Mälkönen, E. (1977). "Annual Primary Production and Nutrient Cycle in a Birch Stand." Communicationes Instituti Forestalis Fenniae (Helsinki) No.91.

61°37'N 24°09'E 160 m Finland, Orivesi.

Fine sandy moraine

Betula pubescens (84%),[a] *Betula verrucosa* (16%)[a]

Age (years)		40
Trees/ha		1012
Tree height (m)		20.6[b]
Basal area (m^2/ha)		18.0
Leaf area index		
Stem volume (m^3/ha)		155
Dry biomass (t/ha)	Stem wood	67.1
	Stem bark	11.4
	Branches	8.6
	Fruits etc.	
	Foliage	2.9
	Root estimate	24.1
CAI (m^3/ha/yr)		6.1
Net production (t/ha/yr)	Stem wood	2.74
	Stem bark	0.30
	Branches	0.79 + 0.20[c] } + 0.21[c]
	Fruits etc.	0.06[c] }
	Foliage	2.90[d] }
	Root estimate	1.85

Twenty trees were sampled in August. Six root systems were excavated and fine roots were core sampled. Stand biomass values for a 0.16 ha plot were derived from regressions on D^2H. There was 0.25 t/ha of dead branches. The root biomass value includes stumps. Roots were assumed to grow at the same relative rates as above-ground parts. Nutrient contents were determined.

a. Percentage of the tree number (*Betula verrucosa* syn. *B. pendula*).
b. Dominant tree height.
c. Litterfall measured over one year; 0.21 t/ha/yr was miscellaneous litterfall.
d. Biomass of new leaves; leaf litterfall was 1.88 t/ha/yr.

Havas, P. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.), p. 582. Cambridge University Press, Cambridge, London, New York, Melbourne.

66°22'N 29°00'E 270 m Finland, Oulu.

Poorly drained podzol, pH 4.7

Picea abies

Age (years)		260
Trees/ha		550
Tree height (m)		16.2
Basal area (m^2/ha)		22.2
Leaf area index		4.9
Stem volume (m^3/ha)		
Dry biomass (t/ha)	Stem wood	56.6
	Stem bark	10.7
	Branches	17.1
	Fruits etc.	0.2
	Foliage	6.6
		+ 0.13[a]
	Root estimate	37.5
CAI (m^3/ha/yr)		
Net production (t/ha/yr)	Stem wood	0.10[b]
	Stem bark	
	Branches	
	Fruits etc.	0.20[b]
	Foliage	1.25[b]
	Root estimate	

There was 4.2 t/ha of standing dead wood.

a. Understorey shrubs.

b. Litterfall only.

Mälkönen, E. (1974). "Annual Primary Production and Nutrient Cycle in some Scots Pine Stands." Communicationes Instituti Forestalis Fenniae (Helsinki) No.84.

60°31' to 61°40' N 23°51' to 24°19' E 125-140 m Finland, Tammela.

Podzols with 2 cm humus layer. Fine or coarse sands with stones.

Pinus sylvestris

Age (years)		28	47	45
Trees/ha		2911	845	1420
Tree height (m)		6.4	12.0	15.4
Basal area (m^2/ha)		7.7	12.1	19.9
Leaf area index				
Stem volume (m^3/ha)		30.2	75.5	148.8
Dry biomass (t/ha)	Stem wood	9.6	27.1	55.6
	Stem bark	1.9	3.3	5.3
	Branches	3.3	6.8	7.4
	Fruits etc.			
	Foliage	2.3	3.5	4.4
	Root estimate	7.0	11.0	19.3
CAI (m^3/ha/yr)		2.3	5.0	5.9
Net production (t/ha/yr)	Stem wood	0.78	1.79	2.35
	Stem bark	0.09	0.10	0.13
	Branches	0.68 + 0.07[a]	0.77 + 0.19[a]	0.87 + 0.32[a]
	Fruits etc.			
	Foliage	0.90[b]	1.38[b]	1.74[b]
	Root estimate	0.96	1.07	1.29

