Reliable estimates of sustainable biomass supply...

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Objectives

• Lay out the structure of the problem
• Examine evidence regarding the structure of supply
• Make conclusions and identify the analytical challenges
Sustainability?

- Past fifty years of southern forest management indicates that the market can organize a sustained yield of wood products... forest investment responds to market signals
  - Vast expansion in production coupled with an expanding inventory
  - What’s the max?

- Sustained yield is not equivalent to sustainability. Still unclear as to what other ecosystem services might become scarce....
  - Requires understanding of other factors
Woody biomass supply

- Coupling biophysical production (inventory, growth and yield) with behavioral model (harvest choice)
- Premise: structure of woody biomass supply is not qualitatively dissimilar to structure of pulpwood supply in the South.
- Supported by trend toward producing homogenous timber product: e.g., plywood to OSB, lumber to engineered wood
Harvest choice

- \( \text{Pr (Harvest)} = f(\text{prices, growth, costs, OTHER VALUES}) \)
- \( \text{Pr (Harvest)} = f(\text{prices, growth, costs, Landowner attributes}) \)
- \( \text{Pr (Harvest | commercial owner)} > \text{Pr (Harvest | family farm owner)} \)
Biophysical Production

- Harvest = \( pr (\text{Harvest}) \times Q (\text{Forest type, age, costs, location}) \)

- How will harvest change in the short run?
  - Changes in prices (harvest probability)

- How will harvest change in the long run?
  - Changes in inventory: investment, land use (Q)
  - Changes in landowner attributes (harvest probability)
Short run supply structure

Supply2010

<table>
<thead>
<tr>
<th>Harvest</th>
<th>0</th>
<th>200</th>
<th>400</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>0</td>
<td>50</td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>

?
Evidence from recent supply modeling for RPA/SFFP

- Empirical harvest choice models
- Tied to forest inventory plots
- Simulation over 50 year period
- Accounts for:
  - Growth and mortality
  - Investment
  - Land use changes
**Short run supply**

<table>
<thead>
<tr>
<th>Elasticities with respect to</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softwood sawtimber</td>
<td></td>
</tr>
<tr>
<td>Price of softwood sawtimber</td>
<td>0.336‡</td>
</tr>
<tr>
<td>Price of softwood pulpwood</td>
<td>0.019‡</td>
</tr>
<tr>
<td>Price of hardwood sawtimber</td>
<td>0.032‡</td>
</tr>
<tr>
<td>Price of hardwood pulpwood</td>
<td>0.009†</td>
</tr>
</tbody>
</table>
# Softwood Pulpwood

<table>
<thead>
<tr>
<th>Softwood pulpwood</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price of softwood sawtimber</td>
<td>0.036‡</td>
</tr>
<tr>
<td>Price of softwood pulpwood</td>
<td>0.062‡</td>
</tr>
<tr>
<td>Price of hardwood sawtimber</td>
<td>0.010‡</td>
</tr>
<tr>
<td>Price of hardwood pulpwood</td>
<td>0.003</td>
</tr>
</tbody>
</table>
# Hardwood Sawtimber

<table>
<thead>
<tr>
<th></th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardwood sawtimber</td>
<td></td>
</tr>
<tr>
<td>Price of softwood sawtimber</td>
<td>0.080‡</td>
</tr>
<tr>
<td>Price of softwood pulpwood</td>
<td>0.008</td>
</tr>
<tr>
<td>Price of hardwood sawtimber</td>
<td>0.307‡</td>
</tr>
<tr>
<td>Price of hardwood pulpwood</td>
<td>0.026‡</td>
</tr>
</tbody>
</table>
# Hardwood Pulpwood

<table>
<thead>
<tr>
<th>Hardwood pulpwood</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price of softwood sawtimber</td>
<td>0.097‡</td>
</tr>
<tr>
<td>Price of softwood pulpwood</td>
<td>0.008†</td>
</tr>
<tr>
<td>Price of hardwood sawtimber</td>
<td>0.130‡</td>
</tr>
<tr>
<td>Price of hardwood pulpwood</td>
<td>0.025‡</td>
</tr>
</tbody>
</table>
Short run sawtimber supply

- Softwood sawtimber
- Hardwood sawtimber

pr, $/mbf

Harvest, bbf

Harvest, bbf

0 100 200 300 400 500
0 4 6 8 10 12

RPA

Department of Agriculture

U.S.
Short run pulpwood supply
Shifts in supply over time…

Shifts in supply reflect land use change due to urbanization, forest investment, and age dynamics.
A 10 percent increase in harvest with a 25 percent reduction in price
Development will restrict expansion

Land Use – u Scenario – A1 AgScen – 2 TimScen – 2 Year – 2030

Section
Conclusions

• **Short run supply**
  - Highly inelastic pulpwood supply, price increases expected in the short run
  - Highly variable hardwood pulpwood supply—linked to come-along harvesting
  - All products are complements in the short run

• **Supply of any timber product is not independent of supply of other products**
  - Supply of pulpwood is especially influenced by markets for higher valued products—weak sawtimber markets will limit supply of woody biomass
  - Emerging market will have implications for competing markets
Conclusions

• Long run supply
  – Supply is substantially more elastic in the long run
  – Products are substitutes in the long run
  – Forecasts indicate expansionary trajectory linked to investments in intensive forest management through 2000
Conclusions

• Long run supply
  – Urbanization will decrease area within which product markets can grow but in specific places
    • Key strategic consideration
    • Focused in Piedmont and along coasts
Conclusions

- New demands for woody biomass could provide a “replacement” for reduced demands from the pulp and paper sector.
  - between 1997 and 2006 harvest reduced by 0.9 billion cubic feet or about 10.8 million dry tons of biomass.
  - Pulpwood prices (softwood) were 50 to 75 percent higher in the late 1990s, indicating that capturing this material would involve price increases for the feedstock.
Key uncertainties

- Information is minimal for unknown products
  - Merchandizing algorithms for logging residues
  - Structure of new treatments/management regimes
- Ownership—behavioral foundation
  - Effects of industrial land base divestiture
  - Effects of changes in small landowner demographics
Thanks for listening...