Ellenberg, H. (ed.) (1971). "Integrated Experimental Ecology. Methods and Results of Ecosystem Research in the German Solling Project." (Chapters B, D and E) Chapman and Hall Ltd, London; Springer-Verlag, Berlin, Heidelberg and New York.

Ellenberg, H. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp. 666-668. Cambridge University Press, Cambridge, London, New York and Melbourne.

51°45-49'N 9°34-36'E 430-500 m Germany, Federal Republic, 55 km NW of Göttingen, Solling plateau.

Brown earths
pH 3.5-3.7

Fagus sylvatica

Age (years)		59	80	122
Trees/ha		3620	1190	243
Tree height (m)		15.1[a]	20.3[a]	26.5[a]
Basal area (m^2/ha)		30.4	25.2	28.3
Leaf area index		6.5[b]	6.7[b]	5.9[b]
Stem volume (m^3/ha)		159[c]	219[c]	348[c]
Dry biomass (t/ha)	Stem wood	102.9	121.2	222.9
	Stem bark	7.2	8.4	15.5
	Branches	41.5	25.9	32.5
	Fruits etc.	0.3	0.3	0.4
	Foliage	3.2	3.3	3.1
	Root estimate	24.0[d]	22.1[d]	30.0[d]
CAI (m^3/ha/yr)				
Net production (t/ha/yr)	Stem wood	7.17	5.52	6.07
	Stem bark	0.50 + 0.40[e]	0.38 + 0.35[e]	0.42 + 0.53[e]
	Branches	0.99	0.45	0.78
	Fruits etc.	0.25[e]	0.28[e]	0.77[e]
	Foliage	3.16[e] + 0.17[f]	3.27[e] + 0.18[f]	2.98[e] + 0.19[f]
	Root estimate	1.26[d]	0.63[d]	0.66[d]

Twenty-seven trees were sampled in winter. Stand biomass values were derived from regressions on D^2H. The 122-year-old trees were measured in a 1.0 ha plot; the other plots were 0.1 ha. There was 0.7 t/ha of standing dead wood in the 122-year-old stand.

a. Stand heights
b. Estimated in April-May over 2-3 years.
c. Volumes of stems over 7 cm D measured two years previously (from Ellenberg 1971).
d. Roots over 5 mm diameter only.
e. Litterfall, measured over 2-3 years (woody litterfall from Ellenberg 1971), excluding any mortality.
f. Consumption.

Ellenberg, H. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp. 669-671. Cambridge University Press, Cambridge, London, New York, and Melbourne.

Droste zu Hülshoff, B. von (1970). Struktur, Biomasse und Zuwachs eines älteren Fichtenbestandes. *Forstwiss. ZentBl.* 89, 162-171.

Germany, Federal Republic. (alt. given below)		51°44-49'N 9°34-35'E 55 km NW of Göttingen, Solling plateau			48°04'N 11°59'E near Münich Ebersberger Forest
Plantations Brown forest soils pH 3.2-4.6		*Picea abies* (Ellenberg 1981) 390 m	505 m	440 m	(Droste zu Hülshoff 1970) ca.600 m
Age (years)		34	87	115	76
Trees/ha		1490	595	300	800
Tree height (m)		17.5[a]	24.9[a]	31.3[a]	28
Basal area (m^2/ha)		35.5	44.8	37.7	57.3
Leaf area index					9.4[e]
Stem volume (m^3/ha)					728
Dry biomass (t/ha)	Stem wood	96.7	182.5	180.1	268.0
	Stem bark	8.4	15.9	15.7	
	Branches	18.7	28.2	24.6	38.3
	Fruits etc.				
	Foliage	18.9	17.9	12.7	15.9
	Root estimate	34.6[b]	71.7[b]	74.9[b]	
CAI (m^3/ha/yr)					16
Net production (t/ha/yr)	Stem wood	4.50[c]	4.93[c]	3.68[c]	5.88[c]
	Stem bark	0.39[c]	0.43[c]	0.32[c]	
	Branches	0.63[c]	0.60[c]	0.39[c]	3.29[c]
	Fruits etc.				
	Foliage	2.92[d]	3.39[d]	3.08[d]	6.34
	Root estimate	1.59[b]		0.85[b]	