Twenty trees were sampled in each stand. Root systems were excavated and fine roots were core sampled. Stand biomass values for the above plots of about 0.1 ha were derived from regressions on D or D^2H. There was 0.8, 1.2 and 3.2 t/ha of dead branches in columns left to right. Root biomass values include the stumps. Roots were assumed to grow at the same relative rates as above-ground parts. Nutrient contents were determined.

a. Woody litterfall, measured over 2 years.

b. Biomass of new foliage plus the increase in weight of old foliage; foliage litterfall was 0.49, 0.80 and 1.11 t/ha/yr in columns left to right.

Paavilainen, E. (1980). "Effect of Fertilization on Plant Biomass and Nutrient Cycle on a Drained Dwarf Shrub Pine Swamp." Communicationes Instituti Forestalis Fenniae (Helsinki) No.98.

62°04'N 24°34'E 5-50 m Finland, Vilppula, Jaakkoinso

Pinus sylvestris (dwarf trees)

Drained peatlands, pH 3.1-3.6	Fertilizer treatments given 13 years previously			Fertilizer treatments given 13 years before, plus NPK 3 years previously		
	Nil	PK	NPK	Nil	PK	NPK
Age (years)	Mature	Mature	Mature	Mature	Mature	Mature
Trees/ha	688	800	784	592	757	784
Tree height (m)						
Basal area (m^2/ha)	16.6	13.1	16.1	13.7	14.0	14.3
Leaf area index						
Stem volume (m^3/ha)	116	79	115	99	92	95
Dry biomass (t/ha) Stem wood	51.8	36.7	50.3	41.0	41.1	41.4
Dry biomass (t/ha) Stem bark	3.3	2.6	3.3	3.0	3.1	3.1
Dry biomass (t/ha) Branches	10.4	7.4	9.8	8.1	8.6	7.9
Dry biomass (t/ha) Fruits etc.	1.2	0.3	0.9	1.1	0.8	0.9
Dry biomass (t/ha) Foliage	4.1	3.5	4.1	4.0	4.5	4.3
Dry biomass (t/ha) Root estimate	27.8	22.6	27.9	25.3	25.5	27.6
CAI (m^3/ha/yr)						
Net production (t/ha/yr) Stem wood	1.81	1.63	1.64	1.98	2.33	2.02
Net production (t/ha/yr) Stem bark	0.29	0.23	0.25	0.27	0.31	0.32
Net production (t/ha/yr) Branches	0.88	0.62	0.83	0.61	0.65	0.60
Net production (t/ha/yr) Fruits etc.	0.58 + 1.06[a]	0.15 + 0.75[a]	0.46 + 0.63[a]	0.56 + 0.68[a]	0.42 + 0.42[a]	0.44 + 0.79[a]
Net production (t/ha/yr) Foliage	1.13[b]	0.95[b]	1.07[b]	1.18[b]	1.41[b]	1.20[b]
Net production (t/ha/yr) Root estimate	1.73	1.52	1.64	1.94	2.15	2.10

Three trees were sampled per plot in April-May, including the fine roots. Stand biomass values for 625-700 m^2 plots were derived from regressions on D^2H and using published regressions for stumps and thick roots. Roots were assumed to grow at the same relative rates as above-ground parts. There was 4.4, 2.7, 4.1, 2.8, 2.5 and 2.6 t/ha of dead branches in columns left to right. Nutrient contents were determined.

a. Non-foliage litterfall (i.e. total litterfall, measured over 4 years, minus new foliage biomass).

b. New foliage biomass.

Auclair, D. and Métayer, S. (1980). Méthodologie de l'évaluation de la biomasse aérienne sur pied et de la production en biomasse des taillis. *Acta Oecologica/ Oecol. Applic.* 1, 357-377.

ca.47°50'N 1°50'E 50-200 m France, near Orléans.

