

Miyata, I. and Shiomi, T. (1965). Ecological studies on the vegetation of Akiyoshi-dai limestone plateau. 1 Structure of the forest community of 'Chojagami'. *Jap. J. Ecol.* 15, 29-34.

ca.34°15'N 131°30'E 200-500 m Japan, Yamaguchi Prefecture.

Calcareous soil *Camellia japonica* (36%)^a, *Machilus thunbergii* (16%)^a
with 9 other evergreen and 15 deciduous broadleaved species.

A religious taboo forest on a plateau.

Age (years)	Mature
Trees/ha	
Tree height (m)	
Basal area (m ² /ha)	68
Leaf area index	6.3
Stem volume (m ³ /ha)	
Dry biomass (t/ha)	
Stem wood	} 268.0
Stem bark	
Branches	
Fruits etc.	
Foliage	12.6
Root estimate	

CAI (m ³ /ha/yr)	
Net production (t/ha/yr)	
Stem wood	
Stem bark	
Branches	
Fruits etc.	
Foliage	
Root estimate	

Stand values for two 2 m wide transects across a 0.2 ha stand were derived using regressions published by Kitazawa *et al.* (1959) (see p.109). Only trees over 3 cm diameter were included.

a. Percentage of total tree number.

Saito, H., Shidei, T. and Kira, T. (1965). Dry matter production by *Camellia japonica* stands. *Jap. J. Ecol.* 15, 131-139.

ca. 34°30'N 136°40'E 300-400 m Japan, Mie Prefecture, Ise Shima Forest.

Fertile soils.	<i>Camellia japonica</i>				<i>C. japonica</i> <i>Quercus glauca</i> and other evergreen broadleaved species		
	Evergreen broadleaved forest						
Age (years)	ca. 60	ca. 60	ca. 60	ca. 60	ca. 60	ca. 60	
Trees/ha	4300	4600	9000	4300	14000	5600	
Tree height (m)	9-11	9-11	9-11	9-11	9-11	9-11	
Basal area (m ² /ha)	32.7	27.1	24.8	32.8	59.6	51.5	
Leaf area index	6.4	5.4	4.1	5.7	6.6	5.5	
Stem volume (m ³ /ha)	173	143	114	170	250	231	
Dry biomass (t/ha)	Stem wood	} 130.0	} 107.0	} 86.0	} 128.0	} 191.0	} 167.0
	Stem bark						
	Branches	47.3	37.1	23.0	43.5	50.2	53.8
	Fruits etc.						
	Foliage	7.3	6.1	5.0	7.4	7.5	6.3
Root estimate							
CAI (m ³ /ha/yr)	5.8	4.8	5.0	5.7	14.0	12.2	
Net production (t/ha/yr)	Stem wood	} 7.2 ^a	} 5.8 ^a	} 6.8 ^a	} 7.0 ^a	} 14.6 ^a	} 12.2 ^a
	Stem bark						
	Branches						
	Fruits etc.						
	Foliage	3.7 ^b	3.1 ^b	2.5 ^b	3.7 ^b	3.8 ^b	3.2 ^b
Root estimate							

Sixty-eight trees were sampled in all, and stand biomass values for plots of 100 to 400 m² were derived from regressions on D² and D²H.

a. Excluding woody litterfall and any mortality.

b. Assumed to be half the foliage biomass.

Kan, M., Saito, H. and Shidei, T. (1965). Studies of the productivity of evergreen broadleaved forests. *Bull. Kyoto Univ. For.* 37, 55-75.

ca. 32°30'N 130°40'E -- Japan, Kumamoto Prefecture.

Castanopsis cuspidata

Evergreen broadleaved two-storeyed forest

Age (years)		40	40	40	40
Trees/ha		7800 + 4700	7200 + 2900	4450 + 2950	3000 + 4700
Tree height (m)		5.9 10.8	6.3 11.6	4.8 11.8	4.7 11.0
Basal area (m ² /ha)		5.9 + 40.0	4.6 + 41.0	3.7 + 48.0	2.7 + 46.0
Leaf area index		2.1 + 8.6	1.6 + 8.5	1.3 + 8.5	0.9 + 7.6
Stem volume (m ³ /ha)		23 + 282	16 + 290	14 + 334	1 + 299
Dry biomass (t/ha)	Stem wood	} 12.0 + 147.0	} 8.3 + 151.0	} 7.4 + 174.0	} 0.5 + 156.0
	Stem bark				
	Branches	3.4 + 29.0	2.5 + 35.0	2.2 + 44.0	1.6 + 30.0
	Fruits etc.				
	Foliage	2.4 + 10.0	1.9 + 9.9	1.5 + 9.8	1.1 + 8.8
Root estimate					
CAI (m ³ /ha/yr)				0.8 + 20.0	0.6 + 17.0
Net production (t/ha/yr)	Stem wood			} 0.4 ^a + 10.0 ^a	} 0.3 ^a + 9.1 ^a
	Stem bark				
	Branches			3.2 ^a	2.1 ^a
	Fruits etc.				
	Foliage			0.6 ^b + 11.0 ^c	0.5 ^b + 9.9 ^c
Root estimate					

About 30 trees were sampled in October. Stand biomass values for plots of 100 to 400 m² were derived from regressions on D²H. Values above are given separately for the lower storey and the upper storey (left and right in each column), except for branch and foliage production.

a. Excluding woody litterfall and any mortality.

b. Foliage increment.

c. Foliage litterfall assumed to be equal to foliage biomass in October.

Kan, M., Saito, H. and Shidei, T. (1965). Studies of the productivity of evergreen broadleaved forests. *Bull. Kyoto Univ. For.* 37, 55-75.

ca. 32°30'N 130°40'E -- Japan, Kumamoto Prefecture.

Castanopsis cuspidata

Evergreen broadleaved single-storey forest

		<i>a</i>					
Age (years)		12		12			
Trees/ha		2900	3100	3150	13800	20900	150000
Tree height (m)		11.8	10.8	10.8	6.2	6.1	0.9
Basal area (m ² /ha)		44	27	27	18	25	17
Leaf area index		7.4	4.4	4.4	5.2	7.2	5.5
Stem volume (m ³ /ha)		294	175	177	63	90	56
Dry biomass (t/ha)	Stem wood	} 153.0	} 91.0	} 92.0	} 33.0	} 47.0	} 29.0
	Stem bark						
	Branches	53.0	16.0	17.0	8.4	11.0	9.1
	Fruits etc.						
	Foliage	8.6	5.1	5.2	6.0	8.4	6.4
Root estimate							
CAI (m ³ /ha/yr)					15	21	
Net production (t/ha/yr)	Stem wood				} 7.7 ^b	} 11.0 ^b	
	Stem bark						
	Branches				2.3 ^b	3.2 ^b	
	Fruits etc.						
	Foliage				1.3 ^c +6.0 ^d	1.9 ^c +8.4 ^d	
Root estimate							

About 30 trees were sampled in October. Stand biomass values for plots of 100 to 400 m² (and see below) were derived from regressions on D²H.

a. Values in this column refer to a dense thicket of 1.2 x 1.5 m which was completely harvested.

b. Excluding woody litterfall and any mortality.

c. Foliage increment.

d. Foliage litterfall assumed to be equal to foliage biomass in October.

- Tadaki, Y., Ogata, N. and Takagi, T. (1962). Studies on the production structure of forest. III Estimation of standing crop and some analyses on productivity of young stands of *Castanopsis cuspidata*. *J. Jap. For. Soc.* 44, 350-359.
- Tadaki, Y. (1965b). Studies on production structure of forests. VII The primary production of a young stand of *Castanopsis cuspidata*. *Jap. J. Ecol.* 15, 142-147.
- Tadaki, Y. (1968b). Studies on the production structure of forests. XIV The third report on the primary production of a young stand of *Castanopsis cuspidata*. *J. Jap. For. Soc.* 50, 60-65.

32°50'N 130°40'E 80 m Japan, Kumamoto Prefecture, near Kumamoto City.

Clayey soil
with some
humus.

Castanopsis cuspidata with a few *Quercus glauca*.

Coppiced evergreen broadleaved forest

	(Tadaki <i>et al.</i> 1962)	(Tadaki 1965b)	(Tadaki 1968b)		
Age (years)	10	10	11	14	
Trees/ha	58000	23592	42000	24667	
Tree height (m)	4.1	4.4	5.2	5.5	
Basal area (m ² /ha)	23.1	14.5	22.3	29.6	
Leaf area index	12.5	8.2	8.0	8.7	
Stem volume (m ³ /ha)	74	49.3	84.6	123.0	
Dry biomass (t/ha)	Stem wood	} 36.3	} 22.9	} 42.6	} 58.7
	Stem bark				
	Branches	9.1	6.0	6.4	13.4
	Fruits etc.				
	Foliage	11.4	7.0	7.4	8.4
	Root estimate			9.8	13.7
CAI (m ³ /ha/yr)	17.4	11.4			
Net production (t/ha/yr)	Stem wood	} 9.1 ^a	} 5.04 ^a	} 11.8 ^b + 0.9 ^c	} 10.11 } +2.38 ^e
	Stem bark				
	Branches				
	Fruits etc.				
	Foliage			3.7 ^d	3.75 ^f
	Root estimate			2.3 ^b	2.45

Tadaki *et al.* (1962) harvested all trees within a 25 m² plot and derived stand values for 8 other 25 m² plots from regressions on basal area per tree. The far left column gives values for the harvested plot; the column with 23592 trees/ha gives the means of all 9 plots. Tadaki *et al.* (1962) reported individual plot values. At age 11 twenty-one trees were sampled, at age 14 all trees were sampled within a 15 m² plot, and in both instances stand values were derived from regressions on D² and D²H.

- a. Excluding woody litterfall. b. Tadaki (1965b) estimated the increment of all woody parts (stems, branches and roots); here it is assumed that 17% of that increment was roots.
- c. Branch litterfall. d. Assumed to be half the foliage biomass.
- e. Woody litterfall and mortality. f. Foliage litterfall, measured over 3 years.

Kawanabe, S. (1977). A subtropical broadleaved forest at Yona, Okinawa. In: "Primary Productivity in Japanese Forests" (T. Shidei and T. Kira, eds) pp. 268-279. JIBP Synthesis vol. 16. University of Tokyo Press.

26°45'N 128°05'E 320 m Japan, Okinawa Island.

Clay loam soils. *Castanopsis cuspidata* var. *sieboldii* (54%)^a
and over 20 other subtropical evergreen broadleaved species

Age (years)	30-85
Trees/ha	2897
Tree height (m)	9.4 (to 14)
Basal area (m ² /ha)	47.9
Leaf area index	6.0
Stem volume (m ³ /ha)	

Dry biomass (t/ha)	Stem wood	} 136.7
	Stem bark	
	Branches	48.9
	Fruits etc.	
	Foliage	7.7
	Root estimate	

CAI (m ³ /ha/yr)		
Net production (t/ha/yr)	Stem wood	} 7.24 ^b
	Stem bark	
	Branches	2.23 + 1.93 ^c
	Fruits etc.	
	Foliage	3.85 ^d
	Root estimate	

Thirteen trees were sampled. Stand biomass values for a 400 m² plot were derived from regressions on D². Only trees at least 4.5 cm in diameter were included. Branches were assumed to grow at the same relative rate as the stems. Nutrient contents were determined.

a. Percentage of the total basal area.

b. Excluding any mortality.

c. Woody litterfall, assumed to be half the value of foliage litterfall.

d. Assumed to be half the foliage biomass (*cf.* Kan *et al.* 1965, see p.103, who assumed that foliage litterfall was equal to foliage biomass).

Satoo, T. (1968). Materials for the studies of growth in stands. VII Primary production and distribution of produced dry matter in a plantation of *Cinnamomum camphora*. *Bull. Tokyo Univ. For.* 64, 241-275.

35°09'N 140°09'E 200 m Japan, Chiba Prefecture.

Plantation.

Alluvial soil.

Cinnamomum camphora

Evergreen broadleaved forest

Age (years)	46	
Trees/ha	1250	
Tree height (m)	16.6	
Basal area (m ² /ha)	32.4	
Leaf area index	4.3 (or 4.8) ^a + 1.8 ^b	
Stem volume (m ³ /ha)	324 (or 271) ^a	
Dry biomass (t/ha)	Stem wood	} 157.0 (or 150.8) ^a } + 2.3 ^b
	Stem bark	
	Branches	
	Fruits etc.	35.0 (or 37.4) ^a
	Foliage	4.1 (or 4.5) ^a + 1.1 ^b
	Root estimate	
CAI (m ³ /ha/yr)	8.2 (or 8.2) ^a	
Net production (t/ha/yr)	Stem wood	} 4.70 ^c (or 4.74) ^{ac} } + 0.48 ^{bc}
	Stem bark	
	Branches	
	Fruits etc.	4.86 ^c (or 5.74) ^{ac}
	Foliage	4.07 ^d (or 4.54) ^{ad} + 1.14 ^{bd}
	Root estimate	

Fifteen trees were sampled and stand biomass values for a 0.97 ha plot were derived from regressions on D.

a. Alternative values derived by proportional basal area allocation.

b. Understorey shrubs.

c. Excluding woody litterfall and any mortality.

d. Assumed to be equal to the foliage biomass.

