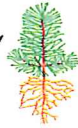


Silviculture

- Silviculture
- Thinning
- Reforestation
- Threats to seedling survival
- Pruning
- Fertility



Silviculture

- "Silva" is from the Latin root for tree.
- *Silviculture*: The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet diverse needs and values of landowners and society on a sustainable basis.



Silviculture

- Silviculture is the forestry equivalent to the term "agriculture".
- Silviculture is the culture of forests.
- Silviculture includes all practices we implement to reach some management objective: harvesting, planting, fertilization, thinning, etc.
- Harvest, reproduction, and regeneration



Silvicultural Prescriptions

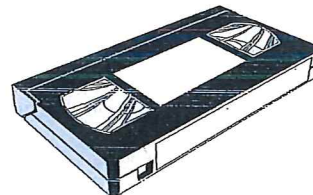
- *Silvicultural prescriptions*: translate management objectives into on-the-ground treatments;
 - Must be based on a working understanding of forest ecology.
 - Determine the current forest condition,
 - Define the desired future forest condition, and
 - Plan how to get from here to there.

Silvicultural Systems

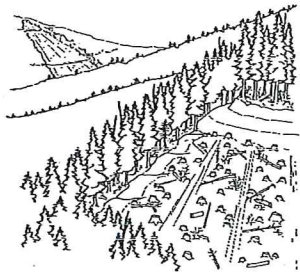
- A *Silvicultural System* is a particular set of planned techniques used to tend, harvest, and re-establish a forest stand.
 - Create *growing conditions* favorable for desired tree species.
 - Synonymous terms: Harvest Systems, Reproduction Systems, Regeneration Systems
- Silvicultural systems often labeled by the number of age classes they produce and/or by the methods they use stimulate natural regeneration of tree seedlings

I Want to Log "Selectively"

- Silvicultural Systems



Clearcut



Clearcutting Advantages

- Maximum immediate dollar return.
- Cost effective logging - one entry, easy to get around.
- Easy to plan, implement, and supervise:
 - No damage to leave trees (there aren't any).
 - Simpler slash disposal.

Clearcutting Advantages

- Potentially less soil disturbance:
 - Fewer roads and skid trails.
 - Fewer stand entries.
 - Easier to use cable logging.
- Can plant genetically superior stock:
 - ex: Blister rust resistant white pine

Clearcutting Advantages

- Good for shade intolerant species:
 - white pine, larch, Douglas-fir, ponderosa pine.
 - Clearcuts mimic conditions created by wildfire (but, clearcuts do not "equal" wildfires)
- Understory plants do well.
 - Good for livestock and big game grazing:
 - Watch for competition with trees.

Clearcutting Disadvantages

- Aesthetics - especially first few years after harvest.
- Long wait till next harvest - At least 20-30 years, when you can get a commercial thinning (depending on markets).
- Need markets for small material:
 - Otherwise small materials are left. However, this may provide nutrients, soil cover.

Clearcutting Disadvantages

- Increases wind, frost, temperature extremes:
 - Can get windthrow at edges of stand.
 - Can create a tougher seedling environment - especially on a dry, thin-soiled, south-facing slope.
 - May need to use shade cards, etc. help seedlings survive.

Clearcutting Disadvantages

- Generates lots of slash:
 - Slash can be a fire hazard, hassle to clean up, impedes grazing.
 - Difficult for the average forest owner to get contractor for a prescribed broadcast burn.
- Natural seeding may not be dependable (only if you rely on natural seeding).

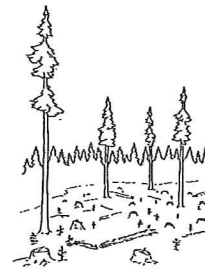
Clearcutting Disadvantages

- Weed Invasion:
 - Exotic, noxious weeds and brush have evolved to take advantage of disturbed site like this.
 - If trees don't get a good head start, brush and other competing vegetation can be a problem.

Clearcutting Disadvantages

- Potential to increase erosion, nutrient loss:
 - Primarily if skidding or site preparation is sloppy
 - If large numbers of clearcuts are made simultaneously in one watershed, there may be more stream erosion.

Seedtree



Seed Tree Advantages

- Same advantages of clearcutting except:
- More reliable seed source (but not as sure as planting).
- Genetic gain by selecting superior seed sources:
 - You don't get this if you are clearcutting and relying on natural seeding from the margins.
 - This (and other non-clear-cut methods) may be the only genetic improvement avenue open to private forest owners without access to seedlings from genetically superior seed sources.

