A Tropical Rain Forest; Div. of Technical Info., U.S. Atomic Energy Commission; edited by H. T. Odum. Chapter B-6, pp. B79-B89, 2 refs. 1970.

Chapter B-6

Stand Structure and Yield in the Tabonuco Forest of Puerto Rico

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Permanent plots were established beginning in 1943 to study growth in the Tabonuco forest type in Puerto Rico. Initially, the most common species were Dacryodes excelsa, *[illegible];* Euterpe globosa, *11%;* Sloanea berteriana, *7%;* Cordia borinquensis, *4%; and* Manilkara bidentata, *4%. Species diversity was less than in mainland British Guiana.*

For canopy species the relation of overall density to diameter class follows the classical L-shaped curve, with less than 4% of the stems larger than 60 cm. Understory species scarcely occur above the minimum size class. Basal area, however, was related to diameter at breast height class by a straight line with a slight negative slope. Growth was greater on cutover plots than on undisturbed ones and was less on both for the second 10-year period. Mortality was not closely related to crown position but was related to tree diameter at breast height. There is some indication that the relation of mortality to diameter at breast height for understory species is independent of the relation for canopy species.

Twenty-three years ago a program of tree-density and growth-rate measurement was started in the Luquillo forest, especially in the Tabonuco forest type, the main subject of this book. Previous reports of this work, as presented in the *Caribbean Forester* and elsewhere, are cited in Chap. B-2. The results of this program with respect to forest structure, diversity, timber properties, growth rates, and mortality are summarized in this chapter.

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METHODS

LOCATION OF PLOTS

Figure 1 shows the locations of areas that have been under long-term study. In 1943 two plots were established (areas 1 and 2). Area 1, of 0.14 ha, is in a secondary stand which was severely cut over several decades ago. Area 2, of 0.75 ha, is in a vigorous well-stocked stand never cleared but from which commercially overmature timber was removed 10 years previously. This area was lightly cut again in 1959. Four additional plots (areas 3 to 6) were established in 1946 in stands that have never been cut over. Areas 3 and 4 are each 0.2 ha, and areas 5 and 6 are each 0.4 ha. The isolated area (6) at the right of Fig. 1, is the Baño del Oro Natural Area. It has not been and presumably will never be modified by man. Area 7 is the U. S. Atomic Energy Commission project.

TREE MEASUREMENTS

All trees 4.0 cm and larger on the plots were tagged with a permanent number and painted at the height of about 1.4 m as a fixed point of measurement. The diameter of each tree was measured periodically with a steel tape, and each tree was classified by crown position as dominant, codominant, intermediate, or overtopped (see Murphy, Chap. D-4).

Recently all measurements and observations were punched in business-machine cards, which are on file

