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Biomass and Stem Volume Equations for Tree Species in Europe

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Abstract

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A review of stem volume and biomass equations for tree species growing in Europe is presented. The mathematical forms of the empirical models, the associated statistical parameters and information about the size of the trees and the country of origin were collated from scientific articles and from technical reports. The total number of the compiled equations for biomass estimation was 607 and for stem volume prediction it was 230. The analysis indicated that most of the biomass equations were developed for aboveground tree components. A relatively small number of equations were developed for southern Europe. Most of the biomass equations were based on a few sampled sites with a very limited number of sampled trees. The volume equations were, in general, based on more representative data covering larger geographical regions. The volume equations were available for major tree species in Europe. The collected information provides a basic tool for estimation of carbon stocks and nutrient balance of forest ecosystems across Europe as well as for validation of theoretical models of biomass allocation.

Keywords aboveground biomass, allometry, belowground biomass, biomass function, dbh, tree diameter, tree height
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Contents

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1 Introduction

The estimation of stem volume and tree biomass is needed for both sustainable planning of forest resources and for studies on the energy and nutrients flows in ecosystems. Planners at the strategic and operational levels have strongly emphasised the need for accurate estimates of stem volume, while Hall (1997) reviewed the potential role of biomass as an energy source in the 21st century. In addition, the United Nations Framework Convention on Climate Change and in particular the Kyoto Protocol recognise the importance of forest carbon sink and the need to monitor, preserve and enhance terrestrial carbon stocks, since changes in the forest carbon stock influence the atmospheric CO_2 concentration. Terrestrial biotic carbon stocks and stock changes are difficult to assess (IPCC 2003) and most current estimates are subject to considerable uncertainty (Löwe et al. 2000, Clark et al. 2001, Jenkins et al. 2003). The reliability of the current estimates of the forest carbon stock and the understanding of ecosystem carbon dynamics can be improved by applying existing knowledge on the allometry of trees that is available in the form of biomass and volume equations (Jenkins et al. 2003, Zianis and Mencuccini 2003, Lehtonen et al. 2004). The biomass equations can be applied directly to tree level inventory data (the measured dimensions of trees; diameter, height), or biomass expansion factors (BEFs) applicable to stand level inventory data can be developed and tested with the help of representative volume and biomass equations (Lehtonen et al. 2004).

Recently, remote sensing data have been used to assess standing volume and forest biomass (Montes et al. 2000, Drake et al. 2002). However, the estimation of biomass depends on ground truth data with measured dimensions of trees, and the empirical biomass equations are therefore needed to predict biomass as a function of recorded variables.

The wealth of allometric equations that relate stem volume as well as the biomass of several tree components to diameter at breast height and/or to tree height has never been summarised for European tree species, although this has been for American (Tritton and Hornbeck 1982, Ter-Mikaelian and Korzukhin 1997, Jenkins et al. 2004) and Australian trees (Eamus et al. 2000, Keith et al. 2000). Since the development of stem volume and biomass equations is laborious and time consuming process – especially the destructive harvesting of large trees – existing equations need to be compiled and evaluated to facilitate identification of the gaps in the coverage of the equations. The compiled equations can also be used to test and compare existing equations with new ones as well as to validate process-based models.

The aim of this study was to develop a database on tree-level stem volume and biomass equations for various tree species growing in Europe. Equations for both whole tree biomass and the biomass of different components were considered. The compiled database is a guide to the original publications of these equations. In ecological studies on forest carbon and nutrient cycling, forest and greenhouse gas inventories as well as in the validation of process-based models, this database facilitates effective exploitation of existing information on the allometry of trees.

2 Material and Methods

The development of the presented compilation of equations was based on published equations for different tree species growing on the European continent. We restricted the compilation to the relationships published on the European continent since similar kinds of information have already been presented for different biomes (Zianis and Mencuccini 2004), for North American tree species (Ter-Mikaelian and Korzukhin 1997, Jenkins et al. 2004), and for Australian ecosystems (see reports by Eamus et al. 2000, Keith et al. 2000, Snowdon et al. 2000). In order to compile the available information we conducted a literature survey on forestry and forest-related journals. However, part of the equations, particularly for stem volume relationships, have been published in the technical reports of research institutes or research programmes across Europe. In many cases, the original papers had not been written in the English language. To obtain these equations, researchers throughout Europe were asked to provide any allometric equation published in their country and readily available to them.

For all the empirical relationships included in the database, the explanatory variables were always the diameter at breast height (D), the tree height (H) or a combination of the two. For latest decades, standardized reference point for breast height and height measurements has been ground level and, in the European countries, the stem diameter at breast height have been measured at 1.3 above ground (Bruce and Schumacher 1950, Köhl et al. 1997). These two variables (D and H) are the most commonly used independent variables, but equations with several other independent variables (e.g. site fertility, elevation, soil type) have been also widely developed. Those equations were not, however, included in this database, since selection of variables is highly dependent on local conditions and intended local use of equations. Some empirical relationships reported in the original articles were excluded from this review and database since the equations with reported values of the parameters generated estimates that were not realistic (e.g. negative values, or shape of equation indicate impossible allometry of trees). In addition, equations with notably low r^2-values were excluded. In the original publications, there might occur several other equations besides the one compiled in the present study. No selection criteria were applied with regard to the species, age, size, site conditions, or sampling method. The compiled biomass equations were presented according to different tree components (Table 1).

The measurement units for the regressed and the explanatory variables, the number of the sampled trees (n), the coefficient of determination (r^2), and the range of diameter and height were also included in this review whenever this information was available in the original article. Additionally, the basal area of the stand and the stand density from which the sampled trees originated, the location (longitude and latitude) of the sampled trees as well as the standard error of the parameters of the regressions, the type and corresponding value of the statistical error, and the correction factor (Sprugel 1983) were also collected for the compiled equations. However, information on these parameters is not shown in the Appendix of the present study since it was reported only in a very limited number of original articles.

3 Results

3.1 Biomass Equations

We found biomass equations for various aboveground and belowground components (Table 1), but most of the biomass equations were for aboveground parts, particularly for branches and foliage (Table 2). Very few equations were available for the biomass of dead branches, coarse, small and fine roots, and only four to estimate the biomass of cones (Table 2). The total number of the compiled biomass equations for different tree components was 607 (Appendix A).

The compiled biomass equations refer to 39 different tree species growing in Europe (Table 3). The vast majority of the compiled empirical equations developed for different tree components was reported for northern and central European countries (Table 3). Totally 82 equations referred to data recorded in southern European countries, particularly Greece, Italy, Portugal and Spain.

Table 1. Abbreviations for tree biomass components.

AB	Total aboveground biomass
ABW	Total aboveground woody biomass
BR	Branch biomass
CO	Biomass of cones
CR	Crown biomass (BR+FL)
DB	Biomass of dead branches
FL	Total foliage biomass
FL(*i*)	Biomass of *i*-year-old needles
RC	Biomass of coarse roots[a]
RF	Biomass of fine roots[a]
RS	Biomass of small roots[a]
RT	Biomass of roots (RC+RF+RS)
SB	Biomass of stem bark
SR	Biomass of the stump-root system[a]
ST	Total stem biomass (SW+SB)
SU	Stump biomass[a]
SW	Stem wood biomass
TB	Total tree biomass (AB+RT)
TW	Total woody biomass

[a] Defined differently in each study

For the some biomass equations of *Abies balsamea* (L.) Mill., *Fagus crenata* Bl., *Picea rubens* Sarg., *Pinus banksiana* Lamb., *Pinus contorta* Doug. ex Loud., and *Pinus taeda* L., the location of the sampled trees was not reported. Only one equation was available for each of the following components: branch biomass within the crown, the biomass of epicormic branches, stem biomass within the crown, woody biomass in the crown, foliage biomass in crown, foliage biomass of epicormic branches (reported by Zianis and Mencuccini 2003). Thus, they were not included in the database.

The vast majority of the reviewed biomass equations (127 in total) took the simple linear form

$$\mathrm{Log}\,(M) = A + B \times \mathrm{Log}(D) \qquad (1)$$

where Log(M) is either the natural or the 10-base logarithmic transformation of the biomass data for different tree components, Log(D) is the diameter at breast height (either in natural or 10-base logarithmic transformation) and *A* and *B* the estimated parameters. In 200 regressions tree height was entered as the second independent variable or was used in combination with *D*. In the 280 empirical regressions, *D* was the only independent variable and the mathematical relationship between tree biomass and *D* fell into several formulae (see Appendix A).

The compiled equations do not refer to the same spatial scale; some of them were built on data obtained from a single stand, whereas others (e.g. Marklund's (1987, 1988) equations for the main tree species of Sweden) are based on data from large geographical areas. There are no such equations for temperate or Mediterranean conditions. The amount of sampled trees varied from 3 to 1503; The most usual amount was between 6 and 40 (Fig. 1a). Only Marklund's (1987, 1988) equations are consistently based on a sample size of several hundred felled trees. In 175 equations

Table 2. Number of compiled biomass equations according to tree species and tree component. For the abbreviations see Table 1.

	AB	ABW	BR	CO	CR	DB	FL	FL(i)	RC	RF	RS	RT	SB	SR	ST	SU	SW	TB	TW	Total
Abies balsamea	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–	4
Abies spp.	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Acer pseudoplatanus	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Alnus glutinosa	2	1	3	–	–	–	2	–	–	–	–	–	–	–	3	–	–	–	–	11
Alnus incana	2	–	2	–	–	–	2	–	–	–	–	–	–	–	2	–	–	–	–	8
Arbutus unedo	1	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Betula pendula	1	1	2	–	–	–	1	–	–	–	–	2	–	–	2	–	–	–	–	9
Betula pubescens	1	–	1	–	–	–	1	–	–	–	–	–	2	–	1	–	2	–	–	8
Betula pubescens ssp. *czerepanovii*	–	–	1	–	–	1	1	–	–	–	–	–	–	–	1	–	–	–	–	4
Betula spp.	–	4	3	–	2	4	2	–	–	–	–	1	4	–	1	1	5	–	–	27
Eucalyptus spp.	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Fagus crenata	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Fagus moesiaca	1	–	1	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	5
Fagus sylvatica	8	4	7	–	4	–	6	–	1	1	1	4	2	–	8	–	2	–	–	48
Fraxinus excelsior	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Larix sibirica	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	2
Larix spp.	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Picea abies	16	1	27	–	17	13	28	–	2	–	2	7	14	1	16	1	12	3	3	159
Picea engelmannii	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	2
Picea rubens	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Picea sitchenis	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Picea spp.	1	–	–	–	3	–	–	–	–	–	–	–	–	–	1	–	–	–	–	5
Pinus banksiana	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Pinus contorta	1	–	–	–	1	–	–	–	–	–	–	3	–	–	1	–	–	–	–	6
Pinus nigra var *maritima*	–	–	–	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	2
Pinus pinaster	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Pinus radiata	1	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	3
Pinus sylvestris	27	4	26	3	11	12	32	2	7	1	1	7	15	3	23	2	13	–	–	191
Pinus taeda	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Populus tremula	2	–	1	–	1	–	1	–	–	–	–	–	–	–	2	–	–	–	–	7
Populus trichocarpa	1	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	3
Pseudotsuga menziesii	3	1	1	–	2	–	1	–	–	–	–	6	–	–	1	–	–	–	–	15
Pseudotsuga spp.	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Quercus conferta	–	2	8	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–	–	16
Quercus ilex	10	1	8	–	1	–	6	–	3	–	3	4	–	–	6	–	–	–	–	42
Quercus petraea	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Quercus pyrenaica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Quercus spp.	1	4	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7
Tilia cordata	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Total	83	29	91	3	50	30	84	2	13	2	7	48	37	4	72	5	41	3	3	607

AB=Aboveground, ABW=Aboveground woody, BR=Branches, CO=Cones, CR=Crown (BR+FL), DB=Dead branches, FL=Foliage, FL(i)=i-year old needles, RC=Coarse roots, RF=Fine roots, RS=Small roots, RT=All roots, SB=Stem bark, SR=Stump-root system, ST=Stem (SW+SB), SU=Stump, SW=Stem wood, TB=Whole tree, TW=Total woody biomass

Table 3. Geographical distribution of the compiled biomass equations. The numbers indicate the total number of equations for all tree components and for each country. Studies for which the region was not specified are indicated by n/a.

	AT	BE	CZ	DK	FI	FR	DE	GR	IS	IT	NL	NO	PL	PO	ES	SE	GB	Eur	n/a	Total
Abies balsamea	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	4
Abies spp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
Acer pseudoplatanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
Alnus glutinosa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	3	–	–	11
Alnus incana	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	–	–	–	8
Arbutus unedo	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	3
Betula pendula	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	3	–	2	9
Betula pubescens	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	4	–	–	–	8
Betula pubescens ssp. *czerepanovii*	–	–	–	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
Betula spp.	–	–	–	–	9	–	–	–	–	–	–	–	–	–	–	14	4	–	–	27
Eucalyptus spp.	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1
Fagus crenata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Fagus moesiaca	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	–	–	5
Fagus sylvatica	1	2	3	–	–	9	2	–	–	10	10	–	–	–	4	5	2	–	–	48
Fraxinus excelsior	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
Larix sibirica	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	2
Larix spp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Picea abies	4	4	16	7	21	–	54	–	4	–	–	12	–	–	–	36	1	5	–	159
Picea engelmannii	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	2
Picea rubens	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Picea sitchenis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Picea spp.	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	2	–	–	5
Pinus banksiana	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Pinus contorta	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	2	–	2	6
Pinus nigra var *maritima*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
Pinus pinaster	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1
Pinus radiata	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	2	3
Pinus sylvestris	–	6	49	–	44	–	–	–	–	–	–	27	17	–	–	27	13	3	3	191
Pinus taeda	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Populus tremula	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	4	–	–	–	7
Populus trichocarpa	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	3
Pseudotsuga menziesii	–	–	–	–	–	–	–	–	–	1	7	–	–	–	–	–	2	–	5	15
Pseudotsuga spp.	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Quercus conferta	–	–	–	–	–	–	–	16	–	–	–	–	–	–	–	–	–	–	–	16
Quercus ilex	–	–	–	–	–	–	–	–	–	5	–	–	–	–	37	–	–	–	–	42
Quercus petraea	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Quercus pyrenaica	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Quercus spp.	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6	–	–	7
Tilia cordata	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Total	6	12	66	7	80	10	59	21	16	22	18	39	17	1	41	109	49	8	22	607

AT=Austria, BE=Belgium, CZ=Czech republic, DK=Denmark, FI=Finland, FR=France, DE=Germany, GR=Greece, IS=Iceland, IT=Italy, NL=Netherlands, NO=Norway, PL=Poland, PO=Portugal, ES=Spain, SE=Sweden, GB= United Kingdom, Eur=Europe

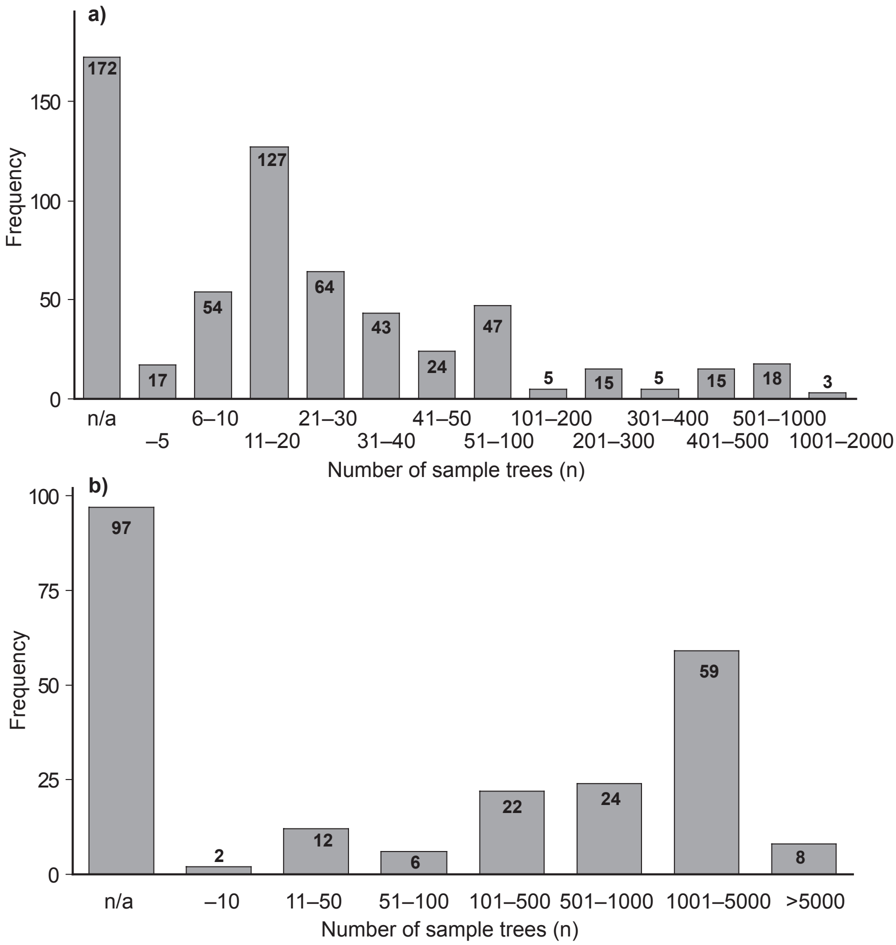

Fig. 1. Frequencies of a) the biomass and b) the volume equations according to the number of sampled trees used for the development of the equation.

the number of sampled trees upon which the estimation of the empirical parametric values had been based was not reported.

The range of size of the sampled trees varied for each equation (Appendix A), implying that diameter and height range should be taken into account when applicability of the equations is evaluated. Our analysis also indicated that different equations generate different biomass predictions for trees of the same size (Fig. 2). The difference between predicted values of foliage biomasses was large, whereas the predicted total aboveground biomass values of *Picea abies* was relatively consistent (Figs. 2a–b). The number of biomass equations available for roots was small and the differences between predicted root biomass values were high (Fig 2c).

The value of the coefficient of determination (r^2) was reported in most of the regressions and varied from 0.012 to 0.99. Especially, the biomass of dead branches of Norway spruce seemed to be difficult to estimate accurately. In general, equations with notably low r^2-values are excluded, but those obtained for dead branched were kept to show overall difficulties in prediction of the biomass of this component. Only in about 1/10

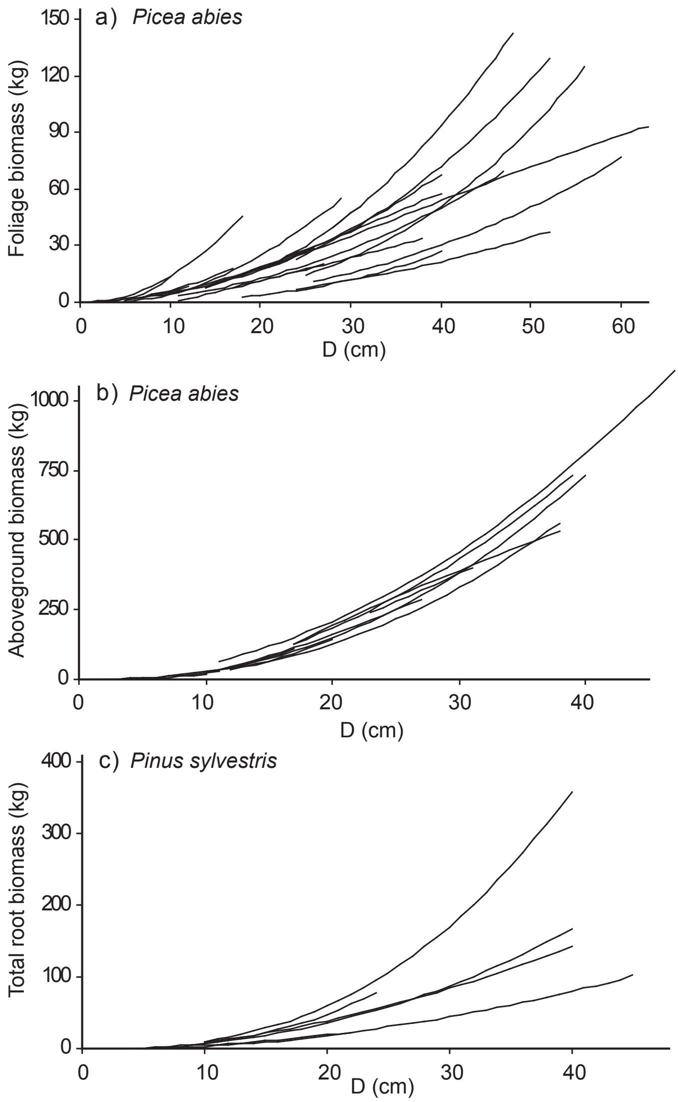

Fig. 2. Predicted foliage biomass a) and total aboveground biomass of *Picea abies* b), and root biomass of *Pinus sylvestris* c) as a function of tree diameters (D). The biomass equations were retrieved from Appendix A. The range of diameter of the illustrated equations indicates the range of observations in the original data on which the equation is based on. When the range of original observation was not reported a minimum of 10 cm and a maximum of 40 cm for diameter was used in this figure.

of the papers concerning biomass equations are some kind of error estimates for the equations presented. The forms of the error estimates are diverse and vary from article to article.

3.2 Stem Volume Equations

The total number of the compiled stem volume equations was 230 (App. B and C), and they covered 55 tree species altogether (Table 4). Most of the European countries have already developed stem volume equations mainly for the planning of the use of forest resources. However, there is no straightforward, commonly accepted definition for stem volume in Europe. In general, the volume of stemwood extending from root collar up to the top of the stems is accounted in the equations developed in the Nordic countries. For some of the reviewed regressions, the stem is the part of the main trunk up to a minimum diameter of 7 cm (it is usually called the merchantable volume) while some authors have not reported definition of the stem related to their equations.

Table 4. Geographical distribution of the compiled stem volume equations. The numbers indicate the total number of equations for each country.

Scientific name	AT	BE	CR	CZ	FI	DE	IS	IT	NL	NO	PL	R0	SE	GB	Total
Abies alba	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Abies grandis	–	–	–	–	–	–	–	–	1	1	–	–	–	–	2
Abies sibirica	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Abies spp.	2	–	–	–	–	–	–	–	–	–	–	1	–	–	3
Acacia spp.	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Acer pseudoplatanus	–	1	–	–	–	–	–	–	1	–	–	1	–	1	4
Alnus alba	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Alnus glutinosa	–	–	–	–	–	–	–	–	1	2	–	–	3	–	6
Alnus incana	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Alnus nigra	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Alnus spp.	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Arbutus unedo	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1
Betula pendula	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Betula spp.	–	1	–	–	4	–	–	–	–	2	–	1	6	1	15
Carpinus spp.	–	–	–	–	–	–	–	–	3	–	–	–	–	–	3
Chamaecyparis lawsoniana	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Corylus avellana	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Fagus spp.	2	–	–	–	–	–	–	–	–	–	–	1	–	1	4
Fagus sylvatica	–	1	–	–	–	2	–	–	2	–	–	–	–	–	5
Fraxinus exselsior	–	1	–	–	–	–	–	–	1	–	–	–	5	–	7
Fraxinus spp.	–	–	–	–	–	–	–	–	–	1	–	1	–	1	3
Larix decidua	2	1	–	–	–	–	–	–	1	1	–	–	–	–	5
Larix hybrid	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Larix kaempferi	–	–	–	–	–	–	–	–	1	1	–	–	–	–	2
Larix sibirica	–	–	–	–	–	–	3	–	–	1	–	–	–	–	4
Larix spp.	–	–	–	–	2	–	–	–	3	–	–	1	–	–	6
Picea abies	2	1	–	2	7	2	1	–	5	12	2	–	8	–	42
Picea engelmannii	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Picea sitchensis	–	–	–	–	–	–	–	–	1	3	–	–	–	–	4
Picea spp.	–	–	–	–	–	–	1	–	–	–	–	1	–	–	2
Pinus contorta	–	–	–	–	–	–	1	–	1	–	–	–	3	–	5
Pinus nigra var *maritima*	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Pinus nigra var *nigra*	–	–	–	–	–	–	–	–	1	–	–	1	–	–	2
Pinus spp.	–	–	–	–	–	2	–	–	3	–	–	–	–	–	5
Pinus sylvestris	1	2	–	–	8	1	–	1	4	8	–	1	8	–	34
Populus spp.	1	–	–	–	–	–	–	–	3	–	–	2	–	1	7
Populus tremula	–	–	–	–	–	–	–	–	–	2	–	1	3	–	6
Populus trichocarpa	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Prunus avium	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Pseudotsuga menziesii	–	1	–	–	–	–	–	–	1	1	–	1	–	–	4
Pseudotsuga spp.	–	–	–	–	–	–	–	–	3	–	–	–	–	–	3
Quercus grisea	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Quercus ilex	–	–	1	–	–	–	–	1	–	–	–	–	–	–	2
Quercus laevis	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Quercus pubescens	–	–	2	–	–	–	–	–	–	–	–	1	–	–	3
Quercus robur	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Quercus rubra	–	1	–	–	–	–	–	–	1	–	–	–	–	–	2
Quercus spp.	2	1	–	–	–	–	–	–	3	–	–	1	–	1	8
Salix caprea	–	–	–	–	–	–	–	–	–	1	–	1	–	–	2
Salix spp.	–	–	–	–	–	–	–	–	–	–	–	2	–	–	2
Sorbus aucuparia	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Thuja pilicata	–	–	–	–	–	–	–	–	1	1	–	–	–	–	2
Tilia cordata	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Tsuga heterophylla	–	–	–	–	–	–	–	–	1	1	–	–	–	–	2
Ulmus spp.	–	1	–	–	–	–	–	–	1	–	–	1	–	–	3
Total	13	13	3	2	21	8	8	3	47	43	2	25	36	6	230

AT=Austria, BE=Belgium, CR=Croatia, CZ=Czech republic, FI=Finland, DE=Germany, IS=Iceland, IT=Italy, NL=Netherlands, NO=Norway, PL=Poland, RO=Romania, SE=Sweden, GB=United Kingdom

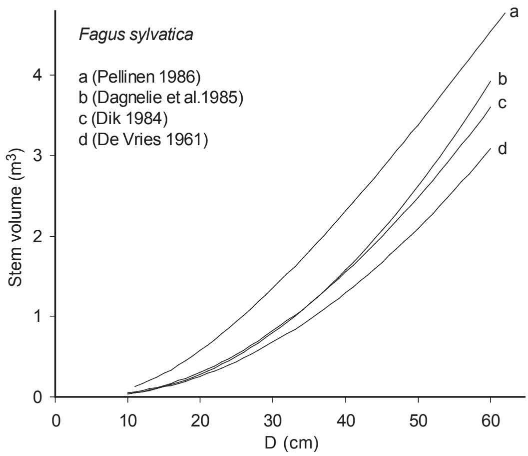

Fig. 3. Predicted stem volume of *Fagus sylvatica* as a function of tree diameter (*D*). The volume equations are presented in Appendices B and C.