At Solling many trees were sampled and stand biomass values were derived from regressions on D and D^2H. The plots were 0.10, 1.00 and 0.25 ha in columns left to right. There was 0.3 t/ha of standing dead wood in the 87-year-old stand.
At Ebersberger Forest five trees in each of several size classes were sampled and stand biomass values for a 0.12 ha plot were obtained by multiplying by the number of trees per hectare in each size class. Branch and foliage increments were estimated by dividing their biomasses by their mean ages.
a. Stand heights. *b*. Roots over 5 mm diameter only.
c. Excluding woody litterfall and any mortality.
d. Foliage litterfall.
e. All-sided LAI was 21.6.

Greenland, D.J. and Kowal, J.M.L. (1960). Nutrient content of the moist tropical forest of Ghana. *Pl. Soil* 12, 154-174.

Nye, P.H. (1961). Organic matter and nutrient cycles under moist tropical forest. *Pl. Soil* 13, 333-346.

John, D.M. (1973). Accumulation and decay of litter and net production of forest in tropical West Africa. *Oikos* 24, 430-435.

6°08'N 0°51'W 150 m Ghana, Kade.

Reddish yellow latosols

Diospyros spp., *Strombosia glaucescens et al.* (35 spp.)

Semi-deciduous secondary tropical rainforest

Age (years)		30-50
Trees/ha		5305[a]
Tree height (m)		15, 20-40, 50-60[b]
Basal area (m^2/ha)		33.3
Leaf area index		
Stem volume (m^3/ha)		
Dry biomass (t/ha)	Stem wood	232.8[c]
	Stem bark	
	Branches	
	Fruits etc.	
	Foliage	
	Root estimate	54.1
CAI (m^3/ha/yr)		
Net production (t/ha/yr)	Stem wood	
	Stem bark	
	Branches	3.5[d] (or 1.9)[e]
	Fruits etc.	0.4[d] (or 0.4)[e]
	Foliage	7.0[d] (or 7.4)[e]
	Root estimate	

All trees were felled within two areas of about 0.24 ha and all were weighed apart from a few large trees whose volumes and densities were estimated. Stumps were excavated on half of each plot, and roots were excavated in 14 areas of 1.35 m^2. Nutrient contents were determined.

a. Trees over 7.6 cm D.

b. Lower storey, mid-storey, and emergents.

c. Including 173.2 t/ha of living wood, 14.5 t/ha lianes, 25.5 t/ha leaves and twigs and 19.6 t/ha above-ground stumps.

d. Litterfall only.

e. Litterfall measured by John (1973), where 1.9 is the sum of small wood and miscellaneous litter.

Elkington, T.T. and Jones, B.M.G. (1974). Biomass and primary productivity of birch (*Betula pubescens* S. Lat.) in south-west Greenland. *J. Ecol.* 62, 821-830.

61°06'N 45°58'W 120-135 m Greenland, Nordre Sermilik Fjord, Eqaluit.

Weathered granitic sand. 22° N-facing sheltered slope

Betula pubescens (*B. pubescens* × *B. glandulosa*)

Age (years)		79[a]
Trees/ha		2150[b]
Tree height (m)		2.5 (1.1-3.6)
Basal area (m^2/ha)		
Leaf area index		1.57
Stem volume (m^3/ha)		
Dry biomass (t/ha)	Stem wood	11.5[b]
	Stem bark	
	Branches	35.8
	Fruits etc.	
	Foliage	1.2
	Root estimate	6.4
CAI (m^3/ha/yr)		
Net production (t/ha/yr)	Stem wood	0.14
	Stem bark	
	Branches	0.64[c]
	Fruits etc.	
	Foliage	1.20
	Root estimate	0.09

Fifteen trees were sampled in August and roots were excavated. Stand biomass values for a 330 m^2 plot were derived from regressions on stem and branch circumferences.

a. Mean age of sampled horizontal stems (caudices).

b. Caudices, from which vertical branches arose; there were 7700 such branches per hectare.

c. Excluding woody litterfall.

