鹿児島大学高隈演習林におけるスギの幹形の計測(1)

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AgriKnowledge

研究資料

Measurement of stem form of Japanese cedar (*Cryptomeria japonica* D. Don) trees in the Takakuma Experimental Forests, Kagoshima University (1)

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Summary

We measured stem form of Japanese cedar (*Cryptomeria japonica* D. Don) trees in the Takakuma Experimental Forests, Kagoshima University, southern Japan. In three stands of Japanese cedar (stand age: 19, 42 and 53 year-old), five straight, healthy trees were felled, and then tree height (H), branch height (H_b), diameters at breast height (D) and base, and stem diameters along a stem with intervals of 0.5 m from tree tip to base (d) were measured. In this paper, original data of the 15 sample trees was published.

Keyword: Japanese cedar, stem form, Takakuma Experimental Forests

1. Introduction

Stem form data is essential to develop growth model as well as volume equation and taper curve (e.g., Corral-Rivas et al., 2017). In November 2017, we measured stem form of Japanese cedar (*Cryptomeria japonica* D. Don) trees in the Takakuma Experimental Forests, Kagoshima University. Japanese cedar is one of the most popular and important coniferous tree species in Japan. In this paper, we published original data obtained by the measurement, which will be useful in various subsequent researches relevant to forest science.

2. Materials and methods

Measurement was performed in the Takakuma Experimental Forests, Kagoshima University located in the northern part of Tarumizu City, Kagoshima Prefecture, southern Japan. For general description of the Experimental Forests, see Takakuma Experimental Forests (2015). Sample trees were gathered in three even-aged pure stands of Japanese cedar, of which age was 19, 42 and 53 year-old (hereafter referred to as stand A, B and C, respectively). Our data covers the standard rotation period for Japanese cedar stands in Kagoshima Prefecture, i.e., 35 year-old (Kagoshima Prefecture, 2017).

Five straight, healthy sample trees with various sizes were selected in each stand, and felled at ground level for direct measurement of height and stem diameter. Therefore, the total number of sample trees was 15 in this paper. Tree height (H) and branch height (H_b) were measured directly on the stem using a tape measure to the nearest tenth of a meter. Diameters outside bark at breast height (1.2 m above ground level; D) and base were also measured using a diameter tape to the nearest tenth of a centimeter. Furthermore, the stem diameters outside bark (d) were measured with equal intervals of 0.5 m from tree tip to base using a caliper or a diameter tape to the nearest tenth of a centimeter. When using a caliper, the diameters of two orthogonal directions were measured, and then averaged. Stem volume (V) of each sample was calculated by the sectional measurement method (West, 2004).

3. Results

A summary of the sample trees is shown in Table 1. The H, D and V of the 15 sample trees ranged from 11.9 m to 19.8 m, 12.9 cm to 31.4 cm and 0.071 m^3 to 0.595 m^3, respectively. Stem form data obtained in this study is summarized in Table 2. Note that l indicates the distance from tree tip. All measurements were conducted after felling trees, resulting in a reliable stem form data. The data can be used to develop and verify the growth model, volume equation and taper curve for Japanese cedar stands in Kagoshima Prefecture.

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Field assistance was provided by the staff of the Takakuma Experimental Forests, Kagoshima University, whose help is

Table 1 Summary of Japanese cedar sample trees

Stand	Compartment *	No.	H (m)	H_b (m)	D (cm)	V (m^3) **
A	107 (76)	1	13.7	9.2	15.4	0.133
(19 year-old)		2	15.2	9.2	20.5	0.238
		3	14.9	9.5	16.6	0.164
		4	15.7	10.8	22.2	0.288
		5	11.9	8.9	12.9	0.071
B	106 (21)	1	18.7	11.8	27.6	0.561
(42 year-old)		2	17.5	10.0	22.1	0.301
		3	19.6	10.2	25.5	0.476
		4	17.8	13.3	22.5	0.333
		5	19.8	13.1	24.7	0.466
C	108 (23)	1	17.2	8.5	28.1	0.475
(53 year-old)		2	17.6	11.7	22.8	0.326
		3	17.1	9.7	23.4	0.342
		4	16.4	11.0	21.3	0.272
		5	18.5	10.5	31.4	0.595

* Values in the parenthesis represent the sub-compartment number.
** Stem volume was computed using the sectional measurement method.

