Wood Products: Where Nature and Engineering Find Balance

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Beginnings

- Iowa, USA
  - Agriculture
    - Corn
    - Soybeans
    - Pigs
    - Cows









Education

- Iowa and Oregon State Universities
  - Land grant universities
  - Support of agricultural practices
  - Focusing on wood science and products

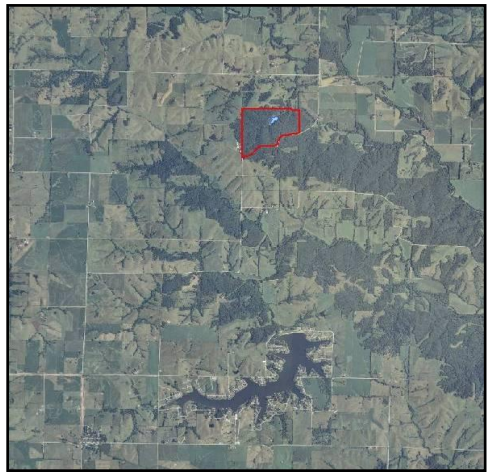






Conservation and ethics

- Forestry practicum
  - Ecological, social, economic, ethical, and institutional/political factors
  - Client goals
    - Wildlife habitat for game
    - Harvest potential
    - Updated GIS



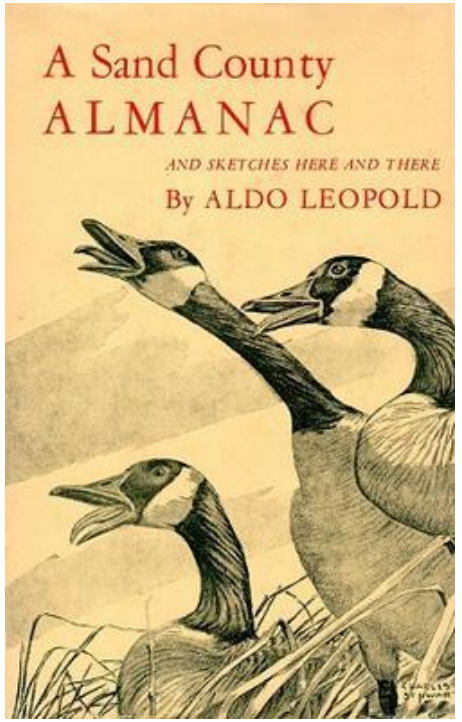




Conservation and ethics

- Forestry practicum
  - Aldo Leopold
    - Forester, conservationist, naturalist, scientist, philosopher, forester
    - Pioneer in modern environmental ethics





Conservation and ethics

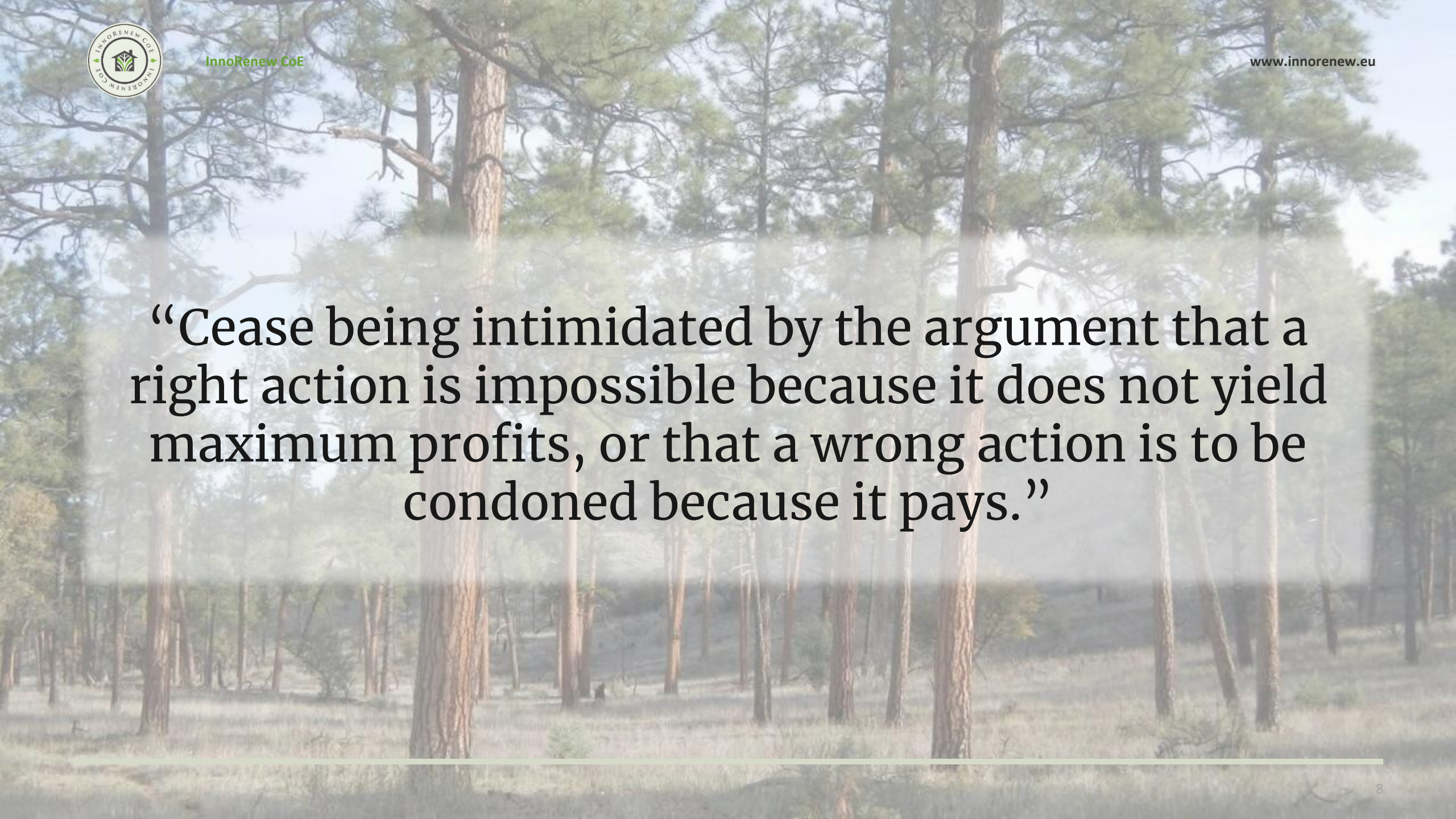
“When we see land as a community to which we belong, we may begin to use it with love and respect.”