Yasui, H. and Fujie, I. (1970). Studies on the productive structure of 'Shirakashi' (*Cyclobalanopsis myrsinaefolia* Oerst.) coppice forest managed by selection method. 7. On the growth in third circulation-period at the Shimoyamasa permanent plot. *Bull. Fac. Agr. Univ. Shimane* 4, 85-92.

ca.35°N 133°E -- Japan, Shimane Prefecture, Hirosecho, Shimoyamasa.

Cyclobalanopsis myrsinaefolia

Evergreen oak coppice, thinned in 1965.

	1965	1966	1967	1968	1969	
Age (years)						
Trees/ha						
Tree height (m)	8	8	8	9	9	
Basal area (m ² /ha)	14.7	17.3	20.0	24.3	28.9	
Leaf area index						
Stem volume (m ³ /ha)	53	64	76	96	117	
Dry biomass (t/ha)	Stem wood	} 37.0	} 44.7	} 53.7	} 68.1	} 83.5
	Stem bark					
	Branches	11.5	13.9	16.4	20.2	24.6
	Fruits etc.					
	Foliage	6.1	7.4	8.7	10.7	13.1
Root estimate						
CAI (m ³ /ha/yr)		10.8	12.2	19.7	20.0	
Net production (t/ha/yr)	Stem wood	} 7.7	} 9.0	} 14.4	} 15.4	
	Stem bark					
	Branches					
	Fruits etc.					
	Foliage					
Root estimate						

Sixteen stems were sampled and stand values were derived from regressions on D and H. The sample trees were 9 to 25 years old.

Yasui, H. and Fujie, I. (1971). Studies on the productive structure of 'Shirakashi' (*Cyclobalanopsis myrsinaefolia* Oerst.) coppice forest managed by selection method. 8. On the growth and the biomass at the Shirakashi sprout forest by clearing system. *Bull. Fac. Agr. Univ. Shimane* 5, 49-55.

ca.35°N 132°E 300 m Japan, Shimane Prefecture, Hakuto cho, Takae.

Cyclobalanopsis myrsinaefolia

Evergreen oak coppices on 30-40° slopes

Age (years)	8	15	25	
Trees/ha	22286 ^a	16417 ^a	12108 ^a	
Tree height (m)	3.3-6.6 ^b	4.0-8.9 ^b	3.9-10.7 ^b	
Basal area (m ² /ha)	17.0	25.2	40.0	
Leaf area index	8.0	8.1	9.0	
Stem volume (m ³ /ha)	56	111	202	
Dry biomass (t/ha)	Stem wood	} 53.0	} 92.5	
	Stem bark			} 131.5
	Branches	20.5	36.7	
	Fruits etc.			
	Foliage	7.8	7.9	8.8
Root estimate				
CAI (m ³ /ha/yr)				
Net production (t/ha/yr)	Stem wood			
	Stem bark			
	Branches			
	Fruits etc.			
	Foliage			
Root estimate				

Eleven to 16 stems were sampled per stand and biomass values for the above 106-123 m² plots were derived from regressions on D.

a. Number of stems per hectare; there were 4245, 5159 and 3920 trees/ha in columns left to right.

b. Range of heights of sample trees.

Kimura, M. (1960). Primary production of the warm-temperate laurel forest in the southern part of Osumi peninsula, Kyushu, Japan. *Misc. Rep. Res. Inst. nat. Resour.*, Tokyo 52/53, 36-47.

Kitazawa, Y., Kimura, M., Tezuka, Y., Kurasawa, H., Sakamoto, M. and Yoshino, M. (1959). Plant ecology of the southern part of Osumi peninsula. *Misc. Rep. Res. Inst. nat. Resour.*, Tokyo 49, 19-36.

ca. 31°15'N 131°00'E 500 m Japan, Kyushu, Osumi peninsula.

Deep volcanic ash with well-developed brown forest soils.

Cyclobalanopsis acuta, *Shiia sieboldii*, *Cyclobalanopsis stenophylla*, *Distylium racemosum* et al.

Evergreen broadleaved forest

Age (years)

Trees/ha

Tree height (m) 13-25^a

Basal area (m²/ha)

Leaf area index 8.8^b

Stem volume (m³/ha)

Dry biomass (t/ha)	Stem wood	}	3 + 36 + 273
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage	0.5 + 2.4 + 8.5	
Root estimate	78 ^{bc}		

CAI (m³/ha/yr)

Net production (t/ha/yr)	Stem wood	}	0.3 ^d + 1.4 ^d + 5.7 ^d
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage	0.5 ^e + 2.4 ^e + 8.5 ^e	
Root estimate			

Many trees were sampled and stand biomass values for plots totalling 0.25 ha were derived from regressions on D. Biomass and production values are given above for the lower plus middle plus upper storeys (written left to right).

a. Upper storey only.

b. All storeys.

c. Assumed to be 25% of the above-ground woody biomass value.

d. Excluding woody litterfall and any mortality.

e. Assumed to be equal to the foliage biomass.

Kira, T., Ono, Y. and Hosokawa, T. (eds) (1978). "Biological Production in a Warm-temperate Evergreen Oak Forest of Japan." JIBP Synthesis vol. 18. University of Tokyo Press.

32°10'N 130°28'E 400-637 m Japan, Kagoshima Prefecture, Minimata.

Brown or
yellow-brown
forest soils.

Cyclobalanopsis spp. (especially *C. gilva*) and
Castanopsis spp. (especially *C. cuspidata*)

Evergreen broadleaved forest

Age (years)	ca. 50	ca. 50	ca. 50	
Trees/ha	(3138 + 4679) ^a	(2580 + 4054) ^a	(1684 + 5613) ^a	
Tree height (m)	ca. 25	ca. 25	ca. 25	
Basal area (m ² /ha)				
Leaf area index	8.3	8.1	6.9	
Stem volume (m ³ /ha)				
Dry biomass (t/ha)	Stem wood	} 289.3	} 316.8	} 289.1
	Stem bark			
	Branches	46.0	53.0	57.6
	Fruits etc.			
	Foliage	7.8	7.8	6.8
	Root estimate	83.8	92.4	86.7
CAI (m ³ /ha/yr)				
Net production (t/ha/yr)	Stem wood	} (3.74+0.74+0.23) ^b	} (2.65+0.74+0.25) ^b	} (3.26+0.74+0.23) ^b
	Stem bark			
	Branches	(0.87+3.19+0.97) ^b	(0.82+2.86+0.95) ^b	(1.28+3.23+0.97) ^b
	Fruits etc.	0.58 ^c	0.58 ^c	0.58 ^c
	Foliage	(3.25+0.23+0.08) ^d	(4.20+0.29+0.08) ^d	(3.86+0.27+0.08) ^d
	Root estimate	3.30	4.78	4.65

All trees were sampled within a 400 m² plot. Stand biomass values for the above three 0.16 ha plots were derived from regressions on D and H. Biomass values are means over 6 years, production values are means over 4 years. The biomass and increment values for thick roots were assumed to be 25% of those of above-ground woody parts.

a. Trees at least 4.5 cm D (3138, 2580 and 1684), plus smaller trees.

b. Increment plus woody litterfall plus pre-fall loss (written left to right); with pre-fall loss assigned to stems and branches in the same proportion as litterfall biomass.

c. Miscellaneous litterfall.

d. Foliage litterfall plus pre-fall loss plus consumption (written left to right).

Tadaki, Y., Hatiya, K. and Tochaiki, K. (1969). Studies on the production structure of forest. XV Primary productivity of *Fagus crenata* in plantation. *J. Jap. For. Soc.* 51, 331-339.

ca.37°30'N 139°00'E (alt. given below) Japan, Niigata Prefecture.

Plantations.

Fagus crenata

	400 m	470 m	580 m	
Age (years)	35	41	over 50	
Trees/ha	5235	2186	2829	
Tree height (m)	10.0	13.6	13.9	
Basal area (m ² /ha)	40.6	38.8	39.9	
Leaf area index	7.7	7.6	7.8	
Stem volume (m ³ /ha)	275	272	331	
Dry biomass (t/ha)	Stem wood	} 168.0	} 166.5	} 202.2
	Stem bark			
	Branches	31.4	43.5	39.5
	Fruits etc.			
	Foliage	4.8	4.7	4.9
	Root estimate	54.2	58.2	49.9
CAI (m ³ /ha/yr)	9.7	10.8	12.5	
Net production (t/ha/yr)	Stem wood	} 5.9	} 6.6	} 7.6
	Stem bark			
	Branches	2.1 + 1.9 ^a	2.5 + 1.9 ^a	2.3 + 2.0 ^a
	Fruits etc.			
	Foliage	4.8 ^b	4.7 ^b	4.9 ^b
Root estimate	1.6	2.5	1.6	

Six to eight trees were sampled per stand. Stand biomass values, for plots of 130, 352 and 438 m², for ages 35, 41 and 50, respectively, were derived from regressions on D²H. Increments were estimated for the previous year. Roots were assumed to grow at the same relative rates as above-ground woody parts.

a. Woody litterfall, assumed to be 40% of the value of foliage litterfall.

b. Foliage litterfall.

Kakubari, Y. (1977). Beech forests in the Naeba Mountains. Distribution of primary productivity along the altitudinal gradient. In: "Primary Productivity in Japanese Forests" (T. Shidei and T. Kira, eds) pp. 201-212. JIBP Synthesis vol. 16. University of Tokyo Press.

36°51'N 138°41'E (alt. given below) Japan, Niigata Prefecture, Naeba Mountains

		<i>Fagus crenata</i> with a few <i>Quercus mongolica</i> , <i>Magnolia obovata</i> , <i>Kalopanax septemlobus</i> et al.			
Brown forest soils.		550 m (92%) ^a	700 m (60%) ^a	700 m (96%) ^a	900 m (38%) ^a
Age (years)		to 100	to 100	to 100	to 100
Trees/ha		375	327	235	680
Tree height (m)		18.8	15.6	24.6	11.2
Basal area (m ² /ha)		24.9	24.5	32.7	22.7
Leaf area index		4.5	4.4	4.9	5.4
Stem volume (m ³ /ha)					
Dry biomass (t/ha)	Stem wood	} 227.2	} 250.6	} 281.6	} 243.9
	Stem bark				
	Branches	45.9	54.0	60.0	99.8
	Fruits etc.	0.1	0.2	0.1	0.1
	Foliage	2.4	2.4	2.7	3.8
	Root estimate	56.8	63.5	71.1	70.2
CAI (m ³ /ha/yr)					
Net production (t/ha/yr)	Stem wood	} 1.78 ^b	} 1.86 ^b	} 2.87 ^b	} 1.59 ^b
	Stem bark				
	Branches	0.41+0.48 ^c	0.47+0.48 ^c	0.70+0.48 ^c	0.78+0.96
	Fruits etc.	0.11 ^e	0.11 ^e	0.11 ^e	0.12 ^e
	Foliage	3.30 ^d	3.29 ^d	3.31 ^d	3.78 ^d
	Root estimate	0.46	0.49	0.74	0.49

Stand biomass values for plots of 800 to 2000 m² were derived from regressions on D²H. Root biomass was assumed to be 20% of the above-ground biomass. Only trees at least 4.5 cm D were included.

a. Percentage of total tree number that were *F. crenata*.

b. Including estimated mortality.

c. Litterfall.

d. Leaf increment; leaf litterfall was 2.37, 2.44, 2.76 and 3.97 t/ha/yr in columns left to right.

Maruyama, K. (1977). Beech forests in the Naeba Mountains. Comparison of forest structure, biomass and net productivity between the upper and lower parts of beech forest zone. In: "Primary Productivity in Japanese Forests." (T. Shidei and T. Kira, eds) pp. 186-201. JIBP Synthesis vol. 16. University of Tokyo Press.

Maruyama, K. (1971). Effect of altitude on dry matter production of primeval Japanese beech forest communities in Naeba Mountains. *Mem. Fac. Agric. Niigata Univ.* 9, 87-171.

ca.36°51'N 138°41'E (alt. given below) Japan, Niigata Prefecture, Naeba Mountains.

Brown forest soils.

Fagus crenata with a few *Quercus mongolica*,
Magnolia obovata, *Kalopanax septemlobus* et al.

	650 m	650 m	700 m	700 m	700 m	700 m	
Age (years)	to 100	to 100	to 100	to 100	to 100	to 100	
Trees/ha	367	289	321	470	356	400	
Tree height (m)	24.6	23.6	25.3	18.7	22.3	23.0	
Basal area (m ² /ha)	43.3	41.3	44.0	39.2	46.9	39.1	
Leaf area index	5.8	5.5	5.6	4.6	6.2	5.3	
Stem volume (m ³ /ha)	523	546	547	457	549	475	
Dry biomass (t/ha)	Stem wood	} 275.1	} 287.7	} 299.7	} 256.9	} 301.1	} 258.0
	Stem bark						
	Branches	56.1	58.6	58.9	54.4	60.9	50.9
	Fruits etc.						
	Foliage	3.0	2.9	3.0	2.5	3.2	2.7
	Root estimate	66.8	69.8	72.3	78.5	73.0	62.3
CAI (m ³ /ha/yr)							
Net production (t/ha/yr)	Stem wood	} 5.41 ^a	} 5.33 ^a	} 3.99 ^a	} 5.09 ^a	} 5.48 ^a	} 5.66 ^a
	Stem bark						
	Branches			2.81 ^a			
	Fruits etc.						
	Foliage	3.01 ^b	2.94 ^b	3.02 ^b	2.52 ^b	3.17 ^b	2.72 ^b
	Root estimate	1.68	1.65	1.96	1.52	1.73	1.68

A total of 59 trees were sampled in the autumn at various altitudes. Stand biomass values for the above plots of 448-1800 m² were derived from regressions on D²H. Only trees at least 4.5 cm D were included. Root biomass was assumed to be 20% of the above-ground biomass, and root death was assumed to be 20% of above-ground litterfall.