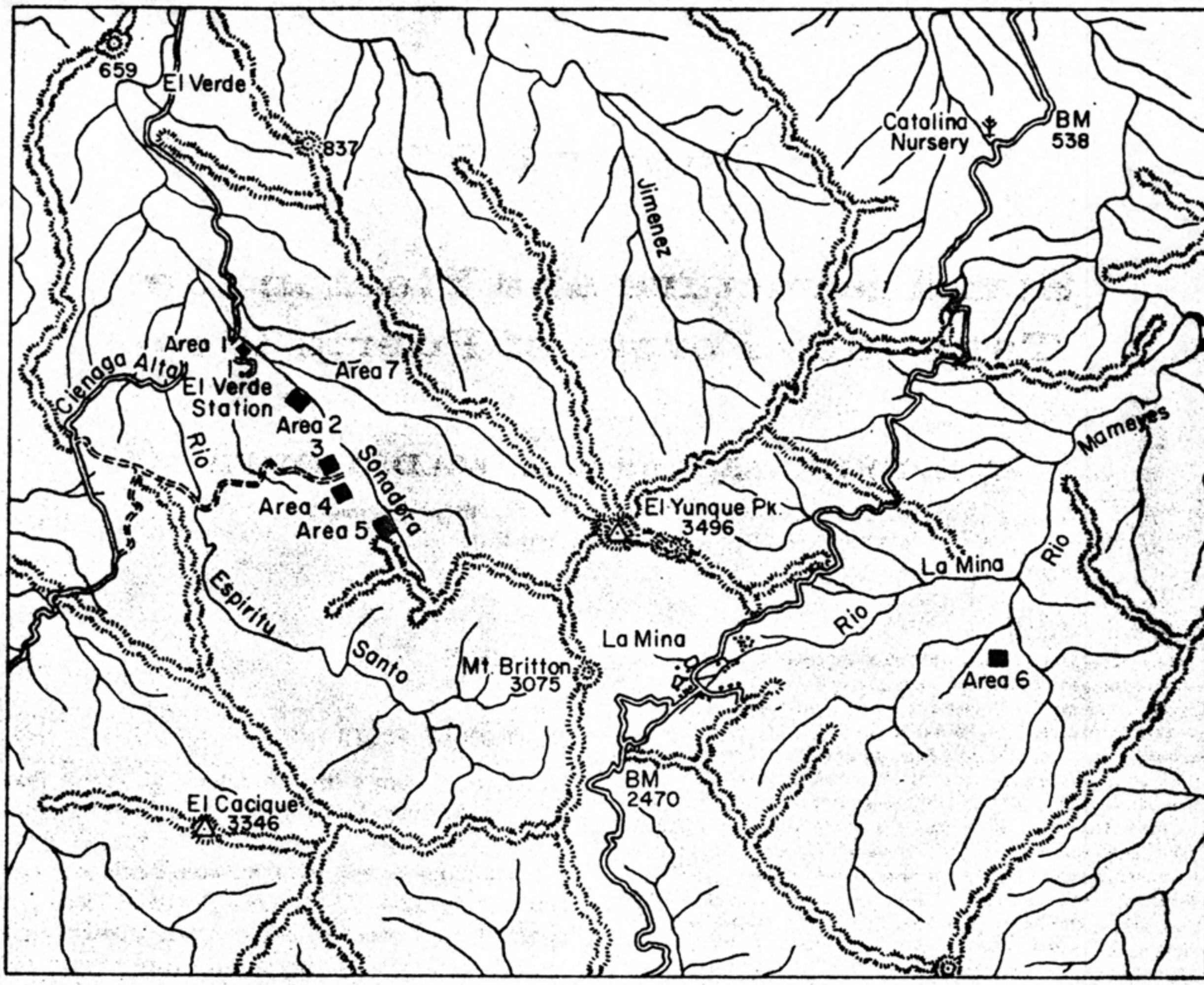

Fig. 1 — Map showing locations of areas under long-range study of trunk growth.

at the U. S. Forest Service Institute of Tropical Forestry.

Similar plots established in the Colorado and Palmbrake forests are not considered in this paper.

The data on individual trees used in this chapter are on machine cards stored at the Institute of Tropical Forestry, Rio Piedras, Puerto Rico, with the following format: cols. 1–4, study number; cols. 5–8, location; cols. 11–14, tree number; cols. 15–17, species; cols. 19–22, 1946 year and fraction; cols. 24–27, 1946 diameter at breast height; col. 29, 1946 crown class; cols. 31–34, 1956 year and fraction; cols. 36–39, 1956 diameter at breast height; col. 41, 1956 crown class; cols. 43–46, 1966 year and fraction; cols. 48–51, 1966 diameter at breast height; col. 53, 1966 crown class; cols. 56–60, 1946 volume; cols. 63–67, 1956 volume; cols. 70–74, 1966 volume.

RESULTS

COMPOSITION

The overall similarity of the plots is indicated by composition, as shown by the 30 most common tree species (Table 1). The only noticeable differences, almost the only differences, involve plots 01-01 and 01-05. Notice particularly that the difference between 01-05 and 01-06 is as great as between any two plots. Since they are the two parts of what was originally a single plot, 01-05 is different from the others probably because it is smaller than the others, not because it is inherently different. The same thing is true of 01-01.

Species diversity (Fig. 2) in Puerto Rico is quite similar to that in Mauritius (Vaughan and Wiehe, 1941) but much less than in British Guiana (Davis