Coppices

		Carpinus betulus	*Betula pubescens*
Age (years)		35	25
Trees/ha		5604[a]	6849[a]
Tree height (m)		11.8	11.4
Basal area (m^2/ha)		23.9	22.8
Leaf area index			
Stem volume (m^3/ha)			
Dry biomass (t/ha)	Stem wood	109	80
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage	3.5	2.8
	Root estimate		
CAI (m^3/ha/yr)			
Net production (t/ha/yr)	Stem wood	5.5[b]	5.6[b]
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage	3.5	2.8
	Root estimate		

163 stems were sampled and stand biomass values for the above plots of about 0.1 ha were derived from regressions on stem circumference.

a. Number of stems per hectare, with several stems per root system.

b. Excluding woody litterfall and mortality.

Lemée, G. (1978). La hêtraie naturelle de Fontainebleau. In: "Problèmes d'Ecologie: Structure et Fonctionnement des Ecosystèmes Terrestres" (M. Lamotte and F. Bourlière, eds), pp.75-127. Masson, Paris, New York, Barcelona and Milan.

48°24'N 2°42'E 135 m France, Fontainebleau, 50 km SE of Paris.

Mixtures of brown leached soils and podzols, pH 3.4-4.8

Fagus sylvatica

		7 plots of 2500 m²	Means of large woodland areas: 'Tillaie'	Means of large woodland areas: 'Gros-Fouteau'
Age (years)		150-270	150-270	150-270
Trees/ha		ca.350	ca.350	ca.350
Tree height (m)		24-40	24-40	24-40
Basal area (m²/ha)		ca.27.5	ca.27.5	ca.27.5
Leaf area index		ca. 6.6	ca. 6.6	ca. 6.6
Stem volume (m³/ha)				
Dry biomass (t/ha)	Stem wood	232	185	195
	Stem bark			
	Branches	58	46	48
	Fruits etc.	0.5		
	Foliage	3.5[b]	3.0[b]	3.2[b] + 0.7[a]
	Root estimate	49	39	41
				+ 4.8[a]
CAI (m³/ha/yr)				
Net production (t/ha/yr)	Stem wood	4.76[c] + 1.06[d]		
	Stem bark			
	Branches			
	Fruits etc.	0.50[d]		
	Foliage	3.45[b]		
	Root estimate	0.80		

Twenty trees were sampled and many windthrown trees were measured. Stand biomass values were derived from regressions on D. Root biomass was assumed to be 17% of the above-ground biomass. Nutrient contents were determined.

a. Understorey shrubs, mostly *Ilex* spp.
b. Leaf litterfall multiplied by 1.1 to account for losses by decay and consumption.
c. Including estimated mortality.
d. Litterfall.

Lossaint, P. and Rapp, M. (1978). La forêt Méditerranéenne de chênes verts (*Quercus ilex* L.). In: "Problèmes d'Ecologie: Structure et Fonctionnement des Ecosystèmes Terrestres" (M. Lamotte and F. Bourlière, eds) pp. 129-185. Masson, Paris, New York, Barcelona and Milan.

Auclair, D. and Métayer, S. (1980). Méthodologie de l'évaluation de la biomasse aérienne sur pied et de la production en biomasse des taillis. *Acta Oecologica/ Oecol. Applic.* 1, 357-377.

France	43°36'N 3°53'E 185 m 14 km NE of Montpellier, Roquet		ca.47°50'N 1°50'E 50-200 m near Orléans
	Quercus ilex		*Quercus robur*
	Infertile, red-yellow soils and rendzinas pH 6.7-7.8		Coppice (Auclair and Métayer 1980)
Age (years)	ca.150		40
Trees/ha	1400		3064[a]
Tree height (m)	10-12		8.9
Basal area (m^2/ha)	38.8		20.4
Leaf area index	4.4		
Stem volume (m^3/ha)			
Dry biomass (t/ha) Stem wood	235	+ 1.9[b]	67
Dry biomass (t/ha) Stem bark			
Dry biomass (t/ha) Branches	27[c]		
Dry biomass (t/ha) Fruits etc.	1		
Dry biomass (t/ha) Foliage	7.0 + 0.3[b]		2.2
Dry biomass (t/ha) Root estimate	40-50		
CAI (m^3/ha/yr)			
Net production (t/ha/yr) Stem wood	2.2 + 0.8[d]		2.7[f]
Net production (t/ha/yr) Stem bark			
Net production (t/ha/yr) Branches			
Net production (t/ha/yr) Fruits etc.	0.8		
Net production (t/ha/yr) Foliage	4.5[e]		2.2
Net production (t/ha/yr) Root estimate			

