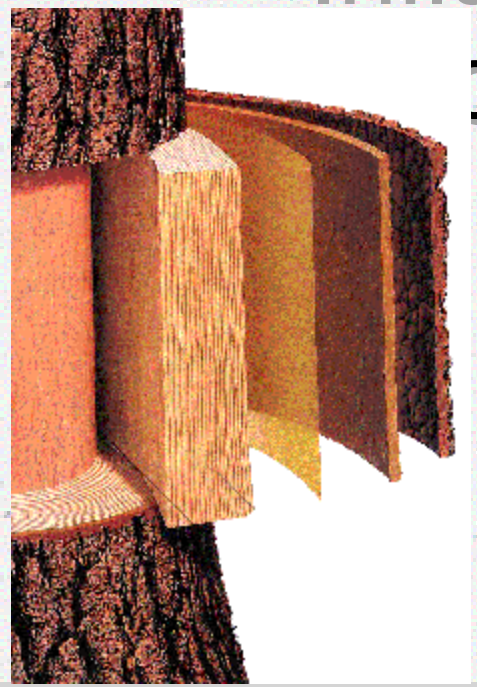
Wood Quality

Influence of forestry practices on ood structure and properties



Wood Quality Defined or not

- a measure of "suitability"
  - i.e., it depends!

- characteristics used in determining quality include
  - density
  - uniformity of growth rings
  - fiber length
  - proportion of heartwood
  - fiber to vessel ratio
  - presence of juvenile & reaction wood
  - straightness of grain
  - chemical composition
  - percent of knot-free wood, position in stem, variability, type of tree,.....

Concepts of Wood Quality

- a NUMBER of factors determine suitability of wood for a specific end use
  - the combined effect determines wood quality; the importance of each is dependent on intended use
- to the Foresters among us, this fact is matched in importance by the fact that silvicultural practices affect virtually ALL OF THEM

Forest Management

- variety of objectives
  - accelerate growth
  - maximize wood production
  - ensure renewal of the forest

- variety of methods
  - reduce competition for light, nutrients, & water
  - modify stem form by pruning
  - addition of nutrients and/or water
  - genetic selection of seed or planting stock
  - intensive culture

Specific gravity sums it up

- often used to represent everything!!
- tree factors that influence SG (density)
  - changes in cell diameter, length, & cell wall thickness
  - proportionate volume of cell types
  - percentage of extractives
  - growth rate
- generally higher density woods are stronger and preferred where high-strength lumber products are required, but not the case with wood composites and pulp
- Conflicting objectives for you foresters

Specific gravity conti.

- sources of variability
  - location in the tree
  - location within the range of the species
  - site conditions
  - genetic source
  - moisture content & extractive content
  - COV of about 10%
  - great deal of literature but inconsistencies indicate the complex interactions

Growth Manipulation and Wood Quality

- thinning
  - young or mature stands
    - growth rate and % earlywood UP
    - incremental SG DOWN
  - over mature stands
    - % latewood and SG UP
  - hardwoods
    - fiber length and SG UP

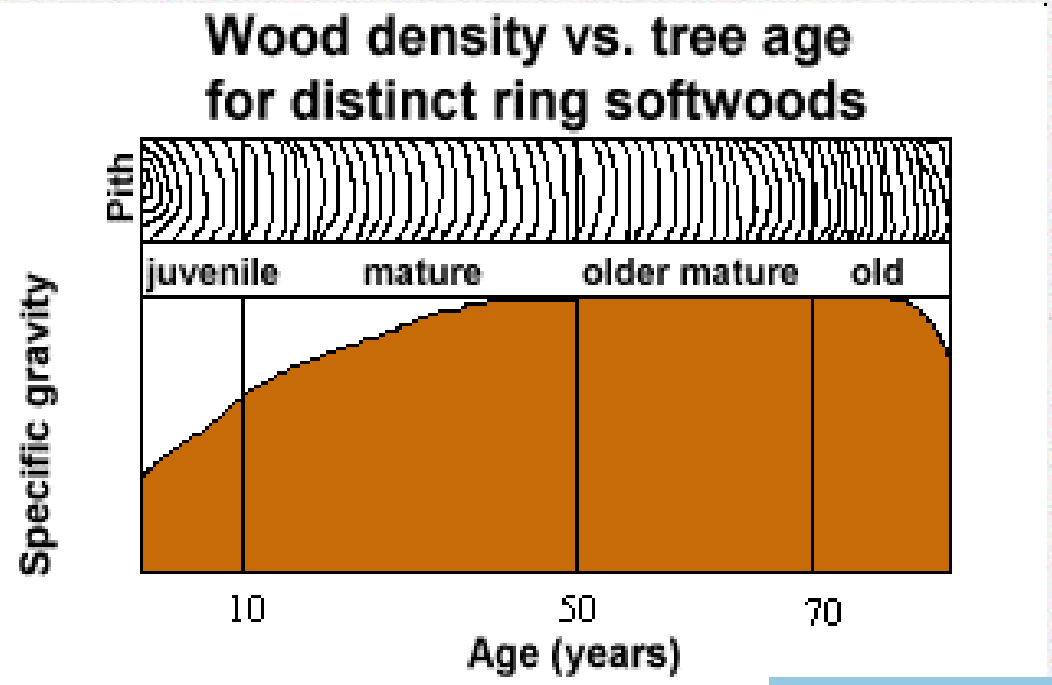
- tree spacing & crown size - SOFTWOODS
  - dominant trees
    - tracheid diameter UP
    - tracheid length & SG DOWN
  - co-dominant trees
    - cell wall thickness & SG UP
  - suppressed trees
    - SG UP

