Tamai, S. and Shidei, T. (1971). Studies on the effects of thinning from small diametered trees. IV Changes in stand condition after the fourth growing season. *Bull. Kyoto Univ. For.* 42, 163-173.

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)	14	14	14	14	14
Trees/ha	4100	3280	2500	2000	1200
Tree height (m)	10.4	10.4	9.4	9.6	12.6
Basal area (m^2/ha)	47.8	38.0	27.7	27.3	24.2
Leaf area index					
Stem volume (m^3/ha)					
Dry biomass (t/ha): Stem wood, Stem bark	78.8	66.6	41.6	43.2	47.2
Dry biomass (t/ha): Branches	6.5	6.2	4.4	5.6	4.7
Dry biomass (t/ha): Fruits etc.					
Dry biomass (t/ha): Foliage	23.5	21.9	15.6	17.3	15.8
Dry biomass (t/ha): Root estimate	25.4	20.5			15.0
CAI (m^3/ha/yr)					
Net production (t/ha/yr): Stem wood, Stem bark	2.7	8.0	3.2	5.0	7.9
Net production (t/ha/yr): Branches	-0.2	0.5	0.3[c]	0.7[c]	0.4
Net production (t/ha/yr): Fruits etc.	+2.8[b]	+8.2[b]			+0.8[b]
Net production (t/ha/yr): Foliage	-1.3	1.4	0.6[c]	0.5[c]	1.8
Net production (t/ha/yr): Root estimate	2.2	0.6			1.6

Twelve trees were sampled and their roots were excavated. Stand biomass values for the above 64-100 m^2 plots were derived from regressions on D, H, and diameters at the base of the crowns. Increments were calculated for the one year prior to sampling (i.e. ages 13 to 14). See also Saito *et al.* (1967), p.152, and (1968), p.153, who measured this experiment at ages 10 and 12, respectively.

a. Percentage of the trees removed at age 9.
b. Total litterfall, but excluding mortality in the stand with 4100 trees/ha.
c. Excluding litterfall, and mortality in the stand with 2500 trees/ha.

Ando, T., Hatiya, K., Doi, K., Kataoka, H., Kato, Y. and Sakaguchi, K. (1968). Studies on the system of density control of Sugi (*Cryptomeria japonica*) stand. *Bull. Govt Forest Exp. Stn Tokyo* 209, 1-76.

34°10'N 136°10'E -- Japan, Nara Prefecture, Yoshino District.

Plantations. *Cryptomeria japonica*

Seedlings planted at close spacings, given frequent, light thinnings[a], and pruned to 1.2-1.5 m height at age 10.

Age (years)	10	15	19	24	31	45	51	60
Trees/ha	12019	6865	4503	3438	2557	1557	1321	980
Tree height (m)	5.3	7.1	10.5	12.3	14.5	18.6	21.3	21.9
Basal area (m^2/ha)	25.1	29.0	36.6	44.8	52.8	61.0	59.1	60.6
Leaf area index								
Stem volume (m^3/ha)								
Dry biomass (t/ha) Stem wood	25.9	40.6	77.6	106.0	137.5	201.4	220.4	238.7
Dry biomass (t/ha) Stem bark								
Dry biomass (t/ha) Branches	3.5	3.2	7.9	8.2	11.6	13.8	15.3	13.6
Dry biomass (t/ha) Fruits etc.								
Dry biomass (t/ha) Foliage	20.0	15.2	22.7	24.0	21.4	21.9	30.4	21.7
Dry biomass (t/ha) Root estimate								
CAI (m^3/ha/yr)	13.4	18.3	22.7	27.7	21.8	24.4	24.1	21.1
Net production (t/ha/yr) Stem wood	4.4[b]	6.1[b]	7.7[b]	9.5[b]	7.5[b]	8.5[b]	8.4[b]	7.4[b]
Net production (t/ha/yr) Stem bark								
Net production (t/ha/yr) Branches	1.8[b]	0.9[b]	2.0[b]	1.9[b]	1.6[b]	1.5[b]	1.8[b]	1.5[b]
Net production (t/ha/yr) Fruits etc.								
Net production (t/ha/yr) Foliage	5.0[c]	3.8[c]	5.7[c]	6.0[c]	5.3[c]	5.5[c]	7.6[c]	5.4[c]
Net production (t/ha/yr) Root estimate	2.4[d]	2.5[d]	3.0[d]	3.5[d]	2.7[d]	2.8[d]	2.9[d]	2.4[d]

Eight trees were sampled in each of the above stands, and stand biomass values were derived by proportional basal area allocation.

a. Values given here refer to the stands before each thinning.

b. Excluding thinnings and any woody litterfall.

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

d. Assuming top/root ratios to be 3.5.

Continued from p.155.

ca.36°N 139°E -- Japan, Saitama Prefecture, Nishikawa District, near Hanno city.

Plantations. *Cryptomeria japonica*

Seedlings planted at close spacings. Lightly thinned[a] and pruned at ages 10-13, 18-20 and 25-26.

Age (years)		10	15	20	25	29	35
Trees/ha		3504	2933	2650	2238	2022	1754
Tree height (m)		6.8	9.5	11.4	14.5	15.5	18.2
Basal area (m^2/ha)		19.0	28.0	37.6	39.9	45.1	49.1
Leaf area index							
Stem volume (m^3/ha)		68	141	230	319	375	499
Dry biomass (t/ha)	Stem wood	} 24.4	} 47.9	} 77.4	} 106.8	} 125.8	} 181.1
	Stem bark						
	Branches	3.1	4.7	7.2	5.1	8.7	11.0
	Fruits etc.						
	Foliage	18.9	25.5	25.7	23.1	24.0	18.1
	Root estimate						
CAI (m^3/ha/yr)		16.6	17.7	21.0	22.1	20.8	23.8
Net production (t/ha/yr)	Stem wood	} 5.8[b]	} 5.8[b]	} 6.9[b]	} 7.6[b]	} 7.0[b]	} 8.9[b]
	Stem bark						
	Branches	0.6[b]	1.0[b]	1.5[b]	0.9[b]	1.2[b]	0.8[b]
	Fruits etc.						
	Foliage	4.7[c]	6.1[c]	6.4[c]	5.8[c]	6.0[c]	4.5[c]
	Root estimate	3.2[d]	2.7[d]	2.8[d]	2.6[d]	2.3[d]	3.0[d]

See p.155.

Continued from p.156.

ca.37°00'N 140°40'E -- Japan, Ibaraki-Fukushima Prefectures, Kitakanto-Abukuma District.

Plantations. *Cryptomeria japonica*

Seedlings planted at intermediate spacings, moderately thinned[a] but not pruned.

Age (years)	9	16	20	26	29	34	45	53
Trees/ha	2210	2652	2378	1723	1528	1189	822	726
Tree height (m)	4.4	7.8	11.4	14.6	15.8	17.6	19.0	22.1
Basal area (m^2/ha)	7.0	28.4	38.8	40.3	48.7	52.2	51.7	53.3
Leaf area index								
Stem volume (m^3/ha)	24	121	255	342	393	487	490	620
Dry biomass (t/ha) Stem wood	6.3	33.8	72.1	97.7	113.5	143.1	150.0	198.3
Dry biomass (t/ha) Stem bark								
Dry biomass (t/ha) Branches	2.8	8.1	8.2	6.3	13.6	13.1	14.8	17.6
Dry biomass (t/ha) Fruits etc.								
Dry biomass (t/ha) Foliage	10.1	20.6	22.9	18.6	16.6	18.3	23.1	28.1
Dry biomass (t/ha) Root estimate								
CAI (m^3/ha/yr)	6.9	13.8	26.6	22.9	27.7	23.4	19.1	28.2
Net production (t/ha/yr) Stem wood	2.0[b]	3.9[b]	7.7[b]	6.7[b]	8.3[b]	7.2[b]	6.4[b]	10.4[b]
Net production (t/ha/yr) Stem bark								
Net production (t/ha/yr) Branches	0.8[b]	2.1[b]	2.1[b]	1.5[b]	1.7[b]	1.5[b]	1.2[b]	1.9[b]
Net production (t/ha/yr) Fruits etc.								
Net production (t/ha/yr) Foliage	2.5[c]	5.2[c]	5.7[c]	4.7[c]	4.2[c]	4.6[c]	5.8[c]	7.0[c]
Net production (t/ha/yr) Root estimate	1.7[d]	1.8[d]	3.0[d]	2.4[d]	3.0[d]	2.5[d]	1.8[d]	3.5[d]

See p.155.