At Roquet an area with 216 trees was clear-felled and the biomass of all trees was determined. Roots were excavated to 40 cm depth in several 25 cm^2 soil blocks. Nutrient contents were determined. At Orléans many stems were sampled and stand biomass values for a plot of about 0.1 ha were derived from regressions on stem circumference.

a. Number of stems/ha.
b. Understorey shrubs.
c. Including 2 t/ha of sprouts (suckers).
d. Woody litterfall.
e. New foliage biomass; leaf litterfall was 2.5 t/ha/yr.
f. Excluding woody litterfall and mortality.

Mounet, J.P. (1978). "Production de quelques Ecosystèmes à Chêne Pubescent: Evaluation de la Biomasse Aérienne des Chênes Pubescents." Ph.D. thesis. Université de Droit d'Economie et des Sciences, Aix-Marseille.

44°31'N 5°05'E (alt. given below) France, Saint Maurice, near Dieulefit.

Calcareous soils

Quercus pubescens (syn. *Quercus lanuginosa*)

	570 m	660 m	670 m	730 m	860 m	880 m
Age (years)						
Trees/ha	4800	6600	6300	6200	4550	1240
Tree height (m)	3.4-6.5	2.2-3.8	1.6-5.8	2.4-4.8	4.3-8.2	5.6-10.7
Basal area (m^2/ha)	21.7	17.6	23.3	22.2	28.0	35.4
Leaf area index						
Stem volume (m^3/ha)						
Dry biomass (t/ha): Stem wood, Stem bark, Branches, Fruits etc., Foliage	66.8	46.3	60.6	63.6	76.7	158.1
Dry biomass (t/ha): Root estimate						
CAI (m^3/ha/yr)						
Net production (t/ha/yr): Stem wood, Stem bark, Branches, Fruits etc., Foliage, Root estimate						

Sixty-seven trees were sampled, and stand biomass values were obtained by multiplying mean tree values by the numbers of trees per hectare separately for different diameter classes.

Ranger, J. (1978). Recherches sur les biomasses comparées de deux plantations de Pin laricio de Corse avec ou sans fertilisation. *Ann. Sci. For.* 35, 93-115.

46°45'N 0°20'E ca.100 m France, Vienne, 20 km N of Poitiers, Moulières.

Plantations		*Pinus nigra* ssp. *laricio* (80%)[a] Received fertilizers before planting	*Quercus robur*, *Picea abies* (98%)[a] Unfertilized
Age (years)		15	15
Trees/ha		3780[b]	3443
Tree height (m)		7.9	5.7
Basal area (m^2/ha)		36.6	19.2
Leaf area index			
Stem volume (m^3/ha)			
Dry biomass (t/ha)	Stem wood	64.0[bc]	31.4[c]
	Stem bark	13.0[bc]	7.7[c]
	Branches	25.7[b]	8.1
	Fruits etc.		
	Foliage	13.8	5.6
	Root estimate	8.6	2.8
CAI (m^3/ha/yr)			
Net production (t/ha/yr)	Stem wood		
	Stem bark		
	Branches		
	Fruits etc.		
	Foliage		
	Root estimate		

Ten trees were sampled per treatment in October, and roots were excavated. Stand values for the above two 0.045 ha plots were derived from regressions on stem circumference.

