Estimating Canopy Fuel Parameters
for Atlantic Coastal Plain Forest Types

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Introduction

It is necessary to quantify forest canopy characteristics to assess crown fire hazard, prioritize treatment areas, and design treatments to reduce crown fire potential. A number of fire behavior models such as FARSITE, FIRETEC, and NEXUS require as input four particular canopy fuel parameters: 1) canopy cover, 2) stand height, 3) crown base height, and 4) canopy bulk density. These canopy characteristics must be mapped across the landscape at high spatial resolution to accurately simulate crown fire. Currently no models exist to forecast these four canopy parameters for forests of the Atlantic Coastal Plain, a region that supports millions of acres of loblolly, longleaf, and slash pine forests as well as pine-broadleaf forests and mixed species broadleaf forests. Many forest cover types are recognized, too many to efficiently model. For expediency, forests of the Savannah River Site are categorized as belonging to 1 of 7 broad forest type groups, based on composition: 1) loblolly pine, 2) longleaf pine, 3) slash pine, 4) pine-hardwood, 5) hardwood-pine, 6) hardwoods, and 7) cypress-tupelo. These 7 broad forest types typify forests of the Atlantic Coastal Plain region, from Maryland to Florida.

Data to calculate the canopy characteristics and develop the models comes from an inventory of 622 plots, started in March 1999 and completed in January 2002. For each tree on a plot the following were recorded: diameter breast height in inches, total height in feet, height to base of live crown in feet, crown class, and species. From this data canopy cover (*CC*) expressed as a proportion, stand height (*SH*) in feet, crown base height (*CBH*) in feet, and canopy bulk density (*CBD*) in lb/ft^3 were computed for each plot. Table 1 gives standard statistical measures on the canopy characteristics. The following information was recorded for each plot: stand age in years (*A*), basal area in square feet per acre (*BA*), site index in feet for base age 50 (*SI*), number of burns for the plot (*NB*), and years since last burn (*YRS*). Table 2 gives standard statistical measures on the plot variables. The Appendix lists the basic data used to develop the canopy models.

Canopy Cover

The canopy variable known as canopy cover (*CC*) is the downward projection onto the ground of the horizontal tree canopies on a plot. To determine the horizontal area of the tree crowns I used a set of crown-diameter prediction models for the Eastern U.S. (Bechtold 2003). Because crowns can overlap, to avoid overestimating *CC* I used only the dominant and codominant trees. In reading the literature, the preferred way to measure *CC* is to use an instrument like a densitometer (Jennings et al. 1999). Barring such data, some authors suggest using crown area of the dominant and codominants, arguing that crowns of intermediate and suppressed trees are almost always overlapped (McElhinny et al. 2005). Other authors suggest using the crown area of all trees and applying an adjustment factor that accounts for overlap (Crookston and Stage 1999). I opted for using the crown area of the dominant and codominant trees to create values of *CC* for each plot.

The next step was to model the plot values of *CC* against the stand level variables of age (*A*), basal area (*BA*), site index (*SI*), number of burns (*NB*), and years since last burn (*YRS*). Because *CC* ranges from 0 to 1 (or 0% to 100%) it seemed appropriate to use the logistic function because it has asymptotes at 0 and 1. The form of the general logistic function is:

Table 1. Basic statistics describing the canopy characteristics for the 7 broad forest types.

Forest Type	N	Characteristic	Median	Mean	STD	Min	Max
Loblolly	277	CC	0.792	0.749	0.215	0.058	0.999
		CBH (ft)	31.5	31.7	16.7	1.0	78.0
		SH (ft)	69.6	66.1	24.3	9.3	120.7
		CBD (lb/ft^3)	0.00350	0.00369	0.00173	0.00018	0.00878
Longleaf	129	CC	0.628	0.614	0.218	0.061	0.992
		CBH (ft)	30.0	27.7	16.4	0.0	55.0
		SH (ft)	68.6	58.9	24.7	9.0	93.0
		CBD (lb/ft^3)	0.00243	0.00284	0.00168	0.00001	0.00769
Slash	58	CC	0.580	0.592	0.184	0.192	0.981
		CBH (ft)	41.3	37.6	15.2	3.0	61.5
		SH (ft)	82.4	80.8	12.1	10.9	97.3
		CBD (lb/ft^3)	0.00376	0.00391	0.00168	0.00074	0.00767
Pine-Hardwood	23	CC	0.596	0.605	0.187	0.054	0.938
		CBH (ft)	26.0	24.2	14.7	3.0	46.5
		SH (ft)	72.6	66.5	26.9	18.5	112.5
		CBD (lb/ft^3)	0.00235	0.00295	0.00179	0.00033	0.00657
Hardwood-Pine	27	CC	0.721	0.707	0.205	0.303	0.992
		CBH (ft)	31.0	31.2	10.6	16.0	52.5
		SH (ft)	84.0	83.4	12.6	56.6	111.8
		CBD (lb/ft^3)	0.00335	0.00416	0.00388	0.00108	0.02152
Hardwoods	103	CC	0.726	0.718	0.208	0.207	0.995
		CBH (ft)	27.0	27.2	12.4	3.0	54.0
		SH (ft)	79.6	76.6	20.5	28.3	115.6
		CBD (lb/ft^3)	0.00279	0.00340	0.00210	0.00022	0.01403
Cypress-Tupelo	5	CC	0.879	0.819	0.171	0.540	0.970
		CBH (ft)	51.0	53.0	4.8	49.0	60.0
		SH (ft)	100.3	98.2	6.7	90.5	105.7
		CBD (lb/ft^3)	0.00479	0.00476	0.00021	0.00440	0.00495

Note: STD is standard deviation, min is minimum value, max is maximum value. For the canopy characteristics, CC is canopy cover, CBH is crown base height, SH is stand height, and CBD is canopy bulk density.

Table 2. Basic statistics describing the stands of the Savannah River Site by forest type.

Forest Type	N	Variable	Median	Mean	STD	Min	Max
Loblolly	277	*Age*	33.00	33.18	18.30	2.00	100.00
		SI	80.00	84.13	9.67	60.00	110.00
		BA	106.54	107.63	39.41	0.98	218.46
		NB	1.00	1.51	1.16	0.00	5.00
		YRS	7.00	13.21	12.14	0.50	33.00
Longleaf	129	*Age*	41.00	38.12	19.54	1.00	88.00
		SI	80.00	75.89	10.28	50.00	100.00
		BA	67.50	71.96	39.30	0.88	212.04
		NB	2.00	1.98	1.09	0.00	5.00
		YRS	4.00	8.02	9.17	0.50	33.00
Slash	58	*Age*	44.00	43.93	7.04	4.00	62.00
		SI	80.00	83.79	6.71	60.00	90.00
		BA	100.67	104.81	34.71	7.39	178.75
		NB	2.00	1.64	0.95	0.00	4.00
		YRS	6.50	10.10	9.59	0.50	33.00
Pine-Hardwood	23	*Age*	48.00	47.35	21.14	3.00	80.00
		SI	80.00	77.61	14.76	40.00	110.00
		BA	76.91	81.35	44.53	13.16	157.20
		NB	1.00	1.48	1.24	0.00	4.00
		YRS	7.00	13.04	13.14	0.50	33.00
Hardwood-Pine	27	*Age*	56.00	54.37	13.66	21.00	88.00
		SI	90.00	85.93	9.71	60.00	100.00
		BA	112.65	116.14	31.97	38.05	180.00
		NB	1.00	1.04	1.19	0.00	4.00
		YRS	14.00	18.50	13.73	0.50	33.00
Hardwoods	103	Age	56.00	54.16	16.78	0.00	95.00
		SI	80.00	80.44	14.45	50.00	110.00
		BA	104.29	112.08	45.35	8.96	238.66
		NB	1.00	0.96	0.99	0.00	3.00
		YRS	19.00	18.65	13.14	0.50	33.00
Cypress-Tupelo	5	Age	80.00	108.40	52.58	75.00	199.00
		SI	90.00	86.00	18.17	60.00	110.00
		BA	313.75	299.75	40.22	234.61	337.50

Note: STD is standard deviation, min and max are minimum and maximum, *Age* is in years, *SI* is site index (ft) at 50 years, *BA* is basal area (ft^2), *NB* is number burns, and *YRS* is years since burn.

$$\widehat{CC} = \left[1 + e^{\mathbf{bX}}\right]^{-1}$$

where the linear combinations for the independent variables can be given as

$$\mathbf{bX} = b_0 + b_1 A + b_2 BA + b_3 SI + b_4 NB + b_5 YRS$$

In a few instances having exponents on the independent variables improved the fit, e.g., A^{c_1} and BA^{c_2}. In no cases were there any significant interactions. Below are the equations for each of the 7 forest type groups. Non-significant coefficients/variables have been dropped.

Loblolly:

$$\widehat{CC} = \left[1 + \exp(4.41413 A^{0.18857} - 3.49500 BA^{0.21977})\right]^{-1}$$
$$N = 274; R^2 = 0.714; RMSE = 0.1131$$

(1)

Longleaf:

$$\widehat{CC} = \left[1 + \exp(4.09530 A^{0.17942} - 5.22865 BA^{0.13916} + 0.014636 SI)\right]^{-1}$$
$$N = 127; R^2 = 0.506; RMSE = 0.1517$$

(2)

Slash:

$$\widehat{CC} = \left[1 + \exp(1.65566 - 0.019317 BA)\right]^{-1}$$
$$N = 57; R^2 = 0.708; RMSE = 0.0972$$

(3)

Pine-Hardwood:

$$\widehat{CC} = -0.2 + \left[1 + \exp(2.61273 - 4.358 \times 10^{-6} BA^{2.71196} - 0.025872 SI - 1.09297 NB)\right]^{-1}$$
$$N = 23; R^2 = 0.631; RMSE = 0.1257$$

(4)

Hardwood-Pine:

$$\widehat{CC} = \left[1 + \exp(2.49703 + 0.026827 A - 0.020864 BA - 0.028661 SI)\right]^{-1}$$
$$N = 26; R^2 = 0.615; RMSE = 0.1334$$

(5)

Hardwoods:

$$\widehat{CC} = \left[1 + \exp(0.30213 + 0.016226 A - 0.020942 BA)\right]^{-1}$$
$$N = 97; R^2 = 0.470; RMSE = 0.1439$$

(6)

Cypress-Tupelo:

$$\widehat{CC} = \left[1 + \exp(3.8558 - 0.0668 SI)\right]^{-1}$$
$$N = 5; R^2 = 0.922; RMSE = 0.0550$$

(7)

Crown Base Height and Stand Height

The variable known as crown base height (*CBH*) is generally defined as the average height to the bottom of the tree crowns in the stand (Keane et al. 2000). According to Scott and Reinhardt (2001), *CBH* is not well defined for a stand. They state that neither the lowest crown base height in a stand nor the average crown base height is likely to be representative of the stand as a whole, especially for multistory stands. Still, many researchers (e.g. Fulé et al. 2004) use height to base of live crown (*HBLC*) per tree and take the average to determine *CBH*. Notwithstanding, I decided to use the median value of *HBLC* to characterize *CBH* for a plot. The median value is a more stable parameter than the mean as it is unaffected by extreme values. In looking closely at the data for the Savannah River Site, I observed that for some plots the mean was smaller then the median, and in other plots the reverse was true. What was most illuminating is that in trying to regress *CBH* against the stand level values of *A*, *BA*, *SI*, *NB*, and *YRS*, the coefficients of determination (R^2) were almost doubled when using the median *HBLC* values for *CBH* as opposed to using the mean *HBLC* values for *CBH*.

There is consensus for the variable known as stand height (*SH*), being the average height of the dominant tree layer (Keane et al. 2000). Basically, I took a weighted average of the heights of the dominant and codominant trees on a plot.

