MANAGING STAND QUALITY (INCLUDING PRUNING)

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Nyland - 2010

Background reading:

Chapter 20, in Nyland, R.D. 2002. *Silviculture: Concepts and Applications.* Waveland Press. Long Grove, IL. 2ed.

Sources cited:

Emmingham, W, and S. Fitzgerald 1995. Stand management: Pruning to enhance tree and stand value. In *The Woodland Workbook*. Ore. State Univ. Ext. Serv. EC 1457.

Rast, E.D., D.L. Sonderman, and G.L. Gammon. 1973. A guide to hardwood log grading. (Revised). US For. Serv. Gen. Tech Rpt. NE-1.

Rast, E.D., J.A. Beaton, and D.L. Sonderman. 1989. Photographic guide of selected external defect indicators and associated defects in white oak. US For. Serv. Res. Pap. NE-628.

In silviculture we strive to …

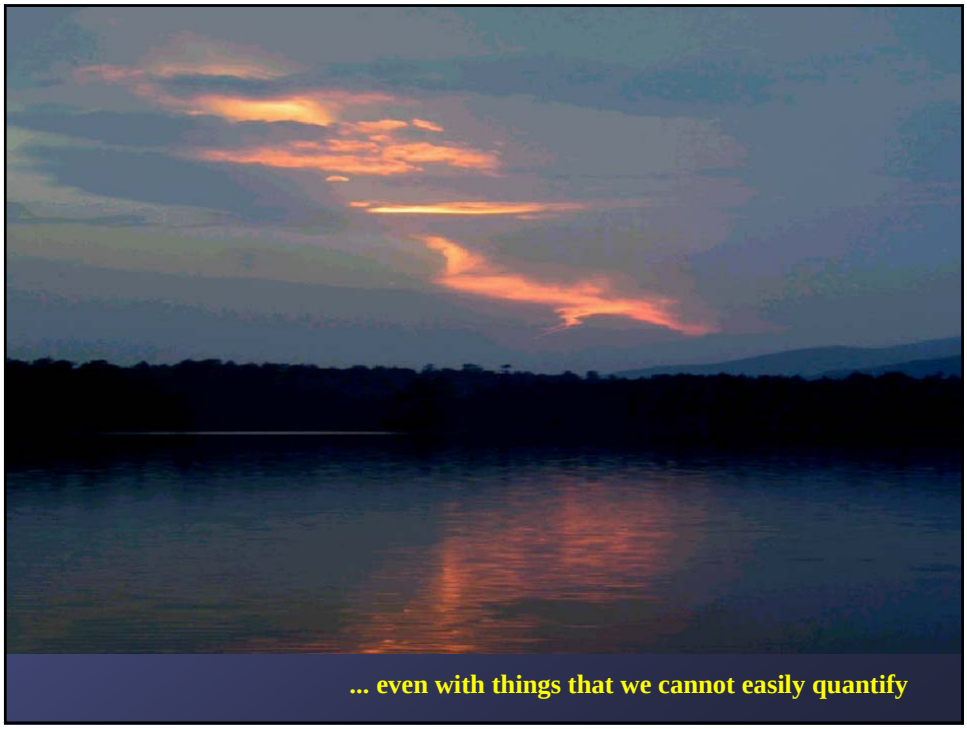
- satisfy landowner objectives

- provide values and goods that maximize benefits to a landowner

These may not have maximum *market place* value, but do optimize benefits of interest to a landowner ...

... this implies that different uses and products may have / offer a range of values

… *depending on quality*



... even with things that we cannot easily quantify

In general, people *willingly* pay / invest more for "stuff" that offers the highest quality *(consistent with their need)* …

… given no differences in quantity

With wood products tree quality reflects …

... future EXPECTED YIELD of valuable boards or veneer sheets

... when eventually reduced by primary manufacturing

... fitting the need, adding to the value

Quality is a function of purpose …

how someone will use it

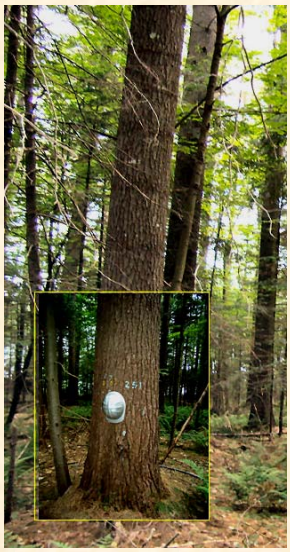
- how well it satisfies the intended use

Quality of trees and logs is reflected in …

- Size *(diameter and length)*

- Straightness

- Visible grading defects



... quality trees
.... quality products

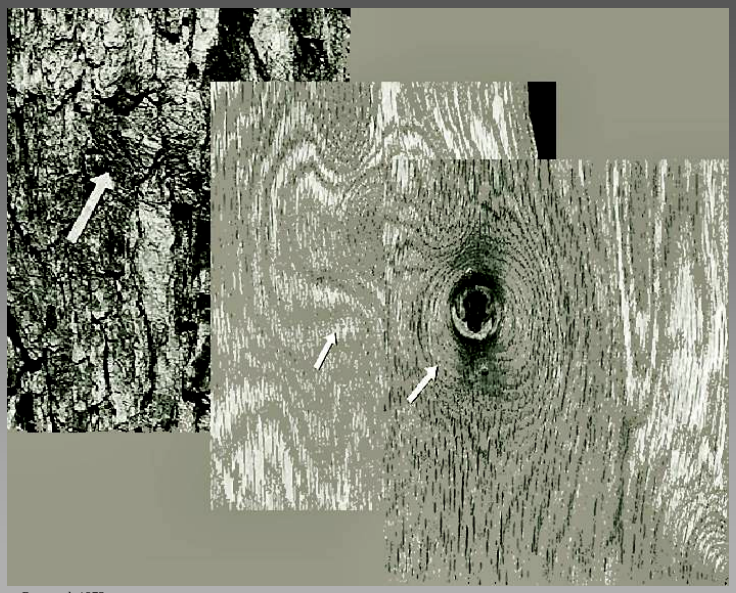
Grading defects include …

- **knots**
- **pitch**
- **holes**
- **ingrown bark**
- **cracks and seams**
- **unsound *(rotten)* wood**
- **unwanted color[a]**

[a]**Not for all products**

... watch this healed branch stub

... first board



Rast et al. 1973

... but underneath

Mostly, physical defects reduce wood quality for strength, machining, and beauty …

... but may include decay as well

Grade / judge

- Softwoods from the *BEST* side

- Hardwoods from the *POOREST* side

... due to the probable end use

Softwoods largely used as structural members ...

