

Decei, I. (1981). Biomass of high productivity trees and young beech stands (*Fagus sylvatica* L.). In: "Kyoto Biomass Studies", pp.125-128. School of Forestry and Natural Resources, University of Maine, Orono, USA.

Donita, N., Bindiu, C. and Mocanu, V. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp.611-612. Cambridge University Press, Cambridge, London, New York, Melbourne.

Rumania	ca.45°N 25°E	44°54'N 28°43'E	ca.175 m	Babadag
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	<i>Fagus sylvatica</i>	<i>Quercus pubescens</i> syn. <i>lanuginosa</i>	<i>Quercus pedunculiflora</i>	Leached chernozem pH 6.4
	(Decei 1981)			(Donita et al. 1981)
Age (years)	21-40	37		37
Trees/ha		2730		1970
Tree height (m)		6.8		8.6
Basal area (m ² /ha)		22.7		19.1
Leaf area index		2.5		3.4
Stem volume (m ³ /ha)				
Dry biomass (t/ha)				
Stem wood	106.0	34.4		26.0
Stem bark	6.6	15.2		19.5
Branches	14.9	7.7		3.3
Fruits etc.				
Foliage	3.0	2.4		3.3
Root estimate	27.0			
CAI (m ³ /ha/yr)				
Stem wood		0.90 ^a		1.01 ^a
Stem bark		0.40 ^a		0.75 ^a
Branches		0.21	} + 0.40 ^b	0.28
Fruits etc.				
Foliage		2.38 ^b		3.26 ^b
Root estimate				

Decei sampled trees in 5 stands, including the roots, and derived stand values from regressions on D.

a. Excluding any mortality.

b. Litterfall.

Bindiu, C. (1973). Unpublished Doctoral Thesis, Academia de Stunte Agricole si Silvice, Bucharest, Rumania.

Bindiu, C., Popescu-Zeletin, I. and Mocanu, V. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp.613-614. Cambridge University Press, Cambridge, London, New York, Melbourne.

45°23'N 23°15'E 950-1010 m Rumania, Sinaia.

Well-drained,
brown forest
soils.
pH 6.1-6.8.

Fagus sylvatica (65%)^a
Abies alba (35%)^a *A. alba*

Age (years)	up to 450	110
Trees/ha	842	485
Tree height (m)	38.5-42.5	36.0
Basal area (m ² /ha)	42.0	76.6
Leaf area index	9.7	12.0
Stem volume (m ³ /ha)		
Stem wood	243.1	365.0
Stem bark	23.2	40.6
Branches	14.3	37.8
Fruits etc.		
Foliage	14.1	26.7
Root estimate		
Dry biomass (t/ha)		
Stem wood	243.1	365.0
Stem bark	23.2	40.6
Branches	14.3	37.8
Fruits etc.		
Foliage	14.1	26.7
Root estimate		
CAI (m ³ /ha/yr)		
Stem wood	4.18 ^b	5.46 ^b
Stem bark	0.37 ^b	0.60 ^b
Branches	0.75	1.90 ^c
Fruits etc.		
Foliage	3.75 ^d	3.35 ^d
Root estimate		
Net production (t/ha/yr)		
Stem wood	4.18 ^b	5.46 ^b
Stem bark	0.37 ^b	0.60 ^b
Branches	0.75	1.90 ^c
Fruits etc.		
Foliage	3.75 ^d	3.35 ^d
Root estimate		

a. Percentage of the total tree number.

b. Excluding any mortality.

c. Excluding woody litterfall.

d. Litterfall.

Alvera, B. (1973). Estudios en bosques de coníferas del Pirineo Central. Serie A: Pinar con acebo de San Juan de la Peña. I Produccion de hojarsca. *Pirineos* 109, 17-29.

Alvera, B. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) p.615. Cambridge University Press, Cambridge, London, New York, Melbourne.

42°30'N 0°40'W 1230 m Spain, San Juan de las Peña, near Jaca.

Well-drained soil
overlying calcareous
conglomerate.

Pinus sylvestris,
with an understorey of
Ilex aquifolium.

Age (years)	80	50-60 ^a
Trees/ha	832	+ 4532 ^a
Tree height (m)	17-19	6-7 ^a
Basal area (m ² /ha)	47.9	+ 3.6 ^a
Leaf area index	11.9 ^b	
Stem volume (m ³ /ha)		

Dry biomass (t/ha)	Stem wood	130.4	} + 9.5 ^a
	Stem bark	15.7	
	Branches	35.0	
	Fruits etc.	0.0	
	Foliage	11.5	+ 1.8 ^a
Root estimate			

CAI (m ³ /ha/yr)			
Net production (t/ha/yr)	Stem wood	} 4.26	+ 0.04 ^c
	Stem bark		
	Branches	4.83	+ 1.34 ^c
	Fruits etc.	0.00	+ 1.05 ^c
	Foliage	2.14	+ 2.45 ^c
Root estimate			

Stand biomass values for fifteen 25 m² plots were derived using regression methods. There was 19.9 t/ha of standing dead wood.

a. Values for *I. aquifolium*. Production values include *I. aquifolium*.

b. Including *I. aquifolium*; all-sided LAI was probably in the range 18-24.

c. Litterfall of *P. sylvestris* and *I. aquifolium*.

Hytteborn, H. (1975). Deciduous woodland at Andersby, eastern Sweden. Above-ground tree and shrub production. *Acta phytogeogr. suec.* 61, 96 pp.

Persson, H. (1975). Deciduous woodland at Andersby, eastern Sweden: field-layer and below-ground production. *Acta phytogeogr. suec.* 62, 71 pp.

60°09'N 17°49'E 25-35 m Sweden, Uppland Province, near Lake Dannemora.				
	<i>Betula</i> spp. (88%) ^a <i>Quercus robur</i> (11%) ^a 20% ground cover only. Clayey till, partly flooded.	<i>Acer platanoides</i> (34%) ^a <i>Tilia cordata</i> (33%) ^a <i>Q. robur</i> (29%) ^a 56% ground cover. Sandy soil.	<i>Q. robur</i> (74%) ^a <i>Sorbus aucuparia</i> (10%) ^a <i>Betula</i> spp. and <i>T. cordata</i> . 48% ground cover. Stoney till.	
Age (years)	70-80	55-177	43-200	
Trees/ha	76	212	452	
Tree height (m)	19.5	6-24	5-23	
Basal area (m ² /ha)	6.5	12.2	12.3	
Leaf area index	1.4 + 0.2 ^b	3.0 + 0.5 ^b	3.1 + 1.6 ^b	
Stem volume (m ³ /ha)				
Dry biomass (t/ha)	Stem wood	28.3	48.7	
	Stem bark	4.7	6.8	
	Branches	16.2	20.3	
	Fruits etc.	0.9	0.3	
	Foliage	0.9 + 0.1 ^b	1.6 + 0.6 ^b	1.6 + 0.4 ^b
	Root estimate		ca.7.0	
CAI (m ³ /ha/yr)				
Net production (t/ha/yr)	Stem wood	0.41 ^c	0.67 ^c	0.77 ^c
	Stem bark	0.07 ^c	0.16 ^c	0.14 ^c
	Branches	0.99 + 0.33 ^d	1.14 + 0.75 ^d	1.32 + 1.32 ^d
	Fruits etc.	0.44 ^d	0.61 ^d	0.30 ^d
	Foliage	0.91 ^d + 0.05 ^b	1.66 ^d + 0.58 ^b	1.61 ^d + 0.43 ^b
	Root estimate			

Thirty-eight trees were sampled, roots were excavated, and stand biomass values for the above 0.25 ha plots were derived by proportional basal area allocation.

a. Percentage of the total basal area.

b. Understorey shrubs and coppice, comprised mainly of *Corylus avellana* in the columns on the left and right and suckers of *Populus tremula* in the centre column.

c. Excluding any mortality.

d. Overstorey litterfall, measured over 3 years.