Goals and adaptation

- Needs
  - Food
  - Air
  - Water
- Growth challenges
- Human Goals





"Cease being intimidated by the argument that a right action is impossible because it does not yield maximum profits, or that a wrong action is to be condoned because it pays."

My mission statement

- To foster industrial agricultural practices and utilization of natural resources that prioritize sustainability, biodiversity, and ecosystem health, while meeting the demands of a growing population.





Strategies for balance

- Head in the sand
- Engineering our way out of it
- Using biobased resources
- Fundamental change in our expectations

Strategies for balance

- Head in the sand
  - Best case – no impact
  - Worst case - regression



Strategies for balance

- Engineering our way out of it
  - Best case – Addressing human needs and acknowledging natural resources
  - Worst case – Irreparable impact



Strategies for balance

- Using biobased resources
  - Best case – shifting the balance towards renewable alternatives
  - Worst case – consumption, demand, and impact outpace resources



Strategies for balance

- Fundamental change in our expectations
  - Service life
  - Performance
  - Accepting what is natural





For consideration

- Nuance is a thing
- Regional context
- Societies are at different stages of development, have different priorities, and values



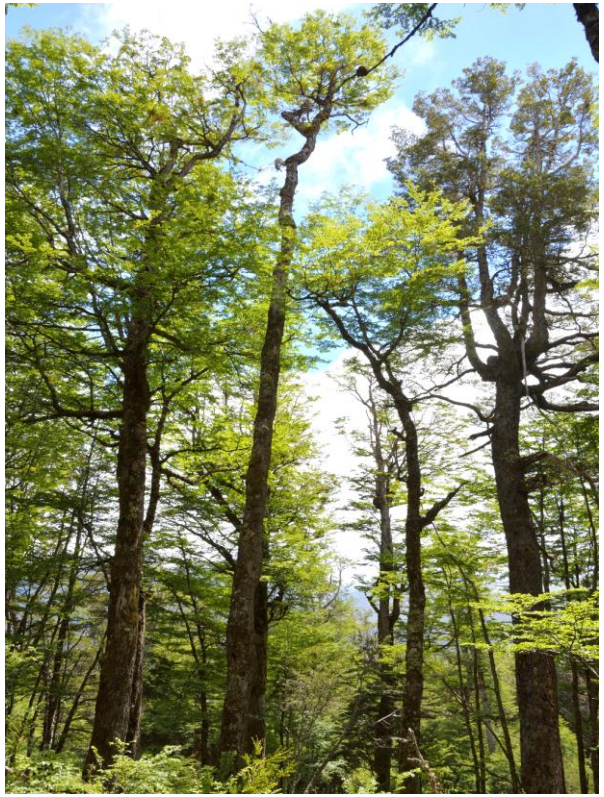


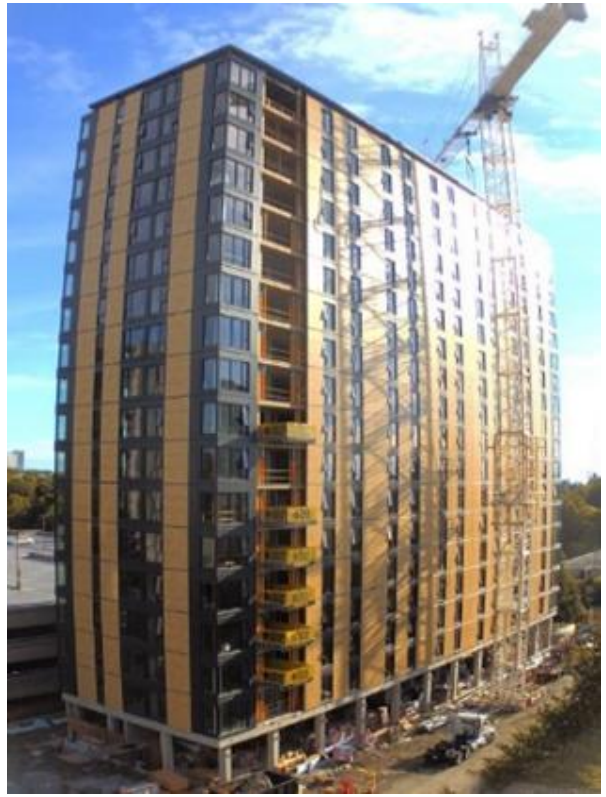
Where are we?

