Overview of Afforestation

Certain Words and their Meanings in Forestry (1)

Forest: 'An area set aside for the production of timber and other forest produce, or maintained under woody vegetation for certain direct and indirect benefits'. (General Definition).

'A plant community predominantly of trees and other woody vegetation, usually with a closed canopy'.

Silviculture:

(1) 'that branch of forestry which deals with the establishment, development, care and reproduction of stands of timber.'

(2) 'the art and science of cultivating forest crops'

'(3) Silvics' is the study of life history and general characteristics of forest trees and crops with particular reference to environmental factors, as the basis for the practice of silviculture.

Certain words and their meanings in Forestry (2):

- **Forestry:** ‘the theory and practice of all that constitutes the creation, conservation and scientific management of forests and utilization of their resources’.
- **Afforestation:** Planting more trees in a region where there were no trees.
- Is a method to create new forests. Afforestation is done to convert barren land into a greener area.
- **Reforestation:** The process of replanting an area with trees.
- **Deforestation:** The action of clearing a wide area of trees.
- **Agroforestry:** Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence.

Certain words and their meanings in Forestry (3):

- **Deciduous trees:** A tree is called deciduous if it normally remains leafless for sometime during the year.
- **Evergreen trees:** A perennial plant which is never entirely without green foliage, the old leaves persisting until a new set has appeared.
- **Even-Aged Forests (Regular Forest):** A forest consisting of trees of approximately the same age.
- **Uneven-aged Forest or Irregular Forests:** A forest composed of trees of markedly different ages. The range of difference in age being 20 years or more.

NATURAL

PLANTED

Certain words and their meanings in Forestry (4):

- **Pure Forest:** A forest composed of almost entirely of one species, usually to the extent of not less than 80%.
- **Mixed Forest:** A forest composed of trees of two or more species intermingled in the same canopy. (Principal species, Accessory Species and Auxiliary Species exist).

Light Requirement of Species:

i. **Light Demanders:** A species that requires abundant light for its best development. *Eg: Blue Pine, Poplar, Chir Pine, Ban Oak, Dipterocarpus, Sal*

ii. **Shade Bearers:** ‘ A species capable of persisting and developing under the shade’. *Eg: Deodar, Quercus dilatate, Artocarpus, Dalbergia latifolia (Rose wood)*

iii. **Shade Demanders:** A species requiring, at least in its early stages, some degree of shade for its normal development. *Eg: Abies pindrow (Fir), Mallotus, Mesua Ferrea (Indian ironwood tree).*

Stages of Growth & Development of a Plant

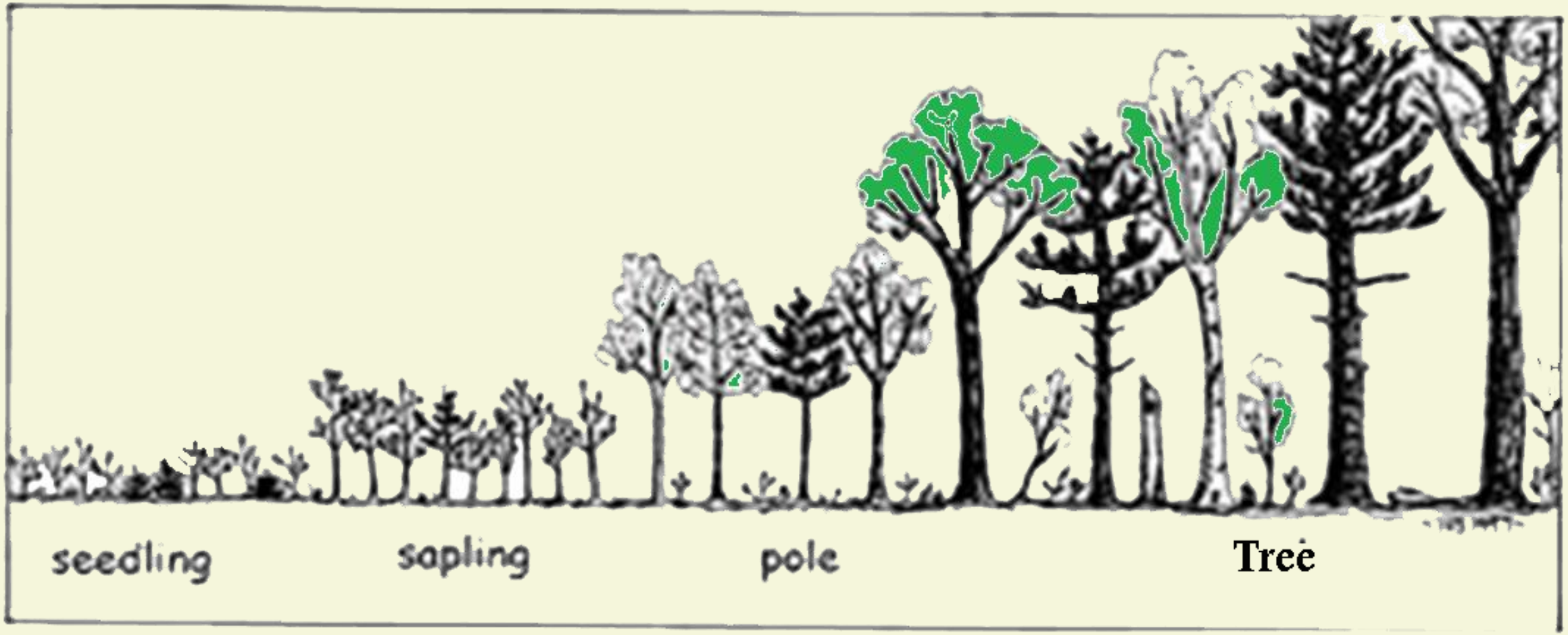
i. **Seedling:** ‘A plant grown from seed till it attains a height of **one metre** before it reaches ‘sapling’ stage.

