Wood Pallets – An Important U.S. Industrial Product

Phil Araman
Virginia Tech/USFS, Blacksburg, VA

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PTF BPI 2012
St. Simons Island, Georgia, USA
Wood Pallets
More Pallets
Wood Pallets – An important U.S. Industrial Product...

• Some history of our pallet R&D in Blacksburg
• Information on wood material use and pallet production
• Research to minimize production waste and producing better pallets
• Pallet recovery, repair, and recycling numbers
• Reclaimed pallets saves trees and is good for the environment and can be labeled
We (US forest Service/VA Tech) have many years of working with the pallet industry

- Monitoring new pallet manufacturing
- Monitoring pallet recovery, repair, reuse and recycling
- Monitoring waste pallets to landfills
- Research supporting making better new pallets
- Research to support the pallet repair industry
- Research to support pallet recycling
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Some Manufacturing Numbers on New Pallets

Phil Araman
US Forest Service

Robert Bush and
Courtney Kepley
VA Tech
This is 2006 data – *we are currently collecting analyzing 2011 data*
Trends in new pallet production have been up

- 1992: 347 million
- 1993: 370 million
- 1995: 411 million
- 1999: 429 million
- 2006: 441 million

# of Pallets (millions)
New Solid Wood Use by the Industry – other than housing, Pallets are the largest user of solid wood

<table>
<thead>
<tr>
<th>Year</th>
<th>Billion Board Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>6.89</td>
</tr>
<tr>
<td>1993</td>
<td>6.94</td>
</tr>
<tr>
<td>1995</td>
<td>6.32</td>
</tr>
<tr>
<td>1999</td>
<td>6.54</td>
</tr>
<tr>
<td>2006</td>
<td>7.26</td>
</tr>
</tbody>
</table>
Stringer Pallets
Block Pallets
Types of New Wood Pallets Produced by the U.S. Wood Pallet and Container Manufacturing Industry – 2006 ... will 2011 data be different?

<table>
<thead>
<tr>
<th>Type of Pallet</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited-use block pallets</td>
<td>1.9%</td>
</tr>
<tr>
<td>Multiple-use block pallets</td>
<td>4.0%</td>
</tr>
<tr>
<td>Limited-use stringer pallets</td>
<td>38.2%</td>
</tr>
<tr>
<td>Multiple-use stringer pallets</td>
<td>41.9%</td>
</tr>
<tr>
<td>Skids and other types of pallets</td>
<td>13.9%</td>
</tr>
</tbody>
</table>

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Estimates of New Wood Volumes Used by the U.S. Wood Pallet and Container Manufacturing Industry - 2006

- Softwood Parts: 8%
- Softwood Lumber and Cants: 28%
- Hardwood Parts: 6%
- Hardwood Lumber and Cants: 58%
FYI -- We are collecting 2011 data on industry heat treating of pallets to compliment our 2006 data.
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Minimize production waste by improving pallet cant quality
Pallet Cants

• Virginia Tech and the Forest Service proposed a minimum grade for pallet cants.
• The maximum allowable unsound defect volume for a cant grade would be 30% of the cant volume.
• Pallet cant grades would help pallet manufacturers improve part yields (reduce waste) and help sawmills market pallet cants.
We then determined Pallet Cant Defects and Soundness at Appalachian Sawmills

Phil Araman and Matt Winn
U.S. Forest Service
Firoz Kabir
Virginia Tech
Blacksburg, VA

Xavier Torcheux and Guillaume Loizeaud
School of Timber Engineering
Nantes, France
The purpose of this study was to...

- Estimate the amount of unsound cant volume for a variety of different mills, species and sizes in order to
- Estimate the percentage of current production cants that would
- Meet proposed pallet cant grades and to
- Determine the general quality of pallet cants
Bark Pocket in Poplar
Decay in Red Oak
Insect Holes in White Oak
Mechanical Defect in Poplar
Shake in Poplar
Split in Red Oak
Unsound Knot in Poplar
Wane in Poplar
Rot in Red Oak
Average Defect Percentage per Cant for All Mills and Species

- Mechanical
- Bark Pocket
- Unsound Knot
- Decay
- Rot
- Hole
- Shake
- Wane
- Split

% of Cant Volume Containing Defect
Average Percentage of Cants in Each Defect Percentage Class for All Mills and Species

![Bar chart showing the percentage of cants in each defect percentage class for all mills and species. The x-axis represents the percentage of cant volume containing defects, ranging from less than 1% to greater than 30%. The y-axis represents the percentage of cants, ranging from 0% to 45%. The chart shows that the majority of cants fall into the 1-10% and 11-20% categories, with significantly fewer in the other categories.](chart.png)
Potential Results ....

