The Hardwood Resource and Sawmilling Industry

William Luppold
USDA Forest Service
Subjects to be Examined

- Change in forest composition – some regional and state examples
- Changes in forest ownership, land fragmentation, and urban/sub urban encroachment
- Bugs, diseases, and evasive plant species
- The interrelationship between sawmills, sawtimber inventories, and markets
The Forest You See Today

- Is the result of biological, climatic, and market induced disturbances that occurred 50 to 150 years ago.

- Is not the same forest that existed 25 years ago.

- Will not be the same as the forest you will see 10 years from now.
Lumber Production in WV 1869 to 2001

Thousand cubic meters

Softwood

Hardwood
Hardwood Regions

- Northern
- West Central
- Central Appalachians
- Southern
Proportional Cubic Volume in all Trees Greater than 5” dbh in the North

- Other
- Soft Maple
- Hard Maple
- White Oak
- N Red Oak
- Aspen
# Changing Composition of Forests in the Northern Region

<table>
<thead>
<tr>
<th></th>
<th>5 to 8.9” 20 to 30 years</th>
<th>9 to 12.9” 10 to 15 years</th>
<th>13 to 16.9” 5 or less years</th>
<th>GT 17” today</th>
</tr>
</thead>
<tbody>
<tr>
<td>S W Oak</td>
<td>2.6%</td>
<td>3.7%</td>
<td>4.9%</td>
<td>7.5%</td>
</tr>
<tr>
<td>S R Oak</td>
<td>3.6%</td>
<td>6.9%</td>
<td>11.4%</td>
<td>17.6%</td>
</tr>
<tr>
<td>H Maple</td>
<td>14.2%</td>
<td>15.2%</td>
<td>15.0%</td>
<td>14.2%</td>
</tr>
<tr>
<td>S Maple</td>
<td>24.0%</td>
<td>21.3%</td>
<td>18.3%</td>
<td>14.7%</td>
</tr>
<tr>
<td>Aspen</td>
<td>12.2%</td>
<td>11.8%</td>
<td>10.9%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Ash</td>
<td>8.2%</td>
<td>7.2%</td>
<td>6.9%</td>
<td>5.8%</td>
</tr>
</tbody>
</table>
# Changing Composition of Forests in Pennsylvania

<table>
<thead>
<tr>
<th>Species</th>
<th>5 to 8.9” (20 to 30 years)</th>
<th>9 to 12.9” (10 to 15 years)</th>
<th>13 to 16.9” (5 or less years)</th>
<th>GT 17” (today)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S W Oak</td>
<td>4.0%</td>
<td>5.7%</td>
<td>6.4%</td>
<td>5.5%</td>
</tr>
<tr>
<td>R Oak</td>
<td>6.4%</td>
<td>10.3%</td>
<td>15.7%</td>
<td>26.1%</td>
</tr>
<tr>
<td>O W Oak</td>
<td>7.1%</td>
<td>9.1%</td>
<td>7.9%</td>
<td>5.7%</td>
</tr>
<tr>
<td>H Maple</td>
<td>9.3%</td>
<td>9.7%</td>
<td>9.0%</td>
<td>7.1%</td>
</tr>
<tr>
<td>S Maple</td>
<td>29.0%</td>
<td>24.2%</td>
<td>20.1%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Cherry</td>
<td>9.7%</td>
<td>10.1%</td>
<td>12.0%</td>
<td>14.3%</td>
</tr>
</tbody>
</table>
In the last 25 years the forests of Pennsylvania have transitioned from oak dominated to maple dominated

- Diameter limit and other selective cutting methods favored the regeneration of maple
- Gypsy moth decimated red oak in several portions of the state
### Changing Composition of Forests in the West Central Region

<table>
<thead>
<tr>
<th>Species</th>
<th>5 to 8.9” 20 to 25 years</th>
<th>9 to 12.9” 10 to 15 years</th>
<th>13 to 16.9” 5 or less years</th>
<th>GT 17” today</th>
</tr>
</thead>
<tbody>
<tr>
<td>S W Oak</td>
<td>11.4%</td>
<td>15.1%</td>
<td>17.7%</td>
<td>18.2%</td>
</tr>
<tr>
<td>O W Oak</td>
<td>7.3%</td>
<td>9.1%</td>
<td>9.0%</td>
<td>8.1%</td>
</tr>
<tr>
<td>R Oak</td>
<td>10.1%</td>
<td>16.1%</td>
<td>20.3%</td>
<td>24.1%</td>
</tr>
<tr>
<td>Hickory</td>
<td>12.0%</td>
<td>13.3%</td>
<td>11.3%</td>
<td>6.1%</td>
</tr>
<tr>
<td>Y-Poplar</td>
<td>5.2%</td>
<td>6.8%</td>
<td>8.6%</td>
<td>9.6%</td>
</tr>
<tr>
<td>S Maple</td>
<td>7.7%</td>
<td>5.4%</td>
<td>4.6%</td>
<td>6.0%</td>
</tr>
</tbody>
</table>
## Changing Composition of Forests in Missouri