.... you can cover or hide the poor side for many/most uses

Hardwoods largely used for furniture and architectural pieces ...

... you expose the wood for its beauty, and machine it with precision

Hardwoods ...

- surface defects on the bole indicate conditions of poor quality inside a log or tree

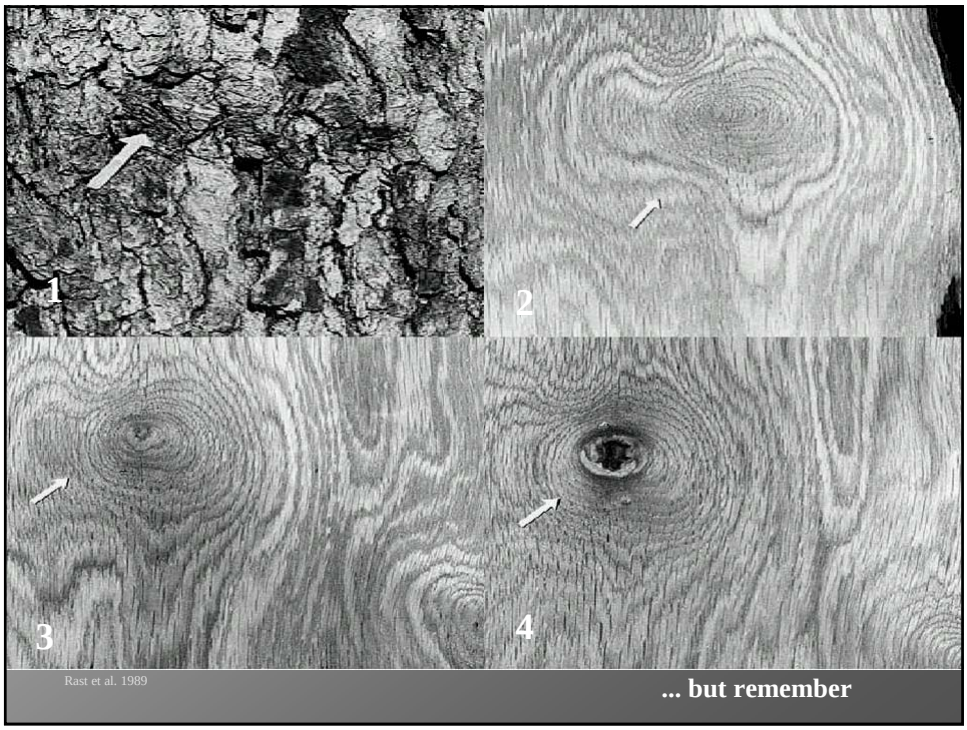
- trees with a "clean" bole will yield better quality lumber and veneer