Table 2 Stem form of Japanese cedar trees

Stand A (19 year-old)									
No. 1		No. 2		No. 3		No. 4		No. 5	
l (m)	d (cm)	l (m)	d (cm)	l (m)	d (cm)	l (m)	d (cm)	l (m)	d (cm)
0.5	1.5	0.5	1.1	0.5	1.1	0.5	1.4	0.5	1.4
1.0	2.6	1.0	2.4	1.0	2.1	1.0	2.4	1.0	2.1
1.5	3.4	1.5	3.7	1.5	3.2	1.5	3.5	1.5	3.0
2.0	4.4	2.0	5.2	2.0	4.9	2.0	5.2	2.0	3.7
2.5	5.5	2.5	6.8	2.5	6.5	2.5	6.4	2.5	4.6
3.0	6.7	3.0	7.7	3.0	7.1	3.0	7.8	3.0	5.2
3.5	7.6	3.5	8.8	3.5	7.6	3.5	8.9	3.5	5.6
4.0	8.1	4.0	9.2	4.0	8.1	4.0	10.4	4.0	6.2
4.5	8.7	4.5	9.7	4.5	8.8	4.5	10.6	4.5	6.9
5.0	9.3	5.0	10.9	5.0	9.0	5.0	11.5	5.0	7.2
5.5	9.7	5.5	11.2	5.5	9.6	5.5	11.7	5.5	7.5
6.0	10.2	6.0	11.8	6.0	9.9	6.0	12.6	6.0	8.1
6.5	10.7	6.5	12.1	6.5	10.3	6.5	13.0	6.5	8.5
7.0	11.0	7.0	12.9	7.0	10.8	7.0	13.9	7.0	9.0
7.5	11.5	7.5	13.3	7.5	11.4	7.5	14.3	7.5	9.5
8.0	11.8	8.0	14.0	8.0	12.1	8.0	15.0	8.0	9.8
8.5	12.3	8.5	14.4	8.5	12.3	8.5	15.2	8.5	10.2
9.0	12.7	9.0	15.2	9.0	12.7	9.0	16.0	9.0	10.7
9.5	13.0	9.5	15.5	9.5	12.9	9.5	16.4	9.5	11.2
10.0	13.5	10.0	16.0	10.0	13.1	10.0	16.8	10.0	11.8
10.5	14.0	10.5	16.3	10.5	13.8	10.5	17.1	10.5	12.2
11.0	14.2	11.0	16.8	11.0	14.2	11.0	17.5	11.0	13.2
11.5	14.5	11.5	17.1	11.5	14.5	11.5	17.9	11.5	14.2
12.0	14.6	12.0	17.8	12.0	15.4	12.0	18.5	11.9	16.3
12.5	15.5	12.5	18.2	12.5	15.8	12.5	19.5		
13.0	16.0	13.0	18.6	13.0	16.0	13.0	20.2		
13.5	18.0	13.5	19.7	13.5	16.5	13.5	20.5		
13.7	18.3	14.0	20.5	14.0	17.6	14.0	21.6		
		14.5	21.5	14.5	19.0	14.5	22.2		
		15.0	24.0	14.9	20.3	15.0	23.3		
		15.2	25.8			15.5	26.7		
						15.7	27.7		

Table 2 Stem form of Japanese cedar trees (*continued*)