- Head in the sand
- Engineering our way out of it
- Using biobased resources
- Fundamental change in our expectations

Our challenge

- How do we get from a living tree to a stable structure?
- Every wood component we use in buildings is used incorrectly…





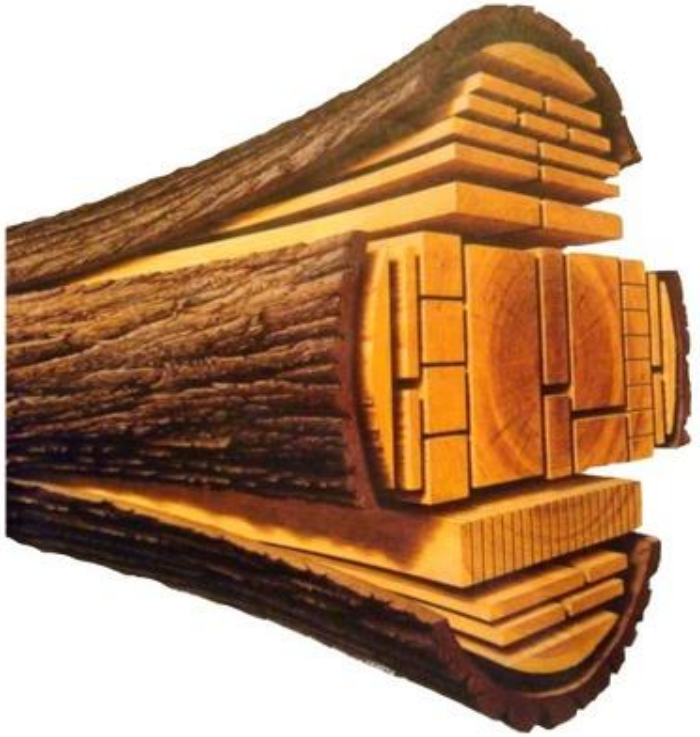
Forest to frame

- In nature it is round, wet, flexible



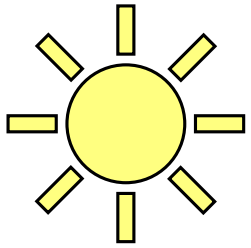
Forest to frame

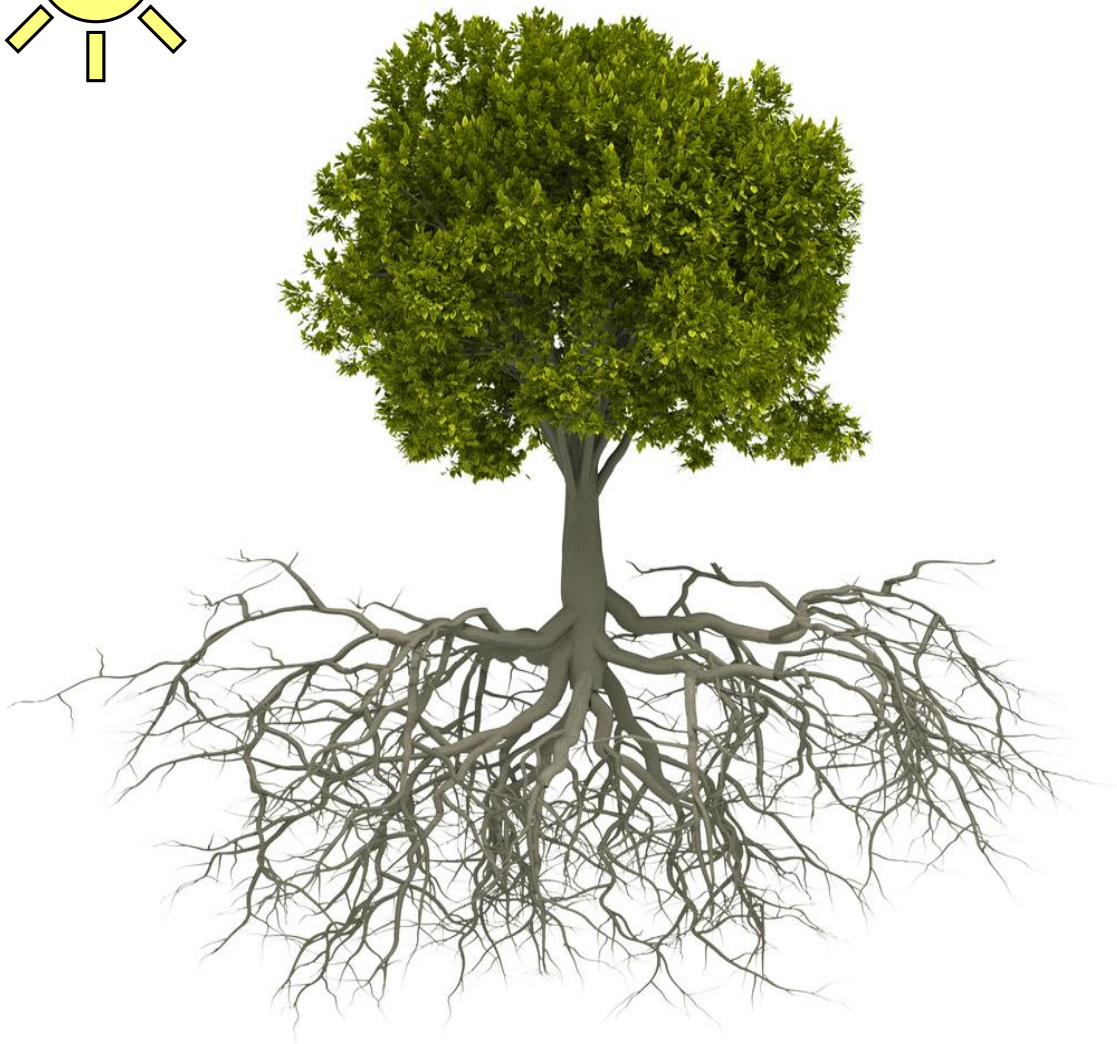
- We alter the application of the wood
- In our uses it’s dry, prismatic, and rigid
- Trees are there for themselves





