

Controlling Stand Density: Thinning & Stand Tending

ESRM 323

Chpt's 5, 6
Smith, et al.

Thinning

- Series of temporary reductions in stand density through removal of surplus trees of the favored species to benefit the existing crop – not intended to start a new crop

Rationale for Thinning

- Controlled reduction in number of trees through time (fundamental law of silv.)
- Allocates growth onto fewer stems, chosen for their potential to optimize certain objectives
- Regulate light so unwanted shrubs, vines, trees don't accelerate their growth at regeneration time

Common Thinning Objectives

- Enhance diameter growth of residual trees to optimize yield of merchantable timber
- Increase water yield of forested watersheds
- Enhance and control composition of understory vegetation providing forage, browse, and seeds for herbivorous animals both wild and domestic
- Increase access for recreational uses; enhance aesthetic appeal

Thinning is Important

Thinning is the primary means by which forest stands are controlled during course of their development

Thinning Goals

- Regardless of intended outcomes, a program of thinnings is often thought of as a series of temporary reductions in stand density to maximize net value of products removed or to increase the quantity or quality of other benefits derived during the rotation

Thinning

- Improvements to Economic Yield through Thinning
 - Salvage of anticipated loss
 - Increased value from accelerated diameter growth
 - Control of investment in growing stock during rotation
 - Improvement of product quality
 - Control of stand composition / affects regeneration
 - Risk reduction / health improvement

Thinning Methods & Application

Four distinct methods (five total)

1. Low thinning
2. Crown thinning
3. Selection thinning (Thinning of dominants)
4. Mechanical thinning
5. [Free]

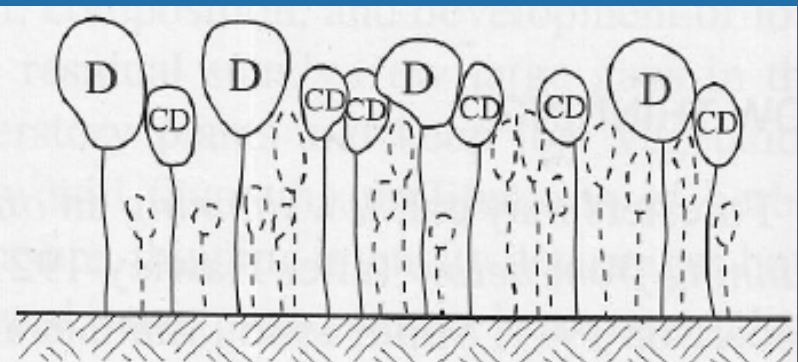
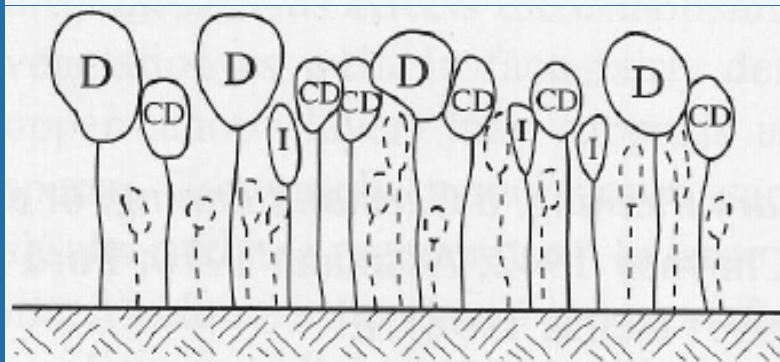
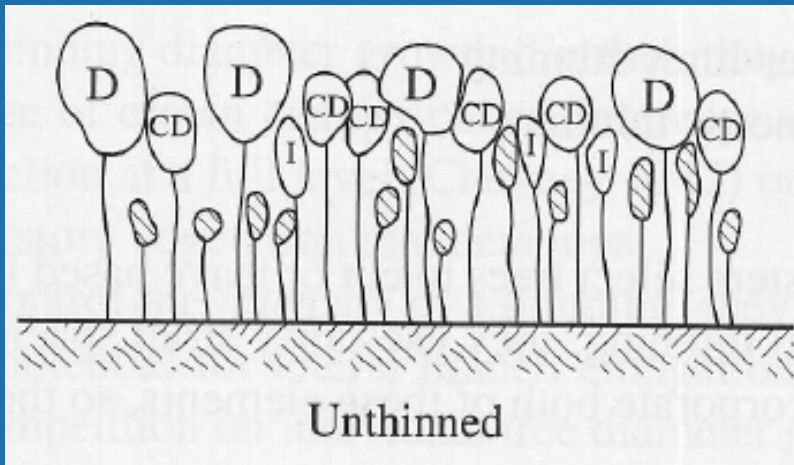
Each of these methods refers to a single operation, NOT to a regime

