

NATURAL REGENERATION

Silviculture

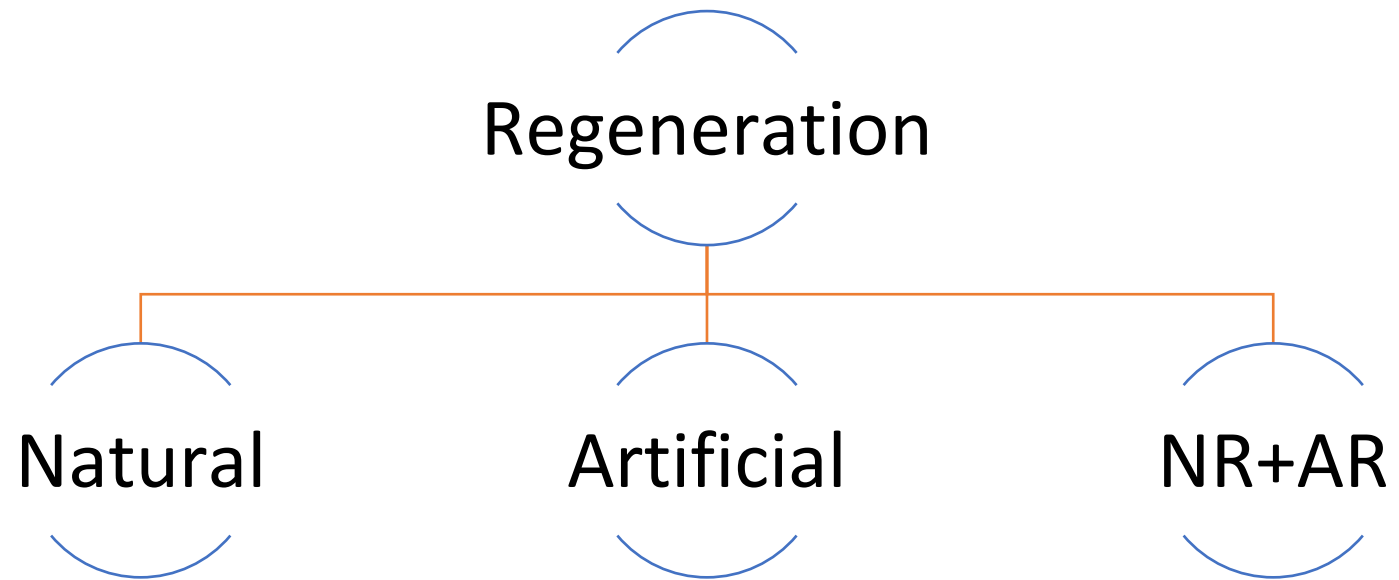


“Status of Regeneration reflects health of the forest ecosystem”



Regeneration

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NATURAL REGENERATION

- Renewal of a forest stand by **self sown seed or by coppice or root suckers**
 - Seeds: Seedling forest / High Forest
 - Vegetative parts : Coppice, root suckers

I. NR from seeds

1. Four parameters of NR from seeds

1.1. Seed Production

1.2. Seed Dispersal

1.3. Seed Germination

1.4. Seedling Establishment

1.1. Seed Production

- Production of adequate quantities of “viable” seeds
 - Depends on species, age, size of crown, climate & external factors
- Age: Immature and over-mature trees produce poor quality seeds
 - More fertile seeds are produced after trees attain maximum height growth
- Crown: Bigger the crown, larger production of seeds
- Climate: Warm weather favours more seed production
- Other factors: Insect attack, fire, injuries might stimulate seed production

- Seed year: A year in which given species bear seeds abundantly
 - Good / moderately / poor / very poor
 - Teak, shisham, khair produce abundant seeds every year

Species	Moderate seed year	Good seed year
<i>Shorea robusta</i> (sal)	2	3-5
<i>Terminalia tomentosa</i> (sain)	2	3-4
<i>Pinus wallichiana</i> (blue pine)	2	2-3
<i>Pinus roxburghii</i> (chir pine)	3	4-5
<i>Abies pindrow</i>	6	10

1.2. Seed dispersal

- The movement or transportation of seeds away from the parent plant is known as seed dispersal
- Agents of seed dispersal
 - WIND: *Populus sp.*, *Bombax ceiba*, *Casuarina etc*
 - WATER: *Dalbergia sissoo*, *Trewia nudiflora*, mangroves
 - BIRDS: Mulberry, Tendu
 - ANIMALS: *Acacia nilotica* (babul), *Zizyphus mauritiana* (ber)