… especially if of large diameter

Branch free …

… few surface indicators

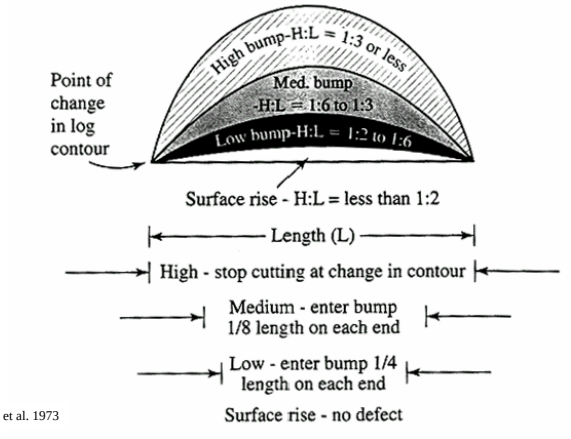
… like this



Rast et al. 1989

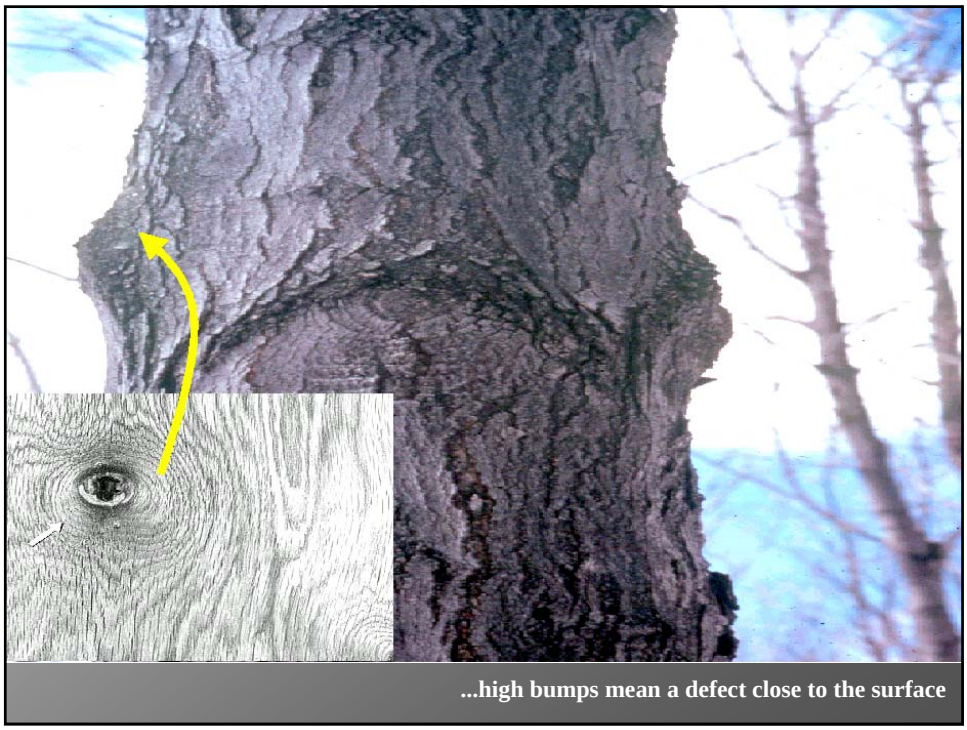
... but remember

Imbedded branches show up as surface bumps ...



Rast et al. 1973

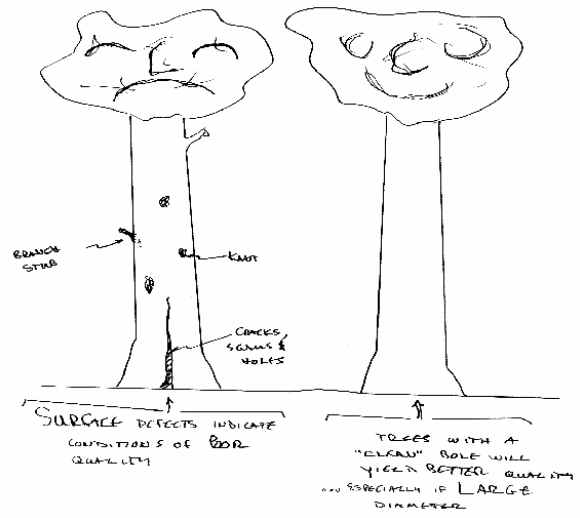
... the lower the bump, the deeper the stub



...high bumps mean a defect close to the surface

… and you can see them

Low-grade trees have many defects ...



We have standard grading rules to aid assessments ...

HARDWOODS

SIMPLIFIED TREE GRADE SPECIFICATIONS*

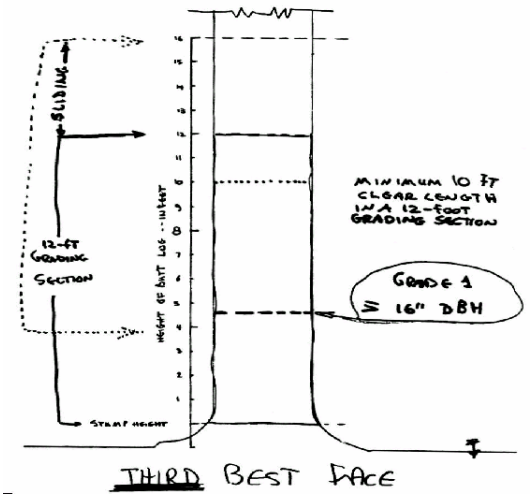
CHARACTERISTIC	GRADE 1	GRADE 2	GRADE 3
MINIMUM LENGTH CLEAR MATERIAL ON FACE	10 ft	8 ft	6 ft
MINIMUM DBH	16" / ≥ 19"	13"	10"
MINIMUM LENGTH PER CUTTING	10 ft / 5 ft	6 ft	2 ft
MAXIMUM SCALING DEFECT	10%	10%, BUT ≤ 40% IF GR 1 FACE	50%

* GRADE 3rd BEST FACE OF A 12-FOOT PORTION OF THE BUTT LOG (WITHIN THE BUTT 16 FEET)

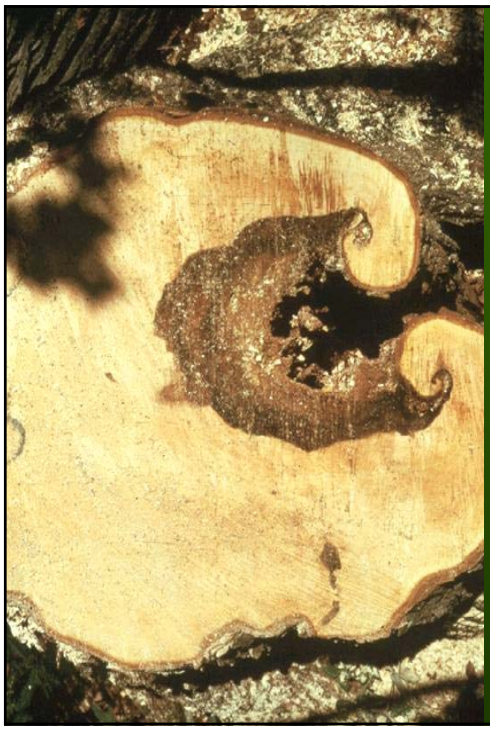
Simplified by R.D. Ingram

Using the butt log as an index to the entire merchantable length ...

