Green moisture content and basic density of 95 woody species growing in Kyushu University Forests, Japan

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https://doi.org/10.15017/19563

出版情報：九州大学農学部演習林報告. 92, pp.33-44, 2011-03-30. 九州大学農学部附属演習林

九大演報（Bull. Kyushu Univ. For.），92：33-44，2011

学 術 情 報

Green moisture content and basic density of 95 woody species growing in Kyushu University Forests, Japan

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We investigated the green moisture content and basic density of 95 woody species growing in Kyushu University Forests. In softwood species, the green moisture content of heartwood ranged from 28% in *Cryptomeria japonica* to 67% in *Abies firma*, and in sapwood, from 75% in *Tsuga sieboldii* to 160% in *Cryptomeria japonica*. The green moisture content of softwood trees was greater in sapwood than heartwood. The green moisture content in the heartwood of hardwood species ranged from 34% in *Euonymus alatus* f. *striatus* to 83% in *Kalopanax pictus*, and in sapwood, from 45% in *Fraxinus sieboldiana* to 153% in *Actinidia polygama*. We found three radial variation pattern types in stems of hardwood species. The green moisture content was higher in heartwood than sapwood, in the first type, whereas in the second, it was higher in sapwood than heartwood. In a third type, differences between heartwood and sapwood were relatively small. The basic density of softwood species ranged from 378 kg/m³ in *Cryptomeria japonica* to 524 kg/m³ in *Tsuga sieboldii*. Most trees tended to decrease in basic density from corewood to outerwood. Basic density in hardwood species ranged from 266 kg/m³ in *Paulownia tomentosa* to 751 kg/m³ in *Rhaphiolepis indica* var. *umbellata*. We identified three types of radial variation pattern in stems of hardwood species. In the first type, basic density was higher in corewood than outerwood, whereas in second, it was higher in outerwood. In the third type, differences between corewood and outerwood were small. We also provided the information on the age and size of heartwood formation.
Keyword：green moisture content; basic density; Kyushu University Forests; Japan

国内に生育する樹木の木材性質に関するデータベースを作成する一環として，九州大学演習林（北海道演習林，宮崎演習林，福岡演習林）に生育するつる性木本植物３樹種を含む95樹種の生材含水率および容積密度数を測定した．針葉樹の生材含水率は辺材が心材より常に大きく，心材ではスギの28%からモミの67%の範囲にあり，辺材ではツガの75%からスギの160%の範囲にあった．一方，広葉樹の生材含水率は，心材ではヌルデの34%からハリギリの83%の範囲にあり，辺材ではアオダモの45%からマタタビの153%の範囲にあった．樹幹半径方向の生材含水率のバラツキについては，辺材よりも心材が高いタイプ，心材よりも辺材が高いタイプ，心材と辺材にほとんど差がないタイプの３タイプが認められた．針葉樹材の容積密度数は，スギの378 kg/m³からツガの524 kg/m³の範囲にあり，樹幹半径方向の変動では，中心部が外周部よりも高かった．広葉樹材の容積密度数は，キリの266 kg/m³からシャリンバイの751 kg/m³の範囲にあり，樹幹半径方向の変動では，外周部よりも中心部が高いタイプ，中心部よりも外周部が高いタイプ，中心部と外側部にほとんど差がないタイプの３タイプが認められた．最後に心材形成を開始する樹齢やサイズに係わる情報について記載した．
キーワード：生材含水率，容積密度数，九州大学演習林，日本

1．Introduction

Wood moisture strongly affects wood quality characteristics, including physical and mechanical properties, dimensional stability, machining, drying performance, adhesion properties, durability, burning characteristics, and transport efficiency (e.g., Watanabe 1978 ; Fushitani *et al*. 1989; Forestry and Forest Products Research Institute 2004). Thus, wood moisture content is of concern to foresters, wood processors, and users at every stage from standing trees to the service performance of various wood products.

Living trees contain a large amount of water in their stems, because they transport water from the soil to their leaves via their stems, and also store some water in their stems (Tyree & Zimmermann 2002). Previous studies

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reported wood moisture content (green moisture content) of living trees growing in Japan. For example, Yazawa *et al.* (1965) reported interspecies variation in green moisture content distribution in the stems of nine hardwood species. Nakada (2006) investigated water distribution in the stems of 11 softwood species. Kawazumi *et al.* (1991) and Nakada *et al.* (1999) reported intraspecies variation in green moisture content in the stems of *Cryptomeria japonica*. Previous studies also have reported seasonal variations in *Fagus crenata* (Yazawa 1960), and *Fraxinus mandshurica* var. *japonica*, *Ulmus davidiana*, and *Populus maximowiczii* trees (Yazawa & Ishida 1965). Kano (1987), Miyajima (1992), and Forestry and Forest Products Research Institute (2004) documented the green moisture content for 27 species (14 softwood species and 13 hardwood species), 25 species (9 softwood species and 16 hardwood species), and 15 species (9 softwood species and 6 hardwood species), respectively. However, previous reports were mainly focused on commercial woody species. Thus, data from many woody species are required to determine green moisture content in various woody species growing in Japan. These data should be supplemented with additional information, because green moisture content varies with a number of factors, e.g., seasons, site conditions, geographical locations, inter-tree variation, and intra-tree variation (Gibbs 1958; Yazawa 1960; Forestry and Forest Products Research Institute 2004).

Wood density (or specific gravity) is an important characteristics of wood, which is strongly correlated with physical properties, mechanical properties, burning characteristics, biomass, and carbon stocking (Watanabe 1978; Zobel & van Buitjenen 1989; Zhang 1997; Niklas 1997; Forestry and Forest Products Research Institute 2004). There are many previous investigations of wood density. Basic density data for woody species growing in Japan are summarized and listed in several reports and books (Nakai & Yamai 1982; Forestry and Forest Products Research Institute 2004). However, as with green moisture content, these data were mainly focused on commercial woody species. Data from many wood species are required to determine the basic density of various woody species growing in Japan. These data should be supplemented with additional information, for the same reasons as noted for variability in moisture content (Zobel & van Buitjenen 1989).

We aimed to provide data on green moisture content and basic density for 95 woody species, including three woody lianas, which were investigated in Kyushu University Forests between 2003 and 2006, as part of a project to develop wood properties database.

2. Materials and methods

Wood samples were collected from three Kyushu University sites, which ranged from warm temperate forest to cool temperate forest, i.e., Kasuya Research Forest, Shiiba Research Forest, and Ashoro Research Forest (Table 1 and Fig.1).

Fig.1 Location of sampling site

We sampled two to four trees for each of 95 species from three sites, comprised of five softwood species and 90 hardwood species. A total of 204 trees were cut down during July and August between 2003 and 2006, i.e., 35 species in Kasuya Research Forest, 58 species in Shiiba Research Forest, and nine species in Ashoro Research Forest. Table 2 shows species name, age, height, and diameter at breast height (DBH) for the trees sampled. DBH, tree height, and tree age ranged from 1 cm to 10 cm, 2 m to 12 m, and one year to 123 years, respectively.

We cut a short log (about 20 cm length) at breast height from each sample tree and vaseline was applied immediately to the cut sections at both ends, to prevent desiccation. Logs were wrapped in plastic and taken to the laboratory. A wood disc (3 cm thickness) was cut from the middle of each log immediately samples arrived in the laboratory. A wedge spanning from pith to bark was removed from the wood disc. The wedge was separated into inner sapwood and outer sapwood. If the wedge contained colored heartwood, it was separated into heartwood and sapwood based on visual demarcation. The heartwood and sapwood blocks were then separated into inner and outer sections. We did not separate the intermediate wood, which was usually recognized as a pale colored zone between the sapwood and heartwood. If heartwood was found in the stem, we regarded heartwood and sapwood as corewood and outerwood, respectively. When heartwood was not present in the stem, inner sapwood and outer sapwood were regarded as corewood

Table 1 Descripton of sampling sites.

	Kasuya Research Forest	Shiiba Research Forest	Ashoro Research Forest
Forest area	481ha	2916 ha	3713 ha
Latitude	33° 38'N	32° 22'N	43° 14'N
Longitude	130° 31'E	131° 08'E	143° 33'E
Altitude	30 m - 553 m	650 m - 1607 m	100 m – 450 m
Annual average temperatur	16.2°C	12.9°C	6.0°C
Warmth Index	134.9	101.6	60.0
Annual average precipitatic	1599 mm	3356 mm	749 mm
Forest type*	WTF	ITF	CTF

*WTF: warm temperate forest, ITF: intermediate temperate forest, CTF: cool temperate forest

and outerwood, respectively. We measured the green weight and volume of each block were measured before reweighting after drying the blocks in a 105 ℃ oven until constant weight. Green volume was determined by the water displacement method.