Paste bear and bird dropping pic

1.3. Seed Germination

1.3.1. Internal factors of germination:

- Hard coat: permeability to water & O₂
- Stage of embryo development
- Seed dormancy: A condition of mature, viable seed in which germination is considerably delayed even though external conditions favour germination
- After-ripening: biochemical & physical changes in seeds / bulbs / fruits / tubers after ripening
- Viability: Potential capacity of a seed to germinate (few days to years)
- Size of seed & Seed weight: Within the species larger seeds have more endosperm

Seed weight / Seed rate: number of seeds per unit weight

Species	Seed weight (approx.)
<i>Abies pindrow</i> (Silver fir)	17000 / kg
<i>Pinus roxburghii</i> (Chir pine)	9000 / kg
<i>Adina cordifolia</i> (haldu)	11000 / gm
<i>Tectona grandis</i> (Teak)	1100 to 2800 / kg
<i>Dendrocalamus strictus</i>	30000 / kg
<i>Terminalia tomentosa</i> (sain)	530 / kg
<i>Eucalyptus tereticornis</i>	230000 – 350000 / kg
<i>Shorea robusta</i> (sal)	

- Germinative capacity: Percentage, by number, of seeds in a given sample that actually germinate, irrespective of time
- Germinative energy: Percentage, by number, of seeds in a given sample that have germinated up to the time when the rate of germination (no. of seeds germinating in a day) reaches its peak

Species	Germinative capacity
<i>Anogeissus latifolia</i> (dhavda)	1-5
<i>Anthocephalus cadamba</i> (kadamb)	10-20
<i>Boswellia serrata</i> (salai), <i>Cassia fistula</i> (amaltas)	20-30
<i>Bombax ceiba</i> (semal), <i>Tectona grandis</i> (teak),	30-50
<i>D. strictus</i> , <i>T. tomentosa</i> (sain), <i>Toona ciliate</i> (Tun), <i>Melia azaderach</i> , <i>Cedrus deodara</i> (deodar)	50-70
<i>Butea monosperma</i> (palash), <i>Acacia catechu</i> (khair), <i>Albizia procera</i> (safed siris), <i>Juglans regia</i> (walnut), <i>S. robusta</i> (sal)	70-90
<i>Albizia lebbeck</i> (siris), <i>Bauhinia variegata</i> (kachnar), <i>Dalbergia sissoo</i> (shisham)	90-100

Plant Percent: Percentage of the number the seeds that develop into seedlings at the end of the first growing season

Species	Germinative capacity	Plant percent
<i>Shorea robusta</i> (sal)	80	66
<i>Tectona grandis</i> (Teak)	50	25
<i>Terminalia tomentosa</i> (Sain)	70	29
<i>Gmelina arborea</i> (gamhari)	85	30
<i>Dalbergia sissoo</i> (shisham)	90	78

1.3. Seed germination

1.3.2. External factors of seed germination

- Moisture
- Air
- Temperature
- Light: Some species like *Cassia fistula* and *Albizia procera* require light
- Seed bed: Appropriate substratum, depth, cover etc
- “Seeds which are covered with soil equal to half their diameter germinate best, provided other factors are favourable”

- Seedling year: A year in which a given species produces abundant first year seedlings
 - Good / fair /poor / very poor
 - Good seedling year = good flowering, good seeding, favourable climatic & edaphic factors, absence of competing weeds