Tree growth

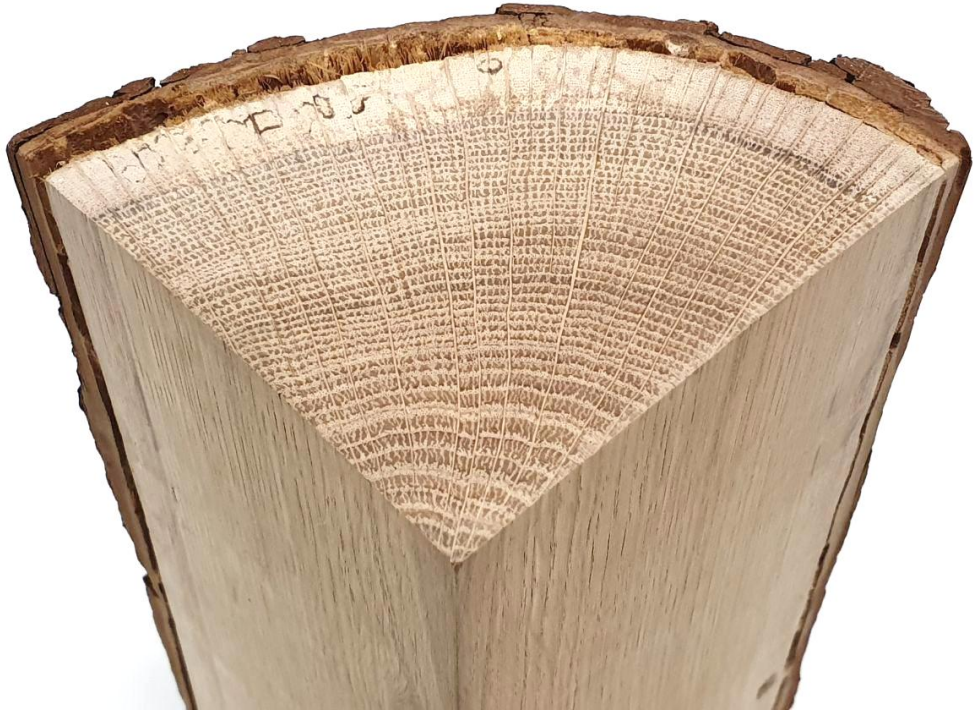




- Needs of a tree
  - Air
  - Food
  - Water
  - Form
- Transpiration and gas exchange through leaves
- Photosynthesis
- Conduction via capillary forces

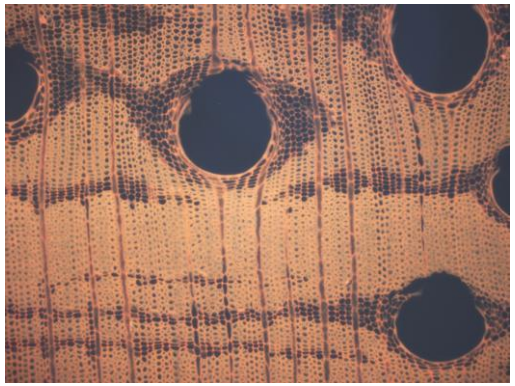
Tree growth

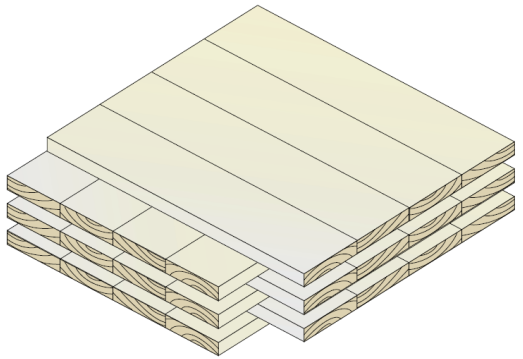
- Needs of a tree
  - Air
  - Food
  - Water
  - Form
- Transpiration and gas exchange through leaves
- Photosynthesis
- Conduction via capillary forces
- Production of xylem/phloem



What defines wood-product performance?