Continued from p.157.

31°40'N 131°20'E ca. 50 m Japan, Miyazaki Prefecture, Obi District, near Nichinan city.

Plantations. *Cryptomeria japonica*

Cuttings planted at wide spacings and lightly thinned[a] but not pruned.

Age (years)		10	17	21	25	31	34	39	45
Trees/ha		1500	1541	923	838	673	575	458	435
Tree height (m)		3.7	7.1	10.0	12.7	14.9	17.9	18.2	20.2
Basal area (m^2/ha)		4.3	19.6	30.2	35.6	40.4	45.1	47.2	54.0
Leaf area index									
Stem volume (m^3/ha)		12	70	151	222	288	376	378	464
Dry biomass (t/ha)	Stem wood	4.2	24.7	53.1	76.6	97.7	129.8	129.7	159.0
	Stem bark								
	Branches	2.0	7.5	12.9	13.6	12.2	13.1	16.0	18.1
	Fruits etc.								
	Foliage	6.7	14.1	20.5	23.3	16.8	17.2	16.5	21.4
	Root estimate								
CAI (m^3/ha/yr)		3.9	7.3	17.6	21.0	12.6	16.7	13.0	16.1
Net production (t/ha/yr)	Stem wood	1.4[b]	2.6[b]	6.2[b]	7.3[b]	4.3[b]	5.8[b]	4.5[b]	5.5[b]
	Stem bark								
	Branches	0.7[b]	2.2[b]	3.2[b]	2.8[b]	2.5[b]	2.6[b]	2.5[b]	3.3[b]
	Fruits etc.								
	Foliage	1.7[c]	3.5[c]	5.1[c]	5.8[c]	4.2[c]	4.3[c]	4.1[c]	5.4[c]
	Root estimate	1.3[d]	1.4[d]	2.9[d]	3.1[d]	1.6[d]	2.0[d]	1.6[d]	2.0[d]

See p.155.

Harada, H., Satoo, H., Hotta, I., Hatiya, K. and Tadaki, Y. (1972). Study on the nutrient contents of mature *Cryptomeria* forest. *Bull. Govt Forest Exp. Stn Tokyo* 249, 17-74.

ca.35°N 138°E (alt. given below) Japan, Shizuoka Prefecture.

Cryptomeria japonica

Plantations. Soils derived from volcanic ash.

	Hakone		Amagi			Keta		
	760 m	680 m	760 m	700 m	560 m	940 m	1040 m	900 m
Age (years)	28	28	35	38	38	48	48	49
Trees/ha	1720	2800	2470	2050	1410	860	1100	1310
Tree height (m)	12.2	5.8	11.4	14.0	18.3	21.8	18.3	12.9
Basal area (m^2/ha)	45	27	41	49	55	66	55	51
Leaf area index								
Stem volume (m^3/ha)	260	70	280	410	520	600	490	350
Dry biomass (t/ha) Stem wood	98	37	103	155	175	183	152	115
Dry biomass (t/ha) Stem bark								
Dry biomass (t/ha) Branches	16	14	20	18	18	24	20	28
Dry biomass (t/ha) Fruits etc.	0	0	0	0	0	1	1	1
Dry biomass (t/ha) Foliage	11	14	12	10	14	17	15	18
Dry biomass (t/ha) Root estimate	30		32	49	45	81		54
CAI (m^3/ha/yr)								
Net production (t/ha/yr) Stem wood	5.87[a]	1.91[a]	3.93[a]	4.39[a]	6.26[a]	4.15[a]	3.94[a]	3.10[a]
Net production (t/ha/yr) Stem bark								
Net production (t/ha/yr) Branches	1.12[a]	0.36[a]	0.75[a]	0.83[a]	1.19[a]	0.79[a]	0.75[a]	0.59[a]
Net production (t/ha/yr) Fruits etc.								
Net production (t/ha/yr) Foliage	3.50[b]	2.75[b]	3.00[b]	2.50[b]	3.50[b]	4.25[b]	3.75[b]	4.50[b]
Net production (t/ha/yr) Root estimate	1.63	0.53	1.09	1.41	1.62	1.76	1.62	1.23

At Hakone and Amagi five to eight trees were sampled per stand and a total of eleven root systems were excavated. At Keta eight trees were sampled from each stand and a total of four root systems were excavated. Stand biomass values were derived from regressions on D^2H. Nutrient contents were determined.

a. Excluding woody litterfall and any mortality.

b. Foliage litterfall.

Continued from p.159.

Japan	36°00'N 139°08'E			38°13'N 139°28'E		
	300 m			160-180 m		
Plantations	Saitama Prefecture, Chichibu			Niigata Prefecture, Murakami		
	Cryptomeria japonica					
Age (years)	55	55	55	59	59	59
Trees/ha	2005	2020	928	837	2680	621
Tree height (m)	13.4	15.1	20.9	21.5	7.1	25.8
Basal area (m^2/ha)	40	50	53	64	31	68
Leaf area index						
Stem volume (m^3/ha)	320	420	520	680	130	770
Dry biomass (t/ha) Stem wood	112	144	170	240	73	268
Dry biomass (t/ha) Stem bark						
Dry biomass (t/ha) Branches	12	17	11	24	28	30
Dry biomass (t/ha) Fruits etc.	0	0	0	0	0	0
Dry biomass (t/ha) Foliage	16	22	15	18	14	20
Dry biomass (t/ha) Root estimate	32		75		27	
CAI (m^3/ha/yr)						
Net production (t/ha/yr) Stem wood	5.45[a]	6.35[a]	3.12[a]	8.79[a]	3.24[a]	7.74[a]
Net production (t/ha/yr) Stem bark						
Net production (t/ha/yr) Branches	1.04[a]	1.21[a]	0.59[a]	1.67[a]	0.62[a]	1.47[a]
Net production (t/ha/yr) Fruits etc.						
Net production (t/ha/yr) Foliage	4.00[b]	5.50[b]	3.75[b]	4.50[b]	3.50[b]	5.00[b]
Net production (t/ha/yr) Root estimate	1.48	2.16	1.43	2.68	0.99	2.36

Five to eight trees were sampled per stand. Four root systems were excavated in all from the 55-year-old stands, and two from the 59-year-old stands. Stand biomass values were derived from regressions on D^2H. Nutrient contents were determined.
a. Excluding woody litterfall and any mortality.
b. Foliage litterfall.

Saito, H., Yamada, I. and Shidei, T. (1972). Some discussions on dry matter production of young stands of *Cryptomeria japonica* D. Don with excessively high stand density. *Bull. Kyoto Univ. For.* 44, 121-140.

