Wood Detective Lab

Objectives of the Lab:

1) Learn some of the practical uses of wood identification.
2) Learn features used to identify wood based on its anatomical features.
3) Explore the wood lab and its resources.
4) Track yearly growth of trees using bud scars and growth rings.

Why bother identifying wood?

Toxicology
Dating
Locational data
Mechanical data

See the article in the Boston Globe (http://www.boston.com/globe/magazine/1998/5-31/ideas/) and in Science News (http://www.sciencenews.org/20020921/bob8.asp) for more information and specific examples. We have printouts of these articles available in the lab.

A review of the major cell types in wood

Fibers: thin, thick-walled cells
Tracheids: long thin cells with relatively thick walls, tapered ends and numerous pits
Vessels elements: variable in length but very wide
Ray parenchyma cells: thin-walled, living cells with their long axis pointing from the inside of the stem out (occasionally slightly taller than long in upright ray cells)
Axial parenchyma cells: thin-walled, living cells with their long axis pointing up and down the length of the stem

Diagnostic features of wood anatomy

- Resin canals: characteristic of some conifer woods (i.e. pines, spruces); these hollow tubes between cells can be distinguished from vessels because they are ringed by a set of epithelial cells
- Perforation of end plates in vessel elements:
  - Simple - completely open
  - Scalariform – ladder-like
- Pattern and arrangement of pits
- Arrangement of rays and of cells within rays
- Distribution of axial parenchyma
- Pattern of thickenings in walls of tracheids and vessels.
- Distribution and size of vessels

Macroscopic features used to identify wood

Aroma: Sassafras smells like root beer, as does black birch
Juniper has a distinct, resiny smell

Color Juniper and redwood both have very distinctive red heartwood.

Relative width of sapwood and heartwood (but this can also be influenced by the environment in which the particular tree was grown)

Wood density is often a fairly good species characteristic that is largely determined by the percentage of wood made up by vessels. However, it can again be affected at some scale by the growth environment.

Introduction to wood identification

You can broadly classify most commercially important conifer woods on the basis of only four characteristics. Try to group the samples we gather in the wood lab according to these characteristics.

Resin canals present and large → Pine
Resin canals present and small → douglas fir, larch or spruce
Resin canals absent, heartwood not very different in color from sapwood → fir, hemlock, some cedars
Resin canals absent, heartwood not very different in color from sapwood → redwood, bald cypress, yew, some cedars

Bud scars and yearly growth of shoots

Many trees form buds to house the next year's growth during their dormant period. In some species these buds are surrounded by a protective scale leaf or leaves. When the tree resumes growth it will shed the bud scales, and the scales leave a distinctive scar on the surface of the branch. Try to identify the bud scale scars on the branches provided, and use them to tally up how old each branch is.

Dendrochronology

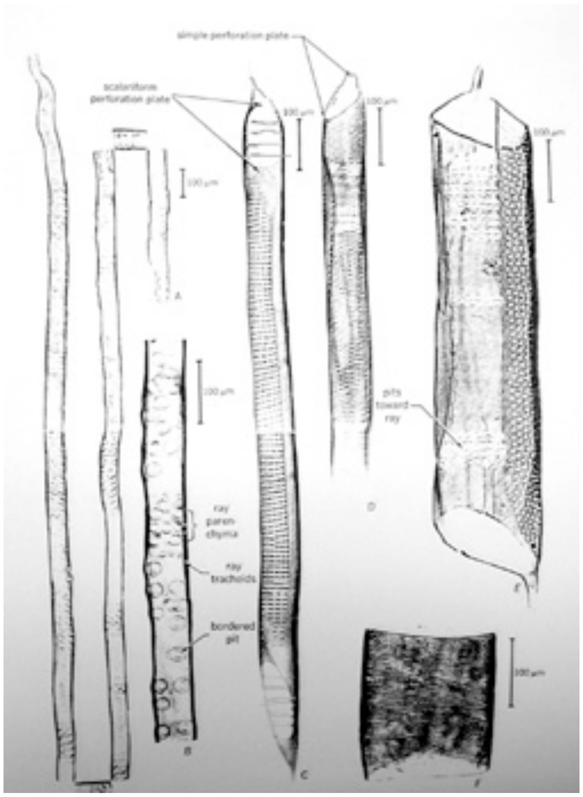
Many trees, especially in seasonal areas, provide a good record of climatic conditions in their annual growth rings. The amount of growth in a given year can be determined locally (e.g. shading or crowding by close neighbors) as well as more regional (e.g. drought) environmental conditions. Many woods show clear yearly growth rings, and the size or width of these rings can be used to estimate the favorability of growing conditions of any given year.