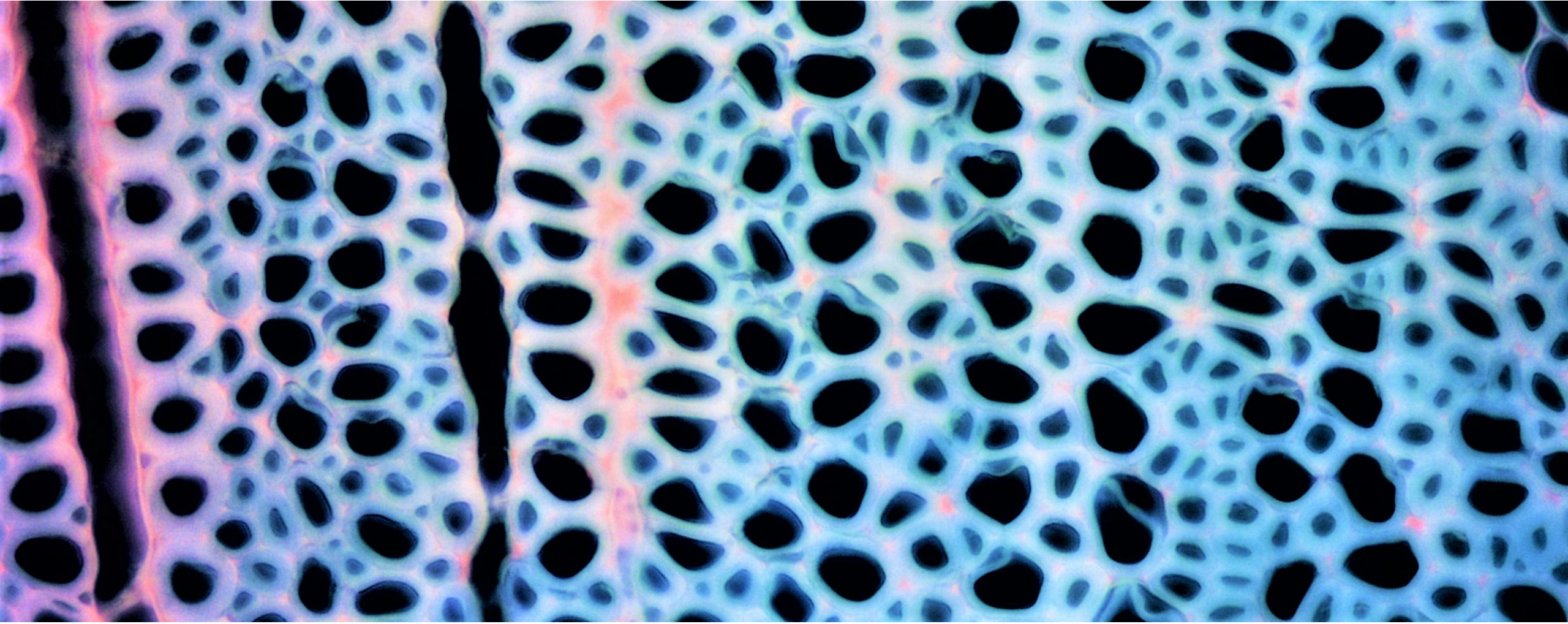
- Wood characteristics
  - Microscopic scale
- Engineered wood products
  - Combination of wood and human ideas
- Structure
  - Building design