Stand B (42 year-old)									
No. 1		No. 2		No. 3		No. 4		No. 5	
l (m)	*d* (cm)	*l* (m)	*d* (cm)	*l* (m)	*d* (cm)	*l* (m)	*d* (cm)	*l* (m)	*d* (cm)
0.5	2.8	0.5	1.9	0.5	1.6	0.5	1.9	0.5	1.7
1.0	4.5	1.0	3.5	1.0	3.3	1.0	3.3	1.0	3.6
1.5	6.1	1.5	4.5	1.5	4.5	1.5	4.3	1.5	5.6
2.0	7.4	2.0	5.5	2.0	5.8	2.0	5.9	2.0	6.6
2.5	8.1	2.5	6.4	2.5	7.4	2.5	6.3	2.5	7.8
3.0	8.5	3.0	7.5	3.0	8.3	3.0	7.3	3.0	8.7
3.5	10.9	3.5	8.1	3.5	9.2	3.5	8.2	3.5	9.8
4.0	12.3	4.0	8.9	4.0	9.6	4.0	9.0	4.0	10.0
4.5	13.4	4.5	9.5	4.5	11.0	4.5	9.9	4.5	11.1
5.0	13.9	5.0	9.9	5.0	11.4	5.0	10.6	5.0	11.8
5.5	14.4	5.5	10.4	5.5	12.1	5.5	10.9	5.5	12.5
6.0	15.3	6.0	11.2	6.0	12.7	6.0	12.2	6.0	13.2
6.5	16.0	6.5	11.6	6.5	13.7	6.5	12.5	6.5	13.5
7.0	16.5	7.0	12.1	7.0	13.8	7.0	13.2	7.0	14.3
7.5	17.1	7.5	13.0	7.5	14.6	7.5	13.7	7.5	14.8
8.0	17.5	8.0	13.2	8.0	15.1	8.0	14.1	8.0	15.4
8.5	18.1	8.5	13.6	8.5	15.3	8.5	14.5	8.5	15.7
9.0	18.5	9.0	14.1	9.0	16.3	9.0	15.0	9.0	16.2
9.5	19.0	9.5	14.7	9.5	16.3	9.5	15.6	9.5	16.6
10.0	19.5	10.0	14.9	10.0	17.1	10.0	16.3	10.0	16.9
10.5	20.0	10.5	15.3	10.5	17.5	10.5	16.5	10.5	17.3
11.0	20.8	11.0	16.0	11.0	18.1	11.0	17.1	11.0	17.7
11.5	21.2	11.5	16.3	11.5	18.5	11.5	17.5	11.5	18.2
12.0	22.1	12.0	16.8	12.0	18.7	12.0	17.9	12.0	18.4
12.5	22.6	12.5	17.4	12.5	19.3	12.5	18.2	12.5	19.3
13.0	23.1	13.0	17.9	13.0	20.0	13.0	18.5	13.0	19.3
13.5	23.6	13.5	18.5	13.5	20.2	13.5	19.1	13.5	19.6
14.0	24.1	14.0	18.7	14.0	20.7	14.0	19.5	14.0	20.1
14.5	24.5	14.5	19.4	14.5	21.5	14.5	20.0	14.5	20.5
15.0	25.0	15.0	20.1	15.0	21.8	15.0	20.5	15.0	21.1
15.5	25.6	15.5	20.9	15.5	22.0	15.5	20.9	15.5	21.4
16.0	25.6	16.0	21.4	16.0	22.6	16.0	21.5	16.0	21.7
16.5	26.4	16.5	22.5	16.5	22.9	16.5	22.5	16.5	22.0
17.0	27.0	17.0	23.9	17.0	23.8	17.0	22.7	17.0	22.4
17.5	27.6	17.5	27.6	17.5	24.3	17.5	24.3	17.5	23.0
18.0	28.2			18.0	25.0	17.8	26.5	18.0	23.6
18.5	31.1			18.5	25.7			18.5	24.5
18.7	36.0			19.0	27.4			19.0	25.9
				19.5	32.3			19.5	29.0
				19.6	33.9			19.8	33.2

Table 2 Stem form of Japanese cedar trees (*continued*)

