

What Is a Silvicultural System?

Silvicultural system is define as the set of silviculture procedure worked out in accordance with accepted set of silviculture principal by which crop constituting forest are tended , harvested and replaced by new crops of distinctive from . It act as a tool for achieving the objectives of forest management.

Introduction:

Silvicultural system may be defined as a method of silvicultural procedure worked out in accordance with accepted sets of silvicultural principles by which, crops constituting mature forests are harvested, regenerated, tended and replaced by new crops of distinctive forms. It begins with regeneration felling and includes adoption of some suitable method of regeneration and tending of the new crop throughout of its life.

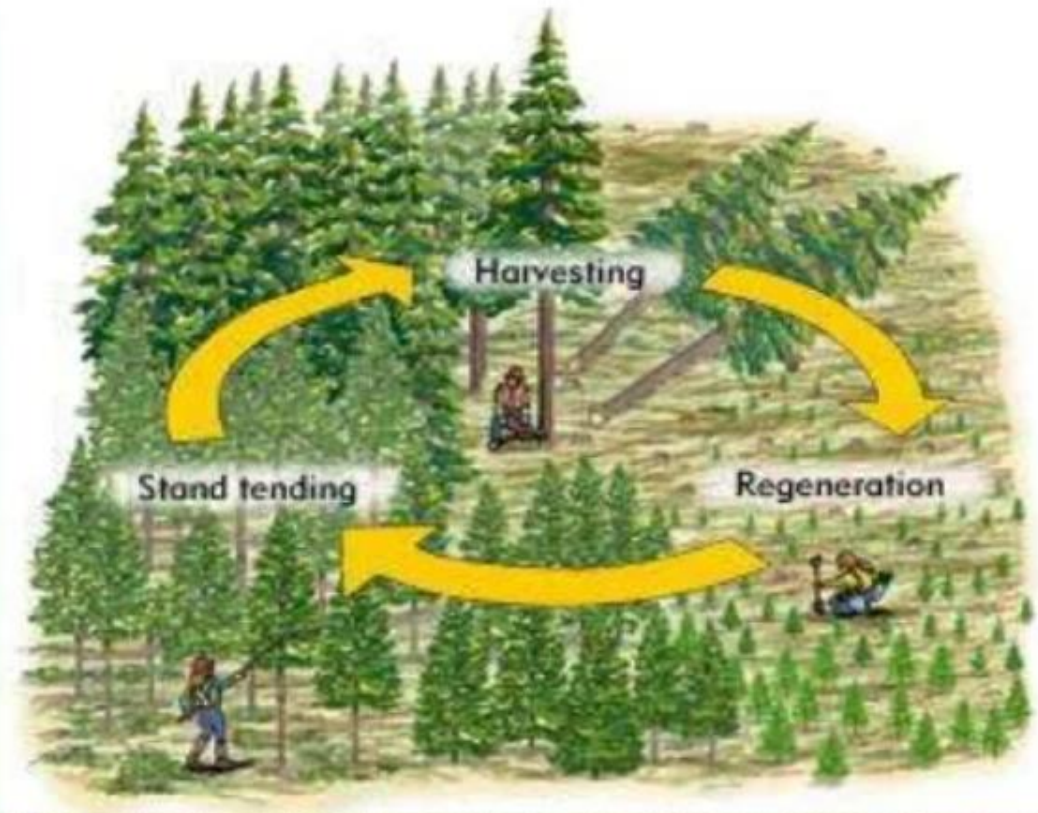


Fig. : Sequence of Silvicultural System



Classification of Silvicultural Systems

Silvicultural systems have been classified in a variety of ways. The most commonly used classification is based primarily on the mode of regeneration. It is further classified according to the pattern of felling carried out in the forest crop. According to the method of regeneration, silvicultural systems are of following two types:

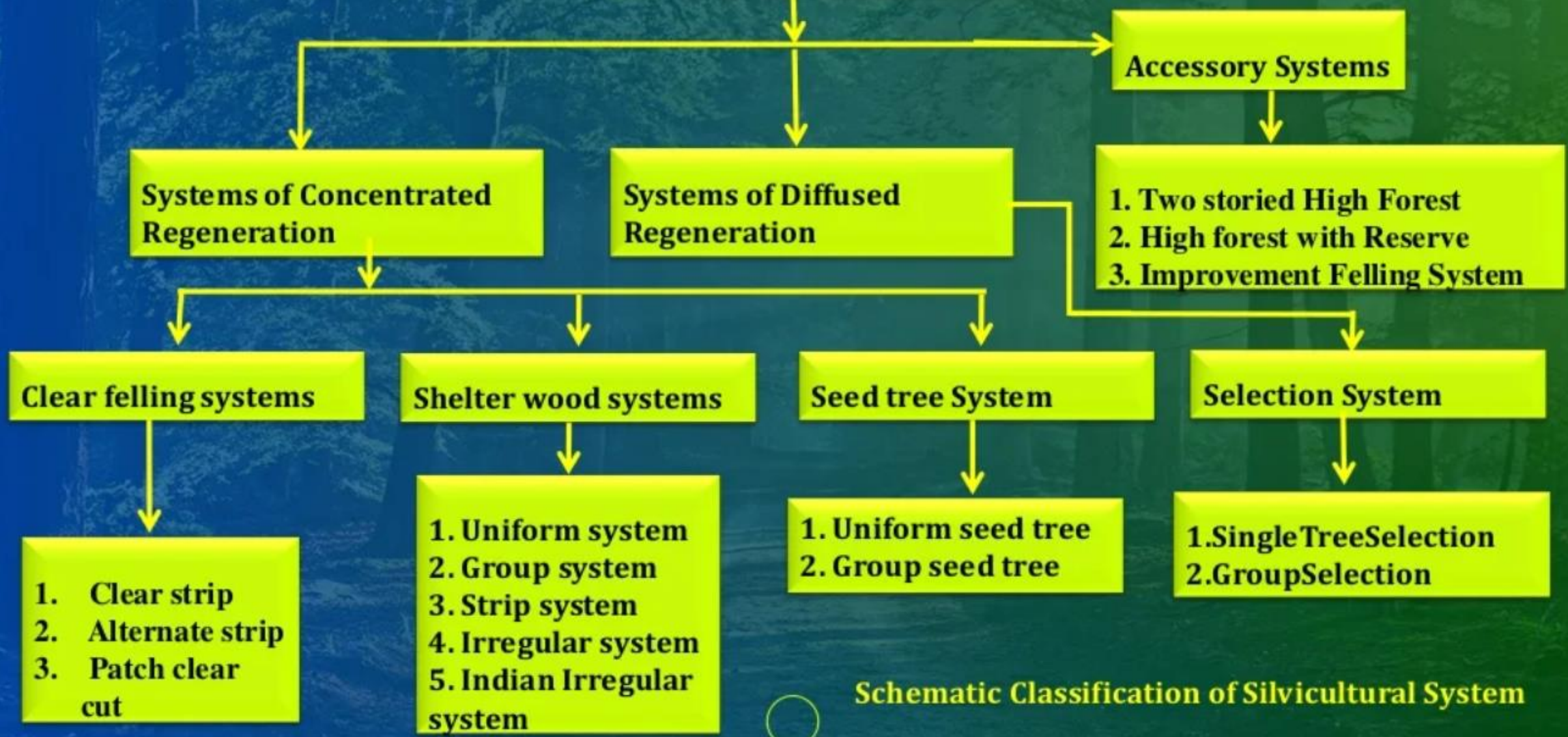
- A. High forest systems and
- B. Coppice systems

1) High forest systems:

High forest systems are those silvicultural systems in which the regeneration is normally of seedling origin, either natural or artificial or a combination of both and the rotation is generally long. The high forest systems are further classified on the basis of pattern of felling and mode of regeneration as well. A schematic classification of these systems is given here.