Andersson, F. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) p.620. Cambridge University Press, Cambridge, London, New York, Melbourne.
 Andersson, F. (1970). Ecological studies in a Scandinavian woodland and meadow area, southern Sweden. II Plant biomass, primary production and turnover of organic matter. *Bot. Notiser* 123, 8-51.
 Andersson, F. (1971). Methods and preliminary results of estimation of biomass and primary production in a south Swedish mixed deciduous woodland. In: "Productivity of Forest Ecosystems" (P. Duvigneaud, ed.) pp.281-287. UNESCO, Paris.

55°44'N 13°18'E 60 m Sweden, near Lund, Linnebjär Wood.

Brown forest gley, pH 4.4-5.0. *Quercus robur* (70%)^a, *Tilia cordata* (14%)^a with understorey of *Sorbus aucuparia* and coppiced *Corylus avellana* (14%)^a

Age (years)	125-190	
Trees/ha	4725	
Tree height (m)	23 ^b	
Basal area (m ² /ha)	31.4 (21.9 <i>Quercus</i>)	
Leaf area index	5.4	
Stem volume (m ³ /ha)	323 (260 <i>Quercus</i>)	
Dry biomass (t/ha)	Stem wood	100.0 + 26.0 ^c
	Stem bark	11.0 + 5.0 ^c
	Branches	41.0 + 12.0 ^c
	Fruits etc.	
	Foliage	3.0 + 2.1 ^c
	Root estimate	39.2 (21.9 <i>Quercus</i>)
CAI (m ³ /ha/yr)		
Net production (t/ha/yr)	Stem wood	} 2.00
	Stem bark	
	Branches	
	Fruits etc.	
	Foliage	} + 3.00 ^c
	Root estimate	
		(or 6.1 + 5.3 ^d) ^e
		(or 2.3) ^e

Ten trees were sampled per tree species, 15 per shrub species, and 10 root systems were excavated including 3 *Quercus* and 2 *Tilia*. Stand biomass values for three 0.16 ha plots were derived from regressions on D²H. The data given are from Andersson (1981).

- a. Percentage of the total basal area.
- b. Stand height.
- c. Understorey shrubs and coppice.
- d. Litterfall, measured over 3 years.
- e. Alternative values taken from Andersson (1970).

- Nihlgard, B. (1972). Plant biomass, primary production and distribution of chemical elements in a beech and a planted spruce forest in south Sweden. *Oikos* 23, 69-81.
- Nihlgard, B. and Lindgren, L. (1977). Plant biomass, primary production and bio-elements of three mature beech forests in south Sweden. *Oikos* 28, 95-104.
- Nihlgard, B. and Lindgren, L. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp.617-621. Cambridge University Press, Cambridge, London.

55°42-59'N 13°10-55'E (alt. given below) Sweden.

	120 m Kongalund Brown loams, pH 4.0-4.5.		60 m Oved <i>F. sylvatica</i> Brown earth gley, pH 6.0-7.5	150 m Langarod <i>F. sylvatica</i> Podzol pH 4.0-4.5	
	<i>Picea abies</i> Plantation.	<i>Fagus sylvatica</i>			
Age (years)	55	90 (45-130)	80-100	80-120	
Trees/ha	880	240	180	320	
Tree height (m)	25	25	28	22	
Basal area (m ² /ha)	55.6	31.4	31.1	29.7	
Leaf area index	11.5 ^a	3.4 ^b	4.3 ^b	3.2 ^b	
Stem volume (m ³ /ha)	802	553	452	301	
Dry biomass (t/ha)	Stem wood	240	212.0	234	158
	Stem bark	22	9.0	11	8
	Branches	28	99.0	} 69	} 59
	Fruits etc.	3.3	3.9		
	Foliage	18.0	3.6		
	Root estimate	58	50.0	41	34
CAI (m ³ /ha/yr)	23	8			
Net production (t/ha/yr)	Stem wood	8.6	4.6	5.3	3.3
	Stem bark	0.8	0.2	0.3	0.2
	Branches	0.5 + 1.2 ^c	5.3 + 1.1 ^c	6.1 + 0.8 ^c	4.4 + 1.1 ^c
	Fruits etc.	0.2 ^c	1.0 ^c	0.7 ^c	0.4 ^c
	Foliage	3.3 ^c	3.6 ^d	4.1 ^d	2.7 ^d
	Root estimate	2.6	2.4	2.3	1.7

Eight or ten trees were sampled per stand and several root systems were excavated. Stand biomass values for the above 0.10 ha plots were derived from regressions on D²H. Bark and roots were assumed to grow at the same relative rates as other woody parts. Nutrient contents were determined.

a. All-sided LAI was about 26.

b. Mid-summer values.

c. Litterfall, measured over 3 years.

d. Leaf biomass plus early summer leaf litterfall; total leaf litterfall in the *F. sylvatica* stands was 2.4 to 2.8 t/ha/yr.

Continued from p.225.

60°20'N 17°13'E 10 m Sweden, Lisselbo.						
Plantation.		<i>Pinus sylvestris</i>				
Gravelly, sandy, iron podzol.		Unfertilized plot	Fertilized plots			
Age (years)		13	13	13	13	
Trees/ha		1131	1194	1244	1281	1156
Tree height (m)		5.5	5.9	5.4	5.0	5.0
Basal area (m ² /ha)		7.7	12.4	12.1	10.5	10.8
Leaf area index						
Stem volume (m ³ /ha)						
Dry biomass (t/ha)	Stem wood	8.0	14.2	13.1	10.2	11.1
	Stem bark	1.6	2.4	2.3	2.1	2.1
	Branches	4.9	10.1	8.5	7.7	8.4
	Fruits etc.	0.0	0.0	0.0	0.0	0.0
	Foliage	3.6	7.3	7.2	6.2	6.6
	Root estimate	0.9 ^a	2.0 ^a	1.9 ^a	1.5 ^a	1.7 ^a
CAI (m ³ /ha/yr)						
Net production (t/ha/yr)	Stem wood					
	Stem bark					
	Branches					
	Fruits etc.					
	Foliage	1.17 ^b	2.28 ^b	2.47 ^b	2.39 ^b	2.51 ^b
	Root estimate					

Sixty-six trees were sampled in all and stand biomass values for the above five plots were derived from regressions on D. There was 0.6, 1.1, 1.2, 1.3 and 0.9 t/ of dead tree parts in columns left to right.

a. Stumps only.

b. Biomass of new foliage.

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60°48-51'N 16°25-31'E 170-205 m Sweden, Jädraås.

Sandy, iron
podzols.*Pinus sylvestris* with *Picea abies* et al.