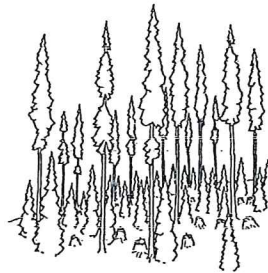
Seed Tree Advantages

- Income when seed trees are removed:
 - Often small, considering harvest cost/unit volume.
- Slightly more aesthetic appeal
- Wildlife benefits:
 - Seed trees can serve as raptor perches, at least until they are removed.

Seed Tree Disadvantages

- Same disadvantages of Clearcutting except:
- Risk losing trees to wind:
 - Especially weak trees or on shallow soils.
- Risk losing seed trees to site preparation, if by fire.
- Risk losing some seedlings when seed trees removed.
- May not be economically feasible to remove seed trees.

Shelterwood



Series of cuts for a shelterwood may take up to 30 years to complete. Number of entries, trees cut may vary. A Shelterwood cut is defined by *intent*: to shelter site

Shelterwood Advantages

- Reliable seed source - leave more trees.
- Protects site (more than seed tree).
- 1st harvest acts like a thinning - more volume on trees harvested during 2nd entry.
- Genetic gain by selecting superior seed sources.
- Distributes income somewhat.
- More aesthetic appeal (changes aren't so abrupt).

Shelterwood Disadvantages

- Risk to residual trees:
 - logging.
 - slash disposal.
 - site preparation.
 - Damage may make residual trees more vulnerable to insects and disease.
- Higher logging costs:
 - More entries.
 - Time working around residual trees.

Shelterwood Disadvantages

- Markets for first harvest are limited.
- More complex (takes more time and energy)
- Tendency to favor shade tolerant regeneration:
 - May not be problem, if site is relatively wet, otherwise these species may be more vulnerable to insects and disease when they get older.

Selection



- Individual or small groups of trees cut at 5-20 year intervals, as they reach economic or biological maturity
- *Individual tree selection*: Harvesting individual trees of all sizes, more or less uniformly throughout the stand.
- *Group selection*: Harvesting all sizes of trees in a small area (twice the height of the mature trees - usually .25 to 1.5 acre)

Selection Advantages

- Aesthetics - it looks like a forest.
- Spread income over more years.
- Provides seedling protection from sun and wind.
- Doesn't require market for small logs (individual tree selection only).

Selection Advantages

- Keep late successional species in the stand.
- Less slash (less fire hazard) makes it more feasible to let slash decompose naturally, providing nutrition benefits.

Selection Disadvantages

- More complex - difficult to do correctly:
 - Emphasis is on getting a stand that has a "L-shaped" distribution of tree ages/diameters:
 - As much of an art as a science when done well.
- Higher logging costs.
- Strong temptation to highgrade.

Selection Disadvantages

- Relatively low income from any one harvest.
 - On a small property, there may not be enough logs to make an economical harvest unless you combine with an adjacent landowner.
- Favors shade tolerant species (group selection less so).

Selection Disadvantages

- Irregular growing conditions may mean more taper, less self pruning in boles.
- Highest risk of damage to residual trees.
- Can result in more roads - more land out of production, and potential sediment production.
- Less grazing.

Diameter limit cutting \neq Selection!

- Diameter limit cutting is a logging method (not a silvicultural system), where all trees above a certain diameter are cut, regardless of individual tree vigor, species, or distribution.
- Diameter limit cuts are simple to apply but often lead to problems. Tendency to leave slow-growing, poor quality trees - the wimpiest competitors in the stand! This erodes forest genetics.



Silvicultural Systems: *Summary*

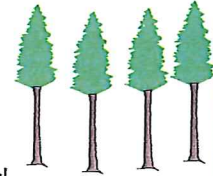
As we move from:

Clearcut → Seedtree → Shelterwood → Selection

- Favor shade tolerant trees.
- Rely more on natural regeneration.
- Spread out income over time.
- Soften visual impact.
- Create milder, more consistent, site climates.
- Get higher risk to residual trees during logging.
- Incur higher logging expense.

Name that Silvicultural System!"

- There can be a lot of variation to how these systems are applied.
- *Observable differences between systems can be slight; "One person's shelterwood is another person's seed tree, is another person's commercial thinning".*
- What makes them different is the *intent*: (e.g.: Is intent to shade new seedlings?, then it is a shelterwood)



Shelterwood or Commercial Thinning?

Choosing a Silvicultural System

- Knowing these systems, how do we choose?
- Consider: *Goals, Site/Stand Characteristics, and Finances.*
- Choose a system (or collection of silvicultural systems, if you have a larger acreage) that provides the best mix of returns to landowner goals, given circumstances.

Silvicultural Systems: *Goals*

- *Grazing:* Clearcut, Seedtree or Shelterwood
- *Large immediate income:* Clearcut
- *Periodic income:* Shelterwood, Selection
- *Financial investment:* Which system leaves healthiest forest?
- *Place to practice conservation:* All systems
- *"Natural" (eye of the beholder):* Selection? Clearcut?
- *Wildlife:* Depends on wildlife species, neighboring property habitats

Silvicultural System: *Site/Stand*

A site inventory will help you appraise this.

