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

Silviculture
- "Silve" 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
**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:
  - 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.

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 nature 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 ≠ 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 as the simplest competitors in the stand! This affects 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)

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

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 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 & 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., knotweed).
- Cover protects site from wind erosion.
- Reduced labor in future.

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%.
- More subsequent thinnings are composition related (when the density of adjacent trees begin to touch), but before diameter growth is reduced too severely.
- Thinning intervals commonly range from 10 to 20 years.

Desired Spacing after Thinning?

- Distance left between trees varies, depending on trees' size; usually 12 - 25 feet.
- D plus (D-1) Rule: "rule of thumb" to estimate desired spacing between thinned trees. Adding a given diameter to the average DBH of the stand gives spacing in feet.
  - Example: Under a "D-6" rule a stand with trees averaging 15" DBH would be spaced 16", 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.