	99% ^a	100% ^a	100% ^a	99% ^a	97% ^a	99% ^a
Age (years)	9	12	14	14	26	27
Trees/ha	1421	1801	2538	2527	3459	3164
Tree height (m)	5.7 ^b	6.6 ^b	7.7 ^b	7.2 ^b	13.7 ^b	13.3 ^b
Basal area (m ² /ha)	8.8	6.4	15.1	12.1	29.5	27.4
Leaf area index						
Stem volume (m ³ /ha)						
Dry biomass (t/ha)						
Stem wood	7.8	5.9	18.8	12.6	76.5	66.9
Stem bark	1.8	1.4	3.0	2.9	7.8	7.2
Branches	8.9	3.6	6.0	6.4	10.7	9.1
Fruits etc.	0.0	0.0	0.0	0.0	0.0	0.0
Foliage	9.1	3.3	4.3	6.1	10.3	4.9
Root estimate	2.5	1.4	3.5	2.8	10.9	10.1
CAI (m ³ /ha/yr)						
Net production (t/ha/yr)						
Stem wood						
Stem bark						
Branches						
Fruits etc.						
Foliage	3.19 ^c	0.90 ^c	1.17 ^c	2.36 ^c	1.92 ^c	1.57 ^c
Root estimate						

Six trees were sampled from each stand, and stand values were derived by proportional basal area allocation, except for the 14-year-old stand with 15.1 m²/ha basal area where 10 trees were sampled and stand biomass values were derived from regressions on D. Root biomass values include stumps which weighed 1.2, 0.8, 1.3, 1.2, 4.2 and 3.9 t/ha in columns left to right. There was 0.0, 0.6, 2.4, 1.3, 4.5 and 5.2 t/ha of dead branches in columns left to right.

a. Percentage of the total basal area accounted for by *P. sylvestris*.

b. Dominant tree height.

c. Biomass of new foliage.

Continued from p.227.

60°50-52'N 16°25-35'E 185-205 m Sweden, Jädraås.

Sandy, iron
podzols.*Pinus sylvestris* with *Picea abies* et al.

	99% ^a	99% ^a	97% ^a	100% ^a	97% ^a	100% ^a
Age (years)	28	29	34	50	77	100
Trees/ha	3102	1337	1116	1775	876	453
Tree height (m)	13.4 ^b	14.8 ^b	15.1 ^b	14.8 ^b	17.1 ^b	19.2 ^b
Basal area (m ² /ha)	29.8	22.4	21.7	22.9	21.7	19.7
Leaf area index						
Stem volume (m ³ /ha)						
Dry biomass (t/ha)						
Stem wood	68.7	57.5	61.4	58.8	61.2	76.4
Stem bark	7.2	5.7	5.3	6.6	5.7	4.9
Branches	10.6	12.4	8.9	6.1	6.9	9.3
Fruits etc.	0.0	0.2	0.1	0.0	0.2	0.2
Foliage	6.6	5.7	5.4	4.4	5.4	3.5
Root estimate	12.2	9.1	13.7	12.1	11.4	19.0
CAI (m ³ /ha/yr)						
Net production (t/ha/yr)						
Stem wood						
Stem bark						
Branches						
Fruits etc.						
Foliage	1.84 ^c	1.46 ^c	1.36 ^c	0.91 ^c	1.01 ^c	0.81 ^c
Root estimate						

Six trees were sampled from each of the stands aged 29, 34 and 77 and stand values were derived by proportional basal area allocation. Ten trees were sampled from each of the other stands, and stand values were derived from regressions on D. Root biomass values include stumps which weighed 4.7, 3.5, 5.0, 4.5, 4.8 and 6.5 t/ha in columns left to right. There was 6.9, 2.8, 2.8, 3.1, 2.4 and 2.3 t/ha of dead branches in columns left to right.

a. Percentage of the total basal area accounted for by *P. sylvestris*.

b. Dominant tree height.

c. Biomass of new foliage.

- Burger, H. (1939). Holz, Blattmenge und Zuwachs. IV Ein 80-jähriger Buchenbestand. *Mitt. schweiz. Anst. forstl. VersWes.* 21, 307-348.
- Burger, H. (1947). Holz, Blattmenge und Zuwachs. VIII Die Eiche. *Mitt. schweiz. Anst. forstl. VersWes.* 25, 211-279.
- Burger, H. (1949). Holz, Blattmenge und Zuwachs. X Die Buche. *Mitt. schweiz. Anst. forstl. VersWes.* 26, 419-468.

Switzerland	47°03'N 7°17'E 480 m Aarburg	ca.47°N 8°E 600 m Sihlwald	47°30'N 8°45'E 505 m Winterthur	
Plantations.	<i>Fagus sylvatica</i>		<i>Quercus</i> spp. (70%) ^a and <i>Fagus sylvatica</i>	
	Thinned (Burger 1939)	Thinned (Burger 1949)	Thinned favouring <i>Quercus</i> . Heavy fluvio-glacial loam. (Burger 1947)	
Age (years)	80	98	65	
Trees/ha	572	460	376 + 732	
Tree height (m)			25.7 12.0	
Basal area (m ² /ha)			19.5 + 8.3	
Leaf area index	7.9 ^b	6.2 ^b	3.9 ^b + 2.7 ^b	
Stem volume (m ³ /ha)			227 + 66	
Dry biomass (t/ha)	Stem wood		} 113.5 + 33.0	
	Stem bark			
	Branches		16.5 + 10.4	
	Fruits etc.			
	Foliage	3.2	3.0	2.1 + 0.9
Root estimate				
CAI (m ³ /ha/yr)	9.8	9.4	6.8 + 1.7	
Net production (t/ha/yr)	Stem wood	} 5.59		
	Stem bark			
	Branches			
	Fruits etc.			
	Foliage	3.18	2.95	2.1 + 0.9
	Root estimate			

Three or five trees were sampled in 3 or 4 crown classes per site, and many others were sampled at other sites. Stand biomass values were obtained by multiplying mean tree values by the numbers of trees per hectare in each crown class. Dry biomass values were derived from the author's data on fresh weights, water contents of branches and leaves, stem volumes and wood specific gravities.

The right column gives values separately for *Quercus* spp. plus *F. sylvatica*.

a. Percentage of the total basal area.

b. Projected leaf areas; the author gave 2-sided leaf areas.

- Burger, H. (1942). Holz, Blattmenge und Zuwachs. VI Ein Plenterwald mittlerer Standortsgüte. Der bernische Staatswald Toppwald in Emmental. *Mitt. schweiz. Anst. forstl. VersWes.* 22, 377-445.
- Burger, H. (1947). Holz, Blattmenge und Zuwachs. VIII Die Eiche. *Mitt. schweiz. Anst. forstl. VersWes.* 25, 211-279.
- Burger, H. (1951). Holz, Blattmenge und Zuwachs. XI Die Tanne. *Mitt. schweiz. Anst. forstl. VersWes.* 27, 247-287.