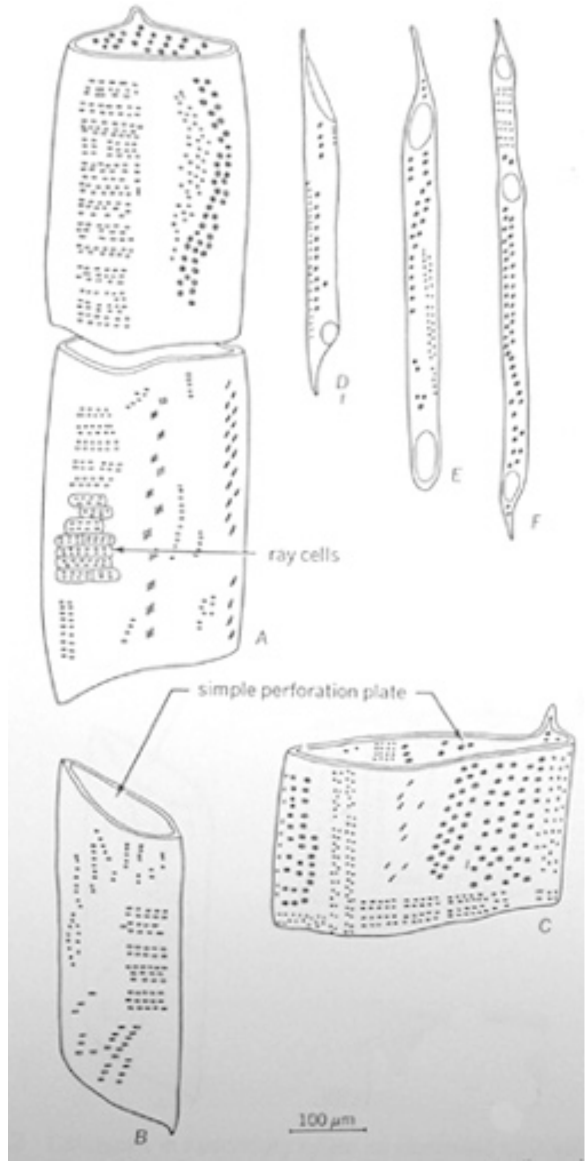
What features of trees make them especially faithful/useful record-keepers of the environment?

Tree ring web resources:

- http://web.utk.edu/~grissino/gallery.htm lots of photos of tree rings with interesting features accompanied by explanations
- http://www.ngdc.noaa.gov/paleo/treering.html International Tree-Ring Data Bank

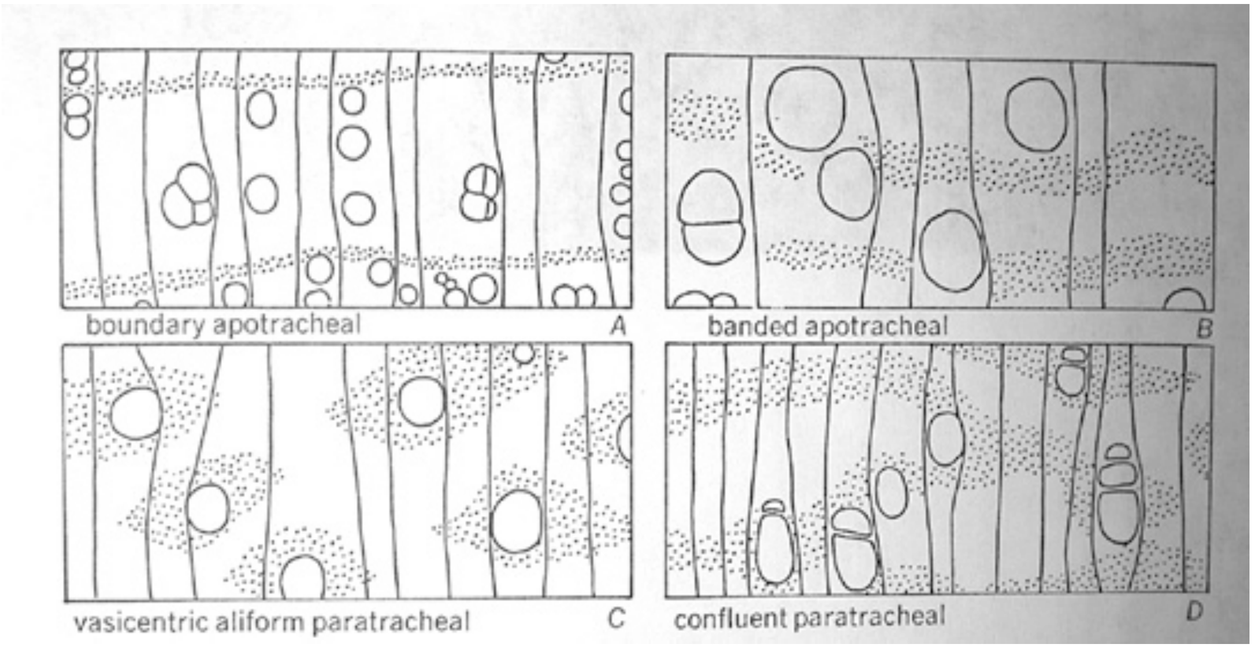
Xylem elements showing bordered and simple pits (labeled in figure as “ray parenchyma” because they lead from the tracheid to the ray parenchyma cells); scalariform perforation plates and simple perforation plates in vessels.
 A&B: Tracheids
C-F: Vessels