Classification of High Forests



Schematic Classification of Silvicultural System

Classification of Coppice System

That silvicultural system in which the crop originates mainly from coppice and the rotation is short is called coppice system.

Kinds of Coppice System (Low Forest System)

- Simple Coppice System.
- Coppice of Two Rotation System.
- Shelter wood Coppice System.
- Coppice with Standard System.
- Coppice with Reserve System.
- Coppice Selection System.
- The Pollard System



a) System of concentrated regeneration

Are those silvicultural system in which the regeneration felling are concentrated on a one part

1) Clear felling system



Soon after harvest



5-7 years
after harvest



15-20 years
after harvest

The clear felling system is a silvicultural system in which equal or equi – productive areas of mature crop are successively clear-felled in one operation to be regenerated most frequently, artificially but sometimes naturally also. The new crop produced is absolutely even-aged. It requires large sums of money and large number of laborers to regenerate the forest artificially.

Methods of obtaining regeneration:

The area can be regenerated sometimes naturally but mostly artificially
Artificial regeneration is preferred due to following reasons

1. It is the surest and quickest method of improving crop composition.
2. It facilitates introduction of fast growing and high yielding exotics.
3. It provides better financial returns.
4. The regeneration is established sooner, so the area can be opened for grazing sooner.

Method of Artificial Regeneration:

(I) Departmental plantation

(ii) Taungya

- Departmental Taungya
- Leased Taungya
- Village Taungya

Method of Natural Regeneration:

- Natural regeneration from seed
- Seeds stored in the area
- Seeds received from outside
- Natural regeneration from advanced growth

Advantages

- It is simplest of all high forest system. It does not require a high degree of skill.
- As felling is concentrated, the yield per unit area is more
- consequently the cost of felling and extraction is low.

Disadvantages

- It is the most artificial system.
- Soil remain open there is more danger of soil deterioration and erosion
- The danger of weeds and grass invasion increases.
- When the crop is pure it becomes more susceptible to damage by Insects, plant parasites and pathogens.



