GEORGIA FORESTRY COMMISSION

Forestry Biomass Assessment for Georgia *General Statewide Estimates*

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This assessment is an update of a similar assessment of forestry biomass made during March of 2008. This assessment uses updated data sources and attempts to provide more detailed analysis of the data than the earlier assessment. The assumptions used have also been updated to reflect the current knowledge of data sources and recovery capabilities of forest practices.

Non-merchantable biomass

Non-merchantable biomass in standing timber is defined by the author as all biomass above stump height in standing timber less merchantable biomass in standing timber. *Potentially available* non-merchantable biomass is defined as the non-merchantable biomass less the amount of non-merchantable biomass that typically is harvested for merchantable products as a result of improved manufacturing and harvesting methods. Georgia Timber Harvest and Utilization studies (Bentley, 2004) have determined that non-merchantable biomass estimates must be reduced to the percentages shown in Table 1 to remove stump volumes and as a result of improved harvesting and utilization.

Table 1: Amount of Non-Merchantable Wood Volume (Non-growing Stock) Remaining in Forests after Harvest in Georgia (Bentley, 2004)

Species Group	Poletimber	Sawtimber
Softwood	33.3%	65.2%
Hardwood	55.6%	70.3%

Non-merchantable forest biomass can be recovered during traditional timber harvesting (thinning and final harvests) and during additional treatments that forest energy markets make economically feasible, such as pre-commercial thinning or stand improvement activities.

Using the above definition applied to the Forest Inventory and Analysis database 2007 timber inventory data yields the following estimates for potentially available non-merchantable forest biomass from forest stands that are old enough to make practical a traditional commercial thinning or final harvest.

Sourced from planted stands of dominant pine type > 15 yrs old = 24.7 million dry tons
Sourced from all other timberland areas > 20 years old = 138.6 million dry tons
Total from all timberland areas of merchantable age = **163.3 million dry tons**

Planted pine stands of dominant pine type older than 15 years and other naturally-regenerated stands older than 20 years are subject to traditional thinning and other forest

practices. An average of 2.0% of Georgia's timberland receives a thinning or partial harvest and 1.4% receives a final harvest treatment each year. An estimation of available non-merchantable biomass on merchantable-aged forest stands in Georgia can be performed by assuming the biomass is distributed evenly across Georgia's forests, that 100% of the biomass can be recovered in final harvest areas, and that 50% can be recovered in partial harvest areas. This can be calculated as follows:

163.3 x 2% x 50% =	1.63 million oven dry tons
163.3 x 1.4% =	2.29 million oven dry tons
Total annual estimate from commercial harvests	3.92 million oven dry tons

Pine and mixed pine/hardwood stands are often overly- dense resulting in slow tree growth and increased risk of insect and disease damage to trees. The health of these stands could benefit from early thinning that would remove material currently considered non-merchantable. This practice is termed pre-commercial thinning. The total estimated "non-merchantable" biomass on naturally regenerated pine forest stands and mixed pine/hardwood forest stands is 46,388,654. An average annual estimated yield of non-merchantable biomass from pre-commercial thinnings on naturally regenerated stands, excluding hardwood timber types, would be **463,887** odt if only 1% of the non-merchantable biomass in all these stands younger than 20 years is recoverable. This would be similar to 40% of the natural pine and pine/hardwood stands receiving one pre-commercial thinning during the 10-15 age time period.

Pre-commercial thinning of planted pine stands could also provide additional biomass, especially by modifying current silvicultural systems and stocking rates. Planted stands are also often overly dense because of natural regeneration occurring in addition to tree planting. However, it is currently difficult to assess the ability of planted stands to provide additional biomass than what is produced during the normal planned commercial thinning and final harvest. It is important to note that the biomass estimates made above do not include 3.1 million acres of planted pine timberland that is less than 15 years old.

The above estimates include only the non-merchantable portions of growing stock trees and only the non-merchantable portions of rough and rotten trees (classifications by US Forest Service FIA program). It follows that the portions of stumps in trees >5" in diameter were not included in the above estimates. It should be considered that assessments made prior to 2009 may have included all biomass in rough and rotten trees as available non-merchantable biomass.

Logging residues and related biomass removals

The Timber Product Output data published by the US Forest Service Southern Research Station provides estimates of timber removals for products, logging residue production and other removals of timber from timberland. The amounts estimated for all of Georgia as an annual average for the period 1995 through 2005 is in Table 2 below. Table 3 shows the estimated amounts for logging residues and other removals, excluding timber products and excluding any biomass amounts in stumps. Conversion from cubic feet to oven-dry tons was accomplished using 32.5 lbs per cubic foot of biomass. The stump estimates were derived using the Georgia Harvest and Utilization Study, 2004.

The non-growing stock estimates shown in Tables 2 and 3 would be included in the non-merchantable biomass from timberland estimates above. However, the "growing stock" estimates might provide an estimate of another source of forest biomass. Growing stock listed under Logging Residues in the table below includes merchantable-sized timber that is severed from the stump and not utilized. The growing stock listed in the "Other removals" section is likely the same, but may include small amounts of timber that remains growing on the land in another land use, such as trees remaining in pasturelands or in newly developed urban areas.