- a. Including estimated mortality, assumed to be 0.3% of the stem biomass; and including woody litterfall, assumed to be 3.8 kg/m³ of 'stand volume'.
- b. Leaf biomass in the autumn.

Continued from p.114.

Same as p.114.

	900 m	1300 m	1500 m	1500 m	1500 m	
Age (years)	to 100	to 100	to 100	to 100	to 100	
Trees/ha	1016	959	639	422	820	
Tree height (m)	8.7	11.3	11.5	13.2	10.6	
Basal area (m ² /ha)	40.4	38.5	37.5	33.5	34.7	
Leaf area index	4.8	4.2	4.0	3.2	4.3	
Stem volume (m ³ /ha)	328	289	301	243	342	
Dry biomass (t/ha)	Stem wood	} 181.0	} 192.3	} 161.6	} 119.4	} 167.7
	Stem bark					
	Branches	72.2	50.4	43.0	31.6	44.3
	Fruits etc.					
	Foliage	3.2	3.1	2.5	1.9	2.7
	Root estimate	51.3	49.2	41.4	30.6	42.9
CAI (m ³ /ha/yr)						
Net production (t/ha/yr)	Stem wood			} 1.64 ^a	} 3.26 ^a	} 3.56 ^a
	Stem bark					
	Branches			1.72 ^a		
	Fruits etc.					
	Foliage			2.47 ^b	1.94 ^b	2.72 ^b
	Root estimate			1.13	1.04	1.26

See p.114.

Kawahara, T., Tadaki, Y., Takeuchi, I., Sato, A., Higuchi, K. and Kamo, K. (1979). Productivity and cycling of organic matter in natural *Fagus crenata* and two planted *Chamaecyparis obtusa* forests. *Jap. J. Ecol.* 29, 387-395.

Ogino, K. (1977). A beech forest at Ashiu - biomass, its increment and net production. In: "Primary Production of Japanese Forests" (T. Shidei and T. Kira, eds) pp. 172-186. JIBP Synthesis vol. 16. University of Tokyo Press.

Japan		ca. 36°47'N 139°56'E 940 m Tochigi Prefecture, near Yaita city <i>Fagus crenata</i> (Kawahara <i>et al.</i> 1979)	35°20'N 135°45'E 680 m Kyoto Prefecture, Yura River <i>Fagus crenata</i> (72%) ^a <i>Carpinus tschonoskii</i> , <i>Acer tschonoskii et al.</i> (Ogino 1977)		
Age (years)		Mature	ca. 150		
Trees/ha		844	785		
Tree height (m)		11.5 (top height 23.9)	14.3		
Basal area (m ² /ha)		30.9	30.7		
Leaf area index			4.5		
Stem volume (m ³ /ha)		288	318		
Dry biomass (t/ha)	Stem wood	} 163.5	} 194.3		
	Stem bark				
	Branches	81.2	95.1		
	Fruits etc.				
	Foliage	3.0	3.0		
	Root estimate	81.6	64.6		
CAI (m ³ /ha/yr)			4.0		
Net production (t/ha/yr)	Stem wood	} 9.80 + 0.05 ^b	} 2.88		
	Stem bark				
	Branches			} + 0.62 ^b	} 2.07 + 1.38 ^c
	Fruits etc.				
	Foliage	3.18 ^b	0.03 + 3.45 ^d		
	Root estimate		0.77 + 0.69 ^e		

Ten trees were sampled at Yaita and stand biomass values for a 0.25 ha plot were derived from regressions on D²H. Root biomass was assumed to be one third of above-ground biomass. Fourteen trees were sampled at Yura, and 8 root systems were excavated; stand biomass values for six 100 m² plots for trees at least 4.5 cm D were derived from regressions on D²H.

a. Percentage of the total tree number.

b. Litterfall, where 0.62 t/ha/yr was miscellaneous litterfall.

c. Woody litterfall, assumed to be 40% of foliage litterfall value.

d. Foliage litterfall; the total foliage production of 3.48 t/ha/yr was equal to foliage biomass in August plus 15%.

e. Root losses, assumed to be 20% of foliage litterfall value.

- Katagiri, S. and Tsutsumi, T. (1975). The relationship between site condition and circulation of nutrients in forest ecosystems. III Aboveground biomass and nutrient contents of stands. *J. Jap. For. Soc.* 57, 412-419.
- Katagiri, S. and Tsutsumi, T. (1976). (as above) IV The amount of mineral nutrient returned to forest floor. *J. Jap. For. Soc.* 58, 79-85.
- Katagiri, S. and Tsutsumi, T. (1978). (as above) V The differences in nutrient circulation between stands located in upper part of slope and lower part of slope. *J. Jap. For. Soc.* 60, 195-202.

35°18'N 135°43'E (alt. given below) Japan, Kyoto Prefecture, Ashiu Forest.

<i>Fagus crenata</i> , <i>Cornus controversa</i> , <i>Aesculus turbinata</i> , <i>Styrax obassia</i> , et al.	<i>Quercus serrata</i> , <i>Quercus crispula</i> , <i>Hydrangea paniculata</i> , <i>Hamamelis japonica</i> , et al.
Ridge top 715-725 m	Lower slope 680-695 m

		Ridge top 715-725 m		Lower slope 680-695 m	
Age (years)					
Trees/ha		2737	3808	433	561
Tree height (m)		7.9	6.0	12.5	15.1
Basal area (m ² /ha)		19.9	25.6	36.4	39.8
Leaf area index					
Stem volume (m ³ /ha)					
Dry biomass (t/ha)	Stem wood	} 56.0	} 56.5	} 143.8	} 170.7
	Stem bark				
	Branches	19.9	18.7	104.6	102.0
	Fruits etc.				
	Foliage	3.2	3.3	2.5	4.2
	Root estimate				
CAI (m ³ /ha/yr)					
Net production (t/ha/yr)	Stem wood	} 0.90 ^a	} 3.29+0.90 ^a	} 1.28 ^a	} 8.95+2.11 ^a
	Stem bark				
	Branches				
	Fruits etc.	} 3.26 ^b	} 3.19 ^b	} 3.25 ^b	} 4.80 ^b
	Foliage				
	Root estimate				

Thirty-two trees were sampled. Stand biomass values for the above four 25 m² plots were derived from regressions on D²H. Nutrient contents were determined.

a. Big wood litterfall; note that stem and branch increments are given for only two plots.

b. Foliage, twig and miscellaneous litterfall.

Satoo, T., Kunugi, R. and Kumekawa, A. (1956). Materials for the studies of growth in stands. III Amount of leaves and production of wood in an aspen (*Populus davidiana*) second growth in Hokkaido. *Bull. Tokyo Univ. For.* 52, 33-51.

Satoo, T. (1970a). A synthesis of studies by the harvest method: primary production relations in the temperate deciduous forests of Japan. In: "Analysis of Temperate Forest Ecosystems" (D.E. Reichle, ed.) pp. 55-72. Springer-Verlag, New York, Heidelberg and Berlin.

ca. 43°13'N 142°25'E 230-260 m Japan, Hokkaido, near Mount Asibetu.

Populus davidiana (82%)^a

Magnolia obovata et al.

Age (years)	25-40
Trees/ha	1244
Tree height (m)	14-21
Basal area (m ² /ha)	26.7
Leaf area index	2.4
Stem volume (m ³ /ha)	274

Dry biomass (t/ha)	Stem wood	} 105.0
	Stem bark	
	Branches	25.4
	Fruits etc.	
	Foliage	2.2
	Root estimate	

CAI (m³/ha/yr) 14.7

Net production (t/ha/yr)	Stem wood	} 5.62 ^b
	Stem bark	
	Branches	0.88 ^b
	Fruits etc.	
	Foliage	2.17
	Root estimate	

Fourteen trees were sampled and stand biomass values for a 0.16 ha plot were derived from regressions on D.

a. Percentage of the total tree number; stand values were calculated for all trees using regressions for *P. davidiana*, as if it were a pure stand.

b. Excluding woody litterfall and any mortality.

Kan, M., Saito, H. and Shidei, T. (1965). Studies of the productivity of evergreen broadleaved forests. *Bull. Kyoto Univ. For.* 37, 55-75.

ca. 34°30'N 136-137°E 300-400 m Japan, Mie Prefecture.

Quercus glauca, *Quercus salicina*, *Quercus acuta*,
Camellia japonica et al.

Evergreen broadleaved two-storeyed forest

Age (years)	70	70	70	
Trees/ha	8300 + 5300	1200 + 4300	10800 + 4800	
Tree height (m)	2.7 9.9	2.2 10.4	3.5 10.0	
Basal area (m ² /ha)	12 + 36	3 + 38	11 + 33	
Leaf area index	1.4 + 6.1	0.5 + 6.5	1.4 + 5.4	
Stem volume (m ³ /ha)	53 + 198	14 + 214	46 + 179	
Dry biomass (t/ha)	Stem wood	} 37 + 136	} 10 + 147	} 32 + 123
	Stem bark			
	Branches	8 + 40	3 + 46	6 + 31
	Fruits etc.			
	Foliage	2.3 + 4.8	0.7 + 5.2	2.0 + 4.3
	Root estimate			
CAI (m ³ /ha/yr)	2.7 + 10.3	0.6 + 11.4	2.6 + 9.4	
Net production (t/ha/yr)	Stem wood	} 1.7 ^a + 7.3 ^a	} 0.4 ^a + 8.1 ^a	} 1.8 ^a + 6.6 ^a
	Stem bark			
	Branches	0.3 ^a	0.4 ^a	0.3 ^a
	Fruits etc.			
	Foliage	2.3 ^b + 4.8 ^b	0.7 ^b + 5.2 ^b	2.0 ^b + 4.3 ^b
Root estimate				

Twenty trees were sampled in August. Stand biomass values for plots of 90 m² (left and centre columns) or 25 m² (right column) were derived from regressions on D²H. Values are given above for the lower storey plus the upper storey (left and right in each column), except for branch production.

a. Excluding woody litterfall and any mortality.

b. Assumed to be equal to the foliage biomass in August.

Kan, M. Saito, H. and Shidei, T. (1965). Studies of the productivity of evergreen broadleaved forests. *Bull. Kyoto Univ. For.* 37, 55-75.

33-34°N 133-134°E -- Japan, Kochi Prefecture.

Quercus phillyraeoides and
Rapanea neriifolia (syn. *Mysine neriifolia*)

Evergreen broadleaved two-storeyed forest.

Age (years)		ca. 80	ca. 80	ca. 80
Trees/ha		14600 + 4000	13400 + 3700	9800 + 5200
Tree height (m)		5.7 9.6	6.0 9.7	6.0 9.6
Basal area (m ² /ha)		11 + 29	16 + 33	11 + 37
Leaf area index		2.7 + 4.2	4.4 + 5.0	2.8 + 4.9
Stem volume (m ³ /ha)		40 + 150	59 + 170	39 + 195
Dry biomass (t/ha)	Stem wood	} 34 + 138	} 50 + 155	} 33 + 178
	Stem bark			
	Branches	6 + 31	11 + 37	7 + 36
	Fruits etc.			
	Foliage	2.8 + 6.0	4.4 + 7.6	2.8 + 7.1
Root estimate				
CAI (m ³ /ha/yr)		3.8 + 4.6	4.6 + 4.7	3.2 + 6.0
Net production (t/ha/yr)	Stem wood	} 3.2 ^a + 4.2 ^a	} 3.9 ^a + 4.4 ^a	} 2.7 ^a + 5.5 ^a
	Stem bark			
	Branches	2.1 ^a	2.6 ^a	2.5 ^a
	Fruits etc.			
	Foliage	0.5 ^c + 8.8 ^b	0.7 ^c + 12.0 ^b	0.6 ^c + 9.9 ^b
Root estimate				

About 20 trees were sampled in November. Stand biomass values for plots of 300, 164 and 9 m² (in columns left to right) were derived from regressions on D²H. Values are given above for the lower storey plus the upper storey (left and right in each column), except for branch and foliage production.

a. Excluding woody litterfall and any mortality.

b. Total foliage litterfall of both storeys, assumed to be equal to foliage biomass in November.

c. Foliage increment.

Oshima, Y. (1961a). Ecological studies of Sasa communities. I Productive structure of some of the Sasa communities in Japan. *Bot. Mag., Tokyo* 74, 199-210.

Oshima, Y. (1961b). Ecological studies of Sasa communities. II Seasonal variations of productive structure and annual net production in Sasa communities. *Bot. Mag., Tokyo* 74, 280-290.

