Woody Biomass Utilization Basics

What make sense?

Gareth J Mayhead
University of California Berkeley
& Resource Innovations

Thorne Bay, May 19 2009

MBF to tons

Approximately 1 MBF = 6 green tons

1 log truck = 4 MBF = 26 green tons

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"England and America are two countries separated by a common language"

George Bernard Shaw *(1856 - 1950)*

Biomass

*any solid, non-hazardous, cellulosic material derived from: forest-related resources, solid wood wastes, agricultural wastes, and plants grown exclusively as a fuel.**

*2005 Energy Act

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Woody biomass








Why are we interested in utilization?

- A tool to assist with restoration:
  - Offset costs of restoration (more acres)
  - Rural economic development

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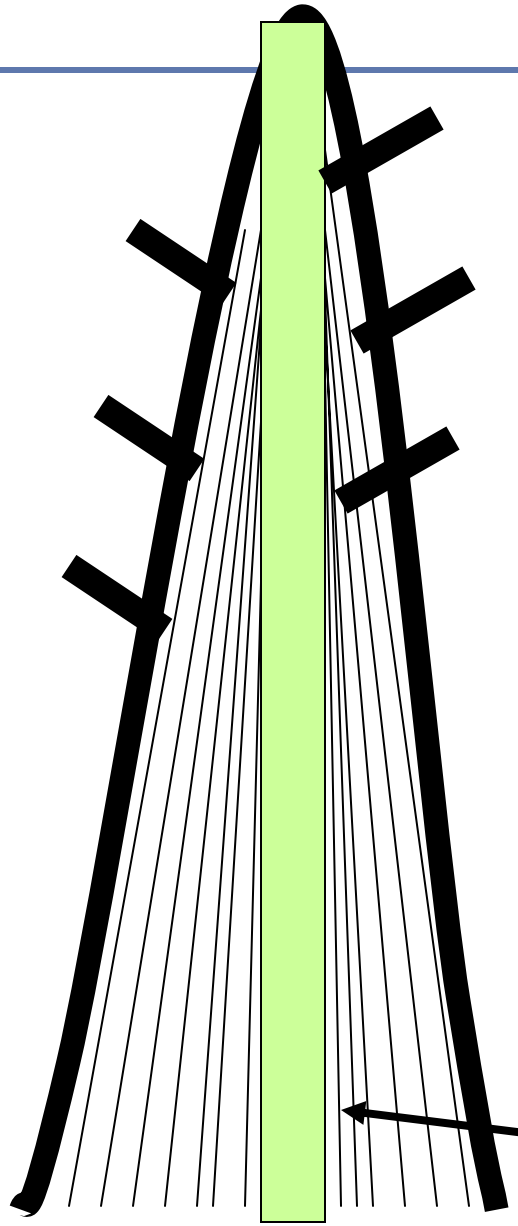
Small Diameter Wood is Different from wood derived from larger trees