Table 2: Annual Wood Volume Removals from Timberland from Georgia TPO Database, Average 1995-2005 (Conversion to Oven Dry Tons from cubic feet using 32.5 lbs wood/cu feet wood)

Item	*All*	*growing stock*	*non-growing stock*
Roundwood products	**odt**	**odt**	**odt**
Softwood	**16,113,500**	**15,328,625**	**784,875**
Hardwood	**4,899,375**	**4,125,875**	**773,500**
Total	**21,012,875**	**19,456,125**	**1,558,375**
Logging residues			
Softwood	**2,312,375**	**1,009,125**	**1,303,250**
Hardwood	**1,865,500**	**931,125**	**936,000**
Total	**4,177,875**	**1,940,250**	**2,239,250**
Other removals			
Softwood	**1,316,250**	**897,000**	**419,250**
Hardwood	**1,334,125**	**939,250**	**394,875**
Total	**2,650,375**	**1,834,625**	**814,125**
Total removals			
Softwoods	**19,742,125**	**17,234,750**	**2,507,375**
Hardwoods	**8,100,625**	**5,996,250**	**2,104,375**
Total	**27,841,125**	**23,231,000**	**4,611,750**

Table 3: Annual Logging Residues and Other Removals, Excluding Merchantable Products and Excluding Stumps from Georgia TPO Database, Average 1995-2005

Item	*All*	*growing stock*	*non-growing stock*
Logging residues			
Softwood	**2,032,828**	**1,009,125**	**1,023,703**
Hardwood	**1,634,342**	**931,125**	**703,217**
Total	**3,667,170**	**1,940,250**	**1,726,920**
Other removals			
Softwood	**1,249,589**	**897,000**	**352,589**
Hardwood	**1,246,858**	**939,250**	**307,608**
Total	**2,494,822**	**1,834,625**	**660,197**

Assuming that the same level of growing stock will continue to be un-utilized would provide an annual estimate of **1,940,250** odt of logging residues. A conservative estimate of biomass from trees which are severed from the stump in "other removals" would be 75%. This would yield **1,375,969** odt (**1,834,625** * .75) of growing stock currently removed from timberland and not utilized.

Forest Product Manufacturing Residues

The average estimated amount of wood residues produced annually from forest manufacturing facilities during 1995-2005 was 7,305,000 odt . Only 86,000 odt were not used as a by-product. The average annual amount of these residues used by the pulp and paper industry in the form of chips for fiber production was 2,365,000 odt.

Additional Growth of Timber on Timberland

Between 1997 and 2008, the average annual net growth of merchantable-sized trees on timberland in Georgia has been **9,556,522** odt of wood and bark in merchantable stems. This is over and above the removals of timber. This estimate is obtained from cubic feet volume estimates using 35 lbs of wood and bark per cubic feet of wood.

Urban Wood Waste

General Bioenergy, Inc. produced a report for the Georgia Forestry Commission in 2005 regarding forest biomass amounts, which included estimates of recoverable urban wood

wastes. The report estimated a total of **1,436,823** odt of urban wood waste was available in 1999 at the cost of $30 per dry ton delivered. This estimate was based on 1999 data and is likely conservative for the 2008 time period. Some of this material may be included in the amounts estimated above for "Other removals". However, the author recommends using the entire urban waste wood estimate because of the lack of updated (and likely increased) estimated amounts. The Georgia Environmental Protection Division has started an assessment of biomass amounts going to Georgia landfills. The project is expected to be complete in mid-2009. Results from this project should be used for urban wood waste, when available.

Pulp and Paper Manufacturing Use of Pulpwood

During the period from 1995 through 2005, the pulp and paper industry in Georgia used an average of **8,669,730** odt per year of fiber from standing roundwood. This is calculated using a 32.5 lbs per cubic foot conversion rate. The same industry also used an average of **2,365,000** odt per year of residue chips.

Summary

The table below provides a summary of general estimates of biomass availability for bioenergy use in Georgia. If no biomass is used from sources that are currently supplying other industries, then the total is approximately 18.7 million odt. This total could be increased by modifying silvicultural practices. This total would also adjust with any future changes in markets for traditional wood products.

Table 4: Summary of General Estimates of Annual Forestry Biomass Amounts for Bioenergy Use in Georgia

Resource		Amount (odt)	Recovery	Amount to Recover (odt)	Additive Amount
"Non-merchantable" biomass inventory in forests	Recovery during regeneration harvests	163,300,000	1.4%	2,286,200	2,286,200
"Non-merchantable" biomass inventory in forests	Recovery during thinnings	163,300,000	1.0%	1,633,000	3,919,200
Biomass from "pre-commercial" thinning of natural forest stands of pine and pine/hardwood		46,388,654	1.0%	463,887	4,383,087
Logging residues produced annually in forest management operations (excluding stumps)	Total	3,667,170		0	4,383,087
	From growing stock	1,940,250	100%	1,940,250	6,323,337
	From non-growing stock (included in non-merchantable	1,726,920	0%	0	6,323,337

	biomass)				
Other annual timber removals resulting from land-use change	Estimate 75% recovery	1,834,625	75%	1,375,969	7,699,305
Mill residues produced annually		7,305,000	0%	0	7,699,305
Recoverable urban wood waste annually		1,436,823	100%	1,436,823	9,136,128
Additional annual timber growth	1998-2008 average	9,556,522	100%	9,556,522	18,692,650

References:

Forest Inventory and Analysis Data as listed on the Mapmaker database. Southern Research Station, US Forest Service. 2007. http://www.ncrs2.fs.fed.us/4801/fiadb/fim30/wcfim30.asp

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Note: The following conversion rates were used, if data did not provide appropriate conversion to weight units: 5600 lbs per cord for hardwood, 5400 lbs per cord for softwood, 32.5 lbs of wood per cubic foot of wood (dry weight), 35 lbs of wood and bark per cubic feet of wood, green biomass was assumed to have 50% moisture content (green weight basis).