ii. **Sapling:** ‘A young tree from the time it reaches about one metre in height till the lower branches begin to fall. A sapling is characterized by the absence of dead bark and its vigorous height growth’.

iii. **Pole:** ‘Pole is defined as a young tree from the time when the lower branches begin to fall off to the time when the rate of height growth begins to slow down and crown expansion become marked.

iv. **Tree:** Tree is the rate of growth beyond the pole stage when the rate of height growth begins to slow down and crown expansion become marked’.

Seedling, Sapling, Pole and Tree

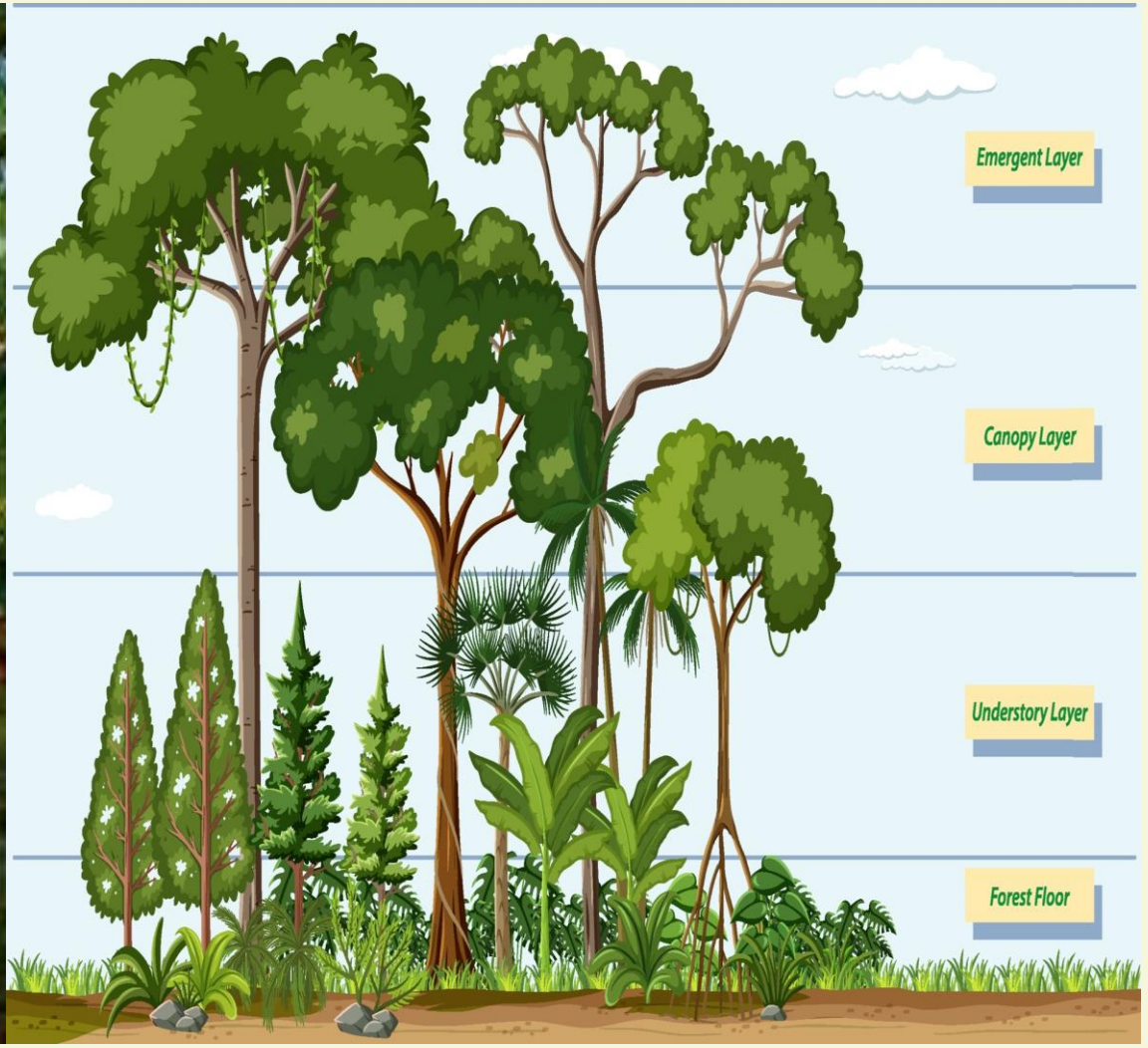


Forest cover Classified in terms of Canopy Density Classes. (source: Forest survey of India. ISFR-2021)

(Canopy: The cover of Branches and foliage formed by the crowns of trees in a forest).

Class	Description
Very Dense	**All lands with tree canopy density of 70% and above**
Moderately Dense	**All lands with tree canopy density of 40% and more but less than 70%**
Open	**All lands with tree canopy density of 10% and more but less than 40%**
Scrub	**All lands with tree canopy density of less than 10%**
Non Forest	**Lands not included in any of the above classes (includes water)**

Forest Canopy



Regeneration of Forests

Regeneration: Renewal of a forest crop by natural or artificial means.

Methods of Regeneration:

i. Natural Regeneration
ii. Artificial Regeneration
iii. Natural Regeneration Supplemented by Artificial Regeneration

Natural Regeneration

- The renewal of forest crop by self-sown seed or by coppice or root suckers. (Root Sucker is ‘that method of vegetative propagation in which a root of a plant is partially or wholly cut to produce a shoot called root sucker.

  - This is obtained from the following two methods:

  i. From seed:

  When the regeneration obtained from seed forms a crop, it is called seedling crop

  ii. **From Vegetative parts:**

Natural Regeneration From Seed: (1)

Depends on:

1. Seed Production:

- Most important prerequisite for NR is the production of adequate quantities of fertile seeds of the area or in the nearby areas. Production depends on species, age of trees, size of crown, climate and other external factors. For eg Teak Babul Shisham seed every year. Conifers seed at an interval of some years. Seed years are described as good, moderate or poor.
- Seeds produced by immature or overmature trees are often infertile.
- Crowns of trees are also important. The bigger the crowns the larger the production of seeds.
- Warmer climate favours larger seed production.

Natural Regeneration From Seed: (2)

2. Seed Dispersal: Seeds are dispersed by wind, water, gravity, birds and animals.

i. **Wind dispersal:** Conifers, Acer, Betula, Dipterocarps, Bombax.

ii. **By Water:** Trewia, mangrove species

iii. **By gravity**: Oak, Juglans, Aesculus

iv. **Birds**: Prunus, mulberry, Trema, Melanoxylon

v. **Animals:** Acacia arabica, Prosopis, Ziziphus

Natural Regeneration From Seed: (3)

3. Germination: Factors affecting the germination of seeds:

A) Internal Factors B) External Factors

A) Internal Factors:

- **Permeability to water:**
- **Permeability to Oxygen:**
- **Development of Embryo:** some seeds are dormant for at least one year Eg, *Fraxinus floribunda. (Seed Dormancy)*
- **After-ripening process:** Eg, *Juniperus macropoda*
- **Seed Viability:** Defined as 'potential capacity of a seed to germinate'. Sal seed viability one week.
- **Size of Seeds:**

Natural Regeneration From Seed: (4)

B) External Factors:

- **Moisture**: Adequqate quantity of moisture is essential. Moisture activates the dormant embryo. Softens seed coat. Helps dissolving of food materials in the cotyledons. Helps in diffusion of gases Oxygen and CO2
- **Air**: Constant supply of Oxygen is required for germinating seed.
- **Temperature:** Various seeds of various species germinate at different temperature
- **Light**: Most species are indifferent to light conditions for germination but *Cassia fistula* and *Albezzia procera* require light for germination
- **Seed Bed**: Seeds falling on the sheet rock, boulder deposits, thick layer of dry leaves are inhibiting factors. Should be adequately covered by soil and also should not be buried very deep in soil.