Juvenile Wood Core – first 5 to 20 growth rings

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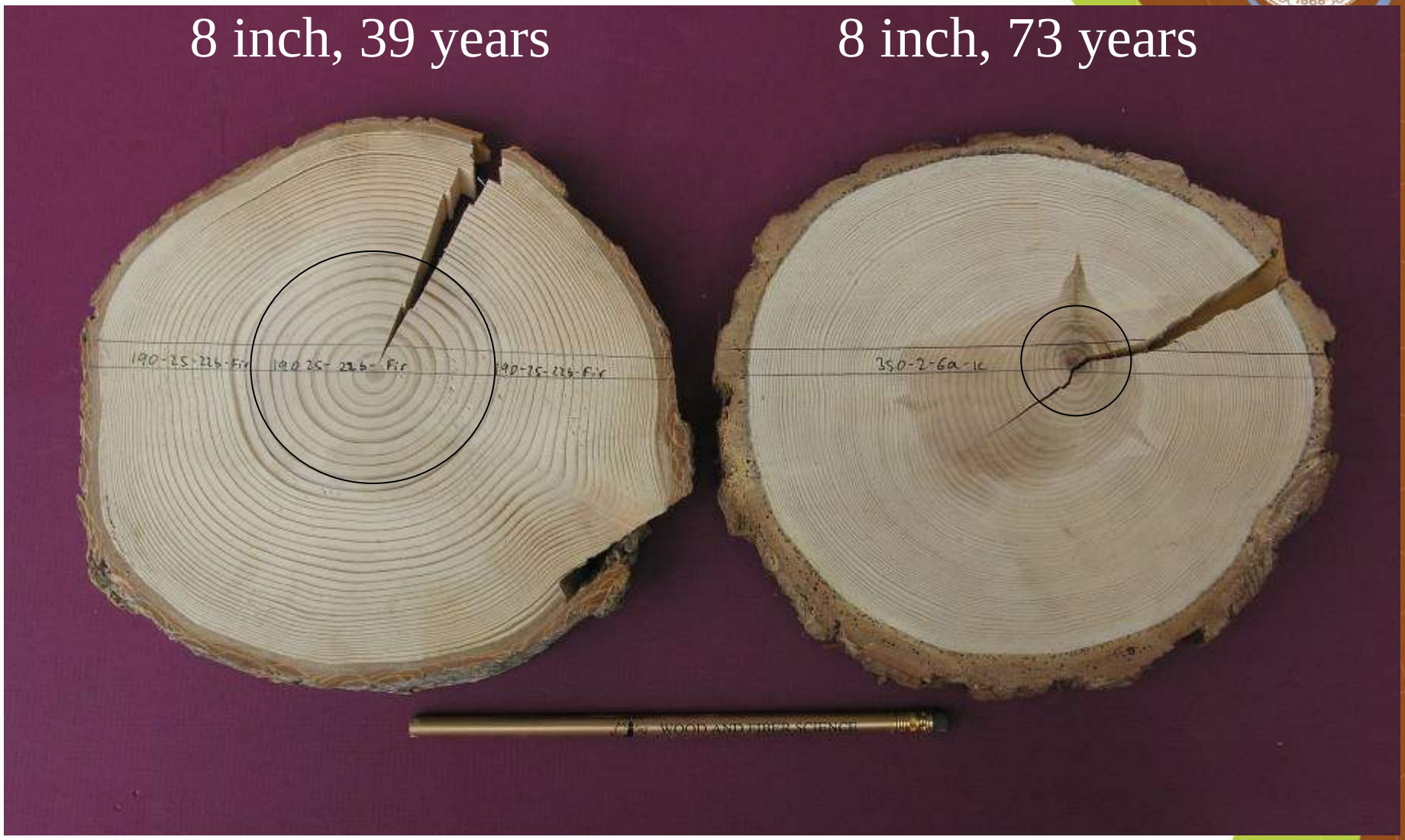
It Cracks



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It Cups

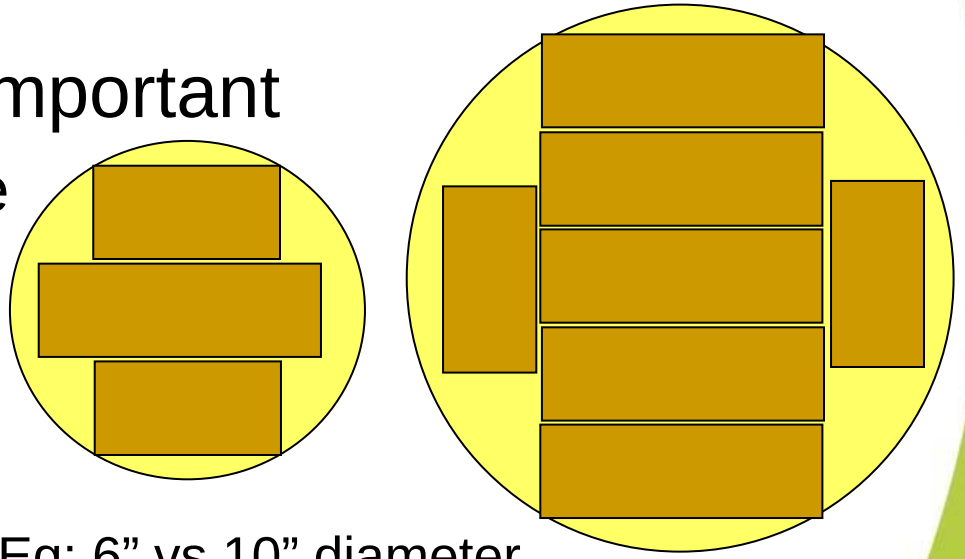
Dimensional change in the tangential direction is twice as great as it is in the radial direction

It Warps and Twists

It behaves badly…

Processing small logs

- More logs to process for same output
- Higher transportation costs
- More handling in mill
- Less valuable products
- Defects have a greater impact (knots, juvenile wood etc)
- Efficiency is very important
  - Speed and volume



Eg: 6” vs 10” diameter

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What can technology do with biomass?