The next step was to model the plot values of *CBH* and *SH* against the stand level variables of age (*A*), basal area (*BA*), site index (*SI*), number of burns (*NB*), and years since last burn (*YRS*). It is important to note that for stands that have not been burned, insert the value 33 for YRS. In general the data is nonlinear. It seemed expedient to use a standard growth function that is widely accepted in forestry, namely the Bertalanffy-Richards function (sometimes known as the Chapman-Richards function). This function has an upper asymptote that constrains the predictions so unreasonably high values will not occur, no matter the combination of input variables. Zero is a lower asymptote (no worries about negative values). The form of the Bertalanffy-Richards function is:

$$\hat{Y} = a\left(1 - e^{\mathbf{bX}}\right)^{P}$$

where $\hat{Y}$ is *CBH* or *SH*, *a* is the upper asymptote, *P* is a power exponent, and the linear combinations for the independent variables can be given as

$$\mathbf{bX} = b_1 A + b_2 BA + b_3 SI + b_4 NB + b_5 YRS$$

Below are the equations for *CBH* for each of the 7 forest type groups. Non-significant coefficients/variables have been dropped. Burn history had a small but noticeable effect on 4 of the forest type groups, all the pines and the hardwood-pine group.

Loblolly:

$$\widehat{CBH} = 55.659\left(1 - \exp(-0.038000A - 0.0045089BA - 0.021561SI + 0.0096688YRS)\right)^{14.876}$$

$$N = 276; R^2 = 0.647; RMSE = 10.0247$$

(8)

Longleaf:

$$\widehat{CBH} = 49.516\left(1 - \exp(-0.043809A - 0.0070967BA - 0.056397SI + 0.018079YRS)\right)^{281.66}$$

$$N = 127; R^2 = 0.718; RMSE = 8.9100$$

(9)

Slash:

$$\widehat{CBH} = 48.702\left(1 - \exp(-0.14817A - 0.030608BA + 0.065986YRS)\right)^{1523.2}$$

$$N = 55; R^2 = 0.464; RMSE = 10.8647$$

(10)

Pine-Hardwood:

$$\widehat{CBH} = 49.289\left(1 - \exp(-0.035551A - 0.039489SI)\right)^{73.938}$$

$$N = 23; R^2 = 0.823; RMSE = 6.6434$$

(11)

Hardwood-Pine:

$$\widehat{CBH} = 50.000\left(1 - \exp(-0.00072979A - 0.044384SI + 0.017028YRS)\right)^{23.503}$$

$$N = 26; R^2 = 0.474; RMSE = 7.6557$$

(12)

Hardwoods:

$$\widehat{CBH} = 50.000\left(1 - \exp(-0.018566A - 0.0036229BA - 0.026947SI)\right)^{20.574}$$

$$N = 101; R^2 = 0.629; RMSE = 7.6990$$

(13)

Cypress-Tupelo:

$$\widehat{CBH} = 60.536\left(1 - \exp(-0.028109A - 0.0084594SI)\right)^{3.7372}$$

$$N = 5; R^2 = 0.998; RMSE = 0.4728$$

(14)

Below are the equations for *SH* for each of the 7 forest type groups. Non-significant coefficients/variables have been dropped. Burn history had no effect on stand height.

Loblolly:
$$\widehat{SH} = 109.47\left(1 - \exp(-0.036511A - 0.0027096BA - 0.015610SI)\right)^{7.0469}$$
$$N = 275;\ R^2 = 0.904;\ RMSE = 7.5798$$
(15)

Longleaf:
$$\widehat{SH} = 87.139\left(1 - \exp(-0.048577A - 0.0081846BA - 0.037393SI)\right)^{56.834}$$
$$N = 127;\ R^2 = 0.872;\ RMSE = 8.9683$$
(16)

Slash:
$$\widehat{SH} = 90.313\left(1 - \exp(-0.058330A - 0.0060502BA - 0.085693SI)\right)^{2433.9}$$
$$N = 57;\ R^2 = 0.899;\ RMSE = 3.9725$$
(17)

Pine-Hardwood:
$$\widehat{SH} = 124.01\left(1 - \exp(-0.024058A - 0.022695SI)\right)^{10.187}$$
$$N = 23;\ R^2 = 0.863;\ RMSE = 10.7087$$
(18)

Hardwood-Pine:
$$\widehat{SH} = 113.12\left(1 - \exp(-0.028269A - 0.026317SI)\right)^{12.221}$$
$$N = 26;\ R^2 = 0.678;\ RMSE = 7.0133$$
(19)

Hardwoods:
$$\widehat{SH} = 115.71\left(1 - \exp(-0.024951A - 0.029544SI)\right)^{15.256}$$
$$N = 101;\ R^2 = 0.815;\ RMSE = 8.8466$$
(20)

Cypress-Tupelo:
$$\widehat{SH} = 104.85\left(1 - \exp(-0.081933A - 0.039090SI)\right)^{2215.0}$$
$$N = 5;\ R^2 = 0.981;\ RMSE = 1.8390$$
(21)

Canopy Bulk Density

By far the most difficult variable to calculate, canopy bulk density (*CBD*) in lb/ft^3 is generally understood to be the mass per unit volume of canopy biomass that would burn in a crown fire. This crown fuel primarily consists of foliage and twigs less than 0.12 inches (0.3 cm) in diameter and some portion of the live and dead branch wood less than 0.25 inches (0.6 cm) in diameter

(Keane et al. 2005, Scott and Reinhardt 2001). A number of instrument-based methods have been evaluated for determining *CBD*, such as the ceptometer and the spherical densiometer (Keane et al. 2005). But the most popular method for estimating *CBD* uses measurements of tree diameter, total height, and *HBLC* to predict available crown fuel load (foliage+twig biomass) for every tree in a stand from allometric crown biomass equations (Keane et al. 1998, 2000). Canopy fuel load (sum of crown fuel loads) per unit area divided by canopy depth (*SH - CBH*) yields *CBD*. Because the Savannah River Site has approximately 70 tree species present, it was a laborious job carefully searching the literature for species-specific and regionally based crown biomass equations. Fortunately, I was able to locate allometric equations for the majority of species on site. There were a number of species, such as blue beech (*Carpinus caroliniana* Walt.), holly (*Ilex opaca* Ait.), Chinaberry (*Melia azedarach* L.), and mulberry (*Morus* spp.), where I was unable to find biomass equations, so I used the national-scale estimators of Jenkins et al. (2004). The primary sources for conifers are Hepp and Brister (1992) for loblolly pine (*Pinus taeda* L.), Baldwin and Saucier (1983) for longleaf pine (*P. palustris* P. Mill.), Lohrey (1984) for slash pine (*P. elliottii* Engelm.), Loomis et al. (1966) for shortleaf pine (*P. echinata* P. Mill.), McNab et al. (1985) for sand pine (*P. clausa* (Chapman ex Engelm.) Vasey ex Sarg.), Wendel (1960) for pond pine (*P. serotina* Michx.), Mitsch and Ewell (1979) for cypress (*Taxodium* spp.), and Norris et al. (2001) for eastern redcedar (*Juniperus virginiana* L.). For broadleaf species the primary sources are Clark, III et al. (1985, 1986a, 1986b) for oaks (*Quercus* spp.), hickories (*Carya* spp.), elms (*Ulmus* spp.), ashes (*Fraxinus* spp.), gums (*Nyssa* spp.), red maple (*Acer rubrum* L.), sycamore (*Platanus occidentalis* L.), and yellow-poplar (*Liriodendron tulipifera* L.); Jenkins et al. (2004) for miscellaneous hardwoods, Schlaegel (1982) for boxelder (*Acer negundo* L.), Boerner and Kost (1986) for dogwood (*Cornus florida* L.), Busing et al. (1993) for beech (*Fagus grandifolia* Ehrh.), Hocker and Early (1983) for eastern hophornbeam (*Ostrya virginiana* (P. Mill.) K. Koch), Martin et al. (1998) for sourwood (*Oxydendrum arboreum* (L.) DC.), and Young et al. (1980) for willow (*Salix* spp.).

The next step was to model the plot values of *CBD* against the stand variables. Four groups (loblolly, longleaf, hardwoods, and cypress-tupelo) showed some curvilinearity in *CBD* against the stand variables and the other 3 groups (slash, pine-hardwood, hardwood-pine) had very linear trends. For the four groups with the curvilinear trends, the natural log transformation linearized the data. The general model form used was

$$\ln \widehat{CBD} = b_0 + b_1 \ln A + b_2 \ln BA + b_3 \ln SI + b_4 \ln NB + b_5 \ln YRS$$

For the remaining three groups the general model form used was

$$\widehat{CBD} = b_0 + b_1 A + b_2 BA + b_3 SI + b_4 NB + b_5 YRS + \text{2-way interactions}$$

Stepwise regression was used to help determine specific equations. The two burn history variables, *NB* and *YRS*, had no effect on *CBD*. Below are the equations for *CBD* for each of the 7 forest type groups. Non-significant coefficients/variables have been dropped. To convert *CBD* in lb/ft^3 to kg/m^3 multiply by 16.0185.

Loblolly:

$$\widehat{\ln CBD} = -3.00460 - 0.48305 \ln A + 0.85787 \ln BA - 1.14064 \ln SI$$

$$N = 277;\ R^2 = 0.678;\ RMSE = 0.3212$$

(22)

Longleaf:

$$\widehat{\ln CBD} = -9.41785 - 0.34737 \ln A + 1.11667 \ln BA$$

$$N = 129;\ R^2 = 0.843;\ RMSE = 0.3120$$

(23)

Slash:

$$\widehat{CBD} = 0.00049677 + 7.27442 \times 10^{-7} A \times BA$$

$$N = 58;\ R^2 = 0.563;\ RMSE = 0.00112$$

(24)

Pine-Hardwood:

$$\widehat{CBD} = 0.00039438 + 7.532 \times 10^{-5} BA - 5.41041 \times 10^{-7} BA \times SI$$

$$N = 23;\ R^2 = 0.623;\ RMSE = 0.00116$$

(25)

Hardwood-Pine:

$$\widehat{CBD} = -0.03292 + 0.00023188 BA + 0.00051652 SI - 2.16 \times 10^{-6} A \times SI$$

$$+ 1.39 \times 10^{-6} A \times BA - 3.37 \times 10^{-6} BA \times SI$$

$$N = 25;\ R^2 = 0.559;\ RMSE = 0.00112$$

(26)

Hardwoods:

$$\widehat{\ln CBD} = -5.16282 - 0.34624 \ln A + 0.96580 \ln BA - 0.86870 \ln SI$$

$$N = 102;\ R^2 = 0.316;\ RMSE = 0.5002$$

(27)

Cypress-Tupelo:

$$\widehat{\ln CBD} = -4.17734 - 0.17291 \ln A + 0.13735 \ln BA - 0.26077 \ln SI$$

$$N = 5;\ R^2 = 0.414;\ RMSE = 0.07046$$

(28)

Discussion

From Table 2 we see that loblolly stands ranged from 2 to 100 years of age with a mean of 33 years. This age spread is also reflected in the stand basal areas from 1 ft^2 (recently harvested stands) to over 200 ft^2 for the older dense stands. Longleaf stands averaged 38 years of age, with a spread of 1 to 88 years but with a much lower mean BA (72 ft^2) compared to loblolly (108 ft^2). Slash pine stands averaged 44 years of age, and ranged from 4 to 62 years, and is less

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represented in ages than loblolly and longleaf. In looking across all forest type groups, the site indexes run from 40 to 110 ft with a median of 80 to 90 for all groups. So there is a range of site productivity from low (40-50 ft) to high (100-110). Only slash stands occurred on a somewhat uniform series of site productivities, from 60-90 ft. Prescribed burning occurred on all forest types except cypress-tupelo. The pine-hardwood stands had a mean age of 47 years, and the hardwood-pine and hardwoods stands were both around 54 years. There were no early successional hardwood-pine stands, the youngest age being 21 years. Basal area averaged 81 ft^2 for the pine-hardwood stands, but the hardwood-pine and hardwoods stands had fairly high basal areas, averaging around 115 ft^2. In looking closely at the values in Table 2, we see that extensive ranges occur in the data. Broad coverage of values is important to capture the natural variability on the landscape and to develop statistically sound models (see caveat for cypress-tupelo data).

It is important to note that there are only 5 observations for the cypress-tupelo stands, so the data is very limited and should not be used for comparison against the other forest types. As information is generally lacking for canopy fuel for eastern forests, this data is included to give general trends, and the canopy parameter models fitted to this data should be used with caution.