Kunkel-Westphal, I. and Kunkel, P. (1979). Litterfall in a Guatemalan primary forest, with details of leaf-shedding by some common tree species. *J. Ecol.* 67, 665-686.

15°30'N 90°27'W (alt. given below) Guatemala, Sierra de Chamá, NW of Cobán.

Acid, sandy loam over clay loam

Calaphyllum sp., *Quercus* spp., *Swartzia* sp. *et al.* (147 species)

Lower montane rainforest

	900 m	1000-1015 m
Age (years)	over 70	over 70
Trees/ha		
Tree height (m)	4, 15-20, 30-40[a]	4, 15-20, 30-40[a]
Basal area (m^2/ha)	46	40
Leaf area index		
Stem volume (m^3/ha)		
Dry biomass (t/ha): Stem wood, Stem bark, Branches, Fruits etc., Foliage	457-499	324-353
Root estimate		
CAI (m^3/ha/yr)		
Net production (t/ha/yr): Stem wood		
Stem bark		
Branches	1.46[b]	2.10[b]
Fruits etc.	0.11[b]	0.04[b]
Foliage	6.74[b] + 1.27[c]	7.30[b] + 1.42[c]
Root estimate		

Stand biomass values of the above 0.1 ha plots were derived from tree basal areas and heights using regressions published by Edwards and Grubb (1977).

a. Lower storey, mid-storey and emergents.

b. Litterfall only, measured over 2 years.

c. Loss from decomposition.

Jakucs, P. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) p. 586. Cambridge University Press, Cambridge, London, New York, Melbourne.

47°54'N 20°28'E 250-280 m Hungary, Sikfokut.

Brown forest soil, pH 4.0-6.2

Quercus petraea and *Quercus cerris* with understorey shrubs

Age (years)		65-68
Trees/ha		
Tree height (m)		17.4
Basal area (m^2/ha)		15.1
Leaf area index		8.1
Stem volume (m^3/ha)		
Dry biomass (t/ha)	Stem wood	140.4 + 3.8[a]
	Stem bark	
	Branches	59.1
	Fruits etc.	
	Foliage	3.4 + 0.3[a]
	Root estimate	35.6
CAI (m^3/ha/yr)		
Net production (t/ha/yr)	Stem wood	3.00 + 0.46[b]
	Stem bark	
	Branches	
	Fruits etc.	
	Foliage	3.71[b]
	Root estimate	

a. Understorey shrubs.
b. Litterfall.

Singh, R.P. and Sharma, V.K. (1976). Biomass estimation in five different aged plantations of *Eucalyptus tereticornis* Smith in western Uttar Pradesh. In: "Oslo Biomass Studies" pp. 145-161. College of Life Sciences and Agriculture, University of Maine, Orono, USA.

ca.29°N 77°W 200-400 m India, Uttar Pradesh.

Plantations.
Canal-side plantings.

Eucalyptus tereticornis

Age (years)		5	6	7	8	9
Trees/ha		1670	1110	700	1360	840
Tree height (m)						
Basal area (m^2/ha)		18[a]	15[a]	38[a]	50[a]	42[a]
Leaf area index						
Stem volume (m^3/ha)						
Dry biomass (t/ha)	Stem wood	53.7	41.3	54.9	101.0	139.2
	Stem bark					
	Branches	10.1	6.3	11.4	28.1	30.9
	Fruits etc.					
	Foliage	6.7	3.4	4.6	16.1	8.0
	Root estimate	10.6	9.7	10.9	22.2	18.6
CAI (m^3/ha/yr)						
Net production (t/ha/yr)	Stem wood					
	Stem bark					
	Branches					
	Fruits etc.					
	Foliage					
	Root estimate					

Nine trees were sampled in each plantation in November-December, and roots were excavated. Stand biomass values for ten 100 m^2 plots in each plantation were derived from regressions on D^2H, H, and stem diameter measured at ground level and at the base of the crowns.

a. Estimated from the authors' data on numbers of trees in three stem girth classes

Foruqi, Q. (1981). In: Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp. 589-591. Cambridge University Press, Cambridge, London, New York, Melbourne.

ca.27°N 83°53'E 81 m India, Uttar Pradesh, Gorakhpur Forest.