Variations in Clear felling system

1. Alternate strip clear cut system
2. Progressive strip clear cut system

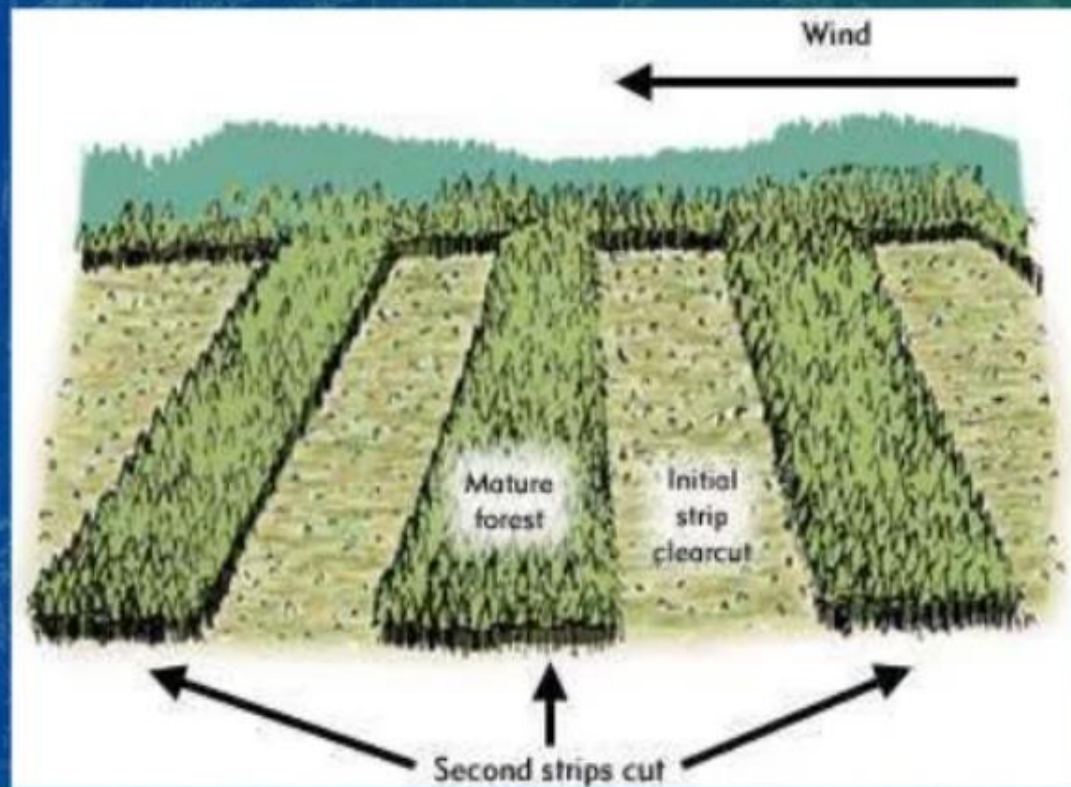


Fig -Pattern of felling in alternate strip

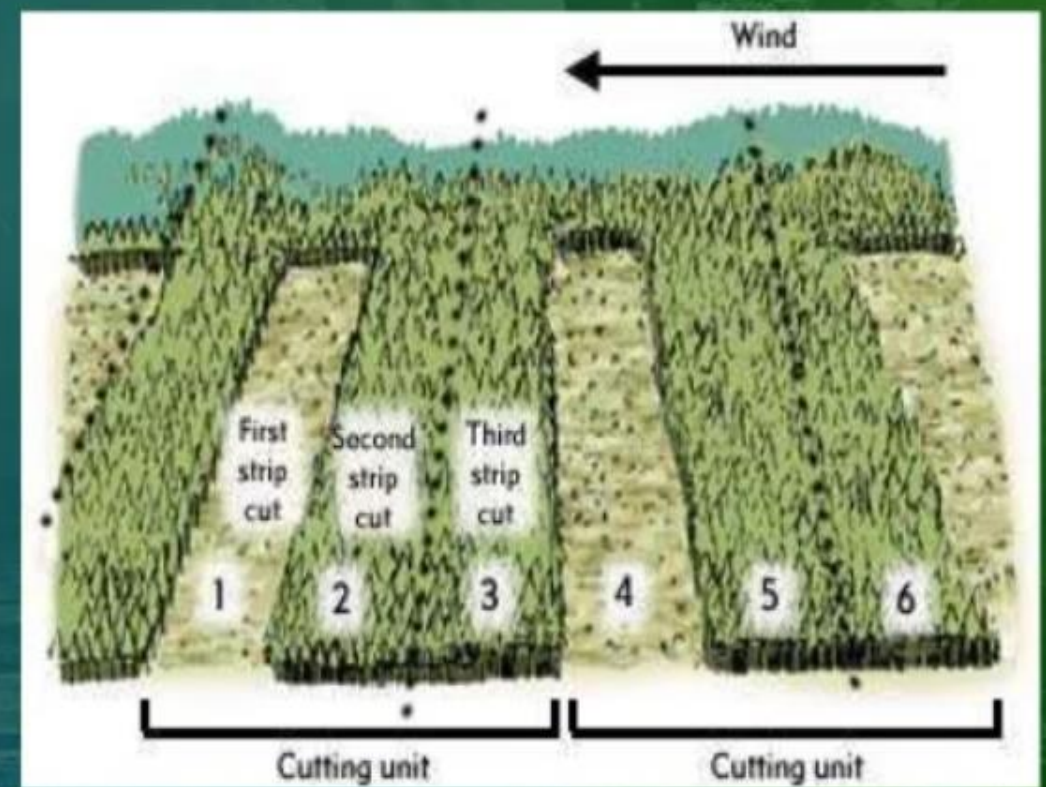


Fig-Pattern of felling in progressive strip

3. Block or patch clear cut system :

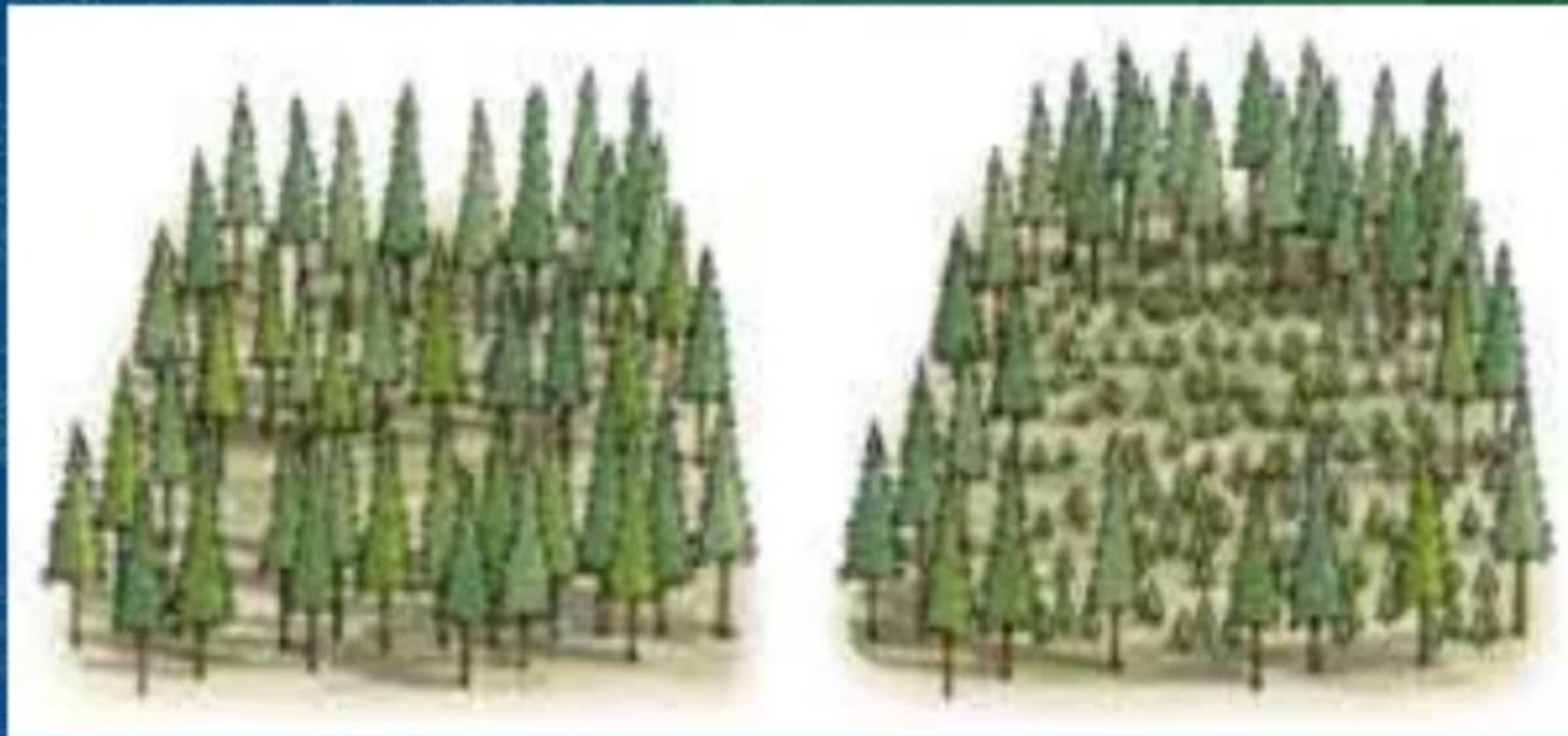


Fig - Patch clear cut system



b) Shelter wood system

A silvicultural system in which the over wood is removed gradually in two or more successive fillings depending on the progress of regeneration. The primary intent of this system is to protect and shelter the developing regeneration.

The trees which are growing vigorously are retained to provide shelter, Seed, rapid diameter increment and value increment and protection of site against deterioration.

Criteria for leave-trees in shelter wood systems are: larger, dominant trees, wind firm trees, desirable species and desirable physical characteristics .



Fig Shelter wood system



Fig -Shelter wood tree



Advantages

- Marking and felling of trees of the over wood are simpler than selection system
- Soil is not completely denuded so there is little risk of soil deterioration and erosion.
- As the regeneration operations are carried out under the shelter of older crop.
- As the regeneration is obtained from seeds obtained from best selected trees, the new crop is superior.
- Suitable system for the regeneration of both light demander and shade bearer saps.

Disadvantages

- As the over wood is removed in more than one operation, there is much damage to the young crop.
- After seeding felling, invasion by weeds and regeneration may be affected.
- weeding and cleaning have to be done for longer period and the natural regeneration becomes costly.



Pattern of Fellings

A. Preparatory Felling : A felling made under a high forest system, usually towards the end of the rotation, with the object of creating conditions favorable to seed production and natural regeneration.

Create gaps in the canopy

Create favorable conditions on the forest floor.

B. Regeneration felling :

1. Seeding felling : Opening the canopy of a mature stand to provide conditions for securing regeneration from the seed of trees retained for that purpose. It is the first stage of regeneration felling.

2. Secondary felling : A secondary felling carried out between the seeding felling and the final felling under a shelter wood system in order to gradually remove the shelter and admit increasing light to the regenerated crop. Removal of trees in secondary felling depends on progress of regeneration and its light requirement. It also helps in the manipulation of mixture of crop.



3. Final felling :The removal of the last seed or shelter trees after regeneration has been affected under a shelter wood system. It is the final stage in regeneration felling when the area is completely stocked with established regeneration



Fig - Patterns of felling in shelter wood system

Periodic Block:

It is necessary to divide the rotation period in to as many parts as the number by which the rotation is divisible by the time taken to regenerate an area.

Example;

If the rotation is 120 years and it takes 30 years to regenerate the area naturally.

The rotation will be divided into periods. As each of this part is felled and regenerated in a particular period, it is called a periodic Block.