Table 1 shows the averages and ranges of the four canopy characteristics by forest type. Canopy cover has the highest average in loblolly at 75%, even though loblolly stands have the lowest mean age at 33 years. This is probably reflective of the higher basal areas carried in the loblolly stands compared to the longleaf, slash and pine-hardwood stands. The hardwood-pine and hardwoods stands have mean *CC*s only slightly lower than loblolly and similarly high mean *BA*s. The values for the canopy parameters *CBH* and *SH* are in line with expectations based on the values of stand variables shown in Table 1. Fore example, slash pine stands have an average age of 44 years and an average *SI* (base age 50) of 84 ft. We would expect average *SH* to be less than 84 ft and in fact it is about 81 ft. Canopy bulk density values are very similar for the 3 pine types. The standard deviations are all about the same (≈ 0.0017 lb/ft^3) as are the maximum values (≈ 0.008 lb/ft^3). For the hardwoods and hardwood-pine stands, *CBD* has greater variance, due no doubt to the large mix of species. The standard deviation for the hardwood-pine stands is 0.0038 lb/ft^3, more than twice that of the pine types. Broadleaf stands in the eastern U.S. do not typically burn, but the potential exists. I report computed *CBD* based on summer foliage. A number of researchers assign a null value to bulk density for some species of hardwoods (Elizabeth Reinhardt, personal communication, JAN 2007)) because they are not considered as available fuel. This is a question that needs further consideration.

Canopy cover was accurately predicted using a logistic function. The R^2s ranged from 0.47 for hardwoods to 0.71 for loblolly and slash. Not surprisingly, stand age and basal area were the predominate predictor variables, but site index played a role with longleaf and the pine-hardwood and hardwood-pine types. In general burning had no effect on *CC* except in the pine-hardwood type. The canopy parameters stand height and crown base height were well predicted using the Bertalanffy-Richards function. Age, basal area, and site index all played a significant role in predicting *CBH* and *SH*. For *CBH*, coefficients of determination ranged from about 0.47 for the slash and hardwood-pine types to nearly 0.72 for longleaf. As might be expected, the regressions for *SH* had relatively high R^2 values compared to the other canopy characteristics, with a low of 0.68 for the hardwood-pine type to 0.87-0.90 for the pine-types. Burn history had an effect on crown base height, especially for the pine types. Unburned pine stands had slightly

lower *CBH* values. The trends for *CC*, *CBH* and *SH* were curvilinear, but not so for *CBD*. Canopy bulk density trends were adequately modeled with linear functions. The hardwoods type had a low fit ($R^2 = 0.32$) but the other forest types had coefficients of determination above 0.55 and the longleaf regression had an excellent fit with $R^2 = 0.84$. Prescribed burning had no discernable effect on *CBD* but the other stand variables were critical predictor variables.

Correlations were moderate to strong among the canopy characteristics and the stand variables of age, site index and basal area. Burn history had an effect on *CBH* for the pine types, and shows the positive influence of having a burning program. The models presented provide critical information to fill data layers required for fire behavior models and aid in assessment of crown fire potential.

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Appendix

Canopy Parameters and Stand-level Variables

plot	canopy_cover	crown_base_height	stand_height	CBD_lb_ft3	CBD_kg_m3	num_burns	years_since_burn	ft_group	group_name	age	si	plt_ba
1001	0.6476	25	70.60	0.00294	0.047	2	4	2	Longleaf pine	44	80	116.61
1002	0.4388	35	64.57	0.00228	0.036	2	4	2	Longleaf pine	41	70	55.02
1003	0.6395	26	58.11	0.00326	0.052	4	2	2	Longleaf pine	34	60	86.16
1004	0.1895	15	26.00	0.00091	0.015	3	2	2	Longleaf pine	6	60	15.64
1005	0.5082	40	95.00	0.00206	0.033	2	2	1	Loblolly pine	45	100	137.41
1006	0.2180	8	50.33	0.00261	0.042	0	33	6	Hardwoods	31	70	96.73
1007	0.9619	1	12.91	0.00368	0.059	0	33	1	Loblolly pine	6	90	25.85
1008	0.5962	31	88.75	0.00381	0.061	0	33	4	Pine-hdwd mix	72	80	135.38
1009	0.0535	35	62.00	0.00033	0.005	0	33	4	Pine-hdwd mix	52	60	15.00
1010	0.5477	37	64.89	0.00424	0.068	0	33	1	Loblolly pine	43	70	114.94
1011	0.9841	11.5	29.11	0.00557	0.089	1	29	2	Longleaf pine	12	70	105.79
1012	0.3768	37	66.83	0.00264	0.042	1	20	2	Longleaf pine	36	70	60.33
1013	0.5848	9	32.60	0.00256	0.041	2	4	1	Loblolly pine	11	70	42.29
1014	0.6529	36	78.55	0.00247	0.040	2	4	2	Longleaf pine	41	90	90.84
1015	0.5651	39	79.60	0.00316	0.051	2	4	2	Longleaf pine	50	80	106.44
1016	0.2070	10	70.00	0.00259	0.041	2	4	6	Hardwoods	54	60	80.27
1017	0.9066	52	93.00	0.00639	0.102	2	4	2	Longleaf pine	73	80	209.62
1018	0.6799	33	84.56	0.00307	0.049	0	33	5	Hdwd-pine mix	51	90	105.89
1019	0.7468	23	86.00	0.00335	0.054	0	33	1	Loblolly pine	39	90	183.13
1020	0.4216	31	63.86	0.00155	0.025	3	4	2	Longleaf pine	65	60	52.50
1021	0.6246	12	32.13	0.00239	0.038	4	4	2	Longleaf pine	40	50	52.21
1022	0.7219	11	62.30	0.00366	0.059	2	6	2	Longleaf pine	51	70	137.19
1023	0.7255	26	62.91	0.00306	0.049	2	6	2	Longleaf pine	35	80	95.77
1024	0.6510	44	69.92	0.00446	0.071	2	6	2	Longleaf pine	82	60	97.50
1025	0.9949	36	70.46	0.00370	0.059	1	7	6	Hardwoods	51	80	131.66
1026	0.9207	5	33.38	0.00112	0.018	2	7	2	Longleaf pine	38	60	32.83
1027	0.7744	6	22.33	0.00265	0.042	0	33	1	Loblolly pine	9	90	31.27
1028	0.7620	14	53.00	0.00203	0.033	2	0.5	1	Loblolly pine	22	80	80.29
1029	0.4056	30	70.14	0.00183	0.029	1	7	2	Longleaf pine	45	70	66.55
1030	0.9781	14	37.58	0.00533	0.085	1	32	1	Loblolly pine	10	70	89.86

1031	0.3725	19	67.83	0.00675	0.108	2	4	2 Longleaf pine	33	80	111.46
1032	0.5262	9	47.33	0.00323	0.052	2	4	4 Pine-hdwd mix	33	75	32.80
1033	0.9090	13	53.50	0.00293	0.047	3	4	1 Loblolly pine	20	90	129.43
1034	0.9821	21	45.79	0.00647	0.104	3	4	1 Loblolly pine	21	70	153.40
1035	0.6381	48.5	97.73	0.00535	0.086	1	4	1 Loblolly pine	68	90	150.14
1036	0.9381	10	37.11	0.00627	0.100	2	8	4 Pine-hdwd mix	44	60	105.06
1037	0.6295	13	55.50	0.00243	0.039	1	4	2 Longleaf pine	81	60	86.37
1038	0.9618	18	53.92	0.00620	0.099	2	6	2 Longleaf pine	29	70	144.10
1039	0.6846	13	50.11	0.00336	0.054	2	6	2 Longleaf pine	33	60	98.64
1040	0.6881	21	57.22	0.00212	0.034	2	6	2 Longleaf pine	38	80	69.92
1041	0.9019	6.5	28.25	0.00441	0.071	2	6	6 Hardwoods	47	50	55.84
1042	0.6545	7.5	41.14	0.00274	0.044	0	33	2 Longleaf pine	50	50	86.59
1043	0.8134	9	49.00	0.00295	0.047	2	7	6 Hardwoods	66	50	123.64
1044	0.9286	10	28.50	0.00776	0.124	0	33	1 Loblolly pine	9	90	87.59
1045	0.9786	30	60.38	0.00585	0.094	2	1	1 Loblolly pine	24	80	142.50
1046	0.9015	35	58.93	0.00381	0.061	2	9	1 Loblolly pine	24	80	105.00
1047	0.9612	4	19.20	0.00452	0.072	2	9	1 Loblolly pine	5	80	36.56
1048	0.5526	43.5	75.20	0.00466	0.075	1	7	2 Longleaf pine	39	80	90.00
1050	0.9733	17	41.33	0.00663	0.106	1	20	1 Loblolly pine	11	70	126.57
1051	0.8339	46	89.21	0.00408	0.065	2	4	1 Loblolly pine	57	80	176.17
1052	0.6880	22	78.78	0.00459	0.074	1	20	6 Hardwoods	50	80	124.13
1053	0.6432	38.5	85.89	0.00409	0.065	0	33	5 Hdwd-pine mix	45	100	108.27
1054	0.9073	6.5	49.82	0.00120	0.019	0	33	6 Hardwoods	47	80	87.16
1055	0.2864	25	43.50	0.00172	0.028	3	4	2 Longleaf pine	47	60	31.53
1056	0.7982	18.5	40.20	0.00287	0.046	1	6	2 Longleaf pine	26	70	56.46
1057	0.7664	23	47.88	0.00356	0.057	1	6	2 Longleaf pine	30	60	58.09
1058	0.5618	28.5	86.63	0.00235	0.038	2	6	5 Hdwd-pine mix	57	70	115.93
1059	0.8892	52	93.60	0.00224	0.036	1	6	1 Loblolly pine	48	90	127.50
1060	0.9908	28	93.21	0.00287	0.046	1	6	5 Hdwd-pine mix	56	80	149.90
1061	0.4766	16	67.29	0.00420	0.067	2	7	5 Hdwd-pine mix	57	70	112.65
1063	0.7299	45	79.54	0.00271	0.043	3	1	2 Longleaf pine	67	70	97.50
1064	0.5886	5	18.50	0.00127	0.020	2	9	4 Pine-hdwd mix	9	60	13.16

1065	0.9254	21	42.18	0.00496	0.079	1	25	1 Loblolly pine	16	70	97.16
1066	0.7286	43	73.10	0.00248	0.040	1	10	1 Loblolly pine	29	90	105.88
1067	0.4600	36	98.38	0.00159	0.025	1	10	1 Loblolly pine	60	90	109.56
1068	0.2873	42.5	76.75	0.00069	0.011	2	7	1 Loblolly pine	39	90	30.00
1069	0.5466	11	61.83	0.00657	0.105	1	7	4 Pine-hdwd mix	70	40	110.33
1070	0.3927	48	85.57	0.00172	0.028	1	7	2 Longleaf pine	45	90	52.50
1071	0.7854	62	98.00	0.00819	0.131	1	7	1 Loblolly pine	54	90	142.90
1072	0.9819	52.5	105.07	0.00831	0.133	0	33	5 Hdwd-pine mix	68	80	180.00
1073	0.9714	3	13.09	0.00126	0.020	1	19	2 Longleaf pine	9	80	16.00
1074	0.9536	30	57.92	0.00553	0.089	2	6	2 Longleaf pine	33	70	118.51
1075	0.4852	30	86.63	0.00289	0.046	0	33	1 Loblolly pine	75	80	114.55
1076	0.6623	69	99.58	0.00240	0.038	2	6	1 Loblolly pine	52	100	120.65
1077	0.5352	19.5	62.14	0.00210	0.034	1	7	6 Hardwoods	57	70	94.13
1078	0.8461	28	83.83	0.00706	0.113	1	3	6 Hardwoods	62	80	167.29
1079	0.6383	35	95.78	0.00229	0.037	2	7	6 Hardwoods	70	80	101.99
1080	0.5363	10	57.00	0.00161	0.026	0	33	1 Loblolly pine	28	80	86.90
1082	0.6967	10.5	26.50	0.00433	0.069	2	6	1 Loblolly pine	12	80	48.88
1083	0.5510	41.5	72.56	0.00433	0.069	2	9	2 Longleaf pine	77	70	96.50
1084	0.7851	31	57.36	0.00318	0.051	2	9	1 Loblolly pine	28	70	85.33
1085	0.3074	3	10.00	0.00044	0.007	3	1	2 Longleaf pine	5	80	5.32
1086	0.6451	44	91.55	0.00255	0.041	2	6	1 Loblolly pine	47	90	118.57
1087	0.7788	50	85.85	0.00198	0.032	3	2	1 Loblolly pine	48	80	105.00
1088	0.5814	37.5	78.90	0.00511	0.082	2	3	2 Longleaf pine	53	80	135.00
1089	0.7449	29	50.70	0.00410	0.066	2	3	1 Loblolly pine	20	80	90.00
1090	0.7088	35.5	78.63	0.00356	0.057	2	7	4 Pine-hdwd mix	47	90	76.13
1091	0.9759	27.5	52.46	0.00570	0.091	1	20	1 Loblolly pine	17	90	137.28
1092	0.9440	45.5	88.80	0.00218	0.035	2	7	1 Loblolly pine	46	90	123.59
1093	0.7873	56	93.77	0.00314	0.050	2	2	1 Loblolly pine	62	90	122.75
1094	0.3980	33	82.86	0.00242	0.039	0	33	1 Loblolly pine	56	80	104.92
1095	0.6436	50	73.17	0.00659	0.105	3	3	2 Longleaf pine	50	70	116.51
1096	0.4991	35.5	77.50	0.00275	0.044	2	7	1 Loblolly pine	45	80	95.71
1097	0.3161	16.5	71.20	0.00172	0.028	3	7	1 Loblolly pine	45	80	91.63

