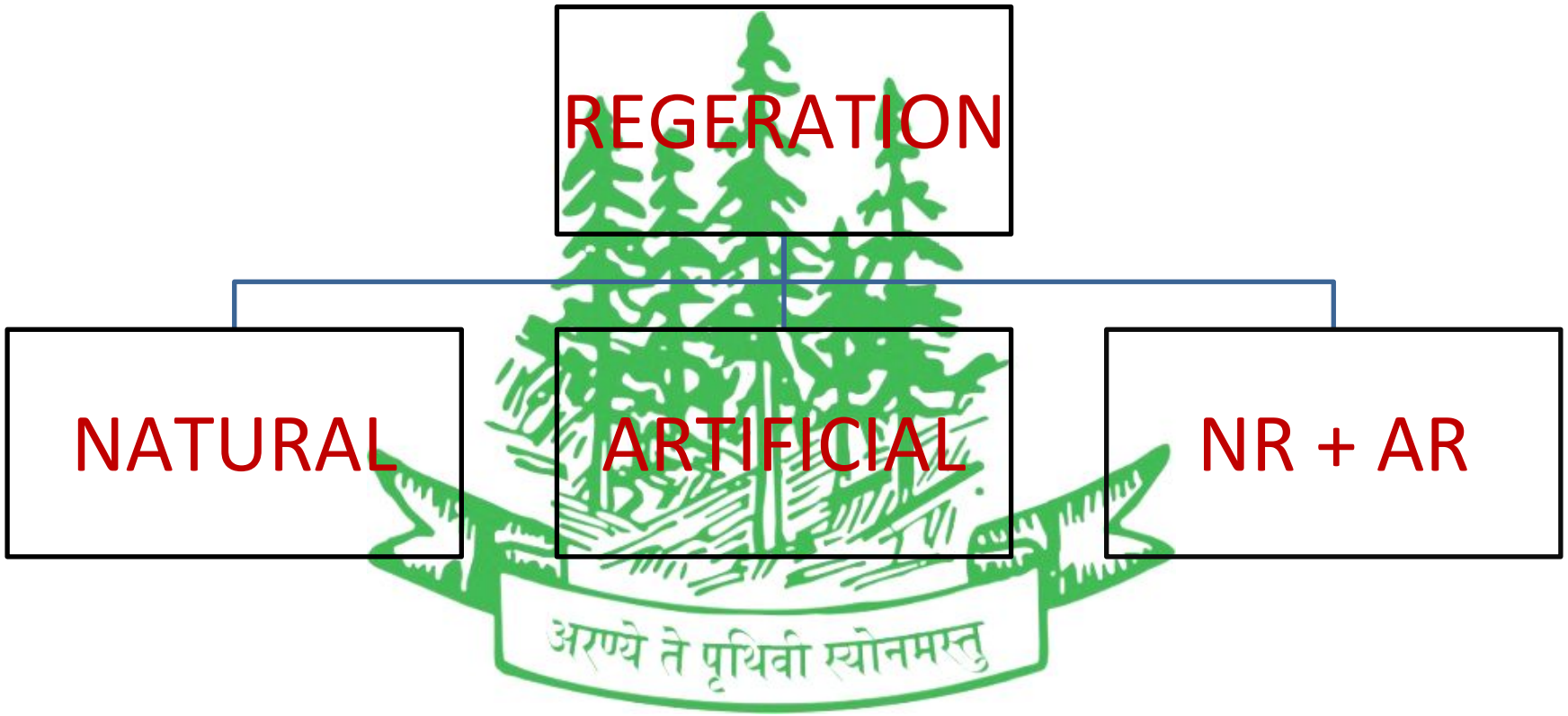
# ARTIFICIAL REGENERATION


REGERATION
NATURAL
ARTIFICIAL
NR + AR
अरण्ये ते पृथिवी स्योनमस्तु

# Artificial Regeneration

- “The renewal of a forest crop by sowing, planting or other artificial methods.”
  - The crop so obtained
- Plantation: Forest crop raised artificially, either by sowing or planting.