Grade 1 hardwoods must be at least 16” DBH …



... counting defects outside the heart center
... radius equal to 1/5 small-end diameter

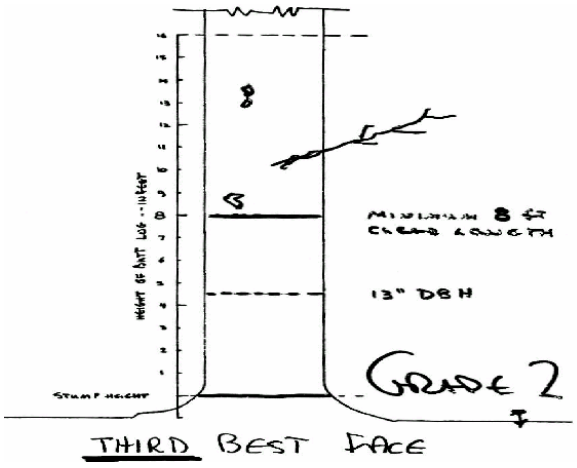


... using sound defects rather than rot as the primary elements of degrade

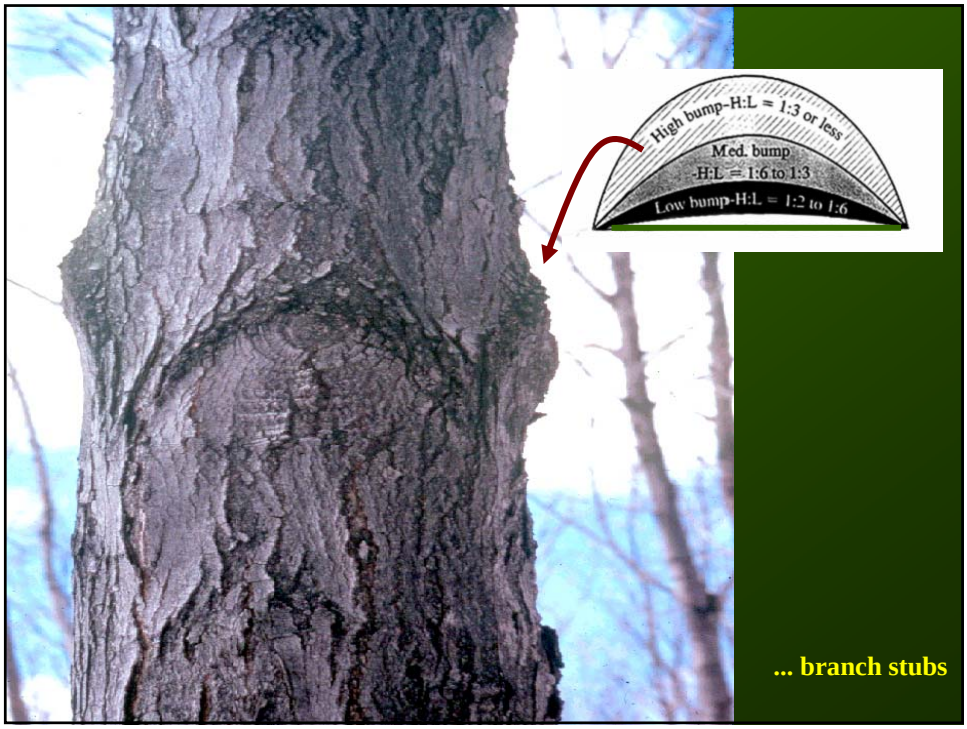
... color NOT directly considered

... but it prevents some uses and may affect lumber prices in some species

Evaluate the standing tree based upon indicators that you can see ...



... on the butt log



... branch stubs

... but not low bumps

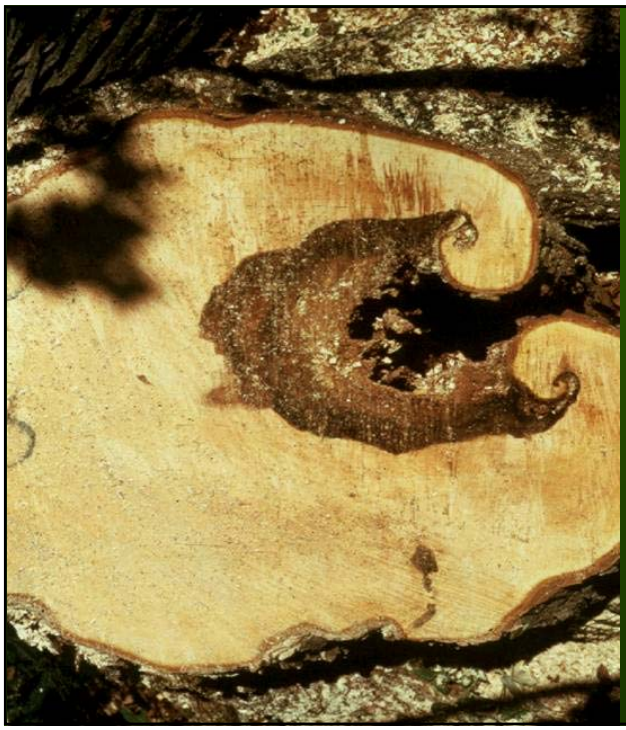
... crook and sweep

... crook

... a reason

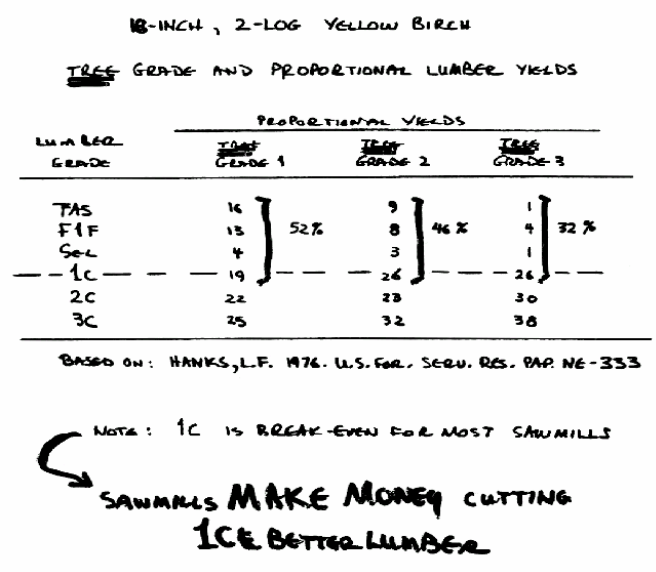
... surface wounds become defects

... like this



… and this inside

See the effect on yield of high-grade boards ...