1098	0.5574	52.5	93.30	0.00248	0.040	0	33	1 Loblolly pine	51	90	111.67
1099	0.9313	54.5	89.56	0.00683	0.109	1	19	3 Slash pine	47	90	175.10
1107	0.8683	46	79.93	0.00459	0.073	4	2	2 Longleaf pine	45	90	120.00
1108	0.2889	39	79.40	0.00109	0.018	2	3	2 Longleaf pine	45	80	37.50
1109	0.7132	34	87.62	0.00180	0.029	0	33	6 Hardwoods	63	90	151.16
1110	0.6828	46.5	95.55	0.00333	0.053	2	5	1 Loblolly pine	45	100	130.11
1111	0.9848	21.5	44.13	0.00640	0.103	2	5	1 Loblolly pine	18	90	129.81
1114	0.9883	47	97.71	0.00636	0.102	1	3	6 Hardwoods	77	90	157.50
1115	0.0611	28	76.00	0.00016	0.003	3	3	2 Longleaf pine	1	80	7.50
1116	0.5921	46	79.90	0.00248	0.040	1	6	1 Loblolly pine	46	80	95.66
1117	0.5462	36	80.63	0.00321	0.051	1	19	1 Loblolly pine	57	80	111.83
1118	0.7271	54	91.08	0.00524	0.084	1	19	3 Slash pine	46	90	128.79
1120	0.9124	15	37.36	0.00620	0.099	1	19	1 Loblolly pine	10	90	100.51
1121	0.9242	27.5	56.85	0.00344	0.055	1	19	1 Loblolly pine	18	90	112.36
1122	0.9301	40	73.35	0.00590	0.095	3	1	1 Loblolly pine	27	90	218.46
1123	0.5816	45	79.56	0.00375	0.060	2	6	3 Slash pine	45	80	86.56
1124	0.8911	39	72.36	0.00460	0.074	1	25	1 Loblolly pine	27	90	151.88
1126	0.4934	21	77.80	0.00262	0.042	3	3	6 Hardwoods	51	80	81.40
1127	0.6665	27	90.44	0.00148	0.024	2	7	6 Hardwoods	55	90	101.57
1128	0.5510	30	79.00	0.00279	0.045	0	33	6 Hardwoods	67	80	78.56
1129	0.9564	34	80.71	0.00320	0.051	0	33	6 Hardwoods	74	80	151.75
1130	0.9504	40	91.00	0.00756	0.121	1	4	1 Loblolly pine	82	80	186.13
1131	0.2826	14	54.00	0.00054	0.009	0	33	6 Hardwoods	69	50	31.92
1132	0.8457	29	61.08	0.00297	0.048	4	0.5	1 Loblolly pine	25	90	94.74
1133	0.5400	27	82.78	0.00208	0.033	2	7	1 Loblolly pine	47	80	103.38
1134	0.9825	20.5	48.13	0.00606	0.097	0	33	1 Loblolly pine	20	80	127.45
1136	0.7264	14	64.75	0.00520	0.083	1	19	6 Hardwoods	53	70	126.04
1138	0.9249	31.5	59.88	0.00444	0.071	1	13	1 Loblolly pine	18	80	146.93
1139	0.6541	27	79.27	0.00288	0.046	1	13	1 Loblolly pine	55	80	131.47
1140	0.2808	48	76.20	0.00168	0.027	2	6	2 Longleaf pine	45	80	37.50
1141	0.7832	48.5	108.21	0.00250	0.040	1	6	6 Hardwoods	68	100	164.86
1142	0.2167	7	85.50	0.00090	0.014	1	11	3 Slash pine	45	90	47.03

1143	0.7649	45	85.92	0.00533	0.085	0	33	1 Loblolly pine	74	80	133.55
1144	0.9488	5	27.17	0.00252	0.040	1	27	2 Longleaf pine	12	80	54.78
1145	0.7782	32	74.25	0.00419	0.067	0	33	5 Hdwd-pine mix	34	90	87.47
1147	0.3866	26	63.20	0.00382	0.061	1	4	6 Hardwoods	48	60	59.66
1148	0.3668	44.5	79.33	0.00421	0.068	2	4	1 Loblolly pine	41	80	61.50
1149	0.7812	35	91.45	0.00263	0.042	2	0.5	6 Hardwoods	57	90	192.70
1150	0.5979	32	91.30	0.00263	0.042	1	19	3 Slash pine	47	90	103.67
1151	0.5636	2.5	15.38	0.00091	0.015	1	19	2 Longleaf pine	8	80	13.89
1152	0.2007	11	58.67	0.00258	0.041	0	33	1 Loblolly pine	52	80	48.72
1154	0.5138	3.5	17.75	0.00067	0.011	0	33	2 Longleaf pine	11	90	12.77
1156	0.7898	36	67.92	0.00439	0.070	1	6	1 Loblolly pine	28	80	130.29
1157	0.6572	50	80.10	0.00416	0.067	1	27	1 Loblolly pine	48	80	105.00
1158	0.9573	16	42.11	0.00469	0.075	0	33	1 Loblolly pine	17	90	106.05
1159	0.9067	28	53.42	0.00359	0.057	1	11	1 Loblolly pine	17	90	99.70
1160	0.9466	3	12.08	0.00061	0.010	1	11	2 Longleaf pine	9	90	9.31
1161	0.7324	27	101.85	0.00137	0.022	0	33	6 Hardwoods	55	100	172.38
1162	0.9301	29	89.67	0.00493	0.079	1	20	6 Hardwoods	74	80	182.01
1163	0.9757	7	33.11	0.00254	0.041	2	4	2 Longleaf pine	12	70	63.28
1164	0.2976	43	80.20	0.00251	0.040	2	4	3 Slash pine	41	80	60.00
1165	0.4333	45	76.71	0.00176	0.028	2	4	1 Loblolly pine	40	80	74.07
1166	0.7852	47	93.14	0.00556	0.089	1	31	3 Slash pine	45	90	151.21
1167	0.9429	59.5	95.95	0.00280	0.045	0	33	1 Loblolly pine	46	90	151.56
1169	0.7769	15	53.64	0.00441	0.071	0	33	2 Longleaf pine	41	70	132.32
1171	0.7212	29.5	85.92	0.00349	0.056	1	13	3 Slash pine	46	80	148.93
1172	0.9349	30.5	65.57	0.00472	0.076	1	6	1 Loblolly pine	28	80	151.07
1173	0.9593	3	31.00	0.00155	0.025	1	27	6 Hardwoods	16	90	42.67
1174	0.8378	36.5	94.50	0.00246	0.039	0	33	1 Loblolly pine	70	90	179.85
1175	0.9701	29	94.75	0.00297	0.048	0	33	6 Hardwoods	57	90	195.04
1176	0.9121	16	72.15	0.00460	0.074	0	33	5 Hdwd-pine mix	48	80	154.67
1177	0.4935	16	82.83	0.00166	0.027	0	33	6 Hardwoods	68	90	96.73
1180	0.6439	47	80.89	0.00317	0.051	2	4	3 Slash pine	42	90	88.72
1181	0.7176	36	89.67	0.00409	0.066	0	33	1 Loblolly pine	39	90	159.21

1182	0.5368	20	70.17	0.00257	0.041	1	0.5	6 Hardwoods	45	80	90.91
1183	0.2480	18	73.75	0.00151	0.024	1	19	1 Loblolly pine	45	80	57.49
1184	0.7243	29	60.80	0.00334	0.054	1	19	2 Longleaf pine	39	70	82.91
1186	0.8403	13	47.40	0.00408	0.065	2	4	1 Loblolly pine	18	90	111.04
1187	0.8119	25	69.40	0.00313	0.050	0	33	6 Hardwoods	33	80	92.31
1188	0.7215	37	93.18	0.00238	0.038	0	33	5 Hdwd-pine mix	57	90	172.66
1189	0.9104	32.5	80.58	0.01403	0.225	0	33	6 Hardwoods	84	70	137.20
1190	0.9996	13	34.82	0.00488	0.078	0	33	1 Loblolly pine	15	70	87.56
1192	0.9007	17	42.13	0.00610	0.098	0	33	1 Loblolly pine	15	80	116.58
1194	0.9198	27	81.64	0.00679	0.109	0	33	6 Hardwoods	38	100	117.09
1195	0.9622	26	64.31	0.00335	0.054	1	19	5 Hdwd-pine mix	21	100	143.24
1196	0.3023	10	28.50	0.00022	0.004	1	19	6 Hardwoods	27	60	8.96
1197	0.9383	20	50.33	0.00393	0.063	1	19	1 Loblolly pine	19	80	111.46
1199	0.9257	42	75.74	0.00506	0.081	1	27	1 Loblolly pine	27	90	176.61
1200	0.9271	48	96.06	0.00625	0.100	1	27	6 Hardwoods	52	110	155.39
1201	0.5160	23	92.57	0.00230	0.037	0	33	6 Hardwoods	35	90	114.68
1202	0.6980	28	76.00	0.00394	0.063	0	33	6 Hardwoods	60	80	99.26
1203	0.7009	34	78.82	0.00346	0.055	0	33	3 Slash pine	43	80	133.11
1206	0.8842	36	96.92	0.00517	0.083	0	33	5 Hdwd-pine mix	52	100	142.43
1207	0.4026	61	96.71	0.00160	0.026	2	6	1 Loblolly pine	46	90	60.84
1208	0.5992	48	111.82	0.00135	0.022	1	0.5	5 Hdwd-pine mix	82	100	140.99
1209	0.7391	37	99.54	0.00258	0.041	1	19	1 Loblolly pine	47	100	159.74
1210	0.5477	3	12.80	0.00090	0.014	1	19	2 Longleaf pine	6	90	14.75
1211	0.9634	17.5	53.93	0.00631	0.101	3	8	1 Loblolly pine	20	80	151.85
1212	0.6401	12	93.82	0.00186	0.030	2	4	1 Loblolly pine	46	100	131.32
1214	0.6221	12	34.00	0.00301	0.048	0	33	1 Loblolly pine	12	70	47.72
1215	0.6922	17.5	79.45	0.00336	0.054	0	33	3 Slash pine	43	80	146.53
1217	0.9268	17	50.17	0.00356	0.057	0	33	1 Loblolly pine	11	90	118.50
1218	0.8209	14.5	69.40	0.00239	0.038	1	6	6 Hardwoods	42	80	104.55
1219	0.6324	51.5	106.45	0.00427	0.068	2	7	1 Loblolly pine	50	100	166.58
1220	0.9511	31.5	51.33	0.00679	0.109	0	33	1 Loblolly pine	14	100	153.75
1222	0.9043	53	90.93	0.00327	0.052	3	9	1 Loblolly pine	50	90	162.83