Japan	34°04'N 131°48'E ca. 50 m Yamaguchi Prefecture, Tokuyama nursery		ca.34°40'N 136°30'E 50 m Mie Prefecture Ichishi nursery
Plantations. Fertile nursery loams.	*Cryptomeria japonica*		
Age (years)	10	10	9
Trees/ha	42600	38900	100000
Tree height (m)	5.3[a]	5.1[a]	3.4[a]
Basal area (m^2/ha)	37.1	26.0	14.4
Leaf area index			
Stem volume (m^3/ha)	131.0	87.8	27.7
Dry biomass (t/ha) Stem wood	60.0	39.9	12.7
Dry biomass (t/ha) Stem bark			
Dry biomass (t/ha) Branches	1.9	0.5	0.8
Dry biomass (t/ha) Fruits etc.	2.0	0.9	0.0
Dry biomass (t/ha) Foliage	18.5	16.5	7.4
Dry biomass (t/ha) Root estimate	15.3	14.1	3.2
CAI (m^3/ha/yr)	18.4	19.6	7.2
Net production (t/ha/yr) Stem wood	8.5[b]	9.0[b]	3.3[b]
Net production (t/ha/yr) Stem bark			
Net production (t/ha/yr) Branches	2.2[b]	2.5[b]	1.0[b]
Net production (t/ha/yr) Fruits etc.	ca.0.5	ca.0.5	0.0
Net production (t/ha/yr) Foliage	4.6[c]	4.1[c]	1.9[c]
Net production (t/ha/yr) Root estimate	2.6	4.0	1.0

Stand values at Tokuyama were derived by harvesting all trees, including roots, within plots of only about 6 m^2. Stand values at Ichishi were derived from regressions on D^2H, calculated using over 45 sample trees, except for branch biomass values which were estimated by proportional basal area allocation. There were 3700, 7400 and 78600 dead trees per hectare in columns left to right. Increments were calculated for the previous one year.

a. Mean height of the dominant trees.

b. Excluding woody litterfall and mortality.

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

Saito, H. and Shidei, T. (1973). Studies on the productivity and its estimation methodology in a young stand of *Cryptomeria japonica* D. Don. *J. Jap. For. Soc.* 55, 52-62.

34°30'N 136°20'E 400 m Japan, Mie Prefecture, Kii Peninsula.

Plantations

		Cryptomeria japonica	
Age (years)		12	12
Trees/ha		6106	5600
Tree height (m)		8.4[a]	9.2[a]
Basal area (m^2/ha)		40.8	40.4
Leaf area index			
Stem volume (m^3/ha)		180	186
Dry biomass (t/ha)	Stem wood	68.3	70.5
	Stem bark		
	Branches	5.3	5.8
	Fruits etc.		
	Foliage	19.8	20.5
	Root estimate	18.1	18.7
CAI (m^3/ha/yr)		23.8	24.6
Net production (t/ha/yr)	Stem wood	9.1 (or 9.0)[c]	9.4 (or 10.3)[c]
	Stem bark		
	Branches	1.9[b] (or 6.4)[bc]	2.2[b] (or 6.9)[bc]
	Fruits etc.		
	Foliage	2.9[d]	3.0[d]
	Root estimate	2.4	2.7

Thirteen trees were sampled in all and 8 root systems were excavated. Stand biomass values for the above two 100 m^2 plots were derived from regressions on D^2H.

a. Mean height of the dominant trees.

b. Including woody litterfall of 0.03 and 0.08 t/ha/yr in the left and right columns, respectively.

c. Alternative values, estimated from the difference in biomass measured at ages 10 and 12, rather than from the increase in D^2H and the biomass of new foliage.

d. New foliage biomass; foliage litterfall was 0.9 and 1.5 t/ha/yr in the left and right columns, respectively.

Satoo, T. (1979d). Loss of canopy biomass due to thinning - a comparison of two young stands of *Cryptomeria japonica* of cutting and seedling origins. *J. Jap. For. Soc.* 61, 83-87.

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ca.35°N 140°E -- Japan, Chiba Prefecture, southern Boso Peninsula.

Plantations. *Cryptomeria japonica*

		Raised from seed		Raised from cuttings	
Age (years)		13	13	13	13
Trees/ha		4800	4700	3700	4300
Tree height (m)		9.0	9.2	8.5	8.9
Basal area (m^2/ha)		38.6	41.7	33.5	34.8
Leaf area index					
Stem volume (m^3/ha)					
Dry biomass (t/ha)	Stem wood	64.1	69.2	57.8	60.7
	Stem bark				
	Branches	8.6	8.4	6.1	5.3
	Fruits etc.				
	Foliage	35.2	30.6	28.5	30.3
	Root estimate				
CAI (m^3/ha/yr)					
Net production (t/ha/yr)	Stem wood	11.3[a]	9.2[a]	7.2[a]	8.0[a]
	Stem bark				
	Branches				
	Fruits etc.				
	Foliage				
	Root estimate				

Five trees were sampled from each of the above 100 m^2 plots in early May and stand values were derived from regressions on D.

a. Excluding woody litterfall and any mortality.

Kawanabe, S., Saito, H. and Shidei, T. (1975). Studies on the effects of thinning small diametered trees. V Changes in stand conditions and biomass of *Cryptomeria japonica* D. Don. stand during six years after thinning. *J. Jap. For. Soc.* 57, 215-223.

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

Plantations.
Soils derived from shale.

Cryptomeria japonica

All plots were unthinned.

Age (years)		10	11	12	13	14	15	16
Trees/ha		4400	4400	4400	4200[a]	4200	4100[a]	4100
Tree height (m)		7.4	8.2	9.0	9.8	10.4	10.6	11.1
Basal area (m^2/ha)		33.1	36.4	41.9	44.6	47.8	48.9	50.5
Leaf area index								
Stem volume (m^3/ha)								
Dry biomass (t/ha)	Stem wood	44.6	53.0	65.4	76.1	81.0	86.9	93.1
	Stem bark							
	Branches	5.0	5.6	6.5	6.7	6.5	6.0	6.2
	Fruits etc.							
	Foliage	18.9	20.8	23.2	24.8	23.5	21.7	22.5
	Root estimate	15.5	17.6	21.2	23.2	25.4	26.5	27.8
CAI (m^3/ha/yr)								
Net production (t/ha/yr)	Stem wood		8.4	12.4	10.7	4.9	5.9	6.2
	Stem bark							
	Branches							
	Fruits etc.							
	Foliage							
	Root estimate							

Twelve trees were sampled at age 10, twenty at age 16, and stand values for the above 64-100 m^2 plots were derived from regressions on D and D^2H.
a. The densities of these stands were decreased by snow breakage.

Continued from p.164.

Same as p.164.

All plots were thinned from 3910 trees/ha at age 10.

Age (years)	10	11	12	13	14	15	16
Trees/ha	3280	3280	3280	3280	3280	3280	3280
Tree height (m)	7.8	8.3	9.4	9.9	10.4	11.0	11.3
Basal area (m^2/ha)	27.3	29.8	33.9	37.4	38.7	41.1	45.5
Leaf area index							
Stem volume (m^3/ha)							
Dry biomass (t/ha) Stem wood	36.9	42.7	53.3	61.8	66.6	73.7	81.1
Stem bark							
Branches	3.9	4.5	5.0	5.7	6.2	5.2	5.4
Fruits etc.							
Foliage	14.9	16.7	18.6	20.5	21.9	18.8	19.4
Root estimate	12.9	14.5	16.5	19.6	20.5	22.3	24.5
CAI (m^3/ha/yr)							
Net production (t/ha/yr) Stem wood		5.8	10.6	8.5	4.8	7.1	7.4
Stem bark							
Branches							
Fruits etc.							
Foliage							
Root estimate							

Twelve trees were sampled at age 10, twenty at age 16, and stand values for the above 64-100 m^2 plots were derived from regressions on D and D^2H.

Continued from p.165.

Same as p.164.

All plots were thinned from 3300 trees/ha at age 10.