Green moisture content (GMC) was calculated using formula 1.

$$\mathrm{GMC}(\%) = \frac{\text{Green weight(g)} - \text{Over dry weight(g)}}{\text{Oven dry weight(g)}} \times 100 \quad (1)$$

Basic density (BD) was calculated using formula 2.

$$\mathrm{BD}(\mathrm{kg/m^3}) = \frac{\text{Oven dry weight(kg)}}{\text{Green volume}(\mathrm{m^3})} \quad (2)$$

3. Results and discussion

Table 3 shows the green moisture content and basic density values of heartwood and sapwood for each sample tree.

3. 1. Green moisture content

Average green moisture content for heartwood in softwood species ranged from 28% in *Chamaecyparis obtusa* to 67% in *Abies firma*. The minimum and maximum values for individual trees were 28% in *Chamaecyparis obtuse* (tree nos. 3 & 4) and 95% in *Abies firma* (tree no. 2), respectively. Average green moisture content for sapwood ranged from 75% in *Tsuga sieboldii* to 160% in *Cryptomeria japonica*. The minimum and maximum values for individual tree were 28% in *Tsuga sieboldii* (tree no. 14) and 202% in *Cryptomeria japonica* (tree no. 8).

It is well known that the green moisture content of softwood species is generally high in sapwood and low in heartwood (e.g, Fushitani *et al.* 1989). However the heartwood of some species also has high moisture content, including *Cryptomeria japonica* and *Abies sachalinensis* (Kano 1987; Kawazumi *et al.* 1991; Nakada *et al.* 1999; Forestry and Forest Products Research Institute 2004; Nakada 2006). Our study found that the green moisture content of sapwood was higher than that of heartwood in all softwood trees. The heartwood of *Abies firma* (tree no.2) had a higher moisture content than all other softwood trees.

Our study also showed that the green moisture content of outer sapwood was higher than that of inner sapwood in all softwood trees. This result may be attributable to intermediate wood, because we did not separate intermediate wood from the sapwood and heartwood. Further investigations testing the separation of intermediate wood from sapwood and heartwood are required.

Only 25 tree samples from 12 heardwood species contained heartwood. Average green moisture content in heartwood ranged from 34% of *Euonymus alatus* f. *striatus* to 83% in *Quercus crispula*. The minimum and maximum values for individual tree were 30% in *Rhus javanica* var. *roxburghii* (tree no.57) and 90% in *Kalopanax pictus* (tree no.32). Average green moisture content of sapwood ranged from 45% in *Fraxinus sieboldiana* to 153% in *Actinidia polygama*. The minimum and maximum values for individual trees were 45 % in *Fraxinus sieboldiana* (tree no.27) and 159% in *Actinidia polygama* (tree no.15).

The difference in green moisture content between the heartwood and sapwood was relatively small in hardwood species (2% to 46%) compared with softwood species (31% to 95%). This result agreed with previous reports (Kano

1987; Fushitani *et al.* 1989).

Yazawa *et al.* (1965) studied radial variation in green moisture content in the stem of nine hardwood species and reported three types of distribution pattern. In the first type, the moisture content was higher in the heartwood than sapwood. In the second type, the moisture content was higher in the sapwood than in heartwood. In the third type, only small differences in moisture contents were detected in the sapwood and heartwood. We found the following species belong to the first type: *Castanea crenata*, *Fraxinus mandshurica* var. *japonica*, *Kalopanax pictus*, *Maackia amurensis* subsp. *buergeri*, *Phellodendron amurense*, and *Quercus crispula*. *Rhus javanica* var. *roxburghii* and *Euonymus alatus* f. *striatus* were of the second type, whereas *Morus australis* belonged to the third type. The attribution of *Fraxinus mandshurica* var. *japonica* to type 1 agreed with the results of Yazawa *et al.* (1965), but our classification of *Morus australis* as type 3 was not agreement.

The outer sapwood had a higher green moisture content than the inner sapwood in the majority of the 173 hardwood trees tested. This finding may be attributed to the fact that the region involved in water transport does not include the entire sapwood in broad-leaved species (Umebayashi et. al. 2007; 2010).

Our study was limited by the short sampling season (July to August) and limits on sampling, i.e., low sample number per species, small tree size, and restriction of tree sampling mainly to Kasuya Forest and Shiiba Forest. Further green moisture content data collection is required.

3. 2. Basic density

The basic density of whole stems showed large interspecies variations, especially in hardwood species. In softwood species, the mean basic density ranged from 378 kg/m^3 in *Cryptomeria japonica* to 524 kg/m^3 in *Tsuga sieboldii*. The minimum and maximum values for individual trees were 326 kg/m^3 in *Cryptomeria japonica* (tree no. 8) and 536 kg/m^3 in *Tsuga sieboldii* (tree no. 13). In contrast, the mean basic density of hardwood species ranged from 266 kg/m^3 in *Paulownia tomentosa* to 725 kg/m^3 in *Rhaphiolepis indica* var. *umbellata*. The minimum and maximum values for individual trees were 251 kg/m^3 in *Zanthoxylum ailanthoides* (tree no. 191) and 751 kg/m^3 in *Rhaphiolepis indica* var. *umbellata* (tree no. 163).

Numerous reports indicate that basic density varies with radial variations from the pith to bark in the stem of woody species (Fushitani et. al. 1989; Zobel & Sprague 1998). In all but one of softwood trees (tree no.1), basic density tended to decrease from corewood to outerwood. We observed three types of radial variation patterns in the basic density of hardwood species. In the first type, basic density was higher in corewood than outerwood (e.g., *Kalopanax pictus* and *Maackia amurensis* subsp. *buergeri*). In the second type, basic density was higher in outerwood than corewood (e.g., *Betula grossa* and *Litsea acuminata*). Only small differences in the basic density of corewood and outerwood were detected in the third type (e.g., *Magnolia obovata* and *Dendropanax trifidus*). Further basic density data are required to determine radial variation patterns for each species.

3. 3. Information on the age and size of heartwood formation

It is well known that heartwood formation begins after trees reach a certain age or size (Watanabe 1978). However, there is little information on the starting size and age of heartwood formation for woody species growing in Japan. We derived data on the age and size of heartwood formation from the presence or absence of heartwood (Table 3), tree age and DBH (Table 2). Heartwood was observed in the stems of three species of five softwood species (16 trees) and 12 of 90 hardwood species (26 trees). Among the softwood species, the smallest size and ring number (cambial age) for a stem containing heartwood was 6 cm and seven growth rings in *Chamaecyparis obtuse* (tree no. 3). Among the hardwood species, this was 4 cm in *Euonymus alatus* f. *striatus* (tree no. 104) and seven growth rings in *Rhus javanica* var. *roxburghii* (tree nos.55, 56 and 57). In contrast, the largest size and ring number for a hardwood species stem containing no heartwood was 9 cm in Chamaecyparis obtuse (trees no. 6) and 11 growth rings in *Pinus densiflora* (tree no.11), whereas among the hardwood species, this was 10 cm in *Ilex crenata* var. *fukasawana* (tree no.120) and 80 growth rings in *Fraxinus sieboldiana* (tree no.27).

Table 2 Description of sample trees.