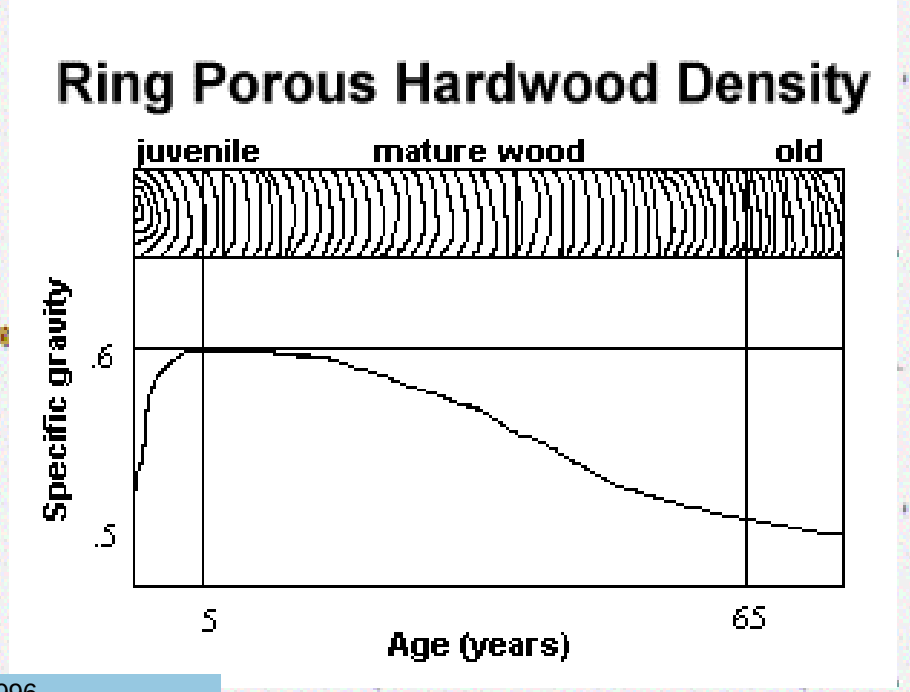
- **water availability**
  - optimum water present
    - wide growth rings, max. latewood, SG high
  - insufficient water
    - reduced growth, early onset of latewood formation, narrowing of growth rings, reduced latewood %
  - too much
    - SG down, decreased % latewood, decreased cell wall thickness

- **fertilization to increase growth**
  - medium to fast growth SOFTWOODS
    - get increased growth
  - DIFFUSE POROUS HARDWOODS
    - diameter growth
    - improved stem form
    - variable influence on wood properties

Growth rate influence

- Widespread belief that rapid growth of distinct ring woods leads to low wood density BUT only a weak relationship
- Its an age effect rather than a fast growth rate, unless its really very rapid