1223	0.5092	34	91.75	0.00220	0.035	0	33	6 Hardwoods	81	90	131.12
1224	0.6220	20	96.86	0.00194	0.031	1	4	6 Hardwoods	77	80	85.69
1225	0.5608	38.5	76.11	0.00354	0.057	1	8	1 Loblolly pine	49	80	88.58
1226	0.9369	68.5	103.84	0.00344	0.055	0	33	1 Loblolly pine	51	100	201.95
1227	0.5773	20	74.33	0.00453	0.073	1	8	1 Loblolly pine	41	80	146.48
1230	0.5277	13	90.67	0.00159	0.025	4	0.5	1 Loblolly pine	45	90	120.25
1231	0.5796	61	96.20	0.00195	0.031	2	1	1 Loblolly pine	46	90	75.00
1234	0.9201	43	85.82	0.00541	0.087	3	9	6 Hardwoods	70	80	104.29
1235	0.8150	58	106.00	0.00290	0.046	0	33	1 Loblolly pine	50	110	127.52
1236	0.4961	14	54.60	0.00201	0.032	1	4	6 Hardwoods	51	60	63.45
1237	0.1330	11	69.00	0.00032	0.005	1	5	1 Loblolly pine	42	80	18.87
1238	0.5028	48	83.63	0.00423	0.068	1	8	3 Slash pine	44	90	110.33
1239	0.8130	54	115.62	0.00350	0.056	0	33	6 Hardwoods	71	110	163.30
1240	0.7336	29	93.40	0.00195	0.031	2	7	5 Hdwd-pine mix	62	90	111.64
1241	0.4696	49	87.75	0.00119	0.019	5	0.5	1 Loblolly pine	47	90	68.56
1242	0.4591	54	87.25	0.00135	0.022	5	0.5	1 Loblolly pine	46	90	62.95
1243	0.9167	55	91.38	0.00265	0.043	3	0.5	1 Loblolly pine	46	90	135.33
1244	0.6699	64	103.25	0.00276	0.044	2	7	1 Loblolly pine	46	100	122.08
1245	0.9644	16	39.92	0.00470	0.075	2	7	1 Loblolly pine	14	90	89.98
1246	0.4439	29	80.00	0.00319	0.051	0	33	1 Loblolly pine	75	80	91.01
1247	0.9243	39	98.73	0.00279	0.045	0	33	6 Hardwoods	68	100	180.19
1248	0.8933	19	81.56	0.00488	0.078	1	4	6 Hardwoods	67	60	127.59
1249	0.5992	17	56.00	0.00335	0.054	2	5	2 Longleaf pine	32	70	106.70
1254	0.8000	7	25.88	0.00268	0.043	2	7	1 Loblolly pine	9	80	35.22
1255	0.5427	31	84.57	0.00218	0.035	2	0.5	5 Hdwd-pine mix	59	90	98.19
1256	0.9893	34	53.82	0.00655	0.105	2	7	1 Loblolly pine	14	85	181.62
1257	0.3576	39	80.83	0.00382	0.061	2	7	1 Loblolly pine	46	80	103.93
1259	0.8825	43	92.20	0.00536	0.086	0	33	6 Hardwoods	75	90	118.56
1260	0.3852	30.5	83.14	0.00170	0.027	0	33	2 Longleaf pine	46	80	73.13
1262	0.4727	11	55.83	0.00254	0.041	1	5	3 Slash pine	31	70	96.96
1263	0.8624	46	91.92	0.00280	0.045	0	33	6 Hardwoods	47	90	112.50
1265	0.7051	42.5	88.11	0.00390	0.062	0	33	6 Hardwoods	64	80	105.08

1267	0.9225	51	100.28	0.00489	0.078	0	33	7 Cypress-Tupelo	78	110	337.50
1268	0.3924	48.5	83.71	0.00268	0.043	0	33	1 Loblolly pine	50	90	76.35
1269	0.6684	38	85.27	0.00175	0.028	0	33	1 Loblolly pine	33	100	108.41
1270	0.4153	27	104.13	0.00095	0.015	0	33	6 Hardwoods	61	100	126.40
1271	0.6501	2	30.00	0.00248	0.040	0	33	1 Loblolly pine	8	90	49.17
1272	0.3672	19	56.60	0.00194	0.031	0	33	1 Loblolly pine	34	70	53.84
1274	0.8790	56	102.70	0.00440	0.071	0	33	7 Cypress-Tupelo	110	90	322.50
1276	0.9425	20	78.06	0.00299	0.048	0	33	5 Hdwd-pine mix	37	90	161.93
1277	0.5556	61.5	93.67	0.00289	0.046	0	33	3 Slash pine	44	90	69.17
1286	0.5410	48.5	106.63	0.00151	0.024	0	33	6 Hardwoods	85	90	94.52
1287	0.8481	46	99.42	0.00280	0.045	0	33	6 Hardwoods	62	100	125.36
1288	0.5412	40	83.57	0.00767	0.123	0	33	3 Slash pine	54	80	104.10
1289	0.7722	38	91.69	0.00365	0.059	0	33	1 Loblolly pine	34	100	166.35
1290	0.9200	31	55.72	0.00570	0.091	1	19	1 Loblolly pine	20	80	159.90
1291	0.9132	29.5	50.00	0.00571	0.091	1	19	1 Loblolly pine	20	80	116.82
1292	0.8409	55	84.93	0.00556	0.089	0	33	2 Longleaf pine	47	90	123.35
1293	0.6216	51	82.36	0.00457	0.073	1	6	1 Loblolly pine	58	80	160.69
1294	0.9633	13	36.92	0.00518	0.083	1	6	1 Loblolly pine	10	90	86.58
1295	0.5995	35	57.44	0.00711	0.114	4	2	2 Longleaf pine	34	70	117.76
1296	0.4126	38	81.29	0.00239	0.038	2	4	2 Longleaf pine	41	80	82.50
1297	0.8462	8	18.82	0.00305	0.049	1	20	1 Loblolly pine	12	80	33.00
1299	0.8961	37.5	69.57	0.00524	0.084	1	25	1 Loblolly pine	27	80	174.16
1300	0.9541	43	88.67	0.00245	0.039	1	20	6 Hardwoods	57	90	179.22
1301	0.7124	49.5	110.67	0.00147	0.024	1	22	6 Hardwoods	65	110	193.82
1302	0.6052	17	81.00	0.00239	0.038	0	33	1 Loblolly pine	43	90	114.87
1303	0.7672	31	80.33	0.00331	0.053	1	8	5 Hdwd-pine mix	57	90	116.36
1305	0.7909	38.5	85.31	0.00280	0.045	0	33	1 Loblolly pine	66	80	147.26
1306	0.5010	21	60.86	0.00207	0.033	2	6	2 Longleaf pine	52	60	71.98
1307	0.7895	41	72.00	0.00424	0.068	2	6	2 Longleaf pine	35	90	100.25
1308	0.4499	34	58.00	0.00316	0.051	2	6	3 Slash pine	54	60	63.56
2001	0.6129	9	29.80	0.00146	0.023	1	3	2 Longleaf pine	10	80	31.47
2002	0.9155	15	37.08	0.00533	0.085	1	13	1 Loblolly pine	10	80	87.72

4001	0.2691	27	63.75	0.00147	0.024	1	17	2 Longleaf pine	48	70	53.34
4002	0.7409	12	45.71	0.00220	0.035	2	3	2 Longleaf pine	47	60	67.54
4003	0.9805	12	41.20	0.00434	0.069	0	33	1 Loblolly pine	36	70	92.60
4004	0.8236	12	34.67	0.00332	0.053	1	7	6 Hardwoods	49	50	71.80
4005	0.2801	12.5	59.50	0.00105	0.017	2	7	6 Hardwoods	61	50	48.17
4006	0.8546	34	66.83	0.00354	0.057	1	7	1 Loblolly pine	46	80	120.08
4007	0.6289	16.5	62.17	0.00375	0.060	0	33	6 Hardwoods	46	70	87.72
4008	0.7869	12.5	36.14	0.00250	0.040	3	3	6 Hardwoods	35	60	51.39
4009	0.8751	43.5	72.40	0.00602	0.096	3	3	2 Longleaf pine	40	80	129.90
4010	0.4140	33	90.57	0.00416	0.067	2	7	1 Loblolly pine	46	80	119.28
4011	0.6814	11	46.00	0.00493	0.079	2	7	6 Hardwoods	41	60	93.75
4012	0.3478	21	56.00	0.00126	0.020	2	7	2 Longleaf pine	43	60	44.06
4013	0.4597	18	63.86	0.00340	0.054	1	7	5 Hdwd-pine mix	57	60	113.14
4014	0.6568	39	78.27	0.00275	0.044	2	7	2 Longleaf pine	41	80	90.00
4015	0.4185	37.5	68.57	0.00228	0.037	2	7	2 Longleaf pine	36	80	55.85
4016	0.6490	42	68.73	0.00446	0.071	2	0.5	2 Longleaf pine	34	80	91.58
4017	0.7480	46	73.62	0.00542	0.087	2	5	2 Longleaf pine	35	80	109.48
4018	0.9216	52	81.31	0.00484	0.078	1	19	1 Loblolly pine	44	80	155.55
4019	0.9044	21	45.41	0.00640	0.103	0	33	1 Loblolly pine	14	80	130.29
4020	0.9417	40	80.50	0.00628	0.101	1	16	3 Slash pine	42	80	178.75
4021	0.9742	14.5	38.20	0.00569	0.091	2	5	1 Loblolly pine	11	70	105.47
4022	0.9434	15	39.73	0.00476	0.076	1	19	1 Loblolly pine	15	70	94.33
4023	0.9768	10	32.36	0.00538	0.086	1	19	1 Loblolly pine	14	70	85.76
4026	0.5894	47	87.60	0.00152	0.024	1	7	1 Loblolly pine	48	90	82.50
4027	0.5917	30	78.50	0.00273	0.044	1	5	4 Pine-hdwd mix	37	90	99.28
4028	0.6921	44	80.55	0.00436	0.070	2	5	3 Slash pine	41	80	95.27
4029	0.6510	47	85.45	0.00183	0.029	1	16	1 Loblolly pine	46	90	92.41
4030	0.5872	48.5	83.10	0.00180	0.029	2	5	1 Loblolly pine	42	80	81.98
4031	0.7685	46	88.27	0.00246	0.039	1	19	1 Loblolly pine	45	90	91.06
4032	0.9833	30.5	72.07	0.00251	0.040	1	19	6 Hardwoods	64	80	139.78
4033	0.9323	10	34.00	0.00457	0.073	0	33	1 Loblolly pine	14	60	84.31
4034	0.8748	32.5	89.36	0.00268	0.043	1	0.5	6 Hardwoods	72	90	145.08