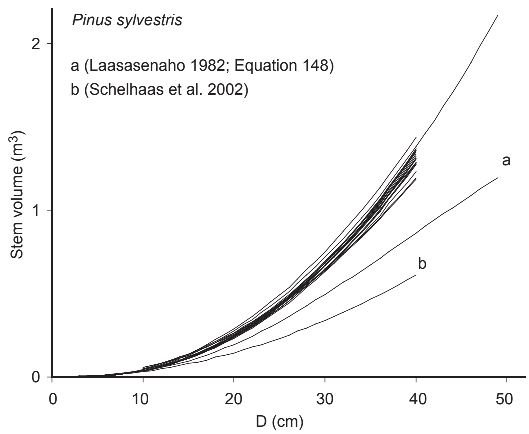

Fig. 4. Predicted stem volume of *Pinus sylvestris* as a function of tree diameter (*D*). The volume equations are presented in Appendices B and C.

If the definition of the stem volume is reported in the original paper, it is indicated in the comment field of the appendix table (Appendix B).

The major part of the stem volume regressions was for coniferous tree species (Table 4). Forty-two equations were reported for Norway spruce (*Picea abies* (L.) Karst.) and 34 for Scots pine (*Pinus sylvestris* L.), from which more than half were built for Scandinavian countries. For the broadleaved tree species within the genera of *Betula*, *Fagus*, and *Quercus* the number of available equations were 16, 9, and 18, respectively.

Most of the stem volume equations were based on a sample size of several hundred or a few thousand felled trees (Fig. 1b). Only three equations were based on a sample size of more than 5000 trees. In 97 of the equations the number of sample trees was not reported.

In almost every of the compiled stem volume equations the independent variables were *D* and/or *H* or various mathematical combinations of these (Appendix C). However, in three equations the formula used to fit the tree-scale data was solely based on *D* and was a simple power function (simple allometric equation). More than two parameters were incorporated into the formulae of 212 stem volume regressions, and 18 equations included six parameters. The number of the sampled trees (from which the empirical stem volume regressions were obtained) varied from five to more than 7446 (Appendix B). The range of diameters of the sampled trees varied between equations and for 125 of the compiled stem volume equations the range was not reported. In all the compiled equations the coefficient of determination was more than 0.58 irrespective of species, location, *D* range, site conditions, etc.

Predicted stem volume estimates varied according to the applied equation (Fig. 3 and Fig. 4). For example, the stem volume of a beech tree with a diameter of 40 cm varies between 1.1 and 2.2 m^3 (Fig. 3). On the other hand, all stem volume equations of e.g. Scots pine produced relatively consistent stem volume estimates. The equation reported by Schelhaas et al. (2002) and one of the equations published by Laasasenaho (1982) seemed to deviate from the others (Fig. 4). However, Laasasenaho (1982) reported two other equations which had different form or more explanatory variables (height in addition to dbh), and they gave consistent predictions with the models of other authors.

4 Discussion

Reliable methods of estimating forest biomass and carbon stocks as well as volume of the growing stock at different spatial and temporal scales and for different biomes are needed. In national forest inventories, emphasis has been placed on the assessment of merchantable timber, and inventories provide highly accurate estimates of the growing stock (Laitat et al. 2000). The current need to assess changes in the forest carbon has arisen as a result of the Climate Convention and the Kyoto Protocol. In general, assessment of forest biomass and carbon stock is based on information on forest resources i.e. estimates of forested area and volume of the growing stock as reported by national forest inventories (Liski and Kauppi 2000). Reported volume estimates are multiplied with simple biomass expansion factors and/or conversion factors to obtain biomass estimates.

In national inventories, the volume of the growing stock is estimated with the help of volume equations. The results of this study show that representative volume equations are available for major tree species in Europe, since volume equations are developed for different vegetation zones and most of the equations are based on a relatively high number of sampled trees. However, the volume equations vary in terms of the dimensions accounted for (merchantable stem volume only or unmerchantable included), and the estimates obtained with different equations cannot be compared or aggregated, and they cannot be converted to biomass estimates by just using a single biomass expansion value. The differences were the most evident with tree species that had irregular branching patterns (e.g. beech), whereas volume equations of e.g. Scots pine were more consistent. The inconsistency of the different volume equations applied to national forest inventories was also reported by Köhl et al. (1997). As national estimates of the volume of the growing stock are converted to biomass estimates, the applicability of the biomass expansion factors to the applied volume equation needs to be evaluated to avoid highly biased biomass estimates.

Reliability of the national carbon inventories can be improved by applying biomass equations directly to tree-scale measurements of diameter (D) at sampled plots of forest inventories (Jalkanen et al. 2005). Consequently, the additional source of error introduced by conversion or expansion factors can be avoided. The compiled database on biomass equations provides a basis for the selection of the applicable biomass equation when representative national equations are not available. The database can be also used as a source of reference for the development of local equations. Since the number of sampled trees used for the development of the biomass equations seemed to be relatively small, it is necessary to use several equations rather than only one in order to obtain unbiased predictions.

The analysis of the collected information showed that both species coverage and the spatial distribution of the equations is limited. The vast majority of the models were developed for coniferous tree species growing in northern and central European forest ecosystems. Only a small number of biomass and stem volume regressions were collected for tree species in the eastern and southern parts of Europe (Tables 3 and 4). A rather limited number of equations for the estimation of root biomass has been compiled so far, indicating that a more extensive survey should take place and that more root biomass datasets should be collected across Europe. In a similar study conducted in Australia, Snowdon et al. (2000) stressed that more root biomass studies are needed and suggested that fractal geometry could be a promising tool to overcome the practical problems arising from the destructive sampling of belowground tree biomass. Ter-Mikaelian and Korzukhin (1997) reported no equations for estimating the root biomass of tree species growing in the USA.

Most of the collected equations lack information on the error estimates of the empirical parameters. According to Keith et al. (2000), the main sources of error in implementing allometric regressions could occur at the treescale and when biomass estimates are extrapolated from plot to regional scale (see also Satoo and Madgwick 1982). It should be noticed that when a logarithmic or any other transformation is applied to the raw data, biomass and stem volume predictions are biased (Baskerville 1972, Sprugel 1983). Mathematical formulae for correcting bias provide accurate estimates even though assumptions about the distribution of statistical errors must be made. The inherent bias arising from data transformation could be eliminated if iterative procedures were to be applied to the data (for a more detailed discussion see Payandeh 1981).

Biased predictions may also be obtained when the sum of biomass estimates (developed for different tree components i.e., stem, crown and roots) does not match the predictions derived from the total biomass equation (what is called the additivity problem). Parresol (2001) provided statistical methods to account for this bias while Snowdon et al. (2000) reported that the additivity problem does not appear when allometric equations are developed from non-transformed data. Another statistical problem is caused by collinearity or multicollinearity, where the independent variables in a regression analysis are themselves correlated (Ott 1993). Thus, the value of the coefficient of determination in stem volume and biomass equations (with more than one independent variable) may not be a reliable criterion for the choice of the best-fitting equation, and biased predictions may be obtained when this problem is not taken into account. However, the collinearity problem is seldom mentioned in original papers, where more often than not, diameter and height are the independent variables in estimating either stem volume or tree biomass.

The equations presented in this review can be used for national biomass and carbon inventories, for ecological studies, for validating theoretical models and for planning the use of forest resources. Since the original biomass studies may have been conducted for very specific purposes, following different sampling procedures and perhaps atypical stand structures, the applicability of an equation to its intended purpose needs to be evaluated in terms of the geographical distribution of the sampled population, the number of sampled trees, the range of dimensions (*D, H*) of sampled trees, accounted dimensions and applied definitions.

Pooled equations based on raw data collected from wide geographical areas may also provide a promising alternative to estimate biomass changes at the landscape scale Wirth et al. 2004). The empirical models reviewed in this article may also be used in order to build generalised stem volume and biomass equations for different species and different tree components (see Pastor et al. 1983/1984 for American species and Zianis and Mencuccini 2003 for the genus *Fagus*), to develop BEF for tree species across Europe (Lehtonen et al. 2004) and to validate process-based models of forest productivity.

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Total of 33 references

Appendix A. Biomass equations for different biomass components by tree species (see abbreviations for dependent variable from table 1). In addition to scientific names of the tree species, common names are shown as they are reported in the original publications. The format of the biomass equation is given in the column labelled Equation, and a, b, c, d, and e are parameter values. The “ln” is the natural logarithm and the “log” is the →

		Unit of Biom.	Unit of *D*	Unit of *H*	Range of *D* (cm)	Range of *H* (m)	Ref.	Cont.	Comm.	*n*	r^2
Abies balsamea											
1 –	log(RT)	kg	cm	–	–	–	68	8		–	–
2 –	log(RT)	kg	cm	–	–	–	68	8		89	0.92
3 –	log(RT)	kg	cm	–	–	–	68	8		40	0.928
4 –	log(RT)	kg	cm	–	–	–	68	8		40	0.898
Abies **spp. (Fir)**											
5 UK	CR	t	cm	–	–	–	9	6	1	–	–
6 UK	CR	t	cm	–	–	–	9	6	2	–	–
Acer pseudoplatanus (Sycamore)											
7 UK	ln(ABW)	kg	cm	–	3.7–31	–	10	14		10	0.991
8 UK	ln(ABW)	kg	cm	–	3.5–28	–	10	14		15	0.995
Alnus glutinosa (Common alder, Black alder, Klibbal)											
9 Sweden	AB	kg	mm	–	1–17.3	2.5–17.6	39	4		–	0.987
10 Sweden	AB	kg	mm	–	12.2–28.3	13–25.4	38	4		–	0.98
11 UK	ABW	kg	cm	–	–	–	32	14		12	0.985
12 Sweden	BR	kg	mm	–	12.2–28.3	13–25.4	38	4		–	0.66
13 Sweden	BR	kg	mm	–	1–17.3	2.5–17.6	39	4		–	0.922
14 UK	BR	kg	cm	–	–	–	32	14		12	0.924
15 Sweden	FL	kg	mm	–	12.2–28.3	13–25.4	38	4		–	0.47
16 Sweden	FL	kg	mm	–	1–17.3	2.5–17.6	39	4		–	0.927
17 Sweden	ST	kg	mm	–	12.2–28.3	13–25.4	38	4		–	0.82
18 Sweden	ST	kg	mm	–	1–17.3	2.5–17.6	39	4		–	0.969
19 UK	ST	kg	cm	–	–	–	32	14		12	0.991
Alnus incana (Grey alder, Gråal, Harmaaleppä)											
20 Sweden	AB	kg	mm	–	0.7–9.3	2–14.8	39	4		–	0.983
21 Sweden	AB	kg	mm	–	8.9–24.6	13–25.3	38	4		–	0.92
22 Sweden	BR	kg	mm	–	0.7–9.3	2–14.8	39	4		–	0.862
23 Sweden	BR	kg	mm	–	8.9–24.6	13–25.3	38	4		–	0.6
24 Sweden	FL	kg	mm	–	0.7–9.3	2–14.8	39	4		–	0.64
25 Sweden	FL	kg	mm	–	8.9–24.6	13–25.3	38	4		–	0.44
26 Sweden	ST	kg	mm	–	0.7–9.3	2–14.8	39	4		–	0.98
27 Sweden	ST	kg	mm	–	8.9–24.6	13–25.3	38	4		–	0.89
Arbutus unedo (Strawberry-tree)											
28 Italy	AB	kg	cm	–	6–15	–	7	8		26	0.955
29 Italy	ABW	kg	cm	–	6–15	–	7	8	3	26	0.955
30 Italy	CR	kg	cm	–	6–15	–	7	8		26	0.955
Betula pendula (Silver birch, Pendula birch, White birch, Rauduskoivu, Vårtbjörk)											
31 Sweden	AB	kg	mm	–	1.8–13.7	3.2–19.9	35	4		–	0.985
32 UK	ABW	kg	cm	–	–	–	32	14		13	0.99
33 Sweden	BR	kg	mm	–	1.8–13.7	3.2–19.9	35	4		–	0.747
34 UK	BR	kg	cm	–	–	–	32	14		13	0.99
35 Sweden	FL	kg	mm	–	1.8–13.7	3.2–19.9	35	4		–	0.884
36 –	log(RT)	kg	cm	–	–	–	68	8		3	0.983
37 –	log(RT)	kg	cm	m	–	–	68	8		3	0.997
38 Sweden	ST	kg	mm	–	1.8–13.7	3.2–19.9	35	4		–	0.979
39 UK	ST	kg	cm	–	–	–	32	14		13	0.99
Betula pubescens (White birch, Pubescent birch, Hieskoivu, Glasbjörk, Björk)											
40 Sweden	AB	kg	mm	–	0.8–8.5	2.3–12	35	4		–	0.977
41 Sweden	BR	kg	mm	–	0.8–8.5	2.3–12	35	4		–	0.875
42 Sweden	FL	kg	mm	–	0.8–8.5	2.3–12	35	4		–	0.918
43 Finland	SB	kg	cm	m	2–16	4.6–16.7	58	8		53	0.986
44 Finland	SB	kg	cm	m	1.3–13	3.3–13.2	58	8		56	0.984
45 Sweden	ST	kg	mm	–	0.8–8.5	2.3–12	35	4		–	0.966

10-based logarithm. Number of sampled trees (n), coefficients of determination (r^2), and range of diameter (D) and height (H) of sampled trees are reported when available in the original article. References (Ref.) to the original papers according to author as well as the contact (Cont.) person who submitted the equation to this database are given at the end of the table. In the comments column (Comm.) occur some comments about the particular equation.

	Equation	Parameters a	b	c	d	e
1	a·log(D)+b	2.4452	–1.7143	–	–	–
2	a·log(D)+b	2.45	0.681	–	–	–
3	a·log(D)+b	2.0027	0.0629	–	–	–
4	a·log(D)+b	2.4613	–0.4023	–	–	–
5	$a \cdot D^b$	$5.2193 \cdot 10^{-4}$	1.459	–	–	–
6	$a+b \cdot D^c$	0.0060722	$9.58 \cdot 10^{-6}$	2.5578	–	–
7	a+b·ln(D)	–2.7606	2.5189	–	–	–
8	a+b·ln(D)	–2.7018	2.5751	–	–	–
9	$a \cdot D^b$	0.00079	2.28546	–	–	–
10	$a \cdot D^b$	0.003090	2.022126	–	–	–
11	$a \cdot D^b$	0.0859	2.3537	–	–	–
12	$a \cdot D^b$	0.000003	2.880598	–	–	–
13	$a \cdot D^b$	0.0000006	3.28106	–	–	–
14	$a \cdot D^b$	0.0146	2.5191	–	–	–
15	$a \cdot D^b$	0.000003	2.547045	–	–	–
16	$a \cdot D^b$	0.00239	1.32535	–	–	–
17	$a \cdot D^b$	0.005609	1.888345	–	–	–
18	$a \cdot D^b$	0.00119	2.17247	–	–	–
19	$a \cdot D^b$	0.0841	2.4501	–	–	–
20	$a \cdot D^b$	0.00030	2.42847	–	–	–
21	$a \cdot D^b$	0.000499	2.337592	–	–	–
22	$a \cdot D^b$	0.00001	2.65455	–	–	–
23	$a \cdot D^b$	0.000100	2.297058	–	–	–
24	$a \cdot D^b$	0.00001	2.44406	–	–	–
25	$a \cdot D^b$	0.000076	2.02604	–	–	–
26	$a \cdot D^b$	0.00029	2.40128	–	–	–
27	$a \cdot D^b$	0.000368	2.335763	–	–	–
28	$a+b \cdot D^2$	–2.7563	0.3045	–	–	–
29	$a+b \cdot D^2$	–2.8816	0.2639	–	–	–
30	$a+b \cdot D^2$	0.1253	0.040617	–	–	–
31	$a \cdot D^b$	0.00087	2.28639	–	–	–
32	$a \cdot D^b$	0.2511	2.29	–	–	–
33	$a \cdot D^b$	0.00002	2.63001	–	–	–
34	$a \cdot D^b$	0.0742	2.24	–	–	–
35	$a \cdot D^b$	0.00371	1.11993	–	–	–
36	a·log(D)+b	2.3547	–1.3	–	–	–
37	$a \cdot \log(H \cdot D^2)+b$	0.9308	–1.8	–	–	–
38	$a \cdot D^b$	0.00080	2.28244	–	–	–
39	$a \cdot D^b$	0.193	2.25	–	–	–
40	$a \cdot D^b$	0.00029	2.50038	–	–	–
41	$a \cdot D^b$	0.00004	2.52978	–	–	–
42	$a \cdot D^b$	0.00090	1.47663	–	–	–
43	$a+b \cdot \ln(D^2 \cdot H)$	–2.1909	0.8808	–	–	–
44	$a+b \cdot \ln(D^2 \cdot H)$	–2.0706	0.7942	–	–	–
45	$a \cdot D^b$	0.00020	2.54302	–	–	–

Appendix A		Unit of			Range of						
		Biom.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
46 Finland	SW	kg	cm	m	2–16	4.6–16.7	58	8		53	0.994
47 Finland	SW	kg	cm	m	1.3–13	3.3–13.2	58	8		56	0.994
Betula pubescens ssp. ***czerepanovii*** (Mountain birch)											
48 Finland	ln(BR)	g	mm	–	–	–	72	8		20	0.836
49 Finland	ln(DB)	g	mm	–	–	–	72	8		20	0.622
50 Finland	ln(FL)	g	mm	–	–	–	72	8		20	0.829
51 Finland	ln(ST)	g	mm	–	–	–	72	8		20	0.98
Betula spp. (Birch, Koivu, Björk)											
52 UK	ln(ABW)	kg	cm	–	2.9–30	–	10	14		27	0.985
53 UK	ln(ABW)	kg	cm	–	2.9–26	–	10	14		15	0.984
54 UK	ln(ABW)	kg	cm	–	3.3–16	–	10	14		16	0.984
55 UK	ln(ABW)	kg	cm	–	3.5–23	–	10	14		15	0.987
56 Finland	BR	kg	cm	m	9–28	13–22.4	57	8		20	0.901
57 Sweden	ln(BR)	g	cm	dm	0.9–9.8	1.8–9.2	19	8		66	0.88
58 Sweden	ln(BR)	kg	cm	–	0–35	0–	50	8	4	235	0.924
59 Finland	ln(CR)	kg	mm	–	–	–	29	8		–	0.839
60 Finland	ln(CR)	kg	mm	–	–	–	29	8		–	0.838
61 Finland	DB	kg	cm	m	9.0–28	13–22.4	57	8		20	0.267
62 Sweden	ln(DB)	kg	cm	–	0–35	0–	50	8		212	0.605
63 Sweden	ln(DB)	kg	cm	m	0–35	0–	50	8		212	0.621
64 Sweden	ln(DB)	g	cm	–	0.9–9.8	18–92	19	8		61	0.56
65 Finland	FL	kg	cm	m	9–28	13–22.4	57	8		20	0.906
66 Sweden	ln(FL)	g	cm	dm	0.9–9.8	1.8–9.2	19	8		14	0.92
67 Finland	RT	kg	cm	m	9–28	13–22.4	57	8	5	20	0.994
68 Finland	SB	kg	cm	m	9–28	13–22.4	57	8		20	0.966
69 Sweden	ln(SB)	kg	cm	–	0–35	0–	50	8		212	0.947
70 Sweden	ln(SB)	kg	cm	m	0–35	0–	50	8		212	0.958
71 Sweden	ln(SB)	g	cm	dm	0.9–9.8	1.8–9.2	19	8		66	0.91
72 Sweden	ln(ST)	kg	cm	m	0–35	0–	50	8		240	0.992
73 Finland	SU	kg	cm	m	9–28	13–22.4	57	8		20	0.96
74 Finland	SW	kg	cm	m	9–28	13–22.4	57	8		20	0.99
75 Sweden	ln(SW)	kg	cm	–	0–35	0–	50	8		240	0.982
76 Sweden	ln(SW)	kg	cm	–	0–35	0–	50	8		212	0.97
77 Sweden	ln(SW)	kg	cm	m	0–35	0–	50	8		212	0.99
78 Sweden	ln(SW)	g	cm	dm	0.9–9.8	1.8–9.2	19	8		66	0.99
Eucalyptus spp. (Eucalypt)											
79 Italy	ln(AB)	kg	cm	–	4–25	–	53	14	6	22	0.99
Fagus crenata											
80 –	log(RT)	kg	cm	m	–	–	68	8		7	0.969
Fagus moesiaca (Beech, Oxia)											
81 Greece	ln(AB)	kg	cm	–	5.4–41	9.2–28	76	14		16	0.99
82 Greece	ln(BR)	kg	cm	–	5.4–41	9.2–28	76	14		16	0.97
83 Greece	ln(FL)	kg	cm	–	5.4–41	9.2–28	76	14		16	0.9
84 Greece	ln(ST)	kg	cm	–	5.4–41	9.2–28	76	14		16	0.98
85 Greece	ln(SU)	kg	cm	–	5.4–41	9.2–28	76	14	7	16	0.78
Fagus sylvatica (Beech, European beech, Hêtres, Rotbuche)											
86 Austria	ln(AB)	kg	cm	m	–	–	31	3		42	0.997
87 Belgium	log(AB)	g	cm	–	35–78.8	–	23	12		6	0.995
88 Czech republic	AB	kg	cm	–	5.7–62.1	9.2–33.9	15	2		20	0.974
89 Germany	AB	kg	cm	–	–	–	65	4		–	–
90 Netherlands	AB	kg	cm	m	–	–	5	8		38	0.991
91 Netherlands	AB	kg	cm	–	–	–	5	8		38	0.988
92 Spain	AB	kg	cm	–	4–34.5	6.1–18.4	67	14		7	0.98
93 Sweden	log(AB)	kg	cm	m	12–64	11–29	61	8		–	–
94 Italy	ABW	kg	cm	m	–	–	11	8	8	–	0.993
95 Italy	ABW	kg	cm	m	–	–	11	8	9	–	0.988
96 Italy	ABW	kg	cm	m	–	–	11	8	10	–	0.991
97 Italy	ABW	kg	cm	m	–	–	11	8		–	0.995
98 Belgium	log(BR)	g	cm	–	35–78.8	–	23	12		6	0.981
99 Czech republic	BR	kg	cm	–	5.7–62.1	9.2–33.9	15	2		20	0.806

	Equation	Parameters a	b	c	d	e
46	$a+b\cdot\ln(D^2\cdot H)$	–1.6047	0.9450	–	–	–
47	$a+b\cdot\ln(D^2\cdot H)$	–1.5195	0.9204	–	–	–
48	$a+b\cdot\ln(D)$	–0.305	1.953	–	–	–
49	$a+b\cdot\ln(D)$	–3.368	2.041	–	–	–
50	$a+b\cdot\ln(D)$	0.525	1.398	–	–	–
51	$a+b\cdot\ln(D)$	–0.313	2.140	–	–	–
52	$a+b\cdot\ln(D)$	–2.4166	2.4227	–	–	–
53	$a+b\cdot\ln(D)$	–2.7584	2.6134	–	–	–
54	$a+b\cdot\ln(D)$	–2.1625	2.3078	–	–	–
55	$a+b\cdot\ln(D)$	–2.6423	2.4678	–	–	–
56	$a+b\cdot\log(D^2\cdot H)$	–3.810	1.2911	–	–	–
57	$a+b\cdot\ln(D)+c\cdot H+d\cdot\ln[(D^2)\cdot H]$	12.0993	8.5963	0.0406	–2.9662	–
58	$a+b\cdot[D/(D+10)]$	–3.3633	10.2806	–	–	–
59	$a+b\cdot\ln(D)$	–10.7699	2.6016	–	–	–
60	$a+b\cdot\ln(D)$	–10.2692	2.5124	–	–	–
61	$a+b\cdot\log(D^2\cdot H)$	–6.510	1.5593	–	–	–
62	$a+b\cdot[D/(D+5)]$	–5.9507	7.9266	–	–	–
63	$a+b\cdot[D/(D+30)]+c\cdot H+d\cdot\ln(H)$	–6.6237	11.2872	–0.3081	2.6821	–
64	$a+b\cdot\ln(D)$	1.637	1.9554	–	–	–
65	$a+b\cdot\log(D^2\cdot H)$	–3.454	1.0961	–	–	–
66	$a+b\cdot\ln(D)+c\cdot\ln[(D^2)\cdot H]$	10.2953	7.9621	–2.3022	–	–
67	$a+b\cdot\log(D^2\cdot H)$	–3.887	1.3668	–	–	–
68	$a+b\cdot\log(D^2\cdot H)$	–2.311	0.9256	–	–	–
69	$a+b\cdot[D/(D+14)]$	–3.2518	10.3876	–	–	–
70	$a+b\cdot[D/(D+14)]+c\cdot\ln(H)$	–4.0778	8.3019	0.7433	–	–
71	$a+b\cdot\ln(D)+c\cdot H+d\cdot\ln[(D^2)\cdot H]$	5.8227	3.3503	0.0259	–0.8584	–
72	$a+b\cdot[D/(D+7)]+c\cdot H+d\cdot\ln(H)$	–3.5686	8.2827	0.0393	0.5772	–
73	$a+b\cdot\log(D^2\cdot H)$	–3.540	1.1488	–	–	–
74	$a+b\cdot\log(D^2\cdot H)$	–1.785	0.9910	–	–	–
75	$a+b\cdot[D/(D+8)]$	–3.0932	11.0735	–	–	–
76	$a+b\cdot[D/(D+11)]$	–2.3327	10.8109	–	–	–
77	$a+b\cdot[D/(D+11)]+c\cdot\ln(H)$	–3.3045	8.1184	0.9783	–	–
78	$a+b\cdot\ln(D)+c\cdot H+d\cdot\ln[(D^2)\cdot H]$	7.4223	3.9941	0.0338	–1.0984	–
79	$a+b\cdot\ln(D)$	–1.762	2.2644	–	–	–
80	$a\cdot\log(H\cdot D^2)+b$	0.6816	–1.0003	–	–	–
81	$a+b\cdot\ln(D)$	–1.3816	2.3485	–	–	–
82	$a+b\cdot\ln(D)$	–5.2898	2.9353	–	–	–
83	$a+b\cdot\ln(D)$	–4.1814	1.6645	–	–	–
84	$a+b\cdot\ln(D)$	–1.6015	2.3427	–	–	–
85	$a+b\cdot\ln(D)$	–1.7716	1.073	–	–	–
86	$a+b\cdot\ln(D)+c\cdot\ln(H)$	–2.872	2.095	0.678	–	–
87	$a+b\cdot\log(D)$	2.85102	2.0666	–	–	–
88	$a\cdot D^b$	0.453	2.139	–	–	–
89	$a\cdot D^b$	0.1143	2.503	–	–	–
90	$a\cdot D^b\cdot H^c$	0.0306	2.347	0.590	–	–
91	$a\cdot D^b$	0.0798	2.601	–	–	–
92	$a\cdot D^b$	0.1315	2.4321	–	–	–
93	$a+\log[H\cdot(D^2)]\cdot b$	–1.7194	1.0414	–	–	–
94	$a\cdot D^b\cdot H^c$	0.04736	1.80521	0.99603	–	–
95	$a\cdot D^b\cdot H^c$	0.16885	2.44639	–0.1431	–	–
96	$a\cdot D^b\cdot H^c$	0.00868	2.25454	1.09409	–	–
97	$a\cdot D^b\cdot H^c$	0.03927	2.01361	0.87832	–	–
98	$a+b\cdot\log(D)$	0.41439	3.18522	–	–	–
99	$a\cdot D^b$	0.021	2.471	–	–	–