Almost anything!

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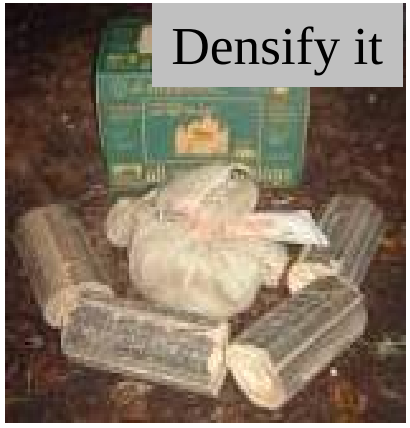
What can we do with biomass?



Ethanol/
Biofuels?

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Innovation in Lumber Processing

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Round Wood Is Stronger and More Stable

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Connections are Difficult-Costly

Slide provided by USDA Forest Service, Forest Products Lab

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End Products Can Be Beautiful!

Verification of design values is necessary to obtain building code approval

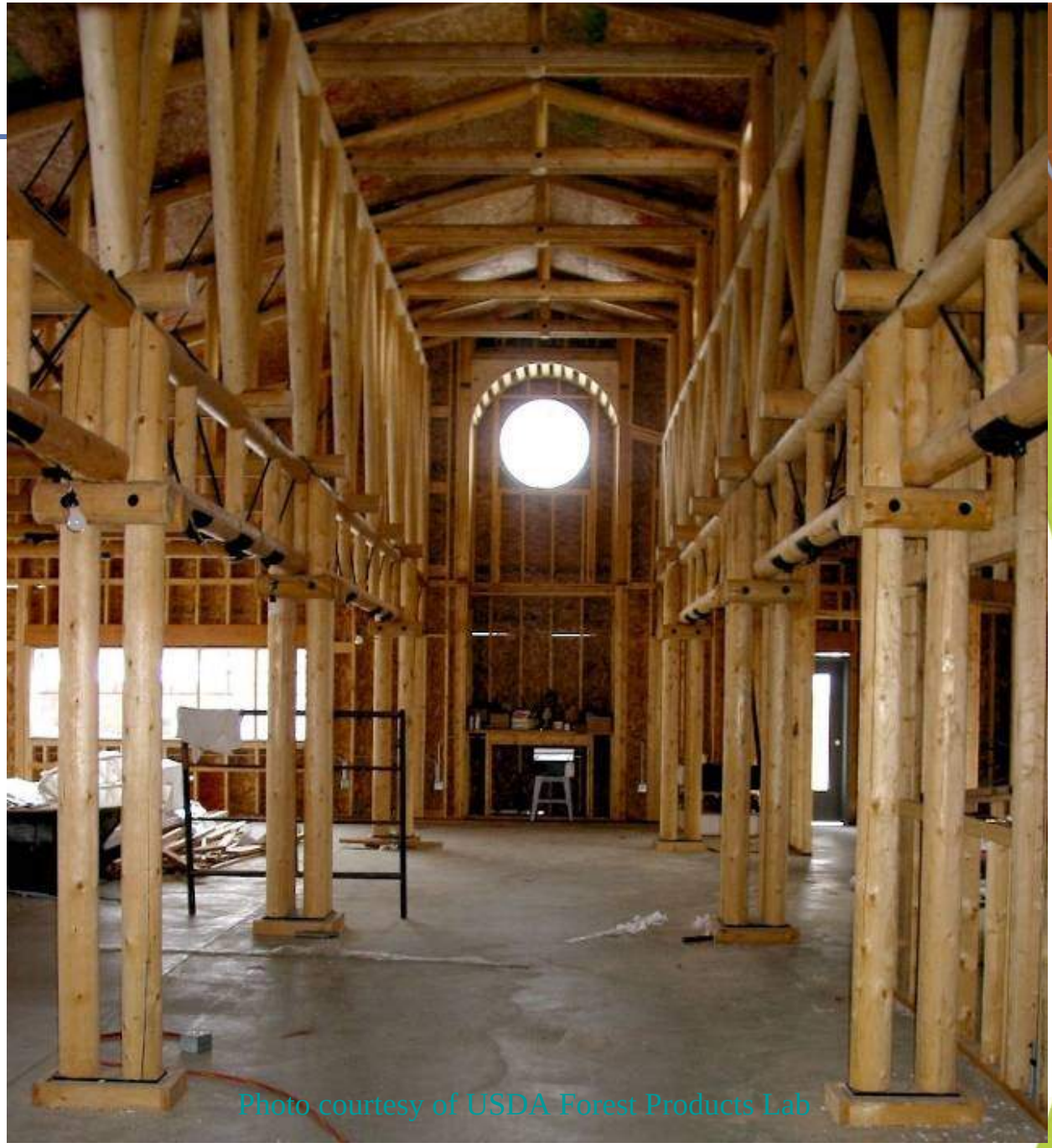

Photo courtesy of USDA Forest Products Lab

Post and Pole

- Low tech
- Low investment

Post and Pole key figures

- Site size - 3-5 acres
- Investment - $750,000+ (ex land and permits)
- Equipment - typically 1 peeler and 1 doweler (production ~1,200 - 2,000 pieces per day)
- Raw material – lodgepole pine, ponderosa pine (treatability, availability, lower taper and smaller knots), White fir and douglas fir less desirable (treating and shipping weight issues)