$120/30 = 4$ periodic blocks

Age Class (Age of crop in years)



Kinds of Shelter wood Systems

1. Uniform shelter wood system(Uniform System)

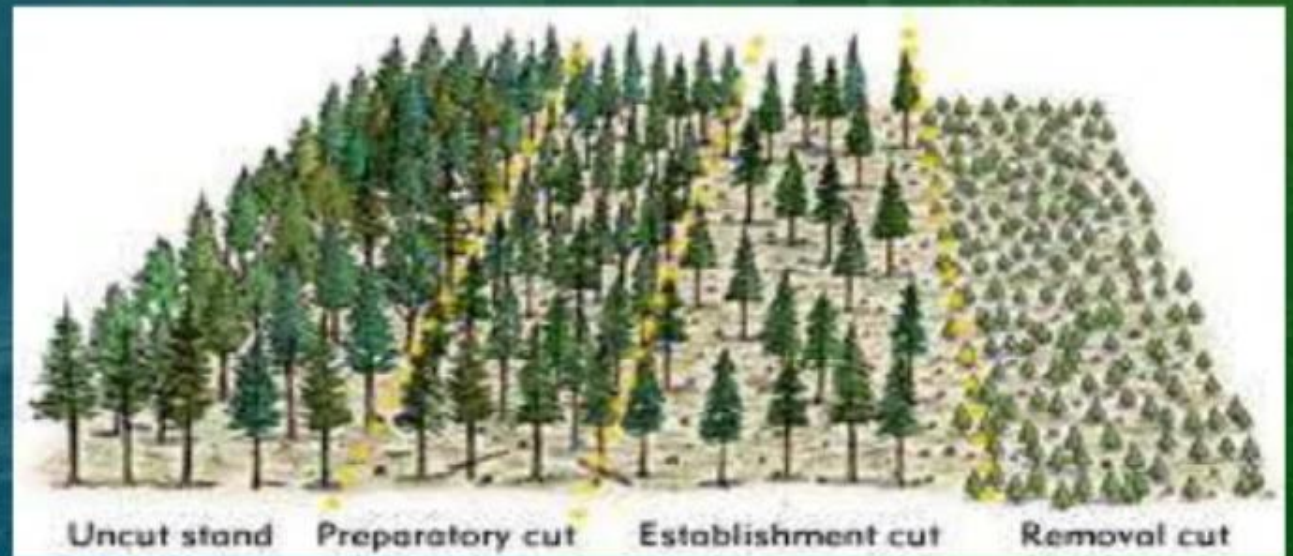
The canopy is uniformly opened up over the whole area of a compartment to obtain uniform regeneration under the shelter of remaining old crop.

2. Strip shelter wood system

Regeneration felling is done in the form of strips successively from one side of the compartment, progressing against the direction of wind. The width of the strip varies according to local conditions.



