



# Supply of Forest Biomass for Energy: Determinants and Estimation

## FACT SHEET 6.1

### INTRODUCTION

The South is endowed with a rich forestland base and favorable physiographical conditions for growing biomass. While the total availability of forest biomass is promising, the actual supply of forest biomass for bioenergy will be affected by an array of factors including economic, environmental, and social considerations. This fact sheet describes these factors and a value-chain approach to estimating biomass supply.

### FACTORS INFLUENCING THE SUPPLY OF FOREST BIOMASS FOR ENERGY

Many factors can affect forest biomass supply. They include production costs, biomass market development, prices of other fuel sources, competing uses of forest resources, policies, environmental considerations, and social acceptance, among others.

**COSTS** — Technologies for forest production, biomass harvesting and transportation, and energy conversion will dictate the production costs of forest biomass and bioenergy. Research and development will be the key to bringing the cost down. The costs will also vary with scale of operation, biomass spatial density, terrain conditions, tree size, and transport distance, among other things. The most cost-

effective production of biomass for energy occurs when it is produced simultaneously with other higher valued products (sawlogs, pulping chips) or in coordination with stand improvement and restoration/rehabilitation.

**BIOMASS MARKET DEVELOPMENT** — To encourage landowners to produce biomass for energy, local markets must have buyers of forest biomass. Though there are some local buyers in limited locations in the South, large buyers have not emerged region-wide. Potential buyers include independent developers, utility companies, biorefineries, larger-scale users of biomass for space heating and chilling, and the producers of future bio-based products.

**ENERGY PRICES** — The prices of other types of energy such as fossil fuels will have an influence on the demand and supply of forest biomass. Increases in the prices of oil, natural gas, or coal will favor bioenergy. Forest bioenergy will also face competition with other renewable energy sources such as agricultural crops and crop residues, solar, wind, and hydro energy, among others.

**WOOD PRODUCTS MARKETS** — Competing uses of forest resources for pulpwood, timber, and ecological services will also affect the supply of forest biomass for energy. Recent adjustments in the forest products industry, particularly in the pulp and paper sector, may present an opportunity for using small-



diameter trees for bioenergy. Yet, currently it is still more profitable to use pulpwood for paper-making than for energy production.

**POLICIES** — Policies pertaining to energy, forest management and utilization, environmental protection, and land use, as well as assistance and incentive programs to forest landowners and bioenergy producers and consumers will affect the supply of forest biomass.

**ENVIRONMENTAL CONSIDERATIONS** — Forest biomass/bioenergy production could have both positive and negative impacts on the environment, which in turn will influence forest biomass supply. On one hand, forest bioenergy can displace CO<sub>2</sub> emissions from burning fossil fuels, and thinning unhealthy or damaged stands can enhance the health and productivity of the forest ecosystems. On the other hand, there is some concern about the potential loss of soil productivity resulting from excessive removals of biomass<sup>1</sup> and possible negative effects on wildlife habitats and biodiversity.

**SOCIAL ACCEPTANCE** — Social acceptance could become an important factor for forest

biomass/bioenergy production. Many questions raised by the public are related to possibly harmful environmental consequences of forest biomass production.

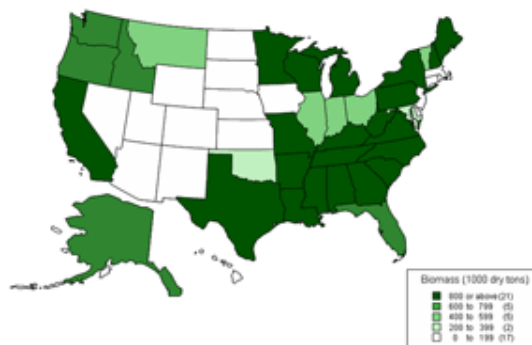
### VALUE-CHAIN APPROACH TO ESTIMATING BIOMASS SUPPLY

Forest bioenergy production involves a series of value-generating activities including growing, harvesting, transporting, processing, and storing biomass and converting biomass to secondary energy products. To achieve the overall efficiency or cost-effectiveness, determine the supply of forest biomass for energy based on the optimization of the entire forest bioenergy value chain, not feedstock production or energy conversion alone.