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

b. Including 668 *P. nigra* felled at age 13.

c. Including the stumps.

Mounet, J.P. (1978). "Production de quelques Ecosystèmes à Chêne Pubescent: Evaluation de la Biomasse Aérienne des Chênes Pubescents." Ph.D. thesis. Université de Droit d'Economie et des Sciences, Aix-Marseille.

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ca.44°30'N 5°30'E 400-700 m France, ca. 50 km S of Grenoble.

Pinus sylvestris

Age (years)						
Trees/ha	2250	3600	1600	640	2750	1100
Tree height (m)	3.5-7.1	2.5-7.3	2.0-3.8	1.6-5.1	4.0-7.6	5-15
Basal area (m^2/ha)	27.6	28.1	8.5	7.6	26.2	33.1
Leaf area index						
Stem volume (m^3/ha)						
Dry biomass (t/ha): Stem wood, Stem bark, Branches, Fruits etc., Foliage	77.1	37.3	23.7	18.9	122.0	108.4
Dry biomass (t/ha): Root estimate						
CAI (m^3/ha/yr)						
Net production (t/ha/yr): Stem wood, Stem bark, Branches, Fruits etc., Foliage, Root estimate						

Fifty-four trees were sampled and stand values were obtained by multiplying mean tree values by the numbers of trees per hectare separately for different diameter classes.

Cabanettes, A. (1979). "Croissance, Biomasse et Productivité de *Pinus pinea* L. en Petite Camargue." Ph.D. thesis. Académie de Montpellier, Université des Sciences et Techniques du Languedoc, France.
Cabanettes, A. and Rapp, M. (1978). Biomasse, minéralomass et productivité d'un écosystème à Pins pignon (*Pinus pinea* L.) du littoral méditerranéen. I Biomasse. *Oecol. Plant.* 13, 271-286.
Rapp, M. and Cabanettes, A. (1980). (As above) II Composition chimique et minéralomasse. *Oecol. Plant.* 15, 151-164.

France	43°40'N 4°15'E 50 m 35 km E of Montpellier, Saint Laurent d'Aigouze	ca.48°45'N 6°30'E -- 15 km NE of Nancy
	Pinus pinea	*Pseudotsuga menziesii*
	Unmanaged stand	Unthinned plantation of Yelm, Washington provenance (Oswald and Pardé 1981, personal communication)
	Sandy soil, pH 7.8-8.4	
Age (years)	up to 35	24
Trees/ha	800	1500
Tree height (m)	10.4	18.8
Basal area (m^2/ha)	33.9	44.8
Leaf area index		
Stem volume (m^3/ha)		379
Dry biomass (t/ha) Stem wood	144.1[a]	158
Dry biomass (t/ha) Stem bark		
Dry biomass (t/ha) Branches		21
Dry biomass (t/ha) Fruits etc.		
Dry biomass (t/ha) Foliage	12.7	14
Dry biomass (t/ha) Root estimate	22.0	
CAI (m^3/ha/yr)	6.9	
Net production (t/ha/yr) Stem wood	5.25 + 0.85[b]	
Net production (t/ha/yr) Stem bark		
Net production (t/ha/yr) Branches		
Net production (t/ha/yr) Fruits etc.	0.84[b]	
Net production (t/ha/yr) Foliage	0.45 + 6.13[b] + 0.81[c]	
Net production (t/ha/yr) Root estimate	1.1	

Nineteen *P. pinea* were sampled in this and previous studies and one root system and one soil monolith were excavated. Stand biomass values were derived from regressions on tree circumference. Roots were assumed to have the same relative growth rates as above-ground parts. Nutrient contents were determined.
Three trees of *P. menziesii* were sampled within each of 2 plots, and stand values were obtained by multiplying mean tree values by the number of trees per hectare. There was 19 t/ha of dead branches.
a. Including 97.5 t/ha of 'bois fort' and 17.0 t/ha of bark.
b. Litterfall, measured over 4 years.
c. Pre-fall losses.