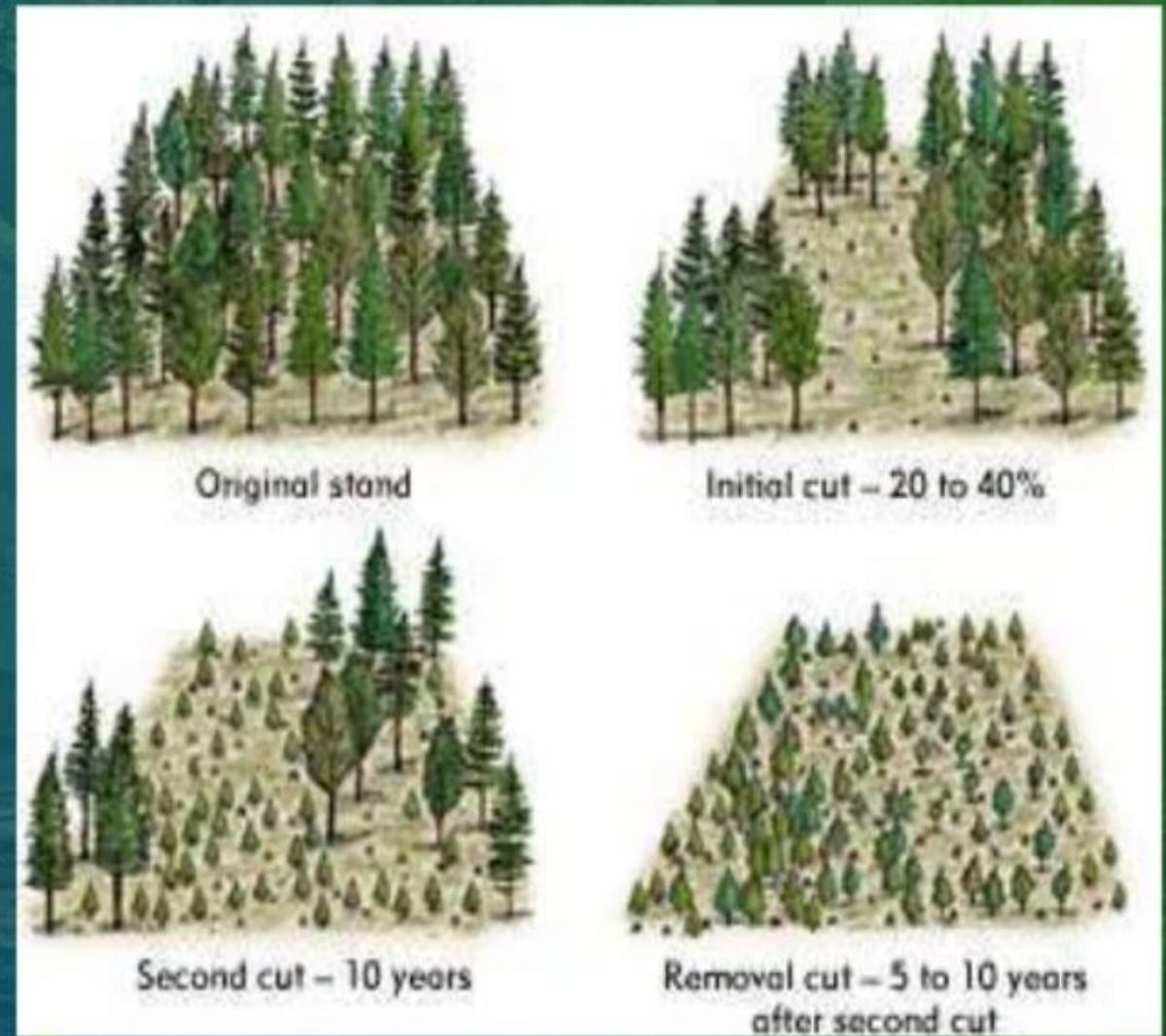
Uniform Shelter wood system



Strip shelter wood system

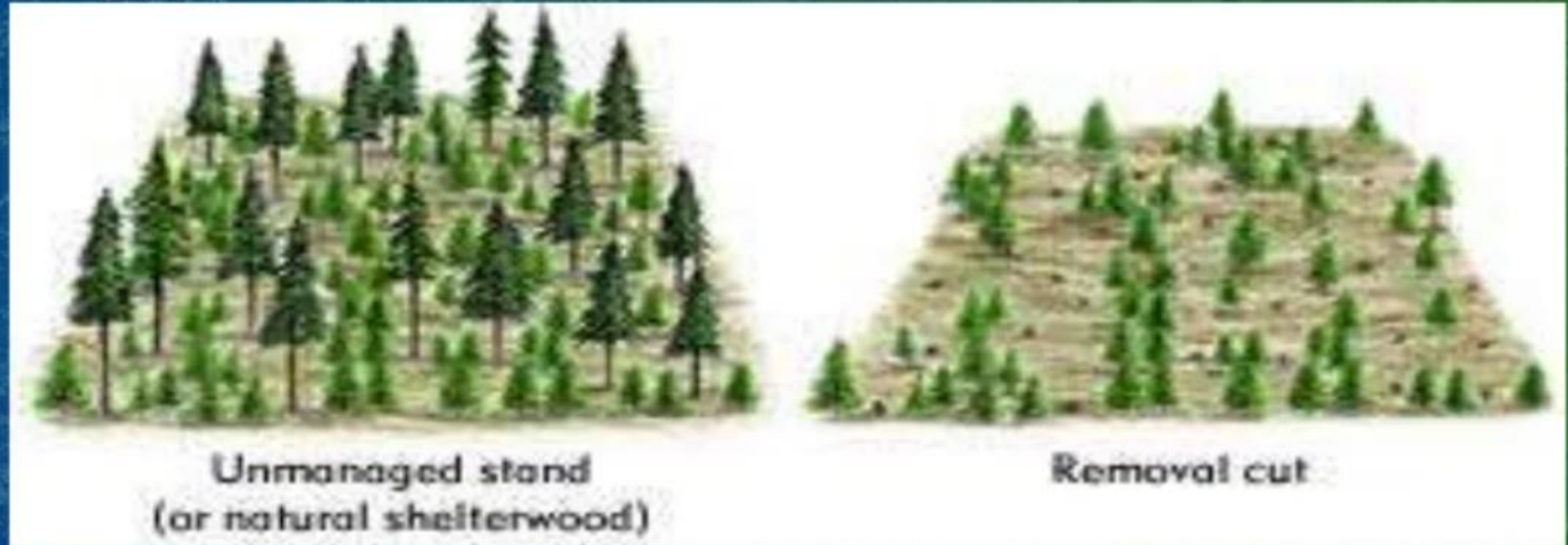
3. Group shelter wood system

A silviculture system in which regeneration fillings, instead of being done uniformly all over the compartment, are carried out in scattered groups in which the foci of regeneration can be enlarged centrifugally to merge with each other ultimately. Advance growth is the main source of regeneration. It was tried in Deodar, and Sal forests in India but it was not successful. Smallest circle for Final filling
Medium circle for secondary “
Largest “ for seeding Felling.



Group shelter wood system

4. One cut shelter wood system: In this system, regeneration felling is done in one operation. It is applied only when advance regeneration is well.



One cut shelter wood system



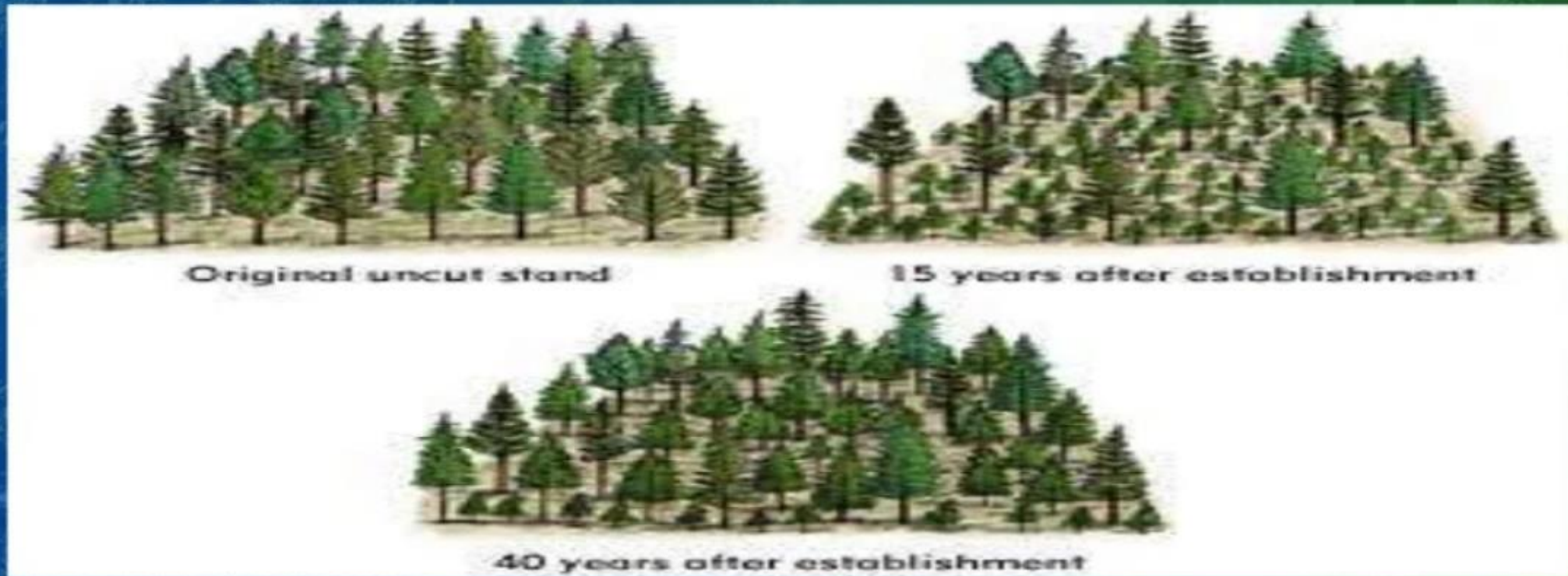
5. Indian Irregular Shelter wood System

Silvicultural System is which mature crop with recalcitrant regeneration having large quantities of advance growth of various ages and sizes including immature poles and trees up to 40 cm dbh , which are retained as part of the future crop to complete regeneration work . The crop to be regenerated is opened up irregularly and the resultant crop is uneven aged. This system is applied to Sal, Deodar, Fir, Spruce and other evergreen forests in India.



6. Irregular shelter wood system

Regeneration felling is on the pattern of group system but as the regeneration period is long, the crop produced is uneven aged or irregular.



Irregular shelter wood system

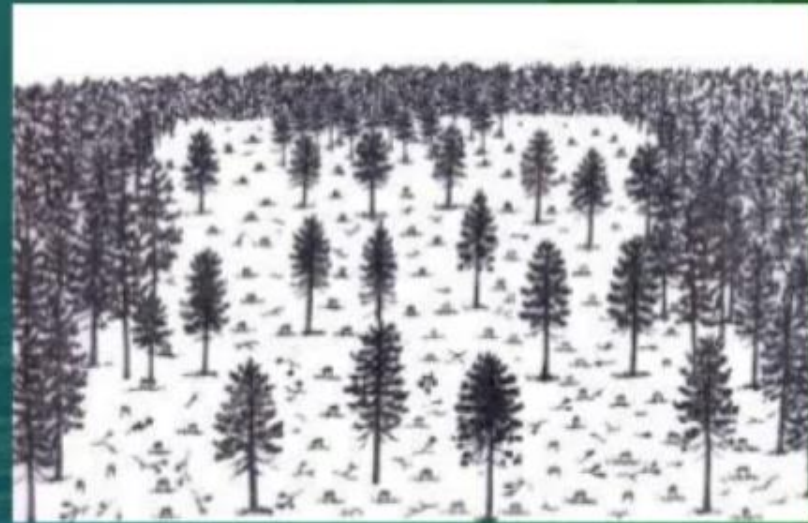


Seed tree system

In this method, the stand is clear felled except for a few seed trees, which are left standing singly or in groups to produce seeds for regeneration. After a new crop is established, these seed trees are removed or left indefinitely. The chief distinction from shelter wood system is that the seed trees are retained only for seed production and not enough to provide shelter. Seed Trees should have wind firm, seed producing ability with dominant crown and age of producing abundant seeds. Fig. see above.