Thinning Methods & Application

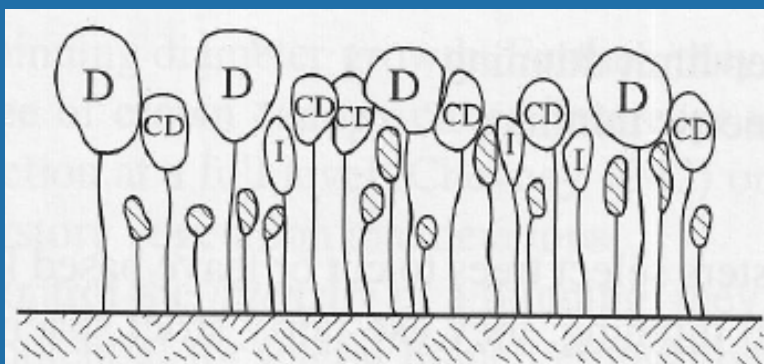
1. Low thinning (a.k.a. “Ordinary,” “German,” “Thinning from below”)
 - Trees are removed from the lower crown classes through a range of intensity classes
 - A – removes only overtopped trees
 - B – removes intermediates also
 - C – eliminates a few scattered co-dominants
 - D – eliminates most co-dominants
 - Mimics natural self-thinning mortality, but at accelerated rate
 - Most applicable to stands in which nearly all trees are merchantable

Thinning Methods & Application

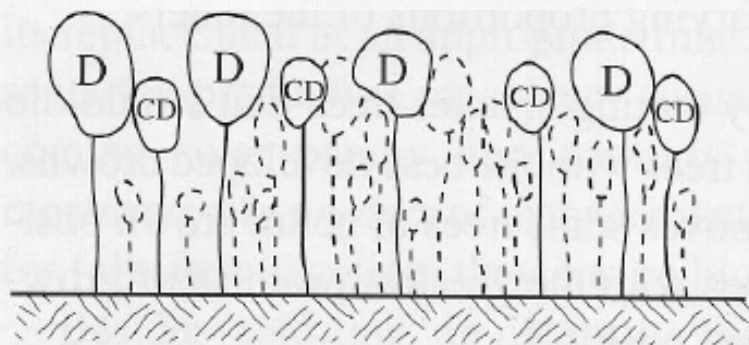
1. Low thinning



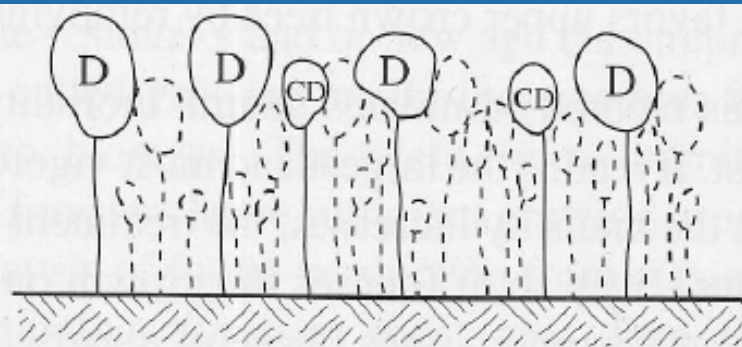
Thinning Methods & Application



Unthinned



Grade C thinning from below
(Cut overtopped, intermediates,
and *some* codominants)
... A moderate thinning



