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

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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

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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

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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

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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

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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

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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

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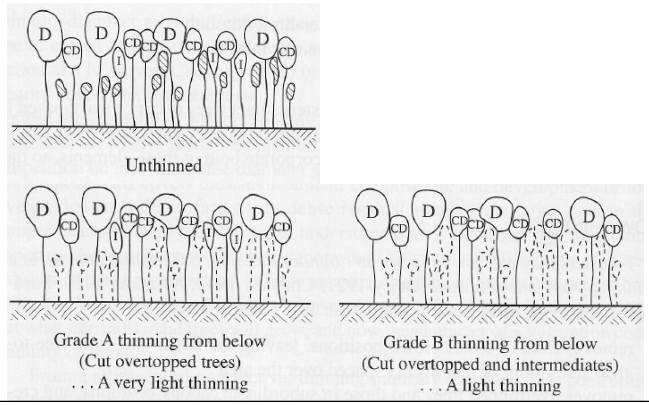
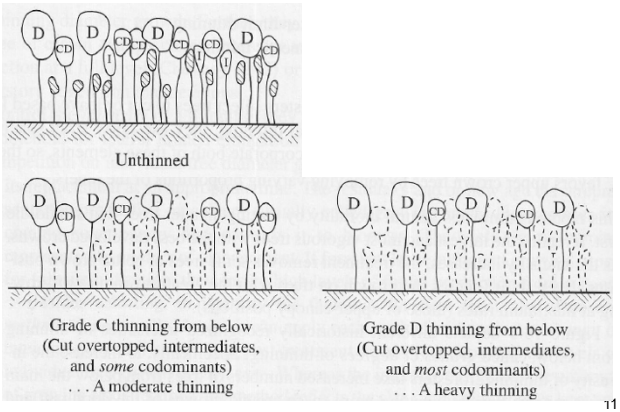
Thinning Methods & Application

1. Low thinning



Thinning Methods & Application



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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
     - Principal cutting is from upper crown classes, no matter how light
     - Bulk of intermediate & overtopped trees remain in the stand
   - Trees to be favored are either in the dominant class or co-dominant if necessary
     - Where co-dom has straighter, smoother bole w/ fewer, smaller branches than an adjacent dom, favor the co-dom
     - Position in canopy is taken as best indicator of past & future performance

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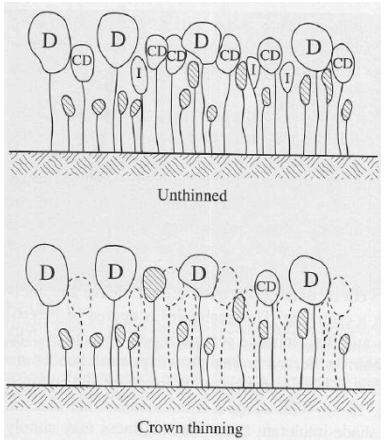
Thinning Methods & Application

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

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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

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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

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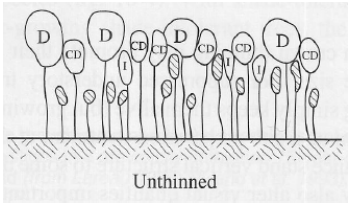
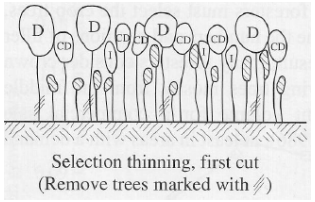
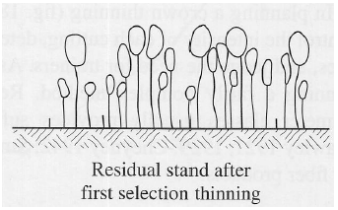
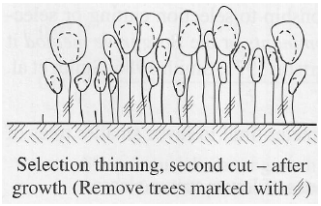
Thinning Methods & Application









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

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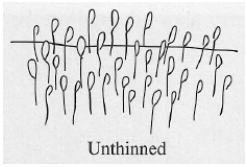
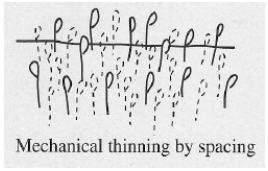
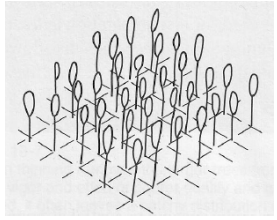
Thinning Methods & Application

4. Systematic thinning







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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

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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)
  - d/D 1.0 indicates a low, crown (or free thinning)
  - d/D = 1.0 indicates a perfect geometric thinning
  - d/D 1.0 indicates thinning of dominants

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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
  - Timing
  - Method of thinning employed
  - Intensity of thinning

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Thinning Schedules

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

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Thinning Schedules

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

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Thinning Schedules

- Timing …
  - Thinning intervals
    - One choice is governing by constant intervals of height growth
    - "Bio-logical" – frequent in young stands, less frequent in older stands
  - Rotation length – long rotations require 'short-' and 'long-term' decisions
    - 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

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Thinning Schedules

- Methods
  - Orderly choice of methods often involves avoiding too much handling of small trees
    - Geometric / Systematic
    - Thinning of Dom's
    - Crown
    - 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

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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

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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

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Stand Tending Methods & Application

Four distinct Methods

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

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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
     - Chemicals – spraying, lethal injection
     - Mechanical – severing or simply breaking off tops of competitors
   – Release enough of the favored species to ensure rapid dominance of the site

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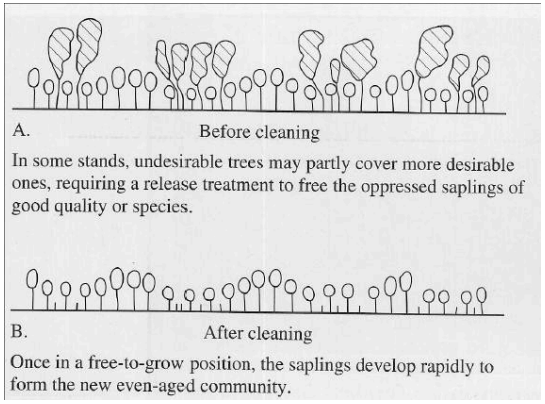
Stand Tending Methods & Application

1.



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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

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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

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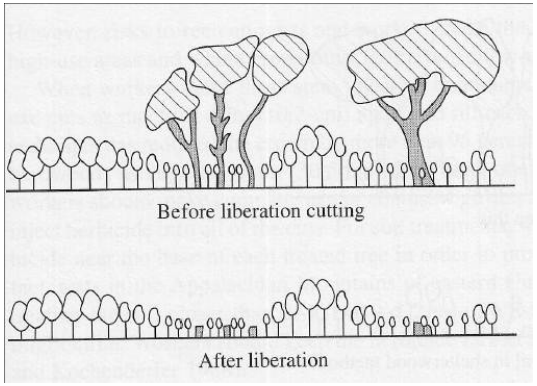
Stand Tending Methods & Application

3. Liberation cut



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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

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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:
  - Weather
  - Disturbance (fire, land slips, slides, etc.)
  - Prices & markets
- Given all these considerations, the schedule should be based on the best biological, economic, and mathematical analyses available

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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

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