

# What is Thinning?

- ◆ The most challenging logging chance faced by a harvesting system.
- ◆ The objectives of thinning are to:
  - Remove small, poorly formed, diseased, or otherwise undesirable trees
  - Improve the remaining stands
- ◆ **Thinning vs. partial cuts**

# Thinning Systems

- ◆ To accomplish the objectives, the harvesting systems:
  - must remove these small, low volume trees,
  - cause minimal damage to the remaining trees
- ◆ Additionally,
  - a minimal amount of land should be cleared for roads and landings
  - this land will be out of timber production during the remainder of the rotation

# Thinning Systems

- ◆ Land managers should understand:
  - the impacts of their thinning prescriptions on economics of harvesting systems
- ◆ Without such understanding, they may prescribe operations which:
  - are uneconomical
  - sacrifice revenue through lower stumpage prices or
  - at worst, are not interested by buyers in their timber sale

# Thinning Methods

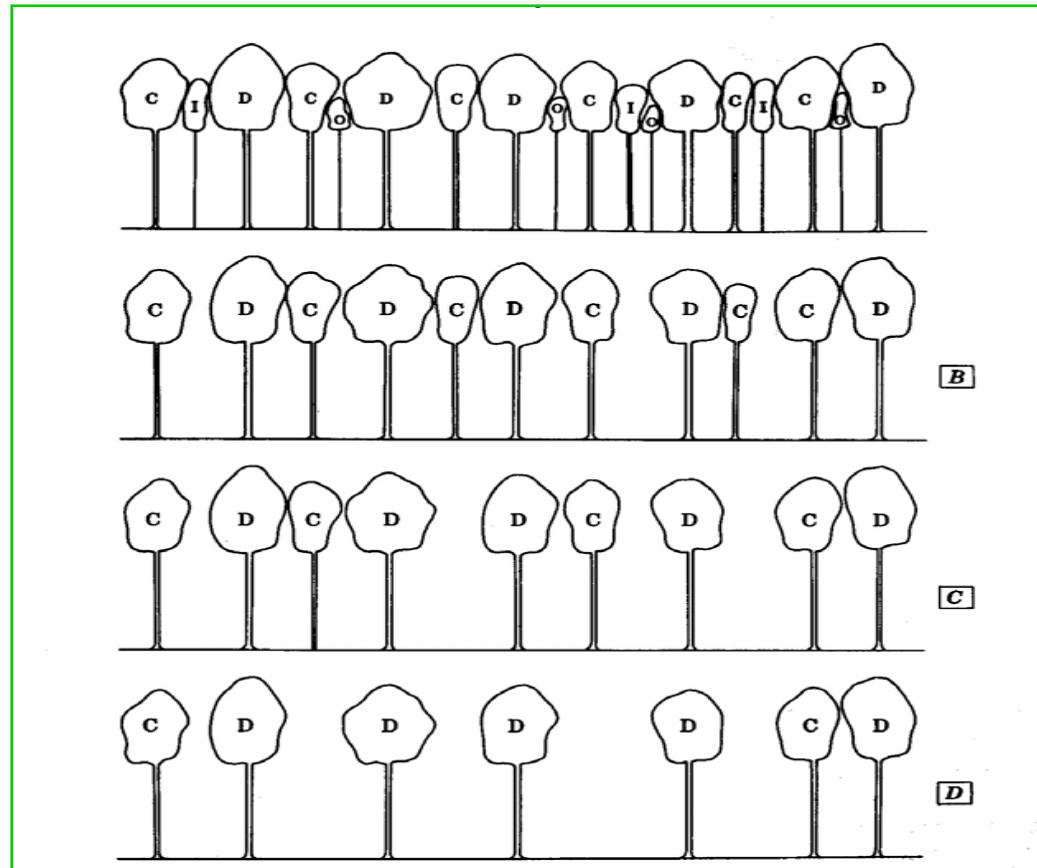
Silviculture textbooks describe several types of thinnings including:

- ◆ Low thinning,
- ◆ Crown thinning,
- ◆ Selection thinning, and
- ◆ Mechanical thinning.