Plantations. *Shorea robusta*

Age (years)		5	8	14	26	30	40
Trees/ha		3150	2568	1660	1620	1496	1134
Tree height (m)		4.7	7.4	11.1	15.5	17.2	21.2
Basal area (m^2/ha)		7.6	18.7	20.4	46.3	58.6	66.6
Leaf area index		2.1	5.8	6.3	6.9	11.4	13.4
Stem volume (m^3/ha)							
Dry biomass (t/ha)	Stem wood	11.6	45.2	73.1	190.9	292.3	482.2
	Stem bark						
	Branches	1.4	7.4	8.7	17.6	30.1	42.2
	Fruits etc.						
	Foliage	2.5	6.8	6.2	8.1	13.5	15.8
	Root estimate	4.4	15.9	16.9	55.1	63.3	100.9
CAI (m^3/ha/yr)							
Net production (t/ha/yr)	Stem wood						
	Stem bark						
	Branches						
	Fruits etc.						
	Foliage	2.3[a]	5.9[a]	5.8[a]	7.9[a]	8.9[a]	9.9[a]
	Root estimate						

Three trees of average size were sampled in each stand. Stand biomass values for the above 0.4 ha plots were obtained by multiplying mean tree values by the numbers of trees per hectare. Nutrient contents were determined.

a. Leaf litterfall.

Ramam, S.S. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp. 595-597. Cambridge University Press, Cambridge, London, New York, Melbourne.

ca.27°N 83°30'E 81 m India, Uttar Pradesh, Gorakhpur Forest.

Plantations. *Shorea robusta*

Age (years)		10	16	22	28	35	38
Trees/ha		2229	1461	1687	1594	1741	742
Tree height (m)		8.6	12.3	14.2	17.1	17.6	20.9
Basal area (m^2/ha)		15.2	14.0	19.9	31.2	41.6	31.6
Leaf area index		6.4	6.2	5.8	11.7	14.0	8.5
Stem volume (m^3/ha)							
Dry biomass (t/ha)	Stem wood	31.7	37.9	96.9	145.5	226.9	207.0
	Stem bark						
	Branches	3.2	4.5	3.7	16.4	14.5	33.0
	Fruits etc.						
	Foliage	3.6	3.5	3.7	5.5	7.0	6.4
	Root estimate	12.2	13.7	23.6	38.8	62.2	47.5
CAI (m^3/ha/yr)							
Net production (t/ha/yr)	Stem wood						
	Stem bark						
	Branches						
	Fruits etc.						
	Foliage	2.90[a]	2.60[a]	2.80[a]	3.80[a]	5.10[a]	4.90[a]
	Root estimate						

Three trees of average size were sampled in each stand. Stand biomass values for the above 0.4 ha plots were obtained by multiplying mean tree values by the numbers of trees per hectare. Nutrient contents were determined.

a. Leaf litterfall.

Singh, R.P. (1975). Biomass, nutrient and productivity structure of a stand of dry deciduous forest of Varanasi. *Trop. Ecol.* 16, 104-109.
Misra, R. (1972). A comparative study of net primary productivity of dry deciduous forest and grassland of Varanasi, India. In: "Tropical Ecology, with an Emphasis on Organic Productivity." (P.M. Golley and F.B. Golley, eds) pp. 279-293. Institute of Ecology, University of Georgia, Athens, USA.
Sharma, V.K., Singh, K.P. and Bandhu, D. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp. 587-588. Cambridge University Press.

ca.25°20'N 83°00'E 300-350 m India, Varanasi, Chakia Forest.