Japan		ca. 35°55'N 138°10'E Nagano Prefecture	ca. 37°00'N 139°20'E	ca. 43°00'N 140°55'E	
Evergreen bamboos					
Black-brown loams.		<i>Sasa nipponica</i>	<i>Sasa nikkoensis</i>	<i>Sasa oseana</i>	<i>Sasa kurilensis</i>
Altitude:		1700 m	2150 m	1400 m	550 m
Age (years)		2	3-5	3-5	9.2
Trees/ha		3,890,000 ^a	2,600,000 ^a	2,160,000 ^a	275,000 ^a
Tree height (m)		0.9	1.2	1.2	3.3
Basal area (m ² /ha)					
Leaf area index		4.7	5.2	4.7	5.3
Stem volume (m ³ /ha)					
Dry biomass (t/ha)	Stem wood	} 5.5 ^b	} 15.7 ^b	} 13.7 ^b	} 7.5 ^b
	Stem bark				
	Branches				
	Fruits etc.				
	Foliage	2.7	3.2	2.8	4.7
Root estimate	7.4 ^c	13.1 ^c	11.4 ^c	31.0 ^c	
CAI (m ³ /ha/yr)					
Net production (t/ha/yr)	Stem wood				} 8.6 ^d
	Stem bark				
	Branches				
	Fruits etc.				
	Foliage				3.1
Root estimate				4.3 ^e	

In the *S. kurilensis* stand all bamboos were harvested within two 4 m² plots; in each of the other stands all bamboos were harvested within two 0.25 m² plots.

a. Numbers of culms per hectare.

b. Culms and branches.

c. Rhizomes and roots.

d. New growth plus estimated losses.

Satoo, T., Negisi, K. and Senda, M. (1959). Materials for the studies of growth in stands. V Amount of leaves and growth in plantations of *Zelkova serrata* applied with crown thinning. *Bull. Tokyo Univ. For.* 55, 101-123.

35°56'N 138°51'E ca. 1000 m Japan, Titibu.

Plantations.

Zelkova serrata

Deciduous broadleaved species

	Thinned	Unthinned	
Age (years)	42	42	
Trees/ha	290 ^a + 983 ^a	2600	
Tree height (m)			
Basal area (m ² /ha)	19.5	33.2	
Leaf area index	2.2	4.0	
Stem volume (m ³ /ha)	157	248	
Dry biomass (t/ha)	Stem wood		
	Stem bark		
	Branches	24.8	48.7
	Fruits etc.		
	Foliage	1.5	2.8
Root estimate			
CAI (m ³ /ha/yr)	3.5	8.7	
Net production (t/ha/yr)	Stem wood		
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage	1.52 ^b	2.75 ^b
Root estimate			

Ten trees were sampled in each stand, and stand values were derived from regressions on D. No values were reported for stem biomass or wood increment.

a. Understorey (290) and overstorey (983).

b. Foliage biomass.

- Furuno, T. and Kawanabe, S. (1967). Investigations on the productivity of Japanese fir (*Abies firma* Sieb. et Zucc.) and hemlock (*Tsuga sieboldii* Carr.) stands in Kyoto University Forest in Wakayama. I On the growth of Japanese fir stands. *Bull. Kyoto Univ. For.* 39, 9-26.
- Furuno, T. (1971). Investigations on the productivity of Japanese fir (*Abies firma* Sieb. et Zucc.) and hemlock (*Tsuga sieboldii* Carr.) stands in Kyoto University Forest in Wakayama. II On the mixed stand of Japanese fir and hemlock. *Bull. Kyoto Univ. For.* 42, 128-142.

34°04'N 135°30'E ca. 700 m Japan, Wakayama Prefecture, Kyoto University Forest.

Abies firma (99%)^a

(Furuno and Kawanabe 1967)

Abies firma and
Tsuga sieboldii

(Furuno 1971)

(53%)^b

(48%)^b

	<i>Abies firma</i> (99%) ^a (Furuno and Kawanabe 1967)	<i>Abies firma</i> and <i>Tsuga sieboldii</i> (Furuno 1971)	(53%) ^b	(48%) ^b
Age (years)				
Trees/ha	3730	1995		2471
Tree height (m)	ca. 7.6	12-15		
Basal area (m ² /ha)	36.1	47.7		26.2
Leaf area index				
Stem volume (m ³ /ha)		445		157
Dry biomass (t/ha)	Stem wood	} 76.9	} 189.1	} 68.6
	Stem bark			
	Branches	30.4	28.3	13.4
	Fruits etc.			
	Foliage	20.8	14.6	7.7
Root estimate				
CAI (m ³ /ha/yr)				
Net production (t/ha/yr)	Stem wood	} 12.4 ^c	} 11.0 ^c	
	Stem bark			
	Branches			6.5 ^c
	Fruits etc.			
	Foliage	2.4 ^d	2.5	1.1
Root estimate				

Furuno and Kawanabe (1967): eight trees were sampled and stand biomass values for a 70 m² plot were derived from regressions on D. (The authors also reported values for 3 plots with many overstorey shade trees.)

Furuno (1971): ten *A. firma* and twenty *T. sieboldii* were sampled and stand biomass values for the above plots of 381 and 85 m² (left and right columns, respectively) were derived from various regressions on D and H.

a. Percentage of the total basal area.

b. Percentage of the total biomass accounted for by *A. firma*.

c. Excluding woody litterfall and any mortality.

d. Assuming foliage production to be 11.5% of the foliage biomass.

Furuno, T., Uenishi, S. and Uenishi, K. (1979). Investigations on the productivity of Japanese fir (*Abies firma* Sieb. et Zucc.) and hemlock (*Tsuga sieboldii* Carr.) stands in Kyoto University Forest in Wakayama. V Biomass of upperground parts and litterfall in fir-hemlock stands. *Bull. Kyoto Univ. For.* 51, 58-70.

Furuno, T. and Yamada, K. (1974). (as above) III Seasonal variation of litterfall and primary consumption by herbivorous insects in the mixed fir and hemlock stand. *Bull. Kyoto Univ. For.* 46, 7-22.

30°04'N 135°30'E 700 m Japan, Wakayama Prefecture, Kyoto University Forest.

Abies firma and *Tsuga sieboldii*

	76% ^a	67% ^a	56% ^a	76% ^a	100% ^a	81% ^a	64% ^a	
Age (years)								
Trees/ha	854	1249	1087	1034	353	1123	1220	
Tree height (m)	ca.26	ca.26	ca.26	ca.26	ca.26	ca.26	ca.26	
Basal area (m ² /ha)	57.4	56.0	49.1	46.3	56.6	47.3	59.0	
Leaf area index								
Stem volume (m ³ /ha)	653	583	515	443	704	480	605	
Dry biomass (t/ha)	Stem wood	}274.1	}246.0	}217.5	}188.0	}294.6	}203.2	}255.9
	Stem bark							
	Branches	56.6	51.4	46.9	40.4	58.1	38.4	55.0
	Fruits etc.	1.2	1.0	0.7	0.8	1.7	1.0	0.9
	Foliage	21.9	20.7	18.2	17.1	22.3	17.7	21.8
Root estimate								
CAI (m ³ /ha/yr)								
Net production (t/ha/yr)	Stem wood							
	Stem bark							
	Branches	1.87 ^b	1.87 ^b	1.87 ^b	1.87 ^b	1.87 ^b	1.87 ^b	1.87 ^b
	Fruits etc.	0.25 ^b	0.25 ^b	0.25 ^b	0.25 ^b	0.25 ^b	0.25 ^b	0.25 ^b
	Foliage	3.63 ^c	3.39 ^c	3.16 ^c	2.70 ^c	3.55 ^c	2.80 ^c	3.64 ^c
Root estimate								

Data from 6 *A. firma* and 5 *T. sieboldii* that were sampled in September were pooled with values for 7 *A. firma* and 12 *T. sieboldii* sampled earlier to calculate regressions on D from which stand values were derived for the above seven sample plots of 474 to 1427 m². In each plot there was about 0.8 t/ha of parasitic plants and lianes. Nutrient contents were determined.

a. Percentage of the total basal area accounted for by *A. firma*.

b. Litterfall only; the average of all plots.

c. New foliage biomass, mean foliage litterfall was 2.77 t/ha/yr.

Ando, T., Chiba, K., Nishimura, T. and Tanimoto, T. (1977). Temperate fir and hemlock forests in Shikoku. In: "Primary Productivity in Japanese Forests" (T. Shidei and T. Kira, eds) pp. 213-245. JIBP Synthesis vol. 16. University of Tokyo Press.

ca. 33°20'N 133°00'E 420 m Japan, Kochi Prefecture, Yusuhara district.

Deep,
fertile
soil.

Abies firma with an understorey of evergreen
and deciduous broadleaved species including
Cyclobalanopsis spp., *Actinodaphne lancifolia* et al.

Age (years)	97-145	
Trees/ha	288 + 1789 ^a	
Tree height (m)	29.1 12.1 ^a	
Basal area (m ² /ha)	60.7 + 21.0 ^a	
Leaf area index	5.4 ^b + 1.3 ^a	
Stem volume (m ³ /ha)	783 + 137 ^a	
Dry biomass (t/ha)	Stem wood } 303.8 + 90.4 ^a	
	Stem bark } 303.8 + 90.4 ^a	
	Branches	57.0 + 26.5 ^a
	Fruits etc.	
	Foliage	15.0 + 2.5 ^a
	Root estimate	114.9 + 28.6 ^a
CAI (m ³ /ha/yr)		
Net production (t/ha/yr)	Stem wood } 1.66 + 0.94 ^a (or 3.9 + 1.3 ^a) ^c	
	Stem bark } 1.66 + 0.94 ^a (or 3.9 + 1.3 ^a) ^c	
	Branches	0.44 + 1.62 ^d + 0.27 ^a + 0.36 ^{ad} (or 1.3 + 2.2 ^a) ^c
	Fruits etc.	1.21 ^d + 0.02 ^{ad}
	Foliage	0.08 + 2.03 ^d + 0.02 ^a + 1.10 ^{ad} (or 3.2 + 1.0 ^a) ^c
	Root estimate	0.9 + 0.3 ^a (or 2.0 + 3.8 ^a) ^c

Twelve *A. firma* and 8 understorey trees were sampled, and the roots of 8 *A. firma* trees were excavated. Stand biomass values for a 0.12 ha plot were derived from regressions on D, except for the biomass of understorey roots which was estimated assuming top/root ratios to be 4.2. Biomass values given above are the means over 4 years. Nutrient contents were determined.

a. Understorey values.

b. All-sided LAI was 12.1.

c. Alternative values (in the brackets) estimated as the new growth over the previous year.

d. Litterfall measured over 1 to 3 years.

Yamamoto, T. and Sanada, E. (1970). Nutrients uptake by planted Todo-fir (*Abies sachalinensis* Mast.), nutrient circulation and a change of soil in forest land. *Bull. Govt Forest Exp. Stn Tokyo* 229, 93-121.

43°33'N 142°10'E 100-160 m Japan, Hokkaido, Takikawa Prefecture,
Tokiwa city.

Plantations.

Abies sachalinensis

Age (years)	8	12	23	29	35	
Trees/ha	2870	2726	1849	1427	1178	
Tree height (m)	1.0	3.8	8.2	10.4	16.2	
Basal area (m ² /ha)	1.8	5.3	17.6	25.2	48.9	
Leaf area index						
Stem volume (m ³ /ha)						
Dry biomass (t/ha)	Stem wood	} 0.3	} 8.5	} 33.1	} 48.1	} 123.6
	Stem bark					
	Branches	0.3	2.6	8.6	15.8	50.6
	Fruits etc.					
	Foliage	0.4	4.2	11.3	13.4	22.0
	Root estimate					
CAI (m ³ /ha/yr)						
Net production (t/ha/yr)	Stem wood					
	Stem bark					
	Branches					
	Fruits etc.					
	Foliage					
	Root estimate					

Stand biomass values for the above five 500 m² plots were estimated using regression methods. Nutrient contents were determined.

Satoo, T. (1973a). Materials for the studies of growth of forest stands. XI Primary production relations in a young plantation of *Abies sachalinensis* in Hokkaido. *Bull. Tokyo Univ. For.* 66, 127-137.

ca.43°13'N 142°23'E 230 m Japan, Hokkaido, Tokyo University Forest.

Plantation.
Brown forest
soil.

Abies sachalinensis

Age (years)	26	
Trees/ha	2400	
Tree height (m)	10.9	
Basal area (m ² /ha)	32.6	
Leaf area index		
Stem volume (m ³ /ha)		
Dry biomass (t/ha)	Stem wood	} 62.6 (or 64.1, 65.2) ^a
	Stem bark	
	Branches	16.3 (or 18.8, 13.9) ^a
	Fruits etc.	
	Foliage	14.6 (or 15.2, 11.7) ^a
Root estimate		
CAI (m ³ /ha/yr)		
Net production (t/ha/yr)	Stem wood	} 7.3 ^b (or 7.9, 6.1) ^{ab}
	Stem bark	
	Branches	4.0 ^b (or 4.6, 3.5) ^{ab}
	Fruits etc.	
	Foliage	3.4 (or 4.1, 2.7) ^a
Root estimate		

Seven trees were sampled and stand biomass values for a 700 m² plot were derived from regressions on D. Production was estimated over the previous one year.

a. Alternative values, estimated by proportional basal area allocation or by multiplying mean tree values by the number of trees per hectare (written left and right, respectively, within the brackets).

b. Excluding woody litterfall and any mortality.

Ueda, S. (1974). Investigation on the nutrients circulation in the mixed natural forest of Todo-matsu (*Abies sachalinensis* Mast.) and broadleaved trees. *Bull. Kyoto Univ. For.* 46, 23-39.

ca.44°N 141-144°E 200 m Japan, northern Hokkaido.