- Typical plant needs 10,000-20,000 tons/yr (depending on plant efficiency)
- Employees – 10-15
- Market Trends - lower Canadian dollar and lower fuel prices mean that there are more Canadian imports and competition
- Other considerations:
  - Residuals market (eg animal bedding, hog fuel and firewood)
  - Sorting/merchandizing system (small processors in yard vs automated sort systems with multiple bins)
  - Treatment plant – onsite or send elsewhere?

Source: Larry Swan, USFS

House logs - specifications

- 20% mc
- 10” small end diameter
- Low taper
- Straight
- Avoid spiral grain, checks/cracks, damage from harvesting/handling equipment
- 35-40ft length
- Typical species: Spuce, Douglas Fir, Cedar, Lodgepole Pine

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Breaking wood down into particles minimizes the impact of defects (knots, juvenile wood, insect galleries etc.)

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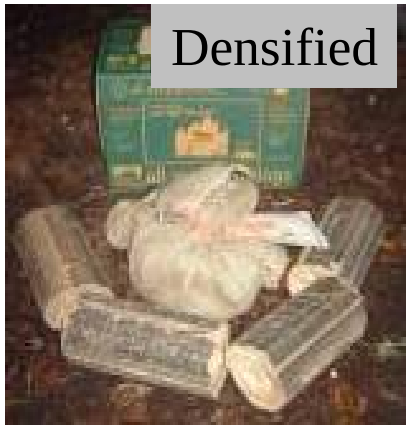
Creating uniformity