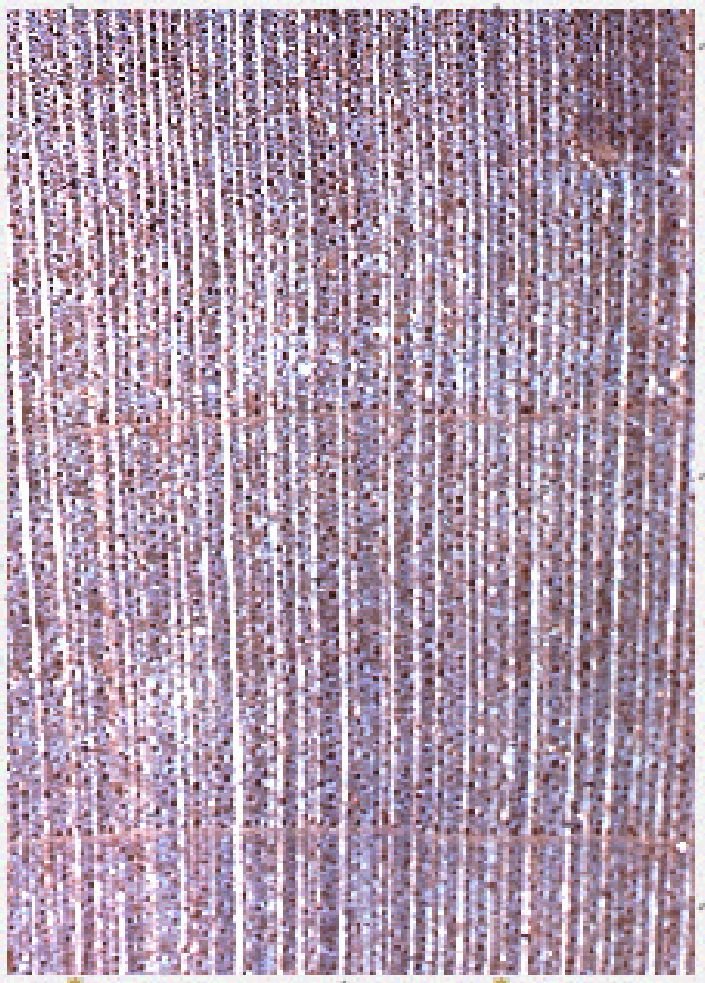




Haygreen and Bowyer. 1996
Forest Products and Wood Science, 3rd ed.
Iowa State University Press, Ames. IA

Growth rate influence

- Diffuse porous hardwoods and indistinct ring softwoods
  - low density in juvenile period, but an inconsistent (though higher) density pattern in relation to growth rate thereafter.



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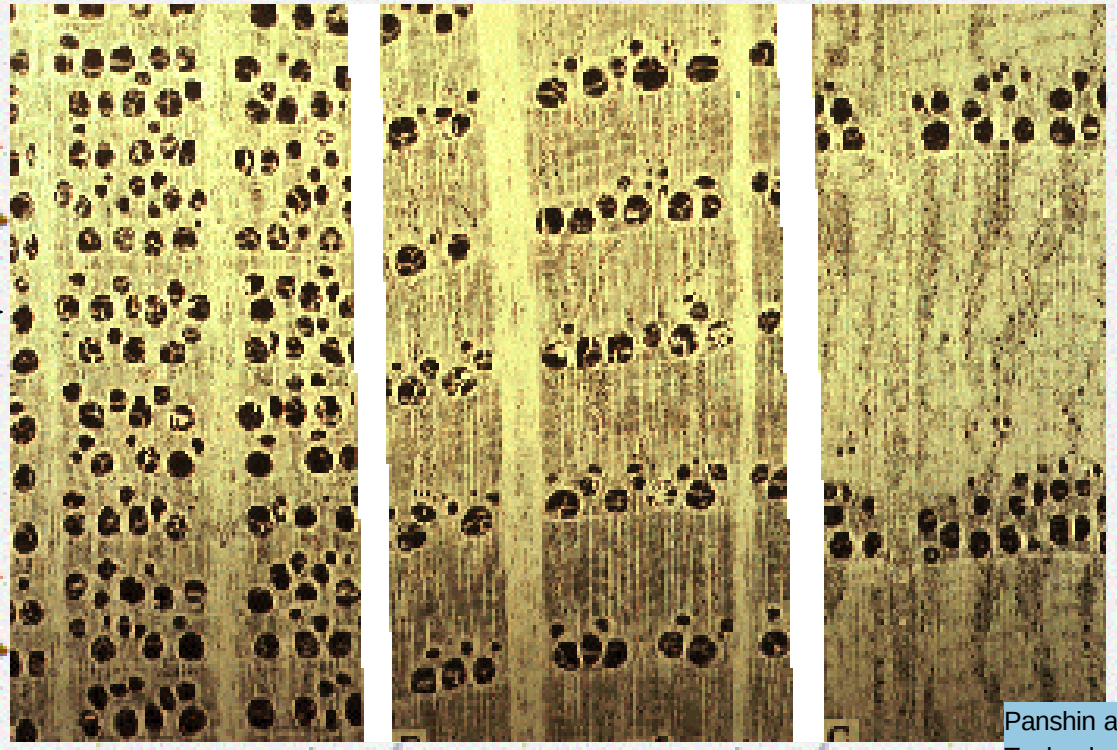
Growth rate influence