Table 1

SPECIES OCCURRENCE BY PLOT, 1946*

Scientific name	Plot 01-01	01-03	01-04	01-05	01-06	02-01
Dacryodes excelsa	x	x	x	x	x	x
Euterpe globosa		x	x	x	x	x
Sloanea berteriana	x	x	x	x	x	x
Cordia borinquensis	x	x	x	x	x	x
Manilkara bidentata	x	x	x	x	x	x
Didymopanax morototoni	x	x	x	x	x	x
Cecropia peltata	x	x	x	x	x	x
Micropholis garciniaefolia		x	x	x	x	x
Calycogonium squamulosum		x	x	x	x	x
Quararibaea turbinata			x	x	x	x
Miconia prasina	x	x	x		x	
Ormosia krugii	x	x	x	x	x	
Psychotria grandis	x	x	x	x	x	x
Ocotea moschata	x	x	x		x	x
Matayba domingensis		x	x	x	x	x
Micropholis chrysophylloides		x	x	x	x	
Croton poecilanthus	x	x	x		x	x
Hirtella triandra	x	x	x	x	x	x
Tetragastris balsamifera	x	x		x	x	x
Alchornea latifolia	x	x	x	x	x	x
Meliosma herbertii	x	x	x	x	x	x
Alchorneopsis portoricensis	x	x	x	x	x	x
Inga vera	x	x			x	
Guarea guidonia	x	x				x
Tabebuia heterophylla	x	x	x			x
Drypetes glauca	x	x	x			
Buchenavia capitata	x	x	x	x	x	x
Andira inermis	x	x	x			x
Cordia sulcata	x	x	x	x		
Inga laurina	x	x				x

*Only the 30 species with highest overall density are included.

and Richards, 1933). This is to be expected since mainland floras are typically more diverse than those of islands.

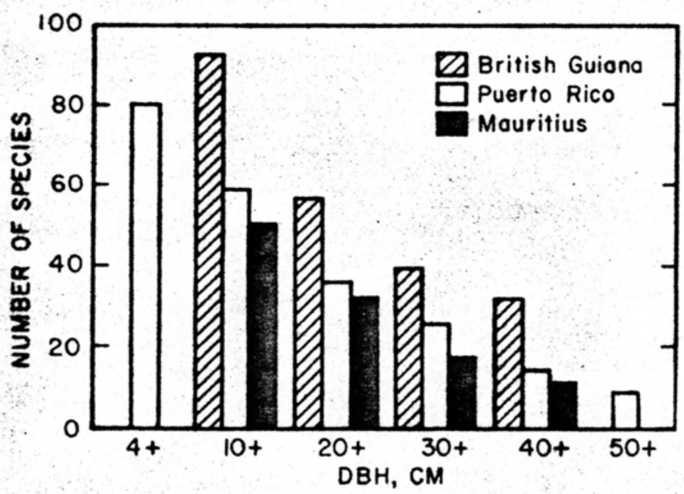

Fig. 2—Comparison of data from Puerto Rico, Guayana (British Guiana), and Mauritius on the number of species according to trunk-size groupings.

The relation of overall density to diameter at breast height (Fig. 3) follows the classical L-shaped curve, with less than 4% of the stems 60 cm or larger in diameter.

Individual species, however, differ markedly from each other (Table 2). *Dacryodes excelsa*, No. 1, is a canopy species and exhibits the same L-shaped diameter at breast height distribution as the stand. *Cordia borinquensis*, No. 4, and *Quararibaea turbinata*, No. 10, are understory species and scarcely occur at all above the minimum size class.

The relation of basal area to diameter (Fig. 4) is quite different; it is a straight line with only a mild negative slope instead of the L-shaped curve. Although less than 4% of the stems exceed 60 cm dbh, nearly 30% of the basal area is in such large stems.

This is, naturally, the characteristic in which the cutover plots, 01-01 and 01-03, differ markedly from the undisturbed plots (Table 3). On the cutover plots, large trees provide only 0 to 2% of the stand basal area; on undisturbed plots, they make up 17 to 35% of the total.