Switzerland	46°55'N 7°35'E 950-1000 m Emmental <i>Abies</i> spp. <i>Picea abies</i> , and <i>Fagus sylvatica</i> Stoney clays pH 4.6-4.9 (Burger 1942)	47°23'N 8°11'E 400 m Staufen nr Lenzburg <i>Abies alba</i> Gravelly soil (Burger 1951)	ca.47°N 650 m Adlisberg <i>Quercus robur</i> Plantation Fertile loam (Burger 1947)
Age (years)	Mixed	56	13
Trees/ha	516 ^a	910	10300
Tree height (m)	5-36		7.0
Basal area (m ² /ha)	44		30.1
Leaf area index	9.0 ^b	7.4 ^b	
Stem volume (m ³ /ha)	530		124
Dry biomass (t/ha)	Stem wood		} 71.8
	Stem bark		
	Branches	21.3	16.8
	Fruits etc.		
	Foliage	13.1	12.6
Root estimate			
CAI (m ³ /ha/yr)	10	19.4	17.5
Net production (t/ha/yr)	Stem wood		} 10.1
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage		
Root estimate			

Three or four trees of *Abies*, *Picea*, *Fagus* and *Quercus* were sampled in three or four crown classes per site, and stand biomass values were obtained by multiplying mean tree values by the numbers of trees per hectare in each crown class. Basal areas were estimated from mean tree diameters and numbers of trees per hectare. Dry biomass values were derived from the author's data on fresh weights, water contents of branches and leaves, stem volumes and wood specific gravities.

a. Trees over 8 cm D.

b. The author estimated all-sided leaf areas to be 20.8 and 17.0 in columns left and right, respectively.

Burger, H. (1941). Holz, Blattmenge und Zuwachs. V Fichten und Föhren verschiedener Herkunft auf verschiedenen Kulturorten. *Mitt. schweiz. Anst. forstl. Verswes.* 22, 10-62.

Switzerland	47°13'N 7°32'E 470 m Solothurn		46°38'N 9°45'E 1600 m Bergün	
Plantations.	<i>Picea abies</i>			
	a		b	
	a	b	a	b
Age (years)	40	40	40	40
Trees/ha	1800	2350	4800	4800
Tree height (m)	19.7	17.2	9.2	9.1
Basal area (m ² /ha)	58.8	62.5	40.8	40.8
Leaf area index	12.0 ^c	10.7 ^c	7.7 ^c	7.9 ^c
Stem volume (m ³ /ha)				
Dry biomass (t/ha)				
Stem wood				
Stem bark				
Branches	91.8	73.6	58.6	60.0
Fruits etc.				
Foliage	19.8	16.2	14.9	14.4
Root estimate				
CAI (m ³ /ha/yr)	26.8	19.0	13.4	13.0
Net production (t/ha/yr)				
Stem wood	} 8.6	} 6.3	} 4.3	} 4.3
Stem bark				
Branches				
Fruits etc.				
Foliage				
Root estimate				

Trees in four crown classes were sampled in each plot, and stand biomass values were obtained by multiplying mean tree values by the numbers of trees per hectare in each crown class. Basal areas were estimated from mean tree diameters and numbers of trees per hectare. Needles were assumed to contain 55% water (percentage of fresh weight).

a. Seed origin at 500 m altitude in Switzerland.

b. Seed origin at 1850 m altitude in Switzerland.

c. All-sided LAI values given by the author have been divided by 2.3.

Burger, H. (1941). Holz, Blattmenge und Zuwachs. V Fichten und Föhren verschiedene Herkunft auf verschiedenen Kulturorten. *Mitt. schweiz. Anst. forstl. VersWes.* 22, 10-62.

Burger, H. (1948). Holz, Blattmenge und Zuwachs. IX Die Föhre. *Mitt. schweiz. Anst. forstl. VersWes.* 25, 435-493.

Switzerland	47°36'N 410 m	8°32'E Eglisau	ca.47°N 605 m	Gurmels	46°52'N 660 m	9°32'E Chur
Plantations.	<i>Pinus sylvestris</i>			Sown after clearfelling.	<i>P. sylvestris</i> (85%) ^a and <i>Larix decidua</i> syn. <i>europaea</i>	
	Three provenances (Burger 1941)				Thinned	Thinned
Age (years)	32	32	32	70	88	
Trees/ha	1550	1550	1550	600	498 + 106	
Tree height (m)	16.1	16.6	16.0	25		
Basal area (m ² /ha)	28.5	33.5	28.1	34.4	37.2 + 6.5	
Leaf area index	2.3 ^b	2.6 ^b	2.3 ^b	2.8 ^b	2.1 ^b + 1.0	
Stem volume (m ³ /ha)				400	642	
Dry biomass (t/ha)	Stem wood			} 173.2	} 267.1	
	Stem bark					
	35.2	42.5	43.7	20.7	24.9 + 2.6	
	Fruits etc.					
	4.8	5.4	5.1	5.2	5.5 + 0.4	
Root estimate						
CAI (m ³ /ha/yr)	13.2	15.0	13.6	13.2	8.0 + 1.4	
Net production (t/ha/yr)	Stem wood			} 5.7	} 3.3 + 0.6	
	Stem bark					
	Branches					
	Fruits etc.					
	Foliage					
Root estimate						

Three or four trees were sampled per stand, and over 200 trees were sampled in other stands. Stand biomass values were obtained by multiplying mean tree values by the numbers of trees per hectare in different crown classes. Dry weights were derived from the author's data on fresh weights, water contents of branches and needles, stem volumes and wood specific gravities. Basal areas were estimated from mean tree diameters and numbers of trees per hectare.

The right column gives values separately for *P. sylvestris* plus *Larix decidua*.

a. Percentage of the total basal area.

b. All-sided leaf areas can be obtained by multiplying by 2.8.

Christensen, B. (1978). Biomass and primary production of *Rhizophora apiculata* Bl. in a mangrove in southern Thailand. *Aquat. Bot.* 4, 43-52.

7°50'N 98°20'E sea level Thailand, Phuket Island, Ao Nam Bor.

Mangrove swamp. *Rhizophora apiculata*, with a few *Ceriops tagal*,
Sonneratia alba, *Rhizophora mucronata* et al.

Regenerated after clearfelling.

Age (years)	14-15
Trees/ha	
Tree height (m)	11
Basal area (m ² /ha)	
Leaf area index	3.7-4.2
Stem volume (m ³ /ha)	

Dry biomass (t/ha)	Stem wood	} 74.4 + 61.2 ^a
	Stem bark	
	Branches	15.8
	Fruits etc.	0.3
	Foliage	7.4
	Root estimate	

CAI (m³/ha/yr)

Net production (t/ha/yr)	Stem wood	} 20.0
	Stem bark	
	Branches	
	Fruits etc.	0.3
	Foliage	6.7 ^b
	Root estimate	

All trees were harvested in one 25 m² plot in February. Wood production was estimated from relationships between biomass and production for mangroves taken from an unpublished Ph.D. thesis (Aksornkoae 1975, Michigan State University).

a. Above-ground prop roots.

b. Estimated by observing leaf longevity on tagged branches for 16 months.

Ogawa, H., Yoda, K., Ogino, K. and Kira, T. (1965). Comparative ecological studies on three main types of forest vegetation in Thailand. II Plant biomass. *Nature and Life in S.E. Asia* 4, 49-80.

Ogawa, H., Yoda, K. and Kira, T. (1961). A preliminary survey on the vegetation of Thailand. *Nature and Life in S.E. Asia* 1, 21-157.