Seed tree



Seed tree system



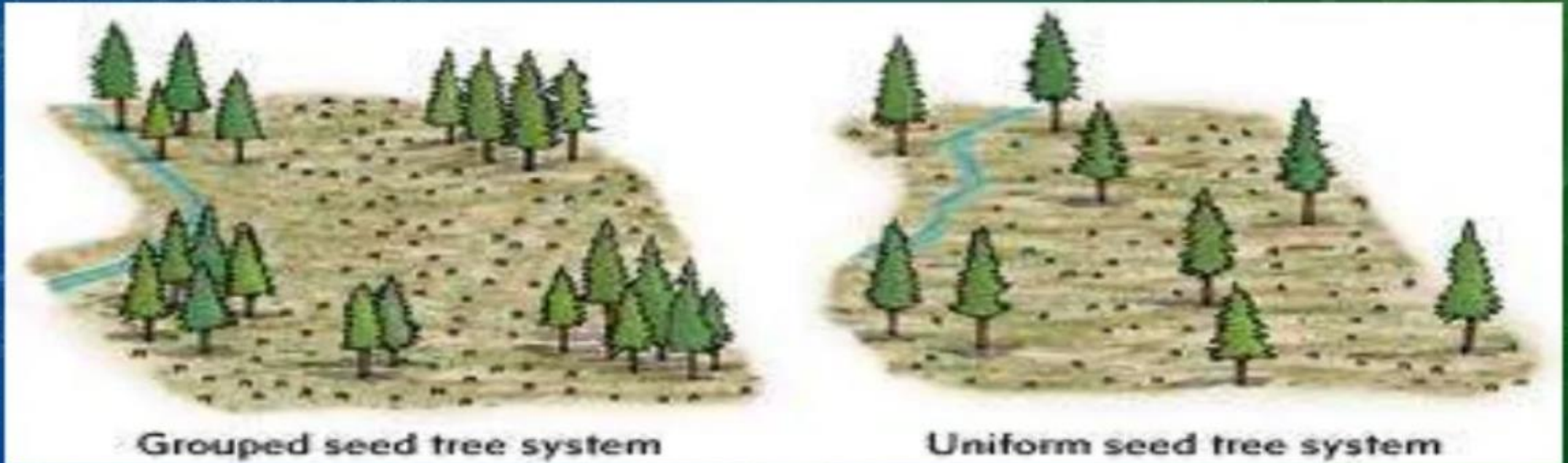
Kinds of Seed Tree System

1. Uniform seed tree system

In uniform seed tree system, individual trees are more or less uniformly distributed throughout the block.

2. Group seed tree system

In a group seed tree system, seed trees are left in the block in small patches. These patches may be arranged in irregular groups or in strips.



Number and distribution of seed trees depend on following factors:

- Amount of seed produced/tree
- The no. of seed required
- Seed Dissemination
- Number of viable seed produced
- Seed germination
- Seedling establishment

Advantage : Ample opportunity for phenotypic selection, suitable for light demanding species.

Disadvantage: Under stocking, over stocking, damage by forest and drought.



C) Selection system

A silvicultural system in which felling and regeneration are distributed over the whole of the area and the resultant crop is so uneven-aged that trees of all ages are found mixed together over every part of the area. Such a crop is referred to as selection forest or all-aged forest. Regeneration operation is carried out throughout the life of crop.



Selection system harvest stand

Ten year after harvest



Selection system

Advantages:

- It results in the production of all aged forest. Trees of all ages are mixed together on each unit of area. Then the growing space and site factors are fully utilized.
- By maintaining continuous leaf cover, the selection systems conserve soil and moisture to the fullest extent possible.
- The selection forest produced is most resistant to injuries by insect pests and adverse climate factors.
- It prevents invasion of grass and weeds.

Disadvantages:

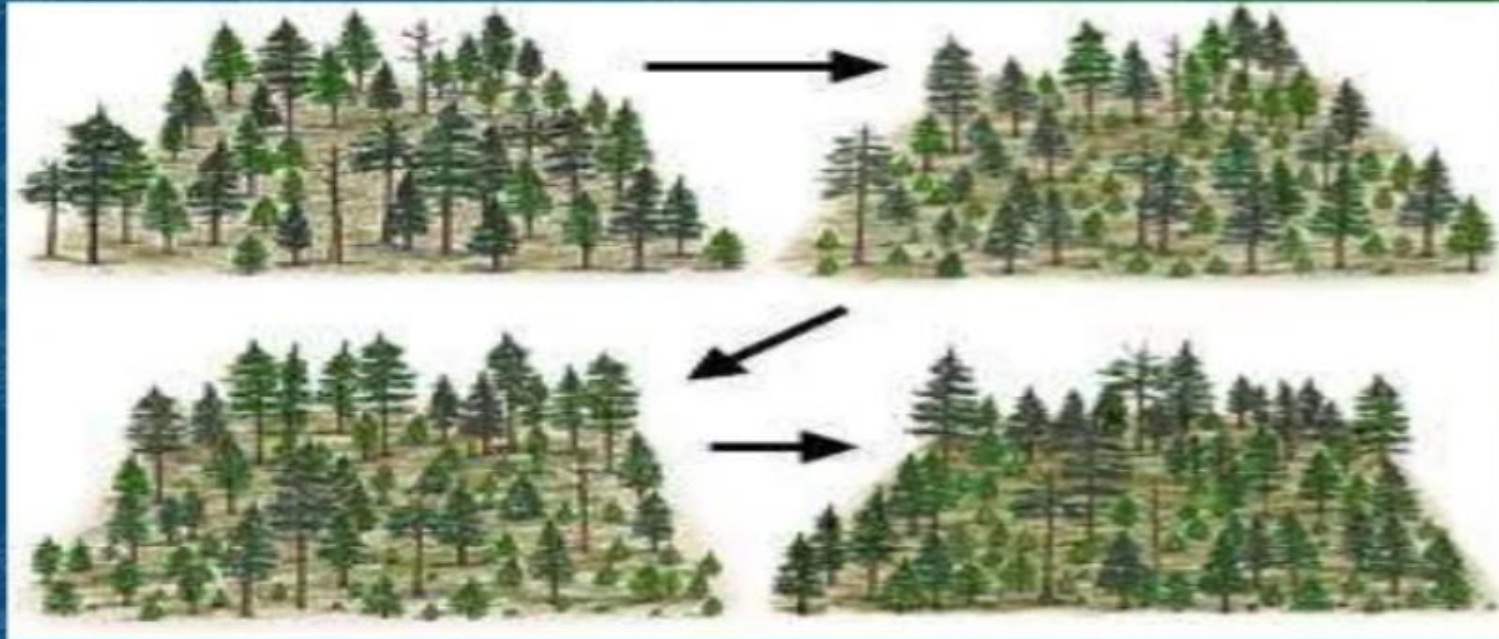
- Considerable skill is required in carrying out marking and felling to ensure regeneration to come up in the gaps. This requires knowledge of silviculture of spps.
- As mature trees to be removed are scattered, cost of logging and extraction is high.
- Felling, logging and extraction causes damage to the young crop.
- Seed is obtained from good as well as bad trees; there is genetic deterioration of future crop.
- There is much damage to regeneration by grazing.



Selection system

Selection system may be of following two types:

1. Single tree selection system: Single tree selection removes individual trees of all size classes more or less uniformly throughout the stand to maintain an uneven-aged stand.