• The poorest cants eliminated– there aren’t that many and would
• Please pallet producers
• Please sawmillers and
• Ultrasound scanning can make this possible – our next R&D effort
Potential Scanning System To Grade Pallet Cants at Sawmills (% Unsound Limit)

Pallet Cants → Ultrasound Scan → Grade 1 & Better

Rot, Ring Shake, Unsound Knots, etc... → Cull → Pallet Parts

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Scanning System In-feed
Close-up View of Rolling Transducers
Potential Ultrasonic Scanning of Pallet Cants for Processing and to Optimize Value
Optimized Sawing can Increase the Value of Material Obtained from Each Cant – Can be done manually!

General sawing practice is to cut adjacent parts, starting at one end of the cant:

Value-optimized sawing:

Other optimizing examples:
Potential Ultrasound System to Grade and Sort Pallet Parts = More Valuable Pallets (slope of grain is also important)

Pallet Parts

Ultrasound Scan

Slope of Grain, Knots, etc...

Grade 1

Grades 2 & 3
Pallet parts and grades – new and used parts
Potential Ultrasound System to Grade and Sort Pallet Parts = More Valuable Pallets (slope of grain is also important)
The Pallet Design System® Version 5.0
3-D Design and Engineering Tool for Wood Pallets and Unit Loads

The industry's premier design tool for wood pallets has evolved into a design tool for unit loads. The next version of PDS is the result of years of planning and development. It will enable clear communication about the customer's unit load handling requirements and the pallet's ability to meet those requirements.

Wood pallet manufacturers produce the key component to successful unit load material handling – the pallet – the interface between the equipment, forces and impacts of the material handling environment and the Customer's valuable, sometimes fragile, unitized load.

And PDS is the key tool in designing this key component.
Part grades and placement on pallets is possible to make a better pallet
Potential Ultrasound System to Grade and Sort Pallet Parts = More Valuable Pallets (Grading can also be done by people)
Use the mouse to choose one of the following two options:

- Pallet Grading Tutorial
- Pallet Grading Exercises
The following major defects can occur in lumber used in pallet manufacturing.

Select the defect (using the mouse, place the cursor over the defect to be selected and click the left button) that you would like to see more information about and click on Enter (with the left mouse button):

Cross Grain
Knots
Splits
Checks
Shake
Wane
Cross Grain

Cross grain exists when the grain of wood is not parallel to the long axis of the piece of lumber. Strength and stiffness drops off rapidly as the degree of cross grain increases.

Measuring Cross Grain

Cross grain is measured in terms of slope of grain stated in terms of 1 inch deviation from a straight line X inches long.
Grading Criteria for Deckboards

Grade 2BTR:
Slope of general cross grain - 1 in. in 10 in.
Max. dimension of local cross grain - 1/4 board width

Grade 3:
Slope of general cross grain - 1 in. in 8 in.
Max. dimension of local cross grain - 1/3 board width

Grade 4:
Slope of general cross grain - 1 in. in 6 in.
Max. dimension of local cross grain - 1/2 board width
Grading Criteria for Stringers

Grade 2BTR: Slope of general cross grain - 1 in. in 10 in.
Max. dimension of local cross grain - 1/4 cross section

Grade 3: Slope of general cross grain - 1 in. in 8 in.
Max. dimension of local cross grain - 1/3 cross section

Grade 4: Slope of general cross grain - 1 in. in 6 in.
Max. dimension of local cross grain - 1/2 cross section
The following major defects can occur in lumber used in pallet manufacturing.