Gan and Smith<sup>2</sup> and Gan<sup>3</sup> describe and apply such an approach to estimate biomass supply from logging residues in the U.S. According to their estimate, the U.S. South is a logging-residue rich region, accounting for about 50 percent of the total national supply (*Figure 1 and Table 1*). Also, the estimated supply

source: Jianbang Gan, Texas Agricultural Experiment Station

*Recoverable Logging Residues from Growing Stock and Other Sources in 1997*



*Figure 1. About half of the available logging residues are located in the U. S. South.*

STATE	AMOUNT
Florida	.67
Georgia	2.19
North Carolina	1.71
South Carolina	1.11
Virginia	1.18
Alabama	2.82
Arkansas	1.71
Kentucky	.89
Louisiana	1.50
Mississippi	2.48
Oklahoma	.24
Tennessee	1.20
Texas	1.54
<i>Southern Total</i>	<i>19.24</i>

source: Data Source: Jianbang Gan, Texas Agricultural Experiment Station

*Table 1. Annual Recoverable Logging Residues in the South by State (million dry tons)*





source: Jianbang Gan, Texas Agricultural Experiment Station

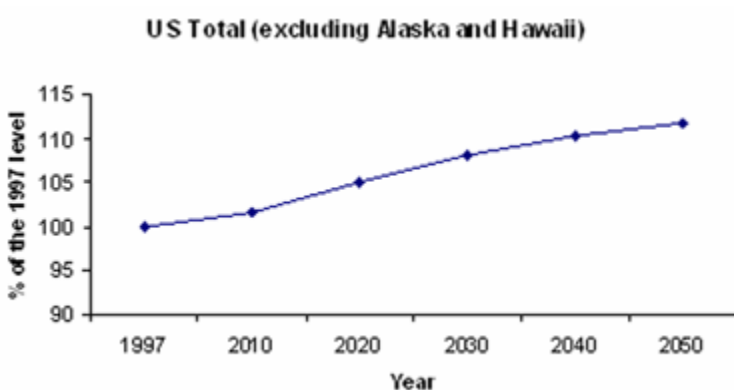


Figure 2. Long-run Supply of Logging Residues in the U.S. South

of logging residues in the South would be relatively stable over the next 40–50 years (Figure 2), a favorable condition for their commercial use for energy production.

## CONCLUSIONS

Forest biomass is a promising renewable energy source. While the South has a large potential supply of this renewable energy source, it is not all readily available for use. A variety of economic, environmental, social, technical, and policy factors will interact to affect the actual supply of forest biomass. Consider these factors altogether when estimating biomass supply. Moreover, given the interplays between feedstock production and energy conversion, ideally biomass supply should be determined by simultaneous optimization of the entire value chain. Finally, a sustainable business model of bioenergy requires a sustainable supply of feedstock. So the long-run supply of biomass is extremely important to the development and sustainability of the bioenergy industry.

For more information, refer to the

Encyclopedia of Southern Bioenergy (<http://www.forestencyclopedia.com/Encyclopedia/bioenergy>) or Forest Bioenergy (<http://www.southernbioenergy.net/>).

## ENDNOTES

- Schaberg, R.H.; Aruna, P.B.; Cabbage, F.W.; Hess, G.R.; Abt, R.C.; Richter, D.D.; Warren, S.T.; Gregory, J.D.; Snider, A.G.; Sherling, S.; and Flournoy, W. 2005. Economic and ecological impacts of woodchip production in North Carolina: An integrated assessment and subsequent applications. *Forest Policy and Economics*. 7: 157–174.
- Gan, J. and C.T. Smith. 2006. Availability of logging residues and potential for electricity production and carbon displacement in the USA. *Biomass and Bioenergy* 30(12): 1011–1020.
- Gan, J. 2007. Supply of biomass, bioenergy, and carbon mitigation: method and application. *Energy Policy* (forthcoming)