Table 2

NUMBER OF TREES ON ALL PLOTS COMBINED (CUT TREES NOT INCLUDED), 1946

Rank	Species	Diameter at breast height, cm					
		4+	10+	20+	30+	40+	50+
1	*Dacryodes excelsa*	403	249	147	107	78	38
2	*Euterpe globosa*	348	334	10			
3	*Sloanea berteriana*	225	40	7	1	1	1
4	*Cordia borinquensis*	133	12				
5	*Manilkara bidentata*	130	53	4	1		
6	*Didymopanax morototoni*	126	57	8	1		
7	*Cecropia peltata*	119	60	14	5	1	
8	*Micropholis garciniaefolia*	103	65	23	3	1	
9	*Calycogonium squamulosum*	90	15	5	2		
10	*Quararibaea turbinata*	87	9				
11	*Miconia prasina*	86	11				
12	*Ormosia krugii*	73	38	13	1	1	1
13	*Psychotria grandis*	71					
14	*Ocotea moschata*	63	19	7	1		
15	*Matayba domingensis*	59	14	7			
16	*Micropholis chrysophylloides*	52	26	15	5		
17	*Croton poecilanthus*	52	23	4			
18	*Hirtella triandra*	52	13				
19	*Tetragastris balsamifera*	50	22	10	6	1	
20	*Alchornea latifolia*	48	12	2			
21	*Meliosma herbertii*	46	15	3	1	1	
22	*Alchorneopsis portoricensis*	45	12	1	1		
23	*Inga vera*	33	21	8	1	1	
24	*Guarea guidonia*	33	8	2	1	1	1
25	*Tabebuia heterophylla*	30	13	2			
26	*Drypetes glauca*	26	6				
27	*Buchenavia capitata*	23	14	9	5	1	1
28	*Andira inermis*	23	11	1	1		
29	*Cordia sulcata*	20	1				
30	*Inga laurina*	19	9	4	1		
31	*Byrsonima coriacea*	19	9	3	1		
32	*Sapium laurocerasus*	19	4				
33	*Magnolia splendens*	18	9	6	6	3	2
34	*Guatteria caribaea*	16	2	1			
35	*Cyrilla racemiflora*	15	7	4	4	3	1
36	*Phoebe elongata*	13	5	2	2	2	1
37	*Coccoloba pyrifolia*	13	2	1			
38	*Laetia procera*	12	3	1			
39	*Ocotea leucoxylon*	12	3				
40	*Ocotea portoricensis*	11					
41	*Myrcia deflexa*	9	1				
42	*Rheedia portoricensis*	9	1				
43	*Casearia sylvestris*	9					
44	*Homalium racemosum*	8	5	2	1		
45	*Nectandra membranacea*	8	1	1			
46	*Cyathea arborea*	8	1				
47	*Aulomyrcia citrifolia*	8	1				
48	*Guarea ramiflora*	8					
49	*Myrcia splendens*	7	1				
50	*Beilschmiedia pendula*	6	6	5	4	4	2
51	*Eugenia stahlii*	6	4	4	1		
52	*Casearia arborea*	6	4				
53	*Linociera domingensis*	5	2				
54	*Tamonea guianensis*	5					
55	*Clusia rosea*	4	1				

Table 2 — (Continued)

Rank	Species	4+	10+	20+	30+	40+	50+
		Diameter at breast height, cm					
56	*Ficus laevigata*	4	1				
57	*Guettarda laevis*	4					
58	*Ilex sideroxyloides*	3	1				
59	*Antirhea obtusifolia*	3					
60	*Daphnopsis americana*	3					
61	*Henrietella fascicularis*	2	2				
62	*Ixora ferrea*	2	1				
63	*Acnistus arborescens*	2					
64	*Hirtella rugosa*	2					
65	*Ocotea floribunda*	1	1	1	1	1	
66	*Taonabo luquillensis*	1	1	1	1	1	
67	*Vitex divaricata*	1	1	1			
68	*Symplocos martinicensis*	1	1				
69	*Artocarpus altilis*	1					
70	*Casearia guianensis*	1					
71	*Cordia nitida*	1					
72	*Cyathea pubescens*	1					
73	*Heterotrichum cymosum*	1					
74	*Ilex sintenisii*	1					
75	*Palicourea crocea*	1					
76	*Phyllanthus nobilis*	1					
77	*Rondeletia portoricensis*	1					
78	*Solanum rugosum*	1					
79	*Trichilia pallida*	1					
80	*Zanthoxylum martinicense*	1					
	Other*	179	20	4			
	Total	3142	1283	343	165	101	48

*Species not identified.

This difference between sizes of trees for the different species is shown in Table 4 by comparative rankings by basal area and by volume of the 30 species with the greatest number of stems. *Dacryodes excelsa* is at the top in all three rankings, but the lesser components of the stand vary widely. Notice that the No. 3 species for density is No. 9 in the comparative ranking by volume and by basal area.

The close parallel shown between basal area and volume distributions is at least partly because local volume tables were prepared, from measurements of felled trees, using only the diameter at breast height to determine volume (Tables 5 and 6).

The relation of number of species to area of each plot and the combined plot total is shown in the upper curve of Fig. 5. The relation to number of stems is shown in the lower curve. Although the curves appear to flatten slightly toward the right, they do not differ significantly from linearity as plotted, forming a definite upward curve if plotted on semilogarithmic paper.