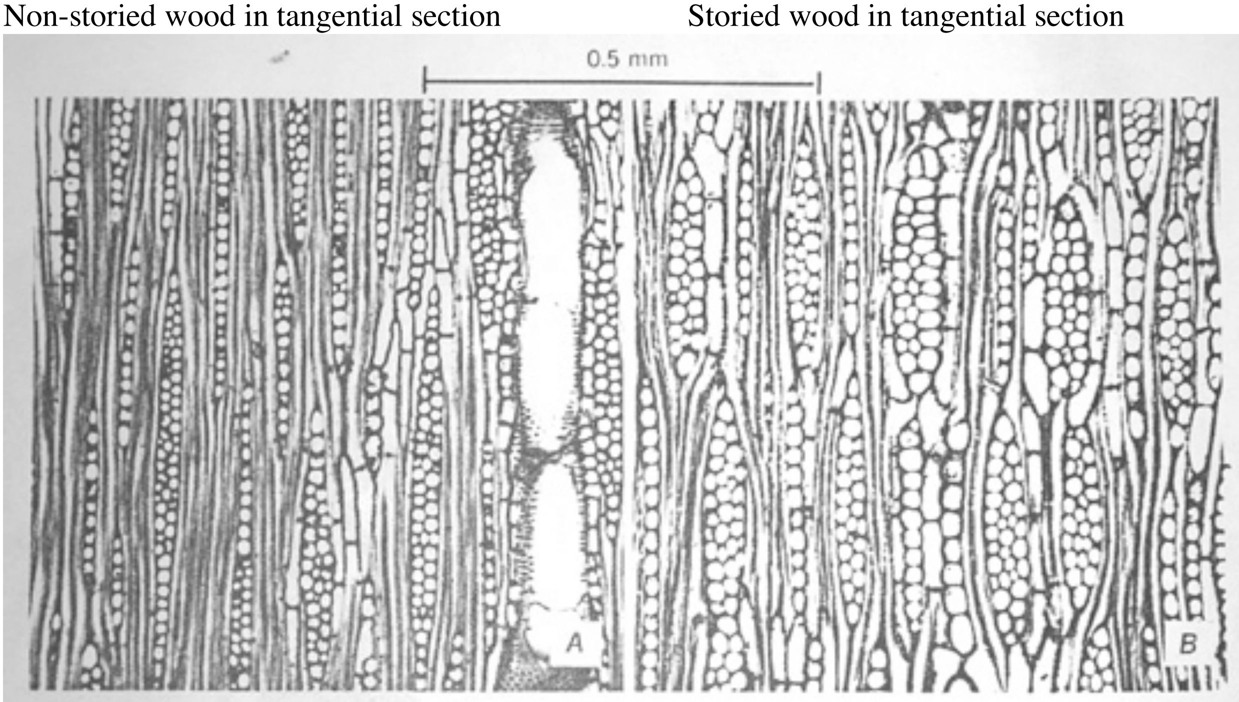


Different shapes of vessel elements

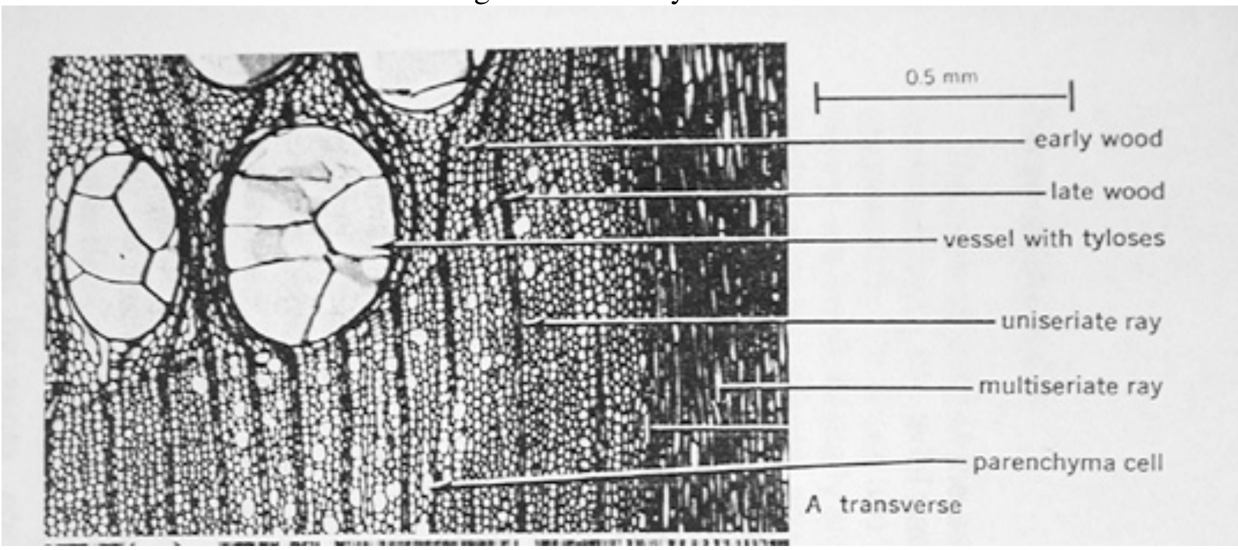
Different distributions of axial parenchyma
Apotracheal axial parenchyma: not consistently associated with vessel elements