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Clean vs Dirty Chips

Raw material form is important

Every process has a raw material specification

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Screening

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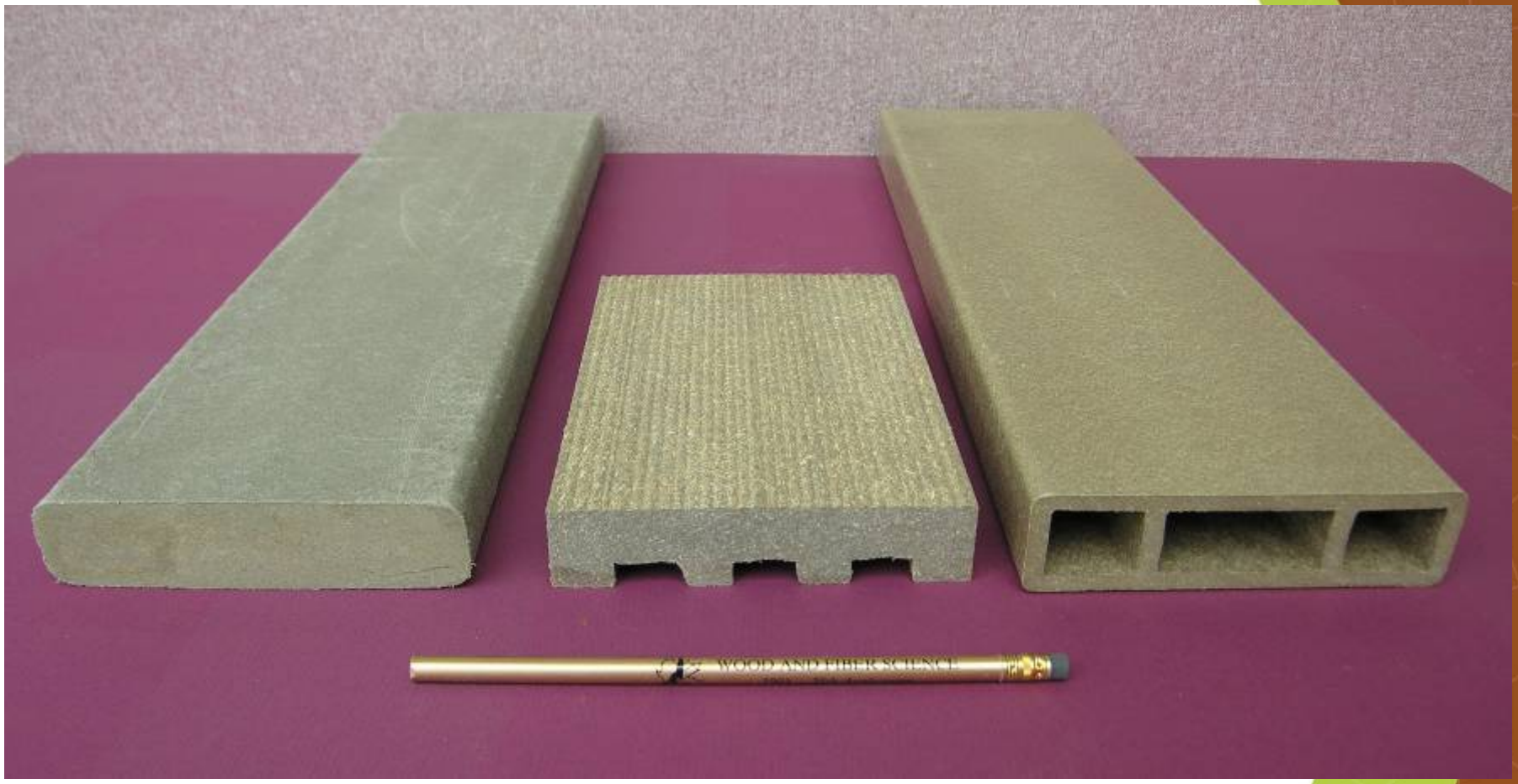
Wood-Plastic Composites



