

Appendix 1: Introduction to basic measurements and conventions

A1.1 Units used in Forestry

Linear measurements		
cm	Centimetre	0.01 metre
m	Metre	
km	Kilometre	1 000 metres
Area measurements		
m ²	Square metre	
ha	Hectare	10 000 m ²
Volume measurement		
m ³	Cubic metre	1 000 litres
Weight measurement		
Tonne		1 000 000 grams

Constants: $\pi = 3.1415927$. As a convention 1 m³ of water is taken to weigh 1 tonne.

A1.2 Measuring diameter

All diameters should be measured in centimetres. Diameters of individual trees are conventionally rounded down to the nearest whole centimetre. Mean diameters may be recorded to the nearest whole centimetre

Diameters may be measured with a special tape marked in cm diameter, known as a girthing tape, which is placed round the circumference of the tree or log. Girthing tapes which are marked in rounded down 1 cm diameter classes are available from specialist suppliers (see Figure A1.1). In cases where the zero point is found to fall on the dividing line between two diameter classes, the higher diameter class should be used.

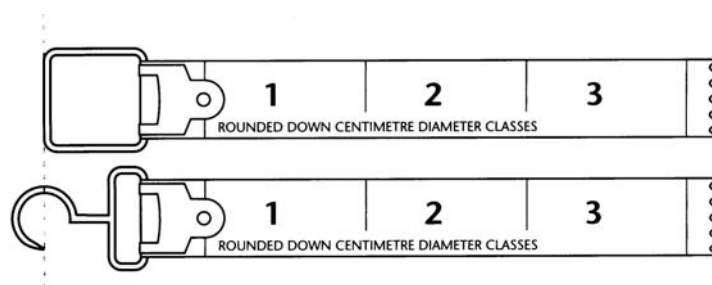


Figure A1.1: Examples of girthing tapes – the dotted line shows the zero point.

Diameters can also be measured with manual or electronic callipers, while the diameters of stumps and of the ends of logs are usually measured with a timber or log rule.

A1.2.1 Measuring diameter at breast height

The dbh is the diameter of the trunk at 1.3 m above ground level (breast height). In forestry in the UK trees with a dbh of less than 7 cm are assumed to have no timber volume and are conventionally classified as 'unmeasurable', however for the purposes of carbon assessment this minimum dbh will ultimately be reduced to 4 cm.

There are conventions for determining the point on the stem where the breast height should be measured. On sloping ground, this is the ground level on the upper side of the tree, while on leaning trees on level ground, this is the ground level on the underside of the tree. More details are given in *Forest Mensuration: a handbook for practitioners* pages 36-37.

A1.2.2 Calculating mean dbh

The mean diameter of a stand or group of trees is the diameter of the tree of mean basal area, which is the same as the quadratic mean of the dbh's of all the trees. Unmeasurable trees (*i.e.* with a dbh of less than 7 cm) are normally excluded from this calculation, but if they are included this should be clearly stated. The mean diameter can be calculated using one of two methods:

- Using a calculator or computer
- Using a table of basal areas.

Using a scientific calculator or computer

- a. Square each dbh.
- b. Add all the squared values together.
- c. Divide by the number of trees, to give the mean squared dbh.
- d. Calculate the square root of this value, to give the quadratic mean dbh.

Using Table A1.1 below

- a. Convert each dbh into the equivalent basal area.
- b. Add all the basal areas together.
- c. Divide by the number of trees, to give the mean basal area.
- d. Convert this to the quadratic mean dbh (using Table A1.1 in reverse), rounding down to the nearest centimetre dbh class when necessary.

Table A1.1 Basal areas

Dbh or diameter (cm)	Basal area or cross-sectional area (m ²)	Dbh or diameter(cm)	Basal area or cross-sectional area (m ²)
7	0.0038	34	0.091
8	0.0050	35	0.096
9	0.0064	36	0.102
10	0.0079	37	0.108
11	0.0095	38	0.113
12	0.0113	39	0.119
13	0.0133	40	0.126
14	0.0154	41	0.132
15	0.018	42	0.139
16	0.020	43	0.145
17	0.023	44	0.152
18	0.025	45	0.159
19	0.028	46	0.166
20	0.031	47	0.173
21	0.035	48	0.181
22	0.038	49	0.189
23	0.042	50	0.196
24	0.045	51	0.204
25	0.049	52	0.212
26	0.053	53	0.221
27	0.057	54	0.229
28	0.062	55	0.238
29	0.066	56	0.246
30	0.071	57	0.255
31	0.075	58	0.264
32	0.080	59	0.273
33	0.086	60	0.283

A1.2.3 Mid diameter

The mid-sectional diameter is measured at the mid-point of the rounded down length section. If the mid diameter falls on a whorl or swelling the diameter should be measured immediately above it (towards the small end). If the mid diameter of a timber length falls below the breast height point on the standing tree, the dbh should be regarded as the mid diameter. Mid diameter should be measured consistently either overbark or underbark.