Appendix A		Unit of Biom.	Unit of D	Unit of H	Range of D (cm)	Range of H (m)	Ref.	Cont.	Comm.	n	r^2
100 France	ln(BR)	kg	cm	–	–	–	42	14		23	0.93
101 Netherlands	BR	kg	cm	m	–	–	5	8		38	0.92
102 Netherlands	BR	kg	cm	–	–	–	5	8		38	0.916
103 Spain	BR	kg	cm	–	4–34.5	6.1–18.4	67	14		7	0.89
104 Sweden	log(BR)	kg	cm	m	12–64	11–29	61	8		–	–
105 Netherlands	CR	kg	cm	m	–	–	5	8		38	0.929
106 Netherlands	CR	kg	cm	–	–	–	5	8		38	0.924
107 UK	CR	t	cm	–	–	–	9	6	1	–	–
108 UK	CR	t	cm	–	–	–	9	6	1	–	–
109 France	ln(FL)	kg	cm	–	–	–	42	14		23	0.95
110 Italy	FL	kg	cm	–	–	–	11	8	8	–	0.956
111 Italy	FL	kg	cm	m	–	–	11	8		–	0.961
112 Netherlands	FL	kg	cm	m	–	–	5	8		38	0.923
113 Netherlands	FL	kg	cm	–	–	–	5	8		38	0.906
114 Spain	FL	kg	cm	–	4–34.5	6.1–18.4	67	14		7	0.89
115 France	ln(RC)	kg	cm	–	–	–	42	14		16	0.99
116 France	ln(RF)	kg	cm	–	–	–	42	14		16	0.94
117 France	ln(RS)	kg	cm	–	–	–	42	14		16	0.95
118 France	RT	kg	cm	–	–	–	43	8		16	0.99
119 France	log(RT)	kg	cm	–	3–20	–	21	8		16	0.99
120 Germany	log(RT)	kg	cm	–	12–47	–	21	8		8	0.98
121 Sweden	log(RT)	kg	cm	m	12–64	11–29	61	8		–	–
122 France	ln(SB)	kg	cm	–	–	–	42	14		23	0.99
123 Sweden	log(SB)	kg	cm	m	12–64	11–29	61	8		–	–
124 Czech republic	ST	kg	cm	–	5.7–62.1	9.2–33.9	15	2		20	0.954
125 Italy	ST	kg	cm	m	–	–	11	8	8	–	0.988
126 Italy	ST	kg	cm	m	–	–	11	8	9	–	0.995
127 Italy	ST	kg	cm	m	–	–	11	8	10	–	0.99
128 Italy	ST	kg	cm	m	–	–	11	8		–	0.996
129 Netherlands	ST	kg	cm	m	–	–	5	8		38	0.996
130 Netherlands	ST	kg	cm	–	–	–	5	8		38	0.979
131 Spain	ST	kg	cm	–	4–34.5	6.1–18.4	67	14		7	0.99
132 France	ln(SW)	kg	cm	–	–	–	42	14		23	0.99
133 Sweden	log(SW)	kg	cm	m	12–64	11–29	61	8		–	–
Fraxinus excelsior (European ash)											
134 UK	ln(ABW)	kg	cm	–	2.9–33	–	10	14	11	15	0.994
135 UK	ln(ABW)	kg	cm	–	3–18	–	10	14	11	15	0.985
Larix sibirica (Siberian larch)											
136 Iceland	AB	kg	cm	m	3.3–31.6	3–20	71	8		44	0.992
137 Iceland	ST	kg	cm	m	3.3–31.6	3–20	71	8		44	0.984
Larix spp.											
138 UK	CR	t	cm	–	–	–	9	6	2	–	–
Picea abies (Norway spruce, Kuusi, Gran, Fichte, Rødgran, Epicéa)											
139 Belgium	AB	g	cm	cm	2.6–10	1.3–4.5	41	5	12	23	0.982
140 Czech republic	AB	kg	cm	m	1–11	2–9	18	7	13	55	–
141 Czech republic	AB	kg	cm	–	11–47	14–33	16	2		17	0.967
142 Czech republic	AB	kg	cm	m	11–47	14–33	16	2		17	0.971
143 Denmark	AB	kg	cm	m	10–17	11–13	59	7	14	5	–
144 Denmark	AB	kg	cm	m	12–20	11–14	59	7	15	10	–
145 Finland	AB	kg	cm	–	–	–	8	8		–	–
146 Finland	AB	kg	cm	m	–	–	8	8		–	–
147 Germany	AB	kg	cm	–	17–39	–	26	12		19	0.995
148 Germany	AB	kg	cm	–	10.–27.2	–	64	12		8	–
149 Germany	AB	kg	cm	–	17–38	–	64	12		9	–
150 Germany	AB	kg	cm	–	23–31	–	64	12		5	–
151 Iceland	AB	kg	cm	m	2.7–27.9	2.7–12	71	8		16	0.981
152 Norway	AB	g	cm	–	5–15	–	6	7		35	0.993
153 Norway	AB	g	cm	–	2–5	–	6	7		35	–
154 Sweden	log(AB)	kg	cm	m	15–38	18–28	61	8		–	–
155 Belgium	log(ABW)	g	cm	–	16.–32.3	–	24	12		6	0.982

	Equation	Parameters a	b	c	d	e
100	$a+b\cdot\ln(D)$	–6.2524	3.328	–	–	–
101	$a\cdot D^b\cdot H^c$	0.0114	3.682	–1.031	–	–
102	$a\cdot D^b$	0.0020	3.265	–	–	–
103	$a\cdot D^b$	0.0317	2.3931	–	–	–
104	$a+\log[H\cdot(D^2)]\cdot b$	–3.2114	1.2481	–	–	–
105	$a\cdot D^b\cdot H^c$	0.0183	3.614	–1.078	–	–
106	$a\cdot D^b$	0.0031	3.161	–	–	–
107	$a\cdot D^2$	$2.595\cdot 10^{-4}$	–	–	–	–
108	$a+b\cdot D^c$	0.00686	$1.92\cdot 10^{-5}$	2.4658	–	–
109	$a+b\cdot\ln(D)$	–4.8599	2.1935	–	–	–
110	$a\cdot D^b$	0.00295	2.43854	–	–	–
111	$a\cdot D^b\cdot H^c$	0.02408	3.04567	–1.51571	–	–
112	$a\cdot D^b\cdot H^c$	0.0167	2.951	–1.101	–	–
113	$a+b\cdot D^c$	0.375	0.0024	2.517	–	–
114	$a\cdot D^b$	0.0145	1.9531	–	–	–
115	$a+b\cdot\ln(D)$	–4.1302	2.6099	–	–	–
116	$a+b\cdot\ln(D)$	–5.7948	2.1609	–	–	–
117	$a+b\cdot\ln(D)$	–5.4415	2.082	–	–	–
118	$a+b\cdot\ln(D)$	–3.8219	2.5382	–	–	–
119	$a+b\cdot\log(D)$	–1.66	2.54	–	–	–
120	$a+b\cdot\log(D)$	–2	2.7	–	–	–
121	$a+\log[H\cdot(D^2)]\cdot b$	–2.8434	1.104	–	–	–
122	$a+b\cdot\ln(D)$	–3.0741	2.0543	–	–	–
123	$a+\log[H\cdot(D^2)]\cdot b$	–2.4279	0.8636	–	–	–
124	$a\cdot D^b$	0.494	2.07	–	–	–
125	$a\cdot D^b\cdot H^c$	0.00519	1.49634	2.10419	–	–
126	$a\cdot D^b\cdot H^c$	0.03638	2.15436	0.6587	–	–
127	$a\cdot D^b\cdot H^c$	0.00269	2.02481	1.65219	–	–
128	$a\cdot D^b\cdot H^c$	0.00519	1.87511	1.27233	–	–
129	$a\cdot D^b\cdot H^c$	0.0109	1.951	1.262	–	–
130	$a\cdot D^b$	0.0762	2.523	–	–	–
131	$a\cdot D^b$	0.0894	2.4679	–	–	–
132	$a+b\cdot\ln(D)$	–2.0445	2.3912	–	–	–
133	$a+\log[H\cdot(D^2)]\cdot b$	–1.6219	0.9813	–	–	–
134	$a+b\cdot\ln(D)$	–2.4598	2.4882	–	–	–
135	$a+b\cdot\ln(D)$	–2.4718	2.5466	–	–	–
136	$a\cdot D^b\cdot H^c$	0.1081	1.53	0.9482	–	–
137	$a\cdot D^b\cdot H^c$	0.0444	1.4793	1.2397	–	–
138	$a+b\cdot D^c$	0.00564	$3.041\cdot 10^{-5}$	2.1058	–	–
139	$a+b\cdot H+c\cdot D^2$	–520.7	–2.8	154.1	–	–
140	$a\cdot(D+1)^{[b+c\cdot\log(D)]}\cdot H^d$	0.4274	0.8674	1.0099	–0.2028	–
141	$a\cdot D^b$	0.57669	1.964	–	–	–
142	$a\cdot[(D^2)\cdot H]^b$	0.11975	0.81336	–	–	–
143	$a\cdot D^2H$	0.02155	–	–	–	–
144	$a\cdot D^2H$	0.01815	–	–	–	–
145	$a+b\cdot D+c\cdot D^2$	19.018	–4.806	0.565	–	–
146	$a+b\cdot D^2+c\cdot(D^2\cdot H)$	0.257	0.187	0.010	–	–
147	$a+b\cdot D+c\cdot D^2$	–43.13	2.25	0.452	–	–
148	$a+b\cdot D+c\cdot D^2$	–60.55702	5.46558	0.27567	–	–
149	$a+b\cdot D+c\cdot D^2$	–283.17413	26.32334	–0.12856	–	–
150	$a+b\cdot D+c\cdot D^2$	–142.60881	13.63896	0.12593	–	–
151	$a\cdot D^b\cdot H^c$	0.2465	2.12	–0.167	–	–
152	$a\cdot D^2+b\cdot(D^2-c)$	200.3691	99.3609	25	–	–
153	$a\cdot D^2$	200.3691	–	–	–	–
154	$a+\log[H\cdot(D^2)]\cdot b$	–1.2908	0.891	–	–	–
155	$a+b\cdot\log(D)$	1.81298	2.51353	–	–	–

Appendix A

		Unit of			Range of						
		Biom.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
156 Austria	BR	kg	mm	–	3.2–20.7	–	60	12		12	0.731
154 Austria	BR	kg	mm	–	2.5–17.9	–	60	12		12	0.95
158 Czech republic	BR	kg	cm	m	1–11	2–9	18	7	13	55	–
159 Czech republic	BR	kg	cm	–	11–47	14–33	16	2		25	0.892
160 Czech republic	BR	kg	cm	m	11–47	14–33	16	2		25	0.89
161 Denmark	ln(BR)	kg	cm	m	14–26	14–18	34	7	16	20	0.83
162 Europe	ln(BR)	kg	cm	–	1.8–67.6	2.1–42.8	74	8		429	0.871
163 Finland	BR	kg	cm	–	–	–	8	8	17	–	–
164 Finland	BR	kg	cm	m	–	–	8	8	17	–	–
165 Finland	BR	kg	cm	–	–	–	8	8	18	–	–
166 Finland	BR	kg	cm	m	–	–	8	8	18	–	–
167 Finland	BR	kg	cm	–	–	–	8	8	19	–	–
168 Finland	BR	kg	cm	m	–	–	8	8	19	–	–
169 Germany	BR	kg	cm	–	17–39	–	27	12		19	–
170 Germany	BR	kg	m	m	0–50	5–30	54	8		32	0.961
171 Germany	BR	kg	m	m	0–10	5–10	54	8	20	10	0.94
172 Germany	BR	kg	m	m	20–30	18–21	54	8	20	7	0.79
173 Germany	BR	kg	m	m	30–50	24–30	54	8	20	15	0.903
174 Germany	BR	kg	cm	–	26–60	30.–36.27	69	10		7	0.959
175 Germany	BR	kg	cm	–	27–55.8	22.–29.80	69	10		7	0.972
176 Germany	BR	kg	cm	–	23–52	32.–38.9	33	10		5	0.921
177 Germany	BR	kg	cm	–	26–60	30–36.26	69	10	20	7	0.892
178 Germany	BR	kg	cm	–	26–55.7	22–29.79	69	10	20	7	0.976
179 Germany	BR	kg	cm	–	23–52	32–38.8	33	10		5	0.886
180 Iceland	BR	kg	cm	m	2.7–27.9	2.7–12	71	8	4	16	0.944
181 Norway	BR	g	cm	–	5–15	–	6	7		35	0.978
182 Norway	BR	g	cm	–	2–5	–	6	7		35	–
183 Sweden	BR	kg	mm	–	4.9–29.8	4.1–23.4	37	4		32	0.955
184 Sweden	ln(BR)	g	cm	–	1.1–9.9	18–83	19	8		43	0.77
185 Sweden	log(BR)	kg	cm	m	15–38	18–28	61	8		–	–
186 Iceland	CR	kg	cm	m	2.7–27.9	2.7–12	71	8		16	0.959
187 Sweden	ln(CR)	kg	cm	–	0.3–63.4	1.3–35.6	49	8		1501	0.933
188 Finland	CR	kg	cm	–	–	–	8	8		–	–
189 Finland	CR	kg	cm	m	–	–	8	8		–	–
190 Finland	CR	kg	mm	–	–	–	29	8	21	–	0.881
191 Finland	CR	kg	mm	dm	–	–	29	8	22	–	0.903
192 Finland	CR	kg	cm	–	–	–	28	8		–	0.912
193 Finland	CR	kg	mm	–	–	–	29	8	22	–	0.892
194 Finland	CR	kg	mm	dm	–	–	29	8	21	–	0.893
195 Germany	CR	kg	cm	–	26–60	–	69	12		7	0.964
196 Germany	CR	kg	cm	–	24–55.5	–	69	12		7	0.972
197 Germany	CR	kg	cm	–	10.–27.2	–	64	12		8	–
198 Germany	CR	kg	cm	–	17–38	–	64	12		9	–
199 Germany	CR	kg	cm	–	23–31	–	64	12		5	–
200 Germany	CR	kg	cm	–	24–52	32.–38.6	20	10		5	0.881
201 Sweden	ln(CR)	kg	cm	–	0–50	0–	50	8		544	0.945
202 Sweden	ln(CR)	kg	cm	m	0–50	0–	50	8		544	0.949
203 Belgium	log(DB)	g	cm	–	16.–32.3	–	24	12		6	0.97
204 Czech republic	DB	kg	cm	–	11–47	14–33	15	2		26	0.431
205 Czech republic	DB	kg	cm	m	11–47	14–33	15	2		26	0.41
206 Denmark	ln(DB)	kg	cm	m	14–26	14–18	34	7	16	20	0.58
207 Europe	ln(DB)	kg	cm	–	3.5–52.8	4.2–33.4	74	8		207	0.794
208 Finland	DB	kg	mm	–	–	–	28	8		–	0.266
209 Germany	DB	kg	cm	–	26–60	31–36	69	10		7	0.819
210 Norway	DB	g	cm	–	5–15	–	6	7		35	0.798
211 Norway	DB	g	cm	–	2–5	–	6	7		35	–
212 Sweden	ln(DB)	g	cm	dm	1.1–9.9	1.8–8.3	18	8		42	0.37
213 Sweden	ln(DB)	kg	cm	–	0–50	0–	50	8		525	0.714
214 Sweden	ln(DB)	kg	cm	m	0–50	0–	50	8		525	0.729
215 Sweden	ln(DB)	kg	cm	–	0.3–63.4	1.3–35.6	49	8		525	0.714

	Equation	Parameters a	b	c	d	e
156	$a \cdot exp(b \cdot D)$	5.3727	0.00876	–	–	–
157	$a \cdot exp(b \cdot D)$	1.325	0.0135	–	–	–
158	$a \cdot (D+1)^{[b+c \cdot log(D)]} \cdot H^d$	0.1895	1.4075	0.8841	–0.9098	–
159	$a \cdot D^b$	0.0042229	2.7044	–	–	–
160	$a \cdot [(D^2) \cdot H]^b$	$4.5394 \cdot 10^{-4}$	1.1262	–	–	–
161	$a+b \cdot ln(D^2 \cdot H)$	–5.88	1.02	–	–	–
162	$a+b \cdot ln(D)$	–3.96201	2.2552	–	–	–
163	$a+b \cdot D+c \cdot D^2$	2.479	–0.552	0.066	–	–
164	$a+b \cdot D^2+c \cdot D \cdot H$	–0.129	0.076	–0.041	–	–
165	$a+b \cdot D+c \cdot D^2$	3.640	–0.476	0.063	–	–
166	$a+b \cdot D+c \cdot D^2+d \cdot D \cdot H$	3.225	–0.295	0.091	–0.045	–
167	$a+b \cdot D+c \cdot D^2$	3.278	–0.728	0.101	–	–
168	$a+b \cdot D^2+c \cdot D \cdot H$	0.115	0.130	–0.074	–	–
169	$a+b \cdot D+c \cdot D^2$	17.6	–2.87	0.141	–	–
170	$a \cdot (H \cdot D^2)^b$	11.74	1.2	–	–	–
171	$a \cdot (H \cdot D^2)^b$	33.53	0.916	–	–	–
172	$a \cdot (H \cdot D^2)^b$	10.81	1.05	–	–	–
173	$a \cdot (H \cdot D^2)^b$	3.98	1.306	–	–	–
174	$a \cdot D^b$	0.000135	3.453183	–	–	–
175	$a \cdot D^b$	$1.96 \cdot 10^{-5}$	4.0576	–	–	–
176	$a \cdot D^b$	0.000999	2.833374	–	–	–
177	$a \cdot D^b$	0.0021994	2.4392	–	–	–
178	$a \cdot D^b$	0.0004947	2.9487	–	–	–
179	$a \cdot D^b$	0.00684	2.0603	–	–	–
180	$a \cdot D^b \cdot H^c$	0.0653	2.9955	–1.3501	–	–
181	$a \cdot D^2+b \cdot (D^2-c)$	37.7513	21.115	25	–	–
182	$a \cdot D^2$	37.7513	–	–	–	–
183	$a \cdot (1-exp^{(-b \cdot D)})^c$	36.2826	0.0080	2.1576	–	–
184	$a+b \cdot ln(D)^2$	4.8678	0.8216	–	–	–
185	$a+log[H \cdot (D^2)] \cdot b$	–3.628	1.2374	–	–	–
186	$a \cdot D^b \cdot H^c$	0.2425	2.7517	–1.3456	–	–
187	$a+b \cdot [D/(D+13)]$	–1.3858	8.6040	–	–	–
188	$a+b \cdot D+c \cdot D^2$	3.416	–0.593	0.140	–	–
189	$a+b \cdot D+c \cdot D^2+d \cdot H+e \cdot (D \cdot H)$	6.721	0.358	0.119	–1.4773	0.030
190	$a+b \cdot D+c \cdot D^3$	–3.71	0.10229	$3.3 \cdot 10^{-6}$	–	–
191	$a+b \cdot D^2+c \cdot D^3+d \cdot (D^3/H)$	0.4866	$3.5026 \cdot 10^{-4}$	$1.35 \cdot 10^{-6}$	$4.2424 \cdot 10^{-4}$	–
192	$a+b \cdot D^2$	3.2	0.1049	–	–	–
193	$a+b \cdot D+c \cdot D^3$	–4.34	0.11571	$3.34 \cdot 10^{-6}$	–	–
194	$a+b \cdot D^2+c \cdot D^3+d \cdot (D^3/H)$	0.4112	$2.6724 \cdot 10^{-4}$	$1.41 \cdot 10^{-6}$	$4.3562 \cdot 10^{-4}$	–
195	$a \cdot D^b$	0.0013	3.1784	–	–	–
196	$a \cdot D^b$	0.0009	3.2112	–	–	–
197	$a+b \cdot D+c \cdot D^2$	–0.55542	–0.39541	0.09537	–	–
198	$a+b \cdot D+c \cdot D^2$	–70.51964	6.11247	–0.04391	–	–
199	$a+b \cdot D+c \cdot D^2$	–12.29435	1.19256	0.0462	–	–
200	$a \cdot D^b$	0.1068	1.8137	–	–	–
201	$a+b \cdot [D/(D+13)]$	–1.2804	8.5242	–	–	–
202	$a+b \cdot [D/(D+13)]+c \cdot H+d \cdot ln(H)$	–1.2063	10.9708	–0.0124	–0.4923	–
203	$a+b \cdot log(D)$	1.82795	1.49367	–	–	–
204	$a \cdot D^b$	0.055571	1.5317	–	–	–
205	$a \cdot [(D^2) \cdot H]^b$	0.021705	0.60715	–	–	–
206	$a+b \cdot ln(D^2 \cdot H)$	–7.75	1.08	–	–	–
207	$a+b \cdot ln(D)$	–3.22406	1.67320	–	–	–
208	$a+b \cdot D+c \cdot D^3$	–0.62	0.0134	$3.9 \cdot 10^{-8}$	–	–
209	$a \cdot D^b$	$4.25 \cdot 10^{-7}$	4.731	–	–	–
210	$a \cdot D^2+b \cdot (D^2-c)$	9.921	–3.6193	25	–	–
211	$a \cdot D^2$	9.921	–	–	–	–
212	$a+b \cdot ln(D^2 \cdot H)$	–1.4358	0.7494	–	–	–
213	$a+b \cdot [D/(D+18)]$	–4.3308	9.9550	–	–	–
214	$a+b \cdot [D/(D+18)]+c \cdot H+d \cdot ln(H)$	–4.6351	3.6518	0.0493	1.0129	–
215	$a+b \cdot [D/(D+18)]$	–4.6654	9.9550	–	–	–

Appendix A

		Unit of Biom.	Unit of D	Unit of H	Range of D (cm)	Range of H (m)	Ref.	Cont.	Comm.	n	r^2
216 Austria	FL	kg	mm	–	3.2–20.7	–	60	12		12	0.898
217 Austria	FL	kg	mm	–	2.5–17.9	–	60	12		12	0.89
218 Czech republic	FL	kg	cm	m	1–11	2–9	18	7	13	55	–
219 Czech republic	FL	kg	cm	–	11–47	14–33	16	2		25	0.941
220 Czech republic	FL	kg	cm	m	11–47	14–33	16	2		25	0.93
221 Denmark	ln(FL)	kg	cm	m	14–26	14–18	34	7	23	20	0.74
222 Europe	ln(FL)	kg	cm	–	1.8–67.6	2.1–42.8	74	8		551	0.847
223 Finland	FL	kg	cm	–	–	–	8	8	24	–	–
224 Finland	FL	kg	cm	m	–	–	8	8	24	–	–
225 Finland	ln(FL)	kg	mm	–	–	–	29	8		–	0.715
226 Finland	FL	kg	cm	m	–	–	46	8		–	–
227 Germany	log(FL)	kg	cm	–	18–62	–	70	12		28	0.911
228 Germany	FL	kg	cm	–	10.–27.2	–	64	12		8	–
229 Germany	FL	kg	cm	–	17–38	–	64	12		9	–
230 Germany	FL	kg	m	m	0–10	5–10	54	8		10	0.961
231 Germany	FL	kg	m	m	20–30	18–21	54	8		7	0.869
232 Germany	FL	kg	m	m	30–50	24–30	54	8		15	0.906
233 Germany	FL	kg	cm	–	14–27	20–24	45	8		8	0.95
234 Germany	FL	kg	cm	–	26–60	30.–36.25	69	10		7	0.857
235 Germany	FL	kg	cm	–	25–55.6	22.–29.78	69	10		7	0.964
236 Germany	FL	kg	cm	–	24–52	32.–38.7	33	10		5	0.854
237 Norway	FL	g	cm	–	5–15	–	6	7		35	0.978
238 Norway	FL	g	cm	–	2–5	–	6	7		35	–
239 Sweden	ln(FL)	kg	cm	–	0–50	0–	50	8		544	0.899
240 Sweden	ln(FL)	kg	cm	m	0–50	0–	50	8		544	0.901
241 Sweden	ln(FL)	kg	cm	–	0.3–63.4	1.3–35.6	49	8		544	0.899
242 Sweden	FL	kg	mm	–	4.9–29.8	4.1–23.4	37	4		32	0.962
243 Sweden	ln(FL)	g	cm	–	1.1–9.9	18–83	19	8		43	0.87
244 Germany	RC	kg	m	m	0–50	5–30	54	8		25	0.872
245 Sweden	ln(RC)	kg	cm	–	0–50	0–	50	8	25	281	0.941
246 Germany	RS	kg	m	m	0–50	5–30	54	8		25	0.872
247 Sweden	ln(RS)	kg	cm	–	0–50	0–	50	8	26	329	0.925
248 Europe	ln(RT)	kg	cm	–	–	–	74	8		–	0.956
249 Germany	RT	kg	cm	–	15–23	–	22	12		15	0.63
250 Germany	RT	kg	cm	–	16–32.5	–	44	12		15	0.711
251 Germany	log(RT)	kg	cm	–	5–25	–	21	8		15	0.79
252 Germany	RT	kg	cm		14–27	20–24	45	8		5	0.96
253 Sweden	log(RT)	kg	cm	m	15–38	18–28	61	8		–	–
254 UK	RT	kg	cm	–	–	–	9	6		–	–
255 Czech republic	SB	kg	cm	–	11–47	14–33	16	2		18	0.927
256 Czech republic	SB	kg	cm	m	11–47	14–33	16	2		18	0.935
257 Denmark	ln(SB)	kg	cm	m	14–26	14–18	34	7	16	20	0.84
258 Germany	SB	kg	cm	–	10.–27.2	–	64	12		8	–
259 Germany	SB	kg	cm	–	26–60	30.–36.28	69	10		7	0.965
260 Germany	SB	kg	cm	–	28–55.9	22.–29.81	69	10		7	0.862
261 Germany	SB	kg	cm	–	23–52	32.–38.10	33	10		5	0.904
262 Norway	SB	g	cm	–	5–15	–	6	7		35	0.981
263 Norway	SB	g	cm	–	2–5	–	6	7		35	–
264 Sweden	ln(SB)	kg	cm	–	0–50	0–	50	8		505	0.966
265 Sweden	ln(SB)	kg	cm	m	0–50	0–	50	8		505	0.968
266 Sweden	ln(SB)	kg	cm	–	0.3–63.4	1.3–35.6	49	8		505	0.966
267 Sweden	ln(SB)	g	cm	dm	1.1–9.9	1.8–8.3	19	8		43	0.97
268 Sweden	log(SB)	kg	cm	m	15–38	18–28	61	8		–	–
269 Sweden	ln(SR)	kg	cm	–	0–50	0–	50	8		316	0.97
270 Belgium	log(ST)	g	cm	–	16.–32.3	–	24	12		6	0.986
271 Czech republic	ST	kg	cm	m	1–11	2–9	18	7	13	55	–
272 Europe	ln(ST)	kg	cm	–	3.5–52.8	4.2–33.4	74	8		235	0.986
273 Germany	ST	kg	cm	–	26–60	–	69	12		7	0.968
274 Germany	ST	kg	cm	–	24–55.5	–	69	12		7	0.962
275 Germany	ST	kg	cm	–	17–38	–	64	12		9	–