Paratracheal axial parenchyma: consistently associated with vessel elements



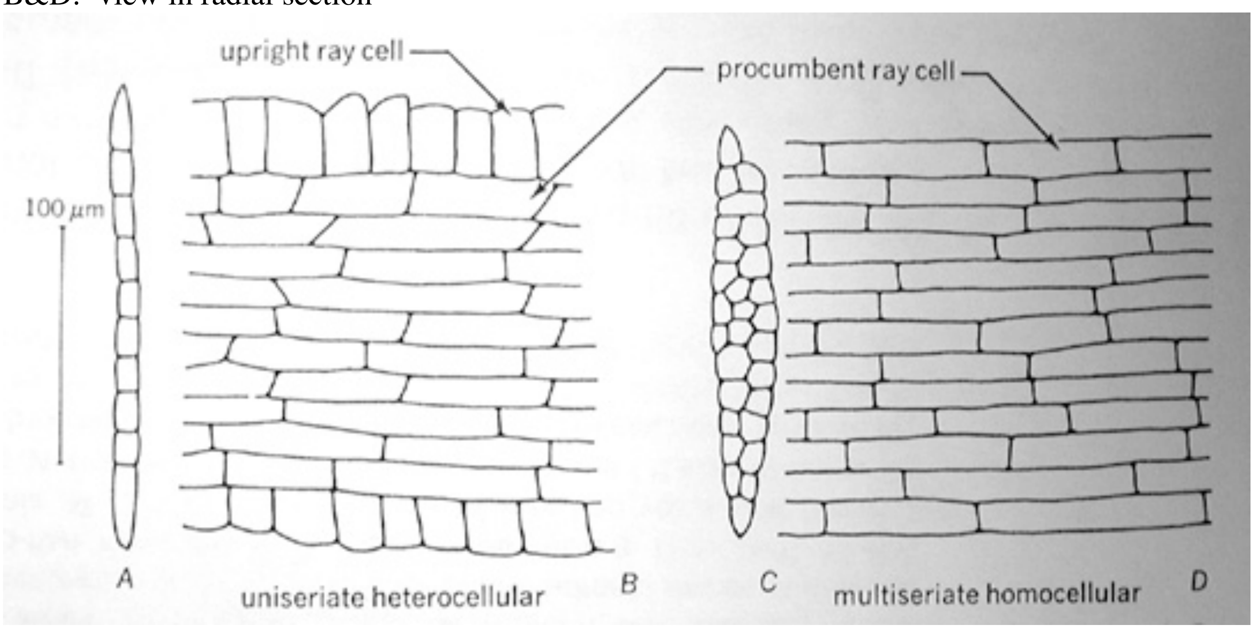
Non-storied wood in tangential section   Storied wood in tangential section