A1.3 Measuring height

Lengths and heights should be measured in metres. They are conventionally rounded down to the nearest 0.1 m for lengths up to 10 m, and to the nearest whole metre for lengths greater than 10 m.

A1.3.1 Measuring length

The length of a piece of felled timber should be measured with a tape in a direct line from end to end (Figure 2). This is a revision to a previous convention that involved measurement along the curve of the log.

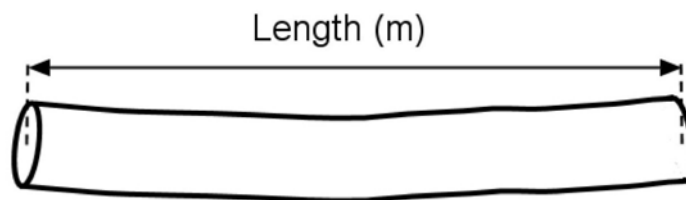


Figure A1.2 – The method of assessment of length on curved logs

A1.3.2 Total height

The total height of a standing tree is the vertical distance from the base of the tree to the uppermost point (tip). The total length of a felled tree is the straight line distance from the base to the tip. The total height of young standing trees can be measured with graduated poles. The total height of felled trees should be measured with a tape. The total height of other trees should be measured with a manual or electronic hypsometer or clinometer, and the instructions supplied with the instrument should be followed. Each tree should ideally be measured from opposite sides perpendicular to any lean, and the two measurements averaged. The distance of the observation points from the tree should be in the region of 1 to 1.5 times the height of the tree. When measuring the heights of trees it is important to remember that accurate use of hypsometers or clinometers requires training, checking, and, most of all, practice.

A1.3.3 Timber height

The timber height of a tree (or the timber length) is the distance from the base of the tree to the lowest point on the main stem where the diameter is 7 cm overbark. In hardwoods and occasionally in conifers this point may alternatively be the 'spring of the crown'; *i.e.* the lowest point at which no main stem is distinguishable. It should be measured in exactly the same way as total height.

A1.4 Classifying trees as live or dead

If the cambium is either active or dormant, the tree is classed as alive. Otherwise it is classed as dead.

A1.5 Classifying maturity.

Maturity is defined as one of three classes for the purposes of this assessment:

- Seedling: Any tree less than 50 cm tall
- Sapling: Any tree that is more than 50 cm tall and less than 7 cm dbh.
- Tree: Any tree with dbh equal to or greater than 7 cm.

A1.6 Species.

Standard species abbreviations are given in Appendix 2 (on page 62).

Appendix 2: Standard species abbreviations

The following standard abbreviations for species are used throughout this document.

Species abbreviation	Common name	Latin name
AH	ash	<i>Fraxinus</i> spp.
AR	alder	<i>Alnus</i> spp.
BE	beech	<i>Fagus sylvatica</i>
BI	birch	<i>Betula</i> spp.
BIP	Bishop pine	<i>Pinus muricata</i>
CP	Corsican pine	<i>Pinus nigra</i> var <i>maritima</i>
DF	Douglas fir	<i>Pseudotsuga menziesii</i>
EL	European larch	<i>Larix decidua</i>
EM	elm	<i>Ulmus</i> spp.
GF	grand fir	<i>Abies grandis</i>
HBM	hornbeam	<i>Carpinus betulus</i>
HL	hybrid larch	<i>Larix x eurolepis</i>
JCR	Japanese cedar/Sugi	<i>Cryptomeria japonica</i>
JL	Japanese larch	<i>Larix kaempferi</i>
LC	Lawson cypress	<i>Chamaecyparis lawsoniana</i>
LEC	Leyland cypress	<i>Cupressocyparis leylandii</i>
LI	lime	<i>Tilia</i> spp.
LP	lodgepole pine	<i>Pinus contorta</i> var <i>latifolia</i>
MAP	maritime pine	<i>Pinus pinaster</i>
MET	dawn redwood (Metasequoia)	<i>Metasequoia glyptostroboides</i>
MX	mixed species	
NF	noble fir	<i>Abies procera</i>
NOM	Norway maple	<i>Acer platanoides</i>
NS	Norway spruce	<i>Picea abies</i>
OBN	southern beech/roble	<i>Nothofagus obliqua</i>
OK	oak	<i>Quercus</i> spp.
OMS	Omorika spruce (Serbian spruce)	<i>Picea omorika</i>
PDP	ponderosa pine	<i>Pinus ponderosa</i>
PO	poplar	<i>Populus</i> spp.
PRN	southern beech/rauli	<i>Nothofagus procera</i>
RAP	radiata pine (Monterey pine)	<i>Pinus radiata</i>
RC	western red cedar	<i>Thuja plicata</i>
ROK	red oak	<i>Quercus rubra</i>
RSQ	coast redwood	<i>Sequoia sempervirens</i>
SC	sweet/Spanish chestnut	<i>Castanea sativa</i>
SP	Scots pine	<i>Pinus sylvestris</i>
SS	Sitka spruce	<i>Picea sitchensis</i>
SY	sycamore	<i>Acer pseudoplatanus</i>