# Low Thinning

- ◆ This method, the oldest, is sometimes called “**thinning from below**”.
- ◆ Trees are removed from the lower crown classes.
- ◆ Low thinning has a simple, close, and logical relationship to the natural course of stand development.
- ◆ It is easy to pick the trees to remove.

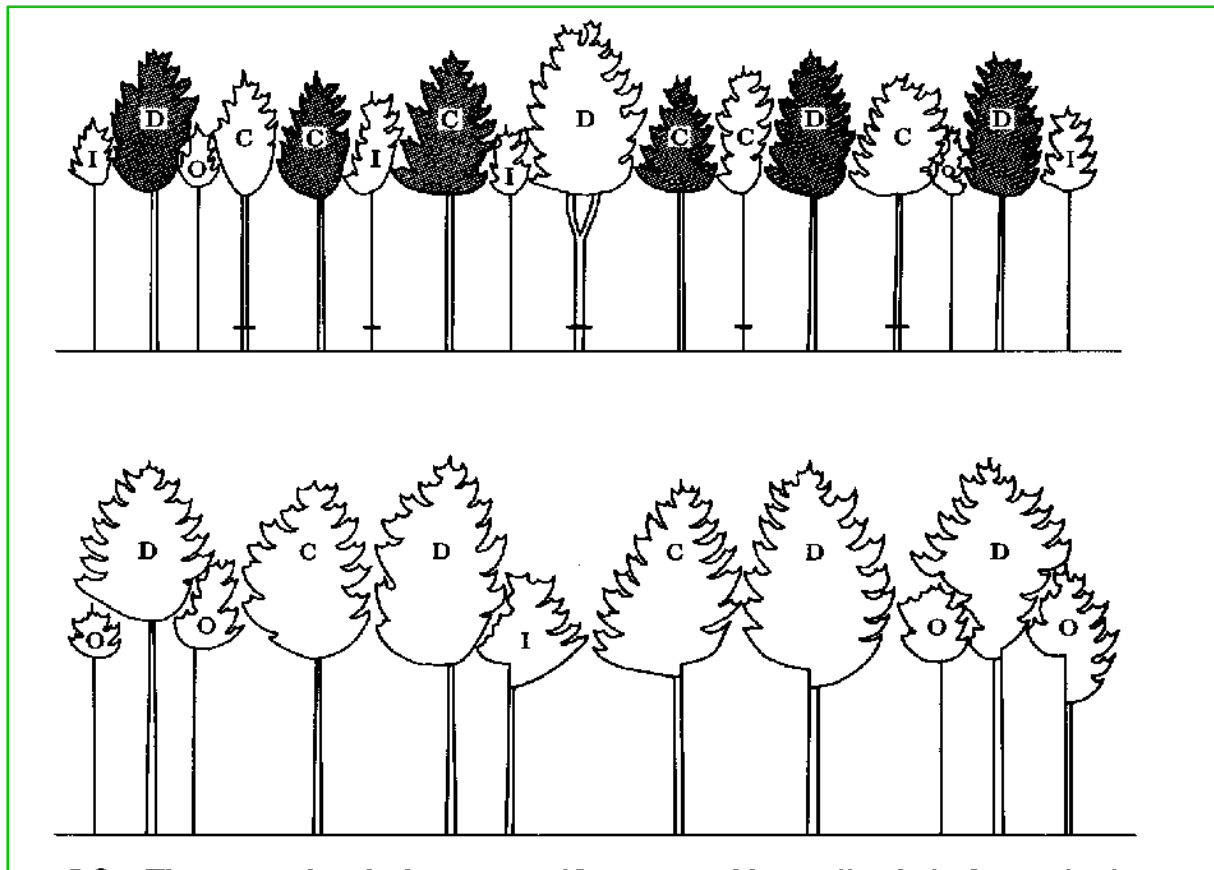
# Low Thinning



# Crown Thinning

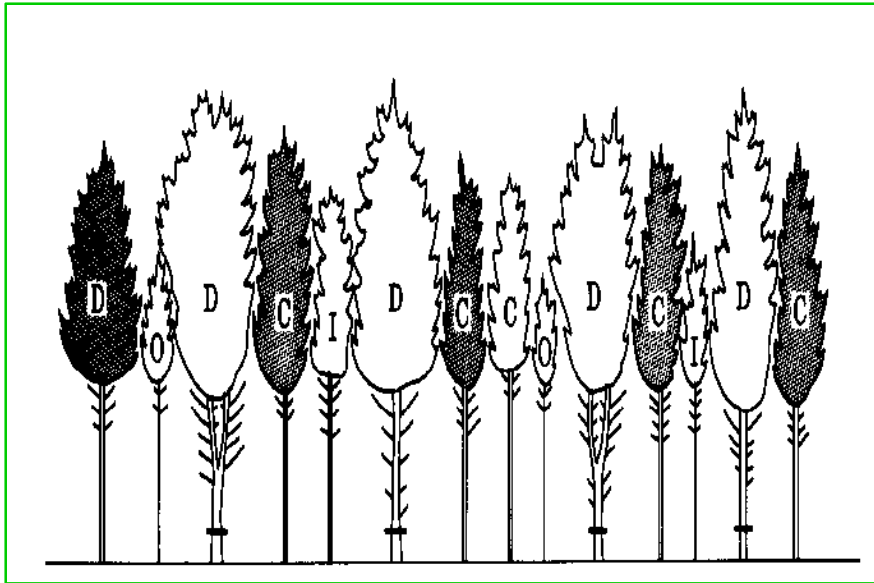
- ◆ Crown thinning was developed in which trees are removed:
  - from the middle and upper portion of the range of crown and diameter classes
  - rather than from the lower end