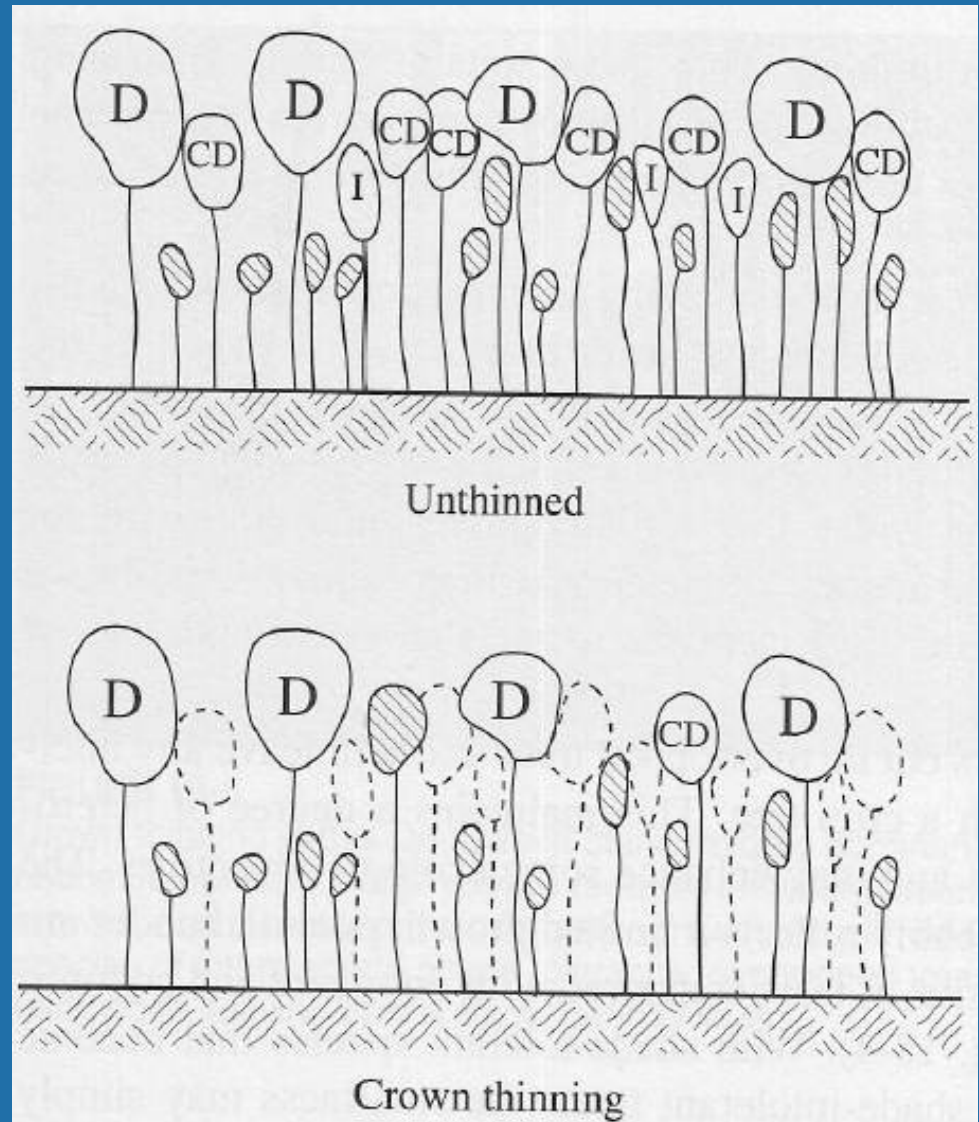
Grade D thinning from below
(Cut overtopped, intermediates,
and *most* codominants)
... A heavy thinning

Thinning Methods & Application

2. Crown thinning (a.k.a. “French method” or “thinning from above” or “high thinning”)
 - Trees are removed from middle and upper portion of the range of crown (and DBH) classes
 - o Principal cutting is from upper crown classes, no matter how light
 - o Bulk of intermediate & overtopped trees remain in the stand
 - Trees to be favored are either in the dominant class or co-dominant if necessary
 - o Where co-dom has straighter, smoother bole w/ fewer, smaller branches than an adjacent dom, favor the co-dom
 - o Position in canopy is taken as best indicator of past & future performance