Japanese common name (Scientific name)	Tree no.	Tree age (year)	DBH (cm)	Tree height (m)	Sampling date	Sampling site*
Softwood						
Momi (*Abies firma*)	1	69	8.9	7.8	2004/7/16	S
	2	26	9.0	5.9	2004/7/16	S
Hinoki (*Chamaecyparis obtusa*)	3	8	6.2	4.7	2005/8/30	S
	4	7	5.7	4.1	2005/8/30	S
	5	10	7.5	5.6	2005/8/26	K
	6	10	8.6	6.0	2005/8/26	K
Sugi (*Cryptomeria japonica*)	7	5	2.8	3.3	2005/8/25	S
	8	8	3.7	4.7	2005/8/25	S
	9	10	3.5	4.1	2005/8/26	K
	10	10	8.1	5.9	2005/8/26	K
Akamatsu (*Pinus densiflora*)	11	11	4.6	4.4	2004/8/24	S
	12	9	4.8	4.2	2004/8/24	S
Tsuga (*Tsuga sieboldii*)	13	76	7.5	7.3	2004/8/24	S
	14	76	8.2	10.0	2004/8/24	S
Hardwood						
Ring-porous wood						
Matatabi (*Actinidia polygama*)	15	12	1.9	8.3	2004/7/16	S
	16	9	2.0	10.9	2004/7/16	S
Urinoki (*Alangium platanifolium* var. *trilobum*)	17	22	2.3	4.4	2003/8/10	S
	18	25	4.4	7.3	2003/8/10	S
Taranoki (*Aralia elata*)	19	4	3.5	2.8	2004/7/16	S
	20	4	4.9	2.7	2004/7/16	S
Kuri (*Castanea crenata*)	21	20	5.8	6.9	2005/8/22	K
	22	18	5.7	4.1	2005/8/22	K
Aodamo (*Fraxinus lanuginosa* f. *serrata*)	23	23	5.7	5.8	2004/8/9	A
	24	35	6.0	8.1	2004/8/9	A
Yachidamo (*Fraxinus mandshurica var. japonica*)	25	22	6.4	7.8	2003/8/13	A
	26	10	4.9	8.7	2003/8/13	A
Marubaaodamo (*Fraxinus sieboldiana*)	27	80	7.5	11.1	2003/8/31	S
	28	34	4.7	10.2	2003/8/31	S
Harigiri (*Kalopanax pictus*)	29	60	5.8	5.8	2003/8/25	S
	30	15	4.7	4.9	2003/8/25	S
	31	48	9.7	11.5	2004/8/12	A
	32	69	8.3	10.3	2004/8/12	A
Inuenjyu (*Maackia amurensis* subsp. *buergeri*)	33	51	7.9	7.4	2004/8/12	A
	34	52	9.8	8.7	2004/8/12	A
Yamaguwa (*Morus australis*)	35	48	5.4	7.5	2004/8/25	S
	36	33	5.5	7.4	2004/8/25	S
Kiri (*Paulownia tomentosa*)	37	1	4.2	5.5	2005/8/17	K
	38	3	5.1	5.0	2005/8/17	K
Kihada (*Phellodendron amurense*)	39	21	9.4	8.3	2004/7/16	S
	40	19	8.6	6.5	2004/7/16	S
Kobannoki (*Phyllanthus flexuosus*)	41	9	3.9	2.3	2005/8/30	K
	42	9	2.4	2.4	2005/8/30	K
Ring-porous wood						
Nogurumi (*Platycarya strobilacea*)	43	4	3.0	3.8	2005/8/8	K
	44	5	2.5	3.7	2005/8/8	K
Kunugi (*Quercus acutissima*)	45	20	6.8	7.6	2003/8/19	S
	46	20	7.3	6.2	2003/8/19	S
Abemaki (*Quercus variabilis*)	47	18	6.8	7.5	2003/8/19	S
	48	20	9.3	8.2	2003/8/19	S
	49	22	6.5	6.1	2005/8/10	K
	50	16	5.5	4.4	2005/8/10	K
Mizunara (*Quercus crispula*)	51	27	7.0	9.2	2003/8/22	S
	52	23	5.5	8.8	2003/8/22	S
	53	44	9.8	11.1	2004/8/12	A
	54	41	9.7	8.8	2004/8/12	A
Nurude (*Rhus javanica* var. *roxburghii*)	55	7	6.4	5.1	2004/8/31	S
	56	7	6.4	7.8	2004/8/31	S
	57	7	4.4	6.7	2005/8/23	K
	58	8	4.1	5.3	2005/8/23	K
Yamaurushi (*Toxicodendron trichocarpum*)	59	33	4.7	4.7	2004/8/7	A
	60	43	6.4	6.0	2004/8/7	A
Kurozuru (*Tripterygium regelii*)	61	10	5.8	9.4	2004/8/31	S
	62	11	6.4	7.9	2004/8/31	S
Yamafuji (*Wisteria brachybotrys*)	63	19	2.5	9.2	2003/7/25	S
	64	22	3.5	11.5	2003/7/25	S
Inuzansho (*Zanthoxylum schinifolium*)	65	7	3.3	4.8	2004/7/7	S
	66	10	2.5	4.5	2004/7/7	S
Semi-ring-porous wood						
Kakuremino (*Dendropanax trifidus*)	67	23	3.5	5.1	2006/7/28	K
	68	36	5.5	6.8	2006/7/28	K
Nawashirogumi (*Elaeagnus pungens*)	69	10	4.7	5.2	2005/8/16	K
	70	9	1.1	2.2	2005/8/16	K
Diffuse-porous wood						
Chidorinoki (*Acer carpinifolium*)	71	26	6.0	5.5	2003/8/22	S
	72	21	5.6	6.1	2003/8/22	S
Irohamomiji (*Acer palmatum*)	73	31	4.5	5.3	2003/7/30	S
	74	23	3.3	3.5	2003/7/30	S
Itayakaede (*Acer pictum* subsp. *dissectum*)	75	29	7.2	5.9	2003/7/31	S
	76	33	7.2	7.0	2003/7/31	S
Ezoitaya (*Acer pictum* subsp. *mono* f. *mono*)	77	28	6.2	8.2	2004/8/11	A
	78	32	6.8	9.4	2004/8/11	A
Enkoukaede (*Acer pictum* subsp. *dissectum* f. *dissectum*)	79	21	7.6	6.6	2003/8/1	S
	80	15	6.8	5.5	2003/8/1	S
Kohauchiwakaede (*Acer sieboldianum*)	81	57	9.7	9.4	2003/7/22	S
	82	54	9.0	6.8	2003/7/22	S
Yashabushi (*Alnus firma*)	83	5	2.9	4.0	2005/8/28	K
	84	8	6.8	5.0	2005/8/28	K

* S: Shiiba Research Forest, K: Kasuya Research Forest, A: Ashoro Research Forest

Table 2 (*Continued*)