Clay loam soil, low in phosphate.	<i>Abies sachalinensis</i> (29%) ^a	<i>A. sachalinensis</i> (62%) ^a
	<i>Quercus crispula</i> (24%) ^a	<i>Betula ermanii</i> (18%) ^a
	<i>Acer mono</i> var. <i>marmoratum</i> (17%) ^a	<i>Q. crispula</i> (13%) ^a

Both stands with *Sasa kurilensis* understorey

Age (years)

Trees/ha 130 + 418 343 + 208

Tree height (m)

Basal area (m²/ha)

Leaf area index

Stem volume (m³/ha)

Dry biomass (t/ha)	Stem wood	} 25.5 + 62.8 + 13.2	} 53.1 + 32.9 + 8.5
	Stem bark		
	Branches	7.4 + 23.7 + 0.0	20.4 + 10.5 + 0.0
	Fruits etc.		
	Foliage	3.7 + 2.3 + 3.1	5.1 + 0.9 + 2.4
	Root estimate		

CAI (m³/ha/yr)

Net production (t/ha/yr)	Stem wood		
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage	0.74 ^b + 2.24 ^b + 0.70 ^b	1.00 ^b + 0.80 ^b + 0.48 ^b
	Root estimate		

Eight trees were sampled in each stand. Stand biomass values for plots of 1.00 ha (left column) and 0.16 ha (right column) were derived from regressions on D²H. Values are given above separately for *A. sachalinensis* plus broadleaved trees plus the bamboo understorey (written left to right; the understorey stem number is not given). Nutrient contents were determined.

a. Percentage of the total overstorey biomass.

b. Foliage litterfall, including bamboo understorey culms.

Tadaki, Y., Hatiya, K. and Miyauchi, H. (1967). Studies on the productivity of *Abies veitchii* in the natural forests at Mount Fuji. *J. Jap. For. Soc.* 49, 421-428.

ca. 35°30'N 138°40'E (alt. given below)		Japan, Yamanashi Prefecture, NNW slope of Mount Fuji.			
Black volcanic ash soils.		<i>Abies veitchii</i>			
		Planted in a nursery	Naturally seeded in an old nursery		
		1530 m	1530 m	1700 m	1640 m
Age (years)		4	20	40-70	60-90
Trees/ha		10 million	19500	9700	3179
Tree height (m)		0.5	4.5	6.8	14.6
Basal area (m ² /ha)			33.7	56.8	64.8
Leaf area index		5.5	8.1	9.7	8.2
Stem volume (m ³ /ha)		12	114	285	516
Dry biomass (t/ha)	Stem wood	} 4.9	} 45.7	} 107.6	} 190.2
	Stem bark				
	Branches	2.2	9.3	16.3	16.5
	Fruits etc.				
	Foliage	5.5	14.0	17.6	16.7
	Root estimate	4.3	16.3	36.9	61.8
CAI (m ³ /ha/yr)			23.1	21.7	18.8
Net production (t/ha/yr)	Stem wood	} 4.1 ^a	} 9.6 ^a	} 8.2 ^a	} 6.9 ^a
	Stem bark				
	Branches				
	Fruits etc.				
	Foliage	1.6 ^b	2.9 ^b	3.4 ^b	3.3 ^b
Root estimate	2.7	3.6	3.1	2.6	

Five to ten trees were sampled per stand, and stand biomass values for the above four 20-100 m² plots were derived by proportional basal area allocation. Several root systems were excavated in each stand. Projected leaf areas were measured. Stem increments were estimated over one year; branch increments were assumed to be the same as stem increments within the crowns; roots were assumed to grow at the same relative rates as above-ground woody parts.

a. Excluding woody litterfall and mortality.

b. New foliage biomass.

Tadaki, Y., Hatiya, K., Tochiaki, K., Miyauchi, H. and Matsuda, U. (1970). Studies on the production structure of forest. XVI Primary productivity of *Abies veitchii* forests in the subalpine zone of Mount Fuji. *Bull. Govt Forest Exp. Stn Tokyo* 229, 1-22.

35°30'N 138°40'E (alt. given below) Japan, Yamanashi Prefecture,
NNW slope of Mount Fuji.

Abies veitchii

		Planted in a nursery	Naturally seeded in an old nursery	Plantation		
		1500 m	1530 m	1530 m	1700 m	1660 m
Age (years)		5	ca.25	23	40-45	45-130
Trees/ha		630000	12106	2076	3814	1204
Tree height (m)		0.7	5.3	8.5	10.1	16.3
Basal area (m ² /ha)			33.4	29.3	58.0	63.4
Leaf area index		7.7	10.9	12.8	7.8	10.6
Stem volume (m ³ /ha)		26	117	138	341	568
Dry biomass (t/ha)	Stem wood	} 9.3	} 42.1	} 45.0	} 129.2	} 205.7
	Stem bark					
	Branches	3.5	13.6	17.0	16.9	32.3
	Fruits etc.					
	Foliage	7.3	18.3	21.3	13.3	18.8
	Root estimate	6.1	17.5	25.9	40.6	54.2
CAI (m ³ /ha/yr)			15.5	22.0	10.6	14.0
Net production (t/ha/yr)	Stem wood	} 4.1 ^a	} 5.3 ^a	} 7.2 ^a	} 4.1 ^a	} 5.0 ^a
	Stem bark					
	Branches		3.2 ^a	3.7 ^a	1.4 ^a	1.8 ^a
	Fruits etc.					
	Foliage	2.5 ^b	3.4 ^b	4.5 ^b	4.1 ^b	4.4 ^b
	Root estimate	2.0	2.7	4.5	1.5	1.6

Eight trees were sampled per stand, and stand biomass values for the above 20-100 m² plots were derived by proportional basal area allocation. Several root systems were excavated. Projected leaf areas were measured. Stem increments were estimated over one year; branch increments were assumed to be the same as stem increments within the crowns; roots were assumed to grow at the same relative rate as above-ground woody parts.

a. Excluding woody litterfall and mortality.

b. New foliage biomass.

Oohata, S. and Oniishi, C. (1974). Some discussions on tree form and dry matter production of a fir stand at Tanohara on Mount Ontake. *Bull. Kyoto Univ. For.* 46, 51-57.

ca. 36°00'N 137°30'E 2100 m Japan, Nagano Prefecture, Mount Ontake.

Abies veitchii

Stunted trees near the snow line

Age (years)	Mature	Mature	Mature	
Trees/ha	2850	2325	2400	
Tree height (m)	2.9	4.2	3.4	
Basal area (m ² /ha)	33.5	58.4	37.8	
Leaf area index				
Stem volume (m ³ /ha)				
Dry biomass (t/ha)	Stem wood	} 23.0	} 40.9	
	Stem bark			
	Branches	8.3	31.8	14.9
	Fruits etc.			
	Foliage	4.2	13.2	7.3
Root estimate				
CAI (m ³ /ha/yr)				
Net production (t/ha/yr)	Stem wood	} 0.32 ^a	} 0.57 ^a	
	Stem bark			
	Branches	0.11 ^a	0.37 ^a	0.20 ^a
	Fruits etc.			
	Foliage	0.75	2.48	1.33
Root estimate				

Nine trees were sampled and stand values for the above three 400 m² plots were derived from regressions on D and H.

a. Excluding woody litterfall and any mortality.

Kimura, M., Mototani, I. and Hogetsu, K. (1968). Ecological and physiological studies on the vegetation of Mount Shimagare. VI Growth and dry matter production of young *Abies* stand. *Bot. Mag., Tokyo* 81, 287-296.

Kimura, M. (1969). (as above) VII Analysis of production processes of young stand based on the carbohydrate economy. *Bot. Mag., Tokyo* 82, 6-19.

Kimura, M. (1963). Dynamics of vegetation in relation to soil development in northern Yatsugataki mountains. *Jap. J. Bot.* 18, 255-287.

ca.36°30'N 138°00'E (alt. given below) Japan, Yatsugataki Mountains.

		<i>Abies veitchii</i>	<i>A. veitchii</i> (58%) ^a <i>Abies mariesii</i> (30%) ^a <i>et al.</i>
		(Kimura <i>et al.</i> 1968, 1969)	(Kimura 1963)
		2340 m	2250 m
Age (years)		15	40-100
Trees/ha			4625
Tree height (m)		0.9	11
Basal area (m ² /ha)			61.5
Leaf area index		5.0	
Stem volume (m ³ /ha)			
Dry biomass (t/ha)	Stem wood	} 9.8	} 154
	Stem bark		
	Branches	7.1	28
	Fruits etc.		
	Foliage	10.2	21
	Root estimate	6.0	55 ^b
CAI (m ³ /ha/yr)			
Net production (t/ha/yr)	Stem wood	} 1.1 ^c	} 4.2 ^c
	Stem bark		
	Branches	1.4 ^d	1.3 ^f
	Fruits etc.		+ 0.9 ^e
	Foliage	3.9	3.9 ^g
	Root estimate	0.9	1.7 ^b

Eleven trees were sampled from the 40- to 100-year-old stand, and stand values for a 400 m² plot were derived from regressions on D. The biomass and production of the 15-year-old stand were estimated by completely harvesting ten 0.5 m² plots at the beginning and end of one growing season.

a. Percentage of the total basal area.

b. Assumed to be one-third the value of above-ground woody parts.

c. Excluding any mortality.

d. Excluding woody litterfall.

e. Litterfall.

f. Assumed to be 30% of the stem increment value.

g. Estimated from the foliage biomass and average foliage longevity.

Tadaki, Y., Sato, A., Sakurai, S., Takeuchi, I. and Kawahara, T. (1977). Studies on the production structure of forest. XVII Structure and primary production in subalpine "dead tree strips" *Abies* forest near Mount Asahi. *Jap. J. Ecol.* 27, 83-90.

ca.36°N 138°E 2420-2440 m Japan, Yamaguchi and Nagano Prefectures.

Abies veitchii, *Abies mariesii*, and *Picea jezoensis* var. *hondoensis*

Stands that naturally deteriorate and die at age 100-130 and then regenerate.

	62% ^a	81% ^a	97% ^a	90% ^a	74% ^a	91% ^a	59% ^a	
Age (years)	1-5	7-19	18-34	31-42	51-79	73-118	119-133	
Trees/ha	730000	380000	233000	96000	20800	10200	4133	
Tree height (m)	0.2	0.6	1.0	2.6	5.4	7.4	8.1	
Basal area (m ² /ha)				9.7	62.2	66.9	52.2	
Leaf area index	1.4 ^b	2.8 ^b	6.5 ^b	6.8 ^b	5.9 ^b	5.4 ^b	2.8 ^b	
Stem volume (m ³ /ha)		7.8	55	179	230	307	232	
Dry biomass (t/ha)	Stem wood	} 1.0	} 6.4	} 29.2	} 74.9	} 97.2	} 130.3	} 92.2
	Stem bark							
	Branches	0.4	2.6	8.1	10.6	12.2	15.7	11.3
	Fruits etc.	0.0	0.0	0.0	0.9	1.4	1.1	0.2
	Foliage	2.3	4.6	13.6	17.1	13.6	14.3	8.3
Root estimate								
CAI (m ³ /ha/yr)								
Net production (t/ha/yr)	Stem wood	} 1.3 ^c	} 3.8 ^c	} 4.7 ^c	} 3.6 ^c	} 3.7 ^c	} 1.2 ^c	
	Stem bark							
	Branches	0.8 ^c	1.4 ^c	1.5 ^c	1.5 ^c	1.6 ^c	0.4 ^c	
	Fruits etc.	0.0	0.0	0.9	1.4	1.1	0.2	
	Foliage	1.3 ^d	2.2 ^d	3.0 ^d	2.2 ^d	2.0 ^d	1.7 ^d	
Root estimate								

Seven to 20 trees were sampled per stand in the autumn, and stand biomass values were estimated for the above plots of 1.0, 1.0, 1.4, 5.0, 25, 50 and 75 m², in columns left to right.

a. Percentage of the total basal area accounted for by *A. veitchii*.

b. Projected LAI values as measured by the authors; approximate all-sided LAI values can be obtained by multiplying by 2.3

c. Excluding woody litterfall and mortality.

d. New foliage biomass.

Satoo, T. and Senda, M. (1958). Materials for the studies of growth in stands. IV Amount of leaves and production of wood in a young plantation of *Chamaecyparis obtusa*. *Bull. Tokyo Univ. For.* 54, 71-100.

Harada, H. Satoo, H., Hotta, I. and Tadaki, Y. (1969). On the amount of nutrient contained in 28-year-old *Cryptomeria* forest (*C. japonica* D. Don) and *Chamaecyparis* forest (*C. obtusa* Sieb. et Zucc.). *J. Jap. For. Soc.* 51, 125-133.

Japan	ca.35°09'N 140°09'E			ca.35°N 138°E 680-760 m			
	Chiba Prefecture			<i>C. obtusa</i> with bamboo understorey			
Plantations	<i>Chamaecyparis obtusa</i>			(Harada <i>et al.</i> 1969)			
	(Satoo and Senda 1958)			Poor gravelly soil	Fertile loam		
Age (years)	28	28	28	28	28		
Trees/ha	5941	6747	6234	3483	2004		
Tree height (m)	10.5	9.0	9.3	5.3	9.9		
Basal area (m ² /ha)	39.5	35.6	33.7	24	38		
Leaf area index							
Stem volume (m ³ /ha)				74	189		
Dry biomass (t/ha)	Stem wood			} 32.6	} 82.0		
	Stem bark					} + 5.7 ^b	} + 1.1 ^b
	Branches	15.7	15.0				
	Fruits etc.						
	Foliage	12.4	10.3	18.2	11.7 + 2.2 ^b	17.5 + 0.3 ^b	
	Root estimate				13.6	27.1	
CAI (m ³ /ha/yr)	17.6 ^a	12.1 ^a	16.8 ^a				
Net production (t/ha/yr)	Stem wood	} 7.3 ^a	} 4.0 ^a	} 7.0 ^a			
	Stem bark						
	Branches						
	Fruits etc.						
	Foliage						
	Root estimate						

Satoo and Senda (1958) sampled 28 trees and derived stand values for the above three plots of 133-182 m² from regressions on D.