<table>
<thead>
<tr>
<th>Species</th>
<th>5 to 8.9” 20 to 25 years</th>
<th>9 to 12.9” 10 to 15 years</th>
<th>13 to 16.9” 5 or less years</th>
<th>GT 17” today</th>
</tr>
</thead>
<tbody>
<tr>
<td>S W Oak</td>
<td><strong>20.14%</strong></td>
<td>24.2%</td>
<td>27.8%</td>
<td>27.1%</td>
</tr>
<tr>
<td>S R Oak</td>
<td>3.6%</td>
<td>4.5%</td>
<td>6.5%</td>
<td>7.7%</td>
</tr>
<tr>
<td>O W Oak</td>
<td>13.8%</td>
<td>12.6%</td>
<td>11.2%</td>
<td>7.7%</td>
</tr>
<tr>
<td>O R Oak</td>
<td>18.8%</td>
<td>24.9%</td>
<td>26.6%</td>
<td>24.3%</td>
</tr>
<tr>
<td>Hickory</td>
<td>15.2%</td>
<td>12.3%</td>
<td>8.8%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Walnut</td>
<td>2.3%</td>
<td>3.3%</td>
<td>2.9%</td>
<td>3.2%</td>
</tr>
</tbody>
</table>
Survey Statistics can be Inconsistent

- Between 1989 and 2004, reported hardwood sawtimber volume in Missouri increased by an astounding 93.3%
- Trouble is that the cubic volume of all live hardwood trees of sawtimber size only increased by 40.2%
- This is a result of a redefinition of what constitutes growing stock and sawtimber
# Changing Composition of Forests in the Central Appalachian Region

<table>
<thead>
<tr>
<th>Species</th>
<th>5 to 8.9” (20 to 25 years)</th>
<th>9 to 12.9” (10 to 15 years)</th>
<th>13 to 16.9” (5 or less years)</th>
<th>GT 17” (today)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S W Oak</td>
<td>7.2%</td>
<td>9.2%</td>
<td>11.4%</td>
<td>12.0%</td>
</tr>
<tr>
<td>S R Oak</td>
<td>2.5%</td>
<td>4.0%</td>
<td>5.7%</td>
<td>10.1%</td>
</tr>
<tr>
<td>O W Oak</td>
<td>6.7%</td>
<td>8.8%</td>
<td>8.6%</td>
<td>7.8%</td>
</tr>
<tr>
<td>O R Oak</td>
<td>6.8%</td>
<td>8.9%</td>
<td>10.4%</td>
<td>11.0%</td>
</tr>
<tr>
<td>Y-Poplar</td>
<td>9.2%</td>
<td>13.0%</td>
<td>17.5%</td>
<td>24.9%</td>
</tr>
<tr>
<td>S Maple</td>
<td>16.4%</td>
<td>12.1%</td>
<td>8.7%</td>
<td>6.4%</td>
</tr>
</tbody>
</table>
### Changing Composition of Forests in the Southern Region

<table>
<thead>
<tr>
<th>Species</th>
<th>5 to 8.9” (15 to 20 years)</th>
<th>9 to 12.9” (10 years)</th>
<th>13 to 16.9” (5 or less years)</th>
<th>GT 17” (today)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S W Oak</td>
<td>11.4%</td>
<td>15.1%</td>
<td>17.7%</td>
<td>18.2%</td>
</tr>
<tr>
<td>S R Oak</td>
<td>2.3%</td>
<td>3.5%</td>
<td>5.1%</td>
<td>8.3%</td>
</tr>
<tr>
<td>O W Oak</td>
<td>7.3%</td>
<td>9.1%</td>
<td>9.0%</td>
<td>8.1%</td>
</tr>
<tr>
<td>O R Oak</td>
<td>8.6%</td>
<td>12.6%</td>
<td>15.2%</td>
<td>15.8%</td>
</tr>
<tr>
<td>Hickory</td>
<td>12.0%</td>
<td>13.3%</td>
<td>11.3%</td>
<td>6.1%</td>
</tr>
<tr>
<td>Y-Poplar</td>
<td>3.0%</td>
<td>6.8%</td>
<td>8.6%</td>
<td>9.6%</td>
</tr>
</tbody>
</table>
Grade of Red Oak and Red Maple Trees in PA in the 15” to 16.9” Size Class

N Red Oak

- Grade 1
- Grade 2
- Grade 3
- 3<

Red Maple

- Grade 1
- Grade 2
- Grade 3
- Less than Grade 3
Factors Influencing Future Forests

- Change in forest land
  - Land reversion back to forest
  - Forest land turning into sub urban land

- Bugs and disease

- Evasive species “weeds”
Changes in Non Family Private Ownership

- Forest industry has been divesting of land
- Much of this land has gone to TMO’s, insurance companies, or real estate organizations
- Some of the land in highly desirable locations has been partitioned for homes
Private Forest Owners
Size of Landholdings

