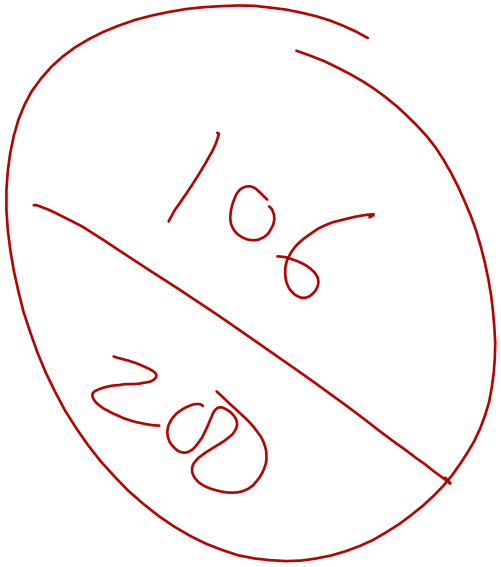
Hornbill Classes	**HORNBILL CLASSES** Forestry Optional
IFoS | 2023 | Main Test Series | Test Paper 1	
Name of candidate	Shashank Bhardwaj
Date	
Examination	IFoS (Main) 2023

Index Table		
QN	Maximum Marks	Obtain marks
1 (a)	8	4.5
1 (b)	8	3.6
1 (c)	8	4
1 (d)	8	4
1 (e)	8	2
2 (a)	15	
2 (b)	15	
2 (c)	10	
3 (a)	20	
3 (b)	10	
3 (c)	10	
4 (a)	15	8.5
4 (b)	15	8
4 (c)	10	6
5 (a)	8	4
5 (b)	8	4.5
5 (c)	8	5
5 (d)	8	4.5
5 (e)	8	4
6 (a)	15	
6 (b)	15	
6 (c)	10	
7 (a)	15	9
7 (b)	15	8.5
7 (c)	10	6
8 (a)	15	7
8 (b)	15	7
8 (c)	10	5.5
		105.5



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Answer Questions in NOT MORE THAN the Word Limit specified for each in the Parenthesis.
(Specimen Answer Booklet - For Practice Purpose Only)

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1. (a) **Mycorrhiza** is a **symbiotic relationship** between fungi and roots of vascular plants.
- Composed of **hyphae** (tubular filaments) and **mycelium** (mass of hyphae)

100%

Types

- **Ecto-mycorrhiza** – Penetrates between cells
- **Endo-mycorrhiza** – Penetrates inside cells
- **Ecto-Endo mycorrhiza** – Presence of both ecto and endo mycorrhiza.

4.5

Role in successful plantation

- Produce growth hormones like Auxins, gibberellin
- Work as **phosphorous bank**
- Resistance to root Pathogens
- Improves water absorption ⇓ Enhances drought tolerance
- Increased resistance to heavy metal toxicity
- Increased mineral absorption

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(b) Tree develops from seed (or coppice) to form a well developed bole.

3.5

Different growth stages of trees

Seed (Recruit.) → Seedling → Sapling → Pole → Tree (bole) → Stand

Seed

Seedling
- Established root and shoot
- Height < 1m

Sapling
- Branching starts
- Height > 1m
- Absence of dead bark

Pole
- fall of lower branches
- Height ~ 6m
- Bark starts developing

Tree (bole)
- Proper primary and secondary branching

Stand
- Group of trees.

Explain them properly.

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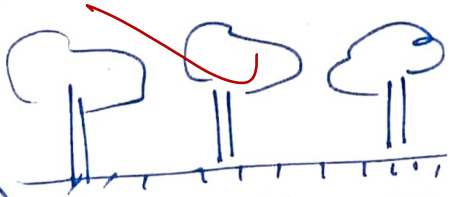
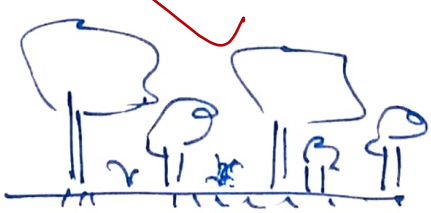
(c) **Stand** is an area composed of trees with specific characteristics. Based on age of trees of stand, it can be classified into even-aged and uneven aged stand.

Defining Stand Problem

Even-aged stand	Uneven-aged stand
1) Stand has almost same age of trees.	1) Different aged trees.
2) Greater uniformity in trees' size and shape	2) lesser uniformity
3) Lighter canopy due to small crown development	3) More canopy cover
4) Longer clean bole	4) Knots may be present in more number of trees
5) Adversely affected by wind, snow, insect attacks.	5) More protected.



e.g Poplar plantation in Terai region



e.g Core area of Valmiki Tiger reserve.

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(d) Forest regeneration is a process of renewal of and replacement of old crops with younger ones.

Role of fire in forest regeneration

Like grazing, fire is a good servant but a bad master. Therefore, controlled burning can be beneficial for forest regeneration in following ways:-

1) Protects from forest fire as it removes litter material from forest floor. e.g Pinus roxburghii forest in Himachal Pradesh.

2) Burnt material provides organic manure that enhances soil structure

3) Seed treatment - e.g Tectona grandis (Teak).

However, uncontrolled fire may destroy the forest structure. e.g Nhadi wildlife sanctuary fire (March, 2023)

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(c)

~~Cover Crop~~ Nurse Crop

- It is a crop that protects the principal crop from stressed climatic conditions like solar radiation or frost.
- e.g Arhar and castor protects seedlings of Shorea robusta (sal) from intense sunlight.

(2)

~~Nurse Crop~~ Cover Crop

- It is a crop that enhances soil structure, moisture and creates favourable condition to regenerate the main species.
- eg Indigofera spp. is used to nurse ~~Tectona~~ grandis (Teak) seedlings.

Diagram

Prevent Soil Erosion.

Prevent Soil Erosion

Grass (Cover Crop)

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4.(a) **Dormancy** - It is the state of physiological inactivity in which viable seed doesnot germinate even in presence of a favourable environment.

Good!