Stand C (53 year-old)									
No. 1		No. 2		No. 3		No. 4		No. 5	
l (m)	*d* (cm)	*l* (m)	*d* (cm)	*l* (m)	*d* (cm)	*l* (m)	*d* (cm)	*l* (m)	*d* (cm)
0.5	1.1	0.5	1.4	0.5	1.2	0.5	1.4	0.5	1.6
1.0	2.3	1.0	2.5	1.0	2.4	1.0	2.7	1.0	2.5
1.5	4.2	1.5	4.0	1.5	3.8	1.5	4.6	1.5	4.7
2.0	5.7	2.0	5.3	2.0	5.4	2.0	5.9	2.0	5.8
2.5	7.0	2.5	6.6	2.5	6.5	2.5	6.6	2.5	7.7
3.0	8.0	3.0	7.7	3.0	7.5	3.0	7.6	3.0	8.6
3.5	9.0	3.5	8.5	3.5	8.4	3.5	8.3	3.5	9.3
4.0	10.0	4.0	9.1	4.0	9.0	4.0	9.3	4.0	10.7
4.5	11.2	4.5	9.9	4.5	10.1	4.5	10.3	4.5	11.4
5.0	11.8	5.0	10.4	5.0	11.1	5.0	10.6	5.0	12.4
5.5	12.7	5.5	10.7	5.5	11.5	5.5	11.1	5.5	13.5
6.0	13.5	6.0	11.6	6.0	12.2	6.0	11.9	6.0	14.5
6.5	14.8	6.5	11.9	6.5	12.8	6.5	12.6	6.5	15.0
7.0	15.0	7.0	12.7	7.0	13.4	7.0	13.2	7.0	15.6
7.5	15.8	7.5	13.7	7.5	13.8	7.5	13.3	7.5	16.6
8.0	16.2	8.0	13.9	8.0	14.7	8.0	14.0	8.0	17.4
8.5	17.2	8.5	14.6	8.5	15.2	8.5	14.1	8.5	17.5
9.0	18.0	9.0	14.7	9.0	15.5	9.0	15.0	9.0	18.2
9.5	18.8	9.5	15.1	9.5	16.3	9.5	15.2	9.5	19.1
10.0	19.7	10.0	15.8	10.0	16.8	10.0	15.5	10.0	19.8
10.5	20.3	10.5	16.3	10.5	17.1	10.5	16.1	10.5	20.4
11.0	20.8	11.0	16.6	11.0	17.8	11.0	16.5	11.0	20.8
11.5	21.2	11.5	17.1	11.5	18.2	11.5	16.8	11.5	21.5
12.0	21.9	12.0	17.8	12.0	19.0	12.0	17.2	12.0	22.1
12.5	22.5	12.5	18.4	12.5	19.5	12.5	17.7	12.5	22.7
13.0	23.2	13.0	18.7	13.0	19.9	13.0	18.1	13.0	23.5
13.5	24.0	13.5	19.0	13.5	20.3	13.5	18.9	13.5	24.2
14.0	24.6	14.0	19.3	14.0	21.0	14.0	19.1	14.0	24.8
14.5	25.5	14.5	19.8	14.5	21.3	14.5	19.8	14.5	25.4
15.0	26.0	15.0	20.2	15.0	22.2	15.0	21.2	15.0	26.2
15.5	27.2	15.5	20.9	15.5	22.8	15.5	21.6	15.5	26.8
16.0	28.1	16.0	22.8	16.0	23.7	16.0	23.0	16.0	28.1
16.5	30.1	16.5	23.1	16.5	25.4	16.4	26.4	16.5	29.2
17.0	33.8	17.0	24.0	17.0	27.7			17.0	30.4
17.2	36.4	17.5	27.0	17.1	28.0			17.5	32.2
		17.6	27.3					18.0	33.9
								18.5	39.4

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鹿児島大学高隈演習林におけるスギの幹形の計測（1）

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要　旨

鹿児島大学農学部附属高隈演習林において，スギの幹形を測定した。林齢19，42および53年のスギ林において，通直かつ健全な立木を5本ずつ伐倒し，樹高，枝下高，胸高直径，地際直径および梢端から地際にかけての0.5 m 間隔での幹直径を測定した。この資料では，これら15本のデータを公表する。

キーワード：幹形，スギ，高隈演習林