Economic Comparison of Woody Biomass Harvesting Strategies in United States

Burton C. English
Tel: (865)974-3716
Email: benglish@utk.edu

Lixia He
Tel: (865)974-8726
Email: llamber3@utk.edu

Daniel G. De La Torre Ugarte
Tel: (865) 974-5005
Email: danielu@utk.edu

Dayton M. Lambert
Tel: (865)-974-7472
Email: dlamber1@utk.edu

The Department of Agricultural and Resource Economics
Institute of Agriculture
The University of Tennessee
2621 Morgan Circle, Knoxville, TN 37996-4518

Poster prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012

Economic Comparison of Woody Biomass Harvesting Strategies in United States

Burton C. English, Lixia He, Daniel G. De La Torre Ugarte, Dayton M. Lambert

Department of Agricultural and Resource Economics, University of Tennessee, Knoxville, TN37996

Introduction

Concern over energy security and the greenhouse gases emissions associated with burning fossil fuels has led to increased national interest in bioenergy production. In the United States, adoption of a Renewable Fuel Standard (RFS) requires domestic production of renewable fuels to increase from 14 billion gallons per year (according to the Renewable Fuels Association) to 36 billion gallons per year by 2022.

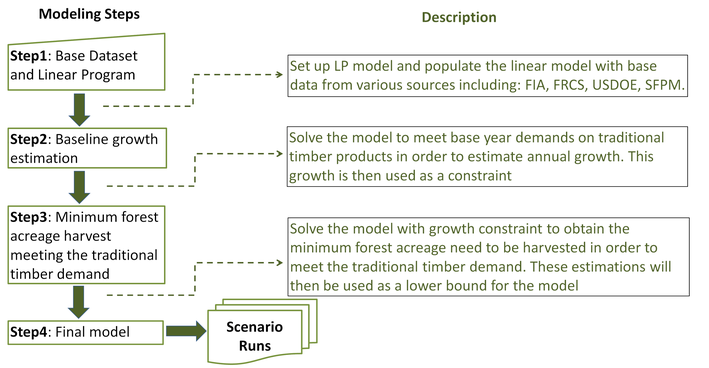
Woody biomass could be a significant component of an RFS portfolio. Woody biomass is collected from logging residue, forest thinning, and small diameter timber. These forest products can be sustainably harvested, and are predictable and reliable in terms of production. Woody biomass has potential to become a primary bioenergy feedstock for heat and co-fire power plants as well as cellulosic-derived biofuels.

The **QUESTION** remains how much and what kind of woody biomass can be sustainability supplied, where is this likely to occur, and at what price will woody biomass products be available?

Woody Biomass Supply Model

A linear mathematical programming model was developed to determine the mix of conventional timber products and woody biomass as energy feedstock, given traditional wood and wood for energy demand targets, standing wood acreage, and timber growth constraints. Total harvest, chipping, and stumpage costs are minimized, subject to production targets, land suitability, woody biomass and conventional timber growth, timber activity types, stand-size types, topography, and timber product types across 305 regions. Federal lands are assumed not available for biomass supply and traditional needs for wood are assumed to be met before biomass demands can be achieved.

Figure 1: Illustration of modeling steps and description



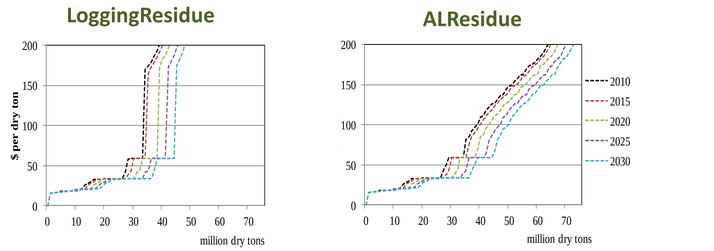
Defining Harvest Strategy Scenarios

- tops and branches of all merchantable timber
- H — boles of hardwood pulpwood
- NS — boles of natural softwood pulpwood
- PS — boles of planted softwood pulpwood
- Non-merchantable timber

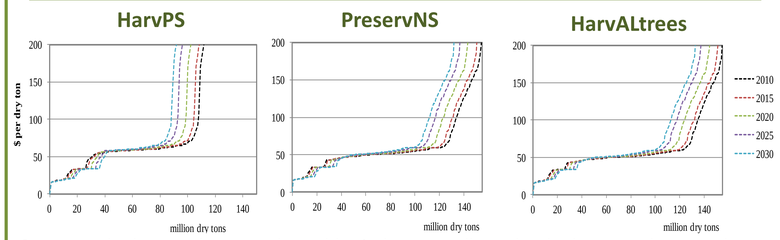
Scenarios	Sources of Harvested Timber Products as Woody Biomass
LoggingResidue	tops and branches of all merchantable timber
ALResidue	tops and branches of all merchantable timber; non-merchantable timber
HarvPS	tops and branches of all merchantable timber; PS; non-merchantable timber
PreserveNS	tops and branches of all merchantable timber; H; PS; non-merchantable timber
HarvALtrees	tops and branches of all merchantable timber; H; NS; PS; non-merchantable timber