Pre-sowing seed treatment helps in overcoming dormancy in free seeds in following ways :-

Good!

b) **Exogenous dormancy** caused by hard seed coat can be removed by following seed treatment:-

1) Water soaking for 24-48 hours - e.g Dalbergia Sissoo

2) Alternate wetting & drying - e.g Tectona grandis

3) Mechanical Scarification. e.g Acacia nilotica

4) Acid treatment - eg Acacia catechu

5) Hot water treatment for few minutes - e.g

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Prosopis juliflora.

6) Fire treatment of seeds - e.g. Teak.

↳ (Endogenous dormancy), caused by immature embryo, can be overcome by following seed treatments —

1) Cold stratification - e.g. Cedrus deodara

2) Gamma ray treatment

3) Gibberellic acid treatment

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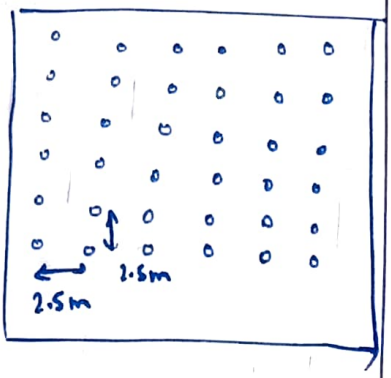
(b) **Square planting pattern**

Here, distance between row to row and plant to plant is same.



Number of plants required per Hectare $= \frac{100 \times 100}{\text{Square of planting distance}}$

$= \frac{100 \times 100}{2.5 \times 2.5}$

$= 1600$

for 10 ha, number of plants required $= 1600 \times 10$

$= 16000.$

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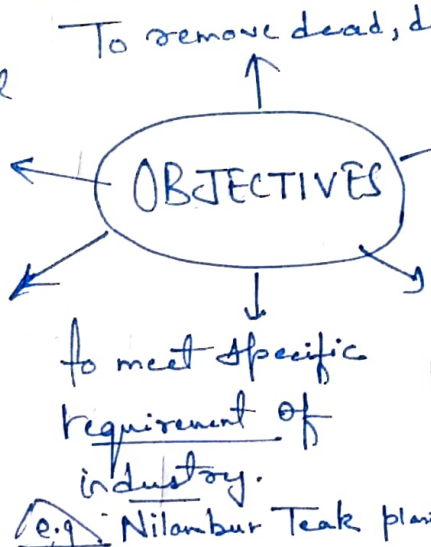
(c) **Thinning operations** are set of felling operations made in an immature stand for purpose of improving growth and form of trees that remain without permanently breaking the canopy.

4 marks



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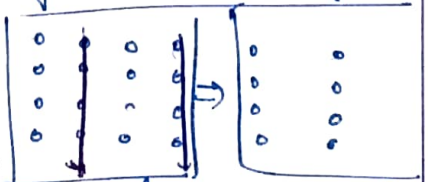
Different Kinds of Thinning

1) **Mechanical thinning** involves removing trees using some thumbs rule. eg Alternate line removal usually applied to young plantation.



2) **Free thinning** – under this 'elite' trees are selected first with respect to stem form and uniform spacing. Then, remaining crop is considered from

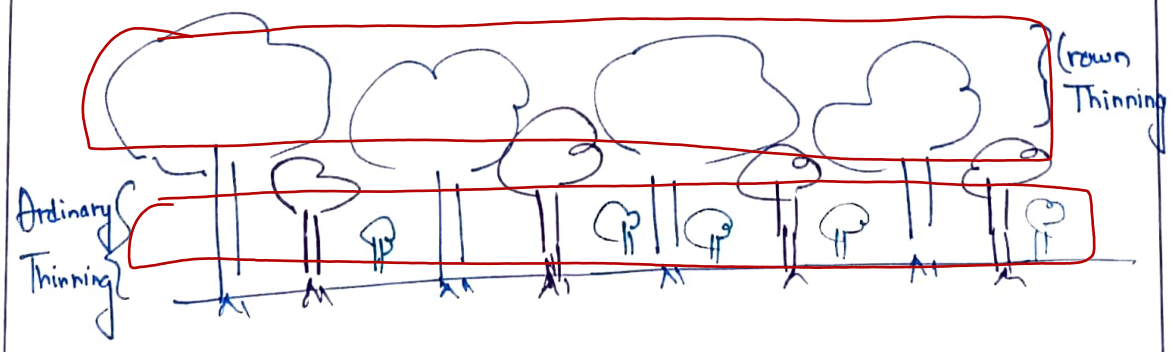
point of view of their effect on elites.

3) Advance thinning is carried out before competition among individual trees has set in.

Explain it below

4) Numerical thinning is carried according to stand density index.

5) Ordinary thinning is the process of removal of inferior individuals starting from suppressed class and then taking the dominated class.



6) Crown thinning - less promising trees of top crown are removed in interest of best individuals.

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5(a)

Mangroves are characteristic littoral plant formation of tropical and sub-tropical sheltered coastlines.

According to Indian State of forest Report 2021, Mangrove cover accounts for 0.15% of India's geographical area (4992 Km^2).

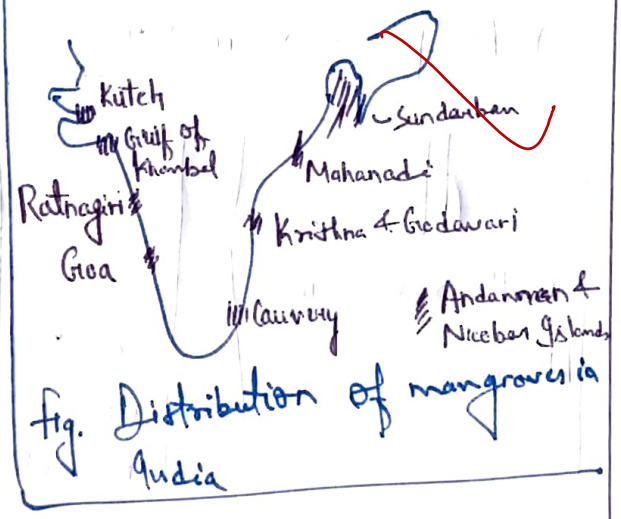

fig. Distribution of mangroves in India

CHARACTERISTIC FEATURES

Climatic Factors
- Strong cyclonic winds
- Salt spray

Oceanic factors
- High saline water
- Diurnal tidal inundation

Edaphic factors
- Anaerobic soil condition
- Nitrogen deficiency

Wildlife - Bengal Tiger, Saltwater Crocodile etc.