Japanese common name (Scientific name)	Tree no.	Tree age (year)	DBH (cm)	Tree height (m)	Sampling date	Sampling site*	Japanese common name (Scientific name)	Tree no.	Tree age (year)	DBH (cm)	Tree height (m)	Sampling date	Sampling site*
Diffuse-porous wood							**Diffuse-porous wood**						
Mukunoki (*Aphananthe aspera*)	85	12	1.8	4.3	2005/7/19	K	Nezumimochi (*Ligustrum japonicum*)	129	26	3.0	3.3	2005/8/23	K
	86	10	5.5	5.6	2005/7/19	K		130	29	2.5	3.2	2005/8/23	K
Mizume (*Betula grossa*)	87	23	8.6	9.5	2003/8/22	S	Kanakuginoki (*Lindera erythrocarpa*)	131	21	5.6	7.0	2003/8/4	S
	88	20	6.8	8.0	2003/8/22	S		132	29	9.7	6.3	2003/8/4	S
Yabutsubaki (*Camellia japonica*)	89	61	7.8	6.0	2003/8/22	S	Aburachan (*Lindera praecox*)	133	14	3.8	5.5	2003/8/1	S
	90	33	5.0	5.8	2003/8/22	S		134	19	2.6	4.0	2003/8/1	S
	91	15	2.6	3.4	2005/8/28	K	Shiromoji (*Lindera triloba*)	135	27	6.0	6.9	2003/8/9	S
	92	18	2.3	3.3	2005/8/28	K		136	15	2.9	5.2	2003/8/9	S
Akashide (*Carpinus laxiflora*)	93	11	4.9	6.6	2003/8/27	S	Baribarinoki (*Litsea acuminata*)	137	15	3.8	4.9	2005/7/19	K
	94	10	5.1	5.4	2003/8/27	S		138	15	3.8	4.8	2005/7/19	K
Inushide (*Carpinus tschonoskii*)	95	11	5.0	6.9	2003/8/27	S	Kagonoki (*Litsea coreana*)	139	9	2.8	3.2	2005/8/6	K
	96	10	5.0	4.6	2003/8/27	S		140	9	3.1	4.1	2005/8/6	K
Isunoki (*Distylium racemosum*)	97	14	3.9	6.2	2005/8/27	K	Tabunoki (*Machilus thunbergii*)	141	13	4.1	4.7	2006/8/3	K
	98	14	3.3	5.5	2005/8/27	K		142	12	3.6	3.5	2006/8/3	K
Yamagaki (*Diospyros kaki* var. *sylvestris*)	99	9	4.9	6.5	2005/8/18	K	Hoonoki (*Magnolia obovata*)	143	17	4.8	5.8	2003/8/28	S
	100	9	4.1	4.9	2005/8/18	K		144	17	5.0	5.4	2003/8/28	S
Utsugi (*Deutzia crenata*)	101	7	2.5	4.2	2004/8/22	S	Tamushiba (*Magnolia salicifolia*)	145	16	4.0	5.2	2003/8/6	S
	102	9	2.9	4.3	2004/8/22	S		146	16	6.3	5.7	2003/8/6	S
Komayumi (*Euonymus alatus* f. *striatus*)	103	57	6.4	5.1	2004/7/16	S	Awabuki (*Meliosma myriantha*)	147	16	6.9	6.5	2003/8/4	S
	104	43	4.0	5.0	2004/7/16	S		148	23	7.5	6.0	2003/8/4	S
Fusazakura (*Euptelea polyandra*)	105	11	4.0	7.3	2003/8/6	S	Shirodamo (*Neolitsea sericea*)	149	28	7.5	6.2	2003/8/20	S
	106	17	4.1	7.4	2003/8/6	S		150	29	8.5	5.9	2003/8/20	S
Hisakaki (*Eurya japonica*)	107	28	3.9	3.3	2005/8/11	K		151	8	2.6	3.2	2005/8/25	K
	108	25	2.2	3.6	2005/8/11	K		152	7	3.9	3.3	2005/8/25	K
Buna (*Fagus crenata*)	109	19	5.5	6.3	2003/8/19	S	Asebi (*Pieris japonica*)	153	9	5.3	5.4	2003/8/5	S
	110	24	6.4	8.2	2003/8/19	S		154	10	6.2	5.4	2003/8/5	S
Inubuna (*Fagus japonica*)	111	16	5.6	5.6	2003/8/5	S	Tobera (*Pittosporum tobira*)	155	8	3.2	4.2	2006/8/9	K
	112	17	5.2	6.4	2003/8/5	S		156	15	5.6	6.0	2006/8/9	K
Hosobainubiwa (*Ficus erecta* f. *sieboldii*)	113	10	2.5	4.2	2006/7/20	K	Yamanarashi (*Populus sieboldii*)	157	36	8.6	8.5	2004/8/12	A
	114	9	3.3	4.0	2006/7/20	K		158	30	7.7	7.3	2004/8/12	A
Nanaminoki (*Ilex chinensis*)	115	15	3.2	6.0	2006/8/8	K	Kamatsuka (*Pourthiaea villosa* var. *laevis*)	159	32	7.2	7.0	2003/8/6	S
	116	15	3.4	4.9	2006/8/8	K		160	35	4.5	5.2	2003/8/6	S
Inutsuge (*Ilex crenata*)	117	10	1.5	2.2	2005/8/13	K	Asagara (*Pterostyrax corymbosa*)	161	21	8.5	6.2	2003/7/25	S
	118	12	2.0	2.7	2005/8/13	K		162	21	5.0	5.1	2003/7/25	S
Tsukushiinutsuge (*Ilex crenata* var. *fukasawana*)	119	43	6.6	6.2	2004/7/16	S	Sharinbai (*Rhaphiolepis indica* var. *umbellata*)	163	22	3.1	4.9	2003/8/6	K
	120	51	9.9	6.8	2004/7/16	S		164	30	5.2	6.3	2003/8/6	K
Soyogo (*Ilex pedunculosa*)	121	38	5.1	5.0	2003/8/22	S	Nekoyanagi (*Salix gracilistyla*)	165	25	6.2	5.2	2004/8/23	S
	122	38	5.0	7.0	2003/8/22	S		166	16	3.3	4.0	2004/8/23	S
Kuroganemochi (*Ilex rotunda*)	123	10	4.3	4.2	2005/7/22	K	Yamayanagi (*Salix sieboldiana*)	167	22	6.0	5.6	2003/8/30	S
	124	11	5.8	3.5	2005/7/22	K		168	23	3.9	4.1	2003/8/30	S
Inuumemodoki (*Ilex serrata* f. *argutidens*)	125	41	3.0	4.1	2004/8/27	S	Shiraki (*Sapium japonicum*)	169	17	4.2	6.2	2003/7/31	S
	126	34	2.2	3.8	2004/8/27	S		170	9	3.7	3.9	2003/7/31	S
Shikimi (*Illicium anisatum*)	127	18	3.6	3.7	2003/8/22	S	Nankinnanakamado (*Sorbus gracilis*)	171	29	1.8	4.9	2003/8/22	S
	128	45	4.6	3.5	2003/8/22	S		172	26	2.0	5.8	2003/8/22	S

Table 2 (*Continued*)

Japanese common name (Scientific name)	Tree no.	Tree age (year)	DBH (cm)	Tree height (m)	Sampling date	Sampling site*	Japanese common name (Scientific name)	Tree no.	Tree age (year)	DBH (cm)	Tree height (m)	Sampling date	Sampling site*
Diffuse-porous wood							**Diffuse-porous wood**						
Himeshara (*Stewartia monadelpha*)	173	21	6.4	6.1	2003/8/19	S	Karasuzanshou (*Zanthoxylum ailanthoides*)	191	10	6.8	4.1	2005/8/8	K
	174	28	5.8	5.8	2003/8/19	S		192	3	5.1	3.7	2005/8/8	K
Egonoki (*Styrax japonica*)	175	22	5.5	5.5	2003/8/23	S	Fuyuzanshou (*Zanthoxylum armatum* var. *subtrifoliatum*)	193	9	4.0	3.8	2006/8/5	K
	176	22	6.2	5.8	2003/8/23	S		194	13	3.0	4.6	2006/8/5	K
Kohakuunboku (*Styrax shiraiana*)	177	7	2.9	3.8	2004/7/7	S	**Radial-porus wood**						
	178	9	3.7	5.8	2004/7/7	S	Sudajii (*Castanopsis sieboldii*)	195	22	5.0	4.6	2005/8/27	K
Kurominosawafutagi (*Symplocos tanakana*)	179	21	3.7	5.7	2006/7/31	K		196	18	3.3	3.6	2005/8/27	K
	180	14	2.2	3.7	2006/7/31	K	Matebashii (*Lithocarpus edulis*)	197	16	4.0	5.5	2006/8/2	K
Kuroki (*Symplocos lucida*)	181	6	2.4	2.9	2005/8/13	K		198	16	3.3	5.0	2006/8/2	K
	182	7	2.7	2.8	2005/8/13	K	Arakashi (*Quercus glauca*)	199	13	6.2	7.6	2005/8/6	K
Kumanomizuki (*Swida macrophylla*)	183	11	3.7	4.4	2003/8/25	S		200	8	5.0	6.3	2005/8/6	K
	184	11	7.4	5.2	2003/8/25	S	Shirakashi (*Quercus myrsinaefolia*)	201	16	2.9	5.5	2006/8/9	K
Oobabodaijyu (*Tilia maximowicziana*)	185	34	6.5	7.4	2004/8/11	A		202	23	5.9	6.7	2006/8/9	K
	186	30	6.0	7.8	2004/8/11	A	Urajirogashi (*Quercus salicina*)	203	24	7.4	7.0	2004/7/16	S
Shashanbo (*Vaccinium bracteatum*)	187	18	3.2	4.1	2006/7/29	K		204	9	3.5	5.4	2004/7/16	S
	188	22	4.1	3.3	2006/7/29	K	**Wood vesselless**						
Koyabudemari (*Viburnum plicatum* var. *parvifolium*)	189	23	4.0	5.3	2004/7/16	S	Yamaguruma (*Trochodendron aralioides*)	205	85	6.8	5.8	2003/8/22	S
	190	27	3.9	5.3	2004/7/16	S		206	123	7.0	4.8	2003/8/22	S

Table 3 Green moisture content and basic density (kg/m^3) of the trees. (-: No observation of heartwood)