4035	0.6891	29	78.22	0.00273	0.044	3	0.5	4 Pine-hdwd mix	55	80	124.81
4036	0.4698	28	79.00	0.00165	0.026	2	7	1 Loblolly pine	49	80	93.40
4037	0.1915	10	73.67	0.00140	0.022	2	7	3 Slash pine	42	80	71.03
4038	0.6579	11	29.83	0.00245	0.039	3	0.5	6 Hardwoods	39	60	43.32
4039	0.9969	52	81.71	0.00374	0.060	4	0.5	1 Loblolly pine	46	80	150.00
4040	0.6993	45	82.83	0.00202	0.032	3	0.5	1 Loblolly pine	67	80	107.41
4041	0.9040	12	31.38	0.00354	0.057	3	0.5	1 Loblolly pine	46	70	49.07
4042	0.3494	53.5	87.67	0.00093	0.015	3	5	1 Loblolly pine	47	90	45.00
4043	0.6616	42	83.36	0.00258	0.041	1	19	1 Loblolly pine	47	80	91.78
4044	0.2889	10	62.00	0.00177	0.028	1	19	4 Pine-hdwd mix	48	60	68.41
4045	0.8754	34	73.08	0.00508	0.081	1	19	2 Longleaf pine	40	80	126.34
4046	0.5488	28	72.57	0.00235	0.038	2	0.5	4 Pine-hdwd mix	58	80	73.85
4048	0.9221	44.5	87.13	0.00322	0.052	0	33	6 Hardwoods	63	90	173.51
4049	0.4940	42.5	80.50	0.00273	0.044	3	0.5	1 Loblolly pine	44	90	105.00
4050	0.7927	49	82.69	0.00262	0.042	3	0.5	1 Loblolly pine	45	80	101.98
4051	0.9242	31	57.81	0.00497	0.080	4	0.5	1 Loblolly pine	20	80	144.76
4052	0.9717	18	56.60	0.00391	0.063	3	0.5	5 Hdwd-pine mix	54	80	95.85
4053	0.8532	30.5	56.25	0.00356	0.057	1	0.5	1 Loblolly pine	25	70	90.00
4054	0.9043	23.5	52.07	0.00389	0.062	3	5	1 Loblolly pine	24	70	105.00
4055	0.4593	38	77.25	0.00231	0.037	2	6	2 Longleaf pine	38	90	69.79
4056	0.6744	40	64.91	0.00337	0.054	2	6	1 Loblolly pine	43	70	97.50
4057	0.9519	39	71.29	0.00385	0.062	2	2	1 Loblolly pine	26	80	137.57
4058	0.4281	21	56.83	0.00140	0.022	3	2	2 Longleaf pine	47	60	48.12
4059	0.3297	9	79.60	0.00074	0.012	3	0.5	3 Slash pine	41	80	41.52
4060	0.0584	42	72.00	0.00018	0.003	1	16	1 Loblolly pine	2	80	7.50
4061	0.3085	21	80.75	0.00126	0.020	1	16	6 Hardwoods	46	90	54.60
4062	0.9445	45	85.47	0.00624	0.100	3	0.5	1 Loblolly pine	73	80	150.75
4063	0.5809	36.5	70.89	0.00236	0.038	4	0.5	1 Loblolly pine	34	80	82.97
4064	0.7279	47	84.15	0.00397	0.064	4	0.5	2 Longleaf pine	46	90	113.42
4066	0.9899	13	33.85	0.00589	0.094	2	1	1 Loblolly pine	12	80	90.52
4067	0.6973	24	69.43	0.00144	0.023	3	1	6 Hardwoods	54	60	70.64
4069	0.6992	21.5	54.80	0.00198	0.032	2	1	2 Longleaf pine	68	60	62.94

4070	0.6839	29	72.82	0.00228	0.037	3	1	2 Longleaf pine	40	90	94.62
4071	0.6419	10	25.33	0.00193	0.031	4	2	2 Longleaf pine	10	70	33.55
4073	0.6675	41	78.00	0.00484	0.078	2	4	3 Slash pine	41	80	99.72
4076	0.9920	11	34.90	0.00479	0.077	1	2	1 Loblolly pine	12	90	77.31
4077	0.6974	50	79.82	0.00511	0.082	3	0.5	3 Slash pine	44	90	97.50
4078	0.9390	25	56.44	0.00456	0.073	4	0.5	1 Loblolly pine	28	80	148.25
4079	0.9406	36.5	80.00	0.00329	0.053	3	0.5	1 Loblolly pine	31	90	156.78
4080	0.9192	12	33.82	0.00534	0.085	0	33	1 Loblolly pine	13	70	79.18
4081	0.3485	28	82.00	0.00213	0.034	4	1	3 Slash pine	45	80	72.05
4082	0.7088	17.5	61.75	0.00188	0.030	3	2	6 Hardwoods	49	60	100.51
4083	0.7938	8	26.83	0.00176	0.028	3	2	2 Longleaf pine	16	80	36.92
4084	0.9834	10	24.82	0.00339	0.054	3	2	2 Longleaf pine	15	60	56.13
4085	0.7834	3	19.67	0.00110	0.018	2	6	4 Pine-hdwd mix	38	70	20.53
4086	0.7851	34	59.13	0.00411	0.066	1	19	2 Longleaf pine	41	90	87.46
4088	0.5963	35.5	85.60	0.00590	0.094	2	7	3 Slash pine	41	90	147.99
4089	0.5445	11	81.56	0.00278	0.045	2	4	3 Slash pine	41	80	116.79
4091	0.9394	52	94.29	0.00472	0.076	1	16	1 Loblolly pine	45	90	158.05
4092	0.9823	41	82.93	0.00369	0.059	4	2	1 Loblolly pine	44	80	149.03
4093	0.6294	3.5	14.75	0.00161	0.026	4	0.5	2 Longleaf pine	10	80	14.60
4094	0.5862	28	82.89	0.00154	0.025	4	2	2 Longleaf pine	76	70	87.21
4095	0.9263	20.5	42.82	0.00701	0.112	4	0.5	1 Loblolly pine	20	70	141.10
4096	0.6549	53	84.64	0.00243	0.039	3	2	1 Loblolly pine	51	80	95.24
4097	0.6562	41.5	81.09	0.00430	0.069	3	2	3 Slash pine	54	80	104.71
4098	0.6270	16	60.00	0.00274	0.044	2	9	6 Hardwoods	55	60	90.19
4099	0.4251	45.5	83.29	0.00373	0.060	4	0.5	3 Slash pine	40	80	95.92
4100	0.6307	29	63.80	0.00306	0.049	3	2	2 Longleaf pine	46	70	94.73
4101	0.1788	1	9.33	0.00024	0.004	1	31	1 Loblolly pine	3	90	0.98
4102	0.9959	17	41.50	0.00516	0.083	2	15	1 Loblolly pine	12	80	99.33
4103	0.9795	17	53.50	0.00742	0.119	3	8	6 Hardwoods	27	80	87.31
4104	0.6115	19	79.86	0.00213	0.034	1	31	6 Hardwoods	30	100	96.84
4105	0.9124	33	75.15	0.00934	0.150	2	4	6 Hardwoods	30	90	154.94
4106	0.3759	44	75.50	0.00139	0.022	3	3	1 Loblolly pine	47	80	58.13

4107	0.5256	36	78.63	0.00179	0.029	1	2	1 Loblolly pine	31	90	85.47
4109	0.6867	3	12.78	0.00075	0.012	3	2	2 Longleaf pine	8	70	11.72
4110	0.9989	4	21.78	0.00229	0.037	3	2	1 Loblolly pine	10	70	25.77
4111	0.5806	26	83.50	0.00387	0.062	4	2	4 Pine-hdwd mix	51	80	108.56
4112	0.4011	57	91.43	0.00133	0.021	2	9	1 Loblolly pine	44	90	58.20
4113	0.6358	49.5	83.50	0.00396	0.063	2	9	2 Longleaf pine	51	80	99.98
4115	0.9100	14	39.73	0.00522	0.084	3	2	6 Hardwoods	43	70	93.75
4116	0.6733	37	72.78	0.00506	0.081	1	8	2 Longleaf pine	49	80	102.74
4117	0.9877	13	35.27	0.00582	0.093	0	33	1 Loblolly pine	12	80	95.83
4118	0.2911	30	72.40	0.00170	0.027	1	1	1 Loblolly pine	52	70	82.97
4119	0.7135	17	64.86	0.00209	0.034	1	1	4 Pine-hdwd mix	25	80	74.60
4122	0.9078	5	16.10	0.00554	0.089	2	1	1 Loblolly pine	9	100	41.27
4123	0.7727	54	91.31	0.00553	0.089	2	1	3 Slash pine	44	90	135.00
4124	0.9172	22	49.11	0.00621	0.099	0	33	1 Loblolly pine	17	80	147.73
4125	0.6825	46	78.18	0.00409	0.066	1	9	3 Slash pine	43	90	95.24
4128	0.7771	21.5	61.71	0.00244	0.039	1	20	6 Hardwoods	60	60	70.85
4130	0.3727	28	71.50	0.00137	0.022	3	2	2 Longleaf pine	50	80	52.54
4131	0.7244	6	21.25	0.00220	0.035	3	0.5	4 Pine-hdwd mix	12	80	31.70
4132	0.2778	3	10.90	0.00124	0.020	1	8	3 Slash pine	4	80	7.39
4135	0.6147	59	89.45	0.00190	0.030	1	1	1 Loblolly pine	47	90	92.95
4136	0.2211	3	10.00	0.00070	0.011	1	29	1 Loblolly pine	5	80	3.04
4137	0.5789	1.5	10.88	0.00130	0.021	1	29	1 Loblolly pine	4	80	6.64
4138	0.7087	46	80.27	0.00469	0.075	2	2	3 Slash pine	44	80	131.23
4139	0.7247	66	95.46	0.00230	0.037	2	2	1 Loblolly pine	56	90	112.18
4140	0.9920	4	13.81	0.00304	0.049	1	20	2 Longleaf pine	5	70	30.21
4141	0.9317	53	84.27	0.00629	0.101	1	10	3 Slash pine	44	80	139.19
4142	0.4028	33.5	56.83	0.00175	0.028	0	33	1 Loblolly pine	28	70	45.00
4143	0.9299	5	19.17	0.00201	0.032	1	9	2 Longleaf pine	12	80	35.73
4144	0.9995	15.5	44.86	0.00558	0.089	1	18	1 Loblolly pine	18	80	130.20
4147	0.7306	48	93.67	0.00316	0.051	3	2	1 Loblolly pine	51	100	126.72
4148	0.6904	26	80.18	0.00277	0.044	0	33	3 Slash pine	44	80	107.90
4151	0.6743	18.5	83.09	0.00164	0.026	0	33	1 Loblolly pine	35	100	134.33

4152	0.9248	34	60.44	0.00498	0.080	2	1	1 Loblolly pine	20	90	142.67
4153	0.9660	31.5	57.28	0.00535	0.086	1	29	1 Loblolly pine	25	80	149.01
4154	0.8084	57	100.36	0.00212	0.034	2	4	1 Loblolly pine	49	100	132.72
4155	0.6695	46.5	77.45	0.00341	0.055	2	4	1 Loblolly pine	43	80	100.24
4156	0.9463	3	11.29	0.00368	0.059	2	2	1 Loblolly pine	6	80	19.57
4157	0.9712	18	35.94	0.00805	0.129	2	2	1 Loblolly pine	16	70	127.21
4158	0.6102	41	72.70	0.00281	0.045	1	10	1 Loblolly pine	40	80	85.84
4159	0.3030	22	80.80	0.00108	0.017	0	33	5 Hdwd-pine mix	70	80	94.21
4161	0.3940	17	51.20	0.00229	0.037	2	9	6 Hardwoods	43	60	51.89
4162	0.9234	21	65.91	0.00426	0.068	2	9	6 Hardwoods	39	80	106.67
4164	0.2398	0	11.50	0.00001	0.000	5	2	2 Longleaf pine	8	100	0.88
4165	0.6429	49	78.64	0.00378	0.061	1	10	3 Slash pine	44	80	98.23
4166	0.9130	19.5	44.94	0.00559	0.090	1	10	1 Loblolly pine	16	90	135.03
4167	0.5730	19.5	62.50	0.00246	0.039	0	33	6 Hardwoods	57	60	70.77
4168	0.6851	32.5	64.00	0.00292	0.047	1	30	1 Loblolly pine	23	90	102.36
4169	0.9267	12	38.08	0.00488	0.078	1	14	1 Loblolly pine	11	80	92.11
4171	0.9508	49.5	91.18	0.00390	0.062	1	13	6 Hardwoods	59	90	187.98
4172	0.5211	33.5	82.38	0.00240	0.038	1	4	1 Loblolly pine	52	80	96.73
4173	0.9670	34.5	57.19	0.00496	0.079	2	4	1 Loblolly pine	19	90	129.51
4174	0.7422	38	75.08	0.00459	0.073	2	2	3 Slash pine	44	70	140.76
4177	0.4194	36	62.83	0.00376	0.060	2	10	3 Slash pine	44	70	75.48
4178	0.8257	48.5	83.50	0.00675	0.108	1	1	1 Loblolly pine	53	80	145.12
4182	0.9810	45	66.15	0.00557	0.089	4	2	3 Slash pine	50	90	94.59
4183	0.7590	36	89.67	0.00325	0.052	3	2	1 Loblolly pine	49	90	148.69
4184	0.5828	1	9.00	0.00039	0.006	3	2	2 Longleaf pine	8	80	5.57
4185	0.9966	16.5	38.38	0.00593	0.095	1	17	1 Loblolly pine	15	70	96.39
4186	0.9872	5	15.64	0.00310	0.050	2	2	2 Longleaf pine	6	80	31.18
4187	0.6747	8	38.00	0.00211	0.034	1	20	1 Loblolly pine	16	90	60.52
4188	0.9305	11.5	30.33	0.00451	0.072	0	33	1 Loblolly pine	12	80	68.48
4189	0.4441	33	74.00	0.00249	0.040	1	10	1 Loblolly pine	47	70	109.95
4190	0.4333	15	37.50	0.00279	0.045	1	14	6 Hardwoods	0	90	15.79
4191	0.8250	36	85.62	0.00527	0.084	1	14	3 Slash pine	43	90	134.22