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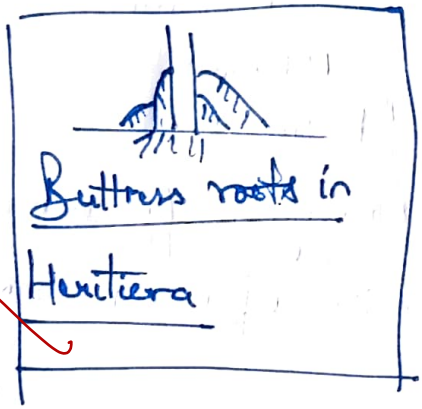
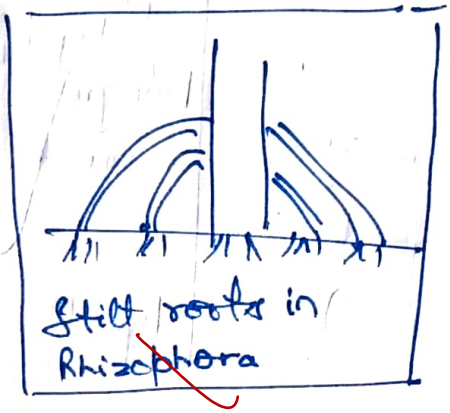
↳ further, Mangroves show following characteristics :-

1) Evergreen ecosystem

2) Adaptations in roots — e.g



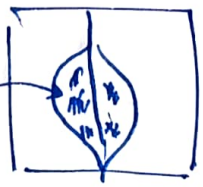


Write flow. 2/3 line. Properly in an paragraph writing way.

3) Viviparity - seeds germinate in tree itself before falling down.

4) Lenticellated bark facilitates more water loss.

5) leaves have Salt secreting glands



6) High cell osmotic concentration.

(b) Cold desert is region experiencing cold weather and denuded terrain.

fig. Distribution in India

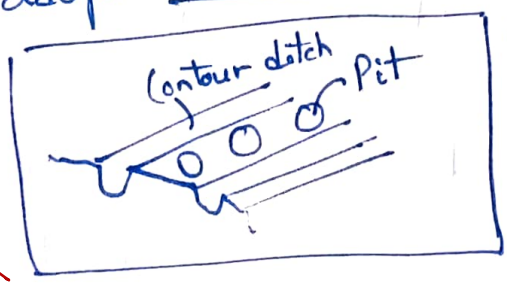
Problems in Afforestation

1) Edaphic factor – Shallow & stony soil ⇒ poor moisture & nutrient
2) Topographic factor – Steep slope ⇒ soil erosion
3) climatic factor – low rainfall & high insolation
4) Biotic pressure – e.g. grazing and browsing.

AFFORESTATION TECHNIQUES

Techniques consider conservation and effective utilisation of soil moisture and nutrients.

↳ for gentle sloping and stony areas, we adopt Trench ~~cum~~ pit type :–



- Contour ditches at 10 m interval
- Between this, pits at spacing of 2 × 2 m.
- Pits filled with dug up soil & fresh silt.

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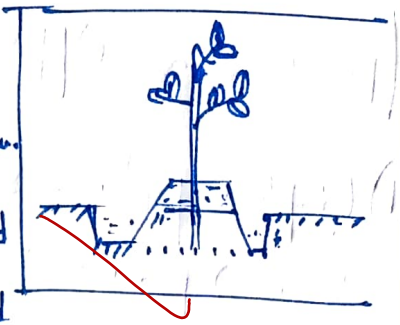
↳ for low lying areas, irrigation cum trench type technique is used. Here, we follow steps:-

- Planting in 40-50 cm crowbar hole.
- Mounds of 45 cm around plant
- Ditch either side of planted row.
- Excess water from ditches drained through artificially constructed channel.
- Protection of seedlings from grazing is required.



↳ further Choice of Species is an important aspect. Some of the preferred choices are-

1) Salix alba (willow)
2) Betula utilis (Birch)
3) Populus deltoides (Poplar)
4) Rhododendron campanulatum (Rhododendron)
5) Pinus gerardiana - Chilgoza
6) Sea buckthorn.

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(c) Tectona grandis (Teak, Verbenaceae) is a medium sized, light demander tree that grows naturally below 24°N latitude. (South Asia and South East Asia).

Teak starts flowering in April–June and fruiting in November to January.

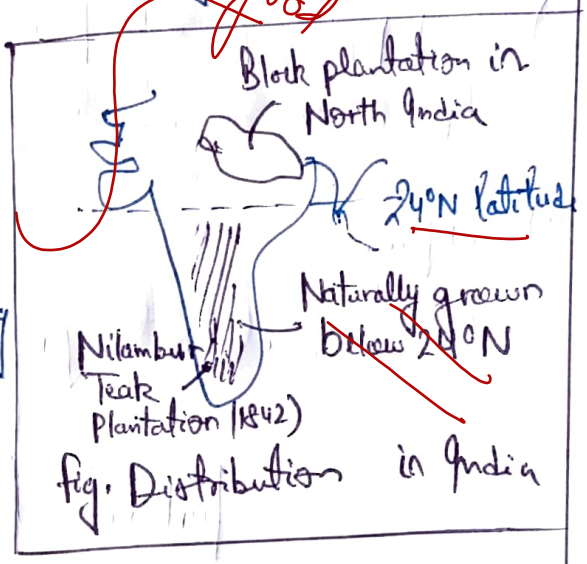

fig. Distribution in India

ARTIFICIAL REGENERATION

Due to increased demand in timber industry and to improve quality and quantity of tree bole, various artificial regeneration methods are applied:-

1) Direct seed sowing by hand broadcasting or dibbling in linear format.

It is to be mentioned that seeds of Teak require weathering treatments to remove its hard seed coat dormancy.

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2) Planting of 1-2 year old nursery raised seedling.

