving red brown fairly strong fibre used for ropes.

(a) Trema orientalis
(b) Hardwickia binate
(c) Grewia optiva
(d) Butea monosperma

131. Name the tree which yields a fatty oil known as Chironji Oil and is a substitute for olive and almond oils.

(a) Buchanania lanzan
(b) Sterculia urens
(c) Helicteres isora
(d) Boswellia serrata

132. In Terminalia arjuna (Arjun), the time of seed collection is

(a) December-January
(b) April-May
(c) July-August
(d) September-October

133. Which tree is known as "Flame of Forest"?

(a) Cassia fistula
(b) Bauhinia variegata
(c) Bombax ceiba
(d) Butea monosperma

134. In teak, the new foliage appears in the month of

(a) March
(b) May
(c) July
(d) October

MPPSC FOREST SERVICE (MAIN) EXAMINATION 2024

SILVICULTURE

135. Protected forest which type of forest has complete protection and it is exclusive property of government ?

(a) Unclassed forest
(b) Village forest
(c) Reserved forest
(d) Protected forest

136. High Forest means

(a) Forest at higher elevation
(b) Climax forest
(c) Forest with tall trees
(d) Forest of seed origin

137. National Forest Policy, 1952 advocated how many functional classification of India's forest ?

(a) Three
(b) Four
(c) Five
(d) Two

138. Halophytes grows on

(a) Acidic soil
(b) Saline soil
(c) Water logged soil
(d) Sandy soil

139. Classification of Indian Forest by Champion and Seth is based on

(a) Botanical
(b) Ecosystem
(c) Climatic
(d) None of the above

INDIAN TREE SPECIES

140. The most dominant tree species of the dry tract in India is

(a) Khejari
(b) Khair
(c) Poplar
(d) Malabar Neem

141. Family of Tendu (Diospyros melanoxylon)

(a) Ebenaceae
(b) Dipterocarpaceae
(c) Combretaceae
(d) Diospyraceae

142. Species which is not an ingredient of Triphala Churan (an ayurvedic herbal formulation)

(a) Terminalia chebula
(b) Terminalia arjuna
(c) Terminalia bellirica
(d) Emblica officinalis

143. Good quality cricket bat is made from which wood ?

(a) Populus deltoides
(b) Celtis oustralis
(c) Salix alba
(d) Salix tetrasperma

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CHAPTER 1

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 growing 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****.

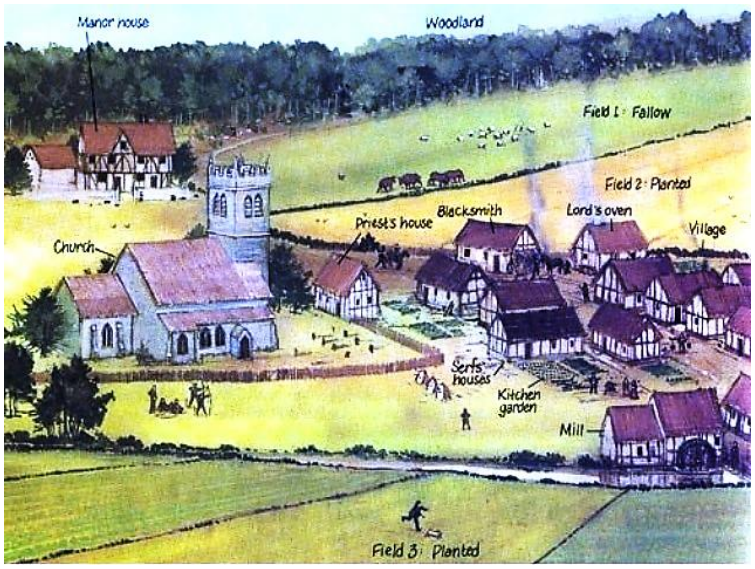


Figure 1.1 : A medieval European village

► 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].

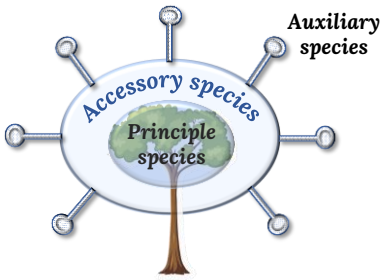
Chapter Outline

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 is obtained by Artificial means, *i.e.*, Miyawaki forest.

► COMPOSITION OF FOREST VEGETATION (FLORISTIC COMPOSITION)

- **Pure Forest** : A forest predominantly composed of a single 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 within 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) ***Dominant*** and ***most commercially valuable*** species in a forest stand; (c) 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***, with relatively ***little silvicultural value*** or ***importance*** [*syn.* **Secondary species**, **Subsidiary species**]. These species *play a supportive role in the forest ecosystem*—such as aiding regeneration, providing shade, or improving soil conditions—but are not the primary focus of forest management.

Virgin Forest

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

► CLASSIFICATION BASED ON *Ownership*

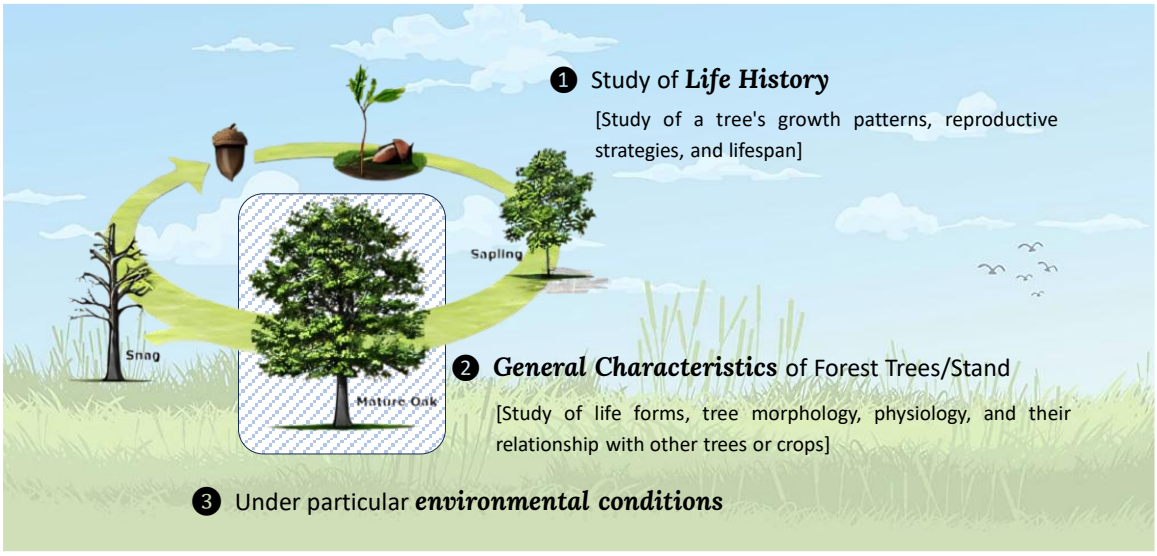
- ***Govt Owned Forest*** : Forests owned and managed *by the state*, accounting for 96% of India's total forest area.
- ***Private Forest*** : Forests owned and managed *by private entities*, such as industries (*e.g.*, BILT paper mill).
- ***Communal Forest*** : Forests owned and managed *by a community*, such as a village, tribal authority, or local government, for the benefit of their well-being (*Synonym* : **Community Forest**) *e.g.*, *Lalwan community reserve*, Punjab.
- ***Contractual forest*** : A forest management system in which the government allocates public forest lands to *private companies* through contracts—such as leases, concessions, licenses, or permits—for their management and use, with the goal of ensuring sustainability and supporting diverse land-use objectives.

The ***Madhya Pradesh government*** recently introduced a draft policy aimed at restoring degraded forest areas by encouraging private investments through ***Corporate Social Responsibility (CSR)***, ***Corporate Environment Responsibility (CER)***, and ***non-governmental funds***. The policy proposed leasing degraded

- Silviculture is the branch of forestry, which deals with the *establishment*, *development*, *care*, and *cultivation* of stand timber [by *Toumey & Korstian*].
- Silviculture is the art of producing and tending forest stands by applying scientifically acquired knowledge to control forest stand establishment, composition, growth, health, and quality [By *Society of American Foresters*].