Harada *et al.* (1969) sampled 5 trees from the poor site, 8 from the fertile site, and derived stand values for the above two plots of 200-400 m² from regressions on D²H; nutrient contents were determined.

a. Values derived from the authors' Table 7 which expressed volume production per unit of foliage biomass.

b. Bamboo understorey.

- Yamakura, T., Saito, H., Shidei, T. (1972a). Investigations on the primary productivity and production structure of *Chamaecyparis obtusa* Sieb. et Zucc. stands. *Bull. Kyoto Univ. For.* 43, 106-123.
- Yamakura, T., Saito, H., Shidei, T. (1972b). Production structure of underground parts of Hinoki (*C. obtusa*) stand. I Estimation of root production by means of root analysis. *J. Jap. For. Soc.* 54, 118-125.
- Saito, H. (1977). *Chamaecyparis* plantations. In: "Primary Productivity in Japanese Forest" (T. Shidei and T. Kira, eds) pp.252-268. JIBP Synthesis vol.16. University of Tokyo Press.

35°00'N 136°20'E 440 m Japan, Shiga Prefecture, Hino.

Plantations.
Brown forest
soils.

Chamaecyparis obtusa

Age (years)	30	40	
Trees/ha	3500	1300	
Tree height (m)	10.4	15.9	
Basal area (m ² /ha)	45.6	60.4	
Leaf area index	5.8 ^a	6.3 ^a	
Stem volume (m ³ /ha)	268	507	
Dry biomass (t/ha)	Stem wood	} 115.0	} 219.0
	Stem bark		
	Branches	12.0	25.0
	Fruits etc.	0.0	0.2
	Foliage	14.0	19.0
	Root estimate	43.0	76.0
CAI (m ³ /ha/yr)	20.7	18.1	
Net production (t/ha/yr)	Stem wood	} 9.8 (or 8.9) ^b	} 11.5 (or 7.8) ^b
	Stem bark		
	Branches	0.6 ^c (or 1.7) ^b	1.0 + 0.6 ^d + 0.2 ^e (or 2.1) ^b
	Fruits etc.	0.0	0.6 (or 0.2) ^b
	Foliage	0.9 + 2.4 ^d + 1.0 ^e (or 3.4) ^b	0.1 + 3.8 ^d + 1.4 ^e (or 4.6) ^b
	Root estimate	3.3 (or 3.0) ^b	3.9 (or 2.4) ^b

Six trees were sampled per stand in the autumn and roots were excavated. Stand biomass values for a 150 m² plot in the 30-year-old stand and a 500 m² plot in the 40-year-old stand were derived from regressions on D²H.

- a. All-sided LAI values can be obtained by multiplying by 2.3.
 b. Alternative values obtained by measuring the new growth (from Saito 1977).
 c. Excluding any woody litterfall.
 d. Litterfall.
 e. Consumption and other losses.

Ogata, N., Nagatomo, Y., Kaminaka, S. and Takeshita, K. (1973). Effects of fertilization and site on the matter production of *Chamaecyparis* stand, and differences between *Chamaecyparis* and *Cryptomeria* stands. A. Rep. Kyushu Branch, Govt Forest Exp. Stn 15, 21-24.

ca. 33°N 131°E -- Japan, Kyushu.

Plantations

Chamaecyparis obtusa

Age (years)	36	51	51	62	62	
Trees/ha	1141	1149	1186	1012	2555	
Tree height (m)	12.5	14.0	12.7	21.2	14.4	
Basal area (m ² /ha)	47.9	47.0	45.0	55.7	63.8	
Leaf area index	6.8 ^α	5.3 ^α	4.8 ^α	5.4 ^α	4.7 ^α	
Stem volume (m ³ /ha)	312	343	304	554	467	
Dry biomass (t/ha)	Stem wood	} 160.2	} 166.8	} 142.9	} 217.0	
	Stem bark					} 207.7
	Branches	13.7	26.7	20.3	13.5	
	Fruits etc.					
	Foliage	20.7	16.3	15.3	15.8	14.9
Root estimate						
CAI (m ³ /ha/yr)	13.9	11.3	8.3	18.9	11.2	
Net production (t/ha/yr)	Stem wood	} 13.4	} 10.8	} 8.6	} 12.3	
	Stem bark					} 9.0
	Branches					
	Fruits etc.					
	Foliage					
Root estimate						

Stand values for the above 100 m² plot were derived using published regressions on D and H.

α. All-sided LAI values can be obtained by multiplying by 2.3.

Takeuchi, I., Tadaki, Y., Hatiya, K., Kawahara, T. and Sato, A. (1975). Thinning experiment of 30-year-old plantation of *Chamaecyparis obtusa*. In reference to line thinning. *Bull. Govt Forest Exp. Stn Tokyo* 272, 141-155.

Tadaki, Y., Ogata, N., Nagatomo, Y. and Yoshida, T. (1966). Studies on the production structure of forest. X Primary productivity of an unthinned 45-year-old stand of *Chamaecyparis obtusa*. *J. Jap. For. Soc.* 48, 387-393.

Japan		ca.33°N 350 m				32°30'N 130°30'E 750 m Kumamoto Prefecture	
Plantations		<i>Chamaecyparis obtusa</i>					
		Values before thinning (Takeuchi <i>et al.</i> 1975)				Unthinned (Tadaki <i>et al.</i> 1966)	
Age (years)		30	30	30	30	45	
Trees/ha		1951	1776	2097	2266	3400	
Tree height (m)		14.9	15.2	14.7	14.5	16.0	
Basal area (m ² /ha)		39.5	39.5	39.7	41.2	70.5	
Leaf area index						5.1	
Stem volume (m ³ /ha)		304	297	301	313	560	
Dry biomass (t/ha)	Stem wood	} 141.1	} 137.7	} 139.2	} 145.4	} 229.6	
	Stem bark						
	Branches	14.4	14.9	13.8	14.1		12.8
	Fruits etc.						0.1
	Foliage	13.3	13.7	12.9	13.2		11.9
	Root estimate	50.7	49.9	49.8	51.9		72.7
CAI (m ³ /ha/yr)		14.6	14.6	14.4	14.7	15.6	
Net production (t/ha/yr)	Stem wood	} 6.7 ^a	} 6.7 ^a	} 6.3 ^a	} 6.7 ^a	} 8.6 ^{ab}	
	Stem bark						
	Branches	1.8 ^a	1.9 ^a	1.7 ^a	1.8 ^a		
	Fruits etc.						0.1
	Foliage	4.0	4.1	3.9	4.0		3.0 ^c
	Root estimate	2.4	2.4	2.3	2.4		3.7 ^b

Eight trees were sampled per plot. Stand biomass values for the above four 400 m² plots containing the 30-year-old trees were derived from regressions on D²H. Stand biomass values for a 100 m² plot containing the 45-year-old trees were derived by proportional basal area allocation. In all cases root biomass was assumed to be 30% of the above-ground woody biomass. Projected leaf areas were measured in the 45-year-old plot.

a. Excluding woody litterfall and mortality.

b. Tadaki *et al.* (1966) gave the total woody increment (stems, branches and roots); here it is assumed that 30% of that total was roots.

c. Assumed to be 25% of the foliage biomass.

Kawanabe, S., Tamai, S. and Tsutsumi, T. (1975). Effects of thinning on the biomass and the light climate in *Chamaecyparis obtusa* Sieb. et Zucc. stand. *Bull. Kyoto Univ. For.* 47, 26-33.

34°04'N 135°30'E 1000 m Japan, Nara Prefecture.

Plantations.
Deep brown
forest soils.

Chamaecyparis obtusa

		Unthinned				30% thinned at age 45 ^a			
		45	46	45	46	45	46	45	46
Age (years)		45	46	45	46	45	46	45	46
Trees/ha		1152	1152	1040	1040	704	704	592	592
Tree height (m)		13.7	13.9	13.8	14.0	14.3	14.5	15.4	15.6
Basal area (m ² /ha)		38.0	39.3	32.4	33.2	27.0	27.8	26.3	27.0
Leaf area index									
Stem volume (m ³ /ha)		262	275	225	234	193	202	203	212
Dry biomass (t/ha)	Stem wood	} 113.1	} 118.5	} 96.8	} 100.7	} 83.1	} 87.1	} 87.5	} 91.2
	Stem bark								
	Branches	16.2	17.3	13.3	14.1	12.7	13.6	14.7	15.6
	Fruits etc.								
	Foliage	10.6	11.2	8.9	9.4	8.0	8.3	8.7	9.1
Root estimate									
CAI (m ³ /ha/yr)		12.5		9.0		9.3		8.6	
Net production (t/ha/yr)	Stem wood	} 5.4		} 3.9		} 4.0		} 3.7	
	Stem bark								
	Branches								
	Fruits etc.								
	Foliage								
Root estimate									

Nine trees were sampled and stand values for the above 625 m² plots were derived from regressions on D²H.

a. The values given here refer to the stands after 30% of the trees had been removed.

Continued from p.138.

Same as p.138.

All stands were thinned at age 45.

	32% ^a		41% ^a		51% ^a		55% ^a		
	45	46	45	46	45	46	45	46	
Age (years)	45	46	45	46	45	46	45	46	
Trees/ha	576	576	544	544	448	448	464	464	
Tree height (m)	14.8	15.0	15.3	15.5	14.7	14.9	14.7	14.9	
Basal area (m ² /ha)	23.3	23.9	25.1	25.8	18.1	18.7	18.4	19.1	
Leaf area index									
Stem volume (m ³ /ha)	172	179	193	201	132	138	136	143	
Dry biomass (t/ha)	Stem wood	} 74.3	} 77.2	} 83.0	} 86.5	} 56.8	} 59.6	} 58.8	} 61.7
	Stem bark								
	Branches	11.7	12.4	14.2	15.1	8.8	9.4	9.3	9.9
	Fruits etc.								
	Foliage	7.2	7.5	8.3	8.7	5.5	5.8	5.7	6.0
	Root estimate								
CAI (m ³ /ha/yr)		6.7		8.1		6.5		6.7	
Net production (t/ha/yr)	Stem wood	} 2.9	} 3.5	} 3.5	} 2.8	} 2.8	} 2.8	} 2.9	
	Stem bark								
	Branches								
	Fruits etc.								
	Foliage								
	Root estimate								

Nine trees were sampled and stand values for the above 625 m² plots were derived from regressions on D²H.

a. Percentage of trees removed at age 45; all values in the table refer to the stands after thinning.

Kawahara, T., Tadaki, Y., Takeuchi, I., Sato, A., Higuchi, K. and Kamo, K. (1979).
Productivity and cycling of organic matter in natural *Fagus crenata* and two
planted *Chamaecyparis obtusa* forests. *Jap. J. Ecol.* 29, 387-395.

36°47'N 139°56'E (alt. given below) Japan, Tochigi Prefecture, near Yaita city

Plantations *Chamaecyparis obtusa*

	600 m	730 m	
Age (years)	17	48	
Trees/ha	3600	1230	
Tree height (m)	7.8	17.6	
Basal area (m ² /ha)	34.5	49.3	
Leaf area index			
Stem volume (m ³ /ha)	153	488	
Dry biomass (t/ha)	Stem wood	} 69.3	} 170.2
	Stem bark		
	Branches	10.8	18.8
	Fruits etc.		
	Foliage	14.3	15.7
	Root estimate	31.5 ^a	68.2 ^a
CAI (m ³ /ha/yr)			
Net production (t/ha/yr)	Stem wood	} 17.3 + 0.01 ^b	} 14.7 + 0.03 ^b
	Stem bark		
	Branches		
	Fruits etc.	0.02 ^b	0.06 ^b
	Foliage	2.42 ^b	2.67 ^b
	Root estimate		

Stand biomass values for the above plots of 100 m² and 1600 m² (in columns left and right, respectively) were derived using published regressions on D and D²H.

a. Assumed to be one third the value of above-ground parts.

b. Litterfall, measured over 4 years.

- Satoo, T. (1979a). Standing crop and increment of bole in plantations of *Chamaecyparis obtusa* near an electric power plant in Owase, Mie. *Jap. J. Ecol.* 29, 103-109.
- Satoo, T. (1979b). Leaf litter production in plantations of *Chamaecyparis obtusa* near an electric power plant in Owase, Mie. *Jap. J. Ecol.* 29, 205-208.
- Satoo, T. (1979c). Production of reproductive organs in plantations of *Chamaecyparis obtusa* near an electric power plant in Owase, Mie. *Jap. J. Ecol.* 29, 315-321.

ca. 34°44'N 136°12'E 400-500 m Japan, Mie Prefecture, near Owase city.

Plantations.