Natural Regeneration From Seed: (5)

4. **Seedling Establishment**: Development of a new crop, naturally or assisted, to a stage, when the young regeneration, natural or artificial, is considered safe from normal adverse influences such as frost, drought or weeds and no longer needs special protection or tending operations other than cleaning, thinning and pruning.

Factors affecting establishment of seedlings:

i. **Development of roots:** The seedling should develop a long tap root as soon as possible in the first growing season itself or else the seedling may die.

ii. **Soil Conditions:** Soil must have adequate moisture, nutrients. Undecomposed organic matter inhibits the establishment. Adequate aeration is a must.

iii. **Light:** Younger seedlings require lesser light but as they grow in age, they require more light.

iv. **Other climatic factors:** Extremely high or low temperatures kill the young seedlings. Not only adequate rainfall but its proper seasonal distribution is essential.

v. **Grass or other competing growth:** Density of weed growth has a great influence on establishment.

Natural Regeneration From Seed: (6)

vi. **Grazing, browsing and burning:** Uncontrolled grazing and browsing completely destroy the regeneration.

vii. **Drip:** Drip from the large leaves is harmful for establishment of seedlings because it remove soil from the roots of the tiny seedlings. Splashed soil on the leaves of the young seedlings prevents photosynthesis and kills the leaves by rotting.

viii. **Composition of crop:** A mixed crop is believed to create more favourable condition for seedling establishment than pure crops.

Seedling Establishment Period: Period which elapsed between the initiation of natural regeneration and the time when it is considered safe from adverse influences such as frost drought or weeds.

NR by Vegetative Reproduction:

i).Coppice: ‘that method of vegetative reproduction in which the tree, plants or seedlings of a species when cut from near the ground level, produce coppice shoots.

Coppice shoot is defined as ‘ a shoot arising from an adventitious bud at the base of a woody plant that has been cut near the ground or burnt back.

ii). Root sucker: Root sucker is that method of vegetative reproduction in which a root of plant is partially or wholly cut to produce a shoot called root sucker.

iii).Cutting: is that method of vegetative reproduction in which a portion of the stem, branch or root is placed in the soil or the other medium, in order that it may develop into a plant.

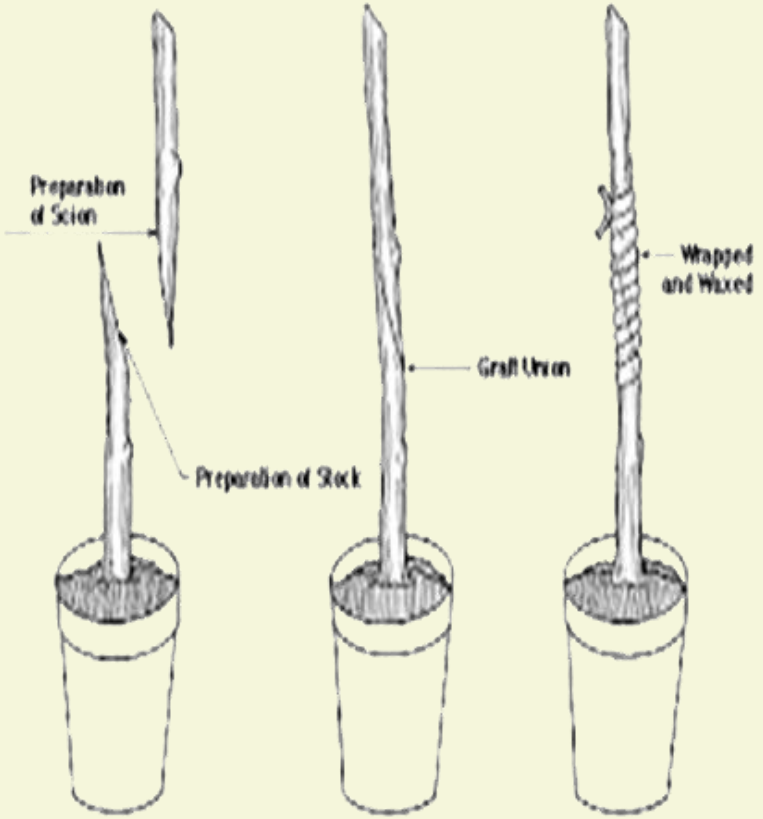
iv) Layering: Inducing development of roots on branches while they are still attached to the trees. This may be done in soil or in air.