	Equation	Parameters a	b	c	d	e
216	$a+b\cdot D+c\cdot D^2$	–1.9745	0.039	0.00382	–	–
217	$a+b\cdot D+c\cdot D^2$	–0.7095	0.0011	0.00142	–	–
218	$a\cdot(D+1)^{[b+c\cdot\log(D)]}\cdot H^d$	0.2139	0.6896	1.2814	–0.6697	–
219	$a\cdot D^b$	0.030997	2.0019	–	–	–
220	$a\cdot[(D^2)\cdot H]^b$	0.0070936	0.81716	–	–	–
221	$a+b\cdot\ln(D^2\cdot H)$	–4.85	0.81	–	–	–
222	$a+b\cdot\ln(D)$	–3.19632	1.91620	–	–	–
223	$a+b\cdot D+c\cdot D^2$	–0.647	0.106	0.040	–	–
224	$a+b\cdot D+c\cdot D^2+d\cdot D\cdot H$	–0.607	0.095	0.039	0.001	–
225	$a+b\cdot\ln(D)$	–9.03	2.2204	–	–	–
226	$a\cdot D^b\cdot H^c$	0.1022	2.5947	–0.8647	–	–
227	$a+b\cdot\log(D)$	–3.084	2.814	–	–	–
228	$a+b\cdot D+c\cdot D^2$	–12.29769	1.14647	0.00179	–	–
229	$a+b\cdot D+c\cdot D^2$	–12.55702	1.14647	0.00179	–	–
230	$a\cdot(H\cdot D^2)^b$	35.05	0.847	–	–	–
231	$a\cdot(H\cdot D^2)^b$	21.37	0.979	–	–	–
232	$a\cdot(H\cdot D^2)^b$	9.26	1.179	–	–	–
233	$a+b\cdot D$	–18.63	1.85	–	–	–
234	$a\cdot D^b$	0.0061379	2.3026	–	–	–
235	$a\cdot D^b$	0.0026146	2.6763	–	–	–
236	$a\cdot D^b$	0.00784	2.14426	–	–	–
237	$a\cdot D^2+b\cdot(D^2-c)$	53.0637	10.4186	25	–	–
238	$a\cdot D^2$	53.0637	–	–	–	–
239	$a+b\cdot[D/(D+12)]$	–1.9602	7.8171	–	–	–
240	$a+b\cdot[D/(D+12)]+c\cdot\ln(H)$	–1.8551	9.7809	–0.4873	–	–
241	$a+b\cdot[D/(D+12)]$	–2.0330	7.8171	–	–	–
242	$a\cdot(1-\exp(-b\cdot D))^c$	348.6448	0.0025	2.6100	–	–
243	$a+b\cdot\ln(D)^2$	5.5129	0.7519	–	–	–
244	$a\cdot(H\cdot D^2)^b$	7.33	1.383	–	–	–
245	$a+b\cdot[D/(D+8)]$	–6.3851	13.3703	–	–	–
246	$a\cdot(H\cdot D^2)^b$	1.13	0.926	–	–	–
247	$a+b\cdot[D/(D+12)]$	–2.5706	7.6283	–	–	–
248	$a+b\cdot\ln(D)$	–5.37891	2.92111	–	–	–
249	$a\cdot D^b$	0.02	2.36	–	–	–
250	$a+b\cdot D$	–33.225	2.3915	–	–	–
251	$a+b\cdot\log(D)$	–1.7	2.36	–	–	–
252	$a+b\cdot D$	–45.94	3.58	–	–	–
253	$a+\log[H\cdot(D^2)]\cdot b$	–2.0274	0.8946	–	–	–
254	$a\cdot D^b$	$1.204\cdot10^{-5}$	2.4920	–	–	–
255	$a\cdot D^b$	0.032777	1.8902	–	–	–
256	$a\cdot[(D^2)\cdot H]^b$	0.0071913	0.7832	–	–	–
257	$a+b\cdot\ln(D^2\cdot H)$	–5.51	0.88	–	–	–
258	$a+b\cdot D+c\cdot D^2$	–6.55127	0.75517	0.02156	–	–
259	$a\cdot D^b$	0.23943	1.439	–	–	–
260	$a\cdot D^b$	0.2917	1.2919	–	–	–
261	$a\cdot D^b$	0.1557	1.5908	–	–	–
262	$a\cdot D^2+b\cdot(D^2-c)$	23.8849	–3.9241	25	–	–
263	$a\cdot D^2$	23.8849	–	–	–	–
264	$a+b\cdot[D/(D+15)]$	–3.3912	9.8364	–	–	–
265	$a+b\cdot[D/(D+15)]+c\cdot H+d\cdot\ln(H)$	–3.4020	8.3089	0.0147	0.2295	–
266	$a+b\cdot[D/(D+15)]$	–3.4216	9.8364	–	–	–
267	$a+b\cdot\ln(D)+c\cdot H+d\cdot\ln[(D^2)\cdot H]$	7.0429	4.946	0.0438	–1.5405	–
268	$a+\log[H\cdot(D^2)]\cdot b$	–1.8073	0.7426	–	–	–
269	$a+b\cdot[D/(D+14)]$	–2.4447	10.5381	–	–	–
270	$a+b\cdot\log(D)$	1.85007	2.45530	–	–	–
271	$a\cdot(D+1)^{[b+c\cdot\log(D)]}\cdot H^d$	0.0468	1.2244	0.5465	0.6481	–
272	$a+b\cdot\ln(D)$	–2.50602	2.44277	–	–	–
273	$a\cdot D^b$	0.408	2.0136	–	–	–
274	$a\cdot D^b$	0.208	2.1531	–	–	–
275	$a+b\cdot D+c\cdot D^2$	–212.04143	20.20032	–0.08466	–	–

Appendix A

		Unit of			Range of						
		Biom.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
276 Germany	ST	kg	cm	–	23–31	–	64	12		5	–
277 Germany	ST	t	cm	–	17–39	21–31	26	7		19	0.989
278 Germany	ST	kg	cm	–	24–52	32.–38.5	20	10		5	0.984
279 Iceland	ST	kg	cm	m	2.7–27.9	2.7–12	71	8		16	0.989
280 Sweden	ln(ST)	kg	cm	–	0–50	0–	50	8		546	0.988
281 Sweden	ln(ST)	kg	cm	m	0–50	0–	50	8		546	0.994
282 Sweden	ln(ST)	kg	cm	m	0.3–63.4	1.3–35.6	49	8		1503	0.994
283 Sweden	ln(ST)	kg	cm	–	0.3–63.4	1.3–35.6	49	8		1503	0.986
284 Sweden	ln(ST)	kg	cm	m	0.3–63.4	1.3–35.6	49	8		505	0.992
285 Sweden	ln(ST)	kg	cm	–	0.3–63.4	1.3–35.6	49	8		505	0.982
286 Sweden	ln(SU)	kg	cm	–	0–50	0–	50	8		328	0.958
287 Czech republic	SW	kg	cm	–	11–47	14–33	16	2		18	0.969
288 Czech republic	SW	kg	cm	–	11–47	14–33	16	2		18	0.976
289 Denmark	ln(SW)	kg	cm	m	14–26	14–18	34	7	16	20	0.96
290 Germany	SW	kg	cm	–	26–60	30.–36.29	69	10		7	0.956
291 Germany	SW	kg	cm	–	29–55.1	22.–29.82	69	10		7	0.963
292 Germany	SW	kg	cm	–	23–51	32.–38.11	33	10		5	0.984
293 Norway	SW	g	cm	–	5–15	–	6	7		35	0.985
294 Norway	SW	g	cm	–	2–5	–	6	7		35	–
295 Sweden	ln(SW)	kg	cm	–	0–50	0–	50	8		505	0.982
296 Sweden	ln(SW)	kg	cm	m	0–50	0–	50	8		505	0.992
297 Sweden	ln(SW)	g	cm	dm	1.1–9.9	1.8–8.3	19	8		43	0.99
298 Sweden	log(SW)	kg	cm	m	15–38	18–28	61	8		–	–
299 Germany	TB	kg	cm	–	26–60	30.–36.23	20	10		7	0.974
300 Germany	TB	kg	cm	–	24–55.5	22.–29.77	20	10		7	0.975
301 Germany	TB	kg	cm	–	24–52	32.–38.4	20	10		5	0.981
Picea engelmannii (Engelmann spruce)											
302 Iceland	AB	kg	cm	m	1.4–12.7	1.7–12.7	71	8		14	0.927
303 Iceland	ST	kg	cm	m	1.4–12.7	1.7–12.7	71	8		14	0.967
Picea rubens											
304 –	log(RT)	kg	cm	–	–	–	68	8		15	0.972
Picea sitchenis (Sitka spruce)											
305 UK	RT	kg	cm	–	–	–	9	6		–	–
Picea spp.											
306 Iceland	AB	kg	cm	m	4.9–28.6	4.8–15.4	71	8		56	0.965
307 Iceland	CR	kg	cm	m	4.9–28.6	4.8–15.4	71	8		56	0.905
308 UK	CR	kg	cm	–	–	–	9	6	1	–	–
309 UK	CR	kg	cm	–	–	–	9	6	2	–	–
310 Iceland	ST	kg	cm	m	4.9–28.6	4.8–15.4	71	8		56	0.981
Pinus banksiana											
311 –	log(RT)	kg	cm	–	–	–	68	8		40	0.917
Pinus contorta (Lodgepole pine)											
312 Iceland	AB	kg	cm	m	4.2–26.3	2.8–12.8	71	8		48	0.984
313 UK	CR	kg	cm	–	–	–	9	6	2	–	–
314 –	log(RT)	kg	cm	m	–	–	68	8		72	0.949
315 –	log(RT)	kg	cm	m	–	–	68	8		221	0.9
316 UK	RT	kg	cm	–	–	–	9	6		–	–
317 Iceland	ST	kg	cm	m	4.2–26.3	2.8–12.8	71	8		48	0.992
Pinus nigra var ***maritima*** (Black pine, Corsican pine)											
318 UK	CR	kg	cm	–	–	–	9	6	2	–	–
319 UK	RT	kg	cm	–	–	–	9	6		–	–
Pinus pinaster (Maritime pine)											
320 Italy	ln(AB)	kg	cm	–	1.5–16	–	2	14	6	8	0.99
Pinus radiata (Radiata pine)											
321 Italy	ln(AB)	kg	cm	–	4–20	–	53	14	6	17	0.99
322 –	log(RT)	kg	cm	–	–	–	68	8		8	0.944
323 –	log(RT)	kg	cm	m	–	–	68	8		8	0.943
Pinus sylvestris (Scots pine, Mänty, Tall)											
324 Czech republic	AB	kg	cm	m	2–6	2–5	17	7		29	–
325 Czech republic	AB	kg	cm	m	2–16	4–11	17	7		50	–

	Equation	Parameters a	b	c	d	e
276	$a+b\cdot D+c\cdot D^2$	–784.923	61.58581	–0.79535	–	–
277	$a+b\cdot D+c\cdot D^2$	0.051	0.0038	0.000344	–	–
278	$a\cdot D^b$	0.5938	1.9423	–	–	–
279	$a\cdot D^b\cdot H^c$	0.0712	1.637	0.7436	–	–
280	$a+b\cdot[D/(D+14)]$	–2.0571	11.3341	–	–	–
281	$a+b\cdot[D/(D+14)]+c\cdot H+d\cdot\ln(H)$	–2.1702	7.4690	0.0289	0.6858	–
282	$a+b\cdot[D/(D+14)]+c\cdot H+d\cdot\ln(H)$	–2.2052	7.4361	0.0186	0.7595	–
283	$a+b\cdot[D/(D+14)]$	–2.0148	11.1926	–	–	–
284	$a+b\cdot[D/(D+14)]+c\cdot H+d\cdot\ln(H)$	–2.3036	7.2309	0.0355	0.7030	–
285	$a+b\cdot[D/(D+14)]$	–2.2727	11.4873	–	–	–
286	$a+b\cdot[D/(D+17)]$	–3.3645	10.6686	–	–	–
287	$a\cdot D^b$	0.52917	1.9123	–	–	–
288	$a\cdot[(D^2)\cdot H]^b$	0.115	0.79159	–	–	–
289	$a+b\cdot\ln(D^2\cdot H)$	–3.24	0.88	–	–	–
290	$a\cdot D^b$	0.31974	2.0595	–	–	–
291	$a\cdot D^b$	0.15739	2.2118	–	–	–
292	$a\cdot D^b$	0.5937753	1.9423097	–	–	–
293	$a\cdot D^2+b\cdot(D^2–c)$	75.7482	75.3706	25	–	–
294	$a\cdot D^2$	75.7482	–	–	–	–
295	$a+b\cdot[D/(D+14)]$	–2.2471	11.4873	–	–	–
296	$a+b\cdot[D/(D+14)]+c\cdot H+d\cdot\ln(H)$	–2.3032	7.2309	0.0355	0.7030	–
297	$a+b\cdot\ln(D)^2+c\cdot\ln[(D^2)\cdot H]$	3.6562	0.4115	0.401	–	–
298	$a+\log[H\cdot(D^2)]\cdot b$	–1.2187	0.8494	–	–	–
299	$a\cdot D^b$	0.2543	2.1872	–	–	–
300	$a\cdot D^b$	0.1245	2.3585	–	–	–
301	$a\cdot D^b$	0.8007	1.9075	–	–	–
302	$a\cdot D^b\cdot H^c$	0.9211	1.438	0.102	–	–
303	$a\cdot D^b\cdot H^c$	0.2288	1.239	0.717	–	–
304	$a\cdot\log(D)+b$	2.1514	–1.2417	–	–	–
305	$a\cdot D^b$	$1.115\cdot10^{–5}$	2.68358	–	–	–
306	$a\cdot D^b\cdot H^c$	0.1334	1.8716	0.4386	–	–
307	$a\cdot D^b\cdot H^c$	0.087	2.287	–0.2897	–	–
308	$a\cdot D^b$	$5.2193\cdot10^{–4}$	1.459	–	–	–
309	$a+b\cdot D^c$	0.0060722	$9.58\cdot10^{–6}$	2.5578	–	–
310	$a\cdot D^b\cdot H^c$	0.0558	1.5953	0.9336	–	–
311	$a\cdot\log(D)+b$	2.16	–0.2089	–	–	–
312	$a\cdot D^b\cdot H^c$	0.1429	1.8887	0.4332	–	–
313	$a+b\cdot D^c$	0.00435	$1.321\cdot10^{–5}$	2.5138	–	–
314	$a\cdot\log(H\cdot D^2)+b$	1.022	–1.818	–	–	–
315	$a\cdot\log(H\cdot D^2)+b$	0.806	–1.062	–	–	–
316	$a\cdot D^b$	$2.242\cdot10^{–5}$	2.42909375	–	–	–
317	$a\cdot D^b\cdot H^c$	0.0669	1.5958	0.9096	–	–
318	$a\cdot D^b$	$1.3997\cdot10^{–4}$	1.72105599	–	–	–
319	$a\cdot D^b$	$1.537\cdot10^{–5}$	2.39136175	–	–	–
320	$a+b\cdot\ln(D)$	–1.457	1.8647	–	–	–
321	$a+b\cdot\ln(D)$	–2.359	2.2936	–	–	–
322	$a\cdot\log(D)+b$	2.4453	–0.9366	–	–	–
323	$a\cdot\log(H\cdot D^2)+b$	1.0519	–2.9005	–	–	–
324	$a(D+1)^{[b+c\cdot\log(D)]}\cdot H^d$	0.0398	2.2993	0.4445	0.1232	–
325	$a(D+1)^{[b+c\cdot\log(D)]}\cdot H^d$	0.0146	2.3868	–0.0618	0.8581	–

Appendix A

		Unit of			Range of						
		Biom.	D	H	D (cm)	H (m)	Ref.	Cont.	Comm.	n	r^2
326	Czech republic	AB	kg	cm	–	2–6	2–5	17	8		–	0.91
327	Czech republic	AB	kg	cm	–	2–6	2–5	17	8		–	0.91
328	Czech republic	AB	kg	cm	–	2–6	2–5	17	8		–	0.94
329	Czech republic	AB	kg	cm	m	2–6	2–5	17	8		–	0.47
330	Czech republic	AB	kg	cm	m	2–6	2–5	17	8		–	0.45
331	Czech republic	AB	kg	cm	m	2–6	2–5	17	8		–	0.45
332	Czech republic	AB	kg	cm	–	2–16	4–11	17	8		–	0.89
333	Czech republic	AB	kg	cm	–	2–16	4–11	17	8		–	0.67
334	Czech republic	AB	kg	cm	–	2–16	4–11	17	8		–	0.98
335	Czech republic	AB	kg	cm	m	2–16	4–11	17	8		–	0.52
336	Czech republic	AB	kg	cm	m	2–16	4–11	17	8		–	0.53
337	Czech republic	AB	kg	cm	m	2–16	4–11	17	8		–	0.82
338	Finland	AB	kg	cm	–	–	–	8	8		–	–
339	Finland	AB	kg	cm	–	–	–	8	8		–	–
340	Finland	ln(AB)	kg	cm	–	–	–	55	8	28	18	0.99
341	Finland	ln(AB)	kg	cm	–	–	–	55	8	29	30	0.97
342	Norway	AB	g	cm	–	7–15	–	6	7		16	0.993
343	Norway	AB	g	cm	–	2–7	–	6	7		16	–
344	Norway	AB	g	cm	–	7–20	–	6	7	30	16	0.993
345	Norway	AB	g	cm	–	2–7	–	6	7	30	16	–
346	Poland	ln(AB)	kg	cm	–	–	–	62	8		65	0.764
347	Poland	ln(AB)	kg	cm	–	–	–	62	8		110	0.89
348	Poland	ln(AB)	kg	cm	–	–	–	62	8		30	0.938
349	Poland	ln(AB)	kg	cm	–	–	–	62	8		15	0.975
350	UK	log(AB)	g	cm		–	–	48	8		10	0.996
351	Poland	ln(ABW)	kg	cm	–	–	–	62	8		65	0.775
352	Poland	ln(ABW)	kg	cm	–	–	–	62	8		110	0.894
353	Poland	ln(ABW)	kg	cm	–	–	–	62	8		30	0.938
354	Poland	ln(ABW)	kg	cm	–	–	–	62	8		15	0.978
355	Belgium	BR	kg	cm	–	–	–	75	13		–	–
356	Czech republic	BR	kg	cm	m	2–6	2–5	17	7		29	–
357	Czech republic	BR	kg	cm	m	2–16	4–11	17	7		50	–
358	Czech republic	BR	kg	cm	–	2–6	2–5	17	8		–	0.81
359	Czech republic	BR	kg	cm	–	2–6	2–5	17	8		–	0.83
360	Czech republic	BR	kg	cm	–	2–6	2–5	17	8		–	0.81
361	Czech republic	BR	kg	cm	–	2–16	4–11	17	8		–	0.77
362	Czech republic	BR	kg	cm	–	2–16	4–11	17	8		–	0.71
363	Czech republic	BR	kg	cm	–	2–16	4–11	17	8		–	0.89
364	Czech republic	BR	kg	cm	m	2–16	4–11	17	8		–	0.74
365	Czech republic	BR	kg	cm	m	2–16	4–11	17	8		–	0.67
366	Finland	BR	kg	cm	–	–	–	8	8	17	–	–
367	Finland	BR	kg	cm	m	–	–	8	8	17	–	–
368	Finland	BR	kg	cm	–	–	–	8	8	18	–	–
369	Finland	BR	kg	cm	m	–	–	8	8	18	–	–
370	Finland	BR	kg	cm	–	–	–	8	8	19	–	–
371	Finland	BR	kg	cm	m	–	–	8	8	19	–	–
372	Finland	ln(BR)	kg	cm	–	–	–	55	8	28	18	0.9
373	Finland	ln(BR)	kg	cm	–	–	–	55	8	29	30	0.93
374	Norway	BR	g	cm	–	7–15	–	6	7		16	0.974
375	Norway	BR	g	cm	–	2–7	–	6	7		16	–
376	Norway	BR	g	cm	–	15–20	–	6	7	30	16	0.971
377	Norway	BR	g	cm	–	2–15	–	6	7	30	16	–
378	Sweden	BR	kg	cm	m	2–40	2–	1	8		73	0.49
379	Sweden	ln(BR)	g	cm	dm	1.1–10	1.7–8.8	19	8		84	0.73
380	UK	log(BR)	g	cm	–	–	–	48	8		10	0.964
381	Norway	CO	g	cm	–	7–15	–	6	7		16	0.688
382	Norway	CO	g	cm	–	2–7	–	6	7		16	–
383	Norway	CO	g	cm	–	2–13	–	6	7	30	16	–
384	Finland	CR	kg	cm	–	–	–	8	8		–	–
385	Finland	CR	kg	cm	m	–	–	8	8		–	–

	Equation	Parameters a	b	c	d	e
326	a+b·D	–3.1381	1.7295	–	–	–
327	a·exp(D·b)	0.2304	0.6536	–	–	–
328	$a \cdot D^b$	0.1599	2.2060	–	–	–
329	a+b·H	–2.2818	1.3799	–	–	–
330	a·exp(H·b)	0.332	0.51	–	–	–
331	$a \cdot H^b$	0.2146	1.8238	–	–	–
332	a+b·D	–25.2864	5.4433	–	–	–
333	a·exp(D·b)	1.8829	0.2445	–	–	–
334	$a \cdot D^b$	0.1182	2.3281	–	–	–
335	a+b·H	–53.8304	8.7802	–	–	–
336	a·exp(H·b)	0.591	0.3794	–	–	–
337	$a \cdot H^b$	0.0023	4.1398	–	–	–
338	$a+b \cdot D+c \cdot D^2$	18.779	–4.328	0.506	–	–
339	$a+b \cdot D+c \cdot D^2$	7.041	–1.279	0.201	–	–
340	a+b·ln(D)	–3.2807	2.6931	–	–	–
341	a+b·ln(D)	–2.3042	2.2608	–	–	–
342	$a \cdot D^2+b \cdot (D^2-c)$	209.69901	48.8075	49	–	–
343	$a \cdot D^2$	209.69901	–	–	–	–
344	$a \cdot D^2+b \cdot (D^2-c)$	200.87186	124.6808	49	–	–
345	$a \cdot D^2$	200.87186	–	–	–	–
346	a+b·ln(D)	–1.954	1.988	–	–	–
347	a+b·ln(D)	–2.202	2.112	–	–	–
348	a+b·ln(D)	–2.103	1.994	–	–	–
349	a+b·ln(D)	–2.001	1.943	–	–	–
350	a+b·log(π·D)	0.981	2.289	–	–	–
351	a+b·ln(D)	–1.979	1.959	–	–	–
352	a+b·ln(D)	–2.204	2.069	–	–	–
353	a+b·ln(D)	–2.087	1.939	–	–	–
354	a+b·ln(D)	–2.017	1.915	–	–	–
355	$a \cdot D^b$	0.0022	2.9122	–	–	–
356	$a \cdot (D+1)^{[b+c \cdot \log(D)9} \cdot H^d$	0.1147	–0.585	3.1296	–0.4967	–
357	$a \cdot (D+1)^{[b+c \cdot \log(D)9} \cdot H^d$	0.0228	–0.2728	1.8144	0.6324	–
358	a+b·D	–0.9086	0.4691	–	–	–
359	a·exp(D·b)	0.0493	0.6818	–	–	–
360	$a \cdot D^b$	0.0356	2.2530	–	–	–
361	a+b·D	–8.9086	1.5897	–	–	–
362	a·exp(D·b)	0.1862	0.2989	–	–	–
363	$a \cdot D^b$	0.0071	2.7743	–	–	–
364	a·exp(H·b)	0.0055	0.7173	–	–	–
365	$a \cdot H^b$	0.0001	4.6817	–	–	–
366	$a+b \cdot D+c \cdot D^2$	2.842	–0.725	0.060	–	–
367	$a+b \cdot D+c \cdot D^2+d \cdot D \cdot H$	3.129	–0.536	0.077	–0.036642	–
368	$a+b \cdot D+c \cdot D^2$	2.171	1.599	0.060	–	–
369	$a+b \cdot D+c \cdot D^2+d \cdot H$	–0.398	–0.642	0.116	1.0275	–
370	$a+b \cdot D+c \cdot D^2$	4.988	–1.104	0.087	–	–
371	$a+b \cdot D+c \cdot D^2+d \cdot H+e \cdot (D \cdot H)$	–2.589	–0.588	0.145	1.1308	–0.143
372	a+b·ln(D)	–3.1296	2.0089	–	–	–
373	a+b·ln(D)	–6.3284	3.0119	–	–	–
374	$a \cdot D^2+b \cdot (D^2-c)$	59.98243	–8.2237	49	–	–
375	$a \cdot D^2$	59.98243	–	–	–	–
376	$a \cdot D^2+b \cdot (D^2-c)$	32.9683	–8.27642	225	–	–
377	$a \cdot D^2$	32.9683	–	–	–	–
378	$\exp(a) \cdot (D+1)^b \cdot H^c$	–3.391	3.263	–1.202	–	–
379	$a+b \cdot \ln(D)+c \cdot \ln(D^2)+d \cdot \ln(H)$	7.0826	1.2301	0.5838	–1.139	–
380	a+b·log(π·D)	–0.662	2.768	–	–	–
381	$a \cdot D^2+b \cdot (D^2-c)$	2.32445	–1.628	49	–	–
382	$a \cdot D^2$	2.32445	–	–	–	–
383	$a \cdot D^2$	0.27462	–	–	–	–
384	$a+b \cdot D+c \cdot D^2$	8.033	–1.156	0.105	–	–
385	$a+b \cdot D+c \cdot D^2+d \cdot H+e \cdot (D \cdot H)$	–1.057	–0.506	0.176	1.3419	–0.173