Alluvial sandy to clay loams. pH 5.7-6.8

Shorea robusta, with *Buchanania lanzan*, *Anogeissus latifolia et al.*

Tropical dry deciduous forest

Age (years)		38	10 to 120	60
Trees/ha		729	1019	664
Tree height (m)		3.0-12.7	2.0-15.0	5.0-18.0
Basal area (m^2/ha)		11.4	12.8	30.6
Leaf area index				6
Stem volume (m^3/ha)				
Dry biomass (t/ha)	Stem wood	20.5	29.1	133.9 (or 141.1)[c]
	Stem bark			
	Branches	5.8	11.6	54.3 (or 58.2)[c]
	Fruits etc.			0.1
	Foliage	2.4	3.6	5.8 (or 6.2)[c]
	Root estimate	6.7	9.5	32.7 (or 34.3)[c]
CAI (m^3/ha/yr)				
Net production (t/ha/yr)	Stem wood		1.01[b]	5.76
	Stem bark			
	Branches	0.58[a]	0.40[b]	2.33
	Fruits etc.			+ 1.12[a]
	Foliage	1.51[a]	0.33 + 3.03[a]	5.66[a]
	Root estimate			0.29

Regressions methods were used to estimate stand biomass values. Nutrient contents were determined.

a. Litterfall.
b. Excluding woody litterfall and any mortality.
c. Alternative values from Misra (1972); unbracketed values in this column are from Sharma *et al.* (1981).

Singh, K.P. and Misra, R (eds) (1979). "Structure and Functioning of Natural, Modified and Silvicultural Ecosystems of Eastern Uttar Pradesh." Tech. Report to UNESCO, MAB. Banaras Hindu University, Varanasi - 221005, India.

Singh, A.K., Pandey, V.N. and Misra, K.N. (1980). Stand composition and phytomass distribution of a tropical deciduous teak (*Tectona grandis*) plantation of India. *J. Jap. For. Soc.* 62, 128-137.

India, Uttar Pradesh, Varanasi Forest.

Plantations. Impoverished, reddish-brown, leached, sandy loams.	24°52-58'N 83°3-12'E 140-380 m		25°03'N 83°13'E ca.50 m
	Tectona grandis		
	Fenced stand	Unfenced stand	(Singh *et al.* 1980)
Age (years)	15	15	15
Trees/ha	467	467	305
Tree height (m)	3.5-10.6	3.5-10.6	7.8
Basal area (m^2/ha)			3.6
Leaf area index	1.11[a]	0.96[a]	
Stem volume (m^3/ha)			
Dry biomass (t/ha) Stem wood	8.71	3.92	7.66
Dry biomass (t/ha) Stem bark			
Dry biomass (t/ha) Branches	3.43	1.44	2.30
Dry biomass (t/ha) Fruits etc.			
Dry biomass (t/ha) Foliage	2.10	0.95	1.71
Dry biomass (t/ha) Root estimate	3.29	1.52	2.85
CAI (m^3/ha/yr)			
Net production (t/ha/yr) Stem wood	1.20	0.45	
Net production (t/ha/yr) Stem bark			
Net production (t/ha/yr) Branches	0.61	0.19	
Net production (t/ha/yr) Fruits etc.			
Net production (t/ha/yr) Foliage	2.10	0.95	
Net production (t/ha/yr) Root estimate	0.46	0.15	

Fifteen trees were sampled in each study in December-February and roots were excavated. Stand biomass values for five 500 m^2 plots per stand were derived by Singh and Misra (1979) from regressions on D and by Singh *et al.* (1980) by multiplying mean tree values in each of 5 girth classes by the numbers of trees per class.

a. Maximum seasonal value attained in October.

b. Including woody litterfall, totalling 0.31 and 0.45 t/ha/yr in columns left and right, respectively; corresponding leaf litterfall was 1.57 and 1.12 t/ha/yr.

Foruqi, Q. (1981). In: "Dynamic Properties of Forest Ecosystems" (D.E. Reichle, ed.) pp. 592-594. Cambridge University Press, Cambridge, London, New York, Melbourne.

ca.27°N 83°53'E 81 m India, Uttar Pradesh, Gorakhpur Forest.