18-INCH, 2-LOG YELLOW BIRCH

TREE GRADE AND PROPORTIONAL LUMBER YIELDS

LUMBER GRADE	PROPORTIONAL YIELDS: TREE GRADE 1		TREE GRADE 2		TREE GRADE 3	
TAS	16	52%	9	46%	1	32%
F1F	13		8		4	
Sel	4		3		1	
1C	19		26		26	
2C	22		28		30	
3C	25		32		38	

BASED ON: HANKS, L.F. 1976. U.S. FOR. SERV. RES. PAP. NE-333

NOTE: 1C IS BREAK-EVEN FOR MOST SAWMILLS

SAWMILLS MAKE MONEY CUTTING 1CE BETTER LUMBER

Hardwoods ...

- **surface defects indicate conditions of poor quality inside a log or tree**

- **trees with a "clean" bole will yield better quality lumber and veneer**

… especially if of large diameter

... large trees with clean boles

In any species …

One important way to get high quality trees

... grow them without branches

e.g., …

- manage *stand density* to promote early lower branch mortality and shedding

- plant / regenerate *genotypes* with good natural pruning capacity

- *cut off* the branches *(usually in conifers)*

... called ***PRUNING***

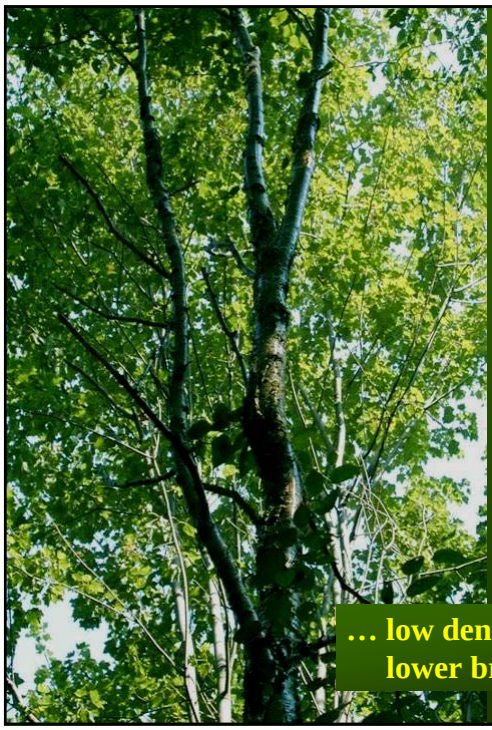
... cutting off the branches

Natural pruning – when branches fall off naturally …

... facilitated by inter-tree crowding early in the aggradation phase

… so branches die and fall off the lower bole sooner

... early crowding causes early death of low branches



By contrast …

… low density with wide spacing promotes lower branch survival and development

Silviculture influences natural pruning ...

- **keep density high until branches die and fall from the lower bole**

- **favor branch-free trees as crop trees *(lower bole)***

- **leave "trainers" to push up on lower branches of crop trees at young ages**

- **reduce crowding to promote *RAPID* diameter growth AFTER lower boles free of live branches**

… BY THINNING

… at least among hardwoods

... as in this even-aged stand

Also ...

- **select an *APPROPRIATE SPACING* for plantation establishment to promote timely crown canopy closure**

- **use an *APPROPRIATE REPRODUCTION METHOD* to secure adequate stocking in natural stands**

... appropriate spacing to insure timely crown closure

Factors related to good natural pruning …

SPECIES

- **shade-intolerant species self-prune readily**
- **some species show great branch retention**
- **within a species some trees drop the branches more readily *(a genetic characteristic)***

SITE

- **tree height growth *more rapid* and canopy closure sooner**
  - ***... on the best site***
- **leading to**
  - ***… earlier lower branch mortality***
  - ***… greater internodal length on best sites (fewer branches per lineal foot)***

… trees grow taller sooner on the best sites, increasing the internode length

... with fewer branches per lineal foot

Characteristics of trees to select for pruning …

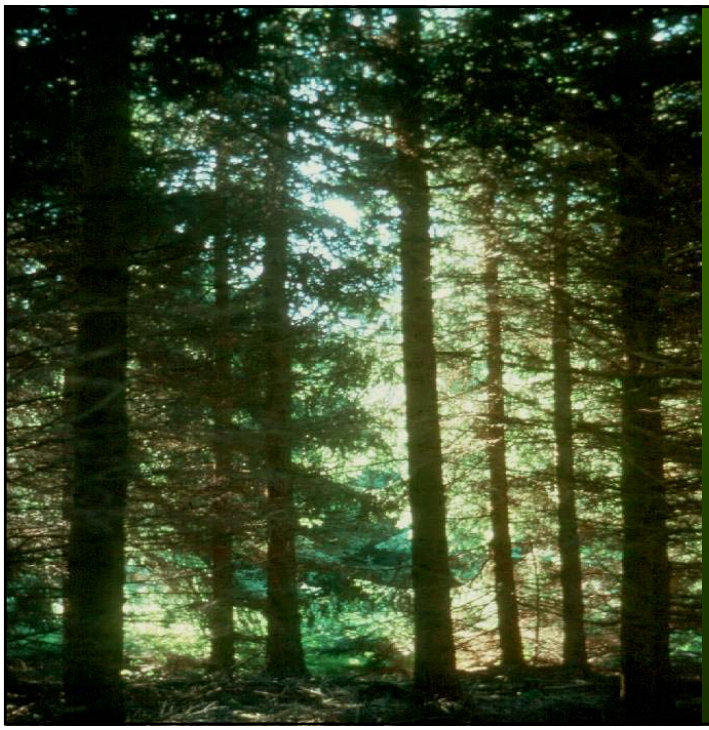
- **good form**
- **good vigor and health**
- **proper species**
- ***RAPID* growth**
- **full and balanced crown**
- **small diameter branches and long length between nodes**

***RAPID* growth comes with …**

- large and full crowns

- trees of upper canopy positions

... the *CODOMINANTS* & *DOMINANTS*



... the most vigorous
... the best

Upper canopy trees in a *FREE-TO-GROW* status ...