3) Stump planting - stump with root-shoot portion of about 20-25 cm long.

4) (office

5) Budding, cutting, layering, grafting etc.

Further, Artificial regeneration must consider tending operations to stimulate growth and to protect it from pest-weeds.

Weeding and cleaning is done in initial years. Thinning is done after 5 years and then at increased intervals.

5

(a) Storied High forest system is a type of silvicultural system where each storey is generally even-aged and are of seedling in origin.

Here, canopy can be differentiated into two or more strata. (e.g. Chir and Sal in Uttarakhand forest

2-storey High forest system

ADVANTAGES

1) Enhances soil productivity

2) useful to shade bearing trees. (eg (cedrus deodara (Deodar)

3) Tree site is more effectively utilised. ⇒ more crops per unit area.

4) Due to different strata, we will get early and relatively continuous returns financially.

5) Protects from frost, wind pressure and from pest-insect attack.

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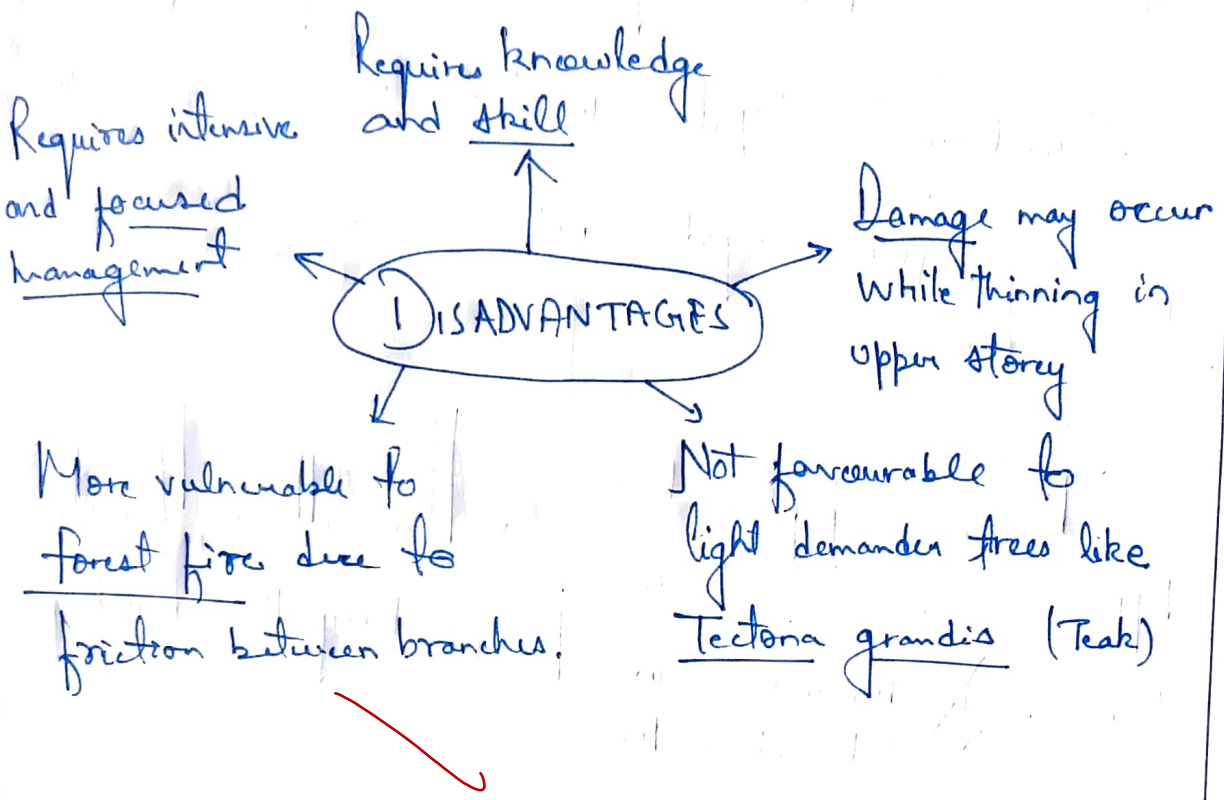

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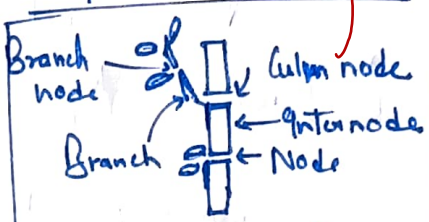
(e)

Bamboo is regarded as "Green gold." It includes number of species. Each species require different management techniques.

Generally, Silviculture system follows selection cutting combined with cleaning and cultural operations.



Anatomy of Bamboo

FELLING RULES

1) Felling cycle of 3-4 years
2) Bamboo to be felled are marked at breast height
3) Cutting of 1-2 year old culms are restricted.
4) Certain old culms are retained for general protection.
5) Bamboo should be cut at height of 15 cm, leaving at least one node.