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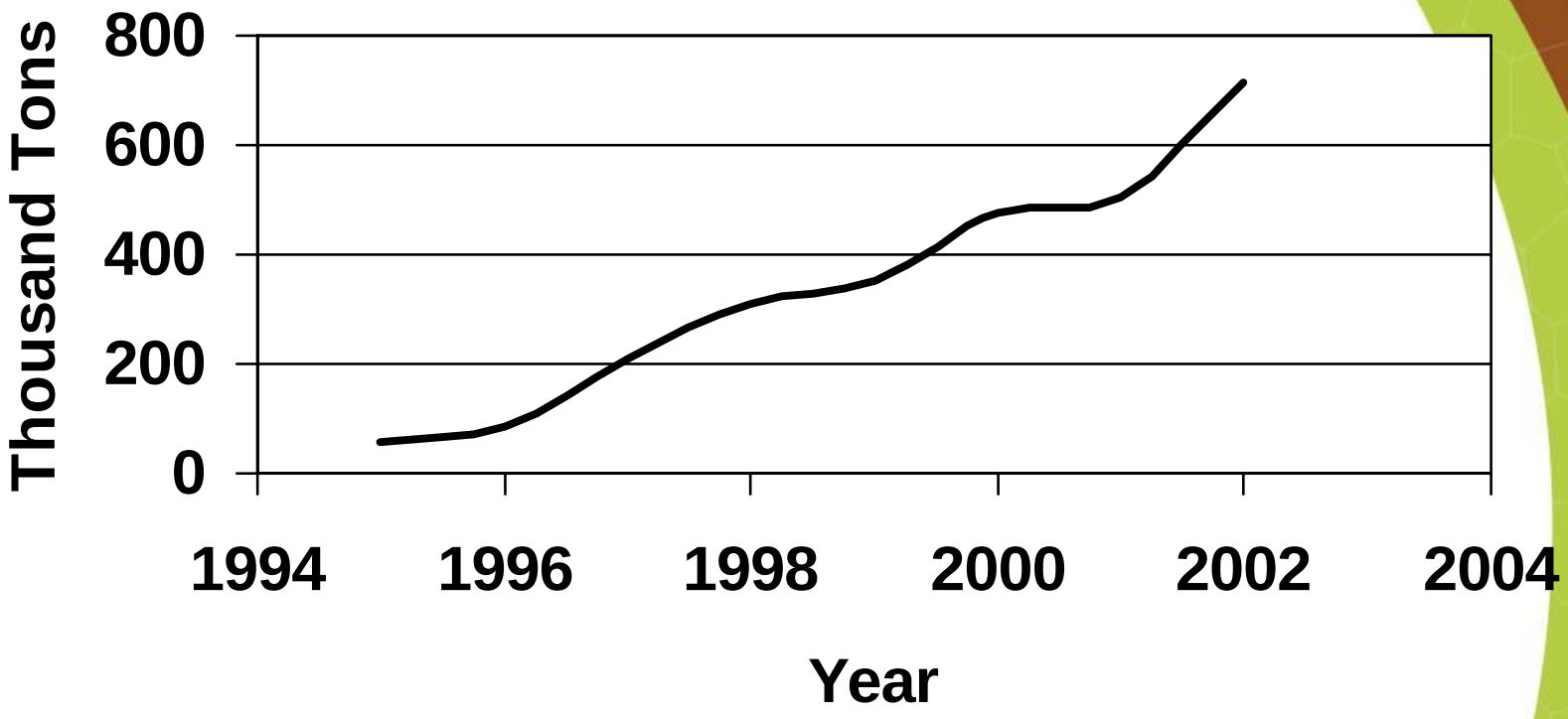
Demand for Natural and Wood Fiber-Plastic Composites



Adapted from Morton, Quarmley, and Rossi. 2004. Seventh International Conference on Wood Fiber – Plastic Composites. Forest Products Society, Madison, WI

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Densified Wood Products

More detail this afternoon…

Woody Biomass for Energy

Heat Only

Power (Electricity)

Combined Heat & Power (CHP or Cogen)

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Scale

10,000 ft^2-1 million+ ft^2

0.35 million BTU/hr-10 million+ BTU/hr

Heat only

Campfire

Powerplant

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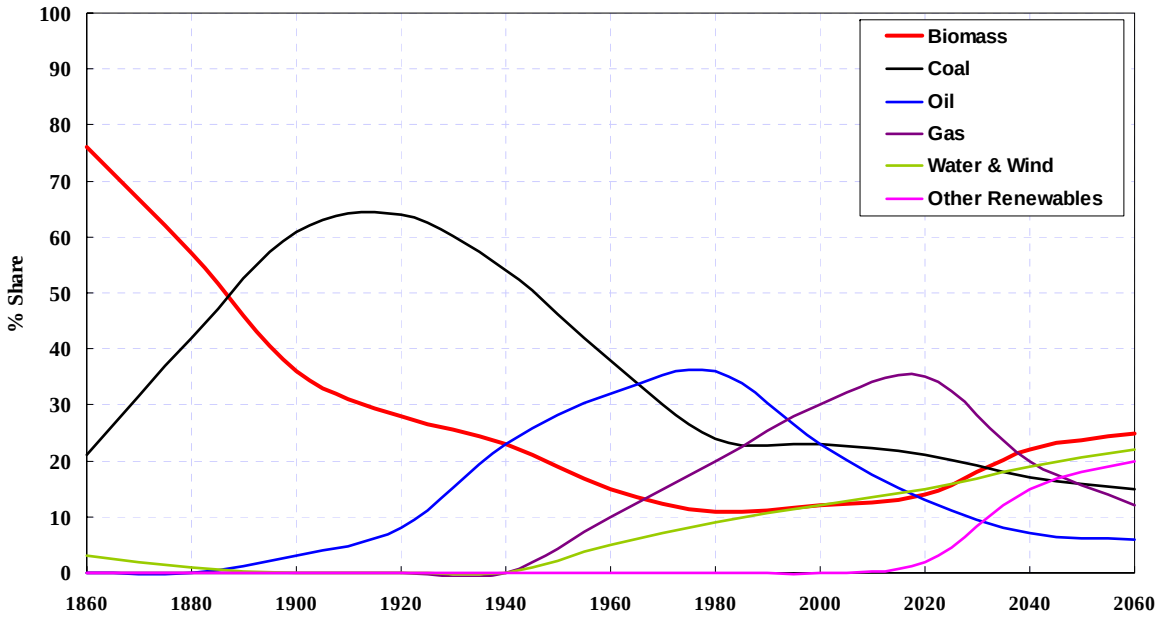
Historical context