Age (years)		10	11	12	13	14	15	16
Trees/ha		1200	1200	1200	1200	1200	1200	1200
Tree height (m)		9.3	10.0	10.6	11.3	12.1	12.9	13.5
Basal area (m^2/ha)		14.0	16.0	19.2	22.3	24.2	26.6	29.5
Leaf area index								
Stem volume (m^3/ha)								
Dry biomass (t/ha)	Stem wood Stem bark	21.6	26.0	32.3	39.3	45.2	52.3	59.9
	Branches	2.1	2.7	3.5	4.3	4.7	5.4	6.2
	Fruits etc.							
	Foliage	7.6	9.2	11.5	13.9	15.8	16.6	19.0
	Root estimate	7.3	8.7	11.1	13.4	15.0	17.0	19.5
CAI (m^3/ha/yr)								
Net production (t/ha/yr)	Stem wood Stem bark		4.4	6.3	7.0	5.9	7.1	7.6
	Branches							
	Fruits etc.							
	Foliage							
	Root estimate							

Twelve trees were sampled at age 10, twenty at age 16, and stand values for the above 64-100 m^2 plots were derived from regressions on D and D^2H.

(The authors present similar data for two other heavily thinned plots.)

Satoo, T. (1970b). Primary production in a plantation of Japanese larch, *Larix leptolepis*: a summarized report of JPTF-66 KOIWAI. *J. Jap. For. Soc.* 52, 154-158.
Satoo, T. (1977). Larch plantations. In: "Primary Productivity of Japanese Forests" (T. Shidei and T. Kira, eds) pp.169-172. JIBP Synthesis vol. 16. University of Tokyo Press.
Satoo, T. (1973b). Materials for the studies of growth in stands. X Primary production relations in a plantation of *Larix leptolepis* in Hokkaido. *Bull. Tokyo Univ. For.* 66, 119-126.

Japan		39°45'N 141°08'E 360 m Iwate Prefecture, Morioka city	ca.43°13'N 142°33'E 230 m Hokkaido, near Mount Asibetu
Plantations		*Larix leptolepis* with understorey broadleaved trees. Deep volcanic ash (Satoo 1970b, 1977)	*L. leptolepis* with understorey shrubs. Brown forest soil (Satoo 1973b)
Age (years)		39	21
Trees/ha		1155 + 2113[a]	1240
Tree height (m)		19.4 3.7[a]	15.3
Basal area (m^2/ha)		36.0 + 1.3[a]	22.4
Leaf area index		4.2[b] + 0.9[a]	
Stem volume (m^3/ha)			169
Dry biomass (t/ha)	Stem wood	145.4 + 1.9[a]	69.2 (or 66.8, 66.5)[d]
	Stem bark		
	Branches	15.5 + 1.0[a]	12.2 (or 12.0, 12.3)[d] +1.3[a]
	Fruits etc.		
	Foliage	3.6 + 0.3[a]	4.9 (or 4.3, 4.4)[d]
	Root estimate	34.8 + 0.8[a]	
CAI (m^3/ha/yr)			
Net production (t/ha/yr)	Stem wood	5.80[c] + 0.35[ac]	6.7[c] (or 6.7, 7.1)[cd]
	Stem bark		
	Branches	3.26[c] + 0.22[ac]	3.0[c] (or 3.1, 3.4)[cd] +0.3[a]
	Fruits etc.		
	Foliage	3.59 + 0.31[a]	4.9 (or 4.3, 4.4)[d]
	Root estimate	1.96 + 0.18[a]	

In both studies 10 trees were sampled. Roots were excavated at Morioka. Stand biomass values were derived for a 407 m^2 plot at Morioka by proportional basal area allocation, and for a 600 m^2 plot at Asibetu from regressions on D. Increments were estimated for the previous one year. Roots at Morioka were assumed to grow at the same relative rates as above-ground woody parts.

a. Understorey trees and shrubs.
b. Approximate all-sided LAI value can be obtained by multiplying by 2.3.
c. Excluding woody litterfall and any mortality.
d. Alternative values, estimated by proportional basal area allocation and by multiplying mean tree values by the numbers of trees per hectare (written left and right, respectively, within the brackets).

Saito, H., Kawahara, T., Shidei, T. and Tsutsumi, T. (1970). Productivity of young stands of *Metasequoia glyptostroboides*. *Bull. Kyoto Univ. For.* 41, 80-95.

Satoo, T. (1974b). Materials for the studies of growth in forest stands. XIII Primary production relations of a young stand of *Metasequoia glyptostroboides* planted in Tokyo. *Bull. Tokyo Univ. For.* 66, 153-164.

Japan	ca.34°10'N 131°30'E 30 m Yamaguchi Prefecture		35°45'N 139°30'E ca.50 m W of Tokyo, Tanasi Expt. Field
Plantations	*Metasequoia glyptostroboides*		2 clone mixture
	(Saito *et al.* 1970)		(Satoo 1974b)
Age (years)	9	9	17
Trees/ha	6180	12900	753
Tree height (m)	8.9	8.0	14.7
Basal area (m^2/ha)	24.3	22.6	23.7
Leaf area index			8.5[e] (or 8.5)[de]
Stem volume (m^3/ha)	125	123	180 (or 174)[d]
Dry biomass (t/ha): Stem wood	40.4	40.0	57.7 (or 54.3)[d]
Dry biomass (t/ha): Stem bark			
Dry biomass (t/ha): Branches	7.5	7.0	12.7 (or 12.2)[d]
Dry biomass (t/ha): Fruits etc.			
Dry biomass (t/ha): Foliage	5.1[a]	5.0[a]	4.3 (or 4.3)[d]
Dry biomass (t/ha): Root estimate	8.9		16.4 (or 17.1)[d]
CAI (m^3/ha/yr)	25.4	24.7	23.3 (or 23.4)[d]
Net production (t/ha/yr): Stem wood	8.2[b]	8.0[b]	6.94[b] (or 7.09)[bd]
Net production (t/ha/yr): Stem bark			
Net production (t/ha/yr): Branches	3.8[b]		4.29[b] (or 4.15)[bd]
Net production (t/ha/yr): Fruits etc.			
Net production (t/ha/yr): Foliage	5.1[c] + 1.0[c]		4.97[f] (or 5.01)[df]
Net production (t/ha/yr): Root estimate			

At Yamaguchi, 17 trees were sampled, roots were excavated, and stand biomass values were derived from regressions on D^2H; increments were estimated for the previous one year. At Tanasi, 5 trees were sampled in October, roots were excavated and stand biomass values for a 600 m^2 plot were derived from regressions on D.

a. Including about 1.0 t/ha of short branchlets.
b. Excluding woody litterfall and any mortality.
c. New foliage biomass (5.1 t/ha/yr) and estimated losses (1.0 t/ha/yr).
d. Alternative values derived by proportional basal area allocation.
e. Approximate all-sided LAI value can be obtained by multiplying by 2.3.
f. Foliage biomass plus estimated leaf fall prior to the October sampling.

Satoo, T. (1971). Materials for the studies of growth in stands. VIII Primary production relations in plantations of Norway spruce in Japan. *Bull. Tokyo Univ. For.* 65, 125-142.

43°13'N 142°26'E 360 m Japan, Hokkaido

Picea abies

Plantations. Brown forest soils.

All stands were thinned at ages 8 and 30.