SILVICS

Silvics deals with the biological characteristics of individual trees and their communities. This includes how trees grow and reproduce and the ways that the physical environment influences their physiology and character. Further, it investigates how communities of trees modify the physical environment that supports them and studies the never-ending interaction between vegetation and the physical environment as forests develop and change over time.



Definition : *Silvics is the study of Life History and General Characteristics of forest trees and stand with particular reference to environmental factors.* It focuses on how trees grow, reproduce, and interact with their environment, including factors like climate, soil, and other organisms.

OBJECTIVES OF SILVICULTURAL STUDY

▷ **Control**

- ***Crop composition*** : controlling the mix of tree species within a stand, promoting desirable species while suppressing unwanted ones.
- ***Stand structure*** & ***Density*** : Operations like thinning and pruning help in manipulate stand structure, arrangement and spatial distribution of trees within a stand.
- ***Growth*** : Silviculturists aim to optimize the growth and development of forest stand. This involves controlling factors that influence growth, such as competition, nutrient availability, and light.

▷ **Facilitation**

- Production of *large volume per unit area* by selecting appropriate tree species, optimizing stand density, and employing silvicultural systems that promote rapid growth.
- Increasing the *quality of timber*.

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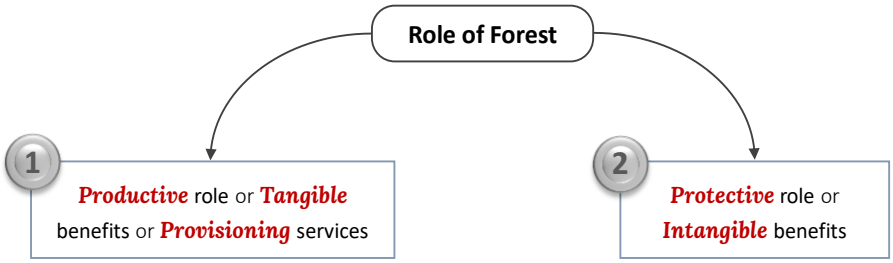
- **Silviculture and forest Utilization** : Here, silviculture helps in – (a) the cultivation of economically more valuable and high-grade forest produce. (b) Sustainable harvesting and extraction of forest products with reducing impact over local watershed and ecosystem.
- **Silviculture and Forest mensuration** : Silviculture deals with raising forest crops and forest mensuration to determine the result of applied applications or methods of silvicultural treatments to decide the best treatment to be given for commercial timber production.
- **Silviculture and Forest Management** : Silviculture deals with the techniques and operations which result in the improvement of forest regeneration, its productivity, reduction in crop rotation period, and improvement of wildlife habitat, including the production of minor forest produce. Whereas Forest management prescribes the time and place where the silvicultural techniques and operations should be carried out so that the objects of management are achieved.
- **Silviculture and Forest economics** : interrelate the silvicultural operation costs with the cost-benefit ratio of the resultant crop, management cost, and investment opportunities in the forest enterprises.
- **Silviculture and wildlife management** : Silvicultural treatments can be used to create or enhance habitat for various wildlife species.
- Silviculture and Forest Ecology
- Silviculture and Social forestry

SILVOLOGY : Studying forests, incorporating the understanding of natural forest ecosystems, and the effects and development of silvicultural practices.

1.5 ROLE OF FOREST

Forests are the lungs of the earth and the most valuable natural renewable resource for humankind. Forest supports the earth's ecosystem by performing various functions like –



PRODUCTIVE ROLES (FUNCTIONS) OF THE FORESTS

- **Timber production** : The forest is a significant source of wood, which is used for agricultural implements, construction of houses, railway sleeps, etc.
- **Fuelwood** : Wood is the chief source of energy in rural areas and most of which is obtained from the forests.
- **Fodder and grazing** : forest provides fodder leaves and grazing facilities to domestic and wild animals.
- **Fisheries and Aquatic Resources** : Mangroves forest works as a fertile breeding ground a wide variety of fish species, Crabs, Shrimp, Reptiles, and Molluscs, etc. Habitat for Amur falcon, Olive ridley turtle, etc. = supporting local fishing industries and food security.
- Forest is also the primary source of **non-wood products**, called *Minor Forest Products* (MFPs) as like –
  - Fibers and flosses

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CHAPTER 2

LOCALITY FACTORS

2.1 LOCALITY FACTORS

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

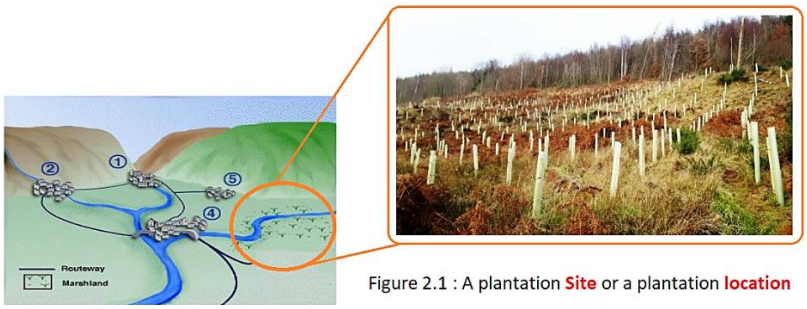


Figure 2.1 : A plantation **Site** or a plantation **location**

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.

2.2 WHY ARE THESE FACTORS IMPORTANT?

Locality factors are very important in silvicultural operations because they directly affect the growth, health, and success of a forest or

Chapter Outline

CHAPTER 3

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.

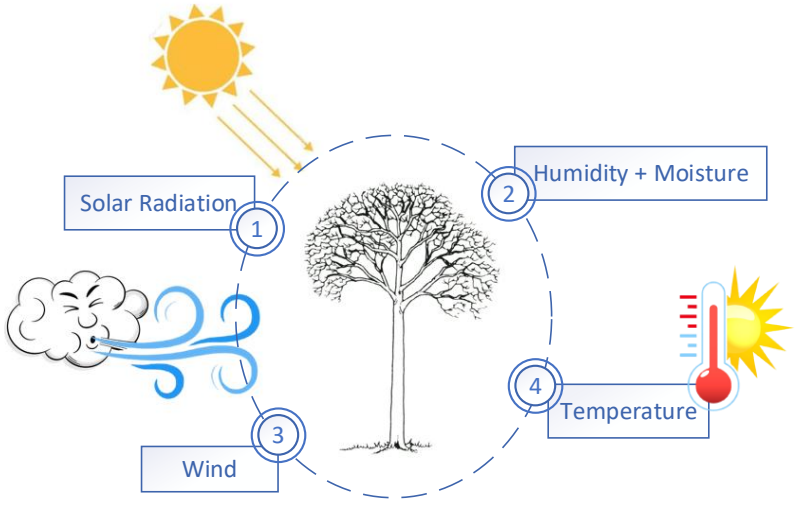


Figure 3.1 : Climatic factors

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 activities*** like photosynthesis, transpiration, and the opening and closing of photoactive stomata.
- Light is crucial for the ***synthesis of chlorophyll molecules***. A prolonged absence of light results in the degeneration of chlorophyll, turning the leaves yellow—a phenomenon known as ***Etiolation***.
- Intense ***light increases the rate of transpiration***, leading to

Chapter Outline

► TEMPERATURE ZONES IN INDIA

Zone	Mean Annual Temperature	Mean January Temperature	Remarks
1. Tropical	Over 24°c	Over 18°c	Cold season short or none. No frost and snow.
2. Sub-tropical	17°c to 24°c	10°c to 18°c	The cold season is definite but not severe. Frost rare.
3. Temperate	7°c to 17°c	-1°c to 10°c	Winter is pronounced with frost and some snow.
4. Alpine	Under 7°c	Under 1°c	Winter is long and severe, much snow.

IMPORTANCE OF TEMPERATURE

AIR TEMPERATURE : A favourable temperature supports plant growth by influencing key physiological processes such as photosynthesis, transpiration, and cambial activity involved in secondary growth.