Wood fuel: the original and best renewable fuel

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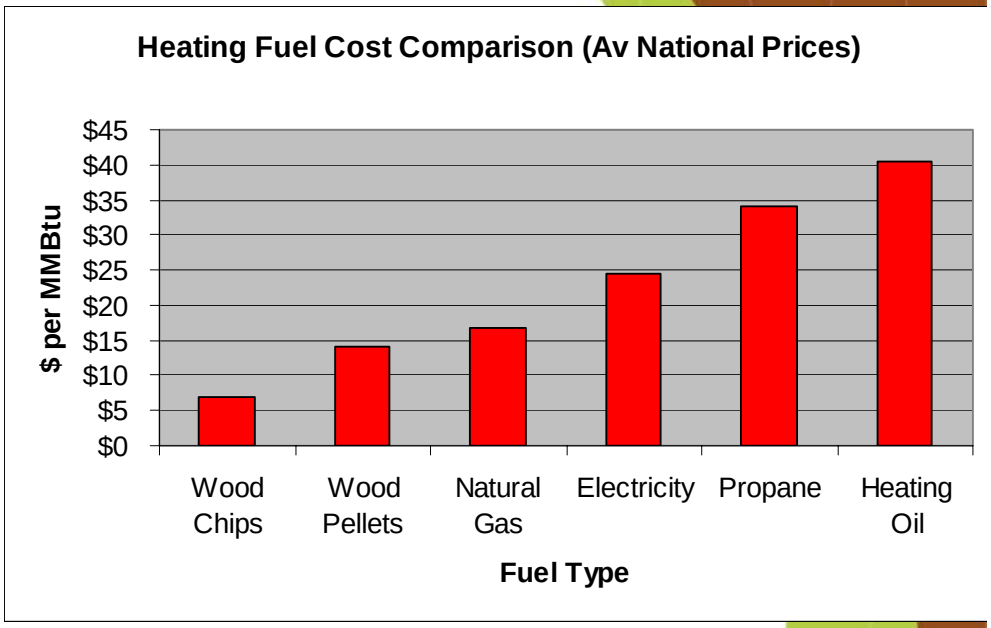
Small scale heat (institutional)

- Can be cheaper than alternatives – it is easy to calculate simple payback
- Carbon neutral
- Local market
- Opportunities for public buildings (10,000 sq ft to 1m+ sq ft)
- Permitting can be an issue
- Long payback period may be a problem (5-15+ yrs)



Source: US DOE Energy Information Administration, Sept 08

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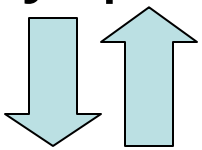
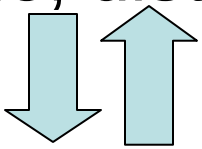
Value chain considerations

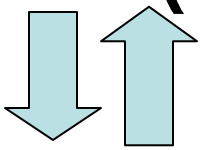
Resource : quality, price, availability



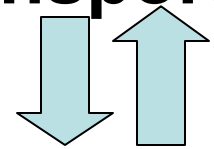
Transport: mode, distance, terrain



Process – Product (technology)