5

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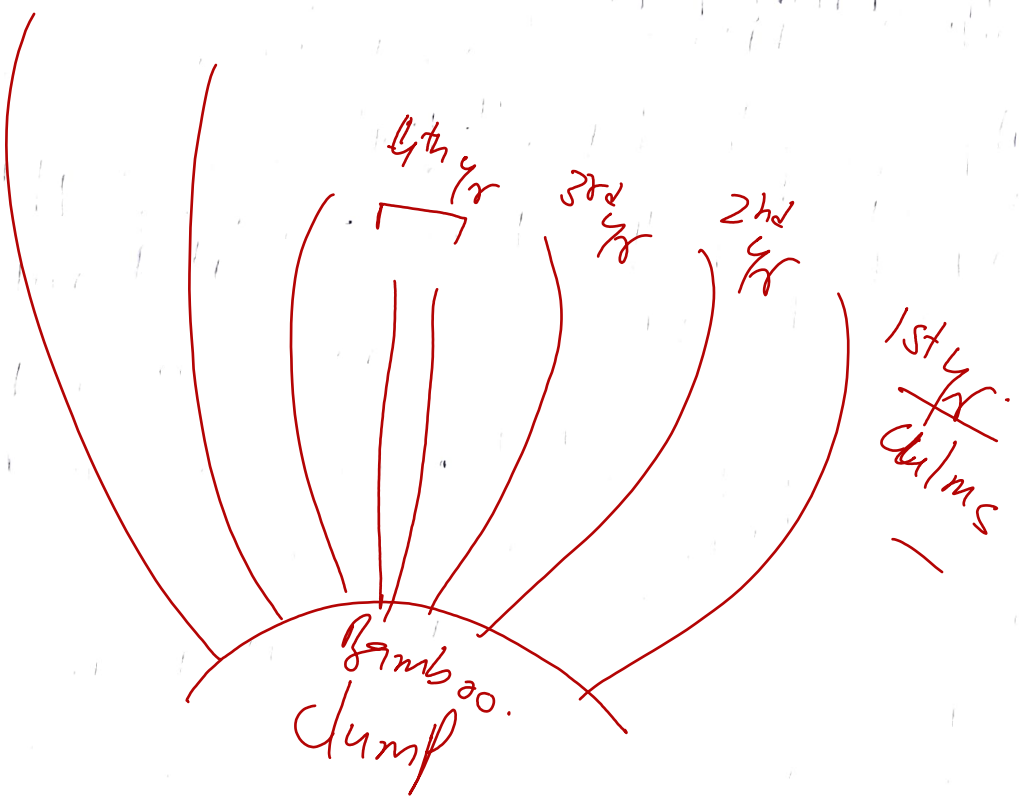
6) Cutting is done with sharp instrument to avoid Spliting.

7) Bamboo should be cut after seed shed to encourage natural regeneration

8) ~~Lopping~~ should be avoided.



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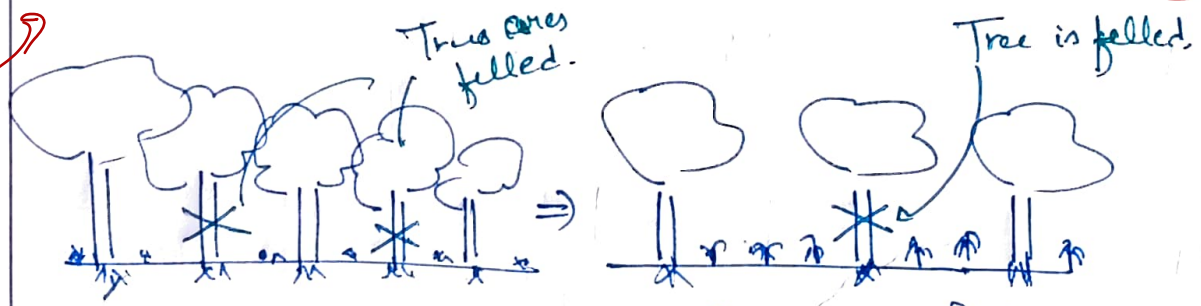
7.(a) Uniform Shelterwood System is a type of Silviculture System where canopy is uniformly opened up over the whole area of a Compartment. Through a Series of felling duration. Some seed bearers are retained per hectare.

KINDS AND PATTERNS OF FELLING



Seeding felling

Secondary felling

Final felling

fig. showing patterns of felling in Uniform System

1) Seeding felling: It is the process of opening up of canopy of a mature stand to provide conditions for securing regeneration from seeds.

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- **Secondary felling** is carried out between seeding and final felling in order to gradually remove shelter and to admit more light to regenerating crop.

- **Final felling** is the process of removal of last seed or shelter trees after regen. has been affected under shelterwood system.

Cedrus deodara forest mixed with Pinus wallichiana

Shade bearer Deodar is often mixed with light demander Kail.

- In case of Deodar, 45-50 seed bearers per hectare are retained during seeding felling.
- In case of Kail, 25-30 seed bearers per Ha retained.

Draw Map like this

- Seeding felling is done first to suit Deodar and then overwood is opened up to facilitate Kail's regeneration.
- After fellings, slash is cut, collected and disposed before snowfall.
- Area is closed to grazing and strictly fire protected.
  Grazing is allowed to areas where regeneration is established.
- During secondary felling, overwood is gradually opened up as regeneration progresses.
  Natural regeneration is often supplemented by artificial regeneration to fill the gaps.
- Final felling is done when all regeneration is complete throughout the compartment.

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(b) Conversion is a process of changing of one silviculture system to another, that changes crop composition of forest.

Adverse situations under which Conversion is advisable

1) failure of existing system may compels us to adopt diffrent system.

e.g. In Haldwani, Indian irregular silviculture system is adopted in place of Uniform system.

2) Silviculture character of species

e.g. Dying back issue of Shorea robusta under Uniform system. This has been changed to Indian irregular shelterwood system..

3) Adverse climatic conditions like frost condition or wind pressure may obligates forester

to adopt selection system in place of clear felling.

4) Adverse natural regeneration through seed may require Coppice with Standard system.

5) Adverse topography. eg. Steep slope or shallow soil condition may require coppice with reserve system.

Conversion Process of Coppice System to clear-felling System

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1) Part of forest taken for current working plan period.
2) Remaining area is progressed as per schedule.
3) Selected forest area undergoes complete felling and regeneration processes.

However, some trees may be left for

general protection.

4) Direct sowing and planting of 1-2 year seedlings of preferred choices is carried out

5) fencing is done to protect it from grazing.

6) After regeneration starts, weeding, cleaning and climber cutting is done.

7) Regeneration assessment is carried out

8) Based on success, second rotation onwards, conversion progressed to whole of forest.

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(c) Bamboo belongs to Graminae family. They are found in different climatic conditions throughout India except Jammu and Kashmir region.

6

Bamboo species	Common Uses	Distribution
1) Dendrocalamus strictus (male bamboo)	• Solid culms used in paper and pulp industry • Timber industry	• Dry deciduous locality — Madhya Pradesh, Rajasthan, etc.
2) Bambusa bamboo	• Used as building material. • Used as fodder and fuel.	Moist soil condition, near river banks — Bihar, Uttar Pradesh, Odisha etc.
3) Bambusa vulgaris (Golden Bamboo)	• basket making. • furniture construction • fibre extraction	Central India, Deccan plateau.