Thailand	18°30'N 98°40'E	300 m	17°00'N 99°30'E	300 m
	Mt Inthanon	Nr Tak	<i>Dipterocarpus alatus</i> ,	
Deep sandy soils.			<i>Mangifera caloneura</i> ,	
	<i>Dipterocarp savanna forest</i> ^a	Mixed savanna forest ^b	<i>Gymnosporia</i> spp.	Evergreen gallery forest
Age (years)				
Trees/ha	1576	1340		16200
Tree height (m)	20-25 ^c	18-25 ^c		29 ^c
Basal area (m ² /ha)	15.3	19.1		82.2
Leaf area index	1.6	1.8		12.1
Stem volume (m ³ /ha)				
Dry biomass (t/ha)	Stem wood	} 58	} 74	} 467
	Stem bark			
	Branches	12	16	214
	Fruits etc.			
	Foliage	1.9	2.2	14.5
	Root estimate	10	11	54
CAI (m ³ /ha/yr)				
Net production (t/ha/yr)	Stem wood			
	Stem bark			
	Branches			
	Fruits etc.			
	Foliage			
	Root estimate			

Many trees were sampled, and biomass values for the above plots of 2500, 1000 and 100 m² (in columns left to right) were derived from regressions on D²H. Values given above are from Ogawa *et al.* (1965) which updated those published earlier.

a. *Pentacme siamensis*, *Terminalia tomentosa*, *Terminalia mucronata* *et al.*

b. *Shorea robusta*, *Dipterocarpus tuberculatus*, *Parinari anamense* *et al.*

c. Height of the top canopy.

Ogawa, H., Yoda, K., Ogino, K. and Kira, T. (1965). Comparative ecological studies on three main types of forest vegetation in Thailand. II Plant biomass. *Nature and Life in S.E. Asia* 4, 49-80.

Ogawa, H., Yoda, K., Kira, T., Ogino, K., Shidei, T., Ratanowongse, D. and Apasutaya, C. (1965). Comparative ecological study on three main types of forest vegetation in Thailand. I Structure and floristic composition. *Nature and Life in S.E. Asia* 4, 13-48.

19°30'N 99°00'E ca.500 m Thailand, Chiang Mai Province, Ping Kong.

Sandy soils.	<i>Dipterocarpus obtusifolius,</i>	<i>D. obtusifolius,</i>	
	<i>Shorea obtusa, et al.</i>	<i>Lagerstroemia calyculata et al.</i>	
	Open savanna forest 58% ^a	Open savanna - monsoon forest 70% ^a	Dry monsoon forest 79% ^a

Age (years)				
Trees/ha	1488	906	713	
Tree height (m)	10-19 ^b	18-29 ^b	17-26 ^b	
Basal area (m ² /ha)	17.4	23.9	35.4	
Leaf area index	1.8 + 0.9 ^c	2.3 + 2.6 ^c	3.9 + 1.8 ^c	
Stem volume (m ³ /ha)				
Dry biomass (t/ha)	Stem wood	} 55 } + 0.1 ^c	} 112 } + 1.0 ^c	} 209 } + 0.7 ^c
	Stem bark			
	Branches			
	Fruits etc.			
	Foliage	2.1 + 0.5 ^c	3.0 + 1.4 ^c	3.8 + 0.5 ^c
	Root estimate	10	16	25

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

Eight to sixteen trees were sampled per stand, representing 6 to 21 species, and roots were excavated. Stand values for the above 0.16 ha plots were derived from regressions on D²H. Only trees at least 4.5 cm D were included.

a. Percentage light interception.

b. Height of the top canopy.

c. Understorey shrubs.

- Kira, T., Ogawa, H., Yoda, K. and Ogino, K. (1967). Comparative ecological studies on three main types of forest vegetation in Thailand. IV Dry matter production, with special reference to the Khao Chong rainforest. *Nature and Life in S.E. Asia* 5, 149-174.
- Kira, T., Ogawa, H., Yoda, K. and Ogino, K. (1964). Primary production of a tropical rainforest of southern Thailand. *Bot. Mag., Tokyo* 77, 428-429.
- Ogawa, H., Yoda, K., Ogino, K. and Kira, T. (1965). (See 1967 reference above) II Plant biomass. *Nature and Life in S.E. Asia* 4, 49-80.

7°35'N 99°45'E ca.100 m Thailand, Trang Province, Khao Chong Reserve.

Deep sandy soil. *Padbruggea pubescens*, *Eugenia clarkeana* and 83 other species.

Evergreen tropical rainforest.

	Mature	Mature	
Age (years)			
Trees/ha	1175	1338	
Tree height (m)	26-36 ^a	26-36 ^a	
Basal area (m ² /ha)	39.9	34.5	
Leaf area index	10.7 (or 10.7) ^b	11.4	
Stem volume (m ³ /ha)			
Dry biomass (t/ha)	Stem wood	} 254 (or 292) ^b	} 206
	Stem bark		
	Branches	106 ^c (or 104) ^b	80 ^c
	Fruits etc.		
	Foliage	7.7 ^c (or 7.8) ^b	8.2 ^c
	Root estimate	32	30
CAI (m ³ /ha/yr)			
Net production (t/ha/yr)	Stem wood	} 4.18 + 0.78 ^d	} 1.69 + 0.27 ^d + 11.39 ^e
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage		12.0 ^e
	Root estimate		0.7

One hundred and nineteen trees representing 80 species were sampled, and roots of three trees were excavated. Stand values for the above two 0.16 ha plots were derived from regressions on D²H. Only trees at least 4.5 cm D were included. Production values given above are from Kira *et al.* (1967) which updated those given by Kira *et al.* (1964).

a. Height of the top canopy.

b. Alternative values obtained by completely clearfelling a 400 m² plot.

c. Including climbers, which consisted of about 18 t/ha wood and 2.4 t/ha leaves.

d. Mortality.

e. Litterfall, measured over 42 days and expressed as annual values.

Hughes, M.K. (1971). Tree biocontent, net production and litterfall in a deciduous woodland. *Oikos* 22, 62-73.

Hughes, M.K. (1969). "Investigations of the Ecosystem Energetics of an English Woodland." Unpublished Ph.D. thesis, University of Durham, England.

54°40'N 1°20'E 67 m U.K., England, Durham.

Alnus glutinosa (55%)^a, *Betula pendula* (44%)^a,
and *Acer pseudoplatanus*.

Variously coppiced and logged in last 100 years, but
untouched for previous 15 years.

Age (years)	5 to 80
Trees/ha	1600
Tree height (m)	12
Basal area (m ² /ha)	ca.21
Leaf area index	3.6
Stem volume (m ³ /ha)	

Dry biomass (t/ha)	Stem wood	} 106.9
	Stem bark	
	Branches	
	Fruits etc.	0.4
	Foliage	1.7
	Root estimate	

CAI (m³/ha/yr)

Net production (t/ha/yr)	Stem wood	} 4.26 + 0.34 ^b
	Stem bark	
	Branches	
	Fruits etc.	0.34 ^b
	Foliage	1.78 ^b
	Root estimate	

Twelve *A. glutinosa* and 13 *B. pendula* trees were sampled, and stand biomass values for 8 plots totalling 0.32 ha were derived from regressions on D.

a. Percentage of the total stem number.

b. Litterfall, measured over 2 years.

Ovington, J.D. and Madgwick, H.A.I. (1959a). The growth and composition of natural stands of birch. I Dry matter production. *Pl. Soil* 10, 271-283.

Ovington, J.D. and Madgwick, H.A.I. (1959b). The growth and composition of natural stands of birch. II The uptake of nutrients. *Pl. Soil* 10, 389-400.