- Ring porous hardwoods
  - a DECLINE in growth rate often results in a decrease in wood density

slow growth →



← fast growth

Panshin and deZeeuw. 1980. Textbook of Wood Technology, 4th ed.
McGraw Hill Book Co. p 175

Effects of Growth Rate on Properties

- Solid wood products - strength is important
  - some aspects of strength are dimished by accelerated growth, others are improved
    - e.g., MOE up, MOR little influence, Work to pl and max load down
  - large percent of juvenile wood
  - more knotty
  - inconsistent but controllable

Effects of Growth Rate on Properties

- veneer yield and stiffness **decreases** in small diameter, rapidly grown trees
- machining properties and strength of rapidly grown hardwoods
  - **no adverse effects**
- pulp yield from woods produced with accelerated growth **similar** to more slowly grown trees and quality just as **desirable or better**

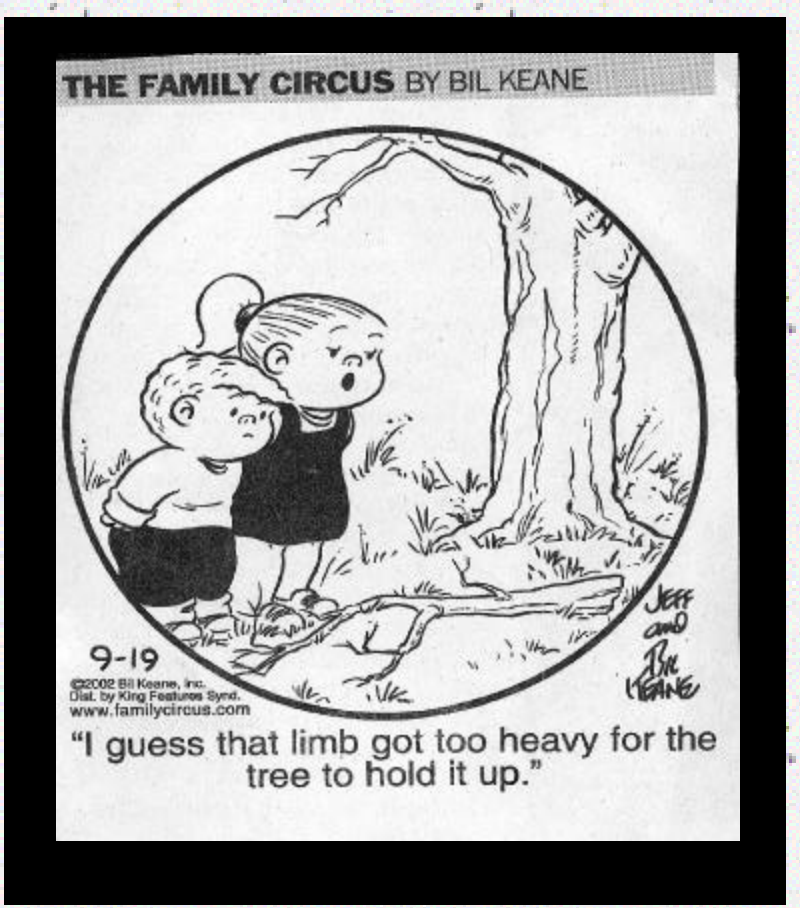
Effects of Growth Rate on Properties

- composite board properties
  - SG - the lower are preferred, so fast or slow growth?
    - better compaction, less variability in board density within a mat, better adhesion
  - presence of extractives, pH, buffering capacity
    - trouble with extractives
    - pH and buffering affect resin cure

Final thoughts

- many definitions
- properties that characterize high quality for one purpose may be insignificant or even a disadvantage for another purpose
- forestry practices affect not only the volume of wood but the properties of the wood produced
- primary factors influence by forestry practices are
  - specific gravity
  - proportion of juvenile wood
  - presence or absence of reaction wood
- many forestry practices influence wood properties

Wood Quality?



it DEPENDS!