Standard species abbreviations (continued)

Species abbreviation	Common name	Latin name
TOK	Turkey oak	<i>Quercus cerris</i>
WEP	Weymouth pine	<i>Pinus strobus</i>
WH	western hemlock	<i>Tsuga heterophylla</i>
WSQ	Wellingtonia (giant redwood)	<i>Sequoiadendron giganteum</i>
XB	miscellaneous broadleaf	
XC	miscellaneous coniferous	
XF	miscellaneous fir	<i>Abies</i> spp.
XP	miscellaneous pine	<i>Pinus</i> spp.
XS	miscellaneous spruce	<i>Picea</i> spp.

Appendix 3: Estimating the tariff number of minor tree species.

This table lists the available relationships for estimating the tariff number of major tree species in Britain. For those species where no relationship has been characterised the table suggests an alternative. It must be stressed that many of these equivalencies for minor species are provisional and the tariff number derived in this way should be regarded as the currently best available estimate.

Common name	Abbreviation	Single tree tariff	Stand tariff from top height
beech	BE	•	OK
English elm	-	•	OK
hornbeam	-	BE	BE
pedunculate oak	OK	•	•
raoul	-	BE	BE
roble	-	BE	BE
red oak	-	BE	OK
sessile oak	OK	•	•
sweet chestnut/Spanish chestnut	-	BE	OK
wych elm	-	•	OK
Corsican pine	CP	•	•
Monterey pine	-	CP	CP
western red pine	-	CP	CP
Bishop pine	-	LP	LP
Douglas fir	DF	•	•
European larch	EL	•	•
hybrid larch	HL	•	•
Japanese larch	JL	•	•
coast redwood	-	GF	GF
grand fir	GF	•	•
Wellingtonia/giant sequoia	-	GF	GF
lodgepole pine	LP	•	•
maritime pine	-	LP	LP

Estimating the tariff number of minor tree species (continued)

Common name	Abbreviation	Single tree tariff	Stand tariff
European silver fir	-	NF	NF
noble fir	NF	•	•
Nordmann fir	-	NF	NF
Siberian fir	-	NF	NF
blue spruce	-	NS	NS
Englemann spruce	-	NS	NS
Norway spruce	NS	•	•
Omorika spruce	OMS	NS	NS
oriental spruce	-	NS	NS
white spruce	-	NS	NS
Sitka spruce	SS	•	•
Lawson cypress	LC	RC	RC
Leyland cypress	-	RC	RC
Monterey cypress	-	RC	RC
Nootka cypress	-	RC	RC
western red cedar	RC	•	•
ash	AH	•	OK
bird cherry	-	BI	BI
black poplar	-	•	BI
common alder	-	BI	OK
downy birch	BI	•	•
field maple	-	SY	BI
grey alder	-	BI	OK
hazel	-	BI	BI
horse chestnut	-	SY	OK
hybrid black poplar	-	•	BI
Italian alder	-	BI	OK
London plane	-	SY	-
Norway maple	-	SY	BI
silver birch	BI	•	•
sycamore	SY	•	BI
wild cherry	-	BI	BI
Scots pine	SP	•	•
Ponderosa pine	-	SP	SP
Weymouth pine/(eastern) white pine	-	SP	SP
western hemlock	WH	•	•