52°29'N 0°15'W ca.50 m U.K., England, near Peterborough, Holme Fen Nature Reserve.

Deep peat.

Betula verrucosa syn. *pendula* (77-96%)^a
and *Betula pubescens*.

Age (years)	6	24	27	32	38	42	46	53	55	
Trees/ha	10450	4990	2480	4210	1500	1340	740	1020	880	
Tree height (m)	2.1	9.1	12.8	9.5	12.3	13.0	18.8	18.5	17.6	
Basal area (m ² /ha)		14.1	19.5	16.2	17.0	20.6	25.6	26.0	25.0	
Leaf area index	0.4	6.2	3.5	4.1	1.7	2.8	4.1	5.9	6.5	
Stem volume (m ³ /ha)										
Dry biomass (t/ha)	Stem wood	} 0.9	} 48.0	} 68.2	} 52.8	} 58.9	} 58.5	} 102.3	} 139.8	} 134.5
	Stem bark									
	Branches	0.4	11.8	8.8	9.4	10.9	9.1	16.9	30.6	27.0
	Fruits etc.									
	Foliage	0.1	2.4	1.3	1.6	0.7	1.1	1.6	2.3	2.5
	Root estimate	0.3	16.9				25.8			49.8
CAI (m ³ /ha/yr)										
Net production (t/ha/yr)	Stem wood	} 2.6	} 3.2	} 4.0	} 4.0	} 4.2	} 4.4	} 4.6	} 4.8	} 5.4
	Stem bark									
	Branches	1.6	1.9	2.8	2.8	2.2	2.0	1.7	1.5	1.3
	Fruits etc.									
	Foliage	1.2	1.2	1.5	1.4	1.4	1.3	1.4	1.5	1.6
	Root estimate									

Two trees of average size were sampled from each stand in August, and two root systems were excavated. Stand biomass values for the above 0.1 ha plots were obtained by multiplying mean tree values by the numbers of trees per hectare. There was 0.1 to 4.5 t/ha of dead branches in each stand. Nutrient contents were determined.

The production values refer to ages 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 40-45, 45-50 and 50-55 in columns left to right, derived from smoothed curves of estimated cumulative dry biomass with age, including estimated mortality and litterfall.

a. Percentage of the total tree number.

Ford, E.D. and Newbould, P.J. (1970). Stand structure and dry weight production through the sweet chestnut (*Castanea sativa* Mill.) coppice cycle. *J. Ecol.* 58, 275-296.

Ford, E.D. and Newbould, P.J. (1971). The leaf canopy of a coppiced deciduous woodland. *J. Ecol.* 59, 843-862.

51°05'N 0°55'E 10 m U.K., England, near Ashford, Ham Street Woods.

Fertile
loam.

Castanea sativa

Managed coppice.

Age (years)	1	2	5	9	
Trees/ha	76190 ^a	40000 ^a	18000 ^a	14000 ^a	
Tree height (m)	1.0	2.5	5.0	7.0	
Basal area (m ² /ha)		2.1	16.0	36.8	
Leaf area index	1.1	2.1	3.6	5.6	
Stem volume (m ³ /ha)					
Dry biomass (t/ha)	Stem wood	} 0.8	} 2.5	} 10.5	} 28.5
	Stem bark				
	Branches				
	Fruits etc.	0.0	0.0	0.0	0.0
	Foliage	0.4 ^b	0.7 ^b	1.9 ^b	3.6 ^b
Root estimate					
CAI (m ³ /ha/yr)					
Net production (t/ha/yr)	Stem wood	} 0.6 ^c	} 1.8 ^c	} 6.5 ^c	} 7.3 ^c
	Stem bark				
	Branches				
	Fruits etc.	0.0	0.0	0.0	0.0
	Foliage	0.4 ^b	0.7 ^b	1.9 ^b	3.6 ^b
Root estimate					

Ten to fifty stems were sampled per age, and stand biomass values for the above 45 m² plots were derived from regressions on H and D². Wood increments were estimated by repeated sampling during one year.

a. Number of stems per hectare.

b. Leaf biomass at the end of the growing season.

c. Including estimated shoot mortality.

Satchell, J.E. (1981). "The Ecology of Meathop Wood." Institute of Terrestrial Ecology, Merlewood Research Station, Grange-over-Sands, England. Unpublished manuscript.

Sykes, J.M. and Bunce, R.G.H. (1970). Fluctuations in litterfall in a mixed deciduous woodland over a three-year period 1966-1968. *Oikos* 21, 326-329.

Satchell, J.E. (1971). Feasibility study of an energy budget for Meathop Wood. In: "Productivity of Forest Ecosystems" (P. Duvigneaud, ed.) pp.619-630. UNESCO, Paris.

54°12'N 2°54'W 45 m U.K., England, Lake District, near Grange-over-Sands, Meathop.

Brown earth with humus, pH 4.1-7.3		<i>Quercus robur</i> (43%) ^a , <i>Fraxinus excelsior</i> (29%) ^a , <i>Betula</i> spp. (13%) ^a , <i>Acer pseudoplatanus</i> (3%) ^a with understorey of <i>Corylus avellana</i> (12%) ^a		
		1962	1967	1972
Age (years)		to 70-81	to 70-81	to 70-81
Trees/ha			519 ^b	537 ^b
Tree height (m)				14.6
Basal area (m ² /ha)			18.2 + 4.8 ^c	20.7 + 4.7 ^c
Leaf area index			4.5 + 0.8 ^c	4.5 + 0.8 ^c
Stem volume (m ³ /ha)				
Dry biomass (t/ha)	Stem wood	} 79.6 + 8.2 ^c	} 93.3 + 14.4 ^c	65.7
	Stem bark			10.2
	Branches			33.6
	Fruits etc.			+ 15.1 ^c
	Foliage		3.7 + 0.4 ^c	3.7 + 0.4 ^c
	Root estimate			74.4
CAI (m ³ /ha/yr)				
Net production (t/ha/yr)	Stem wood	} 2.73 ^d + 1.23 ^{cd}	} 1.87	1.87
	Stem bark			0.38
	Branches			0.95
	Fruits etc.		0.60 ^e	+ 0.15 ^c + 1.60 ^e
	Foliage		3.7 + 0.4 ^c	3.7 + 0.4 ^c
	Root estimate			

Seventy-two trees and 30 *C. avellana* were sampled in winter, and roots were excavated. Stand biomass values for a 1.0 ha plot were derived from regressions on stem girths. Increments for 1962-67 were derived by core sampling, and for 1967-72 by remeasurement. In 1972 there was 5.1 t/ha of overstorey dead wood, and 2.4 t/ha of understorey dead wood. Leaf biomass values are for June. These data update those given by Satchell (1971).

a. Percentage of the total biomass.

b. There were 752 to 759 stems per hectare.

c. Understorey shrubs.

d. Excluding woody litterfall.

e. Litterfall, measured over 4 to 5 years; mean leaf litterfall was 3.2 t/ha/yr.

Peterken, G.F. and Newbould, P.J. (1966). Dry matter production by *Ilex aquifolium* L. in the New Forest. *J. Ecol.* 54, 143-150.

50°50'N. 1°35'W ca.100 m U.K., England, New Forest.

Well-drained
podzols over
gravel subsoils.

Ilex aquifolium

Beneath an overstorey of
broadleaved trees.