Appendix A

		Unit of			Range of						
		Biom.	D	H	D (cm)	H (m)	Ref.	Cont.	Comm.	n	r^2
386 Finland	ln(CR)	kg	mm	–	–	–	29	8	22	–	0.905
387 Finland	ln(CR)	kg	mm	m	–	–	29	8	22	–	0.925
388 Finland	CR	kg	cm	–	–	–	28	8		–	0.91
389 Finland	ln(CR)	kg	mm	–	–	–	29	8	21	–	0.878
390 Finland	ln(CR)	kg	mm	m	–	–	29	8	21	–	0.908
391 Sweden	ln(CR)	kg	cm	–	0–45	0–	50	8		482	0.901
392 Sweden	ln(CR)	kg	cm	m	0–45	0–	50	8		482	0.922
393 UK	log(CR)	g	cm	–	–	–	48	8		10	0.975
394 UK	CR	kg	cm	–	–	–	9	6	2	–	–
395 Finland	log(DB)	kg	cm	m	2.4–9.7	3–7.8	56	8		–	0.742
396 Finland	log(DB)	kg	cm	m	7–21.6	7.9–14.8	56	8		–	0.655
397 Finland	log(DB)	kg	cm	m	5.6–23.6	8–18.2	56	8		–	0.89
398 Finland	DB	kg	mm	–	–	–	29	8		–	0.228
399 Norway	DB	g	cm	–	2–7	–	6	7	30	16	–
400 Norway	DB	g	cm	–	7–20	–	6	7	30	16	0.925
401 Norway	DB	g	cm	–	11–15	–	6	7	31	16	0.989
402 Norway	DB	g	cm	–	2–11	–	6	7		16	–
403 Sweden	ln(DB)	kg	cm	–	0–45	0–	50	8		467	0.741
404 Sweden	ln(DB)	kg	cm	m	0–45	0–	50	8		467	0.748
405 Sweden	ln(DB)	g	cm	dm	1.1–10	1.7–8.8	19	8		80	0.58
406 UK	log(DB)	g	cm	–	–	–	48	8		10	0.512
407 Belgium	FL	kg	cm	–	–	–	75	13		–	–
408 Czech republic	FL	kg	cm	m	2–6	2–5	17	7	32	29	–
409 Czech republic	FL	kg	cm	m	2–16	4–11	17	7		50	–
410 Czech republic	FL	kg	cm	–	2–6	2–5	17	8		–	0.67
411 Czech republic	FL	kg	cm	–	2–6	2–5	17	8		–	0.68
412 Czech republic	FL	kg	cm	–	2–6	2–5	17	8		–	0.72
413 Czech republic	FL	kg	cm	–	2–16	4–11	17	8		–	0.84
414 Czech republic	FL	kg	cm	–	2–16	4–11	17	8		–	0.8
415 Czech republic	FL	kg	cm	–	2–16	4–11	17	8		–	0.89
416 Czech republic	FL	kg	cm	m	2–16	4–11	17	8		–	0.43
417 Czech republic	FL	kg	cm	m	2–16	4–11	17	8		–	0.75
418 Czech republic	FL	kg	cm	m	2–16	4–11	17	8		–	0.72
419 Finland	FL	kg	cm	–	–	–	8	8	24	–	–
420 Finland	FL	kg	cm	–	–	–	8	8	24	–	–
421 Finland	ln(FL)	kg	cm	–	–	–	55	8	28	18	0.78
422 Finland	ln(FL)	kg	cm	–	–	–	55	8	29	30	0.9
423 Finland	ln(FL)	kg	mm		–	–	29	8		–	0.688
424 Finland	FL	kg	cm	m	–	–	46	8		–	–
425 Norway	FL	g	cm	–	7–15	–	6	7		16	0.95
426 Norway	FL	g	cm	–	2–7	–	6	7		16	–
427 Norway	FL	g	cm	–	7–20	–	6	7	30	16	0.946
428 Norway	FL	g	cm	–	2–7	–	6	7	30	16	–
429 Poland	ln(FL)	kg	cm	–	–	–	62	8		64	0.355
430 Poland	ln(FL)	kg	cm	–	–	–	62	8		108	0.546
431 Poland	ln(FL)	kg	cm	–	–	–	62	8		29	0.752
432 Poland	FL	kg	cm	cm	0.2–9.2	1.3–5.6	3	8		–	0.75
433 Poland	ln(FL)	kg	cm	–	–	–	62	8		15	0.71
434 Sweden	ln(FL)	kg	cm	–	0–45	0–	50	8		482	0.841
435 Sweden	ln(FL)	kg	cm	m	0–45	0–	50	8		482	0.865
436 Sweden	FL	kg	cm	m	2–40	2–	1	8		73	0.908
437 Sweden	ln(FL)	g	cm	dm	1.1–10	1.7–8.8	19	8		84	0.75
438 UK	log(FL)	g	cm	–	–	–	48	8		10	0.962
439 Belgium	FL(1)	kg	cm	–	–	–	75	13	33	–	–
440 Belgium	FL(2)	kg	cm	–	–	–	75	13	34	–	–
441 Belgium	RC	kg	cm	–	–	–	75	13		–	–
442 Europe	RC	kg	cm	–	4.1–45	–	77	1	35	–	0.97
443 Poland	ln(RC)	kg	cm	–	–	–	62	8		61	0.589
444 Poland	ln(RC)	kg	cm	–	–	–	62	8		106	0.803
445 Poland	ln(RC)	kg	cm	–	–	–	62	8		30	0.891

	Equation	Parameters a	b	c	d	e
386	$a+b \cdot \ln(D)$	–8.8027	2.2475	–	–	–
387	$a+b \cdot D+c \cdot \ln(D)+d \cdot H$	–9.7486	0.0016023	2.5600	–0.0063173	–
388	$a+b \cdot D^2$	2.7	0.0799	–	–	–
389	$a+b \cdot \ln(D)$	–9.3954	2.3268	–	–	–
390	$a+b \cdot \ln(D)+c \cdot \ln(H)+d \cdot D/H^2$	–5.2678	3.4914	–1.9498	–47.454	–
391	$a+b \cdot [D/(D+10)]$	–2.8604	9.1015	–	–	–
392	$a+b \cdot [D/(D+10)]+c \cdot \ln(H)$	–2.5413	13.3955	–1.1955	–	–
393	$a+b \cdot \log(\pi \cdot D)$	–0.383	2.723	–	–	–
394	$a+b \cdot D^c$	0.00435122	$1.321 \cdot 10^{-5}$	2.51380074	–	–
395	$a+b \cdot \log(D^2 \cdot H)$	–2.130	0.6797	–	–	–
396	$a+b \cdot \log(D^2 \cdot H)$	–2.702	0.8486	–	–	–
397	$a+b \cdot \log(D^2 \cdot H)$	–2.735	0.8977	–	–	–
398	$a+b \cdot D$	–0.84	0.0194	–	–	–
399	$a \cdot D^2$	10.3135	–	–	–	–
400	$a \cdot D^2+b \cdot (D^2–c)$	10.3135	15.8006	49	–	–
401	$a \cdot D^2+b \cdot (D^2–c)$	4.21541	19.4571	121	–	–
402	$a \cdot D^2$	4.21541	–	–	–	–
403	$a+b \cdot [D/(D+10)]$	–5.3338	9.5938	–	–	–
404	$a+b \cdot [D/(D+10)]+c \cdot H+d \cdot \ln(H)$	–5.8926	7.1270	–0.0465	1.1060	–
405	$a+b \cdot \ln(D)+c \cdot H$	1.1059	0.7017	0.0494	–	–
406	$a+b \cdot \log(\pi \cdot D)$	0.959	1.569	–	–	–
407	$a \cdot D^b$	0.00445	2.2371	–	–	–
408	$a \cdot (D+1)^{[b+c \cdot \log(D)]} \cdot H^d$	0.0009	6.7765	–2.1552	–1.3905	–
409	$a \cdot (D+1)^{[b+c \cdot \log(D)]} \cdot H^d$	0.0012	2.6479	–0.0549	0.6776	–
410	$a+b \cdot D$	–0.564	0.3324	–	–	–
411	$a \cdot \exp(D \cdot b)$	0.0425	0.6652	–	–	–
412	$a \cdot D^b$	0.0279	2.2877	–	–	–
413	$a+b \cdot D$	–2.9979	0.6293	–	–	–
414	$a \cdot \exp(D \cdot b)$	0.1044	0.3192	–	–	–
415	$a \cdot D^b$	0.009	2.4794	–	–	–
416	$a+b \cdot H$	–5.6616	0.9373	–	–	–
417	$a \cdot \exp(H \cdot b)$	0.0066	0.6513	–	–	–
418	$a \cdot H^b$	0.0002	4.3542	–	–	–
419	$a \cdot D+b \cdot D^2$	0.023	0.015	–	–	–
420	$a+b \cdot D+c \cdot D^2$	–0.105	0.365	0.010	–	–
421	$a+b \cdot \ln(D)$	–0.7714	0.9513	–	–	–
422	$a+b \cdot \ln(D)$	–5.613	2.5804	–	–	–
423	$a+b \cdot \ln(D)$	–7.47	1.6975	–	–	–
424	$a \cdot D^b \cdot H^c$	0.1179	2.1052	–0.7931	–	–
425	$a \cdot D^2+b \cdot (D^2–c)$	37.78194	–16.7693	49	–	–
426	$a \cdot D^2$	37.78194	–	–	–	–
427	$a \cdot D^2+b \cdot (D^2–c)$	7.88144	19.3471	49	–	–
428	$a \cdot D^2$	7.88144	–	–	–	–
429	$a+b \cdot \ln(D)$	–5.478	2.494	–	–	–
430	$a+b \cdot \ln(D)$	–6.193	2.869	–	–	–
431	$a+b \cdot \ln(D)$	–6.621	3.155	–	–	–
432	$a+b \cdot H^2+c \cdot H^3$	0.4365	0.0033	0.0001	–	–
433	$a+b \cdot \ln(D)$	–5.777	2.481	–	–	–
434	$a+b \cdot [D/(D+7)]$	–3.7983	7.7681	–	–	–
435	$a+b \cdot [D/(D+7)]+c \cdot H+d \cdot \ln(H)$	–3.4781	12.1095	0.0413	–1.5650	–
436	$\exp(a) \cdot (D+1)^b \cdot H^c \cdot \exp(d \cdot D) \cdot \exp(e \cdot H)$	–4.634	4.496	–2.439	–0.0977	0.0984
437	$a+b \cdot \ln(D)+c \cdot \ln(D^2)+d \cdot \ln(H)$	7.5174	1.29	0.4486	–1.1229	–
438	$a+b \cdot \log(\pi \cdot D)$	–0.502	2.527	–	–	–
439	$a \cdot D^b$	0.00394	2.1534	–	–	–
440	$a \cdot D^b$	0.00083	2.4074	–	–	–
441	$a \cdot D^b$	0.33989	1.4728	–	–	–
442	$a \cdot D^b$	0.02157	2.221205	–	–	–
443	$a+b \cdot \ln(D)$	–3.636	1.977	–	–	–
444	$a+b \cdot \ln(D)$	–3.782	2.066	–	–	–
445	$a+b \cdot \ln(D)$	–4.079	2.252	–	–	–

Appendix A

		Unit of			Range of						
		Biom.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
446 Poland	ln(RC)	kg	cm	–	–	–	62	8		15	0.909
447 Sweden	ln(RC)	kg	cm	–	0–45	0–	50	8	26	305	0.901
448 Europe	RF	kg	cm	–	4.1–45	–	77	1	35	–	0.75
449 Sweden	ln(RS)	kg	cm	–	0–45	0–	50	8	25	286	0.889
450 –	log(RT)	kg	cm	–	–	–	68	8		–	0.965
451 –	log(RT)	kg	cm	–	–	–	68	8		17	–
452 –	log(RT)	kg	cm	m	–	–	68	8		6	0.966
453 Europe	RT	kg	cm	–	4.1–45	–	77	1	35	–	0.964
454 Finland	log(RT)	kg	cm	–	7.0–21.6	7.9–14.8	56	8	5	–	0.935
455 Finland	log(RT)	kg	cm	–	4–24	–	21	8		20	0.99
456 UK	RT	t	cm	–	–	–	9	6		–	–
457 Finland	log(SB)	kg	cm	m	5.6–23.6	8.0–18.2	56	8		–	0.968
458 Finland	log(SB)	kg	cm	m	2.4–9.7	3.0–7.8	56	8		–	0.964
459 Finland	log(SB)	kg	cm	m	7.0–21.6	7.9–14.8	56	8		–	0.961
460 Finland	ln(SB)	kg	cm	m	5.1–45	3.5–27.5	40	8		–	0.981
461 Finland	ln(SB)	kg	cm	–	–	–	55	8	28	18	0.98
462 Finland	ln(SB)	kg	cm	–	–	–	55	8	29	30	0.95
463 Norway	SB	g	cm	–	7–15	–	6	7		16	0.999
464 Norway	SB	g	cm	–	2–7	–	6	7		16	–
465 Norway	SB	g	cm	–	7–20	–	6	7	30	16	0.993
466 Norway	SB	g	cm	–	2–7	–	6	7	30	16	–
467 Sweden	ln(SB)	kg	cm	–	0–45	0–	50	8		461	0.929
468 Sweden	ln(SB)	kg	cm	m	0–45	0–	50	8		461	0.935
469 Sweden	SB	kg	cm	m	2–40	2–	1	8		73	0.984
470 Sweden	ln(SB)	g	cm	dm	1.1–10	1.7–8.8	19	8		84	0.96
471 UK	log(SB)	g	cm	–	–	–	48	8		10	0.98
472 Sweden	SR	kg	cm	m	2–40	2–	1	8		73	0.943
473 Sweden	SR	kg	cm	m	2–40	2–	1	8		73	0.962
474 Sweden	ln(SR)	kg	cm	m	0–45	0–	50	8		296	0.958
475 Belgium	ST	kg	cm	–	–	–	75	13		–	–
476 Czech republic	ST	kg	cm	m	2–6	2–5	17	7		29	–
477 Czech republic	ST	kg	cm	m	2–16	4–11	17	7		50	–
478 Czech republic	ST	kg	cm	–	2–6	2–5	17	8		29	0.95
479 Czech republic	ST	kg	cm	–	2–6	2–5	17	8		29	0.92
480 Czech republic	ST	kg	cm	–	2–6	2–5	17	8		29	0.95
481 Czech republic	ST	kg	cm	m	2–6	2–5	17	8		29	0.77
482 Czech republic	ST	kg	cm	m	2–6	2–5	17	8		29	0.61
483 Czech republic	ST	kg	cm	m	2–6	2–5	17	8		29	0.61
484 Czech republic	ST	kg	cm	–	2–16	4–11	17	8		50	0.93
485 Czech republic	ST	kg	cm	–	2–16	4–11	17	8		50	0.84
486 Czech republic	ST	kg	cm	–	2–16	4–11	17	8		50	0.98
487 Czech republic	ST	kg	cm	m	2–16	4–11	17	8		50	0.58
488 Czech republic	ST	kg	cm	m	2–16	4–11	17	8		50	0.86
489 Czech republic	ST	kg	cm	m	2–16	4–11	17	8		50	0.85
490 Sweden	ln(ST)	kg	cm	–	0–45	0–	50	8		488	0.978
491 Sweden	ln(ST)	kg	cm	m	0–45	0–	50	8		488	0.99
492 Sweden	ST	kg	cm	m	2–40	2–	1	8		73	0.996
493 UK	log(ST)	g	cm	–	–	–	48	8		10	0.995
494 UK	log(ST)	g	cm	cm	–	–	63	8		–	–
495 UK	log(ST)	g	cm	–	–	–	63	8		–	–
496 UK	log(ST)	g	cm	cm	–	–	63	8		–	–
497 UK	log(ST)	g	cm	–	–	–	63	8		–	–
498 Finland	log(SU)	kg	cm	–	7–21.6	7.9–14.8	56	8		–	0.85
499 Sweden	ln(SU)	kg	cm	–	0–45	0–	50	8		306	0.945
500 Finland	log(SW)	kg	cm	m	5.6–23.6	8–18.2	56	8		–	0.994
501 Finland	log(SW)	kg	cm	m	2.4–9.7	3–7.8	56	8		–	0.992
502 Finland	log(SW)	kg	cm	m	7–21.6	7.9–14.8	56	8		–	0.991
503 Finland	ln(SW)	kg	cm	m	121–	–	40	8		–	0.992
504 Finland	SW	kg	cm	–	–	–	55	8	28	18	–
505 Finland	SW	kg	cm	–	–	–	55	8	29	30	–

	Equation	Parameters a	b	c	d	e
446	$a+b\cdot\ln(D)$	–3.514	1.909	–	–	–
447	$a+b\cdot[D/(D+10)]$	–3.8375	8.8795	–	–	–
448	$a\cdot D^b$	0.038386	1.240689	–	–	–
449	$a+b\cdot[D/(D+9)]$	–6.3413	13.2902	–	–	–
450	$a\cdot\log(D)+b$	2.2419	–1.3705	–	–	–
451	$a\cdot\log(D)+b$	2.6	–1.61	–	–	–
452	$a\cdot\log(H\cdot D^2)+b$	0.7665	–1.3736	–	–	–
453	$a\cdot D^b$	0.038872	2.066783	–	–	–
454	$a+b\cdot\log(D)$	–1.967	2.458	–	–	–
455	$a+b\cdot\log(D)$	–1.89	2.74	–	–	–
456	$a\cdot D^b$	$5.595\cdot10^{-5}$	2.10019503	–	–	–
457	$a+b\cdot\log(D^2\cdot H)$	–2.024	0.7603	–	–	–
458	$a+b\cdot\log(D^2\cdot H)$	–1.827	0.7183	–	–	–
459	$a+b\cdot\log(D^2\cdot H)$	–1.771	0.7106	–	–	–
460	$a+b\cdot\ln(D^2)+c\cdot\ln(H)$	–4.344	0.885	0.435	–	–
461	$a+b\cdot\ln(D)$	–4.6637	2.4282	–	–	–
462	$a+b\cdot\ln(D)$	–3.5682	1.9976	–	–	–
463	$a\cdot D^2+b\cdot(D^2-c)$	22.63177	–6.7506	49	–	–
464	$a\cdot D^2$	22.63177	–	–	–	–
465	$a\cdot D^2+b\cdot(D^2-c)$	23.31516	–6.2686	49	–	–
466	$a\cdot D^2$	23.31516	–	–	–	–
467	$a+b\cdot[D/(D+16)]$	–2.9748	8.8489	–	–	–
468	$a+b\cdot[D/(D+16)]+c\cdot\ln(H)$	–3.2765	7.2482	0.4487	–	–
469	$\exp(a)\cdot(D+1)^b\cdot\exp(c\cdot D)\cdot\exp(d\cdot H)$	–4.494	2.026	–0.0187	0.0494	–
470	$a+b\cdot\ln(D)+c\cdot\ln(D^2)+d\cdot H$	3.6931	0.9434	0.1778	0.0123	–
471	$a+b\cdot\log(\pi\cdot D)$	0.007	2.146	–	–	–
472	$\exp(a)\cdot D^b$	–6.158	3.071	–	–	–
473	$\exp(a)\cdot D^b\cdot H^c$	–6.383	2.613	0.569	–	–
474	$a+b\cdot[D/(D+12)]$	–3.3913	11.1106	–	–	–
475	$a\cdot D^b$	0.12269	2.3272	–	–	–
476	$a\cdot(D+1)^{[b+c\cdot\log(D)]}\cdot H^d$	0.0038	4.4553	–1.5591	0.5661	–
477	$a\cdot(D+1)^{[b+c\cdot\log(D)]}\cdot H^d$	0.006	3.1093	–0.5812	0.897	–
478	$a+b\cdot D$	–1.666	0.928	–	–	–
479	$a\cdot\exp(D\cdot b)$	0.1259	0.6526	–	–	–
480	$a\cdot D^b$	0.0867	2.2099	–	–	–
481	$a+b\cdot H$	–1.572	0.8417	–	–	–
482	$a\cdot\exp(H\cdot b)$	0.1348	0.5912	–	–	–
483	$a\cdot H^b$	0.0778	2.1498	–	–	–
484	$a+b\cdot D$	–13.3349	3.223	–	–	–
485	$a\cdot\exp(D\cdot b)$	1.0594	0.274	–	–	–
486	$a\cdot D^b$	0.1163	2.1826	–	–	–
487	$a+b\cdot H$	–31.7127	5.3844	–	–	–
488	$a\cdot\exp(H\cdot b)$	0.0814	0.584	–	–	–
489	$a\cdot H^b$	0.0025	3.9472	–	–	–
490	$a+b\cdot[D/(D+13)]$	–2.3388	11.3264	–	–	–
491	$a+b\cdot[D/(D+13)]+c\cdot H+d\cdot\ln(H)$	–2.6768	7.5939	0.0151	0.8799	–
492	$\exp(a)\cdot(D+1)^b\cdot H^c\cdot\exp(d\cdot H)$	–3.760	1.882	0.758	0.0355	–
493	$a+b\cdot\log(\pi\cdot D)$	0.981	2.194	–	–	–
494	$a+b\cdot\log(H)$	–1.34	1.89	–	–	–
495	$a+b\cdot\log(D)$	1.38	2.41	–	–	–
496	$a+b\cdot\log(H)$	–1.23	1.92	–	–	–
497	$a+b\cdot\log(D)$	1.4	2.64	–	–	–
498	$a+b\cdot\log(D)$	–1.740	0.9247	–	–	–
499	$a+b\cdot[D/(D+15)]$	–3.9657	11.0481	–	–	–
500	$a+b\cdot\log(D^2\cdot H)$	–1.730	0.9626	–	–	–
501	$a+b\cdot\log(D^2\cdot H)$	–1.411	0.8316	–	–	–
502	$a+b\cdot\log(D^2\cdot H)$	–1.663	0.9447	–	–	–
503	$a+b\cdot\ln(D^2)+c\cdot\ln(H)$	–4.182	0.879	1.215	–	–
504	$\exp[a+b\cdot\ln(D)]+\exp[c+d\cdot\ln(D)]$	–3.9212	2.668	–13.575	5.2043	–
505	$\exp[a+b\cdot\ln(D)]+\exp[c+d\cdot\ln(D)]$	–2.5809	2.1595	–5.6832	2.407	–

Appendix A

		Unit of			Range of						
		Biom.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
506 Norway	SW	g	cm	–	7–15	–	6	7		16	0.992
507 Norway	SW	g	cm	–	2–7	–	6	7		16	–
508 Norway	SW	g	cm	–	7–20	–	6	7	30	16	0.991
509 Norway	SW	g	cm	–	2–7	–	6	7	30	16	–
510 Sweden	ln(SW)	kg	cm	–	0–45	0–	50	8		461	0.966
511 Sweden	ln(SW)	kg	cm	m	0–45	0–	50	8		461	0.986
512 Sweden	ln(SW)	g	cm	dm	1.1–10	1.7–8.8	19	8		84	0.98
Pinus taeda											
513 –	log(RT)	kg	cm	–	–	–	68	8		7	0.863
Populus tremula (European aspen, Asp)											
514 Germany	AB	kg	cm	–	13.2–33	15.9–24.7	66	11		16	0.941
515 Sweden	AB	kg	mm	–	1.9–9.2	3.6–15.8	36	4		–	0.958
516 Sweden	BR	kg	mm	–	1.9–9.2	3.6–15.8	36	4		–	0.959
517 Germany	CR	kg	cm	–	13.2–33	15.9–24.7	66	11		16	0.925
518 Sweden	FL	kg	mm	–	1.9–9.2	3.6–15.8	36	4		–	0.944
519 Germany	ST	kg	cm	–	13.2–33	15.9–24.7	66	11		16	0.909
520 Sweden	ST	kg	mm	–	1.9–9.2	3.6–15.8	36	4		–	0.95
Populus trichocarpa (Black cottonwood)											
521 Iceland	AB	kg	cm	m	4.6–34	4.6–20.7	71	8		22	0.98
522 Iceland	CR	kg	cm	m	4.6–34	4.6–20.7	71	8		22	0.884
523 Iceland	ST	kg	cm	m	4.6–34	4.6–20.7	71	8		22	0.98
Pseudotsuga menziesii (Douglas–fir)											
524 Italy	ln(AB)	kg	cm	–	8.7–27	–	52	14	36	69	0.94
525 Netherlands	AB	kg	cm	–	3–38	6.7–25.9	4	14		23	0.995
526 Netherlands	AB	kg	cm	–	5–	–	30	9		–	–
527 Netherlands	ln(ABW)	kg	cm	–	5–	–	30	9		–	–
528 Netherlands	BR	kg	cm	m	3–38	6.7–25.9	4	14		23	0.944
529 Netherlands	CR	kg	cm	m	3–38	6.7–25.9	4	14		23	0.945
530 UK	CR	kg	cm	m	–	–	9	6	2	–	–
531 Netherlands	FL	kg	cm	m	3–38	6.7–25.9	4	14		23	0.941
532 –	log(RT)	kg	cm	–	–	–	68	8		18	0.908
533 –	log(RT)	kg	cm	–	–	–	68	8		33	0.902
534 –	log(RT)	kg	cm	–	–	–	68	8		14	0.907
535 –	log(RT)	kg	cm	–	–	–	68	8		3	0.966
536 –	log(RT)	kg	cm	m	–	–	68	8		3	0.947
537 UK	RT	t	cm	–	–	–	9	6		–	–
538 Netherlands	ST	kg	cm	m	3–38	6.7–25.9	4	14		23	0.998
Pseudotsuga spp.											
539 Netherlands	log(RT)	kg	cm	–	5–27	–	21	8		21	0.96
Quercus conferta (Hungarian oak, Platifilos dris)											
540 Greece	ln(ABW)	kg	cm	–	2–19	2.2–14.7	51	14		27	0.98
541 Greece	ln(ABW)	kg	cm	cm	2–19	2.2–14.7	51	14		27	0.98
542 Greece	ln(BR)	kg	cm	–	2–19	2.2–14.7	51	14	37	27	0.82
543 Greece	BR	kg	cm	–	2–19	2.2–14.7	51	14	38	27	0.65
544 Greece	ln(BR)	kg	cm	–	2–19	2.2–14.7	51	14	39	27	0.73
545 Greece	ln(BR)	kg	cm	–	2–19	2.2–14.7	51	14	40	27	0.89
546 Greece	ln(BR)	kg	cm	cm	2–19	2.2–14.7	51	14	37	27	0.79
547 Greece	BR	kg	cm	cm	2–19	2.2–14.7	51	14	38	27	0.5
548 Greece	ln(BR)	kg	cm	cm	2–19	2.2–14.7	51	14	39	27	0.68
549 Greece	ln(BR)	kg	cm	cm	2–19	2.2–14.7	51	14	40	27	0.86
550 Greece	ln(SW)	kg	cm	–	2–19	2.2–14.7	51	14	41	27	0.96
551 Greece	ln(SW)	kg	cm	–	2–19	2.2–14.7	51	14	42	27	0.89
552 Greece	ln(SW)	kg	cm	–	2–19	2.2–14.7	51	14	43	27	0.97
553 Greece	ln(SW)	kg	cm	cm	2–19	2.2–14.7	51	14	41	27	0.98
554 Greece	ln(SW)	kg	cm	cm	2–19	2.2–14.7	51	14	42	27	0.89
555 Greece	ln(SW)	kg	cm	cm	2–19	2.2–14.7	51	14	43	27	0.98
Quercus ilex (Holm oak)											
556 Italy	AB	kg	cm	–	20–90	–	73	14		–	–
557 Italy	AB	kg	cm	–	5–20	–	47	14		12	–
558 Italy	AB	kg	cm	m	4.5–26.1	6–16	7	8		94	0.952