Select the defect (using the mouse, place the cursor over the defect to be selected and click the left button) that you would like to see more information about and click on Enter (with the left mouse button):

- Cross Grain
- Knots
- Splits
- Checks
- Shake
- Wane

[ENTER]
## Pallet Grading Exercises

<table>
<thead>
<tr>
<th>Board 1</th>
<th>Board 2</th>
<th>Board 3</th>
<th>Board 4</th>
<th>Board 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board 6</td>
<td>Board 7</td>
<td>Board 8</td>
<td>Board 9</td>
<td>Board 10</td>
</tr>
<tr>
<td>Board 11</td>
<td>Board 12</td>
<td>Board 13</td>
<td>Board 14</td>
<td>Board 15</td>
</tr>
<tr>
<td>Board 16</td>
<td>Board 17</td>
<td>Board 18</td>
<td>Board 19</td>
<td>Board 20</td>
</tr>
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</table>

Select a board to grade and click here.
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Pallet recovery, repair, and recycling numbers

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US Forest Service

Robert Bush and Courtney Kepley
VA Tech
Pallets going to repair and incoming trailers from pallet users – We collect this data
Pallet recovery -- Separation area at large recycler
Modern repair facility
Repair operations
Three repair stations
Salvaging pallet parts
Recovered Parts for Repairs
Numbers of Wood Pallets Recovered has Increased

Number of Pallets Recovered for All Uses (Millions)
Wood Pallet Recovery, Reuse, and Recycling

(SAVES TREES ..... SAVES LANDFILL SPACE ..... AND PROVIDES NEEDED WOOD PRODUCTS)

The Urban Resources

Questions - Contact Phil Araman
USDA Forest Service
Southern Research Station
Blacksburg, VA
(540) 231-5341 paraman@vt.edu

Shouldn’t Do

LANDFILLING

Repair
Pallet Disassembly
Mulch
Animal Bedding
Flooring/Paneling
Fuel
Survey shows most pallets are repaired
What happens to the Recovered Pallets? – Most Were Reused in 2006 that you received

- 68% Used for repair
- 15% Un-nailed
- 10% Reused without repair
- 6% Ground or chipped
- <1% Landfilled
- 1% Other

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Pallets recovered, repaired, rebuilt and sold to pallet users

<table>
<thead>
<tr>
<th>Year</th>
<th># of Pallets (millions)</th>
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<tbody>
<tr>
<td>1992</td>
<td>51</td>
</tr>
<tr>
<td>1993</td>
<td>62</td>
</tr>
<tr>
<td>1995</td>
<td>143</td>
</tr>
<tr>
<td>1999</td>
<td>223</td>
</tr>
<tr>
<td>2006</td>
<td>357</td>
</tr>
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</table>
What happens to the Recovered Pallets? –
Ground or chipped material

- 68% Used for repair
- 15% Un-nailed
- 10% Reused without repair
- 6% Ground or chipped
- <1% Landfilled
- 1% Other

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Use of Ground/Chipped Recycled Pallet Materials

- Colored landscape mulch: 32%
- Uncolored landscape mulch: 22%
- Fuel: 23%
- Animal bedding: 8%
- Fiber-based products: 9%
- Other: 6%
Tub Grinder and Colored Mulch
New pallets compared to pallets recovered, repaired, rebuilt and sold to pallet users

<table>
<thead>
<tr>
<th>Year</th>
<th>Recovered Pallets</th>
<th>New Pallets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>51</td>
<td>347</td>
</tr>
<tr>
<td>1993</td>
<td>62</td>
<td>370</td>
</tr>
<tr>
<td>1995</td>
<td>143</td>
<td>411</td>
</tr>
<tr>
<td>1999</td>
<td>223</td>
<td>429</td>
</tr>
<tr>
<td>2006</td>
<td>357</td>
<td>441</td>
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This is a powerful slide -- New pallets compared to pallets recovered, repaired, rebuilt and sold to pallet users
Is pallet recovery/repair/reuse important? Yes – millions of trees are saved every year for future use = Green Commercial

* Based on trees 12” in diameter (DBH) with 2.5 16 foot long logs. (Estimated to contain 100 board feet of lumber)
Pallet Recyclers – Can join the very visible environmental movement of FSC – Forest Stewardship Council
Green Products from Recycled Wood = Good PR
They could qualify as a chain-of-custody companies and use on-product labels such as ..... Many pallet users are pushing FSC for products they sell
These could be their words ...

It's official - We Are FSC Certified!

Are we green yet? Turns out we always were. But now it's official. Our repaired pallet line was recently awarded the Forest Stewardship Council designation, and we didn't have to strain to meet the conditions for it. As it turns out, we were doing things the right way from the beginning. That means low ecological impact just as we, and the FSC intended.
What are the 3 ‘On-product Labels?’

**100%**

Products only contain material from FSC Certified forest that meet the environmental and social standards of FSC.

**Mixed sources**

Products with material from FSC certified forests, recycled material or other controlled sources.

**Recycled**

Products only contain post consumer material and may include some pre-consumer material content.