Japanese common name (Scientific name)	Tree no.	Green moisture content (%)							Basic density (kg/m^3)						
		Heartwood			Sapwood			stem	Heartwood			Sapwood			stem
		Inner	Outer	All	Inner	Outer	All		Inner	Outer	All	Inner	Outer	All	
Softwood															
Momi (*Abies firma*)	1	42	35	39	43	113	84	61	453	422	438	492	473	481	458
	2	115	75	95	155	181	167	152	373	356	364	337	309	323	331
	AVG	79	55	67	99	147	126	106	413	389	401	415	391	402	394
Hinoki (*Chamaecyparis obtusa*)	3	32	26	28	100	148	123	78	481	489	486	460	446	453	468
	4	36	24	28	92	135	115	81	501	503	502	467	401	430	456
	5	-	-	-	109	162	131	131	-	-	-	458	387	426	426
	6	-	-	-	123	155	138	138	-	-	-	458	398	428	428
	AVG	34	25	28	106	150	127	107	491	496	494	461	408	434	444
Sugi (*Cryptomeria japonica*)	7	-	-	-	123	200	154	154	-	-	-	444	331	391	391
	8	-	-	-	162	247	202	202	-	-	-	357	297	326	326
	9	-	-	-	116	206	154	154	-	-	-	427	321	375	375
	10	-	-	-	122	142	131	131	-	-	-	444	394	420	420
	AVG	-	-	-	131	199	160	160	-	-	-	418	336	378	378
Akamatsu (*Pinus densiflora*)	11	-	-	-	152	169	160	160	-	-	-	397	372	385	385
	12	-	-	-	121	159	139	139	-	-	-	411	369	390	390
	AVG	-	-	-	137	164	150	150	-	-	-	404	371	387	387
Tsuga (*Tsuga sieboldii*)	13	58	47	53	60	108	83	64	600	540	569	532	452	491	536
	14	30	32	31	32	97	66	46	563	498	534	503	471	486	513
	AVG	44	39	42	46	103	75	55	581	519	552	518	461	488	524
Hardwood															
Ring-porous wood															
Matatabi (*Actinidia polygama*)	15	-	-	-	116	206	159	159	-	-	-	463	310	374	374
	16	-	-	-	100	192	146	146	-	-	-	414	316	358	358
	AVG	-	-	-	108	199	153	153	-	-	-	439	313	366	366
Urinoki (*Alangium platanifolium* var. *trilobum*)	17	-	-	-	58	59	58	58	-	-	-	648	605	627	627
	18	-	-	-	50	59	55	55	-	-	-	567	551	558	558
	AVG	-	-	-	54	59	57	57	-	-	-	607	578	593	593
Taranoki (*Aralia elata*)	19	-	-	-	86	113	105	105	-	-	-	183	455	322	322
	20	-	-	-	48	65	60	60	-	-	-	184	402	304	304
	AVG	-	-	-	67	89	83	83	-	-	-	184	428	313	313
Kuri (*Castanea crenata*)	21	71	85	78	83	87	85	82	502	493	498	484	495	490	494
	22	66	79	73	84	101	93	83	517	513	515	495	463	479	496
	AVG	69	82	75	83	94	89	82	509	503	506	490	479	485	495
Aodamo (*Fraxinus lanuginosa* f. *serrata*)	23	-	-	-	49	63	57	57	-	-	-	622	604	612	612
	24	-	-	-	49	56	53	53	-	-	-	640	610	625	625
	AVG	-	-	-	49	60	55	55	-	-	-	631	607	619	619
Yachidamo (*Fraxinus mandshurica* var. *japonica*)	25	72	87	80	45	66	56	68	502	486	493	487	479	483	488
	26	74	89	82	49	70	61	72	609	613	611	616	547	575	591
	AVG	73	88	81	47	68	58	70	555	550	552	552	513	529	539
Marubaaodamo (*Fraxinus sieboldiana*)	27	-	-	-	43	46	45	45	-	-	-	608	627	618	618
	28	-	-	-	42	50	46	46	-	-	-	597	599	598	598
	AVG	-	-	-	43	48	45	45	-	-	-	602	613	608	608
Harigiri (*Kalopanax pictus*)	29	77	75	76	58	95	79	77	498	506	502	525	405	451	474
	30	-	-	-	67	115	90	90	-	-	-	558	408	474	474
	31	57	67	62	86	101	94	76	540	538	539	481	394	431	485
	32	80	99	90	92	102	98	92	498	465	481	389	313	342	436
	AVG	72	80	76	76	103	90	84	512	503	507	488	380	424	467
Inuenjyu (*Maackia amurensis* subsp. *buergeri*)	33	29	64	46	85	92	90	53	567	533	550	453	424	429	528
	34	63	80	71	89	97	95	75	585	545	565	466	471	470	546
	AVG	46	72	59	87	94	93	64	576	539	558	460	447	450	537

Japanese common name (Scientific name)	Tree no.	Green moisture content (%)							Basic density (kg/m^3)						
		Heartwood			Sapwood			stem	Heartwood			Sapwood			stem
		Inner	Outer	All	Inner	Outer	All		Inner	Outer	All	Inner	Outer	All	
Ring-porous wood															
Yamaguwa (*Morus australis*)	35	68	69	69	65	76	71	70	594	600	597	582	569	574	584
	36	81	72	76	54	95	75	76	613	580	595	498	486	492	540
	AVG	75	71	73	59	85	73	73	603	590	596	540	527	533	562
Kiri (*Paulownia tomentosa*)	37	-	-	-	68	113	91	91	-	-	-	244	283	263	263
	38	-	-	-	72	142	107	107	-	-	-	260	275	269	269
	AVG	-	-	-	70	127	99	99	-	-	-	252	279	266	266
Kihada (*Phellodendron amurense*)	39	51	63	57	67	101	87	68	377	398	387	446	378	403	393
	40	42	42	42	43	77	61	48	397	467	433	423	388	403	423
	AVG	46	53	50	55	89	74	58	387	433	410	434	383	403	408
Kobannoki (*Phyllanthus flexuosus*)	41	-	-	-	60	76	68	68	-	-	-	715	624	668	668
	42	-	-	-	57	73	64	64	-	-	-	752	640	708	708
	AVG	-	-	-	58	75	66	66	-	-	-	733	632	688	688
Nogurumi (*Platycarya strobilacea*)	43	-	-	-	94	116	105	105	-	-	-	415	442	429	429
	44	-	-	-	84	101	93	93	-	-	-	473	486	480	480
	AVG	-	-	-	89	109	99	99	-	-	-	444	464	455	455
Kunugi (*Quercus acutissima*)	45	-	-	-	72	70	71	71	-	-	-	659	615	635	635
	46	-	-	-	65	70	68	68	-	-	-	628	611	619	619
	AVG	-	-	-	69	70	69	69	-	-	-	644	613	627	627
Abemaki (*Quercus variabilis*)	47	-	-	-	84	83	84	84	-	-	-	626	564	593	593
	48	-	-	-	84	113	97	97	-	-	-	649	509	579	579
	49	-	-	-	70	74	72	72	-	-	-	659	646	652	652
	50	-	-	-	70	79	74	74	-	-	-	685	645	663	663
	AVG	-	-	-	77	87	82	82	-	-	-	655	591	622	622
Mizunara (*Quercus crispula*)	51	-	-	-	75	85	81	81	-	-	-	579	566	572	572
	52	-	-	-	67	72	69	69	-	-	-	638	565	600	600
	53	80	82	81	67	60	63	74	634	630	632	596	537	558	600
	54	83	87	85	65	71	68	78	649	647	648	598	527	555	607
	AVG	82	84	83	68	72	70	75	641	639	640	603	549	571	594
Nurude (*Rhus javanica* var. *roxburghii*)	55	67	57	62	72	122	99	80	371	361	366	365	372	369	367
	56	67	71	69	89	136	111	86	377	452	416	488	272	356	390
	57	36	24	30	40	113	76	76	410	420	415	472	426	450	450
	58	35	29	32	31	99	72	72	419	452	432	460	407	427	427
	AVG	51	45	48	58	117	90	78	394	421	407	446	369	401	409
Yamaurushi (*Toxicodendron trichocarpum*)	59	46	41	43	60	83	73	53	422	484	455	434	472	454	455
	60	51	56	53	50	85	68	59	535	542	539	521	476	496	523
	AVG	48	48	48	55	84	70	56	479	513	497	478	474	475	489
Kurozuru (*Tripterygium regelii*)	61	-	-	-	129	129	129	129	-	-	-	630	375	482	482
	62	-	-	-	77	136	101	101	-	-	-	656	412	528	528
	AVG	-	-	-	103	132	115	115	-	-	-	643	393	505	505
Yamafuji (*Wisteria brachybotrys*)	63	-	-	-	121	204	149	149	-	-	-	394	265	338	338
	64	-	-	-	100	173	136	136	-	-	-	380	337	357	357
	AVG	-	-	-	111	188	143	143	-	-	-	387	301	347	347
Inuzansho (*Zanthoxylum schinifolium*)	65	-	-	-	40	63	52	52	-	-	-	567	544	555	555
	66	-	-	-	40	52	46	46	-	-	-	560	551	555	555
	AVG	-	-	-	40	57	49	49	-	-	-	563	547	555	555
Semi ring porous wood															
Kakuremino (*Dendropanax trifidus*)	67	-	-	-	72	93	83		-	-	-	481	488	486	486
	68	-	-	-	75	100	87		-	-	-	431	428	430	430
	AVG	-	-	-	74	96	85	85	-	-	-	456	458	458	458