# Means of AR

- Direct Sowing: Sowing of seed directly on an area where a crop is to be raised.
- Planting: Transferring of seedlings or plants in the area to be regenerated after they have successfully passed the critical stages of germination and initial development.
  - Nursery grown seedlings, more economical
  - Wildlings: natural seedlings

Why Artificial Regeneration?

# Objects of AR

- Risk of deterioration and loss of soil.
- Crop composition: Do we need to change original crop composition for better output?
- Density of stocking
- Yield : AR gives higher yield
- Time factor: AR saves time – crops with shorter rotation
- Objectives of management: AR Agroforestry, wasteland reclamation, production forestry, specific objectives

# OBJECTS OF AR

- REFORESTATION
  - "Restocking of a felled or otherwise cleared woodland by artificial means."
- AFFORESTATION
  - "establishment of forest by artificial means on an area from which forest vegetation has always or long been absent."
- *ENRICHMENT / GAP PLANTING*
  - *"Planting of seedlings in gaps or in understory to increase the canopy density of a forest."*

# REFORESTATION: WHY

## objects of reforestation

- Assist/ supplement natural regeneration
- Improve the quality & quantity of the forest produce
- Replace natural regeneration where NR is uncertain, slow & uneconomical
- To restock degraded forests (eg. Post fire reforestation)
- To change the crop composition to more desired species
- Introduction of exotics
- To utilize and reclaim wastelands
- To generate employment

# NR vs AR

| Sl.no. | NR | AR |
|---|---|---|
| 1. | No control over spacing and stocking | Desired spacing and level of stocking |
| 2. | Uncertain, slow, initial stages of growth exposed to biotic and abiotic damages | More certainty of survival germination and initial stages of growth are under well managed conditions in nursery |
| 3. | Lacks uniformity, uneven aged crops | Gives uniform, even aged crops |
| 4. | Maintains genetic and species diversity by virtue of being mixed crop | Narrow genetic base |
| 5. | Does not allow change in species composition as per objectives | Allows change in species composition |
| 6. | Lower cost | Higher cost |

# CHOICE OF SPECIES

**Species for AR is to be selected based on:**

*Geography – climate, soil, topography*

*Ecology – Stage of succession*

*End-use or objective of management*

*Growth rate*

*Ease of establishment*

*Effect on the site*

# 1. Climate & Micro-climate

- Important to have weather data / info
- Use native species as indicator
  - *Glycosmis pentaphylla* indicator of Teak
  - *Clerodendron infortunatum* indicator of teak and Sal
  - *Viola* sp. Indicator of Deodar
- Analyse information regarding performance of exotics in similar climate

# 2. Soil conditions

- Important to know soil type of the area
  - Type, Nutrient status, Depth, Structure, composition
- Plant indicator species
  - Soils with high concentration of soluble salts: *Tamarix, Prosopis juliflra, Salvadora oleoides*

# 3. Topography

- Topography influences micro-climate and edaphic factors
- Terrain – smooth even, undulating, plain, mountainous
- Rockiness
- Aspect in the hills

# 4. Ecological considerations

- Stage of succession:
  - Eg. Khair and Shisham on riverine areas Doon area
  - Wattle Acacias and Eucalyptus grown in grasslands of Western Ghats (Kerala) resulted into failure

# 5. Objectives of management

- Objective of management
  - Wasteland reclamation, bio-drainage
  - Eco-restoration of degraded forests (Shola forests, evergreen forests, mangrove restoration)
  - Beauty
- End use
  - Market oriented

Shola Forest, Western Ghats

# Restoration of Shola grassland ecosystem in Pambadum Shola, Munnar

# Mangrove plantation, Andamans

# 6. Growth Rate

- Short rotation tree crops for market consumption
- Consideration to cover the canopy as soon as possible
- Fast Growing species