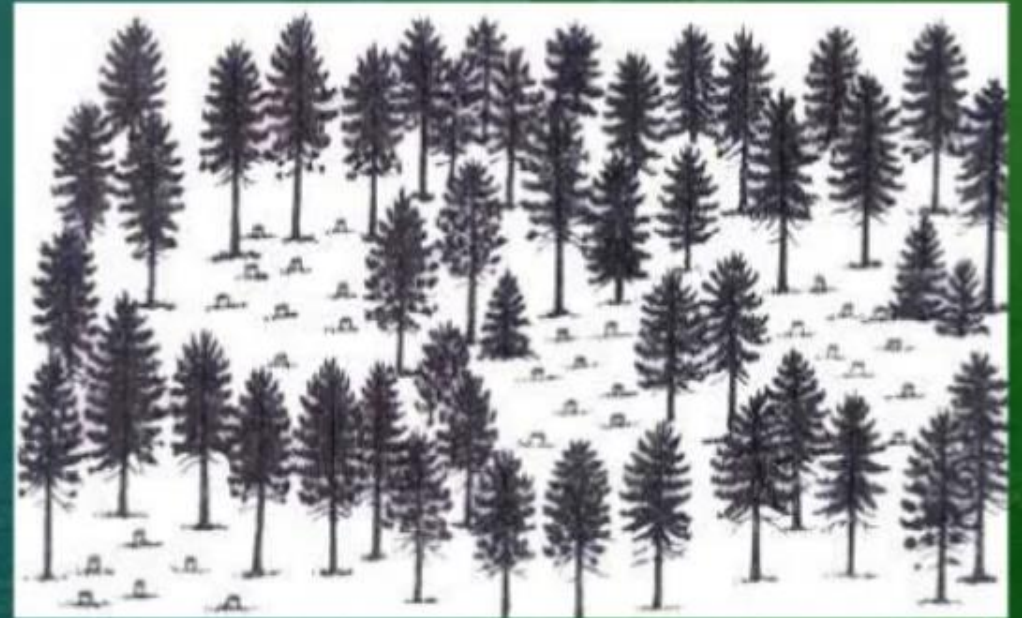
Single tree selection



Selection system

2. Group tree selection system

Group selection systems also promote uneven-aged stands with clumps of even-aged trees well distributed throughout the cutting unit.



Group tree selection system



Accessory System

Accessory systems refer to those high forest systems which originate from even-aged systems by modification of technique, resulting in an irregular or two storied high forest.

Kinds:

1. Two-storied High Forest System
2. High Forest with Reserves System
3. Improvement Felling System

1. Two-storied High Forest System

A system which results in the formation of a two-storied forest having two strata in the canopy, but each of different species. For instance, deodar in the top canopy and Quercus in the lower storey, etc. sometimes, it is obtained by under-planting with the following objects:

- (I) For soil protection.
- (II) For increasing the no. of valuable species
- (III) For propagation of species which can not be raised in the open



2. High Forest with Reserves System

An accessory silvicultural system in which selected trees of the crop being regenerated are retained for part or whole of the second rotation in order to produce large sized timbers. The recent trends of reserving some trees of the old crop in the clear-felling system is an example of this system. In uniform system some trees are retained at the time of final felling for light increment.

3. Improvement Felling System

Actually, improvement felling is not a silvicultural system as it neither aims at regenerating crop, not producing a crop of distinctive characteristics. Large areas of degraded and poor forests are likely to remain under improvement felling top repair them for eventual management aiming at bringing the forests to the normal state. It is only treated as an accessory system suggested by Trevor.



Improvement felling is defined as a method of treatment involving essentially the removal of inferior growing stock in the interest of better growth of the more valuable individuals. It is usually applied to mixed uneven-aged forests. The following operations are usually done in this fillings:

- (i) Dead, dying (>75% parts) and diseased trees
- (ii) Saleable unsound over-mature trees
- (iii) Unsound or badly shaped mature or immature trees
- (iv) Thinning of congested groups of poles and trees
- (v) Cutting back of badly –shaped and damaged saplings and advance growth
- (vi) Removal of undesirable undergrowth or trees of inferior species
- (vii) Climber cutting

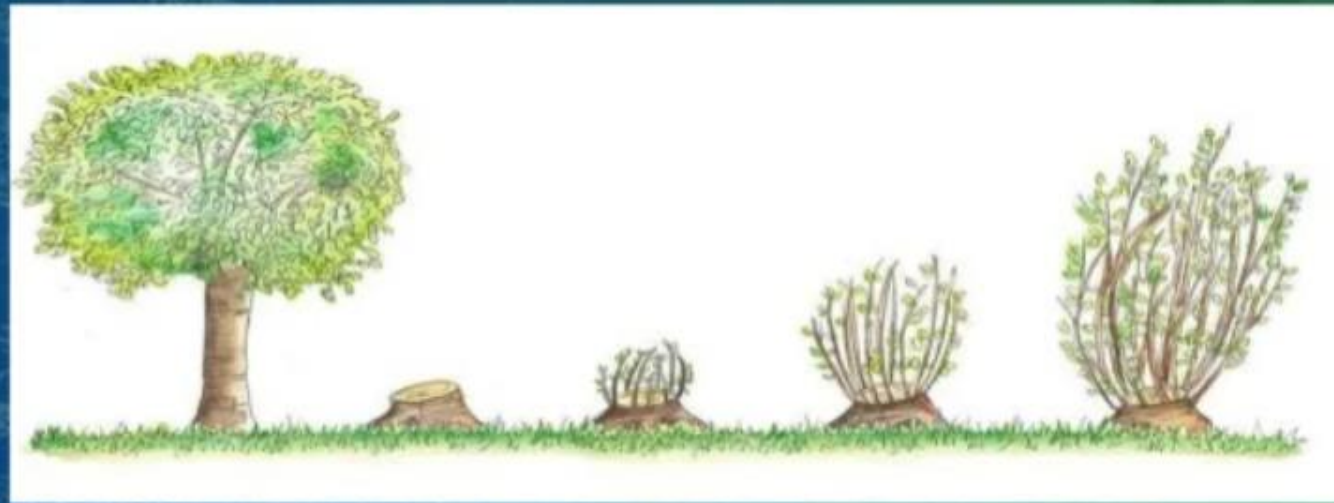


Coppice System (Low Forest System)

The silvicultural system in which the crop is regenerated mainly from stool coppice and with short rotation is known to be coppice system. Reproduction is obtained from the shoots arising from the adventitious buds of the stump of felled trees. Coppice systems are further classified on the basis of pattern of felling and mode of regeneration as well

1. Simple coppice system

A silvicultural system based on stool coppice in which the old crop is clear felled completely with no reservation.