Table 3 (*Continued*)

Japanese common name (Scientific name)	Tree no.	Green moisture content (%)							Basic density (kg/m^3)						
		Heartwood			Sapwood			stem	Heartwood			Sapwood			stem
		Inner	Outer	All	Inner	Outer	All		Inner	Outer	All	Inner	Outer	All	
Semi ring porous wood															
Nawasirogumi (*Elaeagnus pungens*)	69	-	-	-	61	74	68	68	-	-	-	710	646	677	677
	70	-	-	-	59	72	64	64	-	-	-	627	592	612	612
	AVG	-	-	-	60	73	66	66	-	-	-	668	619	644	644
Diffuse-porous wood															
Chidorinoki (*Acer carpinifolium*)	71	-	-	-	71	82	77	77	-	-	-	453	483	468	468
	72	-	-	-	75	83	79	79	-	-	-	455	491	475	475
	AVG	-	-	-	73	83	78	78	-	-	-	454	487	471	471
Irohamomiji (*Acer palmatum*)	73	-	-	-	53	62	57	57	-	-	-	521	538	529	529
	74	-	-	-	52	63	58	58	-	-	-	502	538	521	521
	AVG	-	-	-	53	63	58	58	-	-	-	512	538	525	525
Itayakaede (*Acer pictum* subsp. *dissectum*)	75	-	-	-	65	89	77	77	-	-	-	423	462	442	442
	76	-	-	-	61	72	66	66	-	-	-	463	489	476	476
	AVG	-	-	-	63	80	72	72	-	-	-	443	476	459	459
Ezoitaya (*Acer pictum* subsp. *mono* f. *mono*)	77	-	-	-	54	60	57	57	-	-	-	548	583	565	565
	78	-	-	-	56	69	63	63	-	-	-	548	541	544	544
	AVG	-	-	-	55	65	60	60	-	-	-	548	562	555	555
Enkoukaede (*Acer pictum* subsp. *dissectum* f. *dissectu*	79	-	-	-	49	61	54	54	-	-	-	613	586	600	600
	80	-	-	-	50	60	55	55	-	-	-	557	590	573	573
	AVG	-	-	-	49	61	55	55	-	-	-	585	588	586	586
Kohauchiwakaede (*Acer sieboldianum*)	81	-	-	-	57	64	60	60	-	-	-	541	580	559	559
	82	-	-	-	63	60	61	61	-	-	-	493	560	528	528
	AVG	-	-	-	60	62	61	61	-	-	-	517	570	544	544
Yashabushi (*Alnus firma*)	83	-	-	-	72	82	78	78	-	-	-	448	459	454	454
	84	-	-	-	75	70	72	72	-	-	-	494	541	515	515
	AVG	-	-	-	73	76	75	75	-	-	-	471	500	485	485
Mukunoki (*Aphananthe aspera*)	85	-	-	-	73	90	83	83	-	-	-	384	462	424	424
	86	-	-	-	63	83	72	72	-	-	-	517	510	514	514
	AVG	-	-	-	68	87	78	78	-	-	-	450	486	469	469
Mizume (*Betula grossa*)	87	-	-	-	71	66	69	69	-	-	-	518	589	548	548
	88	-	-	-	69	69	69	69	-	-	-	508	560	533	533
	AVG	-	-	-	70	67	69	69	-	-	-	513	574	540	540
Yabutsubaki (*Camellia japonica*)	89	-	-	-	77	82	79	79	-	-	-	631	605	619	619
	90	-	-	-	74	73	74	74	-	-	-	610	643	626	626
	91	-	-	-	71	80	75	75	-	-	-	631	614	622	622
	92	-	-	-	71	68	70	70	-	-	-	615	656	635	635
	AVG	-	-	-	73	76	74	74	-	-	-	622	629	626	626
Akashide (*Carpinus laxiflora*)	93	-	-	-	88	88	88	88	-	-	-	451	488	471	471
	94	-	-	-	88	88	88	88	-	-	-	451	488	471	471
	AVG	-	-	-	88	88	88	88	-	-	-	451	488	471	471
Inushide (*Carpinus tschonoskii*)	95	-	-	-	95	95	95	95	-	-	-	449	474	462	462
	96	-	-	-	95	95	95	95	-	-	-	449	474	462	462
	AVG	-	-	-	95	95	95	95	-	-	-	449	474	462	462
Isunoki (*Distylium racemosum*)	97	-	-	-	76	80	78	78	-	-	-	623	647	634	634
	98	-	-	-	85	89	87	87	-	-	-	624	596	610	610
	AVG	-	-	-	81	85	83	83	-	-	-	623	621	622	622
Yamagaki (*Diospyros kaki* var. *sylvestris*)	99	-	-	-	63	79	71	71	-	-	-	561	546	553	553
	100	-	-	-	53	57	55	55	-	-	-	587	566	577	577
	AVG	-	-	-	58	68	63	63	-	-	-	574	556	565	565

Japanese common name (Scientific name)	Tree no.	Green moisture content (%)							Basic density (kg/m^3)						
		Heartwood			Sapwood			stem	Heartwood			Sapwood			stem
		Inner	Outer	All	Inner	Outer	All		Inner	Outer	All	Inner	Outer	All	
Diffuse-porous wood															
Utsugi (*Deutzia crenata*)	101	-	-	-	93	109	102	102	-	-	-	600	518	549	549
	102	-	-	-	83	79	81	81	-	-	-	587	610	601	601
	AVG	-	-	-	88	94	91	91	-	-	-	593	564	575	575
Komayumi (*Euonymus alatus* f. *striatus*)	103	34	33	34	53	70	62	42	718	681	697	766	483	581	660
	104	33	38	35	74	85	80	51	666	700	682	701	587	635	664
	AVG	33	36	34	63	77	71	71	692	691	689	734	535	608	662
Fusazakura (*Euptelea polyandra*)	105	-	-	-	123	90	103	103	-	-	-	494	571	537	537
	106	-	-	-	121	136	128	128	-	-	-	504	461	483	483
	AVG	-	-	-	122	113	116	116	-	-	-	499	516	510	510
Hisakaki (*Eurya japonica*)	107	-	-	-	107	109	108	108	-	-	-	524	528	526	526
	108	-	-	-	96	105	101	101	-	-	-	565	528	545	545
	AVG	-	-	-	101	107	104	104	-	-	-	544	528	535	535
Buna (*Fagus crenata*)	109	-	-	-	65	75	70	70	-	-	-	528	557	543	543
	110	-	-	-	109	112	111	111	-	-	-	504	519	511	511
	AVG	-	-	-	87	94	90	90	-	-	-	516	538	527	527
Inubuna (*Fagus japonica*)	111	-	-	-	91	94	93	93	-	-	-	515	551	532	532
	112	-	-	-	89	93	91	91	-	-	-	513	559	538	538
	AVG	-	-	-	90	94	92	92	-	-	-	514	555	535	535
Hosobainubiwa (*Ficus erecta* f. *sieboldii*)	113	-	-	-	132	116	123	123	-	-	-	479	536	508	508
	114	-	-	-	104	104	104	104	-	-	-	562	529	545	545
	AVG	-	-	-	118	110	113	113	-	-	-	520	533	527	527
Nanaminoki (*Ilex chinensis*)	115	-	-	-	91	87	89	89	-	-	-	531	545	539	539
	116	-	-	-	87	94	91	91	-	-	-	578	551	562	562
	AVG	-	-	-	89	91	90	90	-	-	-	555	548	551	551
Inutsuge (*Ilex crenata*)	117	-	-	-	63	85	74	74	-	-	-	593	532	562	562
	118	-	-	-	70	89	79	79	-	-	-	588	512	548	548
	AVG	-	-	-	67	87	76	76	-	-	-	590	522	555	555
Tsukushiinutsuge (*Ilex crenata* var. *fukasawana*)	119	-	-	-	66	75	71	71	-	-	-	655	608	629	629
	120	-	-	-	58	63	60	60	-	-	-	704	646	675	675
	AVG	-	-	-	62	69	66	66	-	-	-	679	627	652	652
Soyogo (*Ilex pedunculosa*)	121	-	-	-	75	89	82	82	-	-	-	571	558	565	565
	122	-	-	-	53	72	62	62	-	-	-	673	614	645	645
	AVG	-	-	-	64	80	72	72	-	-	-	622	586	605	605
Kuroganemochi (*Ilex rotunda*)	123	-	-	-	99	119	110	110	-	-	-	531	474	499	499
	124	-	-	-	94	105	100	100	-	-	-	544	512	528	528
	AVG	-	-	-	97	112	105	105	-	-	-	538	493	513	513
Inuumemodoki (*Ilex serrata* f. *argutidens*)	125	-	-	-	63	137	88	88	-	-	-	515	446	489	489
	126	-	-	-	85	98	91	91	-	-	-	438	545	488	488
	AVG	-	-	-	74	117	89	89	-	-	-	476	496	489	489
Shikimi (*Illicium anisatum*)	127	-	-	-	89	130	106	106	-	-	-	563	472	520	520
	128	-	-	-	80	109	94	94	-	-	-	616	532	574	574
	AVG	-	-	-	85	119	100	100	-	-	-	589	502	547	547
Nezumimochi (*Ligustrum japonicum*)	129	-	-	-	61	63	62	62	-	-	-	671	646	659	659
	130	-	-	-	61	60	60	60	-	-	-	662	647	654	654
	AVG	-	-	-	61	62	61	61	-	-	-	667	646	657	657
Kanakuginoki (*Lindera erythrocarpa*)	131	-	-	-	65	88	77	77	-	-	-	438	448	443	443
	132	65	66	66	76	111	93	81	432	468	451	508	461	483	467
	AVG	65	66	66	70	99	85	85	432	468	451	473	454	463	455