- Fast Growing Species:
  - Species which has a height increment of 60 cm per annum in the earlier stages of its life and which gives a minimum yield of 10 cu.m / Ha / yr in a short rotation of 10-15 years.
- Indigenous fast growing species: Acrocarpus fraxinifolius, *Ailanthus excelsa, Anthocephalus cadamba, Bombax ceiba, Gmelina arborea, Melia azaderach*
- *Exotics: Eucalyptus sp., Broussonetia papyrifera, Populus sp., Acacia mangium, A. auriculiformis*

# 7. Ease of Establishment

- The species should be easy to establish on the given site
  - Establishment of sal is affected by Die back hence very difficult

# 8. Effect on the site

- The species selected should not deteriorate the site
  - Allelopathy
  - Large consumption of ground water
  - Allergy causing pollens (Eg. Pollen allegry of *Acacia auriculiformis*)

which method of AR to be followed?

# CHOICE OF METHODS OF AR

- SOWING
- PLANTING

# SOWING

- Putting the seeds directly into the soil where plantation is to be raised.
  - Broadcasting
  - Line sowing
  - Strip sowing
  - Patch sowing
  - Dibbling
- Seed treatment
- Pelletization – encapsulation of seeds

# PLANTING

- Planting nursery raised seedlings after they have crossed initial development stages that are vulnerable to damages
- Seedlings, Tall plants
- Stumps (as in teak)
- Other propagules (grafted propagules)

# SPACING

- Rate of growth of species
  - Fast growing sps wider, slow growing sps closer
- Branching pattern
  - Many branching closer to facilitate natural pruning
- Height of plants
  - Higher plants wider spacing
- Site factor
  - Drier sites closer spacing
- Objectives
  - Fruit production: wider spacing (as in seed orchards)
  - Small timber: Closer spacing
- Cost
  - Closer spacing is costlier
- Inter-cultivation

# Choice between sowing & planting

- Species characters
- Site characters
- Availability of planting material
- Cost

# Sowing Vs. Planting

| | ADVANTAGES | DISADVANTAGES |
|---|---|---|
| SOWING | •Less cost<br>•Less time<br>•Early root development is good | •Large quantities of seed are required<br>•Seedling mortality is higher |
| PLANTING | •Less seed quantity<br>•Bird damage eliminated<br>•Success percentage is greater | •Costlier<br>•More labor intensive |

# Choice between pure and mixed crops

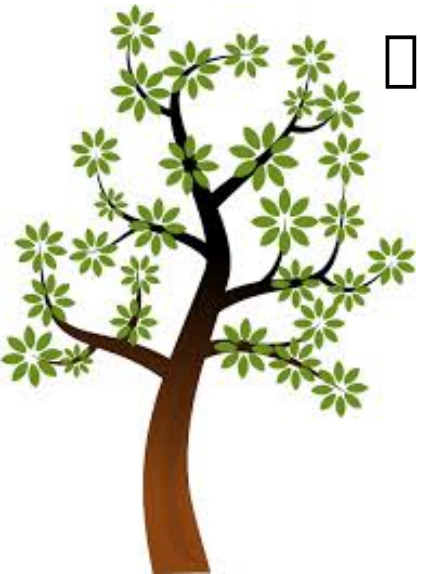
| *Criteria* | *Pure* | *Mixed* |
|---|---|---|
| ***Soil deterioration*** | *Higher* | *Lower* |
| ***Resistance to diseases*** | *Low*<br>*Skeletonizer & defoliators in teak*<br>*Sal borer in Sal* | *High* |
| ***Increment & yield*** | *Higher* | *Lower* |
| ***Difficulty in execution of silvicultural operations & mgmt.*** | *Lower* | *Higher (different rotations, growth rates etc)* |