Climate Connection

- ***Cardinal temperature*** : Seeds require an optimal temperature for germination, usually **20°C to 35°C***. In recent years, due to *global warming*, these cardinal temperatures are becoming *less available* in *native forest areas*, hindering natural regeneration. As a result, *forests are gradually shifting towards higher altitudes or polar regions* where more favourable temperatures exist.
- **Photosynthesis Rate** : The rate of photosynthesis increases with rising air temperature up to **25–30°C***. Beyond this range, the rate begins to decline. At around 50°C, plant enzymes begin to denature, ultimately leading to plant death. This critical threshold is known as the ***Thermal Death Point*** (Also refer, ***Light Compensation point***).
- ***Transpiration rate*** : High temperatures increase the rate of transpiration in plants.
- ***Enzymatic and microbial activity*** : Higher temperatures enhance microbial activity, leading to faster decomposition and the release of nutrients through the conversion of organic matter into humus. In contrast, temperate forests often have high organic matter accumulation due to low microbial activity.

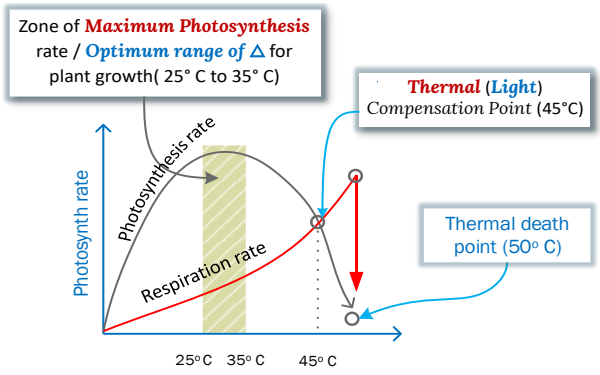


Figure 4.6 : effect of temperature on photosynthesis as well as on plant respiration rate.

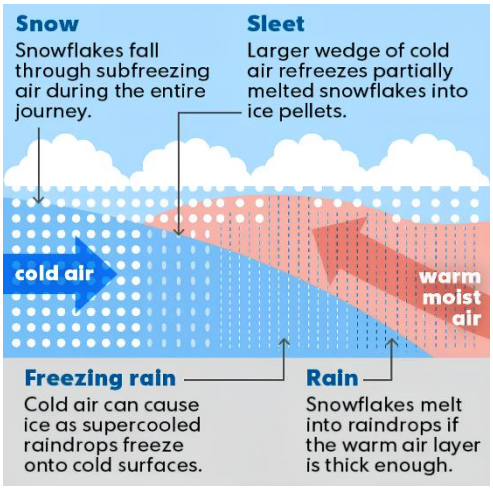
For instance, in Uttarakhand, the ***Chir pine*** (***Pinus roxburghii***)—locally known as ***Pirul***—which decompose slowly and are highly flammable, significantly contributing to forest fires. To address this, the Uttarakhand government launched the '***Pirul Lao-Paise Pao***' initiative, purchasing collected pine needles at ₹50 per kg to reduce fire risk.

- ***Pollen grains*** : Both the quality and quantity of pollen grains decline under high temperatures, leading to reproductive challenges in plants.

SOIL TEMPERATURE : ◈ Soil temperature influences ***water absorption***, which generally increases with rising temperature up to an optimal range (**27–35 °C**). Beyond 35 °C, absorption declines as the permeability of the plasma membrane are affecting adversely. ◈ Soil temperature also affects ***cambial activity***, which is essential

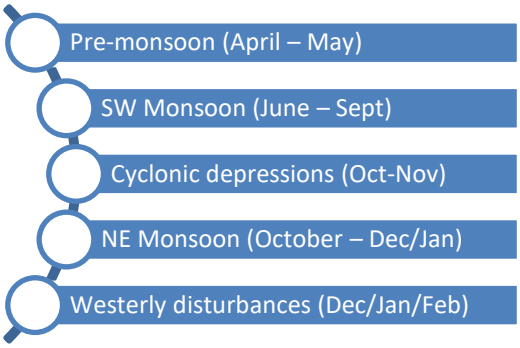
- ***Rain*** : Precipitation with droplet sizes ***larger than 0.5 mm****, usually ranging up to 6 mm in diameter. Rainfall intensity varies: light rain falls at 2.5 mm/hr or less, moderate rain between 2.5–7.5 mm/hr, and heavy rain exceeds 7.5 mm/hr.
- ***Sleet*** : Occurs when snowflakes partially melt as they pass through a warm atmospheric layer and then refreeze into ***ice pellets*** before reaching the ground. These pellets often bounce upon impact.

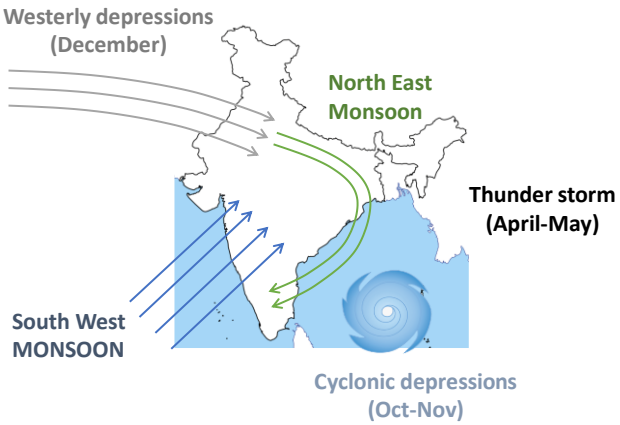
  Sleet = Frozen raindrops*
- ***Snow*** : ice crystals that form in clouds when the atmospheric temperature is at or below freezing.
- ***Glaze*** : A smooth, transparent coating of ice formed by the freezing of supercooled rain or drizzle upon contact with cold surfaces.



- ***Hail*** : Balls or ***Small irregular lumps of ice****, that formed by alternate freezing and melting (Resulting formation of layers)
- ***Frost*** : *Due to chilling of air below freezing point****
- ***Fog*** : Forms when the air becomes saturated, and water vapor condenses. ***Visibility is reduced to below 1 km****

► SOURCES OF MOISTURE



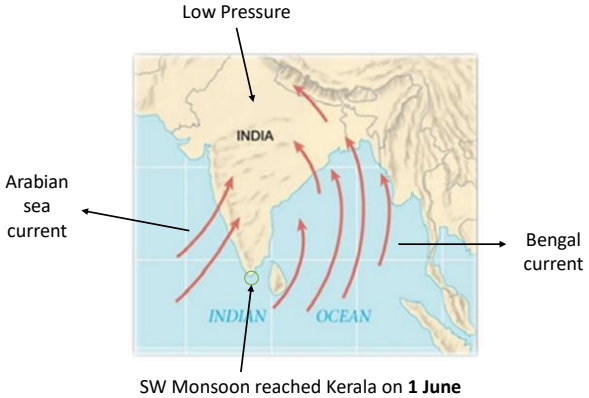


❑ PRE-MONSOON RAINFALL

- During April-May
- Intense rainfall with dark, furious clouds known as ***Kal-Vaishakhi*** (*Nor wester*) in North India, Bengal, and ***Tea Shower*** or ***Bardoli Chheerha*** in Assam region.
- ***Mango Shower*** – in Karnataka region; ***Cherry Blossom*** In Kerala

❑ SW MONSOON

- Kerala = **1 June** (Normal date), Covered the entire country by **8 July**.



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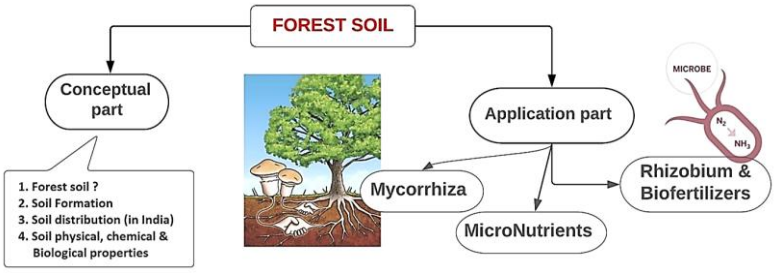
CHAPTER 4

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*).

- ***Mycorrhiza*** term was given by – A. B. ***Frank****
- ***Symbiosis*** term was given by – Anton De ***Bary****
- The term ***Rhizosphere*** was first time coined by – Lorenz ***Hiltner****

TYPES OF MYCORRHIZAE

- **ECTO-MYCORRHIZA** : Under this, fungal mycelium forms a thick ***Mantle Sheath*** around the lateral roots, and some *mycelia*

Chapter Outline

CHAPTER 5

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 influencing ***rainfall patterns***, ***temperature***, ***solar radiation***, and ***soil profile depth***. It also impacts ***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, the surrounding hills make the valleys extremely hot. The soil in valleys is deeper, more fertile and productive, and supports dense vegetation.