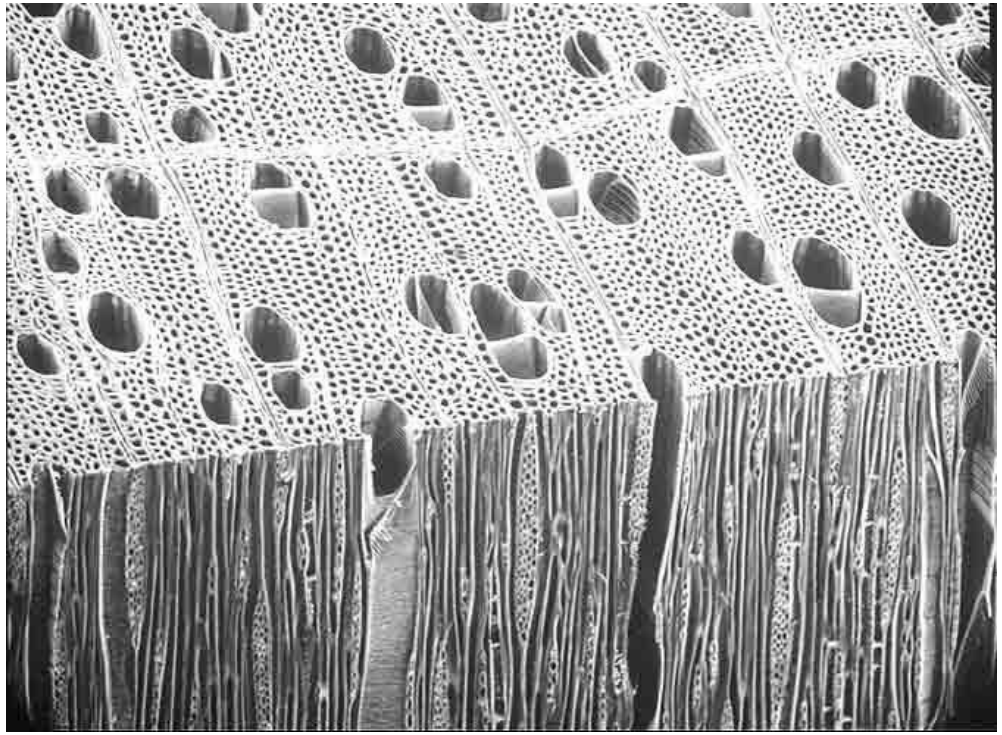
Source: CLT Handbook

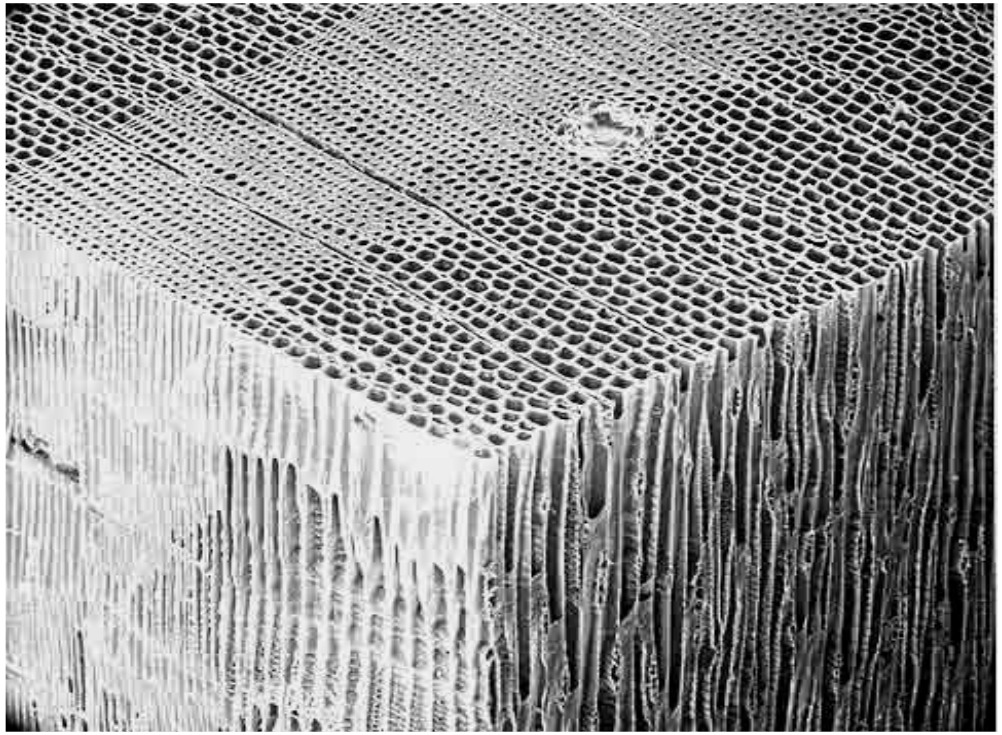




Wood Characteristics

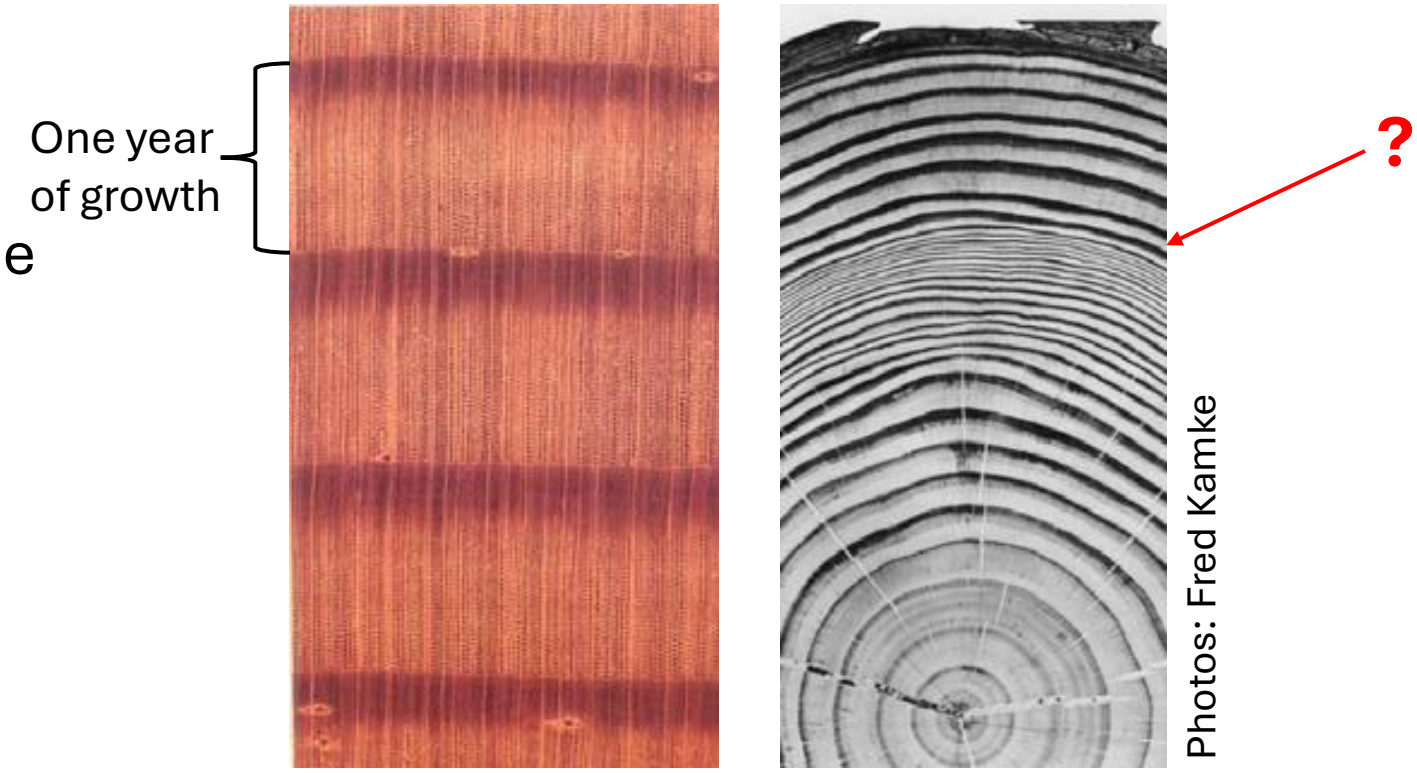
Cell types





Annual growth

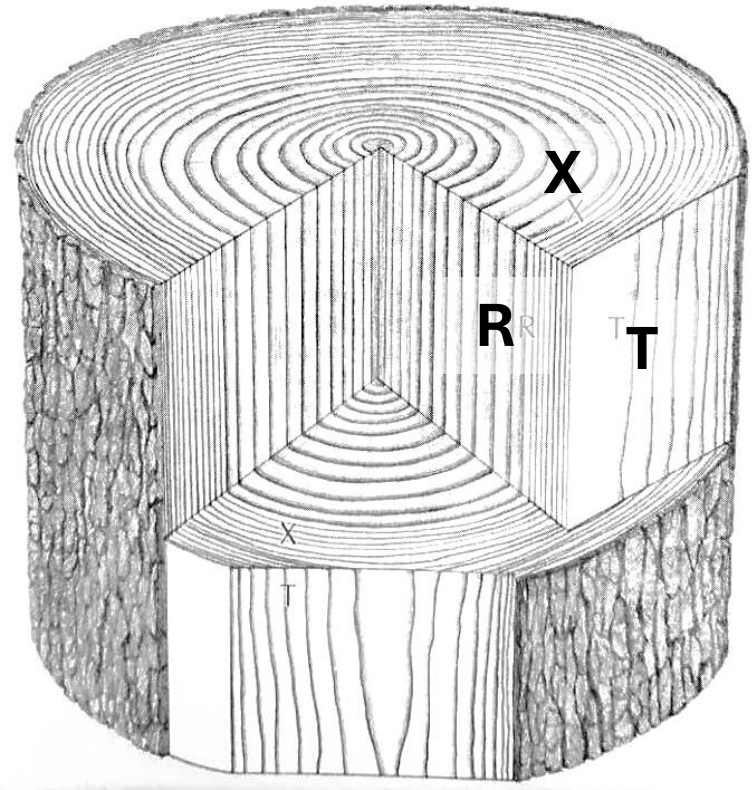
- Growth rings
  - Change in cell size
  - Frequency of cell occurrence
- Variations between years
  - Climactic
  - External forces
    - Competition
    - Aspect of landscape
    - Fire
    - Drought



Pseudotsuga menziesii - Douglas-fir

Cylindrical, Orthogonal, Anisotropic

- Different properties in different directions
  - Longitudinal – parallel with the stem
  - Tangential – tangent to the stem
  - Radial – radiating from the pith
- How do we handle this natural variation and heterogeneity?