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4) Bambcoosa tulda	• Used as food, fuel and fodder.	• North Eastern India.
5) Bambcosa polymorpha	• Used as building material.	• found in Manipur, Mizoram etc.
6) Dendrocalamus hamiltoni	• Basket construction. • food and pulp wood	• Prevalent in North East.
7) Dendrocalamus sikkimensis	• Used as fuel as well as fodder.	• Prevalent in Sikkim, Assam valley etc.
8) Dendrocalamus gigantus	• Can be used as building construction in Earthquake prone area.	• North Eastern States like Mizoram, Tripura etc
9) Ochlandria travancorica	• Used as basket making, poles construction	• Deccan region – Chhatisgarh, Kerala etc
10) Arundinaria Falcata	• Edible uses • Medicinal properties.	low level Western Himalaya

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8. (a)

Casuarina equisetifolia (Safeda, Myrtaceae) + Eucalyptus

↳ Beef wood

Distribution

↳ High rainfall area
  ↳ Eucalyptus grandis
↳ Semi-area region-
  Eucalyptus Camaldunensis
↳ Pan-India presence
  ↳ Eucalyptus globulus, E. hybrida, E. tereticornis.

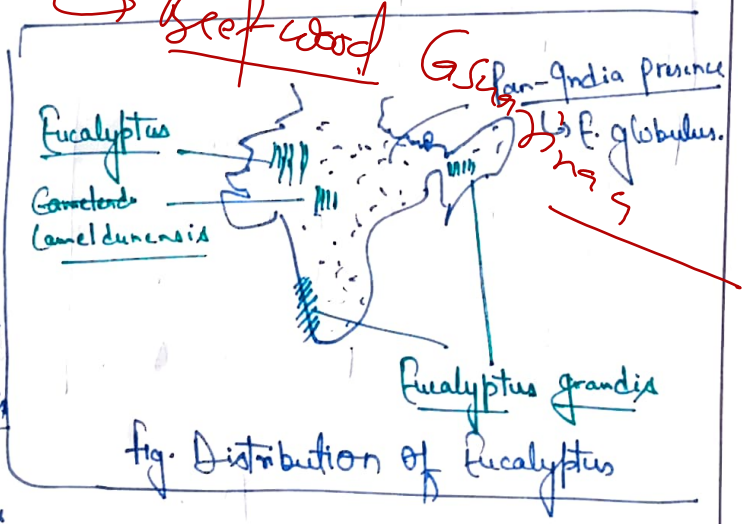

fig. Distribution of Eucalyptus

Phenology

- Eucalyptus is an evergreen species. Therefore, it's leaf flushing and leaf shedding is not well defined.
- It shows two times flowering - one in March-April and other in August-September.
- It shows two times fruiting - June and December.

Silvicultural characteristics

- light demander tree
- fire hardy due to thick bark
- Wind firm - ~~xxx~~ } ⇒ widespread root system.
- frost sensitive (especially seedling)
- Drought sensitive

Acacia nilotica (Babool, Mimosaceae)

Distribution

- Rainfall - 35 cm - 200 cm
- Temperature - 10-40°C
- Geology and soil - found in black, alluvial, Alkaline soil condition.
- Associated Species - Acacia catechu ; Prosopis juliflora, Azadirachta indica (Neem).

Distribution of Babool

Phenology

- Medium - sized tree
- Leaf shedding - feb - April
- leaf flushing - May - June
- flowering - January to March
- fruiting - May - June

Silvicultural characteristics

- Light demander tree
- Drought hardy
- frost resistant
- Wind thrown (especially seedlings).
- Produce root suckers
- Has coppicing power

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Shorea robusta (Sal, Dipterocarpaceae)

Distribution

- Rainfall – 100 – 400 cm
- Temperature – 5 – 40° C
- Wide variety of soil, but best grown in well drained loamy soil.
- Associated species – Dalbergia sissoo; Tamarindus indica etc.

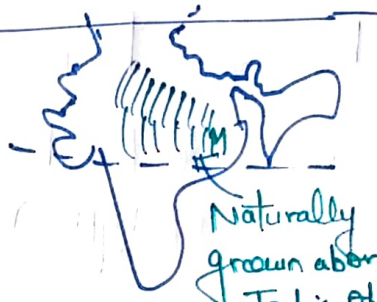

fig. Distribution of Sal

Phenology

- Medium sized tree.
- Leaf shedding and renewal in february – March in dry localities.
- Evergreen Nature is observed in moist localities.
- flowering occurs in february to April, while fruiting occurs in May – June.

Silvicultural characteristics

- light demander tree
- Drought sensitive
- frost tender
- fire resistant
- Well developed root system.
- Dying back issue in stressed environment like frost.