Unshaded

	Beneath an overstorey of broadleaved trees.			Unshaded		
	80	94	92	100	82	
Age (years)	80	94	92	100	82	
Trees/ha	3100	5510	5700	3130	5400	
Tree height (m)	9	9	5	8	8	
Basal area (m ² /ha)						
Leaf area index	2.4 ^a	2.1 ^a	1.4	5.6	5.6	
Stem volume (m ³ /ha)						
Dry biomass (t/ha)	Stem wood	} 39.6	} 52.6	} 25.2	} 85.3	
	Stem bark					} 152.3
	Branches	15.7	15.4	10.0	36.2	
	Fruits etc.					
	Foliage	4.1	3.7	2.5	9.3	18.0
	Root estimate	22.6				
CAI (m ³ /ha/yr)						
Net production (t/ha/yr)	Stem wood	} 3.6 ^b	} 3.8 ^b	} 2.2 ^b	} 9.7 ^b	
	Stem bark					} 15.4 ^b
	Branches					
	Fruits etc.					
	Foliage					
	Root estimate					

One tree in each of three size-classes was sampled, and one root system was excavated. Stand biomass values for the above 100-170 m² plots were obtained by multiplying mean tree values by the numbers of trees per hectare in each size class.

a. The overstorey canopies had summer LAI values of about 2.8.

b. Total production, including woody litterfall (assumed to be equal to the number of new branch scars multiplied by mean branch weight) and new foliage production (derived from the average foliage longevity).

Ford, D.E. (1981). A high rate of dry matter production in an early pole stage plantation of Sitka spruce and its relation to canopy structure and development. *Forestry* (in press).

Deans, J.D. (1979). Fluctuations of the soil environment and fine root growth in a young Sitka spruce plantation. *Pl. Soil* 52, 195-208.

Deans, J.D. (1981). Dynamics of coarse root production in a young plantation of *Picea sitchensis*. *Forestry* 54, 139-155.

55°19'N 3°33'W 355 m U.K., Scotland, near Moffat, Greskine Forest.

Plantation. *Picea sitchensis*
Peaty gley
soil.

Fertilizers were applied at planting.

Age (years)	17	
Trees/ha	3817	
Tree height (m)	8	
Basal area (m ² /ha)	26.6	
Leaf area index	9.1 ^a	
Stem volume (m ³ /ha)	ca.110	
Dry biomass (t/ha)	Stem wood	} 56.3
	Stem bark	
	Branches	25.0
	Fruits etc.	0.0
	Foliage	26.6
	Root estimate	(4.9 + 20.1) ^b
CAI (m ³ /ha/yr)	ca.20	
Net production (t/ha/yr)	Stem wood	} 16.43 ^c
	Stem bark	
	Branches	4.30 ^e
	Fruits etc.	
	Foliage	6.01 ^d
	Root estimate	(5.28 + 3.15) ^b

Seven trees were sampled at age 16, and 9 trees were sampled at age 18. Seven root systems were excavated, and fine roots were extensively sampled by soil coring. Stand biomass values for a 990 m² plot were derived from regressions on basal area per tree.

a. Projected LAI was 10.6 at age 16, and 7.5 at age 18.

b. Fine plus thick roots.

c. Woody litterfall was negligible, and there was no tree mortality.

d. New foliage biomass.

Wright, T.W. and Will, G.M. (1958). The nutrient content of Scots and Corsican pines growing on sand dunes. *Forestry* 31, 13-25.

57°39'N 3°40'W 10 m U.K., Scotland, Morayshire, Culbin Forest.

Plantations.
Poor aolian
sand dunes.

Pinus nigra var. *calabrica*
syn. var. *maritima*

Pinus sylvestris

	<i>Pinus nigra</i> var. <i>calabrica</i> syn. var. <i>maritima</i>			<i>Pinus sylvestris</i>			
	18	28	48	18	28	64	
Age (years)							
Trees/ha	5189	3608	1112	5189	2125	815	
Tree height (m)	4.6	8.5	13.6	5.5	11.9	16.5	
Basal area (m ² /ha)							
Leaf area index							
Stem volume (m ³ /ha)	25	65	147	50	138	157	
Dry biomass (t/ha)	Stem wood	11.3	39.8	74.0	28.4	67.0	83.2
	Stem bark	4.9	12.9	21.3	7.3	8.4	14.2
	Branches	6.4	10.9	11.2	13.1	14.0	16.7
	Fruits etc.						
	Foliage	3.1	4.8	5.6	6.2	4.7	4.7
Root estimate							
CAI (m ³ /ha/yr)							
Net production (t/ha/yr)	Stem wood						
	Stem bark						
	Branches						
	Fruits etc.						
	Foliage						
	Root estimate						

Three trees of average size were sampled per stand at various times of year. Stand biomass values for plots of 400 or 800 m² were obtained by multiplying mean tree values by the numbers of trees per hectare. Nutrient contents were determined.

Ovington, J.D. (1957). Dry matter production of *Pinus sylvestris* L. *Ann. Bot.* 21, 287-316.

Ovington, J.D. (1959). Mineral content of plantations of *Pinus sylvestris* L. *Ann. Bot.* 23, 75-88.

Ovington, J.D. (1961). Some aspects of energy flow in plantations of *Pinus sylvestris* L. *Ann. Bot.* 25, 12-20.

52°30'N 1°53'E 50 m U.K., England, Thetford Chase.

Sandy soils.

Pinus sylvestris

	Plan- tation	Naturally regenerated		Plantations						
		11	14	17	20	23	31	35	55	
Age (years)	7									
Trees/ha	4810	4230	5190	5640	5400	3640	2370	1890	760	
Tree height (m)	1.4	2.9	3.6	4.9	5.8	8.2	12.6	14.2	16.0	
Basal area (m ² /ha)	0.1	4.1	7.2	14.4	19.6	25.3	36.0	32.5	30.8	
Leaf area index	0.8 ^α	2.1 ^α	2.5 ^α	3.3 ^α	3.9 ^α	1.9 ^α	3.1 ^α	3.6 ^α	2.7 ^α	
Stem volume (m ³ /ha)										
Dry biomass (t/ha)	Stem wood	} 1.0	} 5.2	} 8.4	} 16.2	} 27.1	} 44.3	} 81.7	} 98.8	} 96.7
	Stem bark									
	Branches	1.0	4.3	7.8	9.4	12.0	13.8	9.4	9.6	12.3
	Fruits etc.	0.0	0.0	0.0	0.1	0.5	0.5	0.6	0.6	1.0
	Foliage	2.1	5.8	6.7	9.0	10.5	5.1	8.3	9.8	7.2
	Root estimate	3.4	10.6	10.4	12.8	14.0	28.1	27.7	44.0	34.1
CAI (m ³ /ha/yr)										
Net production (t/ha/yr)	Stem wood	} 1.1	} 1.1	} 2.6	} 3.6	} 11.0	} 8.5	} 9.3	} 5.0	
	Stem bark									
	Branches	1.1	1.4	3.8	2.3	3.0	3.0	3.8	0.8	
	Fruits etc.	0.0	0.0	0.7	1.3	1.0	0.4	0.8	0.8	
	Foliage	1.7	3.9	4.3	3.6	3.7	3.6	3.5	3.3	
	Root estimate									

One to three trees of average size were sampled per stand in August, and their roots were excavated. Stand biomass values were obtained by multiplying mean tree values by the numbers of trees per hectare. The production values refer to ages 7-11, 11-14, 14-17, 17-20, 20-23, 23-31, 31-35 and 35-55 in columns left to right, derived from smoothed curves of estimated cumulative dry biomass with age, including estimated mortality, thinnings and litterfall. Nutrient contents were determined.