Transport



Market

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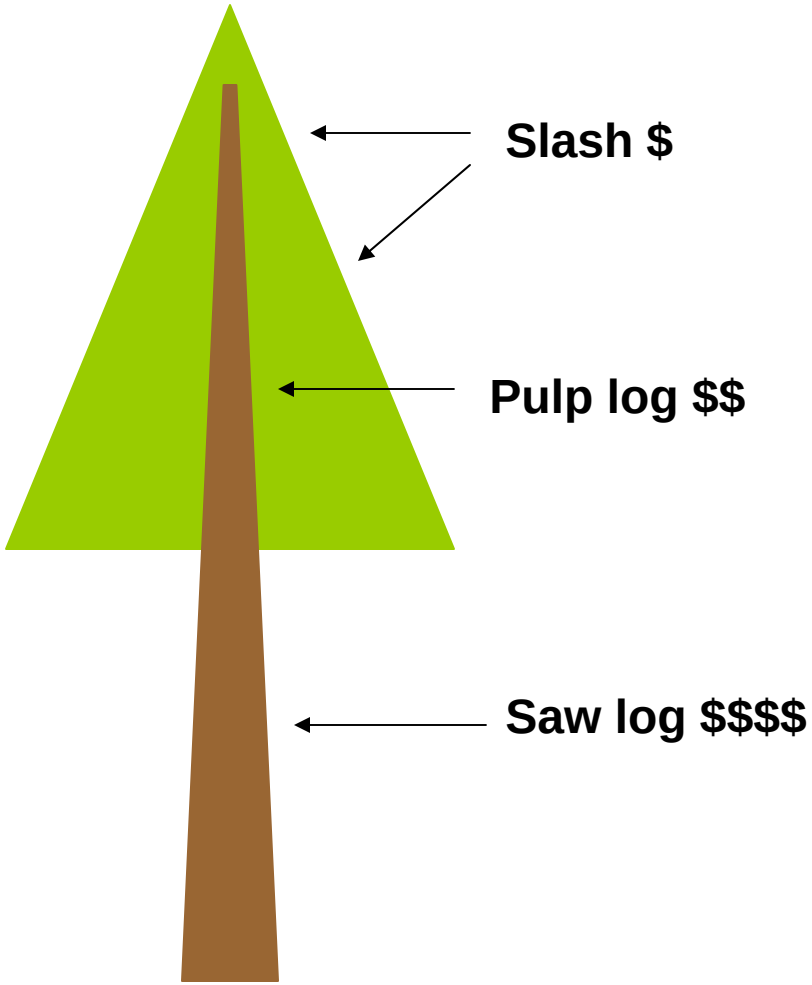
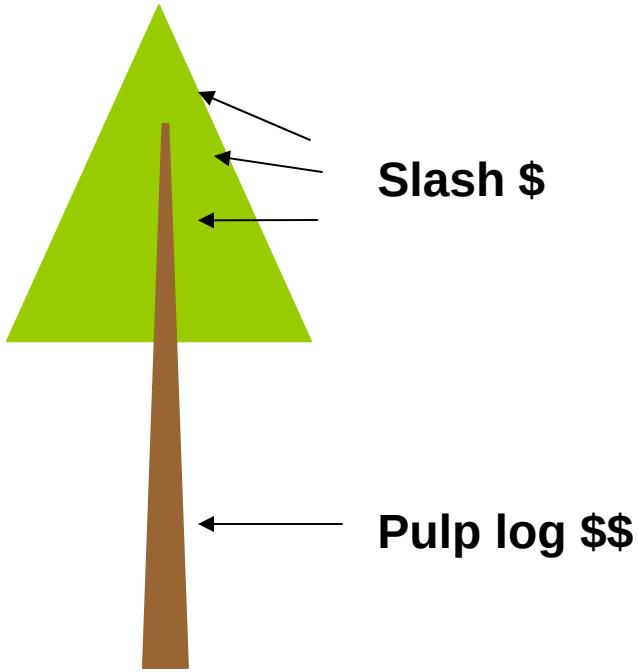
Scale of markets and distance

- **Bulk**
  - A monster to feed?
  - Long term (10+ years) supply commitments required in order for investment to happen
  - Is this compatible with what society wants from Federal lands?
  - Export markets
- **Small-medium markets (<60,000 ton/yr)**
  - Smaller investment (less risk?)
  - Less impact (can be located closer to the resource)
  - Niche or local markets

Value helps to move residuals





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Market development

- Existing infrastructure is important:
  - Contractors
  - Sawmills
  - Firewood
  - Others…

  - What do they pay?
  - Feedstock specification?
  - Opportunity to adapt to changing feedstock?

Infrastructure is hard to bring back

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Key Points

- Raw material supply
- Market identification
- Focus on market needs
  - Analyse costs vs potential income
- Learn from previous experience
- Avoid being over ambitious
- Identification of “easy wins”
- Woody biomass will not pay its way out of the forest but it can add value
- Existing infrastructure is important

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