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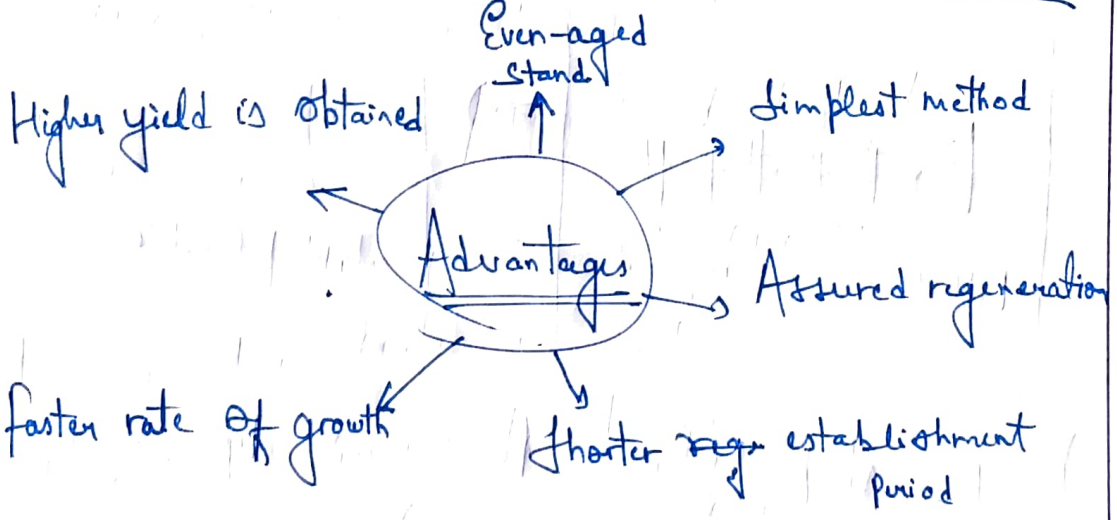
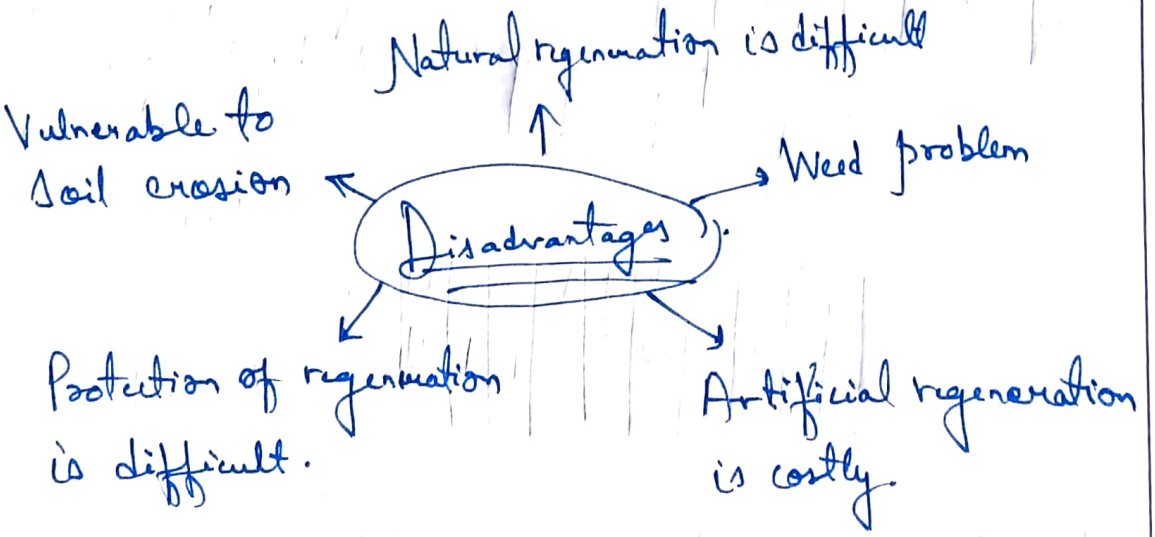
(b)

define it

Clear felling is a type of high forest system which removes all trees from an area chosen in single operation for harvesting.

- Here, regeneration fellings are concentrated on a part of forest at a time.





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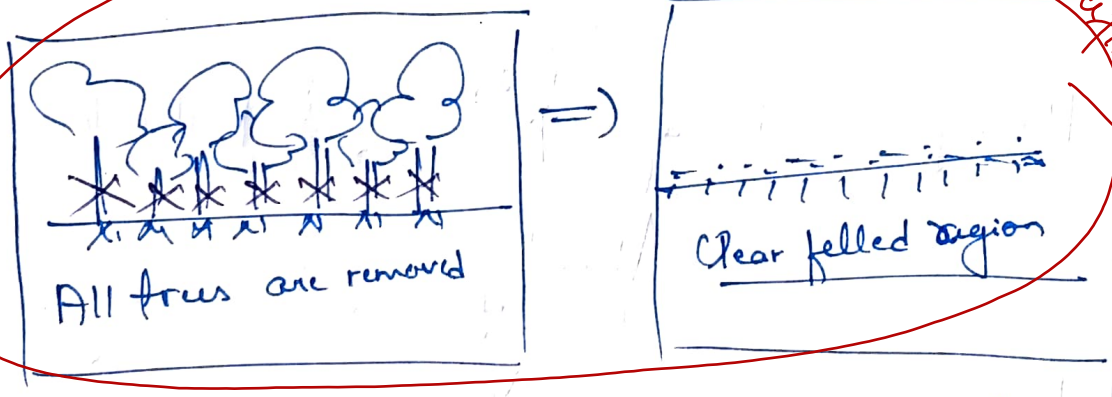
Types

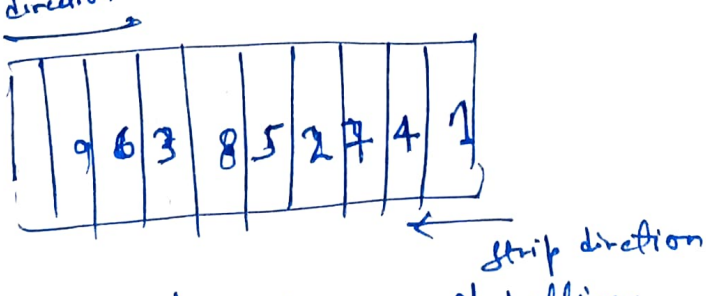
Based on felling pattern, this system can be categorised into three types –

1) Clear felling system – Trees are removed in single operation.

Use this form just to add definition



2) Clear strip system – felling is done in form of strips which progress successively in one direction across area generally against wind direction.



Here, Roman number shows sequence of fellings.