Thinning Methods & Application

2. Crown thinning



Thinning Methods & Application

2. Crown thinning (continued ...)

- Lower canopy trees remaining may “train” crop trees to prevent epicormic branching, may prevent establishment of undesirable lower canopy veg.
- Provides more continuous vertical distribution of foliage, which may create more diverse habitat for feeding and nesting animals
- Immediate cash return is greater for crown thinning than for low thinning of equal intensity

Thinning Methods & Application

2. Crown thinning (continued ...)

- More flexible than low, requires more skill and knowledge
- Not really feasible to “grade” intensity of a crown thinning – severity of cutting is regulated by basal area or some other index of stand density
- Principal disadvantage is there is that if left long enough, the subordinate classes of trees may be mistaken for a younger age class

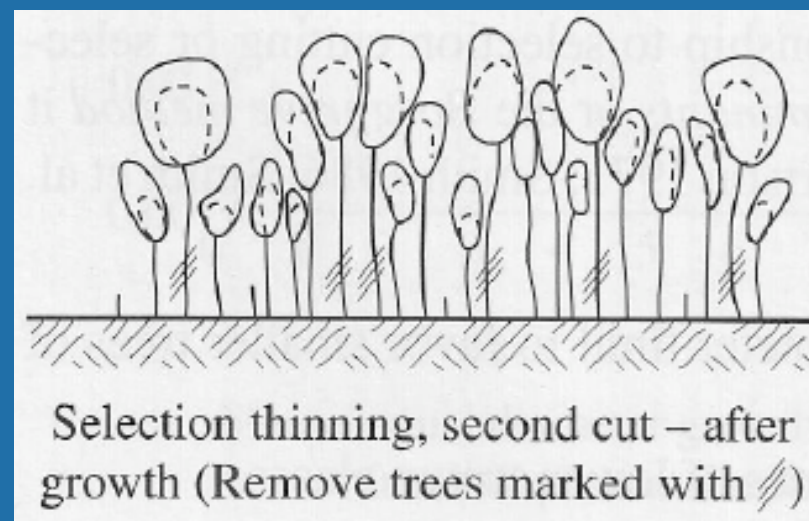
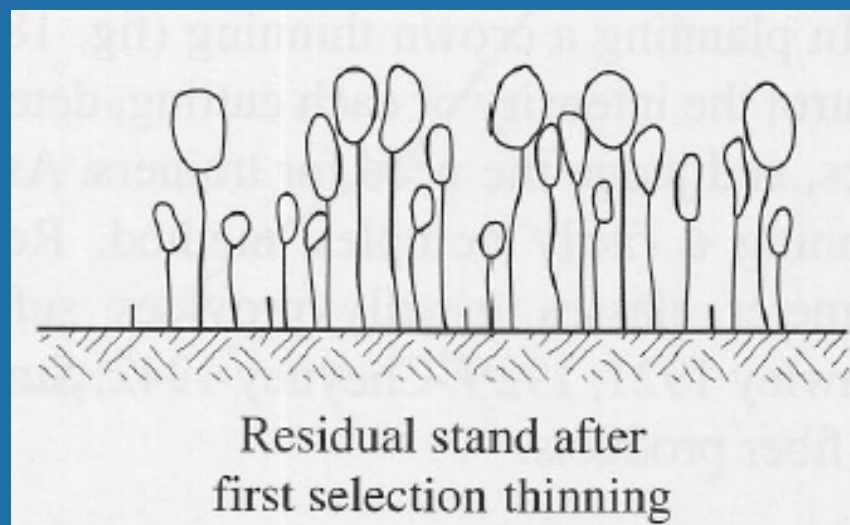
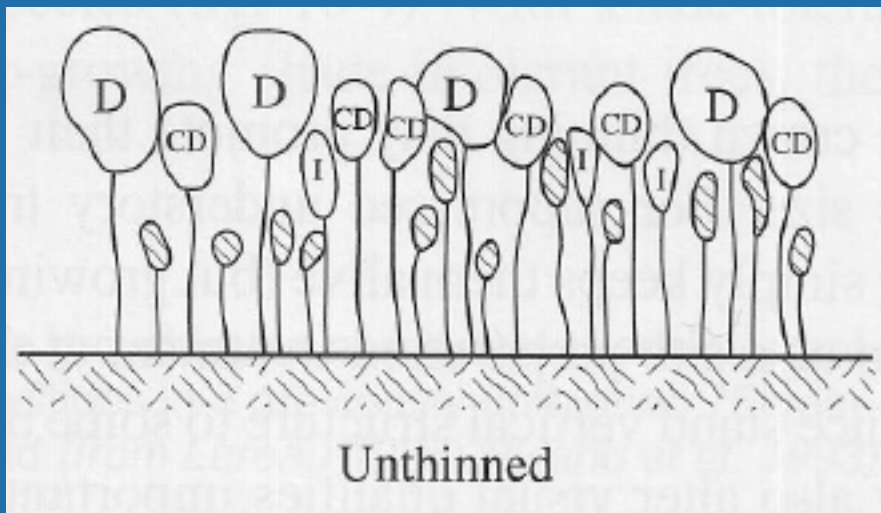
Thinning Methods & Application