Table 3 (*Continued*)

Japanese common name (Scientific name)	Tree no.	Green moisture content (%)							Basic density (kg/m^3)						
		Heartwood			Sapwood			stem	Heartwood			Sapwood			stem
		Inner	Outer	All	Inner	Outer	All		Inner	Outer	All	Inner	Outer	All	
Diffuse-porous wood															
Inubuna (*Fagus japonica*)	111	-	-	-	91	94	93	93	-	-	-	515	551	532	532
	112	-	-	-	89	93	91	91	-	-	-	513	559	538	538
	AVG	-	-	-	90	94	92	92	-	-	-	514	555	535	535
Hosobainubiwa (*Ficus erecta* f. *sieboldii*)	113	-	-	-	132	116	123	123	-	-	-	479	536	508	508
	114	-	-	-	104	104	104	104	-	-	-	562	529	545	545
	AVG	-	-	-	118	110	113	113	-	-	-	520	533	527	527
Nanaminoki (*Ilex chinensis*)	115	-	-	-	91	87	89	89	-	-	-	531	545	539	539
	116	-	-	-	87	94	91	91	-	-	-	578	551	562	562
	AVG	-	-	-	89	91	90	90	-	-	-	555	548	551	551
Inutsuge (*Ilex crenata*)	117	-	-	-	63	85	74	74	-	-	-	593	532	562	562
	118	-	-	-	70	89	79	79	-	-	-	588	512	548	548
	AVG	-	-	-	67	87	76	76	-	-	-	590	522	555	555
Tsukushiinutsuge (*Ilex crenata* var. *fukasawana*)	119	-	-	-	66	75	71	71	-	-	-	655	608	629	629
	120	-	-	-	58	63	60	60	-	-	-	704	646	675	675
	AVG	-	-	-	62	69	66	66	-	-	-	679	627	652	652
Soyogo (*Ilex pedunculosa*)	121	-	-	-	75	89	82	82	-	-	-	571	558	565	565
	122	-	-	-	53	72	62	62	-	-	-	673	614	645	645
	AVG	-	-	-	64	80	72	72	-	-	-	622	586	605	605
Kuroganemochi (*Ilex rotunda*)	123	-	-	-	99	119	110	110	-	-	-	531	474	499	499
	124	-	-	-	94	105	100	100	-	-	-	544	512	528	528
	AVG	-	-	-	97	112	105	105	-	-	-	538	493	513	513
Inuumemodoki (*Ilex serrata* f. *argutidens*)	125	-	-	-	63	137	88	88	-	-	-	515	446	489	489
	126	-	-	-	85	98	91	91	-	-	-	438	545	488	488
	AVG	-	-	-	74	117	89	89	-	-	-	476	496	489	489
Shikimi (*Illicium anisatum*)	127	-	-	-	89	130	106	106	-	-	-	563	472	520	520
	128	-	-	-	80	109	94	94	-	-	-	616	532	574	574
	AVG	-	-	-	85	119	100	100	-	-	-	589	502	547	547
Nezumimochi (*Ligustrum japonicum*)	129	-	-	-	61	63	62	62	-	-	-	671	646	659	659
	130	-	-	-	61	60	60	60	-	-	-	662	647	654	654
	AVG	-	-	-	61	62	61	61	-	-	-	667	646	657	657
Kanakuginoki (*Lindera erythrocarpa*)	131	-	-	-	65	88	77	77	-	-	-	438	448	443	443
	132	65	66	66	76	111	93	81	432	468	451	508	461	483	467
	AVG	65	66	66	70	99	85	85	432	468	451	473	454	463	455
Aburachan (*Lindera praecox*)	133	-	-	-	75	76	75	75	-	-	-	520	526	523	523
	134	-	-	-	56	81	69	69	-	-	-	488	522	506	506
	AVG	-	-	-	66	78	72	72	-	-	-	504	524	514	514
Shiromoji (*Lindera triloba*)	135	-	-	-	72	92	81	81	-	-	-	525	519	522	522
	136	-	-	-	69	77	73	73	-	-	-	500	517	509	509
	AVG	-	-	-	70	84	77	77	-	-	-	512	518	516	516
Baribarinoki (*Litsea acuminata*)	137	-	-	-	71	74	73	73	-	-	-	397	459	427	427
	138	-	-	-	87	71	78	78	-	-	-	359	440	400	400
	AVG	-	-	-	79	73	76	76	-	-	-	378	450	414	414
Kagonoki (*Litsea coreana*)	139	-	-	-	82	97	90	90	-	-	-	386	404	395	395
	140	-	-	-	78	99	89	89	-	-	-	424	443	434	434
	AVG	-	-	-	80	98	89	89	-	-	-	405	424	415	415
Tabunoki (*Machilus thunbergii*)	141	-	-	-	62	92	78	78	-	-	-	491	459	474	474
	142	-	-	-	69	86	79	79	-	-	-	451	454	453	453
	AVG	-	-	-	66	89	78	78	-	-	-	471	456	463	463