α. All-sided LAI values can be obtained by multiplying by 2.8.

Miller, H.G., Cooper, J.M. and Miller, J.D. (1976). Effect of nitrogen supply on nutrients in litterfall and crown leaching in a stand of Corsican pine. *J. appl. Ecol.* 13, 233-248.

Miller, H.G. and Miller, J.D. (1976). Effect of nitrogen supply on net primary production in Corsican pine. *J. appl. Ecol.* 13, 249-256.

57°39'N 3°40'W ca.50 m U.K., Scotland, Morayshire, Culbin Forest.

Plantations.

Pinus nigra var. *maritima*

Blown sand.

All plots received 21 kg/ha P and 120 kg/ha K at age 36, plus the following amounts of N at ages 36, 37 and 38.

	Nil	84 kg/ha	168 kg/ha	336 kg/ha	504 kg/ha	
Age (years)	39	39	39	39	39	
Trees/ha	2110	2110	2110	2110	2110	
Tree height (m)	12.9	13.3	13.3	13.2	13.1	
Basal area (m ² /ha)	39.4	41.1	41.7	42.0	42.4	
Leaf area index	2.8 ^a	3.8 ^a	4.1 ^a	4.8 ^a	5.0 ^a	
Stem volume (m ³ /ha)						
Dry biomass (t/ha)	Stem wood	78.4	80.4	86.2	86.8	92.5
	Stem bark	13.3	14.8	15.2	15.0	16.7
	Branches	14.8	18.0	16.9	16.7	16.7
	Fruits etc.					
	Foliage	7.4	9.8	11.8	13.4	14.8
	Root estimate	28.1	36.1	33.8	31.7	37.0
CAI (m ³ /ha/yr)						
Net production (t/ha/yr)	Stem wood	3.58	4.90	6.88	7.48	5.70
	Stem bark	0.78	1.01	1.12	0.94	1.14
	Branches	1.79 + 0.33 ^b	2.20 + 0.28 ^b	2.05 + 0.24 ^b	1.87 + 0.20 ^b	1.90 + 0.36 ^b
	Fruits etc.	0.16 ^b	0.13 ^b	0.13 ^b	0.16 ^b	0.17 ^b
	Foliage	3.18 ^c	4.01 ^c	4.97 ^c	5.37 ^c	5.46 ^c
	Root estimate	1.46	4.39	3.16	2.81	4.37

Thirty trees were sampled at age 36, and 15 trees were sampled per treatment at age 39. Roots were excavated. Stand values for three 400 m² plots per treatment were derived from regressions on basal area per tree.

a. All-sided LAI values can be obtained by multiplying by 2.85.

b. Litterfall, measured over 6 years.

c. Foliage increment plus 85% of the total litterfall; mean foliage litterfall was 2.13, 2.72, 3.29, 3.48 and 3.44 t/ha/yr in columns left to right.

Miller, H.G., Miller, J.D. and Cooper, J.M. (1980). Biomass and nutrient accumulation at different growth rates in thinned plantations of Corsican pine. *Forestry* 53, 23-39.

54-58°N 2-6°W -- U.K. Scotland.

Plantations.

Pinus nigra var. *maritima*

Stands with a maximum mean annual increment of 12 m³/ha/yr.^a

Age (years)	20	30	40	50	60	70	80	
Trees/ha	4046	1678	908	614	474	403	358 ^b	
Tree height (m)	6.4	11.2	15.4	18.8	21.6	23.8	25.4	
Basal area (m ² /ha)	24.8	26.8	28.3	30.4	32.2	34.3	35.5	
Leaf area index								
Stem volume (m ³ /ha)	122	215	294	359	413	464	500	
Dry biomass (t/ha)	Stem wood	39.9	70.0	95.6	116.6	134.1	150.6	162.3
	Stem bark	7.6	12.2	16.0	19.2	21.9	24.4	26.2
	Branches	5.7	12.2	17.8	22.4	26.2	29.8	32.4
	Fruits etc.							
	Foliage	9.0	9.8	9.6	8.9	8.0	7.1	6.3
	Root estimate	23.4	29.7	34.5	38.2	41.0	43.6	45.3
CAI (m ³ /ha/yr)	14.2	16.4	15.8	14.0	11.8	9.4	7.2	
Net production (t/ha/yr)	Stem wood							
	Stem bark							
	Branches							
	Fruits etc.							
	Foliage							
	Root estimate							

Regressions relating biomass to stem volumes, based on data collected by Miller *et al.* (1976) (see p.246) were applied to stand volume tables. Values given above refer to stands prior to each thinning. Root values include the stumps. There was 2.4, 4.4, 6.2, 7.6, 8.8, 9.9 and 10.7 t/ha of dead branches in columns left to right. Nutrient contents were determined.

a. Tables for other yield classes can be obtained from the Macaulay Institute for Soil Research, Craigiebuckler, Aberdeen, Scotland.

b. An error in the authors' Table 6 has been corrected.

Whittaker, R.H. (1966). Forest dimensions and production in the Great Smoky Mountains. *Ecology* 47, 103-121.

Whittaker, R.H. and Woodwell, G.M. (1971). Measurement of net primary production of forests. In: "Productivity of Forest Ecosystems" (P. Duvigneaud, ed.) pp.159-175. UNESCO, Paris.

35°28-47'N ca.84°W (alt. given below) U.S.A. Great Smoky Mountains.

	Surrey Fork Flats <i>Acer saccharum</i> (43%) ^a <i>Tsuga canadensis</i> (35%) ^a <i>Fagus grandifolia</i> (17%) ^a et al. 870 m	Porter Creek Flats <i>A. saccharum</i> (29%) ^a <i>Aesculus octandra</i> (19%) ^a <i>Halesia carolina</i> (19%) ^a et al. 730 m	
Age (years)	Mature	Mature	
Trees/ha	1210 ^b	1110 ^b	
Tree height (m)	33 ^c	32 ^c	
Basal area (m ² /ha)	64.0	53.2	
Leaf area index			
Stem volume (m ³ /ha)	890 ^d	764 ^d	
Dry biomass (t/ha)	} 606.5	} 496.2	
			Stem wood
			Stem bark
			Branches
	Fruits etc.		
Foliage	3.5	3.8	
Root estimate			
CAI (m ³ /ha/yr)	5.9 ^d	5.3 ^d	
Net production (t/ha/yr)	} 8.0 ^e	} 11.5 ^e	
			Stem wood
			Stem bark
			Branches
	Fruits etc.		
Foliage	3.5	3.8	
Root estimate			

Stand biomass values for 0.1 ha plots were derived from published regressions on D, stem volumes and from branch/stem biomass ratios and other relationships. The foliage production of *T. canadensis* was taken as its foliage biomass divided by its mean foliage age.

a. Percentage of the total volume increment; *A. octandra* syn. *flava*.

b. Stems over 1.9 cm D.

c. Canopy height.

d. Parabolic volumes.

e. Excluding woody litterfall and any mortality.