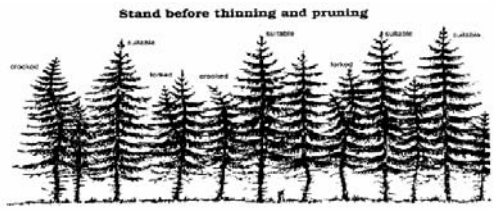
… kept free by thinning

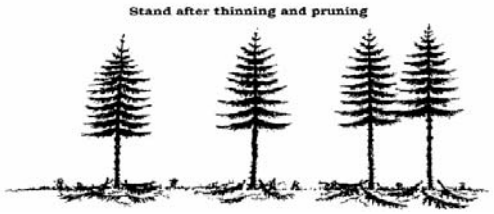
... thinning reduces crowding

... speeding the growth of pruned trees

... and recovering excess trees

... so link pruning to a thinning!





... like this

Emmingham and Fitzgerald 1995

… and this

Note this ...

On full-crown *(high LCR)* trees you can remove more branches without affecting diameter or height growth

e.g., with 60% LCR, *NO* effect on growth by taking up to 20% of the crown

… with 80% LCR, *NO* effect by removing 30%

With young ponderosa pine, Douglas-fir, and western white pine …

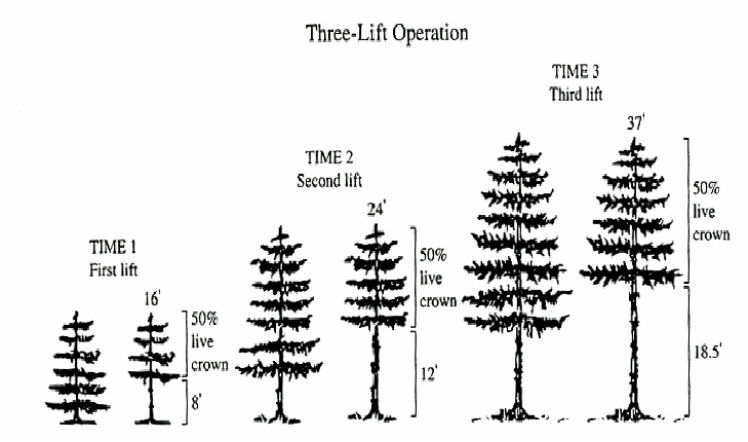
… removing lower 25% of crown

... *increased* the long-term diameter growth

Conclusion …

… among *young trees* with a high LCR you can remove between 1/3 and 1/2 of the crown (lower branches) *WITHOUT* reducing long-term growth

If start early in a rotation ...



Emmingham and Fitsgerald 1995

... prune in successive lifts

With young ponderosa pine, Douglas-fir, and western white pine …

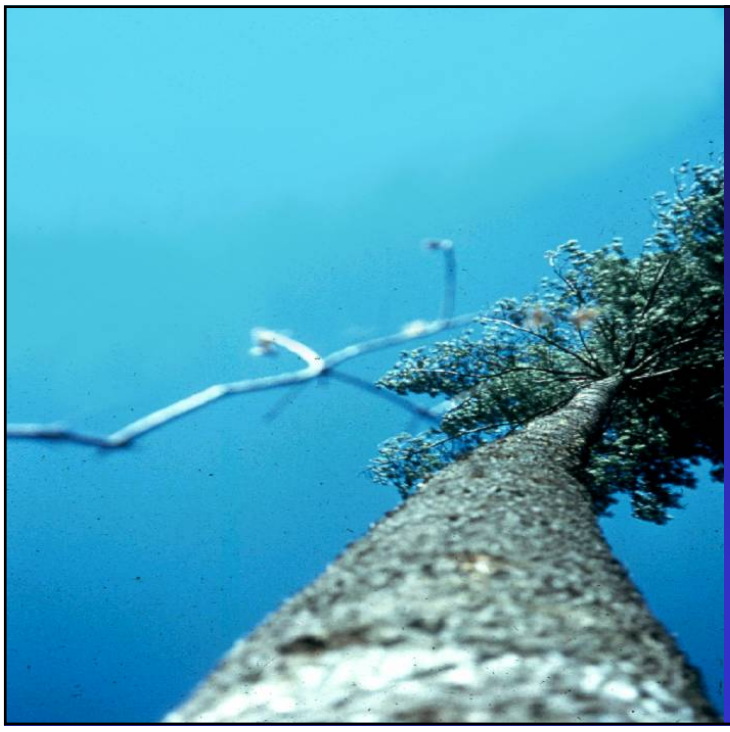
Pruning *DON'Ts* (after Nyland) …

… removing lower 25% of crown

- *DON'T* prune filler trees *(pulpwood)*
- *DON'T* prune trees that will not increase the long-term diameter growth
- *DON'T* prune parts that you cannot prune efficiently
  - *... not reaching too high*
  - *... not cutting oversized branches*
- ***DON'T*** **prune too little length**
  - ***…you need at least one minimum log (plus stump and trim)***

MOST IMPORTANT !!!!

... DON'T prune unless you also thin!!!



Keep it in perspective

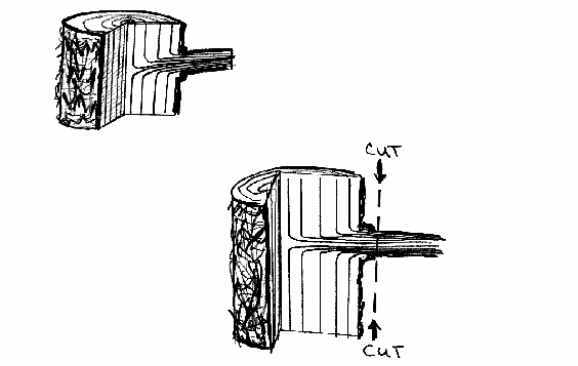
Pruning technique ...