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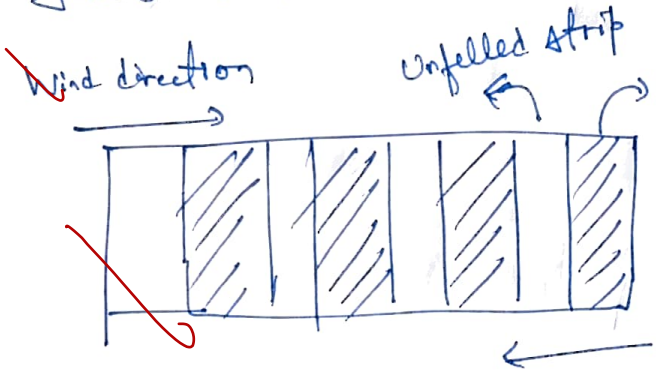
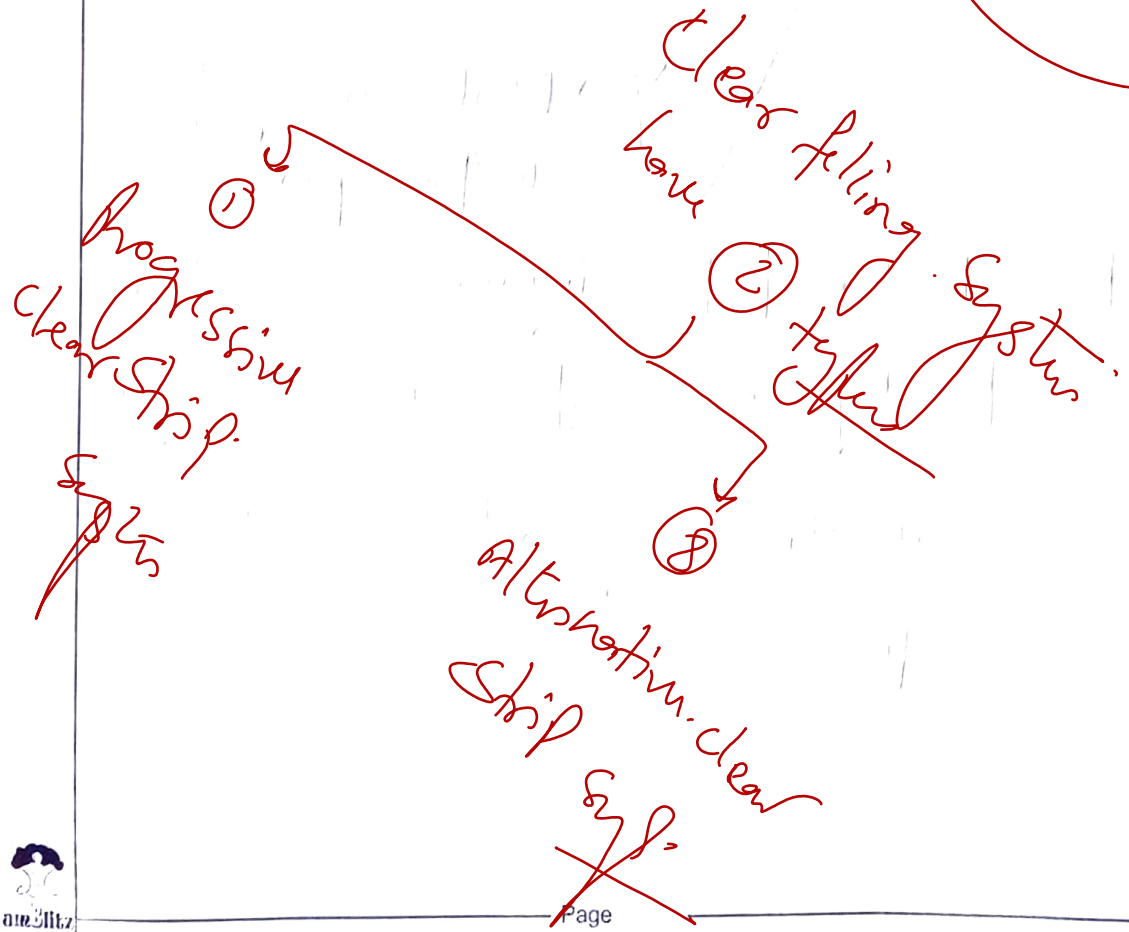
(c) Alternate strip direction – Here, clear felled strip is alternated with unfelled strips of similar width.



7



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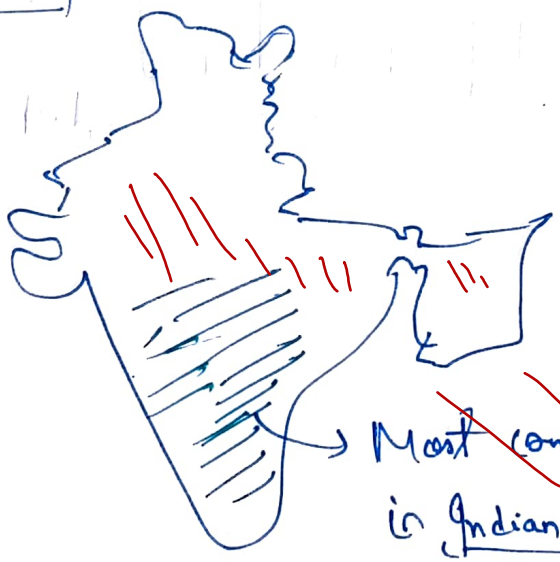
(C)

Dendrocalamus Strictus (Male bamboo, Gramineae) is most commonly used for its solid culms as other bamboo species are generally hollow inside.

Distribution



Most commonly found in Indian peninsula.

Male bamboo prefers dry deciduous locality in tropical region. It is found in Chhattisgarh, Madhya Pradesh, Telangana, Maharashtra, Andhra Pradesh etc.

Regeneration methods

1) Natural regeneration through:

a) by seed

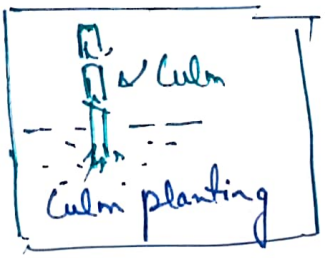
b) by Rhizome

2) Artificial regeneration methods :-

a) direct seed sowing

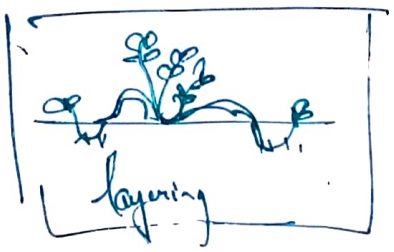
b) Rhizome cutting.

c) Entire culm planting.



d) Offset planting

e) by layering



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Commercial uses

1) Male bamboo is used in paper and pulp industry.

2) Used for furniture and basket making

3) Used as building material

4) Used as fuelwood in dry locality

5) Can be used as fodder for cattle.

Subsidence and animal husbandry.