		Fertile site	Sites of average fertility		Infertile site
Age (years)		47	46	46	45
Trees/ha		488	756	756	914
Tree height (m)		23.5	18.3	18.3	15.6
Basal area (m^2/ha)		33.8	24.9	26.1	21.4
Leaf area index					
Stem volume (m^3/ha)		427	244	252	193
Dry biomass (t/ha)	Stem wood	208.6	119.3	123.2	94.1
	Stem bark				
	Branches	16.7	14.1	18.5	12.2
	Fruits etc.				+0.4[a]
	Foliage	18.6	14.4	14.7	16.9
	Root estimate				
CAI (m^3/ha/yr)		16.5	11.7	11.7	8.8
Net production (t/ha/yr)	Stem wood	8.04[b]	5.70[b]	5.67[b]	4.31[b] + 0.13[ba]
	Stem bark				
	Branches	0.98[b]	1.17[b]	1.29[b]	0.84[b] + 0.01[ba]
	Fruits etc.				
	Foliage	3.37	4.54	4.69	2.19 + 0.03[a]
	Root estimate				

Five trees were sampled per stand and biomass values for the above four 0.16 ha plots were derived by proportional basal area allocation. Increments were estimated for the previous one year.

a. Understorey shrubs.

b. Excluding woody litterfall and any mortality.

Satoo, T. (1971). Materials for the studies of growth in stands. VIII Primary production relations of Norway spruce in Japan. *Bull. Tokyo Univ. For.* 65, 125-142.

Yoshimura, K. (1967). Growth and biomass of Norway spruce forest in Ashu experimental forest. *Bull. Kyoto Univ. For.* 39, 27-34.

Japan	35°56'N 138°51'E 1030 m Titibu	Ashu, Kyoto University Forest
Plantations. Brown forest soils.	*Picea abies* Unthinned stand (Satoo 1971)	*Picea abies* (Yoshimura 1967)
Age (years)	39	30
Trees/ha	2240[a]	1072
Tree height (m)	16.5	15.3
Basal area (m^2/ha)	52.6	41.7
Leaf area index		
Stem volume (m^3/ha)	386	269
Dry biomass (t/ha) Stem wood	188.5	120.2
Dry biomass (t/ha) Stem bark		
Dry biomass (t/ha) Branches	8.6	31.3
Dry biomass (t/ha) Fruits etc.		
Dry biomass (t/ha) Foliage	23.9	24.6
Dry biomass (t/ha) Root estimate		
CAI (m^3/ha/yr)		
Net production (t/ha/yr) Stem wood	8.5[b]	
Net production (t/ha/yr) Stem bark		
Net production (t/ha/yr) Branches	0.9[b]	
Net production (t/ha/yr) Fruits etc.		
Net production (t/ha/yr) Foliage	4.5	
Net production (t/ha/yr) Root estimate		

At Titibu 6 trees were sampled and stand biomass values for a 0.10 ha plot were derived by proportional basal area allocation; increments were estimated for the previous one year. At Ashu, 9 windfall trees were sampled (i.e. biassed towards large trees) and stand values for a 0.17 ha plot were derived from regressions on D and D^2H.

a. There were also 570 dead trees per hectare, not included here.

b. Excluding woody litterfall and any mortality.

Ando, T., Sakaguchi, K., Narita, T. and Satoo, S. (1962). Growth analysis on the natural stands of Japanese red pine (*Pinus densiflora* Sieb. et Zucc.). I Effects of improvement cutting and relative growth. *Bull. Govt Forest Exp. Stn Tokyo* 144, 1-30.

Ando, T. (1962). Growth analysis on the natural stands of Japanese red pine (*Pinus densiflora* Sieb. et Zucc.). II Analysis of stand density and growth. *Bull. Govt Forest Exp. Stn Tokyo* 147, 45-77.

36°00'N 140°00'E -- Japan, Tochigi Prefecture, Mashiko town National Forest

Pinus densiflora

		Heavily thinned at age 8	Lightly thinned at age 8	Unthinned
Age (years)		18	18	18
Trees/ha		5167	9633	36933
Tree height (m)		4.3	4.5	3.9
Basal area (m^2/ha)		13.3	18.7	25.1
Leaf area index				
Stem volume (m^3/ha)		41.1	72.1	93.2
Dry biomass (t/ha)	Stem wood	19.7	31.1	44.1
	Stem bark			
	Branches	6.2	8.7	7.7
	Fruits etc.	0.0	0.0	0.0
	Foliage	5.3	6.5	6.3
	Root estimate			
CAI (m^3/ha/yr)				
Net production (t/ha/yr)	Stem wood			
	Stem bark			
	Branches			
	Fruits etc.			
	Foliage			
	Root estimate			

Twenty to thirty trees were sampled per treatment, and stand values were estimated by proportional basal area allocation. Values given in each column above are the means of 3 replicate 100 m^2 plots.

Hatiya, K., Fujimori, T., Tochiaki, K. and Ando, T. (1966). Studies on the seasonal variations of leaf and leaf-fall amount in Japanese red pine (*Pinus densiflora*) stands. *Bull. Govt Forest Exp. Stn Tokyo* 191, 101-113.

Japan	35°40'N 139°20'E 100 m Kanagawa Prefecture, Hachioji, Asakawa nursery			ca.36°40'N 140°00'E -- Tochigi Prefecture, Mashiko	
	Pinus densiflora				
	Plantations			Natural stands	
Age (years)	7	7	7	13	13
Trees/ha	145000	62500	20400	69300	14900
Tree height (m)	1.3	1.1	1.2	3.2	6.5
Basal area (m^2/ha)					
Leaf area index					
Stem volume (m^3/ha)					
Dry biomass (t/ha) Stem wood	12.40	9.00	5.92		
Dry biomass (t/ha) Stem bark					
Dry biomass (t/ha) Branches	6.35	7.13	8.39		
Dry biomass (t/ha) Fruits etc.					
Dry biomass (t/ha) Foliage	9.83	10.63	11.48	6.1	9.9
Dry biomass (t/ha) Root estimate					
CAI (m^3/ha/yr)					
Net production (t/ha/yr) Stem wood					
Net production (t/ha/yr) Stem bark					
Net production (t/ha/yr) Branches					
Net production (t/ha/yr) Fruits etc.					
Net production (t/ha/yr) Foliage	8.42[a]	7.70[a]	4.90[a]	3.73[a]	5.60[a]
Net production (t/ha/yr) Root estimate					

Trees were sampled on several occasions during the year; values given above are for June at Asakawa and August at Mashiko, when foliage biomass values were greatest. Stand values were derived by proportional basal area allocation for plots of 16, 26, 54, 16 and 77 m^2 in columns left to right.

a. Foliage litterfall measured during one year.

Hatiya, K., Doi, K. and Kobayashi, R. (1965). Analysis of the growth of Japanese red pine (*Pinus densiflora*) stands. A report on the matured plantation in Iwate Prefecture. *Bull. Govt Forest Exp. Stn Tokyo* 176, 75-88.

41°30'N 139°30'E -- Japan, Iwate Prefecture

Plantations

Pinus densiflora

These stands, with different numbers of trees/ha, were growing on sites of similar quality.

Age (years)		46	44	43	46	33
Trees/ha		370	750	1009	1310	2340
Tree height (m)		19.5	18.5	18.2	19.2	15.7
Basal area (m^2/ha)		23.7	32.3	38.5	46.4	45.6
Leaf area index						
Stem volume (m^3/ha)		215	325	375	473	409
Dry biomass (t/ha)	Stem wood	83.9	126.0	153.6	198.5	163.4
	Stem bark					
	Branches	14.1	13.4	15.6	16.6	14.6
	Fruits etc.					
	Foliage	4.0	5.1	6.4	7.0	6.9
	Root estimate	29.1[a]	41.3[a]	50.2[a]	63.4[a]	52.8[a]
CAI (m^3/ha/yr)		9.5	13.3	13.7	14.1	21.8
Net production (t/ha/yr)	Stem wood	3.7[b]	5.2[b]	5.6[b]	5.9[b]	8.7[b]
	Stem bark					
	Branches	1.8[b]	1.7[b]	1.9[b]	2.1[b]	2.1[b]
	Fruits etc.					
	Foliage	2.2[c]	2.8[c]	3.4[c]	3.8[c]	3.4[c]
	Root estimate	1.3	1.7	1.8	1.9	2.8

Three to ten trees were sampled per stand. Stand biomass values were estimated by proportional basal area allocation for plots of 216, 400, 308, 397 and 180 m^2 in columns left to right.

a. Assuming top/root ratios to be 3.5.

b. Excluding woody litterfall and any mortality.

c. New foliage biomass.