NR by Vegetative Reproduction (2):

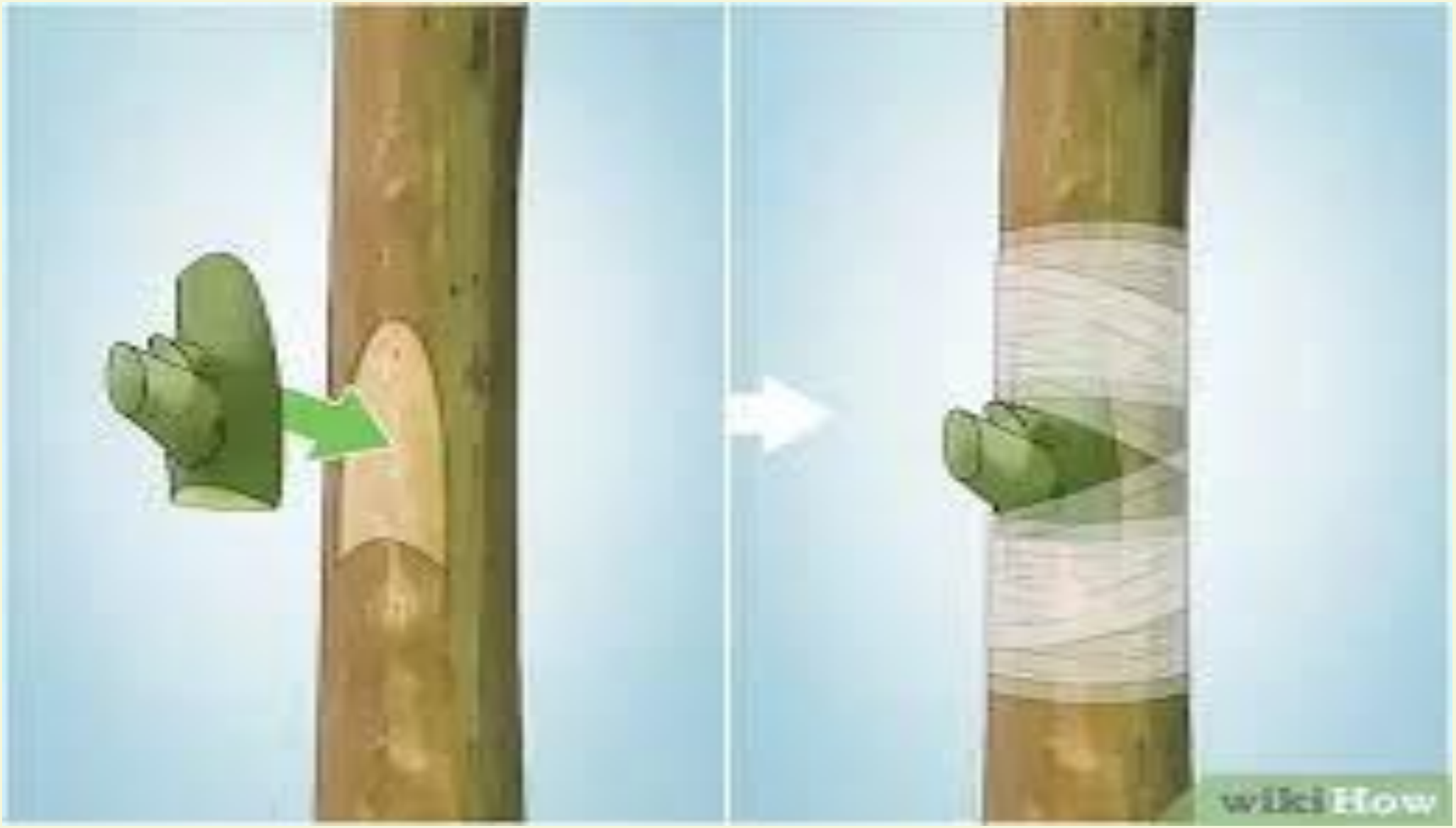
- **Grafting:** is a method of vegetative propagation in which a portion called ‘scion’ of one plant is applied to ‘stock’, usually rooted which is another plant, with the object of securing vegetative union between the two. ‘Cleft grafting has been found to be more useful for genetic improvement work in forestry.