- *LEAVE* the bark ridge at the base of each branch

- *DON'T* destroy the callus ridge

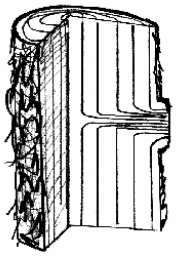
... the tissue where the overgrowth develops best

... saws accomplish this well



Leave the bark ridge at the base of the branch so you don't destroy the callus ridge …

… where new growth initiates and covers the wound

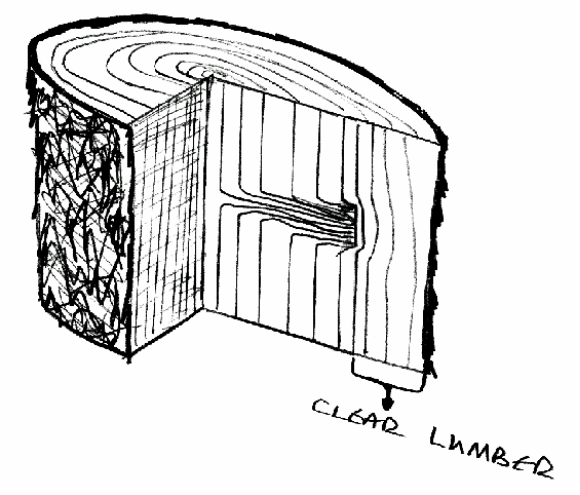


... like this

... with a long pole to gain height

... no stubs

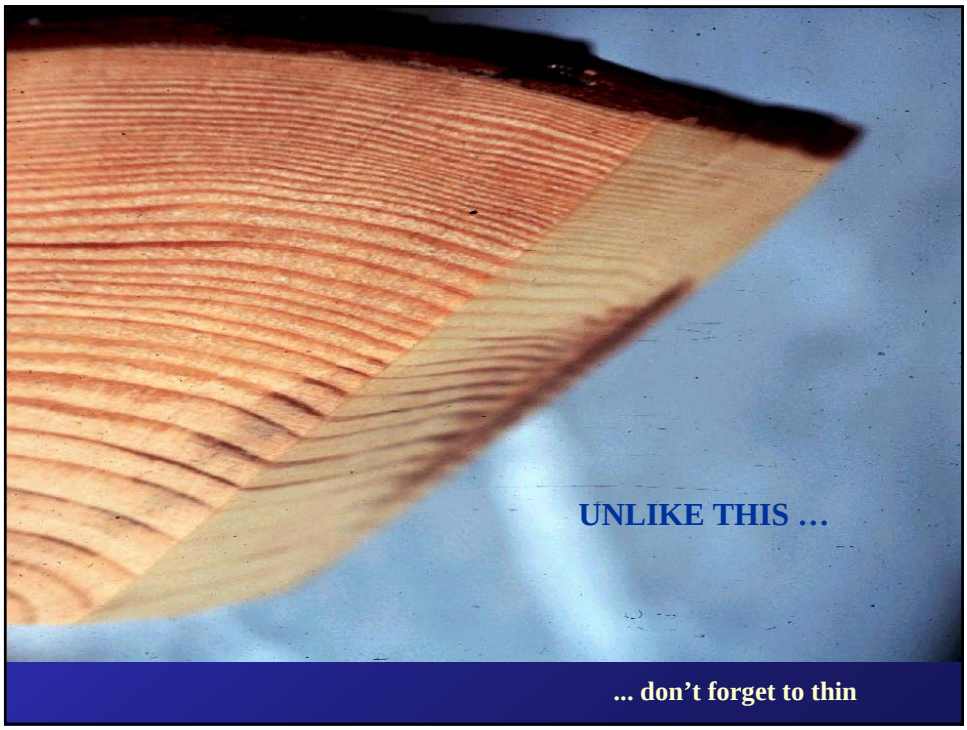
... no extra wounds



To promote *rapid* healing …

... and clear wood


... due to new growth


UNLIKE THIS …
... don’t forget to thin

You can time pruning to …

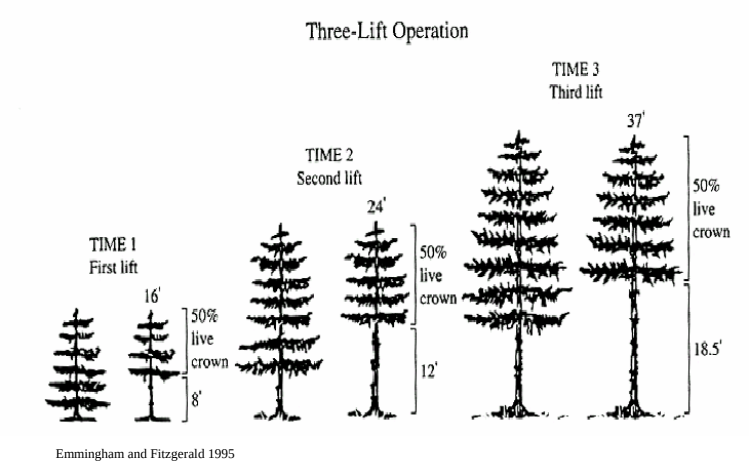
- *MAXIMIZE* knot-free volume per tree

... then prune as soon as you can afford to do it

- *MAXIMIZE* return on investment

... then time the pruning to yield the greatest compound interest on the investment

Financial factors dictate the options ....



Emmingham and Fitzgerald 1995

... what gives an acceptable *ARR*

In addition ...

Limit pruning to the number/acre that you can grow for the final crop …

… NO MORE!