Chamaecyparis obtusa

	Stands exposed to a sulphur polluted atmosphere since age 33.		Unpolluted	
Age (years)	40	40	38	
Trees/ha	1345	1231	1206	
Tree height (m)	17.3	17.1	16.7	
Basal area (m ² /ha)	38.2	34.1	37.4	
Leaf area index				
Stem volume (m ³ /ha)	300 (or 307) ^a	241 (or 242) ^a	255 (or 259) ^a	
Dry biomass (t/ha)	Stem wood	137.3 (or 144.0) ^a	105.6 (106.4) ^a	115.8 (or 106.3) ^a
	Stem bark	10.0 (or 10.0) ^a	7.1 (or 6.9) ^a	9.0 (or 8.2) ^a
	Branches	13.3 (or 17.1) ^a	13.2 (or 15.7) ^a	16.2 (or 14.7) ^a
	Fruits etc.	0.1 (or 0.1) ^a	0.1 (or 0.1) ^a	0.1 (or 0.1) ^a
	Foliage	6.7 (or 7.8) ^a	5.9 (or 6.9) ^a	10.2 (or 9.8) ^a
	Root estimate			
CAI (m ³ /ha/yr)	7.2 (or 6.6) ^a	7.9 (or 8.1) ^a	12.4 (or 11.9) ^a	
Net production (t/ha/yr)	Stem wood	} 3.63 ^b (or 3.26) ^{ab}	} 3.68 ^b (or 2.85) ^{ab}	} 5.28 ^b (or 5.10) ^{ab}
	Stem bark			
	Branches			
	Fruits etc.	0.06 ^c	0.08 ^c	0.18 ^c
	Foliage	1.27 ^c	1.57 ^c	2.60 ^c
	Root estimate			

Five trees were sampled per stand, and stand values for the above 200 to 400 m² plots were derived from regressions on D.

a. Alternative values derived by proportional basal area allocation.

b. Excluding any woody litterfall and mortality.

c. Litterfall measured over 17 months.

Miyamoto, M., Tanimoto, T., and Ando, T. (1980). Analysis of the growth of Hinoki (*Chamaecyparis obtusa*) artificial forests in Shikoku district. *Bull. Forestry and Forest Products Research Inst. (Ibaraki, Japan)* 309, 89-107.

34°10'N 133°40'E 150 m Japan, Kagawa Prefecture, Manno Town.

Plantations.

Chamaecyparis obtusa

All stands on 'site class 1'.

Age (years)	20	20	20	20	
Trees/ha	2600	3025	3125	3244	
Tree height (m)	8.9	9.0	9.2	9.4	
Basal area (m ² /ha)	30.1	30.8	31.1	34.1	
Leaf area index	6.4 ^a	6.3 ^a	6.3 ^a	7.1 ^a	
Stem volume (m ³ /ha)	139	139	139	157	
Dry biomass (t/ha)	Stem wood	} 55.2	} 55.6	} 55.7	} 62.2
	Stem bark				
	Branches	7.9	7.5	7.3	8.7
	Fruits etc.				
	Foliage	14.5	14.4	14.3	16.3
	Root estimate	22.2 ^b	22.1 ^b	22.1 ^b	24.9 ^b
CAI (m ³ /ha/yr)	18.4	17.7	17.4	20.5	
Net production (t/ha/yr)	Stem wood	} 7.3 ^c	} 7.1 ^c	} 7.0 ^c	} 8.1 ^c
	Stem bark				
	Branches	2.2 ^c	2.1 ^c	2.0 ^c	2.4 ^c
	Fruits etc.				
	Foliage	3.6	3.6	3.6	4.1
	Root estimate	2.9	2.8	2.8	3.2

Fourteen trees were sampled in each stand, and biomass values for each of the above 225 - 400 m² plots were estimated by proportional basal area allocation. Increments were estimated over one year.

a. Approximate all-sided LAI values may be obtained by multiplying by 2.3.

b. Assuming top/root ratios to be 3.5.

c. Excluding any woody litterfall and mortality.

Continued from p.142.

33°30'N 133°30'E 1250 m Japan, Kochi Prefecture, Terakawa National Forest.

Plantations.

Chamaecyparis obtusa

All stands on 'site class 1'.

Age (years)	42	42	42	42	42	
Trees/ha	1338	1375	1463	1488	1613	
Tree height (m)	15.8	16.6	16.0	15.9	14.6	
Basal area (m ² /ha)	60.7	57.6	61.0	64.4	64.0	
Leaf area index	5.6 ^a	5.4 ^a	5.8 ^a	6.0 ^a	5.9 ^a	
Stem volume (m ³ /ha)	468	482	486	506	464	
Dry biomass (t/ha)	Stem wood	} 188.3	} 178.3	} 189.5	} 200.0	} 199.2
	Stem bark					
	Branches	18.0	17.2	17.9	18.9	18.3
	Fruits etc.					
	Foliage	16.2	15.4	16.2	17.1	16.8
	Root estimate	63.6 ^b	60.3 ^b	63.9 ^b	67.4 ^b	66.9 ^b
CAI (m ³ /ha/yr)	25.3	26.2	26.1	27.3	24.8	
Net production (t/ha/yr)	Stem wood	} 10.2 ^c	} 9.7 ^c	} 10.2 ^c	} 10.8 ^c	} 10.7 ^c
	Stem bark					
	Branches	2.7 ^c	2.5 ^c	2.6 ^c	2.8 ^c	2.7 ^c
	Fruits etc.					
	Foliage	4.1	3.9	4.1	4.3	4.2
	Root estimate	3.4	3.3	3.4	3.6	3.6

Ten trees were sampled in each stand.

See p.142.

Continued from p.143.

33°10'N 133°10'E 450 m Japan, Kochi Prefecture, Kubokawa Forest Station.

Plantations.	<i>Chamaecyparis obtusa</i>			Fertilizers applied at age 43			
	'Site class 1'			'Site class 3'	'Site class 2'	'Site class 2'	
Age (years)	48	50	48	49	49	50	
Trees/ha	1325	1434	1600	2854	2470	3192	
Tree height (m)	17.2	17.8	17.6	11.3	13.3	13.7	
Basal area (m ² /ha)	56.5	58.3	59.4	47.6	50.8	59.5	
Leaf area index	4.7 ^a	5.9 ^a	5.4 ^a	6.6 ^a	5.7 ^a	6.2 ^a	
Stem volume (m ³ /ha)	455	472	503	264	331	412	
Dry biomass (t/ha)	Stem wood	} 190.9	} 179.6	} 208.2	} 114.2	} 140.8	} 171.6
	Stem bark						
	Branches	32.9	20.4	25.7	26.4	20.9	22.2
	Fruits etc.						
	Foliage	12.1	12.8	13.3	14.7	11.7	11.4
	Root estimate	67.4 ^b	60.8 ^b	70.6 ^b	44.4 ^b	49.5 ^b	58.6 ^b
CAI (m ³ /ha/yr)	11.6	16.9	17.2	16.7	14.1	12.5	
Net production (t/ha/yr)	Stem wood	} 4.8 ^c	} 6.4 ^c	} 7.1 ^c	} 7.2 ^c	} 6.0 ^c	} 5.2 ^c
	Stem bark						
	Branches	1.8 ^c	2.0 ^c	1.6 ^c	2.7 ^c	1.7 ^c	1.2 ^c
	Fruits etc.						
	Foliage	3.0	3.2	3.3	3.7	2.9	2.8
	Root estimate	1.7	2.2	2.4	2.8	2.1	1.8

Eight trees were sampled in each stand.

See p.142.

Ando, T., Takeuchi, I., Saito, A. and Watanabe, H. (1969). Some observations of dry-matter production on the artificial two-storied stand. *J. Jap. For. Soc.* 51, 102-107.

ca. 33°30'N 132°30'E -- Japan, Ehime Prefecture.

Cryptomeria japonica (overstorey) with

Chamaecyparis obtusa (understorey)

Plantations.

Before pruning or thinning

Overstorey Understorey Overstorey Understorey

	Overstorey	Understorey	Overstorey	Understorey				
Age (years)	8	4	68	36				
Trees/ha	4100	+	4700	+	383	+	950	
Tree height (m)	6.7		2.1		23.6		9.5	
Basal area (m ² /ha)	19.8	+	1.0		38.2	+	8.1	
Leaf area index								
Stem volume (m ³ /ha)	70.5	+	3.6		452	+	36	
Dry biomass (t/ha)	Stem wood	} 23.4	+	1.6	} 160.3	+	15.2	
	Stem bark							
	Branches	3.6	+	0.6		14.5	+	4.5
	Fruits etc.	0.0	+	0.0		1.4	+	0.0
	Foliage	11.0	+	2.1		17.0	+	3.8 ^a
	Root estimate	10.8 ^b	+	1.2 ^b		55.2 ^b	+	6.7 ^b
CAI (m ³ /ha/yr)	25.6	+	1.5		11.8	+	1.9	
Net production (t/ha/yr)	Stem wood	} 8.5 ^c	+	0.6 ^c	} 4.2 ^c	+	0.8 ^c	
	Stem bark							
	Branches	2.2 ^c	+	0.2 ^c		0.6 ^c	+	0.5 ^c
	Fruits etc.	0.0	+	0.0		1.4	+	0.0
	Foliage	5.5	+	1.0		4.2	+	1.0
	Root estimate	3.9	+	0.5		1.4	+	0.4

Stand biomass values were derived by proportional basal area allocation. The younger plot was 100 m², the older one was 600 m².

a. An error in the authors' Table 2 has been corrected.

b. Assuming top/root ratios to be 3.5.

c. Excluding any woody litterfall and mortality.

Tadaki, Y., Ogata, N., Nagatomo, Y., Yoshioka, K. and Miyagawa, Y. (1964). Studies on production structure of forest. VI Productivities of scaffolding producing stands of *Cryptomeria japonica*. *J. Jap. For. Soc.* 46, 246-253.

Tadaki, Y., Ogata, N. and Nagatomo, Y. (1965). The dry matter productivity in several stands of *Cryptomeria japonica* in Kyushu. *Bull. Govt Forest Exp. Stn Tokyo* 173, 45-66.

ca.32°45'N 130°00'E 100 m Japan, Nagasaki Prefecture, Higashi-Nagasaki.

Plantations.

Cryptomeria japonica

Unthinned stands, raised from seed.

	11	11	22	22	31	
Age (years)	11	11	22	22	31	
Trees/ha	10000	9500	6400	6300	3600	
Tree height (m)	6.0	5.3	9.1	9.4	10.7	
Basal area (m ² /ha)	27.1	21.3	38.8	38.1	40.1	
Leaf area index	4.7 ^a	4.7 ^a	5.1 ^a	5.1 ^a	5.9 ^a	
Stem volume (m ³ /ha)	98	77	220	215	247	
Dry biomass (t/ha)	Stem wood	} 34.9	} 27.4	} 83.2	} 81.6	} 93.8
	Stem bark					
	Branches	3.4	2.7	7.7	7.6	12.3
	Fruits etc.					
	Foliage	18.7	14.7	18.7	18.3	21.8
Root estimate						
CAI (m ³ /ha/yr)	13.2	10.4	17.3	16.9	22.0	
Net production (t/ha/yr)	Stem wood	} 4.97 ^{bd}	} 3.90 ^{bd}	} 7.58 ^{bd}	} 7.43 ^{bd}	} 8.99 ^{bd}
	Stem bark					
	Branches					
	Fruits etc.					
	Foliage	4.68 ^c	3.68 ^c	4.68 ^c	4.58 ^c	5.45 ^c
Root estimate	1.24 ^d	0.98 ^d	1.90 ^d	1.86 ^d	2.25 ^d	

Eight or nine trees were sampled per stand in November, and biomass values for the above plots (25 m² at age 11, 100 m² at age 22 and 510 m² at age 31) were derived by proportional basal area allocation. Increments were estimated over one year.

a. All-sided LAI values can be obtained by multiplying by 2.3.

b. Excluding any woody litterfall and mortality.

c. Assumed to be 25% of the foliage biomass.

d. The authors gave total woody increment (stems, branches and roots); here it is assumed that the roots grew at the same relative rates as above-ground woody parts; alternatively the roots could be assumed to be 20% of the total increment including leaves.

Tadaki, Y., Ogata, N. and Nagatomo, Y. (1965). The dry matter productivity in several stand of *Cryptomeria japonica* in Kyushu. *Bull. Govt Forest Exp. Stn Tokyo* 173, 45-66.

Japan		ca.33°00'N 131°30'E 850 m Oita Prefecture			ca.32°00'N 131°31'E 150 m Miyazaki Prefecture		
Plantations		<i>Cryptomeria japonica</i>					
		Clone 'Yabukuguri'			Clone 'Aka'		
Age (years)		34	34	34	24	34	49
Trees/ha		1333	1952	2420	2110	1239	722
Tree height (m)		12.3	11.4	12.9	12.5	14.7	17.3
Basal area (m ² /ha)		59.4	58.0	63.3	46.6	42.7	47.6
Leaf area index		4.1 ^a	5.3 ^a	5.7 ^a	6.4 ^a	5.0 ^a	4.3 ^a
Stem volume (m ³ /ha)		380	377	409	266	311	372
Dry biomass (t/ha)	Stem wood	} 115.7	} 110.3	} 120.3	} 95.2	} 88.4	} 109.0
	Stem bark						
	Branches	9.0	14.6	10.4	15.6	14.7	13.3
	Fruits etc.						
	Foliage	16.5	21.1	22.7	25.6	20.0	17.3
	Root estimate	35.3 ^b	36.5 ^b	38.3 ^b	34.1 ^b	30.8 ^b	34.9 ^b
CAI (m ³ /ha/yr)		15.2	22.5	25.6	19.4	17.8	8.5
Net production (t/ha/yr)	Stem wood	} 3.6 ^c	} 5.9 ^c	} 7.1 ^c	} 5.5 ^c	} 4.8 ^c	} 2.8 ^c
	Stem bark						
	Branches						
	Fruits etc.						
	Foliage	4.1 ^d	5.3 ^d	5.7 ^d	6.4 ^d	5.0 ^d	4.3 ^d
	Root estimate	1.9 ^e	2.8 ^e	3.2 ^e	3.2	2.5	1.8

Eight to ten trees of clone 'Yabukuguri' were sampled per stand in March; three to six trees of clone 'Aka' were sampled per stand in November. Stand biomass values for the above 999-1373 m² plots of 'Yabukuguri' and 123-416 m² plots of 'Aka' were derived by proportional basal area allocation. Increments were estimated over one year.

a. All-sided LAI values can be obtained by multiplying by 2.3.

b. Assumed to be 20% of the total biomass.

c. Excluding any woody litterfall and mortality.

d. Assumed to be 25% of the foliage biomass.

e. The authors gave total woody increment (stem, branches and roots); here it is assumed that 20% of that total was roots.