	Equation	Parameters a	b	c	d	e
506	$a \cdot D^2 + b \cdot (D^2 - c)$	89.24474	64.8925	49	–	–
507	$a \cdot D^2$	89.24474	–	–	–	–
508	$a \cdot D^2 + b \cdot (D^2 - c)$	175.40886	1.7509	49	–	–
509	$a \cdot D^2$	175.40886	–	–	–	–
510	$a + b \cdot [D/(D+14)]$	–2.2184	11.4219	–	–	–
511	$a + b \cdot [D/(D+14)] + c \cdot H + d \cdot \ln(H)$	–2.6864	7.6066	0.0200	0.8658	–
512	$a + b \cdot \ln(D) + c \cdot \ln(D^2) + d \cdot H$	4.3823	1.19	0.1969	0.0149	–
513	$a \cdot \log(D) + b$	3.0742	–2.6683	–	–	–
514	$a \cdot D^b$	0.0519	2.545	–	–	–
515	$a \cdot D^b$	$1.46 \cdot 10^{-4}$	2.6035333	–	–	–
516	$a \cdot D^b$	$5.75 \cdot 10^{-4}$	1.873298	–	–	–
517	$a \cdot D^b$	0.0644	2.001	–	–	–
518	$a \cdot D^b$	$8.47 \cdot 10^{-4}$	1.481578	–	–	–
519	$a \cdot D^b$	0.0197	2.764	–	–	–
520	$a \cdot D^b$	$6.5 \cdot 10^{-5}$	2.739823	–	–	–
521	$a \cdot D^b \cdot H^c$	0.0717	1.8322	0.6397	–	–
522	$a \cdot D^b \cdot H^c$	0.0586	2.8285	–1.0282	–	–
523	$a \cdot D^b \cdot H^c$	0.0379	1.581	1.0795	–	–
524	$a + b \cdot \ln(D)$	–1.957	2.2996	–	–	–
525	$a + b \cdot \ln(D)$	–1.62	2.410	–	–	–
526	$a \cdot D^b$	0.111	2.397	–	–	–
527	$a \cdot D^b$	0.111	2.397	–	–	–
528	$a + b \cdot \ln(D) + c \cdot \ln(H)$	–2.675	4.420	–2.784	–	–
529	$a + b \cdot \ln(D) + c \cdot \ln(H)$	–1.345	3.924	–2.514	–	–
530	$a \cdot D^b \cdot H^c$	$3.461 \cdot 10^{-4}$	2.7169	–1.26060	–	–
531	$a + b \cdot \ln(D) + c \cdot \ln(H)$	–1.346	3.351	–2.201	–	–
532	$a \cdot \log(D) + b$	2.1641	–1.4467	–	–	–
533	$a \cdot \log(D) + b$	2.5786	–1.8899	–	–	–
534	$a \cdot \log(D) + b$	2.9108	–2.3807	–	–	–
535	$a \cdot \log(D) + b$	2.5309	–1.6393	–	–	–
536	$a \cdot \log(H \cdot D^2) + b$	1.0472	–2.6287	–	–	–
537	$a \cdot D^b$	$2.179 \cdot 10^{-5}$	2.4209	–	–	–
538	$a + b \cdot \ln(D) + c \cdot \ln(H)$	–2.535	2.009	0.709	–	–
539	$a + b \cdot \log(D)$	–2	2.63	–	–	–
540	$a + b \cdot \ln(D)$	–2.1686	2.4407	–	–	–
541	$a + b \cdot \ln(D^2H)$	–2.5259	0.8605	–	–	–
542	$a + b \cdot \ln(D)$	–3.3508	1.7235	–	–	–
543	$[a + b(1/D) + c(1/D^2)] \cdot D^2$	0.0536	–0.3269	–	–	–
544	$a + b \cdot \ln(D)$	–11.433	4.9391	–	–	–
545	$a + b \cdot \ln(D)$	–4.1909	2.5403	–	–	–
546	$a + b \cdot \ln(D^2H)$	–3.5363	0.5957	–	–	–
547	$[a + b(1/D^2H)] \cdot D^2 \cdot H$	0.0015	0.0402	–	–	–
548	$a + b \cdot \ln(D^2H)$	–12.7333	1.8202	–	–	–
549	$a + b \cdot \ln(D^2H)$	–4.4702	0.8791	–	–	–
550	$a + b \cdot \ln(D)$	–2.5518	2.3887	–	–	–
551	$a + b \cdot \ln(D)$	–3.8649	2.4261	–	–	–
552	$a + b \cdot \ln(D)$	–2.32	2.4147	–	–	–
553	$a + b \cdot \ln(D^2H)$	–2.9275	0.8468	–	–	–
554	$a + b \cdot \ln(D^2H)$	–4.2122	0.854	–	–	–
555	$a + b \cdot \ln(D^2H)$	–2.6916	0.8546	–	–	–
556	$a \cdot D^b$	0.2306	2.2791	–	–	–
557	$a \cdot D^b$	0.2179	2.0513	–	–	–
558	$a + b \cdot D^2 \cdot H$	–0.6165	0.03582	–	–	–

Appendix A

		Unit of			Range of						
		Biom.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
559 Spain	log(AB)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		69	0.908
560 Spain	log(AB)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		33	0.91
561 Spain	log(AB)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		30	0.927
562 Spain	log(AB)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		41	0.939
563 Spain	log(AB)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		28	0.867
564 Spain	log(AB)	kg	cm	m	5.3–24.4	4.4–12.8	12	8		63	0.942
565 Spain	AB	kg	cm	–	–	–	25	14		15	–
566 Italy	ABW	kg	cm	m	4.5–26.1	6–16	7	8	3	94	0.952
567 Spain	log(BR)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	44	69	0.803
568 Spain	log(BR)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	44	33	0.784
569 Spain	log(BR)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	44	30	0.697
570 Spain	log(BR)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	44	41	0.84
571 Spain	log(BR)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	44	28	0.775
572 Spain	log(BR)	kg	cm	m	5.3–24.4	4.4–12.8	12	8	44	63	0.807
573 Spain	log(BR)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	45	56	0.781
574 Spain	log(BR)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	46	69	0.443
575 Italy	CR	kg	cm	m	4.5–26.1	6–16	7	8		94	0.952
576 Spain	log(FL)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		69	0.615
577 Spain	log(FL)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		33	0.467
578 Spain	log(FL)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		30	0.65
579 Spain	log(FL)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		41	0.735
580 Spain	log(FL)	kg	cm	–	5.3–24.4	4.4–12.8	12	8		28	0.74
581 Spain	log(FL)	kg	cm	m	5.3–24.4	4.4–12.8	12	8		63	0.593
582 Spain	log(RC)	kg	cm	–	7.2–23.1	4.4–12.8	13	8	25	31	0.64
583 Spain	log(RC)	kg	cm	–	7.2–23.1	4.4–12.8	13	8	25	19	0.7
584 Spain	log(RC)	kg	cm	–	8.8–19.8	5.5–9.0	13	8	25	12	0.7
585 Spain	log(RS)	kg	cm	–	7.2–23.1	4.4–12.8	13	8	47	31	0.67
586 Spain	log(RS)	kg	cm	–	7.2–23.1	4.4–12.8	13	8	47	19	0.75
587 Spain	log(RS)	kg	cm	–	8.8–19.8	5.5–9.0	13	8	47	12	0.63
588 Spain	log(RT)	kg	cm	–	7–23	–	21	8		32	0.73
589 Spain	log(RT)	kg	cm	–	7.2–23.1	4.4–12.8	13	8		32	0.73
590 Spain	log(RT)	kg	cm	–	7.2–23.1	4.4–12.8	13	8		20	0.81
591 Spain	log(RT)	kg	cm	–	8.8–19.8	5.5–9.0	13	8		12	0.71
592 Spain	log(ST)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	2	71	0.918
593 Spain	log(ST)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	2	33	0.929
594 Spain	log(ST)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	2	32	0.958
595 Spain	log(ST)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	2	43	0.941
596 Spain	log(ST)	kg	cm	–	5.3–24.4	4.4–12.8	12	8	2	28	0.882
597 Spain	log(ST)	kg	cm	m	5.3–24.4	4.4–12.8	12	8	2	65	0.963
Quercus petraea											
598 France	log(RT)	kg	cm	–	7–17	–	21	8		71	0.94
Quercus pyrenaica (Pyrenean oak)											
599 Portugal	ln(SW)	kg	cm	m	2.5–46	3.3–27	14	8		166	0.99
Quercus spp. (Oak, Eiche)											
600 Austria	ln(AB)	kg	cm	–	–	–	31	3		33	–
601 UK	ln(ABW)	kg	cm	–	4.5–52	–	10	14	11	20	0.99
602 UK	ln(ABW)	kg	cm	–	4.3–35	–	10	14	11	16	0.99
603 UK	ln(ABW)	kg	cm	–	3.8–11	–	10	14	11	15	0.974
604 UK	ln(ABW)	kg	cm	–	5.7–33	–	10	14	11	18	0.995
605 UK	CR	t	cm	–	–	–	9	6	1	–	–
606 UK	CR	t	cm	m	–	–	9	6	2	–	–
Tilia cordata (Lime)											
607 UK	ln(ABW)	kg	cm	–	3.2–15	–	10	14	11	10	0.984

		Parameters				
	Equation	a	b	c	d	e
559	a+b·log(D)	–0.656	2.217	–	–	–
560	a+b·log(D)	–0.275	1.831	–	–	–
561	a+b·log(D)	–0.854	2.413	–	–	–
562	a+b·log(D)	–0.902	2.433	–	–	–
563	a+b·log(D)	–0.313	1.900	–	–	–
564	a+b·log(D)+c·H	–0.568	1.953	0.029	–	–
565	$a \cdot D^b$	0.2313	2.2662	–	–	–
566	$a+b \cdot D^2 \cdot H$	–1.0906	0.031073	–	–	–
567	a+b·log(D)	–0.704	1.833	–	–	–
568	a+b·log(D)	–0.411	1.546	–	–	–
569	a+b·log(D)	–0.825	1.953	–	–	–
570	a+b·log(D)	–0.996	2.077	–	–	–
571	a+b·log(D)	–0.370	1.544	–	–	–
572	a+b·log(D)+c·H	–0.617	1.672	0.014	–	–
573	a+b·log(D)	–0.825	1.789	–	–	–
574	a+b·log(D)	–1.429	2.089	–	–	–
575	$a+b \cdot D^2 \cdot H$	0.4741	0.0047473	–	–	–
576	a+b·log(D)	–1.624	1.891	–	–	–
577	a+b·log(D)	–1.347	1.654	–	–	–
578	a+b·log(D)	–2.128	2.309	–	–	–
579	a+b·log(D)	–2.142	2.269	–	–	–
580	a+b·log(D)	–1.366	1.774	–	–	–
581	a+b·log(D)+c·H	–1.533	1.808	0.002	–	–
582	a+b·log(D)	–1.188	2.139	–	–	–
583	a+b·log(D)	–1.563	2.422	–	–	–
584	a+b·log(D)	–0.714	1.79	–	–	–
585	a+b·log(D)	–1.145	1.897	–	–	–
586	a+b·log(D)	–1.417	2.093	–	–	–
587	a+b·log(D)	–0.835	1.688	–	–	–
588	a+b·log(D)	–1.05	2.19	–	–	–
589	a+b·log(D)	–1.047	2.191	–	–	–
590	a+b·log(D)	–1.393	2.451	–	–	–
591	a+b·log(D)	–0.448	1.734	–	–	–
592	a+b·log(D)	–1.166	2.478	–	–	–
593	a+b·log(D)	–0.747	2.044	–	–	–
594	a+b·log(D)	–1.355	2.674	–	–	–
595	a+b·log(D)	–1.336	2.640	–	–	–
596	a+b·log(D)	–0.839	2.156	–	–	–
597	a+b·log(D)+c·H	–1.088	2.157	0.039	–	–
598	a+b·log(D)	–1.56	2.44	–	–	–
599	$a+b \cdot \ln(H \cdot D^2)$	–3.323	0.95	–	–	–
600	a+b·ln(D)	–0.883	2.140	–	–	–
601	a+b·ln(D)	–2.4232	2.4682	–	–	–
602	a+b·ln(D)	–2.3223	2.4029	–	–	–
603	a+b·ln(D)	–3.1404	2.8113	–	–	–
604	a+b·ln(D)	–3.1009	2.6996	–	–	–
605	$a \cdot D^2$	$2.1612 \cdot 10^{-4}$		–	–	–
606	$a \cdot D^b \cdot H^c$	$5.4224 \cdot 10^{-4}$	2.35	–1.022	–	–
607	a+b·ln(D)	–2.6788	2.4542	–	–	–

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Comments – Appendix A

1 Trees 7 cm or less in diameter
2 Trees more than 7 cm in diameter
3 Merchantable parts, >3–4 cm
4 Living branches
5 Roots more than 1 cm in diameter
6 Regressions developed by D Zianis. Original data from tables
7 0.3 m from forest floor
8 Young trees
9 Middle age trees
10 Adult trees
11 Original regressions relate girth to biomass
12 D at tree base
13 Other types of functions with D and H and independent variables are given for the same material, includes determination coefficients
14 Newly cut trees
15 Cut trees dried in the stand during summer with a total loss of needles of about 75%
16 Includes fertilized plots
17 Wood of all living branches
18 Branch and top wood
19 Wood and bark of all living branches
20 Twigs
21 Living crown
22 Whole crown
23 Other than current year needles, includes fertilized plots
24 Includes needles, twigs, and branches less than 1 cm in diameter
25 Roots more than 5 cm in diameter
26 Roots less than 5 cm in diameter
28 Dominant trees over an age gradient
29 Trees of different sizes in one age group
30 Fertilised plot
31 Doubt about the parameters.
32 Doubt about the sign of the parameter c. The sign of the parameter c has been changed on this table.
33 One year old needles
34 Two years old needles
35 The equation is derived from 3 different sources:
Makkonen, K. & Helmisaari, H.-S. 1998. Seasonal and yearly variations of fine-root biomass and necromass in a Scots pine (Pinus sylvestris L.) stand. Forest Ecology and Management 102: 283–290.
Oleksyn, J., Reich, P.B., Chalupka, W. & Tjoelker, M.G. 1999. Differential above- and below-ground biomass accumulation of European Pinus sylvestris populations in a 12-year-old provenance experiment. Scandinavian Journal of Forest Research 14: 7–17.
Vanninen, P., Ylitalo, H., Sievänen, R. & Mäkelä, A. 1996. Effects of age and site quality on the distribution of biomass in Scots pine (Pinus sylvestris L.). Trees 10: 231–238.
The equation is based on 38 different values of total root biomass and diameter at breast height; some values were derived from individual trees; some values were averages from several trees.
36 Regressions developed by D Zianis. Original data from graphs
37 Branches less than or equal to 1 cm
38 Branches between 1 and 3 cm
39 Branches bigger than 3 cm
40 All branches
41 Stem wood beneath crown
42 Stem wood in crown
43 Total stem wood
44 Branches less than 5 cm in diameter
45 Branches 1 to 5 cm in diameter
46 Branches greater than 5 cm in diameter

Appendix B. General descriptions of volume equations. Both scientific and common names of the tree species are shown, since that helps in reading the original papers. Number of sampled trees (*n*), coefficients of determination (r^2), and range of diameter (*D*) and height (*H*) of sampled trees are reported when available in original article. References (Ref.) to the original papers according to author as well as the contact (Cont.) person who submitted the equation to this database are given at the end of the table. In the comments column (Comm.) occur some comments about the particular equation. Format and parameter values of these equations are shown in Appendix C.

	Unit of			Range of						
	Vol.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
Abies alba (Silver fir)										
1 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
Abies grandis (Grand fir)										
2 Netherlands	dm^3	cm	m	–	–	16	4		285	0.996
3 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
Abies sibirica (Fir)										
4 Germany	m^3	cm	–	10–48	–	20	3		–	–
Abies spp. (Fir, Brad)										
5 Austria	dm^3	dm	dm	1–	–	29	5		–	–
6 Austria	dm^3	dm	dm	0.5–1.04	–	32	5		–	0.848
7 Romania	m^3	cm	m	–	–	18	3		–	–
Acacia spp. (Salcim)										
8 Romania	m^3	cm	m	–	–	18	3		–	–
Acer pseudoplatanus (Maple, Erable sycomore, Paltin, Sycamore)										
9 Belgium	m^3	cm	m	–	–	14	6	2	419	–
10 Netherlands	dm^3	cm	m	–	–	16	4		143	0.99
11 Romania	m^3	cm	m	–	–	18	3		–	–
12 UK	m^3	cm	m	–	–	8	2		–	–
Alnus alba (Anin alb)										
13 Romania	m^3	cm	m	–	–	18	3		–	–
Alnus glutinosa (Black alder, Klibbal)										
14 Netherlands	dm^3	cm	m	–	–	16	4		55	0.991
15 Norway	dm^3	cm	m	10–	–	7	9		–	–
16 Norway	dm^3	cm	m	0–12	–	7	9		–	–
17 Sweden	dm^3	cm	m	–	–	17	3	3	1643	–
18 Sweden	dm^3	cm	m	–	–	17	3	3	1643	–
19 Sweden	dm^3	cm	m	–	–	17	3	4	1643	–
Alnus incana (Grey alder)										
20 Norway	dm^3	cm	m	5–	–	3	9		–	–
Alnus nigra (Anin negru)										
21 Romania	m^3	cm	m	–	–	18	3		–	–
Alnus spp. (Alder)										
22 Austria	dm^3	dm	dm	0.5–1.04	–	32	5		–	0.583
Arbutus unedo (Strawberry–tree)										
23 Italy	dm^3	cm	–	6–15	–	6	3	5	26	0.965
Betula pendula (Birch, Berk)										
24 Netherlands	dm^3	cm	m	–	–	16	4		27	0.999
Betula spp. (Birch, Björk, Bjørk, Bouleaux, Mesteacan)										
25 Belgium	m^3	cm	m	–	–	14	6	2	329	–
26 Finland	$\ln(dm^3)$	cm	–	1.2–49.7	2.4–29.5	22	3		863	–
27 Finland	dm^3	cm	–	1.2–49.7	2.4–29.5	22	3		863	–
28 Finland	dm^3	cm	m	1.2–49.7	2.4–29.5	22	3		863	–
29 Finland	m^3	cm	m	–	–	19	3		863	–
30 Norway	m^3	cm	m	2–44	4–28	3	3		3312	0.984
31 Norway	m^3	cm	m	2–44	4–28	3	3		722	0.979
32 Romania	m^3	cm	m	–	–	18	3		–	–
33 Sweden	dm^3	cm	m	5–34.9	5.0–26.9	27	3		1746	–
34 Sweden	dm^3	cm	m	4.5–	6–	5	3	6	761	0.992
35 Sweden	dm^3	cm	m	4.5–	6–	5	3	7	761	0.988
36 Sweden	dm^3	cm	m	4.5–	6–	5	3	8	521	0.995

Appendix B

	Unit of			Range of						
	Vol.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
37 Sweden	dm^3	cm	m	4.5–	6–	5	3	9	521	0.993
38 Sweden	dm^3	cm	m	5–34.9	5–26.9	27	3		1363	–
39 UK	m^3	cm	m	–	–	8	2		–	–
Carpinus spp.										
40 Netherlands	dm^3	mm	m	–	–	31	3	10	–	–
41 Netherlands	dm^3	mm	m	–	–	31	3	11	–	–
42 Netherlands	dm^3	mm	m	–	–	31	3	12	–	–
Chamaecyparis lawsoniana (Lawson cypress)										
43 Netherlands	dm^3	cm	m	–	–	16	4		101	0.987
Corylus avellana (Hazel)										
44 Norway	dm^3	cm	m	5–	–	3	9		–	–
Fagus spp. (Beech, Fag)										
45 Austria	dm^3	dm	dm	1–	–	29	5		–	–
46 Austria	dm^3	dm	dm	0.5–1.04	–	32	5		–	0.748
47 Romania	m^3	cm	m	–	–	18	3		–	–
48 UK	m^3	cm	m	–	–	8	2		–	–
Fagus sylvatica (Beech, Rotbuche, Beuk)										
49 Belgium	m^3	cm	m	–	–	14	6		–	–
50 Germany	dm^3	cm	dm	10.7–61.8	10.2–34.6	28	1	13	20	0.994
51 Germany	dm^3	cm	dm	10.7–61.8	10.2–34.6	28	1	14	20	0.973
52 Netherlands	dm^3	cm	m	–	–	16	4		30	0.999
53 Netherlands	dm^3	cm	m	–	–	15	3		–	–
Fraxinus exselsior (Ash, Frêne, Es)										
54 Belgium	m^3	cm	m	–	–	14	6	2	534	–
55 Netherlands	dm^3	cm	m	–	–	16	4		121	0.984
56 Sweden	dm^3	cm	m	–	–	17	3	15	5294	–
57 Sweden	dm^3	cm	m	–	–	17	3	16	5294	–
58 Sweden	dm^3	cm	m	–	–	17	3	15	5294	–
59 Sweden	dm^3	cm	m	–	–	17	3	17	5284	–
60 Sweden	dm^3	cm	m	–	–	17	3	18	5284	–
Fraxinus spp. (Ash)										
61 Norway	dm^3	cm	m	5–	–	3	9		–	–
62 Romania	m^3	cm	m	–	–	18	3		–	–
63 UK	m^3	cm	m	–		8	2		–	–
Larix decidua (Larch, Mélèzes)										
64 Austria	dm^3	dm	dm	1–	–	29	5		–	–
65 Austria	dm^3	dm	dm	0.5–1.04	–	32	5		–	0.775
66 Belgium	m^3	cm	m	–	–	14	6	2	503	–
67 Netherlands	dm^3	cm	m	–	–	16	4		123	0.996
68 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
Larix hybrid (Hyprid larix)										
69 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
Larix kaempferi (Japanese larch)										
70 Netherlands	dm^3	cm	m	–	–	16	4		1023	0.996
71 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
Larix sibirica (Siberian larix)										
72 Iceland	m^3	cm	m	4–34	4–16	26	7		100	0.993
73 Iceland	m^3	cm	m	4–34	4–16	26	7	19	100	0.991
74 Iceland	m^3	cm	m	3.3–31.6	3–20	33	3		44	0.995
75 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
Larix spp. (Lehtikuusi, Lork, Larice)										
76 Finland	dm^3	cm	m	–	2–10	35	3		2813	–
77 Finland	dm^3	cm	m	–	2–10	35	3		2813	–
78 Netherlands	dm^3	mm	m	–	–	31	3	10	–	–
79 Netherlands	dm^3	mm	m	–	–	31	3	11	–	–
80 Netherlands	dm^3	mm	m	–	–	31	3	12	–	–
81 Romania	m^3	cm	m	–	–	18	3		–	–
Picea abies (Norway spruce, Kuusi, Gran, Epicéa, Fijnspar)										
82 Austria	dm^3	dm	dm	1–	–	29	5		–	–
83 Austria	dm^3	dm	dm	0.5–1.04	–	32	5		–	0.812

