

Plot-level Biomass and Inventory Estimations

TIER III Dataset

Carlos A. Gonzalez

For all plots in Tier3 dataset, above-ground biomass (foliage, branch, bark, stemwood) was calculated using the general functions reported in Gonzalez-Benecke et al. (2014). Coarse root biomass was calculated using the unpublished function that correlates root/woody biomass ratio (RFRAC) to tree age. This function, that estimated a root fraction of about 25% for mature stands, was discussed with Harold Burkhart and we agreed to use it. Site index was calculated using the function reported in Diéguez-Aranda et al. (2006). Stem volume was calculated using the function of Van Deusen et al. (1981).

Functions used to estimate biomass (kg):

$$\text{FOL} = 3.746583 * (\text{dbh}^{**0.883835}) * (\exp(0.062461 * \text{dbh})) * (\text{Ht}^{**-0.284381}) * (\text{Age}^{**-0.413381}) * (\text{Nha}^{**-0.212743}) * (\text{Dp}^{**0.174500})$$

$$\text{BRANCH} = 0.001568 * (\text{dbh}^{**2.119937}) * (\exp(0.040940 * \text{dbh})) * (\text{Ht}^{**0.667628}) * (\text{Age}^{**-0.352632}) * (\text{Nha}^{**0.414580}) * (\text{BA}^{**-0.511470})$$

$$\text{BOLE} = 0.088273 * (\text{dbh}^{**1.497337}) * (\text{Ht}^{**1.462580}) * (\text{Age}^{**-0.160971}) * (\text{Nha}^{**-0.160969}) * (\text{Dp}^{**0.383145})$$

$$\text{TAGB} = 0.347585 * (\text{dbh}^{**1.515726}) * (\text{Ht}^{**1.179694}) * (\text{Age}^{**-0.183786}) * (\text{Nha}^{**-0.214381}) * (\text{Dp}^{**0.591226})$$

$$\text{BFRAC} = \exp(-0.765819 + -0.165263 * \log(\text{Ht} * (\text{dbh}^{**2}))) + 0.117441 * \text{Dp}$$

$$\text{WOOD} = (1 - \text{BFRAC}) * \text{BOLE};$$

$$\text{BARK} = \text{BOLE} - \text{WOOD};$$

$$\text{RFRAC} = 0.2479 + (1.8022 - 0.2479) * \exp(-\log(2) * (\text{Age} / 3.0224))^{**2}$$

$$\text{ROOT} = \text{RFRAC} * \text{BOLE}$$

DBH, Ht, Nha, BA, Dp : in metric units

Bole=Bark + Wood

BFRAC= Ratio of Bark to Bole

RFRAC= Ratio of Root to Bole (unpublished)

For each plot and measurement, peak annual projected Leaf area Index (LAI, m² m⁻²) was calculated using two alternative models (called LAI1 and LAI2).

LAI1 was calculated from a function developed by researchers at VT (unpublished):

$$\text{LAI1} = (\text{SIft}^{**0.3326}) * \exp(-45.15 / \text{BAft}^2). \text{ Note that SIft and BAft}^2 \text{ are SI and BA in English units}$$

LAI2 was calculated using a function reported in Gonzalez-Benecke et al. (2012).

References:

- Diéguez-Aranda, U., H.E. Burkhart and R.L. Amateis. 2006. Dynamic site model for loblolly pine (*Pinus taeda* L.) plantations in the United States. *For. Sci.* 52:262-272.
- Gonzalez-Benecke, C.A., E.J. Jokela, and T.A. Martin. 2012. Modeling the effects of stand development, site quality, and silviculture on leaf area index, litterfall, and forest floor accumulation in loblolly and slash pine plantations, *For. Sci.* 58: 457-471.
- Gonzalez-Benecke, C.A., S.A. Gezan, T.J. Albaugh, H.L. Allen, H.E. Burkhart, T.R. Fox, E.J. Jokela, C.A. Maier, T.A. Martin, R.A. Rubilar, and L.J. Samuelson. 2014. Local and general above-stump biomass functions for loblolly and slash pine trees. *For. Ecol. Manage.* *in press*. doi: 10.1016/j.foreco.2014.09.002
- Van Deusen, P. C., A. D. Sullivan and T. G. Matney. 1981. A prediction system for cubic foot volume of loblolly pine applicable through much of its range. *South. J. Appl. For.* 5:186-189.

List of Variables in file:

StudyID	Study Name code
Age	Age at measurement time
REP	Replicate (block)
TRT	Treatment Code
LONG_WGS84	Longitude in WGS84 format (decimal)
LAT_WGS84	Latitude in WGS84 format (decimal)
Day	Day of the month of measurement
Month	Month of measurement
Year	Year of measurement
DBH	Average dbh (cm)
Ht	Average height (m)
BA	Basal area (m ² /ha)
Nha	Trees per hectare (ha ⁻¹)
Dq	Quadratic mean diameter (cm)
SDI	Stand Density Index (ha ⁻¹)
VOB	Stem volume over bark at Age1 (m ³ /ha)
VIB	Stem volume inside bark at Age1 (m ³ /ha)
Hdom	Dominant Height (m)
SI	Site Index (m)
LAI1	Peak LAI on measurement year using model 1
LAI2	Peak LAI on measurement year using model 2
FOL	Foliage Biomass (Mg/ha)
BRANCH	Branch Biomass (Mg/ha)
BOLE	Stemwood + Bark Biomass (Mg/ha)
TAGB	Total aboveground Biomass (Mg/ha; FOL + BRANCH + BOLE)
BARK	Bark Biomass (Mg/ha)
ROOT	Coarse Root Biomass (Mg/ha)
Contact	PI to be contacted regarding authorship when data are used