4192	0.9996	42	72.56	0.00646	0.104	0	33	1 Loblolly pine	25	90	154.24
4193	0.9871	27.5	72.55	0.01052	0.169	0	33	6 Hardwoods	50	80	105.00
4194	0.8007	46.5	101.54	0.00643	0.103	0	33	4 Pine-hdwd mix	79	90	153.28
4196	0.7358	28	85.13	0.00387	0.062	1	14	5 Hdwd-pine mix	62	90	87.30
4197	0.9477	43	103.93	0.00282	0.045	0	33	6 Hardwoods	57	100	152.22
4199	0.5868	14	36.33	0.00282	0.045	1	17	1 Loblolly pine	12	80	49.10
4200	0.7021	30.5	53.70	0.00342	0.055	3	1	1 Loblolly pine	24	80	88.32
4201	0.8773	49	82.07	0.00560	0.090	1	6	3 Slash pine	38	90	149.98
4202	0.6779	16	43.40	0.00421	0.067	0	33	1 Loblolly pine	43	60	106.36
4203	0.9618	9	30.40	0.00606	0.097	0	33	1 Loblolly pine	12	70	77.99
4204	0.8996	45.5	100.93	0.00311	0.050	0	33	1 Loblolly pine	60	100	165.74
4205	0.9137	36	71.33	0.00762	0.122	0	33	6 Hardwoods	48	90	93.32
4206	0.9558	17.5	42.42	0.00741	0.119	1	17	1 Loblolly pine	15	70	152.22
4207	0.4056	16	84.00	0.00192	0.031	0	33	5 Hdwd-pine mix	55	80	90.56
4208	0.9797	15	37.25	0.00591	0.095	0	33	1 Loblolly pine	15	80	101.48
4209	0.6613	21.5	75.56	0.00172	0.028	1	20	4 Pine-hdwd mix	43	80	76.91
4211	0.9284	23	55.87	0.00389	0.062	1	10	1 Loblolly pine	21	80	130.44
4212	0.4206	50	78.86	0.00213	0.034	1	10	1 Loblolly pine	42	80	56.98
4215	0.7889	36.5	79.63	0.00248	0.040	1	14	6 Hardwoods	44	80	73.04
4217	0.8061	52	86.57	0.00386	0.062	0	33	1 Loblolly pine	52	80	137.66
4218	0.6867	44.5	90.00	0.00585	0.094	0	33	4 Pine-hdwd mix	70	90	118.89
4219	0.9240	42	93.50	0.00452	0.072	1	1	1 Loblolly pine	49	90	172.50
4220	0.9349	18	42.73	0.00511	0.082	1	17	1 Loblolly pine	12	80	97.20
4221	0.9467	27.5	54.95	0.00718	0.115	1	17	1 Loblolly pine	24	80	184.35
4222	0.9242	49.5	79.06	0.00418	0.067	2	7	1 Loblolly pine	24	100	173.35
4223	0.9702	49	90.48	0.00479	0.077	0	33	7 Cypress-Tupelo	75	90	234.61
4224	0.7405	28	70.00	0.00449	0.072	1	1	1 Loblolly pine	40	80	115.55
4225	0.6734	59	98.92	0.00141	0.023	1	0.5	1 Loblolly pine	53	90	94.73
4227	0.6730	14	70.29	0.00324	0.052	1	3	6 Hardwoods	53	70	89.30
4228	0.6075	34	97.38	0.00210	0.034	0	33	5 Hdwd-pine mix	88	90	98.04
4229	0.4778	41	91.71	0.00302	0.048	0	33	4 Pine-hdwd mix	59	90	103.51
4231	0.7220	14.5	57.00	0.00330	0.053	0	33	6 Hardwoods	35	80	49.06

4232	0.9528	26	54.53	0.00562	0.090	1	20	1 Loblolly pine	17	90	144.52
4234	0.8680	4	13.86	0.00412	0.066	1	15	1 Loblolly pine	5	70	24.60
4235	0.9514	11	36.33	0.00402	0.064	1	10	1 Loblolly pine	12	80	85.86
4236	0.8546	40.5	80.64	0.00821	0.132	1	10	5 Hdwd-pine mix	57	80	112.90
4237	0.4855	7	68.29	0.00105	0.017	0	33	2 Longleaf pine	45	70	62.98
4239	0.2042	25	60.00	0.00112	0.018	0	33	1 Loblolly pine	22	80	37.32
4240	0.9813	38	63.60	0.00415	0.066	0	33	1 Loblolly pine	23	90	129.37
4243	0.7671	44	91.50	0.00353	0.057	1	1	6 Hardwoods	85	90	198.86
4244	0.7202	39	62.73	0.00303	0.048	3	0.5	1 Loblolly pine	24	90	83.71
4245	0.6527	54	85.09	0.00640	0.102	3	0.5	3 Slash pine	45	90	94.13
4246	0.9773	11	41.09	0.00423	0.068	1	17	1 Loblolly pine	14	90	89.71
4247	0.8196	55	96.21	0.00213	0.034	1	5	1 Loblolly pine	58	90	124.73
4248	0.5502	44.5	82.78	0.00495	0.079	2	3	3 Slash pine	41	80	86.89
4249	0.6975	26	74.00	0.00168	0.027	2	3	6 Hardwoods	39	80	75.59
4250	0.7890	16.5	42.63	0.00406	0.065	2	1	1 Loblolly pine	13	70	84.61
4252	0.9904	16	36.83	0.00534	0.086	4	0.5	1 Loblolly pine	12	90	82.90
4254	0.9006	17	43.38	0.00722	0.116	1	20	1 Loblolly pine	19	80	149.72
4255	0.8865	41	94.77	0.00181	0.029	0	33	6 Hardwoods	46	90	123.93
4259	0.9901	13	36.58	0.00595	0.095	1	23	1 Loblolly pine	10	90	100.08
4260	0.9048	28	59.41	0.00617	0.099	1	15	1 Loblolly pine	21	90	165.05
4261	0.4865	21.5	86.13	0.00262	0.042	1	15	3 Slash pine	43	90	101.62
4263	0.9625	38	65.13	0.00437	0.070	1	10	1 Loblolly pine	23	90	142.27
4264	0.6516	27	79.33	0.00769	0.123	0	33	2 Longleaf pine	74	70	114.51
4265	0.7578	50	88.08	0.00563	0.090	2	10	3 Slash pine	44	80	150.98
4268	0.3715	42.5	78.67	0.00270	0.043	2	3	3 Slash pine	44	80	73.69
4269	0.4528	48	84.75	0.00377	0.060	2	3	3 Slash pine	43	80	78.61
4273	0.5744	63	100.20	0.00152	0.024	2	1	1 Loblolly pine	42	100	80.70
4274	0.7856	7	28.17	0.00398	0.064	1	13	1 Loblolly pine	10	80	52.48
4275	0.7367	51	88.00	0.00350	0.056	2	3	1 Loblolly pine	42	90	122.72
4276	0.3636	39	81.83	0.00275	0.044	4	3	1 Loblolly pine	40	80	80.84
4277	0.9959	16	40.73	0.00521	0.084	2	8	1 Loblolly pine	12	80	106.54
4278	0.3734	35	74.17	0.00163	0.026	1	8	2 Longleaf pine	43	80	53.05

4281	0.9315	25.5	58.00	0.00432	0.069	0	33	1 Loblolly pine	17	100	134.00
4283	0.7227	57.5	86.54	0.00321	0.051	1	21	1 Loblolly pine	51	90	128.02
4284	0.6707	14	58.83	0.00134	0.021	0	33	6 Hardwoods	37	90	78.81
4285	0.5091	41	83.63	0.00216	0.035	1	23	3 Slash pine	45	90	73.75
4286	0.5968	13.5	72.67	0.00193	0.031	1	23	6 Hardwoods	57	60	90.78
4287	0.6243	25.5	67.20	0.00218	0.035	1	15	2 Longleaf pine	56	60	93.17
4288	0.7498	20	54.89	0.00283	0.045	2	15	1 Loblolly pine	23	90	87.56
4289	0.6521	52	79.75	0.00643	0.103	2	10	2 Longleaf pine	52	80	127.50
4290	0.8391	59	116.47	0.00378	0.061	1	10	1 Loblolly pine	58	110	217.40
4291	0.5343	40	89.00	0.00326	0.052	2	10	3 Slash pine	45	90	131.02
4293	0.6234	17	47.50	0.00358	0.057	2	3	1 Loblolly pine	29	70	93.63
4294	0.6278	46	80.55	0.00290	0.046	1	3	2 Longleaf pine	44	80	82.50
4295	0.3213	17	77.80	0.00156	0.025	2	5	3 Slash pine	41	90	72.82
4296	0.4838	8.5	83.00	0.00122	0.020	2	5	3 Slash pine	42	90	93.34
4297	0.9090	44	78.00	0.00752	0.121	3	1	2 Longleaf pine	55	70	212.04
4298	0.9025	37	60.93	0.00497	0.080	3	2	1 Loblolly pine	16	80	139.73
4299	0.4088	7.5	19.00	0.00130	0.021	2	2	2 Longleaf pine	8	80	20.63
4300	0.7916	51	100.36	0.00219	0.035	3	4	1 Loblolly pine	62	90	140.57
4301	0.4093	41	82.43	0.00148	0.024	2	4	2 Longleaf pine	42	80	52.50
4302	0.5078	50	85.33	0.00214	0.034	2	8	2 Longleaf pine	47	80	75.04
4303	0.4980	44	89.89	0.00212	0.034	2	8	2 Longleaf pine	46	80	87.53
4304	0.6295	49	93.27	0.00261	0.042	1	8	1 Loblolly pine	45	100	136.41
4306	0.5111	36	88.67	0.00234	0.038	0	33	6 Hardwoods	40	80	155.75
4309	0.4666	37	101.88	0.00098	0.016	1	27	1 Loblolly pine	47	100	83.11
4311	0.5044	35.5	82.00	0.00496	0.079	1	17	3 Slash pine	51	80	105.25
4313	0.9514	52	83.50	0.00562	0.090	1	23	1 Loblolly pine	49	80	177.08
4314	0.5529	28	76.44	0.00345	0.055	1	13	3 Slash pine	42	80	115.08
4315	0.4504	18	50.83	0.00155	0.025	1	10	1 Loblolly pine	20	70	52.89
4316	0.5140	60	97.44	0.00178	0.028	2	10	1 Loblolly pine	49	100	87.82
4318	0.3958	49	79.00	0.00224	0.036	1	3	2 Longleaf pine	41	90	52.50
4319	0.1802	43.5	82.67	0.00151	0.024	1	3	2 Longleaf pine	45	90	45.00
4321	0.9934	28	45.53	0.00821	0.131	2	5	1 Loblolly pine	17	80	178.35

