Estimating Biomass Supply in the U.S. South

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Presentation available at:

http://www.cnr.ncsu.edu/sofac/
My focus

- Forest resource modeler focused on regional outlooks for the medium run 5-20 years.
- Usually take current inventory, growth, and removals as a starting point to model supply over time
- Then look at the impact of various demand scenarios
Outline

- Three themes
  - Views of “supply”
    - Quantity on the ground
    - Quantity that could be economically harvested
    - Quantity likely to be harvested based on past behavior - empirical
  - Role of residuals
  - Scale and timing of impacts
“Supply” Questions (1)

☐ How much wood is there to convert to energy?

■ Naïve: all of the wood
  ☐ Simple GIS procurement circles

■ Filtered by some definition of sustainability – “growth”
  ☐ Southern Bioenergy Roadmap
“Supply” Questions
(1 continued)

☐ How much wood is there to convert to energy?

■ Southern Bioenergy Roadmap
☐ Table 4. Summary of energy values of biomass feedstock resources in the South
☐ Gross energy value of “net annual growth” – net of mortality
■ No other wood use
■ All trees grow – only a few are harvested
“Supply” Questions (2)

☐ How much would it cost to provide different quantities of wood?
  ■ Engineering cost curves
  ☐ Or how much wood could be economically harvested at different prices
  ☐ Arrays resources from least to most expensive and tabulates quantities
  ☐ Other studies using this approach: Billion ton study, FASOM, NEMS, POLYSYS
“Supply” Questions (3)

☐ Based on past behavior – how much wood would be harvested at different prices?

☐ Because bioenergy markets don’t exist (yet), we use

- Existing wood markets and behavior, and
- Assumptions about residuals (by-products of current harvest)
“Supply” Questions

- Some things we know about wood markets:
  - Harvesting and transportation cost are more than half of the delivered cost of pulpwood
  - Forest resources are spatially diverse (forest types, management, ownership, age classes, productivity, harvest intensity)
  - Demand and supply are relatively price insensitive (inelastic)
What does price inelastic mean?

(price impacts bigger than harvest impacts – more energy wood comes from displacement of current users due to high prices than from increased harvest)
So how do you project inventory over time?

- Track changes in growth, removals, land use change
- By region, owner, forest type, age, product class (e.g. pulpwood, sawtimber)
- Important because tomorrow’s forest won’t be like today's, and
- Possible, because tomorrow’s forest is already planted (15 years or so)
Southern Tree Planting, All States and Ownerships, 1945-2007

Source: USFS, GFC, TMS
Plantation Acres

Pine Plantation Acres by Age Class

<table>
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<tr>
<th>Age Class</th>
<th>Total</th>
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5 yr age class

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SE Regional Mtg 8/25/2009
Bioenergy Approach

☐ The challenge of projecting emerging bio-energy markets

☐ A few unknowns: which technologies, using which feedstocks, at what scale, where, and when?
NC RPS “Potential” Wood Demand

“Forest Resources” = 55%
Scale of RPS to Current PW Harvest

NC Pulpwood Removals vs. RPS Biomass Wood Requirements

- Baseline PW Tons
- Biomass Tons

Million Gm Tons

NC RPS “Potential” Wood Demand
NC RPS “Potential” Wood Demand

NC Base Pine Pulpwood

NC Base Pine Sawtimber
NC RPS “Potential” Wood Demand

NC RPS Pine Pulpwood

NC RPS Pine Sawtimber
NC RPS “Potential” Wood Demand

RPS Wood Sources
66% max pine 50% max hwd residual utilization

Million Gt Tons


- Biomass Hvst Residuals
- HPW Displacement
- PPW Displacement
- HPW Harvest Chg
- PPW Harvest Chg
- HW Residuals
- Pine Residuals
- Biomass Consumption
Additional High Intensity Plantation Acres Required \( (10 \text{ grn tons/ac/yr}) \)

High Yield \( (10 \text{ grn tons/ac/yr}) \)
BioCrop Requirements to Avoid Competition with Traditional Industry

- Addtional High Yield Acres w/o Residual Util 1.
- Addtional High Yield Acres w/Residual Util 1.
- Current Plantation Acres

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NC Co-firing Consumption

Pine Pulpwood

*biomass demand increase - max 50% residual utilization*

Feedstock Source

*50% max residual utilization*

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Market-Sustainability

- Residuals could be important but expected demand will quickly exceed residual availability
- Inelastic timber supply implies more displacement than increased harvest
- Observation: energy and biofuel firms are looking at roundwood first
- Resulting higher wood prices helps landowners and may make other renewable energy sources look better and reduce “realized” biomass demand
- Timing - recession for traditional forest product industries – boom for bio-energy – plus plantation age gap
Policy Interactions

- Incentives and outcomes will result from interaction of energy, forest, agriculture, environmental, and carbon policy