Satoo, T. (1968). Primary production relations in woodlands of *Pinus densiflora*. In: "Symposium on Primary Productivity and Mineral Cycling in Natural Ecosystems" pp. 52-80. University of Maine, Orono, U.S.A.
Satoo, T. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) p. 602. Cambridge University Press, Cambridge, London, New York, Melbourne.
Yuasa, Y. and Kamio, K. (1973). Leaf biomass and leaf-fall of young stands of Japanese red pine (*Pinus densiflora*) and Japanese black pine (*Pinus thunbergii*). *Bull. Shizuoka Univ. For.* 2, 25-33.

Japan	39°02'N 141°21'E 300 m Okita		Shizuoka University Forest
Brown forest soils, pH 5.4	*Pinus densiflora*		*P. densiflora*
	(Satoo 1968)	(Satoo 1981)	(Yuasa and Kamio 1973)
Age (years)	17	20	16
Trees/ha		6600	8390
Tree height (m)	8	10.2	5.4
Basal area (m^2/ha)		32.3	24.0
Leaf area index			
Stem volume (m^3/ha)			
Dry biomass (t/ha): Stem wood	41.9	70.9	34.5
Dry biomass (t/ha): Stem bark			
Dry biomass (t/ha): Branches	6.3	15.6	8.0
Dry biomass (t/ha): Fruits etc.			
Dry biomass (t/ha): Foliage	4.6	6.8	5.1
Dry biomass (t/ha): Root estimate	7.6[a] + 3.3[b]	22.9	
CAI (m^3/ha/yr)			
Net production (t/ha/yr): Stem wood	7.50	11.33 + 0.35[d]	
Net production (t/ha/yr): Stem bark			
Net production (t/ha/yr): Branches	2.73[c]		
Net production (t/ha/yr): Fruits etc.			
Net production (t/ha/yr): Foliage	4.24	1.25 + 3.44[d] + 0.12[e]	2.9[f]
Net production (t/ha/yr): Root estimate	0.92[a] + 0.40[b]		

Satoo (1968, 1981) sampled all the trees, including the roots, in a 20 m^2 plot, and derived stand biomass values by proportional basal area allocation. Yuasa and Kamio (1973) sampled 11 trees and derived stand values from regressions on D and D^2H.

a. Stumps.
b. Roots.
c. Excluding woody litterfall.
d. Litterfall.
e. Frass litterfall.
f. New foliage biomass; foliage litterfall was 2.4 t/ha/yr.

Akai, T., Ueda, J. and Furuno, T. (1970). Mechanisms related to matter production in young slash pine forest. *Bull. Kyoto Univ. For.* 41, 56-79.

ca.33°40'N 135°30'E 50 m Japan, Wakayama Prefecture, Shirahama, Kyoto University Forest

Plantation.
Sandy infertile soil

Pinus elliottii

		100[a]	200[a]	50[a]	100[a]	0[a]	25[a]	50[a]
Age (years)		8	8	8	8	8	8	8
Trees/ha		2200	2000	2800	4000	4000	5400	5800
Tree height (m)		6.8	6.9	6.5	6.2	1.9	5.8	7.4
Basal area (m^2/ha)		25.8	23.5	24.1	29.3		27.5	43.6
Leaf area index								
Stem volume (m^3/ha)		102	91	95	111	8	105	196
Dry biomass (t/ha)	Stem wood	37.6	33.7	34.9	40.6	3.8	38.2	72.1
	Stem bark							
	Branches	7.8	6.9	6.6	6.9	0.4	4.1	9.3
	Fruits etc.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Foliage	11.7	10.5	10.6	12.2	1.9	8.7	17.6
	Root estimate							
CAI (m^3/ha/yr)								
Net production (t/ha/yr)	Stem wood	6.9	6.4	6.5	8.8		5.2	10.1
	Stem bark							
	Branches							
	Fruits etc.							
	Foliage							
	Root estimate							

Twenty-four trees were sampled. Stand values for the above seven 500 m^2 plots were derived from regressions on D^2H. Nutrient contents were determined.

a. Grammes of NPK (15:13:12) applied per tree in the first and second years after planting.

Shidei, T. (1963). Productivity of Haimatsu (*Pinus pumila*) community growing in Alpine zone of Tateyama-Range. *J. Jap. For. Soc.* 45, 169-173.

ca.36°30'N 137°00'E 2200-2800 m Japan, near Mount Tsurugi

Pinus pumila

Dwarf stand in the 'alpine' zone.

Age (years)		22	22	40	45
Trees/ha		400000	880000	360000	80000
Tree height (m)		0.65	0.45	0.55	1.3
Basal area (m^2/ha)					
Leaf area index					
Stem volume (m^3/ha)					
Dry biomass (t/ha)	Stem wood	40.6	34.2	24.5	57.3
	Stem bark				
	Branches	15.9	16.1	17.4	46.9
	Fruits etc.				
	Foliage	22.6	25.3	17.1	21.6
	Root estimate				
CAI (m^3/ha/yr)					
Net production (t/ha/yr)	Stem wood	3.14[a]	2.83[a]	1.36[a]	3.69[a]
	Stem bark				
	Branches	1.60[a]	1.33[a]	0.96[a]	3.02[a]
	Fruits etc.				
	Foliage	7.04[b]	7.92[b]	5.52[b]	6.76[b]
	Root estimate				

All trees were harvested within the above four plots of only 0.5 x 0.5 m and biomass values were expressed per hectare. Creeping stems and roots were not included.

a. Excluding woody litterfall and mortality.

b. New foliage biomass.

Akai, T., Ueda, S. and Furuno, T. (1971). Mechanisms related to matter production in a young white pine forest. *Bull. Kyoto Univ. For.* 42, 143-162.

35°32'N 137°48'E 1100 m Japan, Nagano Prefecture, near Iida City, Achi National Forest.

Plantation.
Sandy loam soil.

Pinus strobus

Age (years)		11	11
Trees/ha		3000	3400
Tree height (m)		5.4	5.2
Basal area (m^2/ha)		12.9	13.4
Leaf area index			
Stem volume (m^3/ha)		45.6	45.3
Dry biomass (t/ha)	Stem wood	14.9	14.9
	Stem bark		
	Branches	7.5	7.3
	Fruits etc.		
	Foliage	2.8	2.7
	Root estimate		
CAI (m^3/ha/yr)		12.2	12.2
Net production (t/ha/yr)	Stem wood	4.0	4.0
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage	2.14[a]	2.08[a]
	Root estimate		

Fourteen trees were sampled and stand biomass values for the above two 200 m^2 plots were derived from regressions on D^2H. Stem increments were estimated for the previous one year. Branch increments were not estimated. Nutrient contents were determined.

a. New foliage biomass.

Akai, T., Furuno, T., Ueda, S. and Sano, S. (1968). Mechanisms of matter producti in young loblolly pine forest. *Bull. Kyoto Univ. For.* 40, 26-49.

ca.33°40'N 135°30'E 50 m Japan, Wakayama Prefecture, Shirahama, Kyoto University Forest.

Plantations. Infertile, sandy loam.