Source: Hoadley



Engineered Wood Products

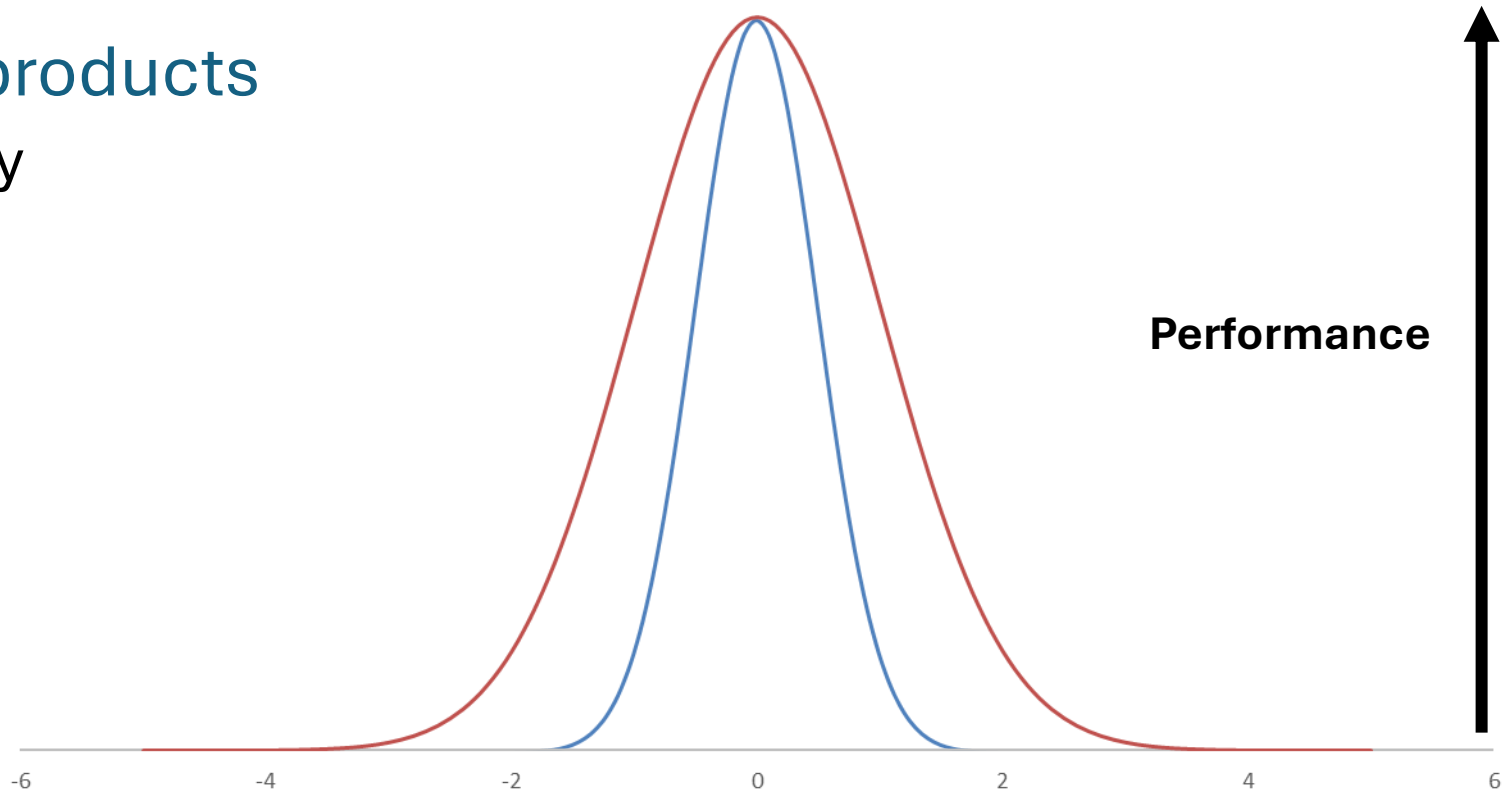
Engineered Wood Products

- Composite Panels
  - Plywood
  - OSB
- Structural Composite Lumber
  - Laminated Veneer Lumber
  - Parallel Strand Lumber
- Engineered Joists and Mass Timber
  - I-Joists
  - Glue-laminated timber
  - Cross-laminated timber



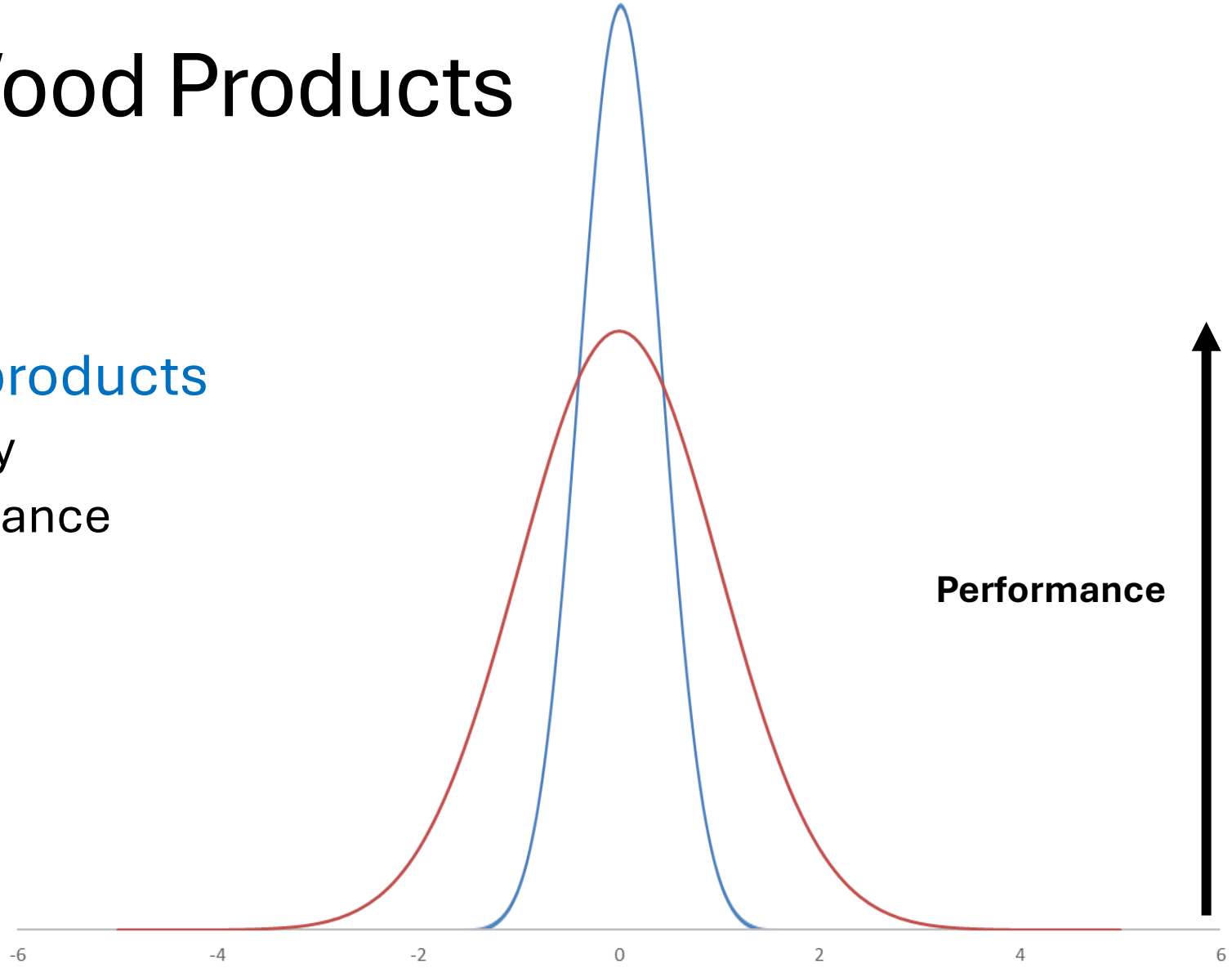
Engineered Wood Products

- Natural variability
- Engineered wood products
  - Reduced variability



Engineered Wood Products

- Natural variability
- Engineered wood products
  - Reduced variability
  - Increased performance



Engineered Wood Products

- Lower quality timber is being produced
- More plantation wood
- Smaller diameter trees



Conclusions

- Humans are an inextricable part of the natural community
- Trees grow wood for the tree and not for us
- Engineered wood products combine natural performance of wood and use human ingenuity for better results

For the WoodPop Meeting with Companies

- Prepare your own personal mission statement
- 1-2 sentences saying who you are and what you're about.

Grouping Up

- For lab activities we will need to split into groups to accommodate everyone
- Please come up to the board and write your name in the 1, 2, or 3 column for group assignment