4322	0.9106	24	44.92	0.00536	0.086	2	5	1 Loblolly pine	17	90	106.97
4323	0.5142	21	90.00	0.00117	0.019	2	2	1 Loblolly pine	44	90	100.71
4324	0.3626	6	15.60	0.00105	0.017	2	2	2 Longleaf pine	8	80	13.96
4325	0.5195	53	84.11	0.00138	0.022	3	0.5	1 Loblolly pine	42	90	67.50
4326	0.5226	37	77.11	0.00232	0.037	3	4	2 Longleaf pine	42	80	77.38
4327	0.8759	25	78.50	0.00487	0.078	3	0.5	1 Loblolly pine	59	80	126.04
4329	0.7230	35.5	70.82	0.00692	0.111	1	9	2 Longleaf pine	48	70	119.01
4330	0.4337	5	27.83	0.00133	0.021	1	9	4 Pine-hdwd mix	3	80	20.48
4339	0.5778	55	89.10	0.00600	0.096	1	1	3 Slash pine	51	90	134.01
4341	0.6149	45	82.60	0.00423	0.068	4	5	5 Hdwd-pine mix	48	90	106.21
4342	0.6504	41.5	81.45	0.00459	0.074	2	10	2 Longleaf pine	44	90	117.78
4344	0.5540	48	82.60	0.00275	0.044	1	3	2 Longleaf pine	41	90	75.00
4345	0.4584	49	80.13	0.00286	0.046	2	3	2 Longleaf pine	41	90	67.50
4346	0.5882	9	37.00	0.00283	0.045	1	1	1 Loblolly pine	11	70	72.10
4347	0.4649	50.5	88.63	0.00294	0.047	2	3	3 Slash pine	43	90	71.10
4349	0.3887	48	81.57	0.00233	0.037	3	5	2 Longleaf pine	44	80	60.95
4351	0.5605	46	79.50	0.00246	0.039	3	0.5	2 Longleaf pine	50	80	75.00
4352	0.6717	51.5	85.08	0.00251	0.040	3	5	1 Loblolly pine	39	90	90.00
4353	0.3434	17	67.75	0.00128	0.021	4	0.5	2 Longleaf pine	88	50	48.48
4354	0.9173	50	79.44	0.00364	0.058	4	0.5	1 Loblolly pine	40	90	120.00
4355	0.2519	34	75.50	0.00099	0.016	0	33	2 Longleaf pine	44	80	35.89
4356	0.9467	11	32.36	0.00283	0.045	3	0.5	1 Loblolly pine	14	70	59.97
4357	0.9398	25	91.64	0.00493	0.079	0	33	6 Hardwoods	66	90	131.47
4359	0.4078	35	110.67	0.00201	0.032	0	33	6 Hardwoods	75	90	84.23
4361	0.8185	78	111.13	0.00215	0.034	3	0.5	1 Loblolly pine	49	110	120.75
4364	0.4388	53	83.13	0.00279	0.045	2	0.5	2 Longleaf pine	43	80	60.00
4366	0.7623	39.5	83.11	0.00851	0.136	1	21	1 Loblolly pine	60	90	125.99
4367	0.4857	57	80.50	0.00269	0.043	3	5	1 Loblolly pine	45	90	69.98
4368	0.7757	46	85.46	0.00238	0.038	1	20	1 Loblolly pine	46	80	124.78
4370	0.3435	37.5	79.83	0.00191	0.031	1	3	2 Longleaf pine	41	80	61.29
4371	0.4394	49	83.38	0.00261	0.042	1	3	2 Longleaf pine	43	80	67.50
4372	0.3066	15	69.33	0.00373	0.060	0	33	6 Hardwoods	63	60	67.55

4374	0.9418	7	24.89	0.00307	0.049	1	24	2 Longleaf pine	11	70	54.11
4375	0.5199	39.5	76.22	0.00276	0.044	2	0.5	2 Longleaf pine	40	80	84.90
4376	0.6379	22	49.00	0.00297	0.048	3	0.5	1 Loblolly pine	19	80	83.86
4377	0.6931	45	92.00	0.00214	0.034	4	0.5	4 Pine-hdwd mix	60	90	106.16
4378	0.4276	31	79.57	0.00162	0.026	4	0.5	1 Loblolly pine	40	90	84.01
4380	0.3892	6	53.80	0.00110	0.018	2	3	2 Longleaf pine	40	60	48.43
4381	0.8040	13	102.07	0.00111	0.018	0	33	1 Loblolly pine	42	110	131.42
4382	0.9441	35	100.85	0.00347	0.056	0	33	6 Hardwoods	95	90	145.47
4388	0.7772	51	89.71	0.00555	0.089	2	0.5	2 Longleaf pine	45	90	155.83
4389	0.4075	41	89.88	0.00217	0.035	2	6	1 Loblolly pine	100	95	102.98
4390	0.4588	41	95.13	0.00208	0.033	4	6	1 Loblolly pine	50	100	127.06
4391	0.4796	59	97.33	0.00373	0.060	2	6	3 Slash pine	51	90	103.10
4393	0.7603	47	84.83	0.00442	0.071	1	21	3 Slash pine	44	90	129.13
4395	0.7019	67	120.69	0.00210	0.034	1	3	1 Loblolly pine	71	110	148.86
4396	0.5645	50.5	80.70	0.00330	0.053	3	3	2 Longleaf pine	80	70	87.48
4397	0.8388	17	48.90	0.00494	0.079	2	6	1 Loblolly pine	22	70	110.23
4398	0.7860	40.5	65.58	0.00304	0.049	1	6	1 Loblolly pine	22	100	95.53
4399	0.9434	17	44.20	0.00429	0.069	2	6	1 Loblolly pine	12	60	108.24
4400	0.9455	9	25.86	0.00253	0.041	3	0.5	2 Longleaf pine	10	80	38.83
4401	0.9260	7	19.91	0.00169	0.027	2	3	2 Longleaf pine	10	80	39.05
4402	0.9823	6	25.80	0.00363	0.058	2	3	2 Longleaf pine	10	80	44.17
4403	0.9303	15	40.90	0.00431	0.069	0	33	1 Loblolly pine	12	70	83.87
4407	0.4346	29	87.86	0.00217	0.035	0	33	6 Hardwoods	56	70	99.89
4411	0.7722	21.5	54.40	0.00322	0.052	1	6	1 Loblolly pine	16	100	83.56
4412	0.7924	43	94.20	0.00613	0.098	1	6	6 Hardwoods	56	90	118.90
4413	0.6432	26	83.22	0.00329	0.053	1	6	6 Hardwoods	66	80	183.35
4416	0.6621	30	94.43	0.00252	0.040	0	33	6 Hardwoods	56	90	94.94
4417	0.5202	42	79.00	0.00223	0.036	3	3	2 Longleaf pine	42	90	67.50
4418	0.4067	41	98.71	0.00213	0.034	3	3	1 Loblolly pine	90	95	109.89
4420	0.7615	55	90.38	0.00257	0.041	3	3	1 Loblolly pine	48	98	130.12
4421	0.7500	46	88.62	0.00281	0.045	2	3	2 Longleaf pine	58	80	115.85
4422	0.4600	25.5	63.17	0.00138	0.022	2	3	4 Pine-hdwd mix	44	70	45.00

4429	0.9841	20	45.06	0.00878	0.141	2	6	1 Loblolly pine	15	80	136.98
4430	0.5558	25.5	83.44	0.00256	0.041	2	6	3 Slash pine	52	90	88.05
4433	0.5817	29	75.25	0.00291	0.047	3	10	6 Hardwoods	38	80	100.44
4435	0.9273	6	26.13	0.00302	0.048	0	33	2 Longleaf pine	80	80	61.47
4436	0.9906	16	67.17	0.00772	0.124	2	3	6 Hardwoods	64	80	165.27
4437	0.4098	46.5	91.29	0.00132	0.021	3	3	1 Loblolly pine	48	90	75.33
4438	0.9933	19	52.78	0.00413	0.066	3	3	6 Hardwoods	20	90	85.09
4443	0.5398	60	105.71	0.00475	0.076	0	33	7 Cypress-Tupelo	199	60	313.75
4446	0.9546	35	109.71	0.00430	0.069	1	6	6 Hardwoods	78	100	203.62
4447	0.4424	46.5	91.67	0.00404	0.065	3	10	5 Hdwd-pine mix	50	90	69.86
4448	0.8492	28	67.00	0.00557	0.089	3	10	1 Loblolly pine	42	80	112.62
4451	0.9920	46	81.80	0.02152	0.345	3	3	5 Hdwd-pine mix	42	90	127.50
4459	0.7455	45	86.08	0.00303	0.049	2	10	2 Longleaf pine	44	90	99.50
4461	0.2875	44	89.40	0.00104	0.017	0	33	2 Longleaf pine	43	90	37.50
4466	0.8194	43	112.50	0.00218	0.035	0	33	4 Pine-hdwd mix	80	110	157.20
4467	0.5154	46	79.00	0.00290	0.046	0	33	1 Loblolly pine	42	80	112.23
4472	0.6187	45	100.00	0.00184	0.029	0	33	1 Loblolly pine	46	100	119.24
4473	0.7847	49	91.78	0.00495	0.079	0	33	7 Cypress-Tupelo	80	80	290.37
4475	0.5513	39	89.00	0.00450	0.072	2	6	6 Hardwoods	57	80	124.59
4476	0.8713	48.5	103.83	0.00386	0.062	1	6	6 Hardwoods	67	95	138.16
4477	0.5506	27	83.00	0.00364	0.058	3	10	6 Hardwoods	38	90	111.86
4478	0.5197	26.5	74.60	0.00170	0.027	0	33	5 Hdwd-pine mix	42	80	38.05
4479	0.5854	49.5	80.20	0.00212	0.034	1	10	1 Loblolly pine	40	80	89.15
4481	0.5582	16	61.75	0.00239	0.038	1	30	1 Loblolly pine	23	80	90.69
4482	0.9962	20.5	50.50	0.00416	0.067	1	14	1 Loblolly pine	25	70	113.32
4483	0.4765	29.5	62.00	0.00258	0.041	0	33	6 Hardwoods	2	80	37.83
4484	0.5267	50	86.33	0.00196	0.031	1	1	1 Loblolly pine	40	90	93.03
4486	0.9145	11	39.33	0.00626	0.100	1	2	1 Loblolly pine	12	90	118.76
4487	0.4185	13	82.86	0.00107	0.017	3	2	3 Slash pine	44	80	62.72
4488	0.9177	3	11.75	0.00236	0.038	1	10	2 Longleaf pine	6	70	22.39
4490	0.2490	16.5	68.75	0.00288	0.046	0	33	1 Loblolly pine	47	70	83.27
4491	0.4590	42	77.75	0.00181	0.029	2	5	2 Longleaf pine	43	80	60.00

4492	0.9901	6	19.89	0.00223	0.036	2	6	2 Longleaf pine	11	60	39.59
4493	0.3668	30.5	72.67	0.00193	0.031	2	3	2 Longleaf pine	64	60	56.06
4494	0.9138	44	85.00	0.00359	0.058	2	4	1 Loblolly pine	42	90	144.14
4496	0.4209	40	71.71	0.00208	0.033	5	2	2 Longleaf pine	40	80	52.50
4497	0.8075	53	89.36	0.00226	0.036	4	0.5	1 Loblolly pine	47	90	118.24
4498	0.4845	22	43.33	0.00248	0.040	3	5	1 Loblolly pine	24	60	47.75
4499	0.6290	47	97.55	0.00189	0.030	3	1	1 Loblolly pine	46	90	141.20
4500	0.6143	33	73.30	0.00226	0.036	4	2	2 Longleaf pine	42	80	75.00
4501	0.9288	12	33.20	0.00718	0.115	1	3	1 Loblolly pine	13	70	114.74
4502	0.8385	47	92.27	0.00413	0.066	0	33	6 Hardwoods	66	90	238.66
4503	0.8938	14	35.00	0.00410	0.066	2	6	1 Loblolly pine	15	80	69.44
4504	0.8927	35	63.46	0.00404	0.065	0	33	1 Loblolly pine	22	80	124.34
4505	0.8167	60	93.79	0.00724	0.116	1	8	3 Slash pine	62	90	169.63
4506	0.9007	23	42.80	0.00670	0.107	4	0.5	1 Loblolly pine	20	70	128.42
4508	0.9330	18	39.40	0.00412	0.066	3	0.5	1 Loblolly pine	14	70	71.24
4510	0.6757	28	79.60	0.00153	0.025	1	20	6 Hardwoods	58	80	139.65