Appendix B	Unit of			Range of						
	Vol.	*D*	*H*	*D* (cm)	*H* (m)	Ref.	Cont.	Comm.	*n*	r^2
84 Belgium	m^3	cm	m	–	–	14	6	2	991	–
85 Czech Republic	m^3	cm	m	–	–	12	3		26	0.97
86 Czech Republic	m^3	cm	m	–	–	12	3		26	0.98
87 Finland	$\ln(dm^3)$	cm	–	1.5–61.9	1.8–32.7	22	3		1864	–
88 Finland	$\ln(dm^3)$	cm	–	1.5–61.9	1.8–32.7	22	3		1864	–
89 Finland	dm^3	cm	m	1.5–61.9	1.8–32.7	22	3		1864	–
90 Finland	$\ln(dm^3)$	cm	m	–	–	19	3		2864	–
91 Finland	dm^3	cm	m	2–18	2–18	21	3		359	0.993
92 Finland	dm^3	cm	m	2–18	2–18	21	3		180	0.995
93 Finland	$\ln(dm^3)$	cm	m	7–45	5–29	23	3		744	–
94 Germany	m^3	m	m	4.9–10.3	5–8.8	25	3		5	0.976
95 Germany	m^3	m	m	8.7–12.3	7.6–10.2	25	3		5	0.998
96 Iceland	m^3	cm	m	2.7–27.9	2.7–12	33	3		16	0.994
97 Netherlands	dm^3	mm	m	–	–	31	3	10	–	–
98 Netherlands	dm^3	mm	m	–	–	31	3	11	–	–
99 Netherlands	dm^3	mm	m	–	–	31	3	12	–	–
100 Netherlands	dm^3	cm	m	–	–	16	4		745	0.995
101 Netherlands	dm^3	cm	m	–	–	15	3		–	–
102 Norway	dm^3	cm	m	–	–	1	3	20	2621	0.998
103 Norway	dm^3	cm	m	–	–	1	3	20	1348	0.998
104 Norway	dm^3	cm	m	–	–	1	3	21	1813	0.996
105 Norway	dm^3	cm	m	–10	–39.49	34	3		3597	0.988
106 Norway	dm^3	cm	m	10.1–12.9	–39.49	34	3		–	–
107 Norway	dm^3	cm	m	13–59.4	–39.49	34	3		7446	0.988
108 Norway	dm^3	cm	m	10–59.4	–39.49	34	3		6096	0.988
109 Norway	dm^3	cm	m	10–59.4	–39.49	34	3		1350	0.993
110 Norway	dm^3	cm	m	–15	–39.49	34	3		699	0.988
111 Norway	dm^3	cm	m	10–59.4	–39.49	34	3		2004	0.986
112 Norway	dm^3	cm	m	–15	–39.49	34	3		2898	0.988
113 Norway	dm^3	cm	m	10–59.4	–39.49	34	3		5442	0.99
114 Poland	m^3	cm	m	–	–	10	3		2000	–
115 Poland	m^3	cm	m	–	–	9	3	22	2000	–
116 Sweden	dm^3	cm	m	5–55.9	3–34.9	27	3		3925	–
117 Sweden	dm^3	cm	m	2–	2–	4	3		2384	–
118 Sweden	dm^3	cm	m	4.5–	4–	5	3	8	2609	0.998
119 Sweden	dm^3	cm	m	4.5–	4–	5	3	6	2171	0.998
120 Sweden	dm^3	cm	m	4.5–	4–	5	3	9	2609	0.997
121 Sweden	dm^3	cm	m	4.5–	4–	5	3	7	2171	0.998
122 Sweden	dm^3	cm	m	5.0–55.9	3–34.9	27	3		2424	–
123 Sweden	dm^3	cm	m	2–	2–	4	3		2173	–
Picea engelmannii (Engelmanni spruce)										
124 Iceland	m^3	cm	m	1.4–12.7	1.7–12.7	33	3		15	0.968
Picea sitchensis (Sitka spruce)										
125 Netherlands	dm^3	cm	m	–	–	16	4		85	0.997
126 Norway	dm^3	cm	m	–	–	1	3	20	2429	0.998
127 Norway	dm^3	cm	m	–	–	1	3	20	1447	0.997
128 Norway	dm^3	cm	m	–	–	1	3	21	1363	0.996
Picea spp. (Molid)										
129 Romania	m^3	cm	m	–	–	18	3		–	–
130 Iceland	m^3	cm	m	4.9–28.6	4.8–15.4	33	3		56	
Pinus contorta (Contorta tall)										
131 Iceland	m^3	cm	m	4.2–26.3	2.8–12.8	33	3		48	–
132 Netherlands	dm^3	cm	m	–	–	16	4		127	0.994
133 Sweden	dm^3	cm	m	–	–	17	3	3	1301	–
134 Sweden	dm^3	cm	m	–	–	17	3	3	1301	–
135 Sweden	dm^3	cm	m	–	–	17	3	22	1301	–
Pinus nigra var ***maritima*** (Black pine)										
136 Netherlands	dm^3	cm	m	–	–	16	4		798	0.997

Appendix B

	Unit of Vol.	Unit of *D*	Unit of *H*	Range of *D* (cm)	Range of *H* (m)	Ref.	Cont.	Comm.	*n*	r^2
Pinus nigra var ***nigra*** (Black pine, Pin negru)										
137 Netherlands	dm^3	cm	m	–	–	16	4		983	0.996
138 Romania	m^3	cm	m	–	–	18	3		–	–
Pinus spp.										
139 Germany	m^3		m	–	–	20	3		–	–
140 Germany	m^3	cm		5–75	–	20	3		–	–
141 Netherlands	dm^3	mm	m	–	–	31	3	10	–	–
142 Netherlands	dm^3	mm	m	–	–	31	3	11	–	–
143 Netherlands	dm^3	mm	m	–	–	31	3	12	–	–
Pinus sylvestris (Scots pine, Mänty, Tall, Furu, Grove den, Pin silvestri)										
144 Austria	dm^3	dm	dm	0.5–	–	29	5		–	–
145 Belgium	m^3	cm	–	–	–	36	8		–	–
146 Belgium	m^3	cm	m	–	–	14	6		–	–
147 Finland	ln(dm^3)	cm	–	0.9–50.6	1.5–28.3	22	3		2050	–
148 Finland	ln(dm^3)	cm	–	0.9–50.6	1.5–28.3	22	3		2050	–
149 Finland	dm^3	cm	m	0.9–50.6	1.5–28.3	22	3		2050	–
150 Finland	ln(dm^3)	cm	m	–	–	19	3		2326	–
151 Finland	dm^3	cm	m	2–18	2–18	21	3		249	0.994
152 Finland	dm^3	cm	m	2–18	2–18	21	3		486	0.989
153 Finland	dm^3	cm	m	–	–	35	3		1493	–
154 Finland	ln(dm^3)	cm	m	7–50	5–28	23	3		1291	–
155 Germany	m^3	cm	m	3–14	5.8–10.7	24	3		–	–
156 Italy	dm^3	dm	dm	13–49	7–27.5	13	3		114	–
157 Netherlands	dm^3	mm	m	–	–	31	3	10	–	–
158 Netherlands	dm^3	mm	m	–	–	31	3	11	–	–
159 Netherlands	dm^3	mm	m	–	–	31	3	12	–	–
160 Netherlands	dm^3	cm	m	–	–	16	4		1207	0.994
161 Norway	dm^3	cm	m	–	–	1	3	20	4816	0.997
162 Norway	dm^3	cm	m	–	–	1	3	20	986	0.997
163 Norway	dm^3	cm	m	–	–	1	3	21	3010	0.994
164 Norway	dm^3	cm	m	10–	–	7	3		4356	0.996
165 Norway	dm^3	cm	m	–12	–	7	3		2622	0.999
166 Norway	dm^3	cm	m	–12	–	7	3		2622	0.999
167 Norway	dm^3	cm	m	–12	–	7	3		2622	0.999
168 Norway	dm^3	cm	m	–12	–	7	3		2622	0.999
169 Romania	m^3	cm	m	–	–	18	3		–	–
170 Sweden	dm^3	cm	m	5–49.9	3–32.9	27	3		4421	–
171 Sweden	dm^3	cm	m	2–	2–	4	3		3407	–
172 Sweden	dm^3	cm	m	4.5–	4–	5	3	8	3734	0.996
173 Sweden	dm^3	cm	m	4.5–	4–	5	3	6	2215	0.996
174 Sweden	dm^3	cm	m	4.5–	4–	5	3	9	3734	0.993
175 Sweden	dm^3	cm	m	4.5–	4–	5	3	7	2215	0.994
176 Sweden	dm^3	cm	m	5–49.9	3–32.9	27	3		2390	–
177 Sweden	dm^3	cm	m	2–	2–	4	3		2071	–
Populus spp. (Poplar, Plop)										
178 Austria	dm^3	dm	dm	5–10.4	–	32	5		–	0.849
179 Netherlands	dm^3	mm	m	–	–	31	3	10	–	–
180 Netherlands	dm^3	mm	m	–	–	31	3	11	–	–
181 Netherlands	dm^3	mm	m	–	–	31	3	12	–	–
182 Romania	m^3	cm	m	–	–	18	3		–	–
183 Romania	m^3	cm	m	–	–	18	3		–	–
184 UK	m^3	cm	m	–	–	8	2		–	–
Populus tremula (Aspen, Plop tremulator)										
185 Norway	dm^3	cm	m	13–	–	11	9		–	–
186 Norway	dm^3	cm	m	0–13	–	11	9		–	–
187 Romania	m^3	cm	m	–	–	18	3		–	–
188 Sweden	dm^3	cm	m	–	–	17	3	3	707	–
189 Sweden	dm^3	cm	m	–	–	17	3	3	707	–
190 Sweden	dm^3	cm	m	–	–	17	3	22	707	–

Appendix B

	Unit of Vol.	D	H	Range of D (cm)	H (m)	Ref.	Cont.	Comm.	n	r^2
Populus trichocarpa (Black cottonwood)										
191 Iceland	m^3	cm	m	4.6–34	4.6–20.7	33	3		25	0.989
Prunus avium (Wild cherry, Merisier, Zoete kers)										
192 Belgium	m^3	cm	m	–	–	14	6	2	334	–
Pseudotsuga menziesii (Douglas fir, Duglas)										
193 Belgium	m^3	cm	m	–	–	14	6	2	632	–
194 Netherlands	dm^3	cm	m	–	–	16	4		1136	0.993
195 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
196 Romania	m^3	cm	m	–	–	18	3		–	–
Pseudotsuga spp.										
197 Netherlands	dm^3	mm	m	–	–	31	3	10	–	–
198 Netherlands	dm^3	mm	m	–	–	31	3	11	–	–
199 Netherlands	dm^3	mm	m	–	–	31	3	12	–	–
Quercus grisea (Gray oak, Stejar brumariu)										
200 Romania	m^3	cm	m	–	–	18	3		–	–
Quercus ilex (Holm oak)										
201 Italy	dm^3	cm	m	4.5–26.1	6–16	6	3	23	94	0.991
202 Croatia	m^3	cm	m	5–15	–	30	3		–	–
Quercus laevis (Turkey oak, Cer)										
203 Romania	m^3	cm	m	–	–	18	3		–	–
Quercus pubescens (Downy oak, Stejar pufos)										
204 Croatia	ln(m3)	cm	m	4.1–23	3.5–15.1	2	3		347	0.96
205 Croatia	ln(m3)	cm	m	4.1–23	3.5–15.1	2	3	23	347	0.932
206 Romania	m^3	cm	m	–	–	18	3		–	–
Quercus robur (Pedunculate oak)										
207 Netherlands	dm^3	cm	m	–	–	16	4		108	0.995
Quercus rubra (Red oak, Chêne rouge)										
208 Belgium	m^3	cm	m	–	–	14	6	2	891	–
209 Netherlands	dm^3	cm	m	–	–	16	4		793	0.996
Quercus spp. (Oak, Chênes, Stejar)										
210 Austria	dm^3	dm	dm	1–	–	29	5		–	–
211 Austria	dm^3	dm	dm	5–10.4	–	32	5		–	0.64
212 Belgium	m^3	cm	m	–	–	14	6	2	290	–
213 Netherlands	dm^3	mm	m	–	–	31	3	10	–	–
214 Netherlands	dm^3	mm	m	–	–	31	3	11	–	–
215 Netherlands	dm^3	mm	m	–	–	31	3	12	–	–
216 Romania	m^3	cm	m	–	–	18	3		–	–
217 UK	m^3	cm	m	–	–	8	2		–	–
Salix caprea (Goat willow, Salcie capreasca)										
218 Norway	dm^3	cm	m	5–	–	3	9		–	–
219 Romania	m^3	cm	m	–	–	18	3		–	–
Salix spp. (Salcie)										
220 Romania	m^3	cm	m	–	–	18	3		–	–
221 Romania	m^3	cm	m	–	–	18	3		–	–
Sorbus aucuparia (Rowan)										
222 Norway	dm^3	cm	m	5–	–	3	9		–	–
Thuja pilicata (Western redcedar)										
223 Netherlands	dm^3	cm	m	–	–	16	4		165	0.993
224 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
Tilia cordata (Tei)										
225 Romania	m^3	cm	m	–	–	18	3		–	–
Tsuga heterophylla (Hemlock)										
226 Netherlands	dm^3	cm	m	–	–	16	4		121	0.995
227 Norway	dm^3	cm	m	5–	–	37	9	1	–	–
Ulmus spp. (Elm, Orme, Ulm)										
228 Belgium	m^3	cm	m	–	–	14	6	2	276	–
229 Netherlands	dm^3	cm	m	–	–	16	4		108	0.996
230 Romania	m^3	cm	m	–	–	18	3		–	–

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Comments – Appendix B

1 Plantations
2 Stem volume to upper girth limit of 22 cm
3 Including bark
4 Excluding bark
5 Merchantable volume >34 cm
6 Including bark, Southern Sweden, adjusted r^2
7 Excluding bark, Southern Sweden, adjusted r^2
8 Including bark, Northern Sweden, adjusted r^2
9 Excluding bark, Northern Sweden, adjusted r^2
10 Dominant
11 Dominated
12 Seed trees
13 Merchantable wood >7 cm
14 Non merchantable wood <7 cm
15 Including bark, trees without forks
16 Including bark, forked trees
17 Excluding bark, trees without forks
18 Excluding bark, forked trees
19 Without bark
20 Tree height 4 m and more
21 Tree height over 10 m
22 Merchantable volume
23 Merchantable volume, >3–4 cm

Appendix C. Volume equations for different tree species. The format of the stem volume equation (where D is diameter and H is height) is given in the column labelled Equation, and a–g are parameter values. The "ln" is the natural logarithm and the "log" is the 10-based logarithm.

	Equation
Abies alba (Silver fir)	
1 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
Abies grandis (Grand fir)	
2 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
3 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
Abies sibirica (Fir)	
4 Germany	$a \cdot D^b$
Abies spp. (Fir, Brad)	
5 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H + b \cdot D^2 \cdot H \cdot \ln(D)^2 + c \cdot D^2 + d \cdot D \cdot H + e \cdot H + f \cdot D + g$
6 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H + b \cdot D^2 \cdot H \cdot \ln(D)^2 + c \cdot D^2 + d \cdot D \cdot H$
7 Romania	$a \cdot 10^{(b \cdot \log(D) + c \cdot \log(D)\hat{}2 + d \cdot \log(H) + e \cdot \log(H)\hat{}2)}$
Acacia spp. (Salcim)	
8 Romania	$a \cdot 10^{(b \cdot \log(D) + c \cdot \log(D)\hat{}2 + d \cdot \log(H) + e \cdot \log(H)\hat{}2)}$
Acer pseudoplatanus (Maple, Erable sycomore, Paltin, Sycamore)	
9 Belgium	$a + b \cdot D + c \cdot D^2 + d \cdot D^3 + e \cdot H + f \cdot D^2 \cdot H$
10 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
11 Romania	$a \cdot 10^{(b \cdot \log(D) + c \cdot \log(D)\hat{}2 + d \cdot \log(H) + e \cdot \log(H)\hat{}2)}$
12 UK	$a + b \cdot D^2 \cdot H^c$
Alnus alba (Anin alb)	
13 Romania	$a \cdot 10^{(b \cdot \log(D) + c \cdot \log(D)\hat{}2 + d \cdot \log(H) + e \cdot \log(H)\hat{}2)}$
Alnus glutinosa (Black alder, Klibbal)	
14 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
15 Norway	$a + b \cdot D^2 + c \cdot D^2 \cdot H$
16 Norway	$a + b \cdot D^2 + c \cdot D^2 \cdot H + d \cdot H^2 \cdot D$
17 Sweden	$a \cdot D^2 + b \cdot D^2 \cdot H + c \cdot D \cdot H^2 + d \cdot D \cdot H + e \cdot D^2 H^2$
18 Sweden	$a \cdot D^b \cdot H^c$
19 Sweden	$a \cdot D^2 + b \cdot D^2 \cdot H + c \cdot D \cdot H^2 + d \cdot D \cdot H + e \cdot D^2 H^2$
Alnus incana (Grey alder)	
20 Norway	$a + b \cdot D^2 + c \cdot D^2 \cdot H + d \cdot H^2 \cdot D + e \cdot H^2$
Alnus nigra (Anin negru)	
21 Romania	$a \cdot 10^{(b \cdot \log(D) + c \cdot \log(D)\hat{}2 + d \cdot \log(H) + e \cdot \log(H)\hat{}2)}$
Alnus spp. (Alder)	
22 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H + b \cdot D^2 + c \cdot D)$
Arbutus unedo (Strawberry–tree)	
23 Italy	$a + b \cdot D^2$
Betula pendula (Birch, Berk)	
24 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
Betula spp. (Birch, Björk, Bjørk, Bouleaux, Mesteacan)	
25 Belgium	$a + b \cdot D + c \cdot D^2 + d \cdot D^3 + e \cdot H + f \cdot D^2 \cdot H$
26 Finland	$a + b \cdot \ln(D)$
27 Finland	$a + b \cdot \ln(c + d \cdot D) + e \cdot D$
28 Finland	$a \cdot (D^b) \cdot (c^D) \cdot (H^d) \cdot (H-1.3)^e$
29 Finland	$a + b \cdot \ln(D) + c \cdot \ln(H) + d \cdot \ln(H-1.3) + e \cdot D$
30 Norway	$a + b \cdot D^2 + c \cdot D^2 \cdot H + d \cdot D \cdot H^2 + e \cdot H^2$
31 Norway	$a + b \cdot D^2 + c \cdot D^2 \cdot H + d \cdot D \cdot H^2 + e \cdot H^2$
32 Romania	$a \cdot 10^{(b \cdot \log(D) + c \cdot \log(D)\hat{}2 + d \cdot \log(H) + e \cdot \log(H)\hat{}2)}$
33 Sweden	$a \cdot D^2 + b \cdot D^2 \cdot H + c \cdot D \cdot H^2 + d \cdot H^2$
34 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
35 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
36 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$

	Parameters a	b	c	d	e	f	g
1	1.6662	3.2394	1.9334	–1.8997	–0.9739	–	–
2	1.77220	0.96736	–2.45224	–	–	–	–
3	1.6662	3.2394	1.9334	–1.8997	–0.9739	–	–
4	0.0001316	2.52	–	–	–	–	–
5	0.580223	–0.0307373	–17.1507	0.089869	–0.080557	19.661	–2.4584
6	0.560673	0.15468	–0.65583	0.033210	–	–	–
7	$4.52 \cdot 10^{-5}$	2.1554	–0.1067	0.9380	0.0228	–	–
8	0.00046903	1.807	0.0292	–0.4155	0.5455	–	–
9	0.010343	–0.00450536	$3.4070 \cdot 10^{-4}$	$-4.0472 \cdot 10^{-6}$	$7.7115 \cdot 10^{-4}$	$2.9836 \cdot 10^{-5}$	–
10	1.89756	0.97716	–2.94253	–	–	–	–
11	0.00035375	1.02	0.3997	0.666	0.021	–	–
12	–0.012668	0.0000737	0.75	–	–	–	–
13	0.00065013	1.6750	0.1001	–0.4990	0.5902	–	–
14	1.85749	0.88675	–2.5222	–	–	–	–
15	8.6524	0.076844	0.031573	–	–	–	–
16	0.6716	0.75708	0.029679	0.004341	–	–	–
17	0.1926	0.01631	0.003755	–0.02756	0.000499	–	–
18	0.05437	1.94505	0.92947	–	–	–	–
19	0.2264	0.01347	0.007665	–0.06669	0.000428	–	–
20	–1.86827	0.21461	0.01283	0.0138	–0.06311	–	–
21	$8.666 \cdot 10^{-5}$	1.7148	0.1014	0.801	0.0530	–	–
22	0.387399	7.17123	0.04407	–	–	–	–
23	–0.5547	0.3757	–	–	–	–	–
24	1.89060	.26595	–1.07055	–	–	–	–
25	–0.011392	–0.00031447	0.000279211	$-5.7966 \cdot 10^{-6}$	$-5.9573 \cdot 10^{-4}$	$3.0409 \cdot 10^{-5}$	–
26	–2.09787	2.55058	–	–	–	–	–
27	–5.41948	3.57630	2	1.25	–0.0395855	–	–
28	0.011197	2.10253	0.986	3.98519	–2.65900	–	–
29	–4.4759	2.0851	4.0691	–2.7375	–0.013311	–	–
30	–1.86827	0.21461	0.01283	0.01380	0.06311	–	–
31	0.99983	0.006325	0.02849	0.00885	–0.00799	–	–
32	$8.141 \cdot 10^{-5}$	2.248	–0.2062	0.1946	0.4147	–	–
33	0.1305	0.01338	0.01757	–0.05606	–	–	–
34	–0.89359	2.27954	–1.18672	7.07362	–5.45175	–	–
35	–0.93631	2.30212	–1.40378	8.01817	–6.18825	–	–
36	–0.44224	2.47580	–1.40854	5.16863	–3.77147	–	–

Appendix C. Volume equations (cont.)

	Equation
37 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
38 Sweden	$a \cdot D^2+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2$
39 UK	$a+b \cdot D^2 \cdot H^c$
Carpinus spp.	
40 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
41 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
42 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
Chamaecyparis lawsoniana (Lawson cypress)	
43 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
Corylus avellana (Hazel)	
44 Norway	$a+b \cdot D^2+c \cdot D^2 \cdot H+d \cdot D \cdot H^2+e \cdot H^2$
Fagus spp. (Beech, Fag)	
45 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H+b \cdot D^2 \cdot H \cdot \ln(D)^2+c \cdot D^2+d \cdot D \cdot H+e \cdot H+f \cdot D+g)$
46 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H+b \cdot D^2+c \cdot D)$
47 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\text{^}2+d \cdot \log(H)+e \cdot \log(H)\text{^}2)}$
48 UK	$a+b \cdot D^2 \cdot H^c$
Fagus sylvatica (Beech, Rotbuche, Beuk)	
49 Belgium	$a+b \cdot D+c \cdot D^2+d \cdot D^3+e \cdot H+f \cdot D^2 \cdot H$
50 Germany	$a+b \cdot D \cdot H^2+c \cdot D^3$
51 Germany	$a+b \cdot D \cdot H^2+c \cdot D^3$
52 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
53 Netherlands	$a \cdot D^b \cdot H^c$
Fraxinus exselsior (Ash, Frêne, Es)	
54 Belgium	$a+b \cdot D+c \cdot D^2+d \cdot D^3+e \cdot H+f \cdot D^2 \cdot H$
55 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
56 Sweden	$a \cdot D^2 \cdot H+b \cdot D^2+c \cdot D \cdot H$
57 Sweden	$a \cdot D^2 \cdot H+b \cdot D^2+c \cdot D \cdot H$
58 Sweden	$a \cdot D^b \cdot H^c$
59 Sweden	$a \cdot D^2 \cdot H+b \cdot D^2+c \cdot D \cdot H$
60 Sweden	$a \cdot D^2 \cdot H+b \cdot D^2+c \cdot D \cdot H$
Fraxinus spp. (Ash)	
61 Norway	$a+b \cdot D^2+c \cdot D^2 \cdot H+d \cdot D \cdot H^2+e \cdot H^2$
62 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\text{^}2+d \cdot \log(H)+e \cdot \log(H)\text{^}2)}$
63 UK	$a+b \cdot D^2 \cdot H^c$
Larix decidua (Larch, Mélèzes)	
64 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H+b \cdot D^2 \cdot H \cdot \ln(D)^2+c \cdot D^2+d \cdot D \cdot H+e \cdot H+f \cdot D+g)$
65 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H+b \cdot D^2+c \cdot D)$
66 Belgium	$a+b \cdot D+c \cdot D^2+d \cdot D^3+e \cdot H+f \cdot D^2 \cdot H$
67 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
68 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
Larix hybrid (Hyprid larix)	
69 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
Larix kaempferi (Japanese larch)	
70 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
71 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
Larix sibirica (Siberian larix)	
72 Iceland	$\exp(a) \cdot D^b \cdot H^c$
73 Iceland	$\exp(a) \cdot D^b \cdot H^c$
74 Iceland	$a \cdot D^b \cdot H^c$
75 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
Larix spp. (Lehtikuusi, Lork, Larice)	
76 Finland	$a+b \cdot D^2+c \cdot D^2 \cdot H+d \cdot H^2 \cdot D$
77 Finland	$a+b \cdot D^2+c \cdot D^2 \cdot H+d \cdot H^2 \cdot D$

	Parameters a	b	c	d	e	f	g
37	–0.35394	2.52141	–1.54257	4.88165	–3.47422	–	–
38	0.1432	0.008561	0.02180	–0.06630	–	–	–
39	–0.009184	0.0000673	0.75	–	–	–	–
40	0.00021491	2.258957614	0.001411006	0.60291075	–	–	–
41	0.00021491	2.258957614	–0.01120638	0.60291075	–	–	–
42	0.00021491	2.258957614	–0.00956695	0.60291075	–	–	–
43	1.85298	.86717	–2.33706	–	–	–	–
44	–1.86827	0.21461	0.01283	0.0138	–0.06311	–	–
45	0.989253	–0.0371508	–31.0674	–0.386321	0.219462	49.6136	–22.372
46	0.517300	–13.62144	9.9888	–	–	–	–
47	0.0000757	1.3791	0.2127	1.1992	–0.0584	–	–
48	–0.014306	0.0000748	0.75	–	–	–	–
49	–0.015572	0.00290013	$-7.0476\cdot10^{-6}$	$2.393\cdot10^{-06}$	–0.0013528	$3.9837\cdot10^{-5}$	–
50	$15.589\cdot10^{-3}$	$0.01696\cdot10^{-3}$	$0.01883\cdot10–^{3}$	–	–	–	–
51	$16.641\cdot10^{-3}$	$0.72179\cdot10^{-3}$	$0.00252\cdot10^{-3}$	–	–	–	–
52	1.55448	1.55880	–3.57875	–	–	–	–
53	0.049	1.78189	1.08345	–	–	–	–
54	–0.039836	0.006262765	–0.00015937	$-1.9902\cdot10^{-7}$	–0.0009834	$3.7872\cdot10^{-5}$	–
55	1.95277	0.77206	–2.48079	–	–	–	–
56	0.03246	0.03310	0.04127	–	–	–	–
57	0.03593	0.03310	0.04127	–	–	–	–
58	0.06328	1.92428	0.88690	–	–	–	–
59	0.03249	0.02941	0.03892	–	–	–	–
60	0.03453	0.02941	0.03892	–	–	–	–
61	–1.86827	0.21461	0.01283	0.0138	–0.06311	–	–
62	0.00030648	1.2676	0.3102	0.4929	0.0962	–	–
63	–0.012107	0.0000777	0.75	–	–	–	–
64	0.609443	–0.0455748	–18.6631	–0.248736	0.126594	36.9783	–14.204
65	0.487270	–2.04291	5.9995	–	–	–	–
66	–0.03088	0.004676261	$-4.8614\cdot10^{-5}$	$-3.8178\cdot10^{-6}$	–0.0011638	$4.0597\cdot10^{-5}$	–
67	1.86670	1.08118	–3.0488	–	–	–	–
68	0.7761	3.6461	1.9166	–2.3179	–0.8236	–	–
69	0.7761	3.6461	1.9166	–2.3179	–0.8236	–	–
70	1.87077	1.00616	–2.8748	–	–	–	–
71	0.7606	3.5377	1.9741	–2.1902	–0.8459	–	–
72	–2.5079	1.7574	0.9808	–	–	–	–
73	–2.9946	1.8105	0.9908	–	–	–	–
74	0.0983	1.551	1.1483	–	–	–	–
75	0.7761	3.6461	1.9166	–2.3179	–0.8236	–	–
76	0.5	0.0753	0.03345	–0.00243	–	–	–
77	0.4	–0.01	0.03355	–0.00359	–	–	–

Appendix C. Volume equations (cont.)