Yoshioka, K. and Miyagawa, Y. (1965). On the productivity with [the] different [of] stand densities in Sugi (*Cryptomeria japonica* D. Don). *Bull. Nagasaki Agric. For. Exp. Stn* 1, 34-43.

ca. 33°N 130°E 200-500 m Japan, Nagasaki Prefecture, Higashi-Nagasaki District.

Plantations.

Cryptomeria japonica

Only the 28-year-old stand was thinned;
all the other stands were unthinned.

	10	10	11	18	21	22	28	31	34	
Age (years)	10	10	11	18	21	22	28	31	34	
Trees/ha	4240	8000	9930	2540	5420	7540	2780	3660	1200	
Tree height (m)	6.3	6.4	5.4	10.1	8.0	8.4	13.9	10.7	13.1	
Basal area (m ² /ha)	20.3	24.2	23.6	29.7	28.3	38.8	39.2	40.1	32.6	
Leaf area index										
Stem volume (m ³ /ha)	83	101	85	179	136	221	304	247	226	
Dry biomass (t/ha)	Stem wood	} 31.3	} 34.5	} 30.6	} 62.0	} 46.6	} 80.7	} 108.3	} 93.8	} 71.6
	Stem bark									
	Branches	4.8	2.2	3.0	6.4	6.5	7.7	7.8	12.3	12.4
	Fruits etc.									
	Foliage	11.0	11.7	16.3	14.6	20.1	18.6	14.5	21.8	17.7
Root estimate										
CAI (m ³ /ha/yr)										
Net production (t/ha/yr)	Stem wood									
	Stem bark									
	Branches									
	Fruits etc.									
	Foliage									
Root estimate										

About 65 trees were sampled in all. Stand values for the above 500-510 m² plots were derived from regressions on D.

Tadaki, Y., Ogata, N. and Nagatomo, Y. (1967). Studies on production structure of forest. XI Primary productivities of 28-year-old plantations of *Cryptomeria* of cuttings and seedlings origin. *Bull. Govt Forest Exp. Stn Tokyo* 199, 47-65.

Tadaki, Y. and Kawasaki, Y. (1966). Studies on the production structure of forest. IX Primary productivity of a young *Cryptomeria* plantation with excessively high stand density. *J. Jap. For. Soc.* 48, 55-61.

Japan ca.33°20'N 131°00'E 300 m ca.32°50'N 130°42'E 50 m
Kyushu District, nr Hita city nr Kumamoto city

Plantations.

Cryptomeria japonica

(Tadaki *et al.* 1967)

Clones

Raised
from cuttings

Raised
from seed

Black volcanic
nursery soil

Age (years)	28	28	5	
Trees/ha	1250	1150	29500	
Tree height (m)	18.5	15.0	5.0	
Basal area (m ² /ha)	54.9	37.0	37.2	
Leaf area index	3.8 ^a	4.3 ^a	7.4 ^a	
Stem volume (m ³ /ha)	501	285	137	
Dry biomass (t/ha)	Stem wood	} 177.5	} 110.6	} 50.7
	Stem bark			
	Branches	9.8	14.6	1.8
	Fruits etc.	0.1	0.4	
	Foliage	15.0	17.3	26.5
	Root estimate	50.6 ^b	35.7 ^b	18.3
CAI (m ³ /ha/yr)	23.7	13.1	35.3	
Net production (t/ha/yr)	Stem wood	} 8.7 ^e + 2.5 ^c	} 5.5 ^e + 3.7 ^c	} 16.6 ^{de}
	Stem bark			
	Branches			
	Fruits etc.	0.1	0.4	
	Foliage	3.8 ^c	4.3 ^c	6.6 ^c
Root estimate	3.7 ^e	2.3 ^e	5.9 ^e	

Six trees were sampled per plot, and stand biomass values for the above plots of 200 m² at Hita and 20 m² at Kumamoto were derived by proportional basal area allocation. At Hita very similar alternative values were derived using regressions on D²H. Increments were estimated over one year.

a. All-sided LAI values can be obtained by multiplying by 2.3.

b. Assumed to be 25% of the above-ground biomass value.

c. Foliage increment and branch litterfall were both assumed to be about 25% of their biomass values. d. Excluding woody litterfall and mortality.

e. The authors gave the total woody increment (stems, branches and roots); here it is assumed that 30% of the woody increment at Hita was roots, and that roots at Kumamoto grew at the same relative rate as above-ground woody parts.

Satoo, T. and Senda, M. (1966). Materials for the studies of growth in stands. VI Biomass, dry matter production, and efficiency of leaves in a young *Cryptomeria* plantation. *Bull. Tokyo Univ. For.* 62, 117-146.

Harada, H., Satoo, H., Hotta, I. and Tadaki, Y. (1969). On the amount of nutrient contained in 28-year-old *Cryptomeria* forest (*C. japonica* D. Don) and *Chamaecyparis* forest (*C. obtusa* Sieb. et Zucc.). *J. Jap. For. Soc.* 51, 125-133.

Japan	ca.43°13'N 230 m	142°23'E Hokkaido	ca.35°N 680-700 m	138°E	
Plantations	<i>Cryptomeria japonica</i> ^a (Satoo and Senda 1966)		<i>C. japonica</i> with bamboo understorey (Harada <i>et al.</i> 1969) Poor gravelly soil Fertile loam		
Age (years)	29		28	28	
Trees/ha	3675		2800	1724	
Tree height (m)	10		5.8	12.2	
Basal area (m ² /ha)			27	45	
Leaf area index					
Stem volume (m ³ /ha)	293 (or 210) ^b		86	245	
Dry biomass (t/ha)	Stem wood	} 98.9 (or 71.0) ^b	} 37.0	} 98.3	
	Stem bark				} + 6.6 ^e
	Branches	11.7	12.9		
	Fruits etc.				
	Foliage	17.9 (or 14.3) ^b	13.0 + 2.2 ^e	17.2 + 0.1 ^e	
Root estimate			30.3		
CAI (m ³ /ha/yr)	9.1 (or 8.4) ^b				
Net production (t/ha/yr)	Stem wood	} 3.07 ^c (or 2.84) ^{bc}			
	Stem bark				
	Branches	1.12 ^c (or 0.98) ^{bc}			
	Fruits etc.				
	Foliage	5.38 ^d (or 4.28) ^{bd}			
Root estimate					

Satoo and Senda (1966) sampled 28 trees and derived stand biomass values for a 600 m² plot from regressions on D.

Harada *et al.* (1969) sampled 5 trees from the poor site, 8 from the fertile site, and derived stand values for 200-400 m² plots from regressions on D²H; nutrient contents were determined.

a. *C. japonica* actually comprised only 70% of the total basal area, but calculation were made as if it were a pure stand.

b. Alternative values estimated by proportional basal area allocation.

c. Excluding woody litterfall and any mortality.

d. Assumed to be 30% of the foliage biomass.

e. Bamboo understorey.

Yamada, I. and Shidei, T. (1968). On the root biomass of *Cryptomeria japonica* stands. *Bull. Kyoto Univ. For.* 40, 67-92.

33-35°N 131-136°E -- Japan.

Plantations

Cryptomeria japonica

Age (years)	13	14	14	17	21	23	23	
Trees/ha	40740	4400	5880	2083	2770	1887	2935	
Tree height (m)	4.3	8.2	8.7	11.5	9.6	13.3	9.3	
Basal area (m ² /ha)								
Leaf area index								
Stem volume (m ³ /ha)								
Dry biomass (t/ha)	Stem wood	} 50.4	} 53.0	} 76.4	} 76.4	} 54.3	} 101.5	} 88.6
	Stem bark							
	Branches	1.2	5.6	6.5	4.5	3.6	7.1	10.9
	Fruits etc.							
	Foliage	18.9	21.0	20.5	21.1	11.8	16.4	23.9
	Root estimate	14.7	18.0	20.1	29.1	21.5	33.6	33.4
CAI (m ³ /ha/yr)								
Net production (t/ha/yr)	Stem wood							
	Stem bark							
	Branches							
	Fruits etc.							
	Foliage							
	Root estimate							

Between 5 and 50 trees were sampled per stand at various locations, and many root systems were excavated. Stand values were derived from regressions on D and D²H.

Saito, H., Yamada, I. and Shidei, T. (1967). Studies on the effects of thinning from small diametered trees. II Changes in stand condition after single growing season. *Bull. Kyoto Univ. For.* 39, 64-78.

Saito, H., Kan, M. and Shidei, T. (1966). Studies on the effects of thinning from small diametered trees. I Changes in stand conditions before and after thinning. *Bull. Kyoto Univ. For.* 38, 50-67.

ca.34°24'N 136°05'E 900 m Japan, Nara Prefecture, Yoshino District.

Plantation.
Soils derived
from shale.

Cryptomeria japonica

Thinning treatments were applied at age 9.

	Unthinned	16% ^a thinned	37% ^a thinned	46% ^a thinned	64% ^a thinned	
Age (years)	10	10	10	10	10	
Trees/ha	4400	3280	2660	2000	1200	
Tree height (m)	8.2	8.3	7.3	7.7	10.0	
Basal area (m ² /ha)	36.4	29.8	19.2	18.0	16.0	
Leaf area index						
Stem volume (m ³ /ha)						
Dry biomass (t/ha)	Stem wood	} 53.0	} 42.0	} 25.0	} 23.0	
	Stem bark					} 26.0
	Branches	5.6	4.5	2.7	2.8	
	Fruits etc.					
	Foliage	21.0	17.0	11.0	10.0	9.3
	Root estimate	18.0	15.0			8.7
CAI (m ³ /ha/yr)						
Net production (t/ha/yr)	Stem wood	} 8.11	} 5.39	} 5.06	} 3.35	
	Stem bark					} 4.37
	Branches	0.63	0.61	0.44 ^c	0.45 ^c	
	Fruits etc.	} +5.03 ^b	} +2.63 ^b	} 1.48 ^c	} 1.45 ^c	} +C
	Foliage					
	Root estimate	2.25	1.71			1.42

Twelve trees were sampled, 9 root systems were excavated, and stand biomass values for the above 64-100 m² plots were derived from regressions on D, H, and diameters at the base of the crowns. Increments were calculated for the one year since thinning. See also Saito *et al.* (1968), p.153, and Tamai and Shidei (1971), p.154, who measured this experiment at ages 12 and 14, respectively.

a. Percentage of the trees removed at age 9.

b. Total litterfall; there was no mortality.

c. Excluding litterfall.

Saito, H., Tamai, S., Ogino, K. and Shidei, T. (1968). Studies on the effects of thinning from small diametered trees. III Changes in stand condition after the second growing season. *Bull. Kyoto Univ. For.* 40, 81-92.

ca. 34°24'N 136°05'E 900 m Japan, Nara Prefecture, Yoshino District.

Cryptomeria japonica

Plantation.

Soils derived from shale.

Thinning treatments were applied at age 9.

	Unthinned	16% ^a thinned	37% ^a thinned	46% ^a thinned	64% ^a thinned		
Age (years)	12	12	12	12	12		
Trees/ha	4400	3280	2660	2000	1200		
Tree height (m)	9.0	9.4	8.0	8.5	10.6		
Basal area (m ² /ha)	41.9	33.9	23.0	22.1	19.2		
Leaf area index							
Stem volume (m ³ /ha)							
Dry biomass (t/ha)	Stem wood	} 65.4	} 53.3	} 32.2	} 31.4	} 32.3	
	Stem bark						
	Branches	6.5	5.0	3.3	3.9	3.5	
	Fruits etc.						
	Foliage	23.2	18.6	12.6	13.8	11.5	
	Root estimate	21.2	16.5			11.1	
CAI (m ³ /ha/yr)							
Net production (t/ha/yr)	Stem wood	} 12.3	} 10.8	} 7.1	} 8.8	} 6.3	
	Stem bark						
	Branches	0.9	} +5.4 ^b	} +5.7 ^b	} 0.6 ^c	} 1.1 ^c	} 0.8
	Fruits etc.						
	Foliage	2.2	1.6	1.9 ^c	3.4 ^c	2.3	
	Root estimate	3.5	2.0			2.4	

Stand biomass values for the above 64-100 m² plots were derived from regressions calculated by Saito *et al.* (1967), p.152. Increments were calculated for the previous one year (i.e. ages 11 to 12). See also Saito *et al.* (1967), p.152, and Tamai and Shidei (1971), p.154, who measured this experiment at ages 10 and 14, respectively.

a. Percentage of the trees removed at age 9.

b. Total litterfall; there was no mortality.

c. Excluding litterfall.