- **Budding:** ‘ A method of vegetative reproduction in which a bud with some portion of the bark of a genetically superior plant is grafted on an inferior plant so that it may produce shoot when the old shoot of the stock is cut off’. Bud is grafted on the stock.

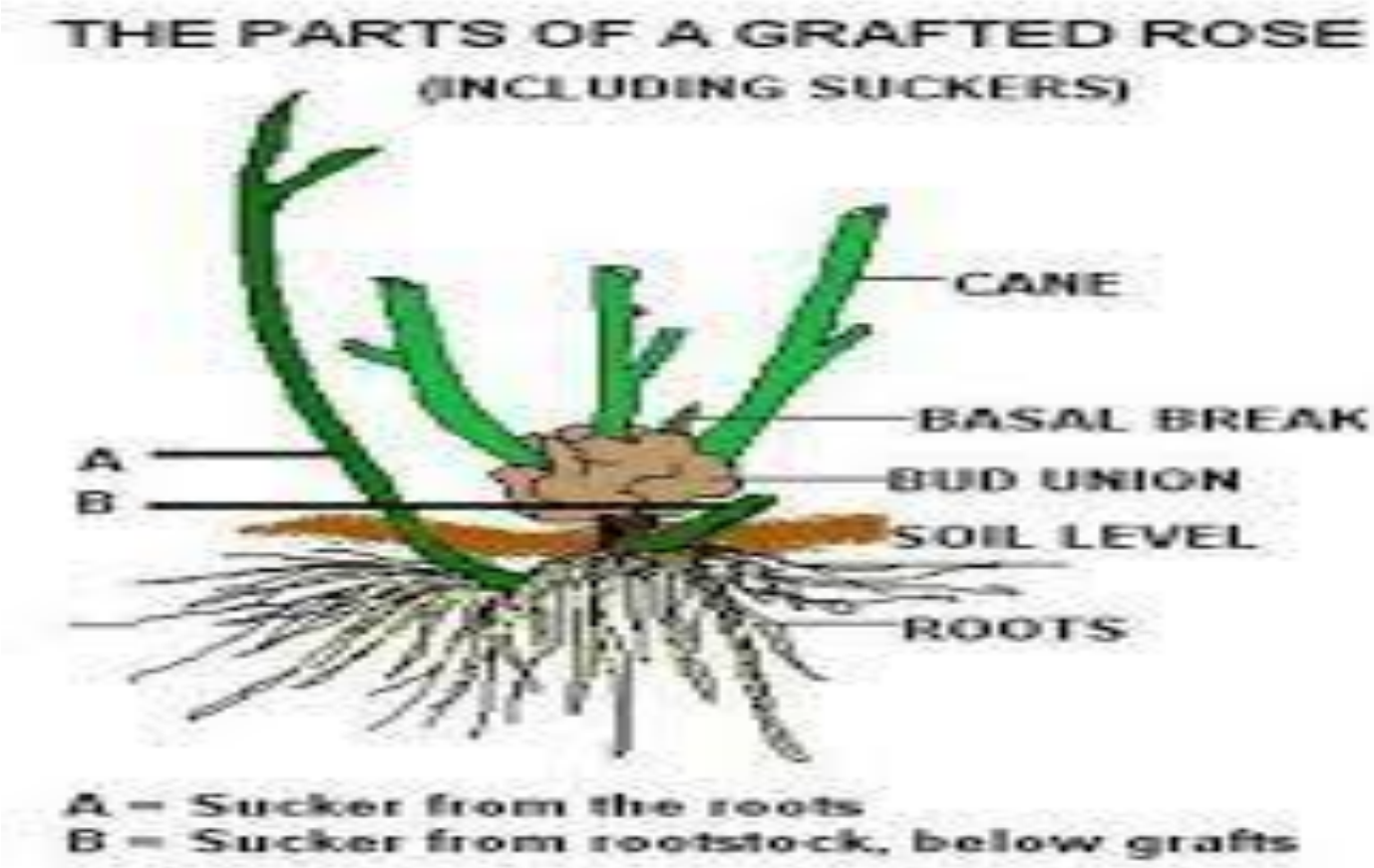
Layering & Grafting



Bud Grafting



Root Suckers

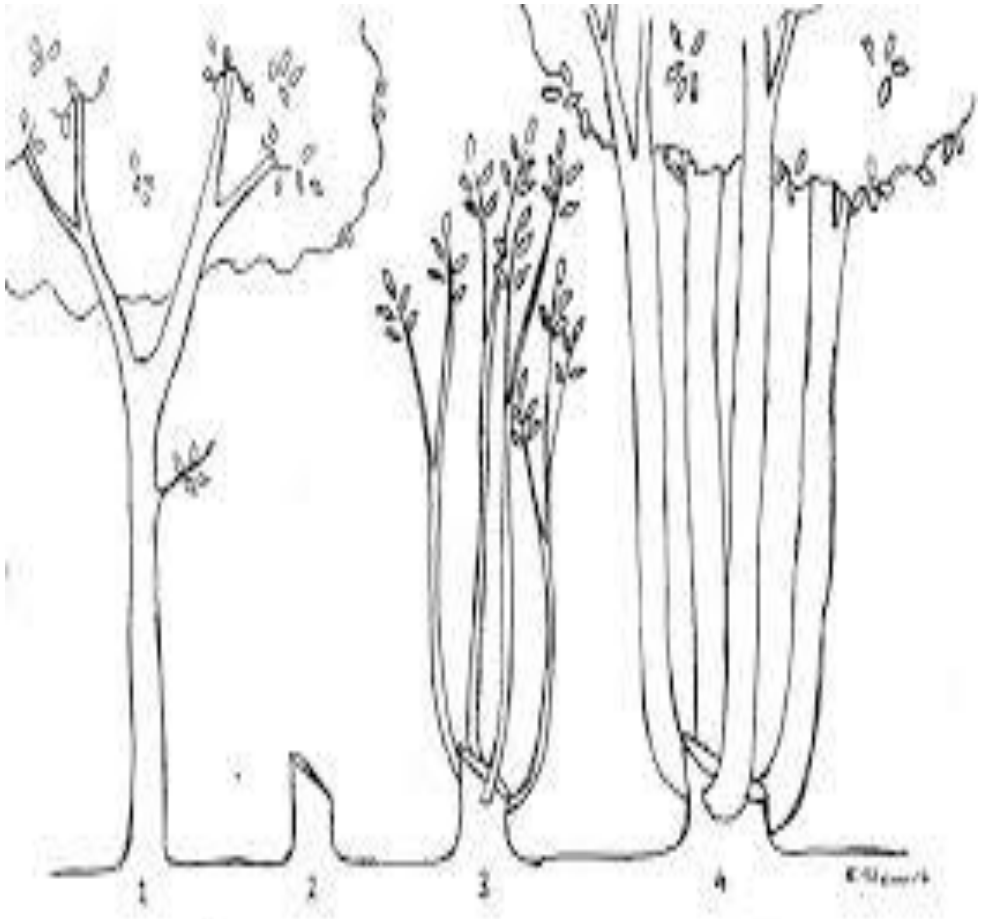


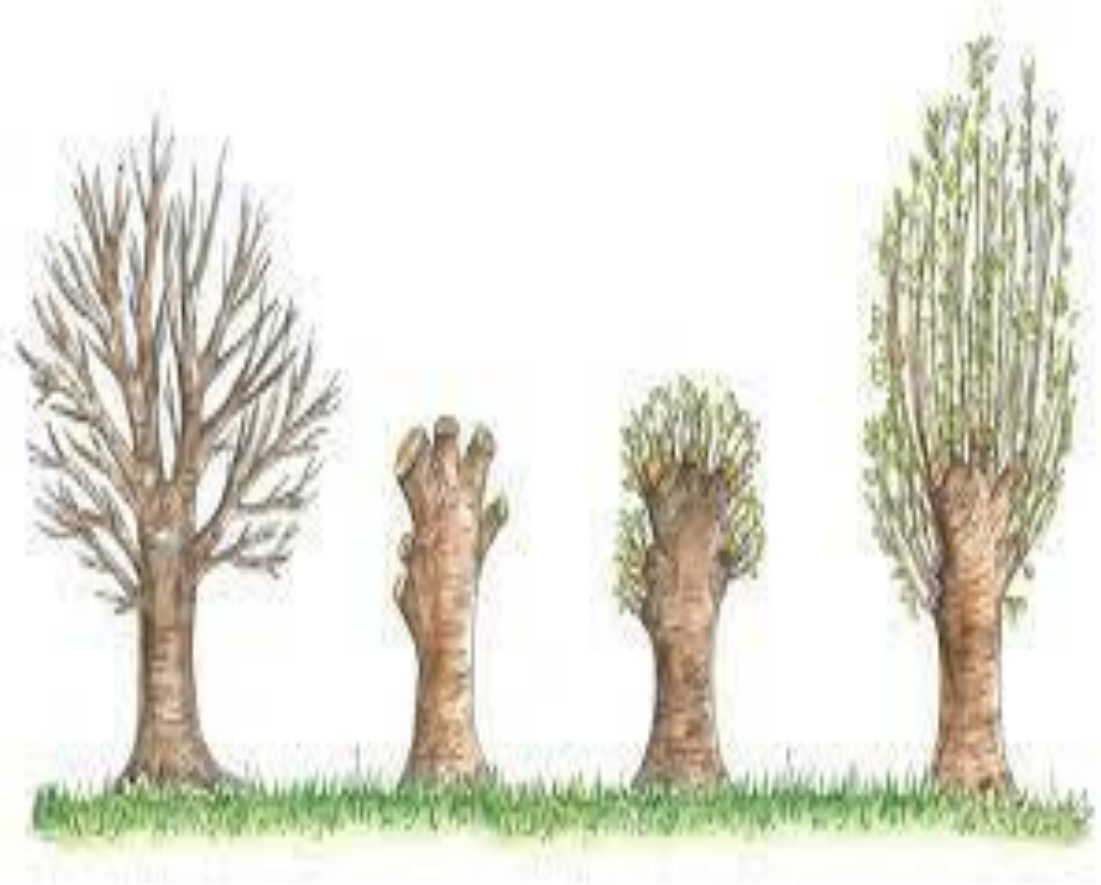
Natural Regeneration by Coppice (1)

- **Seedling Coppice:** the ‘Coppice Shoots arising from the base of seedlings that have been cut or burnt back’. Eg Sal and Teak.

- **Stool Coppice:** ‘ Coppice arising from the stool or a living stump. Regeneration is obtained from the shoots arising from the adventitious buds of the stump of felled tree.The coppice shoots arise either from near base of the stump or from its top.Of the two, those arising from near the base are better because they get established easily.

Coppicing and Pollarding





Natural Regeneration by Coppice (2)