... *not* all the trees

#/ac to prune … an example

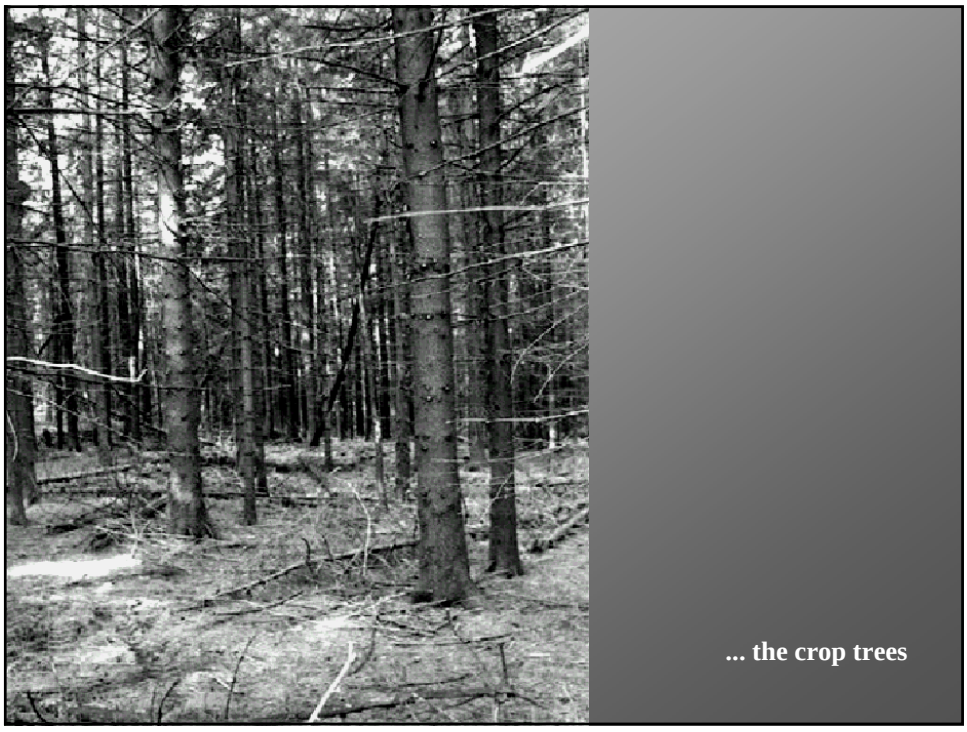
43560 ÷ (crown area per tree) = # trees/ac

So with a 10-foot crown radius

... occupying a 20- x 20-ft box of space

43560 ÷ 400 = 110/ac

... or a spacing of 20x20 feet



... quality equals value

Now consider this example of some financial aspects of pruning ...

Now consider this example of some financial aspects of pruning ...

Note this …

A 20-inch, 3-log spruce has ~480 bdft in it …

- at $35/MBF *(assumed stumpage price)*, the tree has a value of $16.80

- at 6 rings/inch, a tree adds 1 inch in 3 years …

... or 10 inches in 30 years

So a pruned 10-inch spruce will grow to 20 inches dbh in 30 years …

... but will that pay

Please note …

You may invest 15-20 minutes to prune a tree to 17 feet height …

... at $6/hr for wages that means $1.50-$2.00 per tree

With a 10% required return on investment, this compounds to between $25.50 and $34.90 in 30 years …

... thus compared to other trees, pruned ones most increase by this amount of

ADDITIONAL VALUE

to justify the investment

So ...

A 20-inch spruce tree pruned 30 years ago …

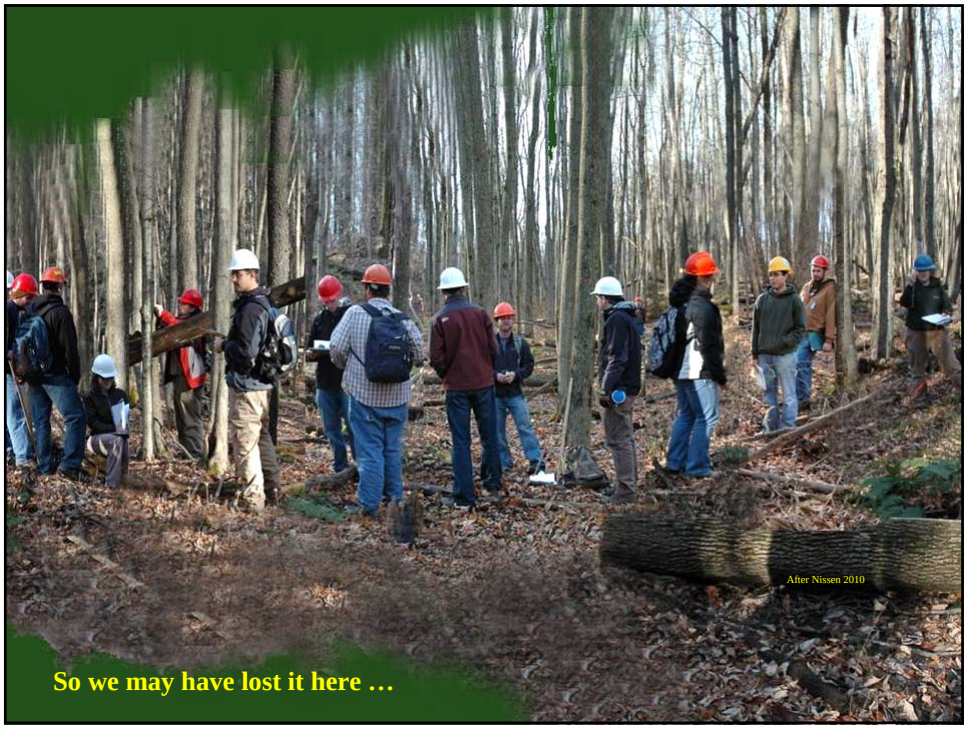
- with an ARR of 10% must have an ending stumpage value of

$35 • (480 ÷ 1000) + $25.50 = *$42.30*

… assuming that you invested $1.50 to prune it

At a cost of $2/tree you must realize an ending stumpage value of …

$35 • (480 ÷ 1000) + 34.90 = *$51.70*


After Nissen 2010
So we may have lost it here …