# Crown Thinning





# Selection Thinning



- ◆ dominant trees are removed
- ◆ stimulate the growth of trees in the lower crown classes

# Mechanical Thinning

- ◆ The trees to be cut or retained are chosen on the basis of :
  - some predetermined spacing or other geometric pattern
  - with little or no regard for their positions in the crown canopy
- ◆ Is an older, ambiguous designation
- ◆ “Mechanical” refers to the mechanistic mode of choices and not to any use of machinery.

# Mechanical Thinning

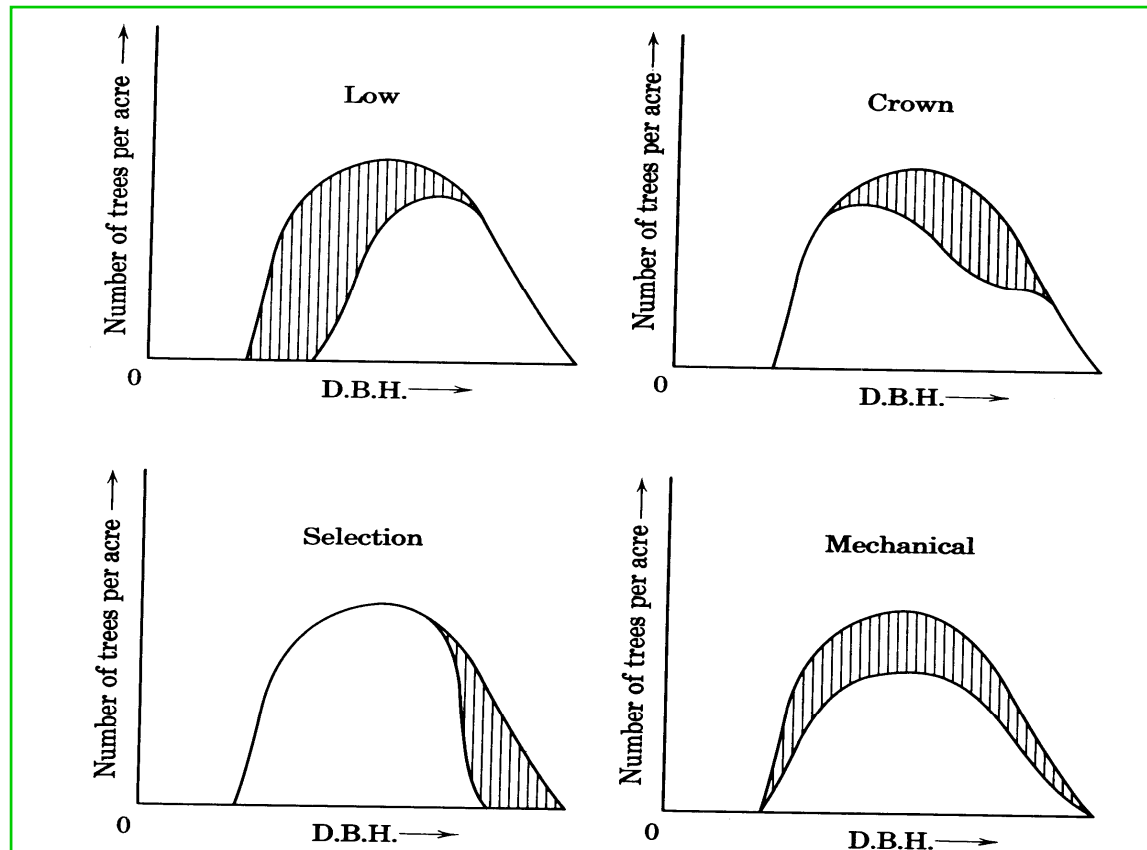
There are two general patterns that may be followed in mechanical thinning:

- ◆ **Spacing thinning** – trees at fixed intervals of distance are chosen for retention and all others are cut.
- ◆ **Row thinning** – trees are cut out in line or narrow strips at fixed intervals throughout the stand.

# Row Thinning



# Thinning Methods



(Source: Smith, D. et al. 1997. The Practice of Silviculture: Applied Forest Ecology)

# Thinning Practices

- ◆ To achieve the silvicultural objectives of thinning, as few trees as possible should be removed non-selectively.
- ◆ However, it will decrease the harvesting productivity and increase the cost accordingly.
- ◆ As a result, we must make a trade-off between thinning selectivity and cost.

# Thinning Practices

- ◆ Purely selective thinning is possible but expensive.
- ◆ Pure row thinning has no silvicultural advantages.

# Thinning Method

- ◆ A common compromise method used is a **fifth row/select thinning**.
  - This method provides a similar removal level for residual stand as a purely selective thinning does.
  - However, removing volume per acre and average tree size are more profitable than pure selection.



# Marking Trees

- ◆ Many foresters feel that timber should be marked prior to thinning if a quality thinning job is to be performed.
- ◆ This is not always the case.
  - costs about \$14 per acre
  - must be done before the sale
  - strong timber market may be missed by waiting for marking to be completed

# Marking Trees

- ◆ The feller-buncher operator might produce the same selective result as marking trees before harvest.
- ◆ The marking of trees to be cut can also make the feller-buncher's job more difficult.
- ◆ If marking is required,
  - it should depend on the harvesting intensity.
  - it is often preferable to mark the trees to leave.
  - leave trees are usually marked on all sides.

# Select Thinning System?

- ◆ The smaller the better?
- ◆ Sometimes this is the case, but often it is not. Because small machines:
  - have smaller payloads
  - require more trips into the stand
  - will result in higher costs per hour or per unit

# Thinning Systems

Four thinning systems:

- ◆ Bobtail truck
- ◆ Conventional systems
  - tree-length skidding
  - shortwood
- ◆ Cut-to-length
- ◆ Chipping system

# Bobtail Truck System

- ◆ This system used a bobtail truck which:
  - is driven into the woods
  - is loaded by hand or with a simple cable loader
  - has payload of 3-5 cords of shortwood
- ◆ Wood was felled, delimbed, and piled by hand.
- ◆ The system could produce about two loads per day or 50 cords per week.

# Bobtail Truck Systems

- ◆ Many foresters:
  - Good memories of these systems
  - Performed thinnings in an excellent manner
- ◆ Problems with these systems:
  - Limiting their ability to work after any significant amount of rainfall
  - Product utilization was often poor
  - Extremely hazardous and strenuous
- ◆ Nearly disappeared in most of the areas

# Conventional Systems

- ◆ Feller-buncher and grapple skidder
  - Use **feller-buncher** to fell and bunch timber
  - Access corridors for removal by **grapple skidder**
- ◆ **Three-wheeled and small four-wheeled feller-bunchers are best suited for this application.**

# Conventional Systems

- ◆ Can deliver:
  - tree-lengths or
  - random lengths bucked with chainsaw or slasher
- ◆ Produce 400-500 cords per week
- ◆ Efficiently use both capital and labor
- ◆ Bucking into smaller products is often performed in order to increase truck payloads.