3. Thinning of dominants (aka “Selection thinning”)

Named for similarity to “selection method of regeneration”

- Expressly dominant trees are removed to favor subordinate crown classes (of better form)
- Degenerates into “high-grading” if not careful
- Useful in young, even-aged, pure stands where just a few dominants have begun to emerge and are threatening to become ‘wolf’ trees
- After a series of low thinnings, when co-doms have become large enough w/ high quality, thin doms to let co-doms come up – works only with species capable of responding
 - Used for advancement of crown classes – very tolerant species only

Thinning Methods & Application



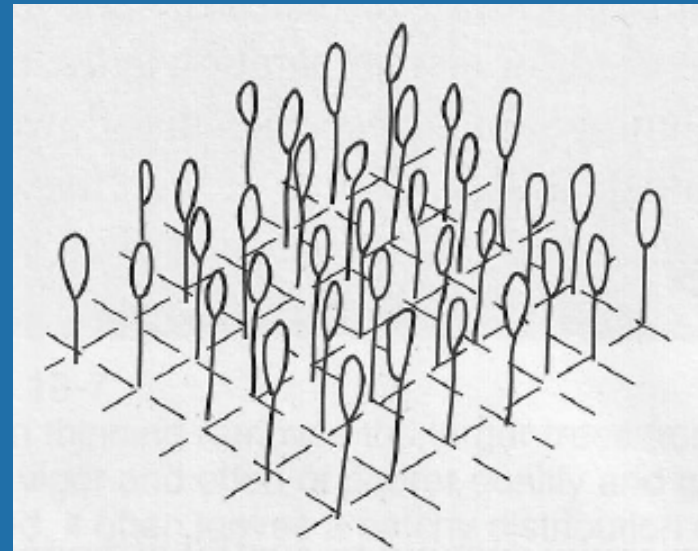
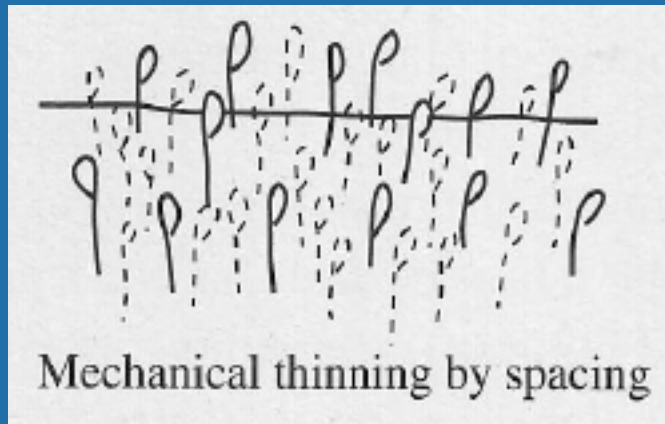
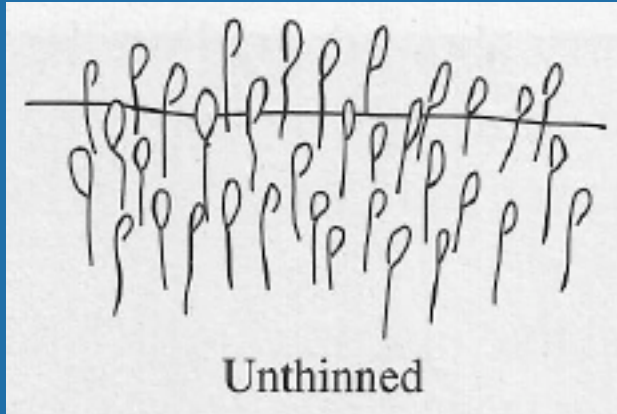
Thinning Methods & Application