Chapter Outline

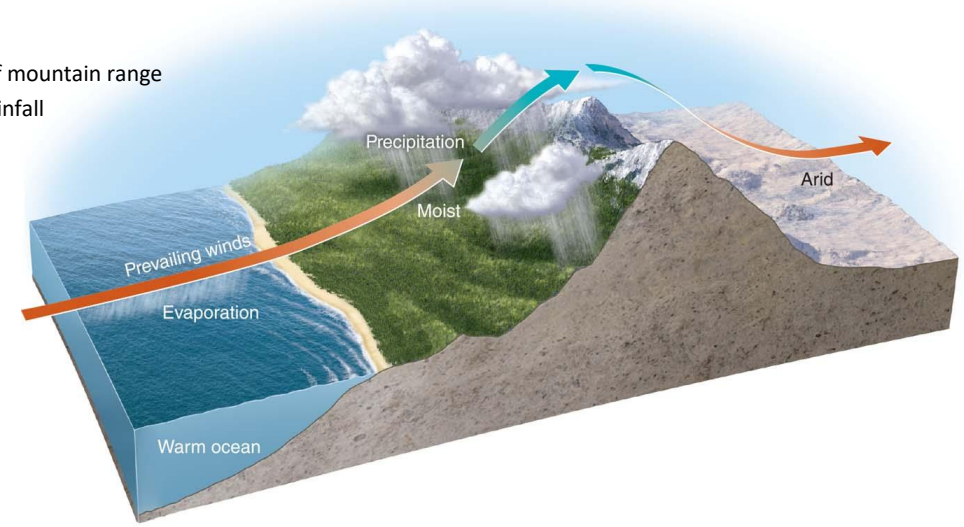


Figure 5.1 : Effect of mountain range on the pattern of rainfall

Concept : CLOUD FORESTS

Cloud forests are a special ***type of rainforest*** found at high altitudes, typically between **1,000** and **2,500** ***meters*** above sea level (≈ 1500 m). These forests are characterized by a ***constant mist*** *or* ***cloud cover at the canopy level***, which provide constant moisture through a process called ***Lateral Cloud Filtration***—where moist ocean air rises over mountains, cools, and condenses.

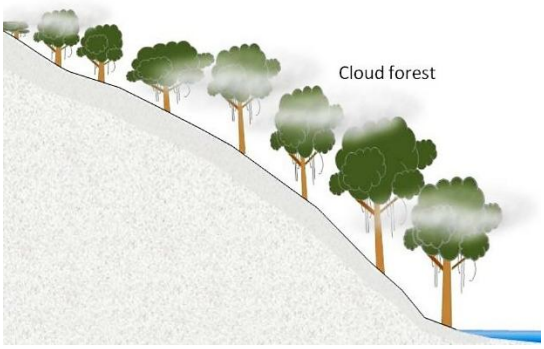


Figure 5.2 : ***Cloud Forest*** — A ***shorter***, ***denser***, and ***gnarled evergreen forest*** shrouded in cloud cover at the canopy level, giving it a ***misty appearance*** with abundant ***epiphytes***. Typically found between ***1,000 to 2,500-meters altitude***.

Cloud forests are home to unique wildlife and lush vegetation, especially ***Epiphytes*** like mosses, ferns, and orchids. Unlike tropical rainforests, cloud forests have ***Shorter***, ***Twisted trees***, ***Cooler temperatures***, ***Less sunlight***, and ***Nutrient-poor***, ***Acidic soils***. In India, they can be found in regions like the ***Western Ghats***, the ***Nilgiris***, ***Palani Hills***, and the ***hilly areas of the Northeast***.

Instrument used for altitude measurement = ***Altimeter***.

5.2 ALTITUDE

Altitude refers to the height of a place above mean sea level. As we ascend mountains, we observe a gradual ***Decrease*** in ***Temperature***, ***Atmospheric Pressure***, ***Rainfall***, and ***Soil Fertility***, while ***Wind Velocity*** and ***Solar Radiation*** tend to ***Increase***. Thus, vegetation at different altitudes is different, showing distinct zonation. Generally, ***Xerophytic*** vegetation (adapted to dry conditions) is more common at lower latitudes, whereas ***Chamaephytic*** plants (low-growing perennials) are more common at higher altitudes.

EFFECTS OF ALTITUDE ON VEGETATION

- *Reduction in tree size* : With increasing altitude, there is a noticeable decrease in *tree diameter*, *height*, and *leaf thickness* and *size*. Above the timberline, tree growth ceases, and only low-growing *scrub vegetation* is found, similar to what is seen in semi-arid regions.
- *Flag tree formation* : Strong, persistent winds near mountain edges deform tree growth, resulting in *flag-shaped trees*.
- *Prolonged maturity period* : Cold temperatures

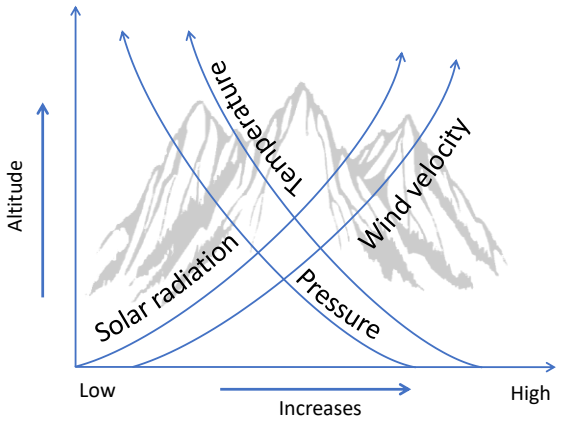


Figure 5.3 : Effect of altitude over climatic factors

CHAPTER 8

TREE'S STRUCTURE & GROWTH FORMS

8.1 WHAT IS A TREE?

Trees are woody plants having one *erect perennial stem or trunk* at least three inches (7.5 cm) in diameter at breast height, a more or less *defined formed crown* of foliage, and a *height of at least 12 ft* (4 m).

CROWN

The crown encompasses all the above-ground parts of a tree, including branches, leaves, and reproductive structures.

FORMS OF TREE CROWN

A crown is an upper branchy part of a tree above the bole. It is the result of branching behaviour in the bole. In some trees, *i.e.*, *Phoenix*, *Cocos*, *Borassas*, etc., there is no branching behaviour in the stem and the crown is formed by larger leaves which come out from the top of the unbranched stems. In other trees crown may be – ◈ ***Conical*** as in the case of *Pines*, and *Deodar*, ◈ ***Cylindrical*** as in *silver fir*, *Eucalyptus*, *Ashoka*, etc. ◈ ***Spherical*** in *mango*, *neem*, *Imli*, *Mahua*, etc., ◈ ***Broad & Flat topped*** in *Acacia planifrons*, *Albizzia spp.*, ◈ ***Broom shape*** as in *Acacia nilotica* (*Babool*), and ◈ ***Frondose crown*** as in *Prosopis juliflora*.

Chapter Outline

Phoenix, Coconut, Borassus

Unbranched stem of Coconut

Conical shape

Abies pindrow (Silver Fir), Eucalyptus, Ashoka

Cylindrical shape

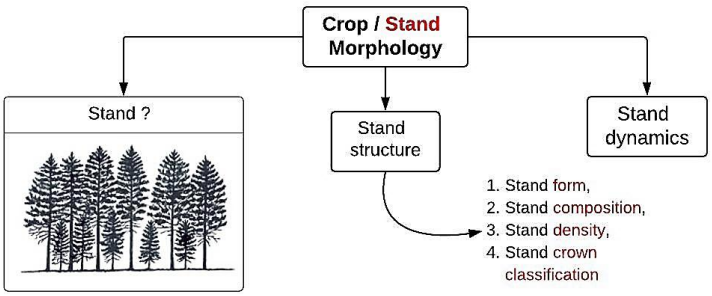
Mango, Neem, Imli, Mahua, etc.