# Conventional Systems

- ◆ Do require removal of trees to create access corridors
- ◆ Therefore, remove some trees in a non-selective manner
- ◆ Require fairly large landings
- ◆ Fifth-row/select thinning is a common method with these systems

# Cut-to-length Systems

- ◆ Have been popular in the Lake States, Canada, and the Scandinavian countries for years.
- ◆ Use **forwarders** to remove processed wood from the woods to roadside.
- ◆ For years these systems relied upon **manual felling, delimiting, and piling of woods** before forwarding.

# Cut-to-length Systems

- ◆ Modern versions of these systems rely on
  - harvesters or feller-bunchers for felling
  - processors to prepare wood for forwarders
- ◆ Interest in such systems has been steadily increasing due to several factors as follows:
  - Less site damage
  - Less labor intensity
  - Reduced residual stand damage
  - ...

# Cut-to-length Systems

## ◆ Some advantages:

- **Leave limbs and debris scattered across the site:**
  - keep nutrients in the woods,
  - look more aesthetically pleasing, and
  - limb mat can reduce soil damage by machines.
- **Perform thinnings more selectively**
- **Require smaller landing**
  - Stack wood higher at roadside

# Cut-to-length Systems

- ◆ Some disadvantages:
  - **Initial capital investment is substantial**
  - **Lower weekly production rate**
    - is often half that of tree-length skidding systems
  - **Higher costs** per unit of wood
  - **Equipment is complex**
    - more skilled labor is usually required

# Chipping Systems

- ◆ Are also very popular for first thinning
- ◆ Since nearly all of the material removed is pulpwood, chipping on site can:
  - increase fiber yields and truck payloads,
  - minimize handling of these small stems,
  - thus improve productivity of the entire system.

# Chipping System

- ◆ The chipping system for thinning:
  - tends to be quite large
  - needs high capital investment
  - requires higher production
  - requires a larger landing for safe and efficient operations
  - best suited for larger tract where the need to move is minimized.

# Thinning Systems

Comparisons of some common mechanized thinning systems

## Delivered Cost, \$ per cord (excluding stumpage)

<b>System</b>	<b>Clear cut</b>	<b>2<sup>nd</sup> Row</b>	<b>3<sup>rd</sup> Row</b>	<b>5<sup>th</sup> Row</b>	<b>9<sup>th</sup> Row</b>	<b>Selective</b>
Tree-length	31.6	33.7	37.3	37.5	37.8	na
Cut-to-length	34.4	38.1	39.5	39.4	na	40.4
Chipping	37.8	39.8	40.1	40.1	na	na

(Source: W. D. Greene and B. L. Lanford, 1999)



# Thinning Systems

Comparisons of some common mechanized thinning systems

## Weekly Production, cords

<b>System</b>	<b>Clear cut</b>	<b>2<sup>nd</sup> Row</b>	<b>3<sup>rd</sup> Row</b>	<b>5<sup>th</sup> Row</b>	<b>9<sup>th</sup> Row</b>	<b>Selective</b>
Tree-length	538	530	422	416	409	na
Cut-to-length	321	284	268	265	na	257
Chipping	515	515	515	515	na	na

(Source: W. D. Greene and B. L. Lanford, 1999)

# Thinnings

- ◆ Solid wood manufacturers generally:
  - perform **one to four thinnings**
  - follow by a final harvest which can be either:
    - seed tree,
    - shelterwood, or
    - clearcut.

# Thinnings

- First thinning:
  - is in 12-18 year age class
  - removals are almost all pulpwood
- Second thinning:
  - is generally stand improvement cut
  - optimizes spacing and removes suppressed or diseased trees
- Third and fourth, if performed:
  - remove some co-dominant and dominant trees down to specified basal area or trees per acre prescription.