Japanese common name (Scientific name)	Tree no.	Green moisture content (%)							Basic density (kg/m^3)						
		Heartwood			Sapwood			stem	Heartwood			Sapwood			stem
		Inner	Outer	All	Inner	Outer	All		Inner	Outer	All	Inner	Outer	All	
Diffuse-porous wood															
Hoonoki (*Magnolia obovata*)	143	-	-	-	77	84	80	80	-	-	-	520	511	515	515
	144	-	-	-	69	80	75	75	-	-	-	491	509	501	501
	AVG	-	-	-	73	82	78	78	-	-	-	506	510	508	508
Tamushiba (*Magnolia salicifolia*)	145	-	-	-	91	78	83	83	-	-	-	378	467	426	426
	146	-	-	-	79	108	94	94	-	-	-	433	423	428	428
	AVG	-	-	-	85	93	89	89	-	-	-	406	445	427	427
Awabuki (*Meliosma myriantha*)	147	-	-	-	90	95	92	92	-	-	-	440	473	456	456
	148	-	-	-	90	112	102	102	-	-	-	469	432	449	449
	AVG	-	-	-	90	103	97	97	-	-	-	455	452	452	452
Shirodamo (*Neolitsea sericea*)	149	-	-	-	63	74	68	68	-	-	-	482	519	500	500
	150	-	-	-	65	81	74	74	-	-	-	482	515	500	500
	151	-	-	-	63	87	75	75	-	-	-	358	366	362	362
	152	-	-	-	77	111	94	94	-	-	-	357	352	354	354
	AVG	-	-	-	67	88	78	78	-	-	-	419	438	429	429
Asebi (*Pieris japonica*)	153	-	-	-	95	114	104	104	-	-	-	516	473	494	494
	154	-	-	-	102	110	106	106	-	-	-	510	474	493	493
	AVG	-	-	-	99	112	105	105	-	-	-	513	473	493	493
Tobera (*Pittosporum tobira*)	155	-	-	-	91	127	107	107	-	-	-	541	500	522	522
	156	-	-	-	75	97	85	85	-	-	-	638	560	601	601
	AVG	-	-	-	83	112	96	96	-	-	-	589	530	561	561
Yamanarashi (*Populus sieboldii*)	157	-	-	-	72	85	81	81	-	-	-	374	392	386	386
	158	-	-	-	67	74	71	71	-	-	-	408	416	413	413
	AVG	-	-	-	69	80	76	76	-	-	-	391	404	399	399
Kamatsuka (*Pourthiaea villosa* var. *laevis*)	159	-	-	-	59	71	64	64	-	-	-	707	670	691	691
	160	-	-	-	61	89	76	76	-	-	-	632	633	632	632
	AVG	-	-	-	60	80	70	70	-	-	-	669	651	662	662
Asagara (*Pterostyrax corymbosa*)	161	-	-	-	112	116	114	114	-	-	-	411	436	424	424
	162	-	-	-	109	117	113	113	-	-	-	437	434	436	436
	AVG	-	-	-	111	116	114	114	-	-	-	424	435	430	430
Sharinbai (*Rhaphiolepis indica* var. *umbellata*)	163	-	-	-	51	57	54	54	-	-	-	783	727	751	751
	164	-	-	-	66	69	67	67	-	-	-	717	681	700	700
	AVG	-	-	-	58	63	61	61	-	-	-	750	704	725	725
Nekoyanagi (*Salix gracilistyla*)	165	70	77	75	50	73	62	66	553	512	522	489	425	454	472
	166	-	-	-	38	83	61	61	-	-	-	511	505	508	508
	AVG	70	77	75	44	78	62	62	553	512	522	500	465	481	490
Yamayanagi (*Salix sieboldiana*)	167	-	-	-	68	99	85	85	-	-	-	520	472	493	493
	168	-	-	-	88	57	70	70	-	-	-	428	486	459	459
	AVG	-	-	-	78	78	78	78	-	-	-	474	479	476	476
Shiraki (*Sapium japonicum*)	169	-	-	-	67	77	71	71	-	-	-	562	563	563	563
	170	-	-	-	63	63	63	63	-	-	-	386	595	479	479
	AVG	-	-	-	65	70	67	67	-	-	-	474	579	521	521
Nankinnanakamado (*Sorbus gracilis*)	171	-	-	-	52	56	54	54	-	-	-	675	686	680	680
	172	-	-	-	52	61	57	57	-	-	-	676	659	667	667
	AVG	-	-	-	52	58	55	55	-	-	-	676	672	673	673
Himeshara (*Stewartia monadelpha*)	173	-	-	-	76	91	83	83	-	-	-	611	591	601	601
	174	-	-	-	71	80	76	76	-	-	-	591	646	620	620
	AVG	-	-	-	73	85	79	79	-	-	-	601	618	610	610

Table 3 (*Continued*)

Japanese common name (Scientific name)	Tree no.	Green moisture content (%)							Basic density (kg/m^3)						
		Heartwood			Sapwood			stem	Heartwood			Sapwood			stem
		Inner	Outer	All	Inner	Outer	All		Inner	Outer	All	Inner	Outer	All	
Diffuse-porous wood															
Egonoki (*Styrax japonica*)	175	-	-	-	86	104	95	95	-	-	-	479	463	471	471
	176	-	-	-	98	98	98	98	-	-	-	463	485	472	472
	AVG	-	-	-	92	101	96	96	-	-	-	471	474	472	472
Kohakuunboku (*Styrax shiraiana*)	177	-	-	-	75	95	85	85	-	-	-	533	492	513	513
	178	-	-	-	92	100	97	97	-	-	-	484	487	486	486
	AVG	-	-	-	84	97	91	91	-	-	-	509	489	499	499
Koyabudemari (*Viburnum plicatum* var. *parvifolium*)	179	-	-	-	69	72	71	71	-	-	-	686	660	672	672
	180	-	-	-	65	73	69	69	-	-	-	671	635	653	653
	AVG	-	-	-	67	72	70	70	-	-	-	678	647	663	663
Kurominosawafutagi (*Symplocos tanakana*)	181	-	-	-	85	92	89	89	-	-	-	613	547	578	578
	182	-	-	-	89	87	88	88	-	-	-	618	557	588	588
	AVG	-	-	-	87	90	88	88	-	-	-	615	552	583	583
Kuroki (*Symplocos lucida*)	183	-	-	-	104	127	116	116	-	-	-	523	467	492	492
	184	-	-	-	90	132	109	109	-	-	-	556	442	498	498
	AVG	-	-	-	97	129	112	112	-	-	-	540	454	495	495
Kumanomizuki (*Swida macrophylla*)	185	-	-	-	106	134	118	118	-	-	-	523	480	504	504
	186	-	-	-	83	114	96	96	-	-	-	573	523	551	551
	AVG	-	-	-	94	124	107	107	-	-	-	548	502	527	527
Oobabodaijyu (*Tilia maximowicziana*)	187	-	-	-	117	122	120	120	-	-	-	296	325	310	310
	188	-	-	-	115	112	113	113	-	-	-	295	362	331	331
	AVG	-	-	-	116	117	116	116	-	-	-	295	344	321	321
Shashanbo (*Vaccinium bracteatum*)	189	-	-	-	106	107	106	106	-	-	-	540	525	532	532
	190	-	-	-	98	103	101	101	-	-	-	552	534	542	542
	AVG	-	-	-	102	105	104	104	-	-	-	546	530	537	537
Karasuzanshou (*Zanthoxylum ailanthoides*)	191	-	-	-	85	186	132	132	-	-	-	239	265	251	251
	192	-	-	-	94	154	127	127	-	-	-	289	286	287	287
	AVG	-	-	-	89	170	130	130	-	-	-	264	275	269	269

Japanese common name (Scientific name)	Tree no.	Green moisture content (%)							Basic density (kg/m^3)						
		Heartwood			Sapwood			stem	Heartwood			Sapwood			stem
		Inner	Outer	All	Inner	Outer	All		Inner	Outer	All	Inner	Outer	All	
Diffuse-porous wood															
Fuyuzanshou (*Zanthoxylum armatum* var. *subtrifoliatu*	193	-	-	-	69	76	73	73	-	-	-	441	531	486	486
	194	-	-	-	59	87	72	72	-	-	-	503	475	489	489
	AVG	-	-	-	64	82	72	72	-	-	-	472	503	488	488
Radial-porus wood															
Sudajii (*Castanopsis sieboldii*)	195	-	-	-	83	96	89	89	-	-	-	628	559	591	591
	196	-	-	-	82	79	81	81	-	-	-	544	564	554	554
	AVG	-	-	-	83	87	85	85	-	-	-	586	561	573	573
Matebashii (*Lithocarpus edulis*)	197	-	-	-	82	75	78	78	-	-	-	593	599	596	596
	198	-	-	-	77	80	79	79	-	-	-	605	582	595	595
	AVG	-	-	-	80	78	78	78	-	-	-	599	591	595	595
Radial-porus wood															
Arakashi (*Quercus glauca*)	199	-	-	-	67	60	63	63	-	-	-	653	701	676	676
	200	-	-	-	70	68	69	69	-	-	-	647	673	661	661
	AVG	-	-	-	68	64	66	66	-	-	-	650	687	668	668
Shirakashi (*Quercus myrsinaefolia*)	201	-	-	-	62	73	67	67	-	-	-	722	661	692	692
	202	-	-	-	68	74	71	71	-	-	-	659	625	642	642
	AVG	-	-	-	65	74	69	69	-	-	-	691	643	667	667
Urajirogashi (*Quercus salicina*)	203	-	-	-	75	77	76	76	-	-	-	670	689	679	679
	204	-	-	-	67	68	67	67	-	-	-	634	641	638	638
	AVG	-	-	-	71	73	72	72	-	-	-	652	665	659	659
Wood vesselless															
Yamaguruma (*Trochodendron aralioides*)	205	-	-	-	86	93	89	89	-	-	-	574	538	556	556
	206	-	-	-	86	85	85	85	-	-	-	562	539	550	550
	AVG	-	-	-	86	89	87	87	-	-	-	568	538	553	553

Conclusion

This paper presents green moisture content and basic density data for 95 woody species, including three woody lianas, collected from Kyushu University Forests, which ranges from a warm temperate forest zone to a cool temperate forest zone, during July and August from 2003 to 2006. Many data are previously unreported, which means this dataset contains scientifically important information.

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