Spherical shape

CHAPTER 9

TREE CROP MORPHOLOGY

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

CHAPTER 10

FORESR SUCCESSION

Succession is the process by which ***one set of biotic communities*** is ***gradually replaced*** by ***another, more advanced*** and ***distinct nature*** biotic community.

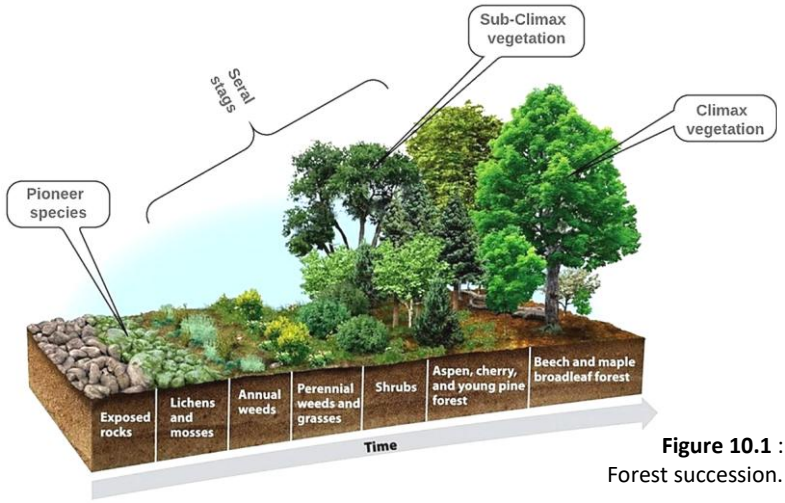


Figure 10.1 : Forest succession.

The 1st species that encroach upon and begin to grow (establish themselves) in a new area are called ***Colonizer**** or ***Pioneer**** species. ***Sere*** or ***Seral Stages*** (sometimes referred to as the ***Consolidation Phases***) are the intermediate stages during which plant communities develop, improve soil conditions, and gradually transform into more advanced and stable communities.

- **Climax Stage** – This is the final, mature, and stable community that can sustain itself over a long period while remaining in balance with the existing environmental conditions.
- **Succession** – The process of development and transition of vegetation from one stage to another (e.g., from grassland to woodland) is called **succession**.
- With each stage of succession, ***Complexity*** and ***Biodiversity Increase***.
- When a **colonizer** species begins to grow on barren land where there is **no trace of previous organic matter**, it is called ***Primary Succession***.

Chapter Outline

Succession term was given by "*Hault*".

CHAPTER 12

NATURAL REGENERATION

WHAT IS REGENERATION ?

Regeneration or **reproduction** is an act of *replacing the old crop* with *younger ones*, either naturally or artificially is called regeneration or reproduction.

TYPES ?

- Natural regeneration : by nature.
- Artificial regeneration : when humans were involved in its propagation.

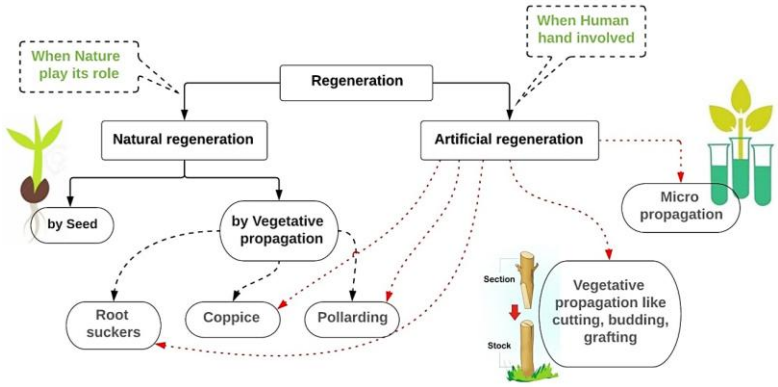


Figure 12.1 : Types of natural regeneration.

NATURAL REGENERATION

Definition : Natural regeneration is the renewal of a forest crop by means of the natural process of seed sowing, germination, and establishment or by coppice shoots or root suckers.

However, the new crop derived by natural regeneration also required some suitable conditions of soil, climate, host plants, and topography. Natural regeneration is often not left to nature, but it is induced by creating a suitable environment. The various measures taken to *induce natural regeneration* may be - (a) cutting some matured trees to allow more light to penetrate, (b) coppicing of seedlings or trees, (c) Closing the area to prevent fire and biotic interference and (d) trenching for getting root suckers, etc.

Chapter Outline

What is Regeneration?

- NR
- AR

Natural regeneration by

- Seed
- Coppice
- Root Sucker
- Pollarding

CHAPTER 13

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.

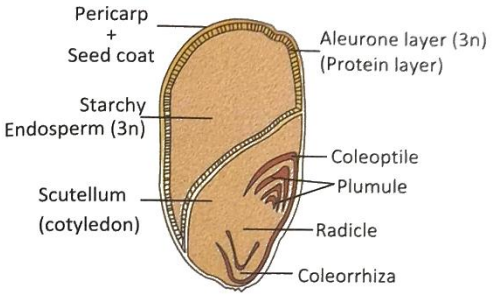
Chapter Outline

15.2 SEED

Seeds are the ***Mature Ovule*** with contain an ***Embryo Axis***, ***Seed Coat*** and ***Cotyledon*** (food reserve) in the form of cotyledons. The seed coat consists of two layers, the ***Testa*** (coloured outer layer) and the ***Tegmen*** (white inner layer), which are hardened by ***Sclerenchymus*** cells.

MONOCOT SEED

Monocotyledonous seeds are typically ***Endospermic***, meaning they retain a significant amount of endosperm to nourish the developing embryo. However, certain exceptions exist, such as in orchids, where the endosperm is absent.



In cereals like maize, the seed coat, *derived from the ovule's integuments*, is membranous and often *fused with the pericarp—the fruit wall*—resulting in a ***Caryopsis***. This fusion creates a protective outer layer that encases the seed, safeguarding the internal structures from mechanical damage and desiccation.

The *endosperm occupies the majority of the seed's volume and functions as the primary storage tissue*, rich in carbohydrates, proteins, and lipids. Surrounding the endosperm is the ***Aleurone Layer***, a single layer of living cells that plays a crucial role during germination. Upon activation by ***Gibberellins*** released from the embryo, the aleurone layer synthesizes and secretes hydrolytic enzymes, such as ***α-amylase***, which degrade the stored macromolecules in the endosperm into simpler forms. These nutrients are then mobilized to support the growth of the embryo.

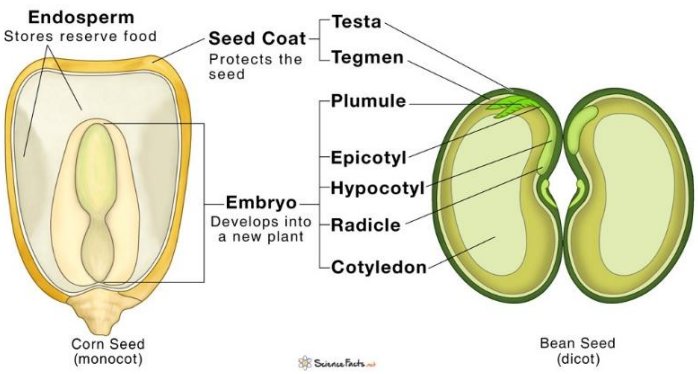
Embryo Structure

The embryo is relatively small and is situated in a groove at one end of the endosperm. It comprises:

- **Scutellum** : A large, shield-shaped ***Cotyledon*** unique to monocots, the scutellum is positioned laterally to the embryonic axis. It serves as an *absorptive organ*, facilitating the *transfer of nutrients from the endosperm to the embryo* during germination.
- **Embryonic Axis** : This includes the ***Plumule*** and ***Radicle***. The plumule, destined to develop into the shoot system, is enclosed within a protective sheath called the ***Coleoptile***. The radicle, which will form the root system, is similarly protected by the ***Coleorhiza***. These sheaths safeguard the delicate meristematic tissues during germination and aid in their emergence through the soil.