	Equation
78 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
79 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
80 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
81 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)^\wedge 2+d \cdot \log(H)+e \cdot \log(H)^\wedge 2)}$
Picea abies (Norway spruce, Kuusi, Gran, Epicéa, Fijnspar)	
82 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H+b \cdot D^2 \cdot H \cdot \ln(D)^2+c \cdot D^2+d \cdot D \cdot H+e \cdot H+f \cdot D)$
83 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H+b \cdot D^2 \cdot H \cdot \ln(D)^2+c \cdot D^2+d \cdot D)$
84 Belgium	$a+b \cdot D+c \cdot D^2+d \cdot D^3+e \cdot H+f \cdot D^2 \cdot H$
85 Czech Republic	$a \cdot D^b$
86 Czech Republic	$a \cdot (H \cdot D^2)^b$
87 Finland	$a+b \cdot \ln(D)$
88 Finland	$a+b \cdot \ln(c+d \cdot D)+e \cdot D$
89 Finland	$a \cdot (D^b) \cdot (c^D) \cdot (H^d) \cdot (H-1.3)^e$
90 Finland	$a+b \cdot \ln(D)+c \cdot \ln(H)+d \cdot \ln(H-1.3)+e \cdot D$
91 Finland	$a \cdot D^b \cdot H^c$
92 Finland	$a \cdot D^b \cdot H^c$
93 Finland	$a+b \cdot \ln(D)+c \cdot D^2$
94 Germany	$a \cdot H \cdot D^2$
95 Germany	$a \cdot H \cdot D^2$
96 Iceland	$a \cdot D^b \cdot H^c$
97 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
98 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
99 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
100 Netherlands	$D^a \cdot H^b \cdot e^c$
101 Netherlands	$a \cdot D^b \cdot H^c$
102 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+40)^e$
103 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+40)^e$
104 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+40)^e$
105 Norway	$a+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2+e \cdot D \cdot H$
106 Norway	$a+b \cdot D \cdot H^2+c \cdot H^2+d \cdot D \cdot H+e \cdot H+f \cdot D$
107 Norway	$a+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2+e \cdot D \cdot H$
108 Norway	$a+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2+e \cdot D \cdot H$
109 Norway	$a+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2+e \cdot D \cdot H$
110 Norway	$a+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot D^2$
111 Norway	$a+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2+e \cdot D \cdot H$
112 Norway	$a+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2+e \cdot D \cdot H$
113 Norway	$a+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2+e \cdot D \cdot H$
114 Poland	$(\pi/40000) \cdot H \cdot D \cdot (a+b \cdot D)$
115 Poland	$(\pi/40000) \cdot H \cdot D \cdot (a \cdot D+b)$
116 Sweden	$a \cdot D^2+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2$
117 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
118 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
119 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
120 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
121 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
122 Sweden	$a \cdot D^2+b \cdot D^2 \cdot H+c \cdot D \cdot H^2+d \cdot H^2$
123 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
Picea engelmannii (Engelmanni spruce)	
124 Iceland	$a \cdot D^b \cdot H^c$
Picea sitchensis (Sitka spruce)	
125 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
126 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+40)^e$
127 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+40)^e$

	Parameters						
	a	b	c	d	e	f	g
78	0.00035217	2.12841828	0.003292718	0.76283925	–	–	–
79	0.00035217	2.12841828	–0.1054168	0.76283925	–	–	–
80	0.00035217	2.12841828	–0.0026067	0.76283925	–	–	–
81	$2.822 \cdot 10^{-5}$	2.2060	–0.1136	1.115	0.0129	–	–
82	0.46818	–0.013919	–28.213	0.37474	–0.28875	28.279	–
83	0.563443	–0.12731	–8.55022	7.6331	–	–	–
84	–0.010929	0.004380951	$-9.4713 \cdot 10^{-5}$	$-7.8024 \cdot 10^{-6}$	–0.0027922	$4.8346 \cdot 10^{-5}$	–
85	0.00059707	2.1286	–	–	–	–	–
86	0.00011261	0.87852	–	–	–	–	–
87	–2.41218	2.62463	–	–	–	–	–
88	–5.39934	3.46468	2	1.25	–0.0273199	–	–
89	0.022927	1.91505	0.99146	2.82541	–1.53547	–	–
90	–3.7544	1.8960	2.8979	–1.6020	–0.007827	–	–
91	0.7877	1.9302	0.79465	–	–	–	–
92	0.10838	1.8202	0.77154	–	–	–	–
93	–2.59385	2.71757	–0.000097	–	–	–	–
94	0.502	–	–	–	–	–	–
95	0.418	–	–	–	–	–	–
96	0.1299	1.6834	0.8598	–	–	–	–
97	0.00053238	2.164126647	0.004108377	0.54879808	–	–	–
98	0.00053238	2.164126647	–0.04670018	0.54879808	–	–	–
99	0.00053238	2.164126647	–0.0102582	0.54879808	–	–	–
100	1.75055	1.10897	–2.75863	–	–	–	–
101	0.04143	1.6704	1.3337	–	–	–	–
102	0.6844	3.0296	2.0560	–1.7377	–0.9756	–	–
103	0.7464	2.496	2.0714	–1.4175	–0.9601	–	–
104	0.5824	1.1987	1.9339	–0.0594	–0.7442	–	–
105	0.52	0.02403	0.01463	–0.10983	0.15195	–	–
106	–31.57	0.0016	0.0186	0.63	–2.34	3.2	–
107	10.14	0.0124	0.03117	–0.36381	0.28578	–	–
108	6.69	0.01308	0.02853	–0.31956	0.28969	–	–
109	0.46	0.02427	0.01521	–0.18254	0.20994	–	–
110	0.67	0.03023	0.00712	0.04175	–	–	–
111	0.28	0.00815	0.03053	–0.50725	0.51643	–	–
112	0.3	0.02593	0.01268	–0.0977	0.14586	–	–
113	4.33	0.01491	0.02606	–0.31854	0.31106	–	–
114	0.666151	0.458507	–	–	–	–	–
115	0.53005	1.229283	–	–	–	–	–
116	0.1150	0.01746	0.02022	–0.05618	–	–	–
117	–0.9513	1.9781	–0.5254	2.7604	–1.4684	–	–
118	–0.79783	2.07157	–0.73882	3.16332	–1.82622	–	–
119	–1.02039	2.00128	–0.47473	2.87138	–1.61803	–	–
120	–0.82249	2.11094	–0.89626	3.51812	–2.05567	–	–
121	–1.06019	2.04239	–0.54292	2.80843	–1.52110	–	–
122	0.1104	0.01925	0.01815	–0.04936	–	–	–
123	–1.0342	1.9683	–0.3850	2.4018	–1.2075	–	–
124	0.4693	1.311	0.781	–	–	–	–
125	1.78383	1.13397	–2.90893	–	–	–	–
126	0.1614	3.7060	1.9747	–2.2905	–0.6665	–	–
127	0.1870	3.7077	1.9854	–2.2816	–0.7161	–	–

Appendix C. Volume equations (cont.)

	Equation
128 Norway	$a \cdot D^b \cdot (H-1.3)^c \cdot (D+40)^d$
Picea spp. (Molid)	
129 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\char94 2+d \cdot \log(H)+e \cdot \log(H)\char94 2)}$
130 Iceland	$a \cdot D^b \cdot H^c$
Pinus contorta (Contorta tall)	
131 Iceland	$a \cdot D^b \cdot H^c$
132 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
133 Sweden	$a \cdot D^2+b \cdot D^2H+c \cdot D^2H^2-d \cdot D \cdot H+e \cdot D \cdot H^2$
134 Sweden	$a \cdot D^b \cdot H^c$
135 Sweden	$a \cdot D^2+b \cdot D^2H+c \cdot D^2H^2-d \cdot D \cdot H+e \cdot D \cdot H^2$
Pinus nigra var ***maritima*** (Black pine)	
136 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
Pinus nigra var ***nigra*** (Black pine, Pin negru)	
137 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
138 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\char94 2+d \cdot \log(H)+e \cdot \log(H)\char94 2)}$
Pinus spp.	
139 Germany	$a \cdot H^b$
140 Germany	$a \cdot D^b$
141 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
142 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
143 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
Pinus sylvestris (Scots pine, Mänty, Tall, Furu, Grove den, Pin silvestri)	
144 Austria	$(\pi/4) \cdot (a \cdot D^2 \cdot H+b \cdot D^2 \cdot H \cdot \ln(D)^2+c \cdot D^2+d \cdot H)$
145 Belgium	$a \cdot D^b$
146 Belgium	$a+b \cdot D+c \cdot D^2+d \cdot D^3+e \cdot H+f \cdot D^2 \cdot H$
147 Finland	$a+b \cdot \ln(D)$
148 Finland	$a+b \cdot \ln(c+d \cdot D)+e \cdot D$
149 Finland	$a \cdot (D^b) \cdot (c^D) \cdot (H^d) \cdot (H-1.3)^e$
150 Finland	$a+b \cdot \ln(D)+c \cdot \ln(H)+d \cdot \ln(H-1.3)+e \cdot D$
151 Finland	$a \cdot D^b \cdot H^c$
152 Finland	$a \cdot D^b \cdot H^c$
153 Finland	$a \cdot H \cdot D^2+b \cdot D \cdot H+c \cdot D^3+d \cdot D \cdot H^2$
154 Finland	$a+b \cdot \ln(D)+c \cdot D^2$
155 Germany	$a \cdot D^b \cdot H^c$
156 Italy	$a \cdot D^b \cdot H^c$
157 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
158 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
159 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
160 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
161 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
162 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
163 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
164 Norway	$a+b \cdot D^2+c \cdot D^2 \cdot H$
165 Norway	$a+b \cdot D^2+c \cdot D^2 \cdot H+d \cdot D \cdot H^2$
166 Norway	$a+b \cdot D^2+c \cdot D^2 \cdot H$
167 Norway	$a+b \cdot D^2+c \cdot D^2 \cdot H$
168 Norway	$a+b \cdot D^2 \cdot H$
169 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\char94 2+d \cdot \log(H)+e \cdot \log(H)\char94 2)}$
170 Sweden	$a \cdot D^2+b \cdot D^2 \cdot H+c \cdot D \cdot H^2$
171 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
172 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
173 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$
174 Sweden	$10^a \cdot D^b \cdot (D+20)^c \cdot H^d \cdot (H-1.3)^e$

	Parameters a	b	c	d	e	f	g
128	0.2101	1.8920	1.1095	–0.3895	–	–	–
129	0.00009464	1.9341	–0.0722	0.6365	0.172	–	–
130	0.0739	1.7508	1.0228	–	–	–	–
131	0.1491	1.6466	0.8325	–	–	–	–
132	1.89303	0.98667	–2.88614	–	–	–	–
133	0.1121	0.02870	–0.000061	0.09176	0.01249	–	–
134	0.04514	1.9005	1.06964	–	–	–	–
135	0.0883	0.03202	–0.000114	–0.07892	0.01049	–	–
136	1.89192	0.95374	–2.72505	–	–	–	–
137	1.95645	0.88671	–2.7675	–	–	–	–
138	0.00010892	1.9701	0.0102	0.4858	0.1330	–	–
139	0.000074	3.1	–	–	–	–	–
140	0.0001078	2.56	–	–	–	–	–
141	0.00042613	2.066225947	–0.001926657	0.80636901	–	–	–
142	0.00042613	2.066225947	–0.07956244	0.80636901	–	–	–
143	0.00042613	2.066225947	0.00369501	0.80636901	–	–	–
144	0.435949	–0.0149083	5.21091	0.028702	–	–	–
145	0.000244	2.32716	–	–	–	–	–
146	–0.039836	$4.8710 \cdot 10^{-3}$	$-6.1028 \cdot 10^{-5}$	$1.4889 \cdot 10^{-5}$	$7.3997 \cdot 10^{-5}$	$2.9221 \cdot 10^{-5}$	–
147	–2.2945	2.57025	–	–	–	–	–
148	–5.39417	3.48060	2	1.25	–0.039884	–	–
149	0.036089	2.01395	0.99676	2.07025	–1.07209	–	–
150	–3.2890	1.9995	2.1395	–1.1411	–0.002847	–	–
151	0.0942	1.9671	0.7005	–	–	–	–
152	0.095	1.9185	0.7381	–	–	–	–
153	0.05782	0.11632	–0.01092	–0.01317	–	–	–
154	–2.37912	2.62903	–0.000126	–	–	–	–
155	$5.6537 \cdot 10^{-5}$	1.960466	0.894433	–	–	–	–
156	1.480589	1.982459514	0.742674501	–	–	–	–
157	0.00207765	1.952764402	–8.6651E–05	0.48560878	–	–	–
158	0.00207765	1.952764402	–0.11110535	0.48560878	–	–	–
159	0.00207765	1.952764402	0.001095496	0.48560878	–	–	–
160	1.82075	1.07427	–2.8885	–	–	–	–
161	0.1424	2.0786	1.9028	–1.0259	–0.2640	–	–
162	0.1263	2.4621	1.9008	–1.3716	–0.2663	–	–
163	0.4434	4.9667	1.9912	–3.6612	–0.7502	–	–
164	8.6524	0.076844	0.031573	–	–	–	–
165	0.6716	0.075708	0.029679	–	–	–	–
166	2.0044	0.029886	0.036972	0.004341	–	–	–
167	2.9121	0.039994	–0.001091	–	–	–	–
168	2.9361	0.038906	–	–	–	–	–
169	0.00014808	1.8341	–0.0448	0.3115	0.3525	–	–
170	0.1028	0.02705	0.005215	–	–	–	–
171	–1.1226	2.0180	–0.2135	1.8271	–0.8297	–	–
172	–1.20914	1.94740	–0.05947	1.40958	–0.45810	–	–
173	–1.38903	1.84493	0.06563	2.02122	–1.01095	–	–
174	–1.25246	1.98244	–0.13118	1.03781	–0.03482	–	–

Appendix C. Volume equations (cont.)

	Equation
175 Sweden	$10^a\cdot D^b\cdot(D+20)^c\cdot H^d\cdot(H-1.3)^e$
176 Sweden	$a\cdot D^2+b\cdot D^2\cdot H+c\cdot D\cdot H^2$
177 Sweden	$10^a\cdot D^b\cdot(D+20)^c\cdot H^d\cdot(H-1.3)^e$
Populus spp. (Poplar, Plop)	
178 Austria	$(\pi/4)\cdot(a\cdot D^2\cdot H+b\cdot D^2+c\cdot D)$
179 Netherlands	$a\cdot D^{(b+c)}\cdot H^d$
180 Netherlands	$a\cdot D^{(b+c)}\cdot H^d$
181 Netherlands	$a\cdot D^{(b+c)}\cdot H^d$
182 Romania	$a\cdot 10^{(b\cdot\log(D)+c\cdot\log(D)^\wedge 2+d\cdot\log(H)+e\cdot\log(H)^\wedge 2)}$
183 Romania	$a\cdot 10^{(b\cdot\log(D)+c\cdot\log(D)^\wedge 2+d\cdot\log(H)+e\cdot\log(H)^\wedge 2)}$
184 UK	$a+b\cdot D2\cdot H^c$
Populus tremula (Aspen, Plop tremulator)	
185 Norway	$a+b\cdot D^2\cdot H$
186 Norway	$a+b\cdot D^2\cdot H$
187 Romania	$a\cdot 10^{(b\cdot\log(D)+c\cdot\log(D)^\wedge 2+d\cdot\log(H)+e\cdot\log(H)^\wedge 2)}$
188 Sweden	$a\cdot D^2+b\cdot D^2\cdot H+c\cdot D^2H^2+d\cdot D\cdot H+e\cdot D\cdot H^2$
189 Sweden	$a\cdot D^b\cdot H^c$
190 Sweden	$a\cdot D^2\cdot H+b\cdot D^2\cdot H+c\cdot D^2H^2+d\cdot D\cdot H+e\cdot D\cdot H^2$
Populus trichocarpa (Black cottonwood)	
191 Iceland	$a\cdot D^b\cdot H^c$
Prunus avium (Wild cherry, Merisier, Zoete kers)	
192 Belgium	$a+b\cdot D+c\cdot D^2+d\cdot D^3+e\cdot H+f\cdot D^2\cdot H$
Pseudotsuga menziesii (Douglas fir, Duglas)	
193 Belgium	$a+b\cdot D+c\cdot D^2+d\cdot D^3+e\cdot H+f\cdot D^2\cdot H$
194 Netherlands	$D^a\cdot H^b\cdot\exp(c)$
195 Norway	$a\cdot H^b\cdot D^c\cdot(H-1.3)^d\cdot(D+40)^e$
196 Romania	$a\cdot 10^{(b\cdot\log(D)+c\cdot\log(D)^\wedge 2+d\cdot\log(H)+e\cdot\log(H)^\wedge 2)}$
Pseudotsuga spp.	
197 Netherlands	$a\cdot D^{(b+c)}\cdot H^d$
198 Netherlands	$a\cdot D^{(b+c)}\cdot H^d$
199 Netherlands	$a\cdot D^{(b+c)}\cdot H^d$
Quercus grisea (Gray oak, Stejar brumariu)	
200 Romania	$a\cdot 10^{(b\cdot\log(D)+c\cdot\log(D)^\wedge 2+d\cdot\log(H)+e\cdot\log(H)^\wedge 2)}$
Quercus ilex (Holm oak)	
201 Italy	$a+b\cdot D^2\cdot H$
202 Croatia	$a\cdot D^b\cdot H^c$
Quercus laevis (Turkey oak, Cer)	
203 Romania	$a\cdot 10^{(b\cdot\log(D)+c\cdot\log(D)^\wedge 2+d\cdot\log(H)+e\cdot\log(H)^\wedge 2)}$
Quercus pubescens (Downy oak, Stejar pufos)	
204 Croatia	$a+b\cdot\ln(D)+c\cdot H$
205 Croatia	$a+b\cdot\ln(D)+c\cdot H$
206 Romania	$a\cdot 10^{(b\cdot\log(D)+c\cdot\log(D)^\wedge 2+d\cdot\log(H)+e\cdot\log(H)^\wedge 2)}$
Quercus robur (Pedunculate oak)	
207 Netherlands	$D^a\cdot H^b\cdot\exp(c)$
Quercus rubra (Red oak, Chêne rouge)	
208 Belgium	$a+b\cdot D+c\cdot D^2+d\cdot D^3+e\cdot H+f\cdot D^2\cdot H$
209 Netherlands	$D^a\cdot H^b\cdot\exp(c)$
Quercus spp. (Oak, Chênes, Stejar)	
210 Austria	$(\pi/4)\cdot(a\cdot D^2\cdot H+b\cdot D^2+c\cdot D\cdot H+d\cdot H+e\cdot D+f)$
211 Austria	$(\pi/4)\cdot(a\cdot D^2\cdot H+b\cdot D^2\cdot H\cdot\ln(D)^2+c\cdot D^2)$
212 Belgium	$a+b\cdot D+c\cdot D^2+d\cdot D^3+e\cdot H+f\cdot D^2\cdot H$
213 Netherlands	$a\cdot D^{(b+c)}\cdot H^d$
214 Netherlands	$a\cdot D^{(b+c)}\cdot H^d$

	Parameters a	b	c	d	e	f	g
175	–1.52761	1.82928	0.07454	1.43792	–0.35559	–	–
176	0.1072	0.02427	0.007315	–	–	–	–
177	–1.2605	1.9322	–0.0897	2.1795	–1.1676	–	–
178	0.366419	1.13323	0.1306	–	–	–	–
179	0.0009507	1.895629295	0.001650837	0.8392146	–	–	–
180	0.0009507	1.895629295	–0.09208823	0.8392146	–	–	–
181	0.0009507	1.895629295	–0.00773694	0.8392146	–	–	–
182	0.00018059	1.9342	0.0013	–0.0161	0.4099	–	–
183	0.00041486	1.4466	0.1089	–0.1963	0.5681	–	–
184	–0.004298	0.0000435	0.89	–	–	–	–
185	9.69	0.0365	–	–	–	–	–
186	–0.21	0.0398	–	–	–	–	–
187	0.00007604	1.7812	0.0528	0.8533	0.0654	–	–
188	0.01548	0.03255	–0.000047	–0.01333	0.004859	–	–
189	0.03597	1.84297	1.15988	–	–	–	–
190	0.03392	–0.01491	–0.000005	0.01704	0.002926	–	–
191	0.0732	1.6933	1.0562	–	–	–	–
192	–0.002311	–0.00117728	0.000149061	$-7.8058\cdot10^{-6}$	$3.3282\cdot10^{-4}$	$3.1526\cdot10^{-5}$	–
193	–0.019911	0.001871101	0.000127328	$-5.7631\cdot10^{-6}$	0.00071591	$3.9371\cdot10^{-5}$	–
194	1.90053	.80726	–2.43151	–	–	–	–
195	1.8211	4.153	2.1342	–2.6902	–1.4265	–	–
196	$4.477\cdot10^{-5}$	1.8688	0.0424	1.1411	–0.1047	–	–
197	0.00095916	2.092560524	0.000297255	0.48824344	–	–	–
198	0.00095916	2.092560524	–0.0449007	0.48824344	–	–	–
199	0.00095916	2.092560524	0	0.48824344	–	–	–
200	$7.188\cdot10^{-5}$	1.4486	0.0204	1.4084	0.0409	–	–
201	1.1909	0.038639	–	–	–	–	–
202	0.000096	1.821	0.759	–	–	–	–
203	0.0001992	2.014	–0.0602	–0.1108	0.4811	–	–
204	–9.646	2.076	0.761	–	–	–	–
205	–11.473	2.548	0.967	–	–	–	–
206	0.00035164	1.1119	0.3108	0.5356	0.2139	–	–
207	2.00333	0.85925	–2.86353	–	–	–	–
208	–0.02149	0.002986681	$-4.2506\cdot10^{-5}$	$-2.1806\cdot10^{-6}$	–0.000743	$3.7473\cdot10^{-5}$	–
209	1.83932	0.9724	–2.71877	–	–	–	–
210	0.115631	65.9961	1.20321	–0.930406	–215.758	168.477	–
211	0.417118	0.21941	13.32594	–	–	–	–
212	–0.0022735	0.000389557	0.000124772	$-1.8434\cdot10^{-6}$	–0.0016657	$3.6985\cdot10^{-5}$	–
213	0.00095853	2.040672356	0.001965013	0.56366437	–	–	–
214	0.00095853	2.040672356	–0.02101921	0.56366437	–	–	–

Appendix C. Volume equations (cont.)

	Equation
215 Netherlands	$a \cdot D^{(b+c)} \cdot H^d$
216 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\text{^}2+d \cdot \log(H)+e \cdot \log(H)\text{^}2)}$
217 UK	$a+b \cdot D^2 \cdot H^c$
Salix caprea (Goat willow, Salcie capreasca)	
218 Norway	$a+b \cdot D^2+c \cdot D^2 \cdot H+d \cdot H^2 \cdot D+e \cdot H^2$
219 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\text{^}2+d \cdot \log(H)+e \cdot \log(H)\text{^}2)}$
Salix spp. (Salcie)	
220 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\text{^}2+d \cdot \log(H)+e \cdot \log(H)\text{^}2)}$
221 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\text{^}2+d \cdot \log(H)+e \cdot \log(H)\text{^}2)}$
Sorbus aucuparia (Rowan)	
222 Norway	$a+b \cdot D^2+c \cdot D^2 \cdot H+d \cdot H^2 \cdot D+e \cdot H^2$
Thuja pilicata (Western redcedar)	
223 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
224 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+40)^e$
Tilia cordata (Tei)	
225 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\text{^}2+d \cdot \log(H)+e \cdot \log(H)\text{^}2)}$
Tsuga heterophylla (Hemlock)	
226 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
227 Norway	$a \cdot H^b \cdot D^c \cdot (H-1.3)^d \cdot (D+100)^e$
Ulmus spp. (Elm, Orme, Ulm)	
228 Belgium	$a+b \cdot D+c \cdot D^2+d \cdot D^3+e \cdot H+f \cdot D^2 \cdot H$
229 Netherlands	$D^a \cdot H^b \cdot \exp(c)$
230 Romania	$a \cdot 10^{(b \cdot \log(D)+c \cdot \log(D)\text{^}2+d \cdot \log(H)+e \cdot \log(H)\text{^}2)}$

	Parameters						
	a	b	c	d	e	f	g
215	0.00095853	2.040672356	–0.04354461	0.56366437	–	–	–
216	$8.839 \cdot 10^{-5}$	1.8905	0.0469	0.8059	–0.0045	–	–
217	–0.011724	0.0000765	0.75	–	–	–	–
218	–1.86827	0.21461	0.01283	0.0138	–0.06311	–	–
219	0.00011585	1.6688	0.1090	0.7781	0.0269	–	–
220	$4.281 \cdot 10^{-5}$	2.0766	–0.1296	0.6843	0.2745	–	–
221	$7.325 \cdot 10^{-5}$	1.5598	0.0302	0.8572	0.1791	–	–
222	–1.86827	0.21461	0.01283	0.0138	–0.06311	–	–
223	1.67887	1.11243	–2.64821	–	–	–	–
224	1.3057	3.9075	1.9832	–2.3337	–1.3024	–	–
225	0.00004124	1.9302	0.0209	0.129	–0.1903	–	–
226	1.76755	1.37219	–3.54922	–	–	–	–
227	0.4291	2.6153	1.9145	–1.2696	–0.6715	–	–
228	–0.034716	0.004268168	–0.00013227	$-1.7667 \cdot 10^{-6}$	0.00016516	$3.8311 \cdot 10^{-5}$	–
229	1.94295	1.29229	–4.20064	–	–	–	–
230	$3.992 \cdot 10^{-5}$	2.1569	–0.0933	1.0728	–0.0708	–	–