Factors affecting NR by Coppice:

i). Species: Power of coppicing is not same in all species anf they are classified as below:

a. **Coppice strongly:** Emblica (Amla), Eucalyptus globulus, Sal, Syzygium cumini, Teak
b. **Coppice fairly**: Terminalia bellerica, Mahagony, Oaks
c. **Coppice badly:** Bombax ceiba, Madhuca latifolia, Adina cordifolia
d. **Do not coppice:** Deodar, Spruce. Chir pine, Khasi pine

ii). Age of Tree: The older the tree, the lesser is its coppicing power,

iii). **Season of Coppicing:** The best season is a little before growth starts in spring.

iv) Height of stump and method of cutting: Some species coppice produce better coppice when the stumps are higher. Egs: *Casuarina equisetifolia, Hardwickia binata*

Natural Regeneration by Coppice (3)

v) Rotation: Since most of the tree species coppice best during the early age, coppice rotation should be short. Long rotation encourages seedling regeneration and for that reason, coppice rotation is generally shorter than the age at which trees produce good viable seeds.

vi). **Silvicultural Systems:** Coppice shoots are strong light demanders and therefore worked under clear felling system. For long rotation seedling coppice is adopted (Sal &Teak in UP, MP, Bihar). For short rotation crops stool coppice is adopted.

Natural Regeneration by Coppice (4)

Stool mortality in coppice: trees can not keep on coppicing indefinitely and they may die after sometime. The mortality of stools in coppicing varies with species and locality.(10-15% in every rotation) The coppice may have to be supplemented with sowing and planting.

Tending of Stool Coppice: Usually each stool produces several coppice shoots. In order to enable them to develop into good poles, it is necessary that the number of shoots be reduced to 2or 3 the second and third year, and on developing further, the number may be reduced to 1.

Natural Regeneration by Root suckers: Not generally being attempted on large scale. Eg: Sissoo canal Bank Plantations in UP; Diospyros (Biri leaf) plantations in MP sometimes.

Thank You