DICOT SEED

Unlike monocot seeds, most dicot seeds are ***Non-Endospermic*** (*Ex-albuminous*), meaning the endosperm is consumed during embryonic development and food is stored in the ***Cotyledons***. However, a few dicots (e.g., castor) retain some endosperm and are



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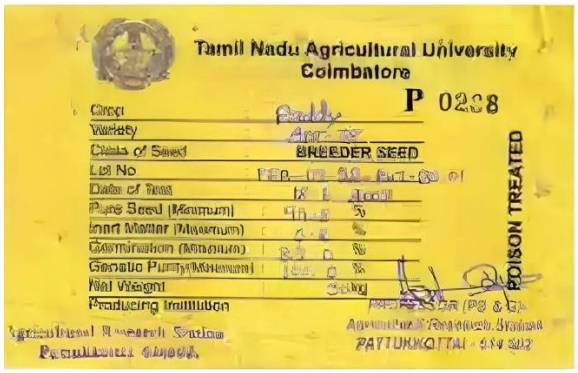
Registered seed : This is the offspring of Foundation seed and is produced under agency regulations to maintain varietal purity and identity.

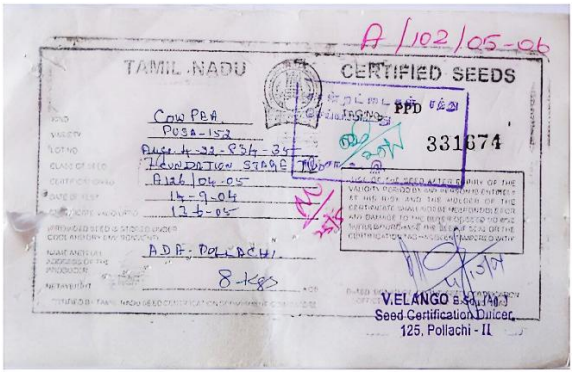
- Used primarily to produce certified seeds.
- In India registered seed is not practiced
- Tog color : **Purple***** Certificate.

⊳ **Certified Seed** :

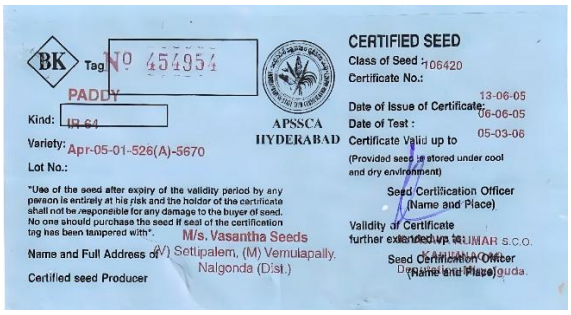
- Derived from foundation seeds ***by officially registered growers***.
- ***Supervised*** rigorously by seed certification agencies.
- ***Meets minimum certification standards*** for quality.
- Must maintain genetic purity of ***at least 99%.***
- Commercially available to farmers.
- Certificate Tag color : **Azure-Blue*****.



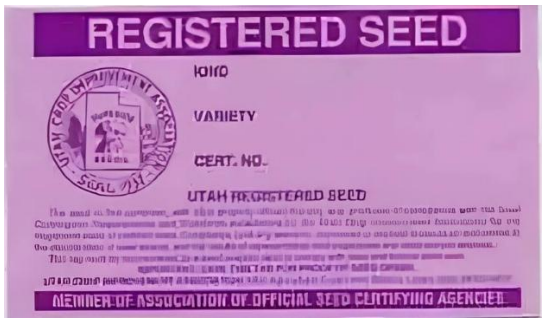
Breeder Seed = Golden-Yellow** Tag*



Foundation Seed = White** Tag*



Certified Seed = Azure-Blue***



Registered seed = Purple

According to Ewart's classification (1908), **seeds** are classified based on their viability lifespan under optimal storage conditions. seeds are divided into three categories,

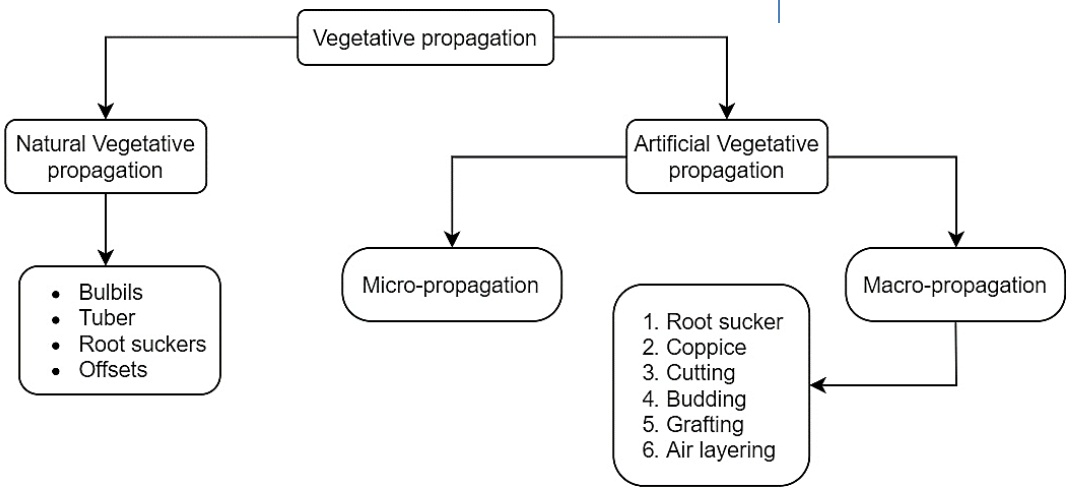
- **Microbiotic**: Seeds with a lifespan of less than 3 years.
- **Mesobiotic**: Seeds with a lifespan ranging from 3 to 15 years.
- **Macrobiotic**: Seeds with a lifespan exceeding 15 years.

CHAPTER 17

VEGETATIVE PROPAGATION

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

- **Objective of plant propagation ?**
  - Increase the number of plants of the same species
  - Preserving the essential characteristics of the plants
  - Way to introduce exotics
- **Methods of plant propagation**?
  - Sexual : by seeds
  - Asexual : by vegetative parts like cutting, Root suckers, etc.
- **Vegetative propagation**?
  - *The method to regenerate the new independent plant from the body tissue of the parent plant*.
  - Also known as *asexual propagation*.
- **Methods of vegetative propagation** ?



Advantages of vegetative propagation

- Vegetative propagation helps to produce genetically identical plants.
- This method eliminates variability and maintains clonal fidelity.

Chapter Outline

CHAPTER 18

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

Site Selection

Site allotted by the Govt.

Green Highway Corridor

CAMPA Forest

CHAPTER 19

MAINTENANCE OF PLANTATION

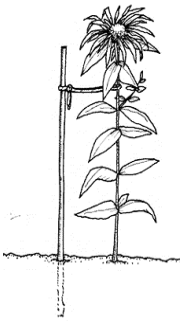
After plantation work is over, several planted seedlings have died due to –

- Defective & carelessness in planting work, *i.e.*, root coiling, shallow planting, unfirm soil, etc.
- Poor soil conditions, *i.e.*, waterlogged, presence of injurious salt concentration, Sub-surface hardpan formation etc.
- Adverse post-planting weather, *i.e.*, Frost, drought
- Insect & pest attacks; Competitive weed growth; Grazing, browsing and trampling – by both domestic as well as wild animals.

SOLUTIONS

- ***Replace Of Casualties*** : 'Refilling' process is also known as – Beating-up, Blanking, and In-felling.
- ***Weeding*** : removing the weeds. Types – Complete weeding, Line weeding, Spot weeding, Inter row weeding.
- ***Soil Working*** : : to improve infiltration rate, remove sub-surface **hardpan** and improve soil aeration.
- ***Watering*** : : During the dry season or in case of monsoon failure. Light soil requires more water than heavy soil.
- ***Abnormal Slow Growth*** –> Casualties replacement
- ***Staking*** : providing support to the plantation so it can withstand against a strong wind.
- ***Singling*** or ***Re-Spacing*** : carried out usually after 2/3 years of plantation.

  Singling involves selecting the most vigorous and well-formed shoot from a coppice stool and removing the others. This practice ensures that the selected shoot can grow into a strong, single-stemmed tree, optimizing the quality and uniformity of the stand. The operation is typically performed when the shoots have reached a height of approximately 1 to 2 meters. At this stage, the shoots are sufficiently developed to assess their form and vigor, yet still young enough that removal of the undesired shoots causes minimal damage to the stool and the selected shoot.