<table>
<thead>
<tr>
<th>Parcel Size (Acres)</th>
<th>1978</th>
<th>1994</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-9</td>
<td>5.5</td>
<td>6.0</td>
<td>6.5</td>
</tr>
<tr>
<td>10-49</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
</tr>
<tr>
<td>50-99</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>100-499</td>
<td>0.2</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>500-999</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>1000+</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
</tr>
</tbody>
</table>
Family Forest Owners
Size of Landholdings

Family Forest Owners (millions)

Size of Forest Holdings (ac)

1993
2003

0 1 2 3 4 5 6

1-9 10-49 50-99 100-499 500-999 1000-4999 5000+

Family Forest Owners
Size of Landholdings
Urban Encroachment (Dwyer et al. 2000)
Change in Forest Land

- **CN 1985 to 2004**
  - Down 6.61%

- **PA 1989 to 2004**
  - Down 1.95%

- **NC 1984 to 2002**
  - Down 3.61 %

- **TN 1989 to 2003**
  - Up 3.89%

- **MI 1980 to 2004**
  - Up 5.13%

- **AL 1990 to 2004**
  - Up 4.47 %
Changes in Forest Land in Tennessee

- West: 12.8%
- West C: 0.5%
- Central: 13.3%
- Plateau: -2.7%
- East: 0.6%
Bugs and Diseases

- Diseases that affect quality that are a result of tree damage - either human or natural

- Bugs and diseases that were part of the ecosystem before European settlement

- Imported bugs and diseases
Damage Induced Heartwood
Kevin Smith

- Is the dark wood in red and sugar maple, the purple/black wood in yellow-poplar, and the brown wood in white ash.
- Is the result of a tree encapsulating and killing pathogens.
- These pathogens are introduced by broken limbs, damaged roots, or bark rub resulting from humans, wildlife, or storms.
Preexisting Bugs

- Spruce-Budworm periodically devastates northern Spruce/Fir Forests
- Cambium Miner – does not kill trees but can cause gum spots in cherry and problems in birch
- Peach Bark Borer – another source of gum spots in cherry
What to Worry About

- We are currently in a period of relatively warm winters. It does not matter if you believe in solar cycles or global warming.
- Warmer temperatures mean that bugs could migrate to areas they may not have been for several decades.
- Gum pockets and other defects may start occurring at higher elevations and latitudes.
Introduced Bugs and Diseases

- Chestnut blight – totally changed the Appalachian forest
- Dutch elm disease
- Beech bark disease
- Gypsy moth
- Emerald ash borer – devastating
- Sudden oak death – has been on the West Coast so far (except for rhododendron nursery stock)
Evasive Species

- Involves the introduction of non-native plants which in many instances have been purposely introduced
- Prime examples include Ailanthus, multiflora rose, and kudzu
- Are more of a long-term problem since these plants usually affect forest regeneration
- However, fast moving vines can be a more near term problem
The Changing Sawmilling Industry

- Historic changes in concentration
- Relationship between lumber production, the market, and the resource
- An apparent structural shift that may reverse some long term trends
Sawmill Concentration In West Virginia 1986 to 2004

- 1986
- 1992
- 2004

Legend:
- 1<
- 1 to 4.9
- 5 to 9.0
- 10+
Inventory to Production Ratio or IPR

- Sawtimber Inventory / Sawmill capacity

- How many years it would take to deplete the resource if nothing grew back. Rough measure of relative utilization

- Is the result of an interaction between the resource and the market
## Net Change by Region in Tennessee
### 1989 to 2000

<table>
<thead>
<tr>
<th>Region</th>
<th>1MM&lt;</th>
<th>1MM to 4.99 MM</th>
<th>5 MM to 9.99 MM</th>
<th>&gt; 10 MM</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>-1.1</td>
<td>-8.2</td>
<td>32.9</td>
<td>-4.0</td>
<td>19.6</td>
</tr>
<tr>
<td>West Cen</td>
<td>-5.1</td>
<td>12.5</td>
<td>-6.1</td>
<td>12.0</td>
<td>13.3</td>
</tr>
<tr>
<td>Central</td>
<td>-5.4</td>
<td>-39.7</td>
<td>-10.3</td>
<td>47.0</td>
<td>-8.4</td>
</tr>
<tr>
<td>Plateau</td>
<td>-4.7</td>
<td>-11.7</td>
<td>26.2</td>
<td>43.5</td>
<td>53.3</td>
</tr>
<tr>
<td>East</td>
<td>8.4</td>
<td>5.8</td>
<td>16.9</td>
<td>44.5</td>
<td>75.6</td>
</tr>
</tbody>
</table>
An Apparent Structural Shift

- In the 1990s the buzz was bigger, more complex mills capable of obtaining maximum yield of high-quality lumber
- Expand production or exit the market was the apparent market plan
- Small and medium size sawmills were declining in importance and yards not affiliated with mills were on the decline
An Apparent Structural Shift

- While large mills appeared to have economy of scale in production and distribution, they had to procure from larger areas and had high fixed costs.

- In the last few years many people have realized mid size mills using low cost resaws and simple headrigs can reduce cost. Unaffiliated yards may again grow in importance.