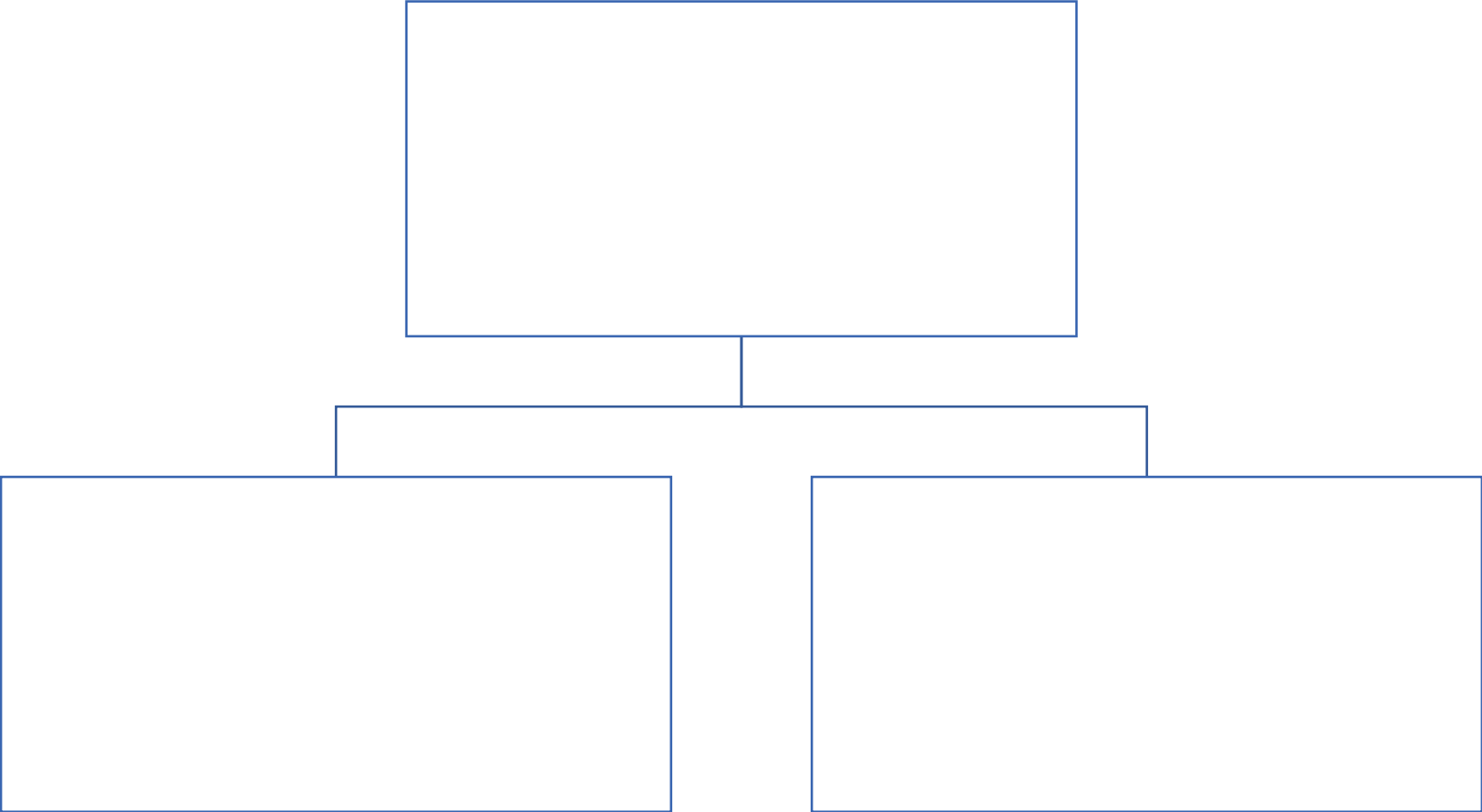
1.4. Seedling establishment

- Good germination does not mean good NR!!
- Establishment: **development of a new stand**, 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
- Seedling establishment period: Period which elapses between the initiation of NR and the time when it is considered safe from adverse influences

Factors affecting establishment of seedlings

- Development of roots:
- Soil conditions: adequate air, moisture, presence of undecomposed organic matter
- Light
- Extreme temperatures
- Presence or absence of competing grasses and weeds
- Grazing, browsing
- Fire
- Drip from canopy
- Stand composition