Simple coppice System



Season for coppicing:

- The best season for coppicing is a little before the growth start in spring because at this time there is a large reserve food material in roots which is utilized by the coppice shoots.
- During the dormancy period. (from Nov. –Feb./March)

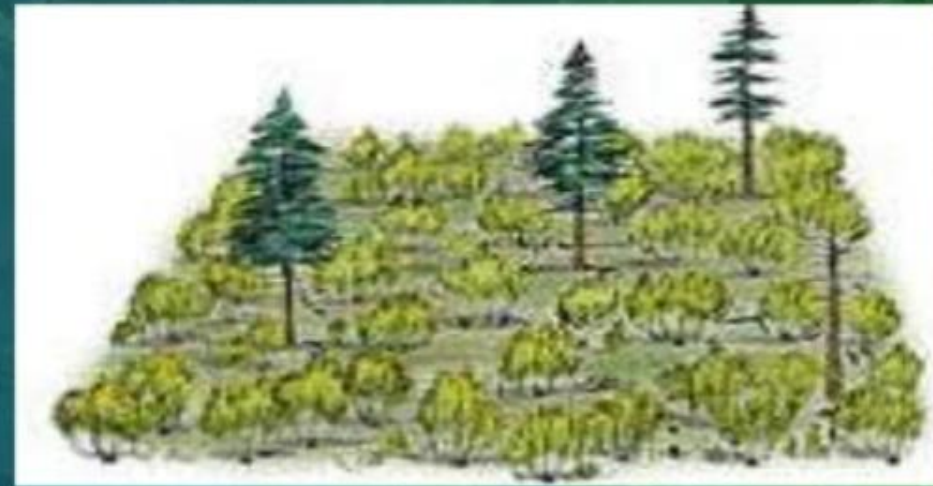
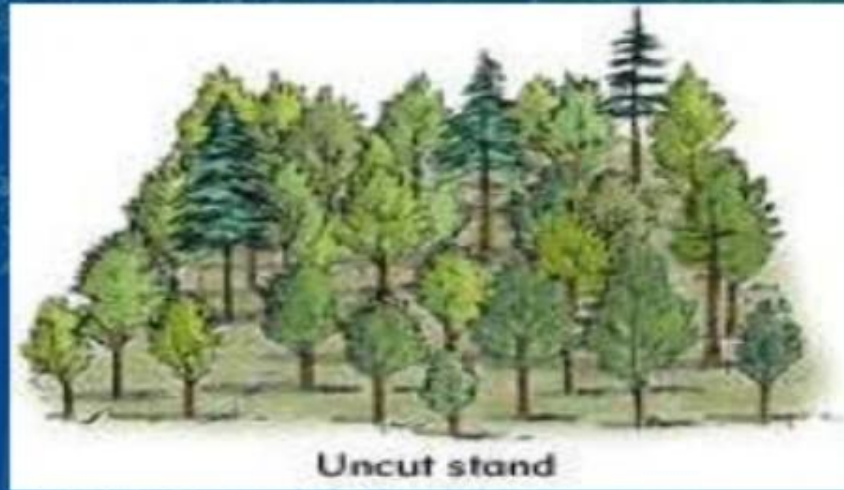
Method of felling:

- The stump should neither be too low nor too high.
- The lower the stump, the better it is for coppice shoot.
- But if the trees are cut very low there is a danger of the stump splitting and or drying up from top.
- On the other hand, the higher the stumps, the greater the possibility of shoots being damaged by wind or animals. Stumps are usually kept, 15-25 cm high. (10 cm for eucalyptus)



2. Coppice with standard system

It is silvicultural system based on stool coppice in which over wood of standards, usually of seedling origin and composed of trees of various ages, is kept over coppice for a period of multiple coppice rotation. It is usually applied in shade-tolerant species.



Coppice with standard

Purpose of standards: (i) To supply large size timber (ii) To protection against frost (iii) To enrichment of coppice (iv) To provide seedling regeneration (v) To increase in revenue



Advantages:

There is greater protection to the soil.

Advantage of heavy shelter wood felling and selection system.

Standards serve as seed bearers and provide seed.

The investment is small and the net return is higher.

Aesthetically superior than simple coppice.

Disadvantages:

It requires great skill in maintaining correct balance between standards and coppice and between standards of different age classes.

This is a combination of simple coppice system and high forest system with the advantage of none. It has an exhaustive effect on soil.

Felling and extraction cost is higher than high forest



3. Coppice with Reserve system

A silvicultural system in which felling is done only in suitable areas likely to benefit, after reserving all financially immature growth of principal as well as other valuable miscellaneous species, either singly or in optimally spaced groups, trees yielding products of economic importance and protective reasons, first introduced in 1934-35.



Reservation by area



Pattern of felling:

In this system, the emphasis is not on felling but on conservation. Distinguish areas which, require protection or some improvement felling and areas in which felling can be done according to the requirement of crop, local people, and site..

Tending:

Tending should be done-clearing, climber cutting, and reduction of coppice shoots.

Character of the crop

The resultant crop under this system comprises of irregular groups of even aged coppice with uneven aged reserve crop scattered irregularly. Thus, taking the crop as whole, it is uneven aged.

Advantages:

It helps in improving the quality of locality as a result of soil and moisture conservation, maintenance of crop mixture.

It helps in improving the condition and composition of crop.

It fulfills the needs of local population and the requirement of industries.

Thus it offers best financial returns per unit area.

Disadvantages:

Its execution requires a high degree of skill.

Reservation of a large number of trees affects coppice growth adversely



Conditions of applicability:

- When the crop varies greatly in density, composition, and quality and population of valuable species is low .
- When most of the species are good coppices and the coppicing power of most valuable species is vigorous.
- When valuable species in the crop is light demanders.

Coppice with reserves system is not suitable:

- When valuable species are shade bears and frost tenders.
- When there is likelihood of invasion of fast growing obnoxious weeds, shrubs, and grasses such as *Lantana*, and *Imperata*.
- When the crop does not contain valuable species and there is no hope to improving it by coppicing.
- When it is not possible to protect the area against fire and grazing at least for five years after main felling.



4. Coppice of Two Rotations System

A coppice system based on stool coppice in which after the initial coppicing of the crop at the beginning of the first rotation, part of the crop is not coppiced to produce large sized timber. The number of trees so reserved from being coppiced again in the second rotation, depends on the quantity of large sized timber required in the market.

5. Shelter wood Coppice System

A coppice system in which even in the initial coppicing, shelter wood (of almost 125 to 150 trees per ha) is retained for frost protection.

It is specially suited to frost tender species in frosty localities and forest hardy species, promising are selected, which are removed gradually when the coppice shoots are fully established and are free from frost danger. When coppice shoots are 5 years old, the shelter trees are to be reduced to 63 to 75 and after 10 years, all the shelter trees are removed. The resultant crop is even aged.



6. Coppice Selection System

A coppice system in which fillings are carried out on the principles of selection system, but regeneration is obtained by coppice. The resultant crop is uneven aged . can be suitably applied in *Acacia species* and also applied for the management of small area of poor quality shorea forest.

7. The Pollard System

Pollard is defined as a tree whose stem are cut off in order to obtain a flush of shoots, usually above the height to which the browsing animals can reach. This system is suitable when demand of fuel wood and fodder is high. For example, salix, Hardwickiabinata, etc species are suited for pollarding, which have high coppicing power.



Considerations for Silviculture Systems

A good silvicultural system is a long-term program of treatment designed to fit a specific set of circumstances (Smith, 1962).

A rational silvicultural system for a particular stand should fit logically into the overall management plan for the forest of which the stand is a part and represent the best possible amalgam of attempts to satisfy all the following major considerations:

1. Harmony with goals and characteristics of ownership
2. Provision for regeneration
3. Efficient use of growing space and site productivity
4. Control of damaging agencies
5. Provision for sustained yield
6. Optimum use of capital and growing stock
7. Concentration and efficient arrangements of operations
8. Resolution of conflicting objectives



A scenic landscape featuring a calm lake in the foreground, surrounded by large, grey rocks on the left and a dense forest of evergreen trees on the right. In the background, a small wooden cabin is nestled among the trees, and a prominent, jagged mountain peak rises against a clear sky. The entire image is overlaid with a gradient that transitions from a deep blue on the left to a vibrant green on the right. Centered in the upper half of the image is the text "THANK YOU!" in a large, white, sans-serif font. A thin, bright yellow horizontal line is positioned directly beneath the text.

THANK YOU!