# KINDS OF MIXTURES

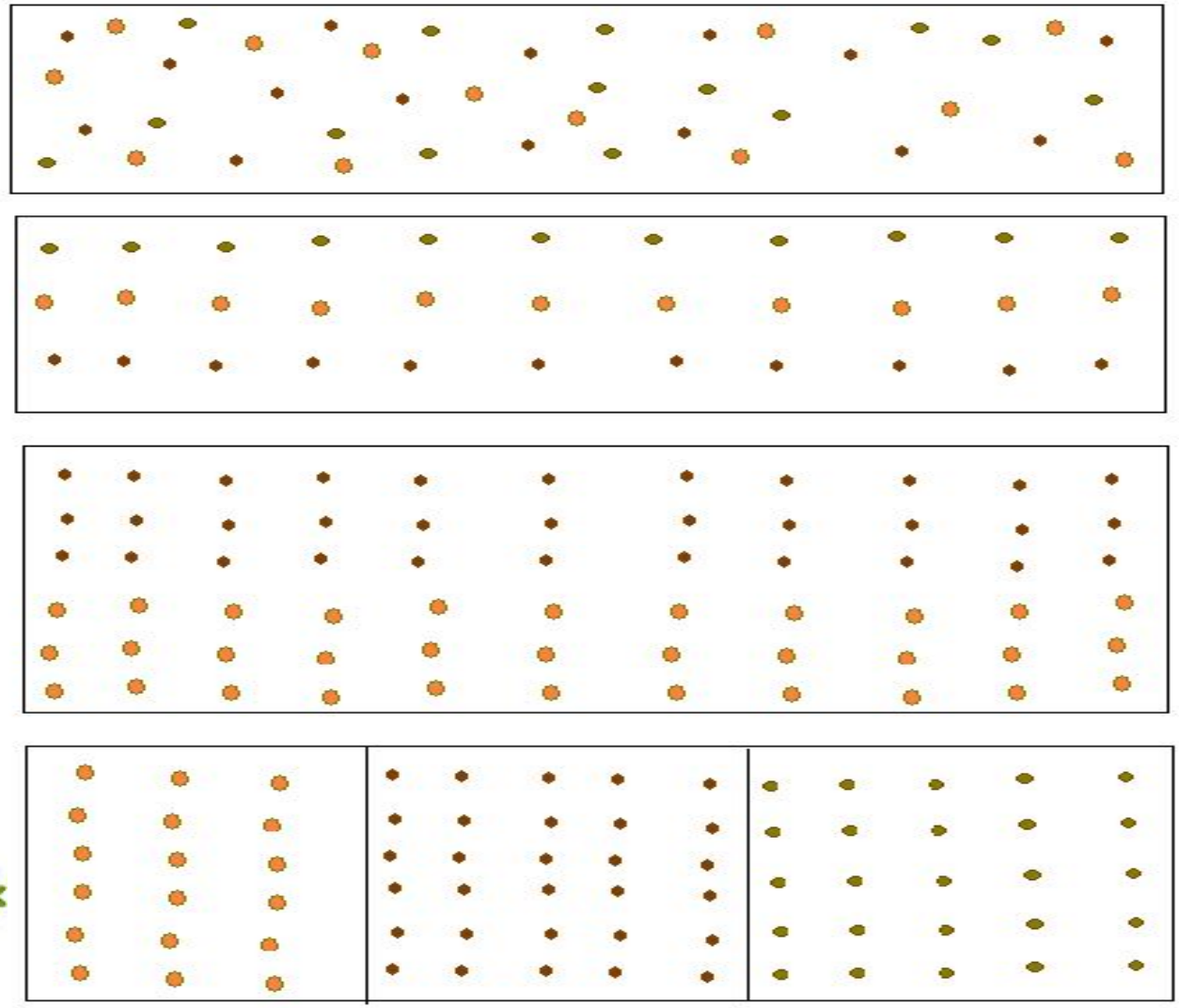
- Temporary mixture
  - Secondary species is mixed only for a part of the rotation of primary / main species
    - Protection from frost, sun
    - Ground cover, suppress weeds
    - Early competition
    - Additional revenue

## Contd...

- Permanent Mixture
  - Accessory sps. remain throughout rotation of main species
  - Horizontal or even-aged mixture: All the species mixed are in the overwood or of same height (khair & sisham, sal and *T. Tomentosa*)
  - Vertical or uneven aged or storeyed mixture: Main species in top canopy and others below it (Teak & bamboo, Sal & Jamun)



# Patterns of mixture



# RECAP