Results

Figure 2: Supply curves of harvesting scenarios

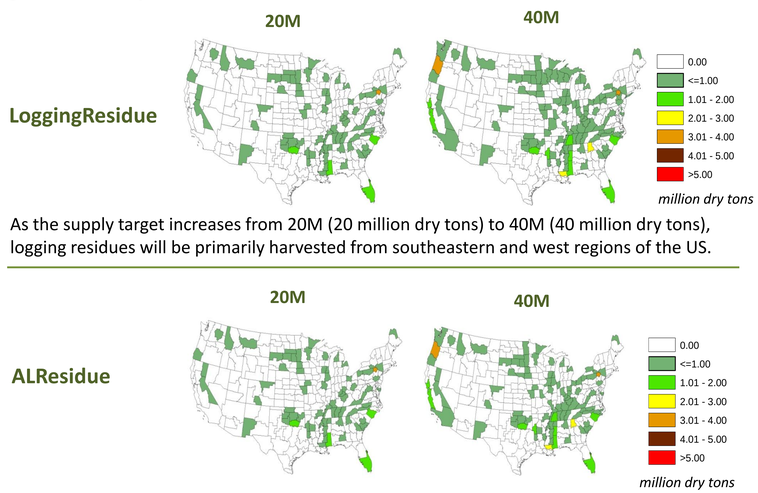


As more traditional wood products are demanded from private industrial and nonindustrial timberlands, woody biomass from logging residue or non-merchantable timbers will be more expensive because of their lower yields and relatively limited availability.



Costs may be lower when merchantable timbers are allowed to be harvested as woody biomass.

Figure 3: Woody biomass distribution in 2020.



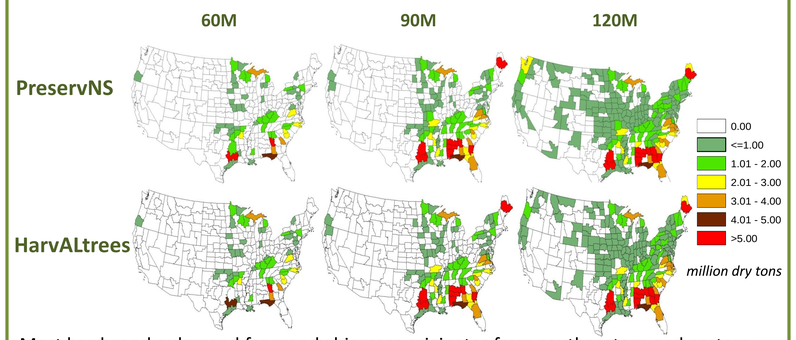
As the supply target increases from 20M (20 million dry tons) to 40M (40 million dry tons), logging residues will be primarily harvested from southeastern and west regions of the US.

When the supply target is 20M (20 million dry tons), the outcome of **ALResidue** is not much different from the **LoggingResidue** scenario because collecting logging residue will meet this goal and no additional non-merchantable timber is harvested. The distribution is more condensed when the supply target is increased.

Correspondence: Dr. Burton C. English Email: benglish@utk.edu Phone: 865-974-3716

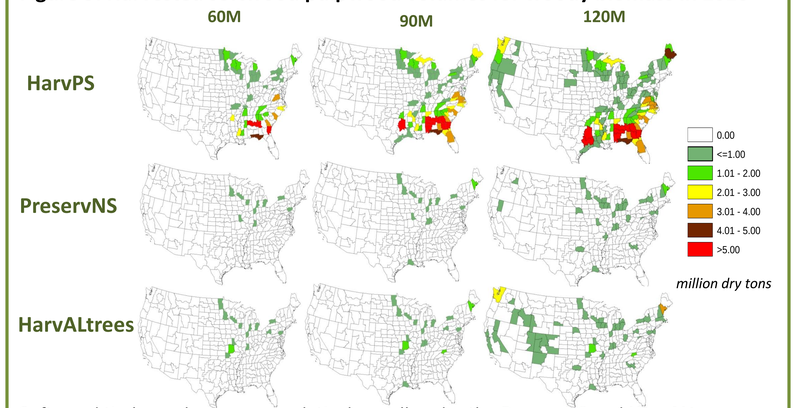
Results

Figure 4: Harvested hardwood pulpwood volumes for woody biomass in 2020



Most hardwood pulpwood for woody biomass originates from southeastern and eastern regions. Western regions may start supplying biomass as well when supply targets are high (120M: 120 million dry tons) .

Figure 5: Harvested softwood pulpwood volumes for woody biomass in 2020



Softwood timber volumes were relatively small under the **PreservNS** and **HarvALtree** compared with the **HarvPS** scenario. More merchantable softwood timber was harvested under the **HarvALtree** compared with the **PreservNS** scenario because costs were lower.

Conclusions

- Forest biomass for energy production is projected to be available over a much wider price range with different timber sources;
- Preserving natural pine or only harvesting planted softwood timber for woody biomass has a relatively small impact on the marginal costs of supply;
- Demand for hardwood and planted softwood biomass from merchantable timber is expected to increase with higher energy production targets;
- Restrictions on the type and size of timber that can be used for biomass will increase the price of biomass.

Acknowledgements

This project was partially funded by the US Forest Service, US. Dept. of Energy, and the Southeastern Sun Grant Center. We thank the National Forest Inventory and Analysis Program and the North Central Forest Lab (Drs. K. Skog, A. Kramp, P.J. Ince, B. Stokes, and D. Dykstra) for assisting with the development of the primary data.