4. Mechanical thinning (a.k.a. 'Geometric' or 'Systematic' thinning)

- Trees to be cut or retained are chosen on the basis of some pre-determined spacing or other geometric pattern with little or no regard to position of their crown in the canopy
- Main advantage is in treating young or densely crowded stands having had no previous thinning
 - Useful where there are surplus dominants or no real differentiation of crowns into classes has yet occurred (very uniform stands)
 - E.g., in pre-commercial thinnings, i.e., thinnings made purely as investments in the future growth of stands so young that none of the cut trees can be extracted & utilized
- Row and strip thinning is a form of geometric thinning

Thinning Methods & Application

4. Systematic thinning



Thinning Methods & Application

[5. Free thinning]

- Designated as “free” as in not being restricted by adherence to any other single method
 - Cuttings are designed to release crop trees without regard for their position in the canopy
 - Most useful in irregular stands; irregular in age, density, species composition

Thinning Methods & Application

Quantitative Definition of Methods

- Most useful method is the “d/D ratio”
- d = average diameter of cut trees
 (“average” most often taken to be QMD)
- D = average diameter of initial, pre-thin stand (most often the QMD)
 - o $d/D \leq 1.0$ indicates a low, crown (or free thinning)
 - o $d/D = 1.0$ indicates a perfect geometric thinning
 - o $d/D > 1.0$ indicates thinning of dominants

Thinning Schedules

A schedule is a systematic plan for a whole rotation based on deliberate decisions about kind of vegetation, products, and other benefits desired at each stage of stand development

- Reason backward from these goals to the schedule of treatments designed to achieve them
- Choosing a schedule involves three sets of choices
 - o Timing
 - o Method of thinning employed
 - o Intensity of thinning

Thinning Schedules ...

- Choosing a schedule involves three sets of choices (continued ...)
 - o Timing
 - Time of first thinning
 - Intervals between subsequent thinnings, if any
 - Rotation length
 - o Method of thinning employed
 - Low
 - Crown
 - Thinning of dominants
 - Systematic / Geometric
 - o Intensity of thinning
 - Amount of growing stock left in the stand, i.e., residual stand density
 - Perhaps the most difficult choice

Thinning Schedules ...

- Timing -
 - Time of first thinning
 - o Theoretically can be made as soon as crowns or root systems of individual trees grow together and start to interfere
 - o Tempered by economic consequences
 - o Best performed when value of anticipated future benefits, discounted to present using compound interest, equals the cost of the operation

Thinning Schedules ...

- Timing ...
 - Thinning intervals
 - o One choice is governing by constant intervals of height growth
 - o “Bio-logical” – frequent in young stands, less frequent in older stands
 - Rotation length – long rotations require ‘short- ‘ and ‘long-term’ decisions
 - o Helpful to consider three categories of trees:
 - Crop trees: the ultimate value in the stand
 - Long-term trees: for using growing space until crop trees need it
 - Surplus trees: eliminated in the current thinning

Thinning Schedules ...

- Methods
 - Orderly choice of methods often involves avoiding too much handling of small trees
 - o Systematic / Geometric
 - o Thinning of Dom's
 - o Crown
 - o Low
 - Irregular stands will likely involve having to do so much with such limited opportunity so the situation dictates use of two or more of these methods simultaneously in a free thinning operation

Thinning Schedules ...