Radial section of a white oak showing vessels with tyloses



Ray types:
A&C: view in tangential section
B&D: view in radial section



Various types of pitting

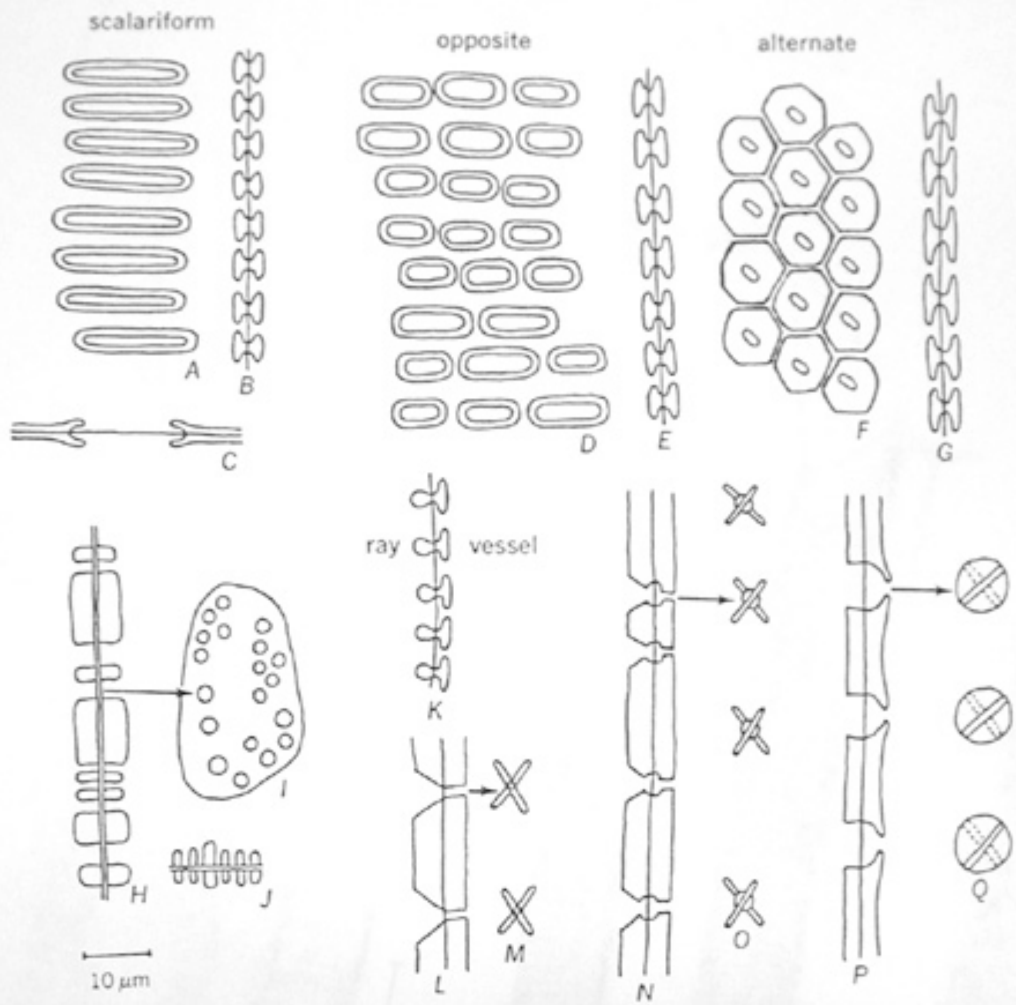


Figure 8.4 Pits and patterns of pitting. *A–C*, scalariform pitting in surface (*A*) and side (*B*, *C*) views (*Magnolia*). *D–E*, opposite pitting in surface (*D*) and side (*E*) views (*Liriodendron*). *F–G*, alternate pitting in surface (*F*) and side (G) views (*Acer*). *A–G*, all bordered pit-pairs in vessel members. *H–J*, simple pit-pairs in parenchyma cells in surface (*I*) and side (*H*, *J*) views; *H*, in side wall; *J*, in end wall (*Fraxinus*). *K*, half-bordered pit-pairs between a vessel and a ray cell in side view (*Liriodendron*). *L*, *M*, simple pit-pairs with slitlike apertures in side (*L*) and surface (*M*) views (libriform fiber). *N*, *O*, bordered pit-pairs with slitlike inner apertures extended beyond the outline of the pit border; *N*, side view, *O*, surface view (fiber-tracheid). *P*, *Q*, bordered pit-pairs with slitlike inner apertures included within the outline of the pit border; *P*, side view, *Q*, surface view (tracheid). *L–Q*, *Quercus*.