ForSite Specification for Estimating Biomass Fractions

User input
Output from GROWFOR is assumed as input to ForSite. This is the responsibility of the user.

Mean dbh[1] at clearfell	cm
Age at clearfell	year
Stemwood overbark volume to 7 cm top diameter	m^3/year

ForSite calculation of biomass fractions
Density estimation from Johnson *et al.*, 2015a; supplementary data to Johnson *et al.*, 2015b:

Stemwood density = 400	kg/m^3
Stem biomass = stem volume × 400	kg/ha

Equations for estimating biomass fractions are from McKay *et al.,* (2003) Appendix 3. These use mean dbh as inputs, and are all applicable for spruces.

Crown biomass = $0.00607220 + 0.00000958.DBH^{2.55784701}$	kg/(ha year)
Needle biomass = $0.22264859 - 0.22264859 \times (0.23934263^{drycrown})$	kg/(ha year)
Dry-branch biomass = Crown biomass – Leaf biomass	kg/(ha year)
Needle mass = $0.19823116 - 0.19823116*(0.10566005^{drybranch})$	kg/(ha year)
Root biomass = $0.00001115 \times dbh^{2.68358135}$	kg/(ha year)
Biomass removal rate = rotation-age biomass / rotation age	kg/(ha year)

Parameters are given by McKay *et* al. for Sitka spruce, Norway spruce, Douglas fir and lodgepole pine (may be used by ForSite), and for trees < 7 cm (not used by ForSite). Stembark estimation, and these other fractions excepting root biomass, are also available from Johnson *et al.*, 2015b.

References
Johnson, Jim, Thomas Cummins and Julian Aherne. 2015. Critical loads and nitrogen availability under deposition and harvest scenarios for conifer forests in Irealand. Science of the Total Environment. http://dx.doi.org/10.1016/j.scitotenv.2015.08.140
Johnson, Jim, Julian Aherne and Thomas Cummins. 2015. Base cation budgets under residue removal in temperate maritime plantation forests. Forest Ecology and Management 343 (2015) 144–156. http://dx.doi.org/10.1016/j.foreco.2015.01.022 http://www.sciencedirect.com/science/article/pii/S0378112715000419#m0005 (supplementary data)
McKay, H., J.B. Hudson, R.J. Hudson (2003) Appendix 3, 4 & 5 in: WOODFUEL RESOURCE IN BRITAIN: APPENDICES FES B/W3/00787/REP/2 DTI/Pub URN 03/1436
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[1] Mean dbh is quadratic mean, the square root of the mean of the sum of squared dbh values.