- Intensity
 - Should generally decrease with age, as stands take longer to fill in available growing space as they age
 - Ultimately is geared toward a rate consistent with which growing space should be filled to achieve objectives

Stand Tending

Intermediate treatments applied early in the development of the stand designed to ensure control over composition and structure – undesirable species are the focus of removal

OBJECTIVES –

Deliberate reallocation of site resources (water, nutrients, temperature, light, etc.) to favor particular components of the vegetation

Stand Tending Methods & Application

Four distinct Methods

1. Cleaning
2. Weeding
3. Liberation cut
4. Improvement cut

Stand Tending Methods & Application

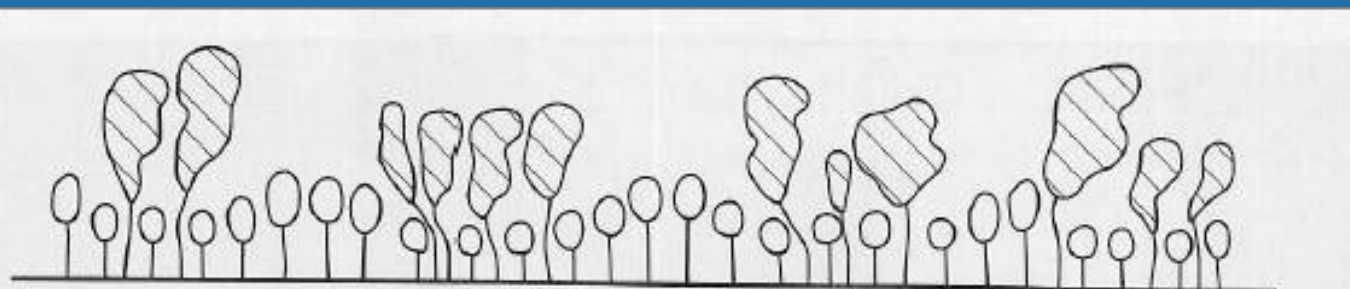
1. Cleaning

Takes place in a stand where trees are saplings or smaller to release one species from the dominance of another (tree) species

- Requires an investment (no immediate cash return)
- Done in the cheapest, most effective way
 - o Chemicals – spraying, lethal injection
 - o Mechanical – severing or simply breaking off tops of competitors
- Release enough of the favored species to ensure rapid dominance of the site

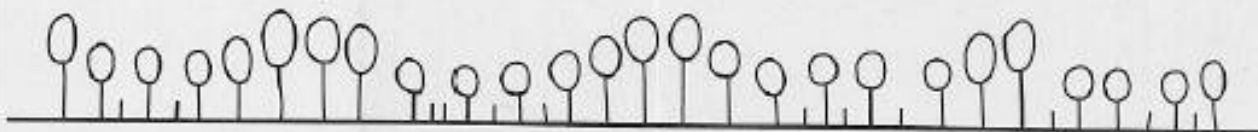
Stand Tending Methods & Application

1.



A. Before cleaning

In some stands, undesirable trees may partly cover more desirable ones, requiring a release treatment to free the oppressed saplings of good quality or species.



B. After cleaning

Once in a free-to-grow position, the saplings develop rapidly to form the new even-aged community.

Stand Tending Methods & Application

2. Weeding

Similar to cleaning, but applies to freeing favored seedlings / saplings from competing groundstory vegetation, vines, and shrubs