  
  Stacking of a plant

  After harvesting apply **Wax** on the open part to ***prevent fungal infection***.

  Re-Spacing : Competing plants of the same or similar species are removed to provide proper spacing and remove unnecessary competition.
- ***Bud Pruning*** /***Debudding***

CHAPTER

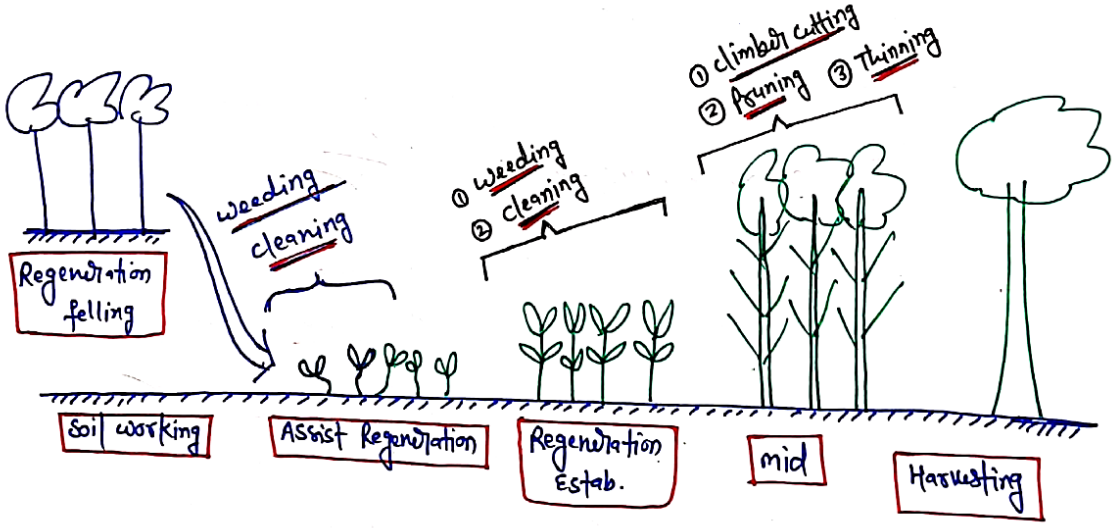
20

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.



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 improvement fellings, and thinning in groups of advance growth, girdling or poisoning of unwanted growth, climber cutting and even piling of felling debris, and controlled-burning but usually not other ground operations nor pruning. It is generally associated with silvicultural systems relying primarily on natural regeneration.

CHAPTER 21

PLANTATION FORESTRY

A forest plantation is an area of land of not less than one hectare owned by the govt. or private sector, upon which the owner proposes to develop and maintain a forest crop of usually even-aged and single species.

Plantation forestry, based on the successful breeding of superior tree genotypes, is becoming more widely used by international forestry companies since it offers the possibility to grow and manage forests of high economic value and superior quality. However, a number of highly desirable traits are not readily available in the breeding population and may be introduced using desirable genes from other organisms.

21.1 OBJECTIVES or NEEDS OF PLANTATION FORESTRY

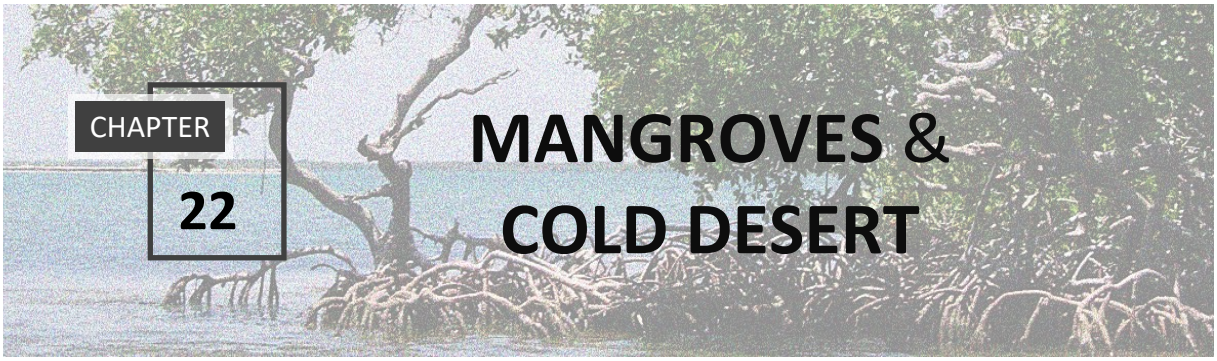
- *Production* purpose : for production of Timber, Fuel wood, fodder, Fibres, pulpwood, etc. to fulfil population demands with depressurized Forest resources.
- *Protection* against adverse weather, *i.e.*, Windbreak, planting a shade tree in Tea gardens (Usually *Albizzia* spp.), Soil and water *conservation* in a given watershed area.
- Forest enrichment and mixing species to control epidemics like the Sal heartwood borer attack in 1998 in central India.
- Climate change and global warming forced many species unsuitable for germinating naturally or sustained after germination, so they required human intervention.
- Our industrial and domestic demands are changing with time in quality, quantity, and requirement specific. We required the introduction of fast-growing species as well as new species.
- To create employment and investment opportunities.
- Environmental concern & Carbon storage purpose : Compensatory afforestation under CAMPA, fulfills our INDC obligations under the *Paris Agreement* by creating an additional carbon sink of **2.5 to 3 billion** tonnes of CO_2 equivalent till 2030. Our PM recently announced, "India will restore **26 m hac**. of degraded land by 2030" at the 14th CoP of UNCCD at Greater Noida.

21.2 PRODUCTIVITY OF INDIAN FOREST

Against the global average productivity of 2.1 million m^3/hectare/ year, the productivity of the Indian Forest is only 0.7 million m^3/hectare/ year.

Causes of Poor Productivity

- Unregulated grazing
- Uncontrolled fuelwood collection : Nearly 50% of the demand for fuel in rural India is being met from the adjoining forests. The annual demand for fuel wood is estimated nearly 250-300 million m^3. The recorded supply of firewood from Indian forests is only 17 million m^3 and there is a huge gap of approximately 260-



CHAPTER 22

MANGROVES & COLD DESERT

Mangroves form the coastal and estuarine wetland ecosystems in the tropical and subtropical regions of the world. This unique intertidal ecosystem acts as a safeguard to the coastlines from the disastrous effects of storm surges, erosion, and floods. Some mangroves occur along open coasts, subject to moderate wave processes, while most of them grow in sheltered, muddy tracts that are either regularly or occasionally immersed by tides

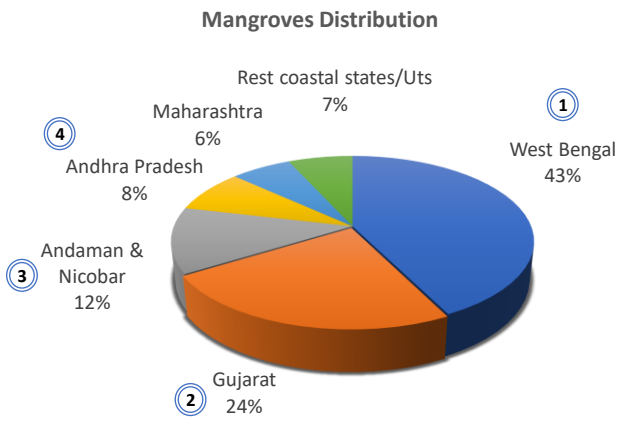
Definition : Mangroves are a diverse group of *salt-tolerant plant communities* found in the *tropical and subtropical coastal* and *intertidal zone* of the world, occurring mainly between *latitudes* 24^0 N *and* 38^0 S.