Pinus taeda

	100 g/tree of NPK (15:8:8) applied each year for three years after planting						No fertiliz applied
Age (years)	7	7	7	7	7	7	7
Trees/ha	2066	2151	3835	3765	6536	6543	3750
Tree height (m)	7.0	6.7	5.1	6.2	7.3	6.3	1.6
Basal area (m^2/ha)	18.4	18.5	16.0	23.0	36.5	34.6	
Leaf area index							
Stem volume (m^3/ha)	69.0	68.9	53.3	81.9	149.4	138.3	3.3
Dry biomass (t/ha) Stem wood / Stem bark	27.2	25.9	21.5	32.7	59.4	55.1	1.3
Dry biomass (t/ha) Branches	9.1	8.7	6.0	10.0	14.4	12.5	0.5
Dry biomass (t/ha) Fruits etc.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry biomass (t/ha) Foliage	8.8	8.4	7.6	11.0	13.9	12.6	0.9
Dry biomass (t/ha) Root estimate							
CAI (m^3/ha/yr)							
Net production (t/ha/yr) Stem wood / Stem bark	8.2	8.2	6.2	9.7	14.4	12.9	
Net production (t/ha/yr) Branches							
Net production (t/ha/yr) Fruits etc.							
Net production (t/ha/yr) Foliage							
Net production (t/ha/yr) Root estimate							

Twenty-three trees were sampled, and stand values for the above seven 100 m^2 plots were derived from regressions on D^2H. Nutrient contents were determined.

Akai, T. and Furuno, T. (1971). Amount of litterfall and grazing in young loblolly pine forest. *Bull. Kyoto Univ. For.* 42, 83-95.

Akai, T., Ueda, S., Furuno, T. and Saito, H. (1972). Mechanisms related to matter production in a thrifty loblolly pine forest. *Bull. Kyoto Univ. For.* 43, 85-105.

Japan	ca.33°40'N 135°30'E 50 m Wakayama Prefecture Shirahama Kyoto Univ. Forest			ca.32°30'N 130°50'E 200 m Kumamoto Prefecture Nishikihara Nat. Forest	
Plantations	*Pinus taeda* A spacing experiment (Akai and Furuno 1971)			Clay loam soil (Akai *et al.* 1972)	
Age (years)	10	10	10	34	34
Trees/ha	2151	3765	6543	696	700
Tree height (m)	6.7	6.2	6.3	21.1	20.3
Basal area (m^2/ha)	18.5	23.0	34.6	42.8	38.7
Leaf area index					
Stem volume (m^3/ha)				337	302
Dry biomass (t/ha) Stem wood				168.0	151.0
Stem bark					
Branches	8.7	10.0	12.5	22.0	19.7
Fruits etc.				0.3	0.4
Foliage	8.4	11.0	12.6	9.5	8.5
Root estimate					
CAI (m^3/ha/yr)				ca.14	ca.14
Net production (t/ha/yr) Stem wood				ca.7.4	ca.7.4
Stem bark					
Branches	0.1[a]	0.1[a]	0.1[a]		
Fruits etc.					
Foliage	6.5[a]	7.1[a]	8.0[a]		
Root estimate					

Akai and Furuno (1971) used published regression equations to derive stand biomass values for the above three 500 m^2 plots from regressions on D^2H.
Akai *et al.* (1972) sampled 13 trees and derived stand values for the above two 0.20 ha plots from regressions on D^2 and D^2H; foliage biomass was estimated in October; there was about 6.6 t/ha of dead branches in each plot, and 0.1 to 0.9 t/ha of dead cones; nutrient contents were determined.

a. Litterfall only; excluding insect consumption estimated to be 0.05 to 0.09 t/ha/yr.

Kabaya, H., Ikusima, I. and Numata, M. (1964). Growth and thinning of *Pinus thunbergii* stand - ecological studies of coastal pine forest. *Bull. Marine Lab. Chiba Univ.* 6, 1-26.

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ca.35°30'N 140-141°E 5-50 m Japan, Chiba Prefecture, Futtsu.

Coastal sites

Pinus thunbergii

Dwarf unthinned stands.

Age (years)	8	9	10	11	12	13
Trees/ha	12400	11938	12329	12384	12353	11860
Tree height (m)	1.2	1.5	1.8	2.2	2.5	2.8
Basal area (m^2/ha)						
Leaf area index						
Stem volume (m^3/ha)						
Dry biomass (t/ha): Stem wood, Stem bark, Branches	12.4	19.1	27.0	37.4	46.2	51.0
Dry biomass (t/ha): Fruits etc.						
Dry biomass (t/ha): Foliage						
Dry biomass (t/ha): Root estimate	3.3[a]	5.2[a]	7.3[a]	10.1[a]	12.5[a]	13.8[a]
CAI (m^3/ha/yr)						
Net production (t/ha/yr): Stem wood, Stem bark, Branches	4.7+0.0[b]	6.7+0.0[b]	7.9+0.0[b]	10.4+1.0[b]	8.8+2.0[b]	5.6+2.6[b]
Net production (t/ha/yr): Fruits etc.						
Net production (t/ha/yr): Foliage	2.3[b]	4.0[b]	5.4[b]	6.5[b]	7.4[b]	8.0[b]
Net production (t/ha/yr): Root estimate						

Twenty trees were sampled and 11 root systems were excavated. Stand values for the above six 19 m^2 plots were derived from regressions on stem basal diameter.
a. Assumed to be 27% of the value of above-ground woody biomass.
b. Litterfall.

Ando, T. (1965). Estimation of dry matter and growth analysis of the young stand of Japanese black pine (*Pinus thunbergii*). *Advg Front. Pl. Sci., New Delhi* 10, 1-10.

35°00'N 139°00'E -- Japan, Shinuoka Prefecture, near Ito city.

Plantations.

		Pinus thunbergii					
		good[a]	good[a]	good[a]	moderate[a]	moderate[a]	poor[a]
Age (years)		10	10	10	10	10	10
Trees/ha		6863	7231	3245	4573	10204	9824
Tree height (m)		4.5	4.5	4.7	3.7	3.2	2.6
Basal area (m^2/ha)		21.1	24.9	17.8	8.5	13.9	7.0
Leaf area index							
Stem volume (m^3/ha)		72.3	81.1	54.4	23.9	40.1	20.9
Dry biomass (t/ha)	Stem wood	33.4	38.1	23.4	11.3	18.7	10.7
	Stem bark						
	Branches	11.2	15.9	10.6	5.6	8.5	4.1
	Fruits etc.	0.0	0.0	0.0	0.0	0.0	0.0
	Foliage	11.9	13.8	10.1	5.7	10.7	6.2
	Root estimate						
CAI (m^3/ha/yr)							
Net production (t/ha/yr)	Stem wood	9.5	8.1	6.9	3.9	6.4	3.5
	Stem bark						
	Branches	4.2[b]	4.7[b]	3.4[b]	2.2[b]	2.9[b]	1.5[b]
	Fruits etc.						
	Foliage						
	Root estimate						

Five to eight trees were sampled in each of the above 60 m^2 plots, and stand biomass values were estimated by proportional basal area allocation.

a. The site quality.

b. Assumed to be equal to the increment of the stems within the crowns; excluding any woody litterfall.

Uenaka, K., Haya, K., Nasu, T. and Akai, T. (1972). Primary production of young stands of *Pinus thunbergii* in various planting densities. *Rep. Kyoto Univ. For.* 10, 53-59.