Plantations. *Tectona grandis*

Age (years)		5	8	14	26	30	40
Trees/ha		2068	1943	1022	791	682	545
Tree height (m)		9.2	9.9	13.2	17.1	17.8	19.2
Basal area (m^2/ha)		15.3	25.3	32.6	40.6	54.9	97.9
Leaf area index		8.6	14.6	10.6	11.5	17.4	17.2
Stem volume (m^3/ha)							
Dry biomass (t/ha)	Stem wood	33.0	63.1	119.9	200.0	237.8	451.7
	Stem bark						
	Branches	6.6	21.0	26.7	52.2	43.8	133.7
	Fruits etc.						
	Foliage	10.0	16.8	12.3	13.3	20.3	20.0
	Root estimate	11.5	27.6	31.2	64.7	75.0	137.9
CAI (m^3/ha/yr)							
Net production (t/ha/yr)	Stem wood						
	Stem bark						
	Branches						
	Fruits etc.						
	Foliage	6.0[a]	10.9[a]	10.8[a]	11.2[a]	14.1[a]	14.3[a]
	Root estimate						

Three trees of average size were sampled in each stand. Stand biomass values for the above 0.4 ha plots were obtained by multiplying mean tree values by the numbers of trees per hectare. Nutrient contents were determined.

a. Leaf litterfall.

Singh, K.P. and Misra, R. (eds) (1979). "Structure and Functioning of Natural, Modified and Silvicultural Ecosystems of Eastern Uttar Pradesh." Tech. Report to UNESCO, MAB. Banaras Hindu University, Varanasi-221005, India.

24°52-58'N 83°3-12'E	140-380 m	India, Uttar Pradesh, Varanasi Forest.	
Reddish-brown, leached, sandy loams.		*Anogeissus latifolia*, *Diospyros melanoxylon*, *Buchanania lanzan*, *Pterocarpus marsupium et al.*, with understorey shrubs	
		Tropical dry deciduous forest	
		Fenced stand (24%, 10%, 13%, 10%)[a]	Unfenced stand (15%, 13%, 12%, 14%)[a]
Age (years)			
Trees/ha		1174 + 132[b]	936 + 554[b]
Tree height (m)		5-6, 7-9, 16-17[c]	5-6, 7-9, 16-17[c]
Basal area (m^2/ha)		18.0 + 0.5[b]	15.1 + 2.2[b]
Leaf area index		3.50[d] + 0.26[bd]	2.93[d] + 0.72[bd]
Stem volume (m^3/ha)			
Dry biomass (t/ha)	Stem wood, Stem bark	32.4 + 0.8[b]	29.3 + 2.3[b]
	Branches	39.2 + 0.6[b]	32.5 + 1.7[b]
	Fruits etc.		
	Foliage	4.7 + 0.2[b]	4.1 + 0.6[b]
	Root estimate	20.7 + 0.6[b]	16.9 + 1.7[b]
CAI (m^3/ha/yr)			
Net production (t/ha/yr)	Stem wood	1.77 + 0.07[b] [e]	1.16 + 0.10[b] [e]
	Stem bark		
	Branches	2.63 + 0.05[b] [e]	2.26 + 0.10[b] [e]
	Fruits etc.		
	Foliage	4.75 + 0.23[b]	4.13 + 0.64[b]
	Root estimate	3.40 + 0.14[b]	2.81 + 0.27[b]

A total of 211 trees were sampled in December-February, and thick roots were excavated. Fine roots were excavated in 5 soil monoliths. Stand biomass values for six 500 m^2 plots per stand were derived from regressions on D. Nutrient contents were determined.

a. Percentage of the total basal area of the tree layer occupied by *A. latifolia*, *D. melanoxylon*, *B. lanzan* and *P. marsupium*, respectively, written left to right within the brackets. *b*. Understorey shrubs.

c. Lower, middle and upper storeys. *d*. Maximum values, attained in October.

e. Including woody litterfall, totalling (for both storeys) 1.44 and 1.18 t/ha/yr in columns left and right, respectively; corresponding total leaf litterfall was 4.25 and 3.87 t/ha/yr.