II. NR from Coppice



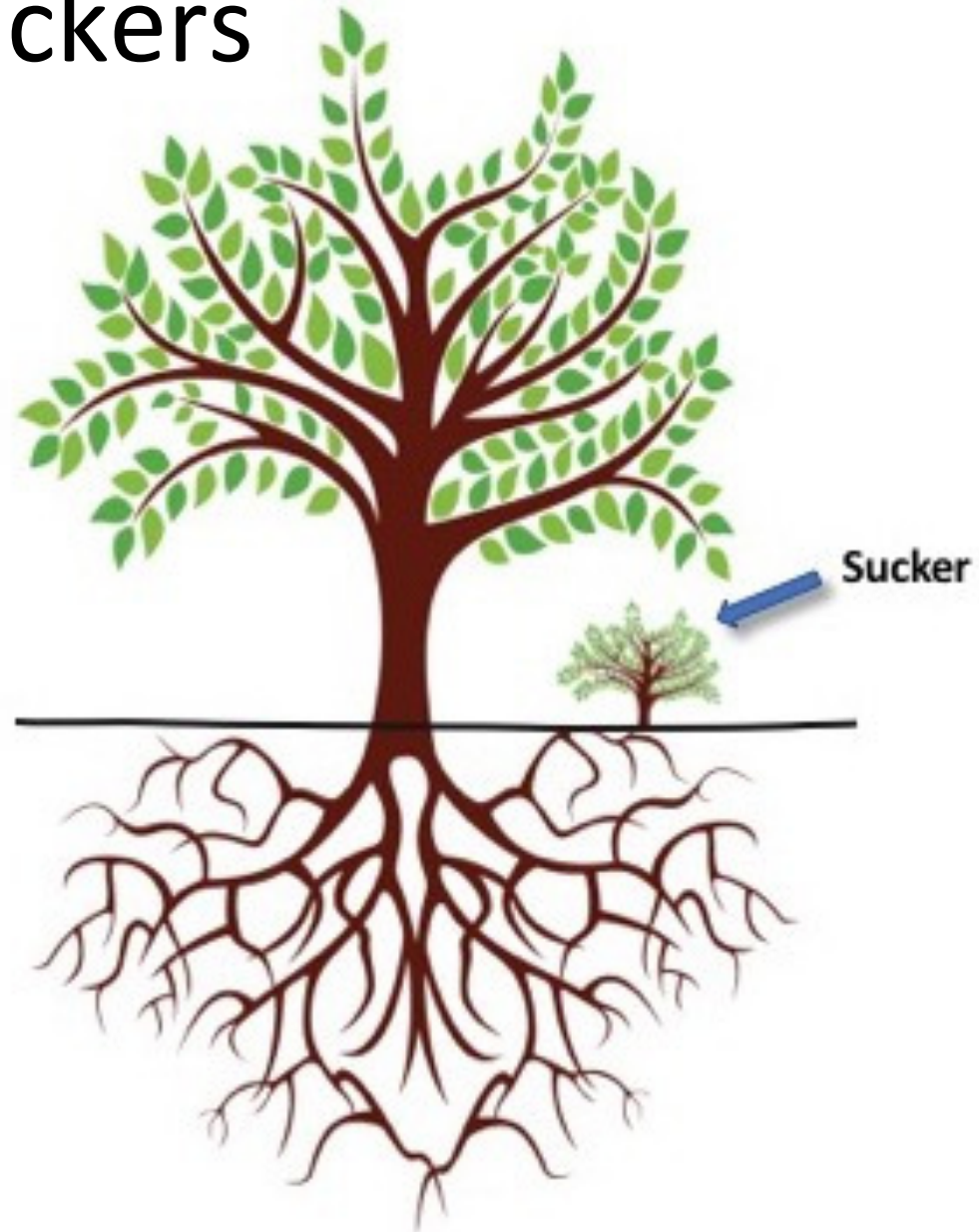
- Seedling Coppice: Coppice shoots arising from the base of seedlings that have been cut or burnt back.
- Stool coppice: Coppice shoots arising from living stump.
 - Adventitious buds on stump
 - Base of stump or top of stump
 - Shoots from base are preferred

Factors affecting NR from Coppice

- Species
 - Strong coppicers: *A. Catechu*, *Azadirachta indica*, *C. fistula*, *D. sissoo*, *D. melanoxylon*, *Phyllanthus emblica*, *Albizia lebbeck*, *A. procera*,
 - Fair coppicers: *Hardwickia binata*, *Terminalia bellerica*, *T. tomentosa*
 - Bad coppicers: *Adina cordifolia*, *Bombax ceiba*, *Madhuca latifolia*
 - Non coppicers: *Cedrus deodara*, *Pinus roxburghii*
- Coppicing power might vary with locality
- Season of coppicing: Just before growing season (Nov – Jan)
- Height of coppicing: Ideally 15-25 cm height

- Rotation: Coppicing happens best at early ages and middle ages due to which coppice rotation is generally shorter
- Singling out: Cutting back several coppice shoots and retaining 1-2 best coppice shoots on a stool

NR By Root suckers



- *Dalbergia sissoo*
- *Diospyros melanoxylon*
- *Santalum album*



Plate No.4.1



Plate No.4.2



Plate No.4.3

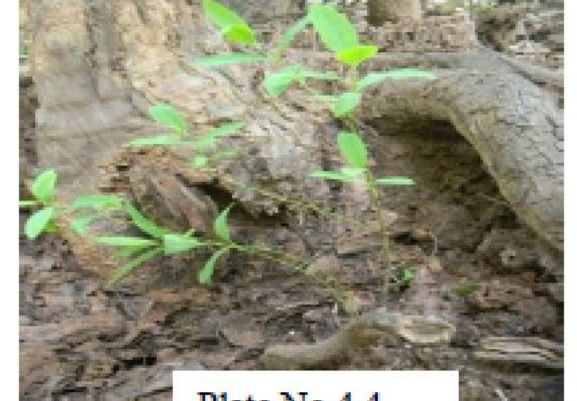


Plate No.4.4



Plate No.4.5



Plate No.4.6



Cultural Operations

- Operation undertaken to assist or complete existing regeneration to promote the proper development of the stand or to minimize the after-effects of felling damage
- Includes
 - Subsidiary felling: Operation done after main felling including removal, girdling, poisoning of marked unfelled trees, cutting back malformed advance growth
 - Improvement felling: Removal of less valuable trees in a stand in the interest of better growth of more valuable individuals
 - Weeding
 - Cleaning
 - Climber cutting
 - Thinning