- Understory is mowed or grubbed out
- Herbicides may also be used

Stand Tending Methods & Application

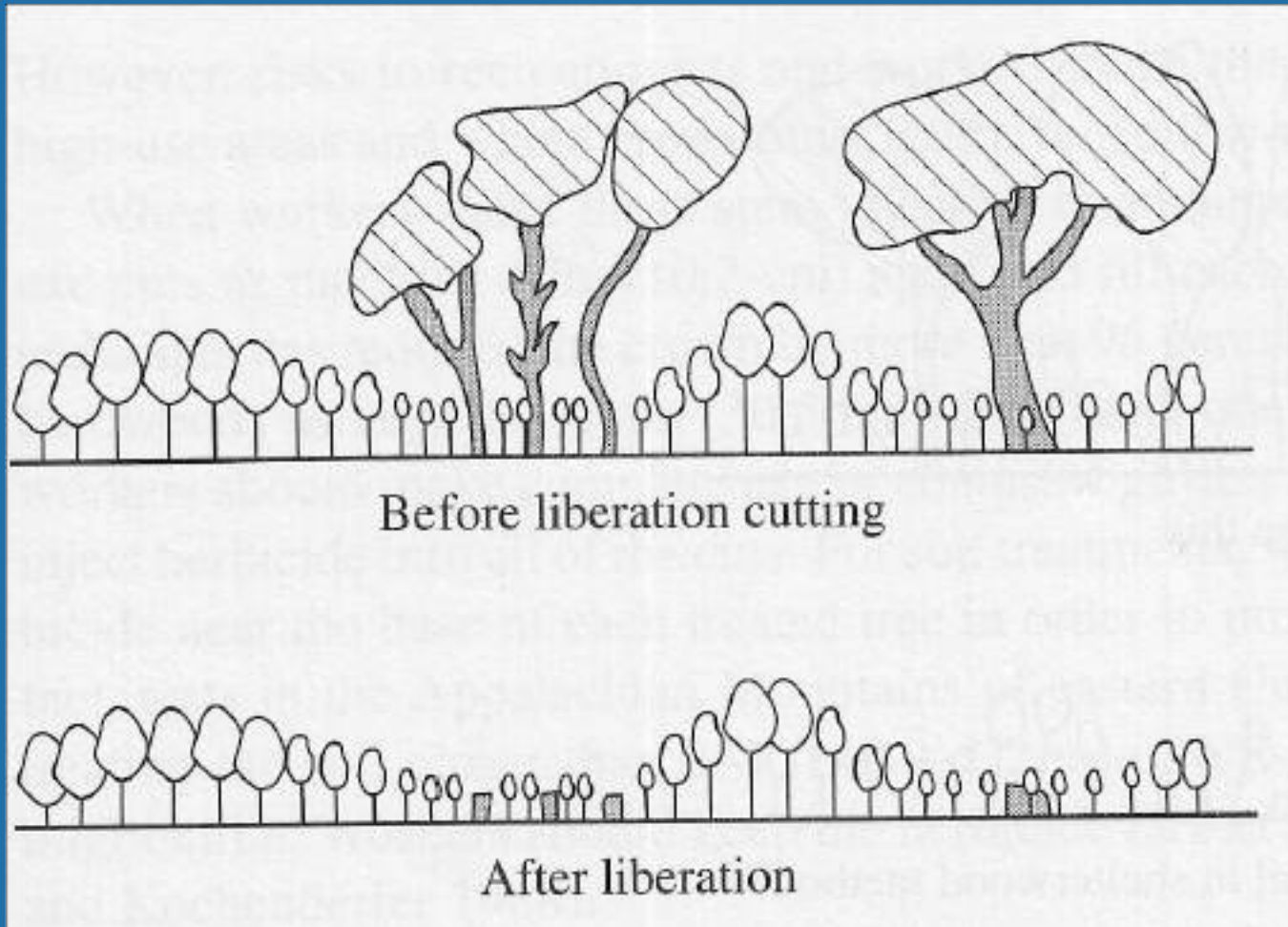
3. Liberation cut

Performed when favored trees are saplings or smaller to “free” them from an older cohort

- Trees removed from the older overstory may be of any species or form
- If merchantable, removal is simplified – usually done at a cost
- Often employed in situations where under-planting took place

Stand Tending Methods & Application

3. Liberation cut



Stand Tending Methods & Application

4. Improvement cut

Used in either even- or uneven-aged stands where released trees are pole-sized or larger to release trees that will improve the composition, form, and/or growth of the residual stand

- Often prescribed where cleaning or liberation cut may have been justified but delayed due to financial or other reasons
- Often the initial cut to bring previously unmanaged stands into a better condition for management

Summary Ideas - Thinning

- Thinning is the controlled acceleration of the reduction in number of favored trees through time
- Thinning objectives can be quite varied, but will involve consideration for a component of crop trees to finance operations
- Striking the proper balance between timing, method, and intensity is not easy – remains highly intuitive because there are so many factors to consider:
 - o Weather
 - o Disturbance (fire, land slips, slides, etc.)
 - o Prices & markets
- Given all these considerations, the schedule should be based on the best biological, economic, and mathematical analyses available

Summary Ideas - Stand Tending

- Cleaning and weeding are associated with comparatively intensive silviculture programs
- Cleaning and weeding are expensive – cheaper to eliminate the seed source
- Liberation operations and improvement cuts receive high priority in the early stages of intensifying silviculture programs
- Improvement cuts can be made at almost any stage of stand development – the later the application, the likelier it is that the released stand will remain irregular