22.1 HABITAT

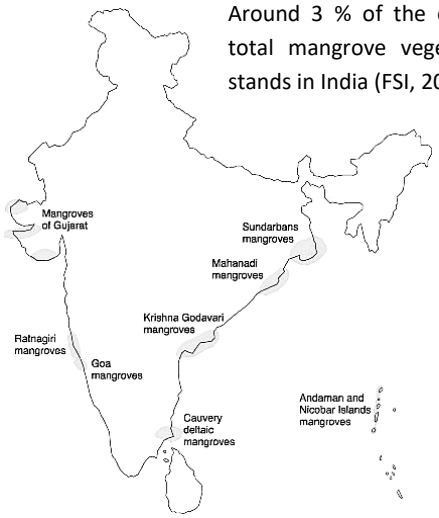
- The *intertidal zone* of coastal and estuarine mudflats.
- *Diurnal tidal inundation* of marine water, making the soil loose, very wet, salty, and low in oxygen.
- The *soil lacks minerals* like nitrogen (N), phosphorus (P), potassium (K), iron (Fe), and sulfur (S).
- Area *experiences strong winds* from cyclones and tsunamis.
- The temperature ranges from 25-35°C, and there is *100 to 300 cm of rainfall* annually
- *Rich biodiversity* because of the edge effect.

Figure 22.1 : Mangroves habitat

22.2 DISTRIBUTION



Around 3 % of the earth's total mangrove vegetation stands in India (FSI, 2021)



CHAPTER 23

IMPORTANT INDIAN TREE SPECIES

MPPSC SYLLABUS

[Unit - 1] Some commercially important trees (botanical name and family) examples Teak, Shisham, Sal, Babul, Harra, Bahera, Amla, Tendu, Palash, Arjun, Khair, Mahua.

23.1 ACACIA NILOTICA (BABOOL)

- *Syn. Acacia arabica*[***] = Gum arabic[***]
- **Family :** *Mimosaceae*[***] (Leguminosae).
- **Distribution :** A tree of *Semi-arid region*[***]**.** Hardy to handle damages created by cracking in *black cotton soil*[***], drought, and moderate frost, so, widely distributed over the north Indian plains, Rajasthan, MP, MH, etc.
- **Fruit :** *Lomentum*[***] type
- **Phenology :** medium-size *deciduous* tree with brood shape crown
  - Leaf fall : April – May
  - Leaf renewal : May - June
  - Flowering : January to March
  - Fruiting : ripen from April to June
  - *Thorny branches*.

- **SILVICULTURAL CHARACTERISTICS**
  - Drought hardy.
  - Frost resistant
  - Light demanded
  - Good copper
  - Root suckers

Phenology[***] is the seasonal changes in the plant behaviors over a year; it is the study of when plants start flowering, fruiting, leaves shedding, etc.

- **UTILIZATION** : **Gum**[***] (Ladoo making), leaves **Fodder**, **Fuelwood**[***], and **Timber** for farm implements. ***Tannins*** *from Bark and Pods*[***].

23.2 AZADIRACHTA INDICA (NEEM)

- **Family** : *Meliaceae*[***] [Non-Leguminous = Rhizobium × = Nitrogen Fixation ×][***]
- **Distribution** : Neem generally grows in tropical dry deciduous and thorn forests in drier parts up to 1500 m.

- Frost hardy species
- Extremely sensitive to drought conditions.
- Nodular bacteria – *Frankia**** has a symbiotic relationship with it.

- **Natural regeneration :** (1) by seed, (2) Coppice, but poor coppicing power, and (3) Root suckers.
- **Uses/importance** : (1) Afforestation of barren coastal land & shifting sand dunes, (2) Timber for boat and house construction.

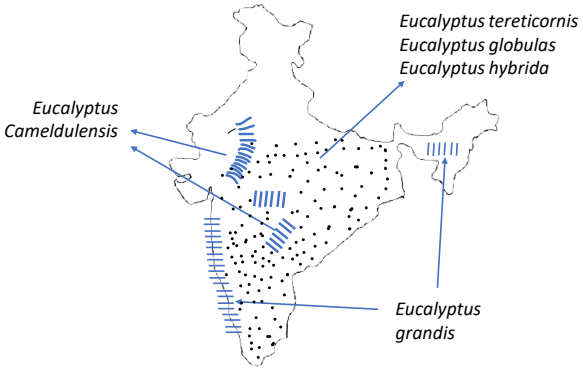
23.5 DALBERGIA SISSOO [SHISHAM, SISSOO]

- **Family :** *Papilionaceae**** (Leguminosae) = *Nitrogen**** fixation ✓
- Shisham is a large (20 to 30 m) *Deciduous* tree with a *Dimorphous Root* system (both horizontal and vertical roots).
- **Distribution :** It is widely distributed over the Sub-Himalayan tract and north Indian plane. Form gregarious patches over the newly formed alluvial deposits.
  - **Climate** : Max - 25° C to 35° C, Minimum - 5° C to 10° C.
  - **Rainfall** : 80 to 300 cm.
  - **Altitude** : upto 1500 mts
- **Phenology** :
  - **Leaf fall** : November/December to January
  - **Leaf renewable** : February
  - **Flowering** : March - April.
  - **Fruiting** : young pods start from the end of April to July. They ripen by November / December / January.
- Uses : Furniture, wheels, agricultural implements, gun carriages, etc.

Dalbergia latifolia = **Rosewood*****

23.6 EMBLICA OFFICINALIS (AONLA)

- *Syn*. *Phyllanthus emblica*
- Also known as *Indian Gooseberry****
- Family : *Euphorbiaceae****
- They are commercially cultivated in UP and Tamil Nadu.
- **Uses** :
  - *Richest Source of Vitamin C* after Barbados cherry.
  - Medicinal value : Dried fruits are helpful in haemorrhages, diarrhoea, dysentery, anaemia, jaundice, dyspepsia, and cough.
  - Aonla is used in the indigenous medicines (Ayurvedic system) viz. *Trifla* and *Chavanprash*.
  - Fruits are commonly used for preservation (murabba), candy, etc.



23.7 EUCALYPTUS SPECIES (SAFEDA, NILGIRI)

07223970423 Hornbillclasses@gmail.com

*Prosopis cineraria***		Khejari	Mimosaceae
*Prosopis juliflora***	Mesquit bean	Vilayati babul	Mimosaceae
*Pterocarpus marsupium***	Indian Kino	Bija, Bijasal	Fabaceae
Pterocarpus santalinus	Red sandalwood	Rakt chandan	Fabaceae
Quercus semicarpifolia	Brown oak	Moru, Ban Oak	Fagaceae*
Quercus incana	Grey oak		Fagaceae
*Rhizophora mangle***	Red mangrove		Rhizophoraceae***
*Ricinus communis****	Castor	Arand	Euphorbiaceae***
*Salix alba****	White willow	Bhusban	Salicaceae***
*Samania saman****	Rain tree, Monkey bread tree	Rain tree	Leguminosae
*Santalum album****	Sandal wood	Chandan	Santalaceae
*Sapindus indica****	Soap nut	Ritha	Sapindaceae*
*Saraca indica****	Ashoka tree	Ashoka	Caesalpiniaceae*
*Schleichera oleosa****	Lac tree	Kusum	Sapindaceae
*Semecarpus anacardium****	Marking nut	Bhilwa	Anacardiaceae
*Shorea robusta****	Sal	Sal, Saku	Dipterocarpaceae
*Swietenia mahoganii***	Mahogany		Meliaceae
*Syzygium cumini**	Java plum	Jamun	Myrtaceae
*Syzygium aromaticum****	clove	Laung	Myrtaceae***
*Tamarindus indica**	Tamarind	Chinch, Imli	Caesalpiniaceae
Taxus baccata	Indian yew	Yew (for Bow making)	Taxaceae
*Tectona grandis***	Teak	Sagwan, sag	Verbenaceae
*Terminalia arjuna**	Arjun	Arjun	Combretaceae
*Terminalia bellerica****	Bellerica myrobalam	Baheda, Harra	Combretaceae***
*Terminalia chebula****	Yellow myrobalam	Hirda, harar	Combretaceae
Toona ciliata	Cedrela tree, Indian Mahogany	toon	Meliaceae
*Vateria indica****	White dammar		Dipterocarpaceae
*Xylia xylocarpa****	Irul wood	Suria	Mimosaceae
*Ziziphus mauritiana****		Ber	Rhamnaceae

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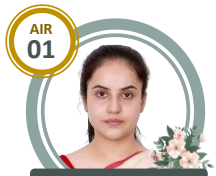

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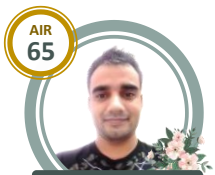

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