Some choices, based on common site/stand characteristics:

- *Site is harsh, dry:* Shelterwood, Selection
- *Heavily high graded stand:* Clearcut
- *Favor shade intolerant species:* Clearcut, Seed Tree
- *Favor shade tolerant species:* Selection, Shelterwood
- *Dwarf Mistletoe:* Clearcut, Group Selection

Questions on Silviculture?

Thinning



Tree-Tree Competition: *Problems*

- Reduced availability of light, water, nutrients, space, CO₂, O₂, etc.
- Pests may be attracted to stressed, competing trees - subsequent fire risk.
- Overtopping by unfavored trees robs light, and can lead to physical damage.
- Wind can whip & break limbs and buds.



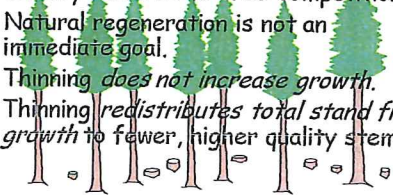
Tree-Tree Competition: *Benefits*

- Self pruning - shade kills lower branches and whipping action from wind knocks them off.
- "Trains" stems to be straight (applies to hardwoods, primarily).
- May help control weeds (e.g.: knapweed).
- Cover protects site from heat, erosion.
- Reduced open intake.



Thinning

- *Thinning*: Tree removal in an even-aged forest stand (or even-aged groups within a stand) that reduces tree density and tree-to-tree competition.
- Natural regeneration is not an immediate goal.
- Thinning *does not increase growth*.
- Thinning *redistributes total stand fiber growth* to fewer, higher quality stems.



Why Thin?

- Reduce competition
- Select the most favorable tree species.
- Reduce insect and disease vulnerability:
 - Increase individual tree vigor,
 - Diversify tree species.
- Improve forest genetics

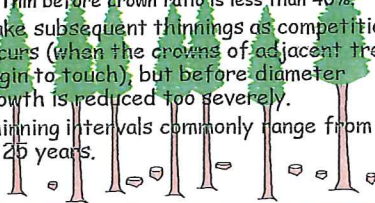


Why Thin?

- Increase individual tree and stand value.
- Use or sell trees that would otherwise die and decay ("capture mortality").
- Provide periodic income.
- Enhance non-timber values:
 - E.g.: Allowing more light into understory may stimulate desirable understory plants and wildlife they depend on.
- Decrease fire hazard

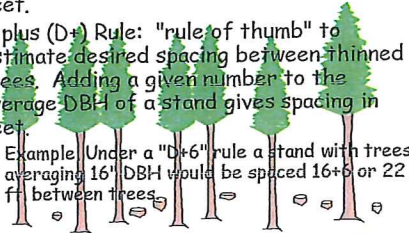
When to Thin

- Old, large trees do not respond to thinning as well as young, small trees:
 - Begin thinning early (10-20 year old trees).
 - Thin before crown ratio is less than 40%.
- Make subsequent thinnings as competition recurs (when the crowns of adjacent trees begin to touch), but before diameter growth is reduced too severely.
- Thinning intervals commonly range from 10 to 25 years.



Desired Spacing after Thinning?

- Distance left between trees varies, depending on trees' size; usually 12 - 25 feet.
- D plus (D+) Rule: "rule of thumb" to estimate desired spacing between thinned trees. Adding a given number to the average DBH of a stand gives spacing in feet.
 - Example: Under a "D+6" rule a stand with trees averaging 16" DBH would be spaced 16+6 or 22 ft between trees.



Thinning Definitions:

- *Pre commercial*: Any thinning of nonmerchantable trees ("PCT")
- *Commercial*: Any thinning of merchantable trees.
- *Low thinning*: Removes trees from lower crown classes to favor those in upper crown classes ("thinning from below").

Thinning Definitions:

- *High thinning*: Removes trees from dominant and codominant crown classes to favor best trees of those same crown classes ("thinning from above", "crown thinning").
- *Free thinning*: Removes trees to control stand spacing and favor desired trees, using a combination of thinning criteria without regard to crown position.

Thinning Definitions:

- *Salvage cut*: Removes dead trees or trees being damaged or dying due to injurious agents other than competition, to recover value that would otherwise be lost.
- *Sanitation cut*: Removes trees which are infected by, or highly susceptible to, insects or diseases, to stop or reduce actual or anticipated spread of insects or diseases.

Which trees to leave?

- Species and spacing?
- Little genetically superior tree seedling stock available to NIPF owners (economically).
- NIPF owners can use thinning to improve forest genetics.