Yuasa, Y. and Kamio, K. (1973). Leaf biomass and leaf-fall of young stands of Japanese red pine (*Pinus densiflora*) and Japanese black pine (*Pinus thunbergii*). *Bull. Shizuoka Univ. For.* 2, 25-33.

ca.35°N -- Japan	Kyoto University Forest				Shizuoka University Forest
Plantations.	*Pinus thunbergii* A spacing experiment. (Uenaka *et al.* 1972)				*P. thunbergii* (Yuasa and Kamio 1973)
Age (years)	14	14	14	14	16
Trees/ha	2554	9938	26605	27649	9786
Tree height (m)	4.2	4.7	6.5	4.7	6.6
Basal area (m^2/ha)	5.2	13.2	38.2	20.6	35.4
Leaf area index					
Stem volume (m^3/ha)	16.6	42.2	159	76	
Dry biomass (t/ha) Stem wood	} 9.1	} 23.9	} 90.7	} 43.8	} 58.1
Dry biomass (t/ha) Stem bark					
Dry biomass (t/ha) Branches	4.5	3.9	11.3	4.5	9.9
Dry biomass (t/ha) Fruits etc.					
Dry biomass (t/ha) Foliage	3.2	3.4	9.9	4.0	8.0
Dry biomass (t/ha) Root estimate					
CAI (m^3/ha/yr)					
Net production (t/ha/yr) Stem wood					
Net production (t/ha/yr) Stem bark					
Net production (t/ha/yr) Branches					
Net production (t/ha/yr) Fruits etc.					
Net production (t/ha/yr) Foliage					4.10[a]
Net production (t/ha/yr) Root estimate					

At Kyoto, 24 trees were sampled and stand values were derived from regressions on D^2 and on D^2H.
At Shizuoka, 11 trees were sampled and stand values were derived from regressions on D^2H.
a. New foliage biomass; foliage litterfall was 3.73 t/ha/yr.

Yasui, H. and Narita, T. (1972). Studies on the selection forest of Ate (*Thujopsis dolabrata* Sieb. et Zucc. var. *hondai* Makino). 3. Biomass of Maate (a cv. of Ate) selection forest. *Bull. Fac. Agr. Univ. Shimane* 6, 39-44.

ca.35°N 132°E -- Japan, Shimane Prefecture

Thujopsis dolabrata var. *hondai*

Natural regeneration with trees of different ages and heights.

Age (years)							
Trees/ha							
Tree height (m)		ca.13	ca.15	ca.17	ca.17	ca.18	ca.23
Basal area (m^2/ha)		26.5	32.4	45.6	42.8	39.8	29.4
Leaf area index							
Stem volume (m^3/ha)		147	213	293	321	343	291
Dry biomass (t/ha)	Stem wood	66.3	95.8	131.8	144.6	154.5	131.0
	Stem bark						
	Branches	12.6	27.8	21.5	22.3	19.7	12.5
	Fruits etc.						
	Foliage	14.6	21.6	24.9	24.9	17.0	11.8
	Root estimate						
CAI (m^3/ha/yr)		10.3	11.1	15.9	15.5	15.2	13.6
Net production (t/ha/yr)	Stem wood						
	Stem bark						
	Branches						
	Fruits etc.						
	Foliage						
	Root estimate						

Twelve to 25 trees were sampled at each of the above six sites, and stand values were derived from regressions on D^2H. The sites were at Koonosu, Koizumi, Futamata, Ishiyasumiba, Yamamoto and Hosoya in columns left to right.

Satoo, T., Negisi, K. and Yagi, K. (1974). Materials for the studies of growth in forest stands. XII Primary production relations in plantations of *Thujopsis dolabrata* in the Noto Peninsula. *Bull. Tokyo Univ. For.* 66, 139-151.

ca.37°30'N 136°50'E (alt. given below) Japan, Noto Peninsula.

Clonal plantations

Thujopsis dolabrata

		150 m	120 m	280 m
Age (years)		24-31	23-27	35-42
Trees/ha		5584	6490	2760
Tree height (m)		8.7	7.4	12.2
Basal area (m^2/ha)		42.2	47.3	56.0
Leaf area index		12.6[b] (or 13.3)[ab]	17.5[b] (or 18.3)[ab]	12.7[b] (or 13.2)[ab]
Stem volume (m^3/ha)		261 (or 265)[a]	233 (or 222)[a]	415 (or 417)[a]
Dry biomass (t/ha)	Stem wood	103.8 (or 105.1)[a]	94.3 (or 95.3)[a]	157.3 (or 156.9)[a]
	Stem bark			
	Branches	13.0 (or 13.0)[a]	20.2 (or 19.8)[a]	24.1 (or 24.6)[a]
	Fruits etc.			
	Foliage	30.1 (or 32.2)[a]	43.6 (or 44.5)[a]	31.7 (or 32.1)[a]
	Root estimate			
CAI (m^3/ha/yr)				
Net production (t/ha/yr)	Stem wood	5.66[c] (or 6.74)[ac]	13.29[c] (or 13.79)[ac]	6.14[c] (or 6.23)[ac]
	Stem bark			
	Branches	1.36[c] (or 1.44)[ac]	1.82[c] (or 1.71)[ac]	
	Fruits etc.			
	Foliage	3.81 (or 3.58)[a]	3.95 (or 3.80)[a]	
	Root estimate			

Ten trees were sampled at each of the above three sites and stand values were derived from regressions on D.

a. Alternative values derived by proportional basal area allocation.

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

c. Excluding woody litterfall and any mortality.

Kitazawa, Y. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) p. 603. Cambridge University Press, Cambridge, London, New York and Melbourne.

36°40'N 138°30'E 1790 m Japan, Shigayama.

Wet podzols, pH 3.6-4.2

Tsuga diversifolia, *Abies mariesii* with *Betula ermanii*.

Age (years)		290
Trees/ha		1199
Tree height (m)		18
Basal area (m^2/ha)		53.1
Leaf area index		6.8
Stem volume (m^3/ha)		
Dry biomass (t/ha)	Stem wood	139.9
	Stem bark	
	Branches	51.7
	Fruits etc.	
	Foliage	9.9
	Root estimate	
CAI (m^3/ha/yr)		
Net production (t/ha/yr)	Stem wood	1.80 + 0.02[a]
	Stem bark	
	Branches	1.79 + 0.93[a]
	Fruits etc.	0.06[c] + 0.13[b]
	Foliage	2.12[c]
	Root estimate	

a. Woody litterfall, excluding any mortality.
b. Miscellaneous litterfall.
c. Litterfall.

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.

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ca.33°20'N 133°00'E 720 m Japan, Kochi Prefecture, Yusuhara district.

Shallow, infertile, soil.

Tsuga sieboldii with a few *Pinus densiflora* and *Chamaecyparis obtusa* and deciduous and evergreen broadleaved understorey trees.

Age (years)		120-443
Trees/ha		475 + 1473[a]
Tree height (m)		24.0 10.2[a]
Basal area (m^2/ha)		70.3 + 17.7[a]
Leaf area index		4.3[b] + 1.0[a]
Stem volume (m^3/ha)		793 + 129[a]
Dry biomass (t/ha)	Stem wood	347.1 + 85.6[a]
	Stem bark	
	Branches	91.8 + 25.5[a]
	Fruits etc.	
	Foliage	7.8 + 1.9[a]
	Root estimate	136.6 + 27.1[ac]
CAI (m^3/ha/yr)		
Net production (t/ha/yr)	Stem wood	1.45 + 0.73[a] (or 1.9 + 1.2[a])[d]
	Stem bark	
	Branches	0.51 + 1.23[e] + 0.23[a] + 0.38[ae] (or 0.8 + 1.5[a])[d]
	Fruits etc.	0.12 + 0.00[a]
	Foliage	0.04 + 2.24[e] + 0.01[a] + 0.62[ae] (or 2.4 + 0.8[a])[d]
	Root estimate	0.6 + 0.2[a] (or 0.8 + 0.4[a])[d]

Seven *T. sieboldii* and 18 understorey trees were sampled, and roots of the seven *T. sieboldii* trees were excavated. Stand biomass values for a 0.12 ha plot were derived from regressions on D. Biomass values given above are the means over 4 years. Nutrient contents were determined.

a. Understorey values.
b. All-sided LAI was 9.9.
c. Understorey root biomass was estimated assuming the top/root ratio to be 4.2.
d. Alternative production values (in the brackets), estimated as the biomass of new growth made during the previous year.
e. Litterfall measured over 1 to 3 years.