CHANGES

The net changes that have taken place during the 20-year period are summarized in Table 7. The number of trees per hectare was naturally highest at the beginning in the undisturbed plots. Somewhat surprisingly, mortality was the same for the first 10 years on both cutover and undisturbed plots, and ingrowth was greater on the undisturbed plots. During the second 10-year period, both mortality and ingrowth were greater on the cutover plots. Over the entire period of measurement, there was a net increase that was slightly greater on the cutover plots.

The most probable explanation of the initial low ingrowth into the 10 cm and larger class on the cutover plots is that many of the smaller trees were damaged or killed during the cutting operation.

Change in basal area was almost as expected. Net growth was greater for each 10-year period on the cutover plots in both percentage and absolute terms, and growth was less during the second 10-year period on both sets of plots in the same terms. Net growth

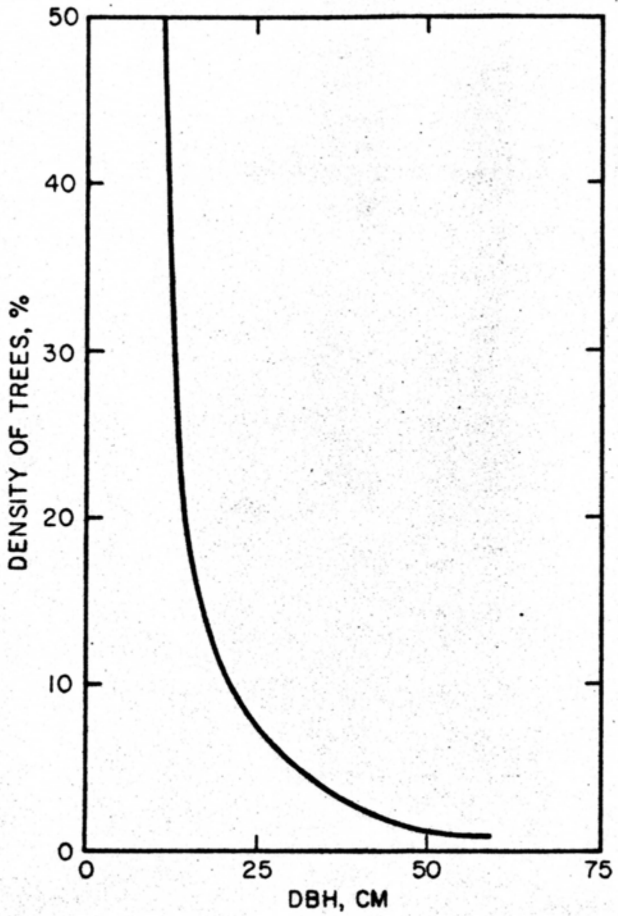

Fig. 3 — Relation of density of trees to diameter at breast height.

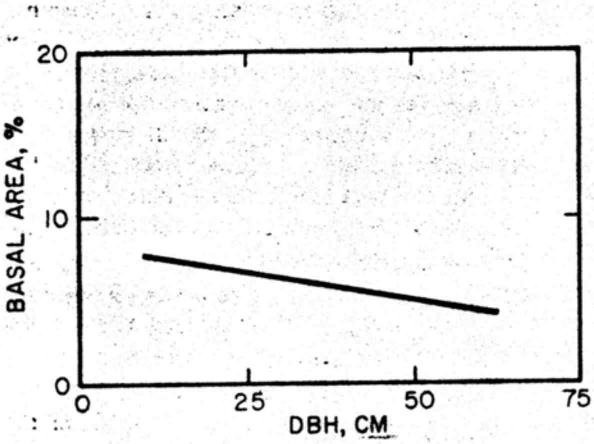

Fig. 4 — Relation of basal area to diameter at breast height.

Table 3

BASAL AREA BY DIAMETER AT BREAST HEIGHT CLASS EXPRESSED AS A PERCENTAGE FOR EACH PLOT, 1946

Diameter at breast height class, cm	Plot					
	01-01	01-03	01-04	01-05	01-06	02-01
10	17	13	18	5	8	9
15	30	15	13	15	26	12
20	27	11	6	6	10	6
25	14	12	4	3	4	7
30	5	7	4	4	7	3
35	7	12	9	3	3	5
40		10	7	4	11	9
45		10	6	7	5	7
50		5	4			5
55		3	3	4		10
60			6	14	9	4
61+		2	20	35	17	23
Total	100	100	100	100	100	100

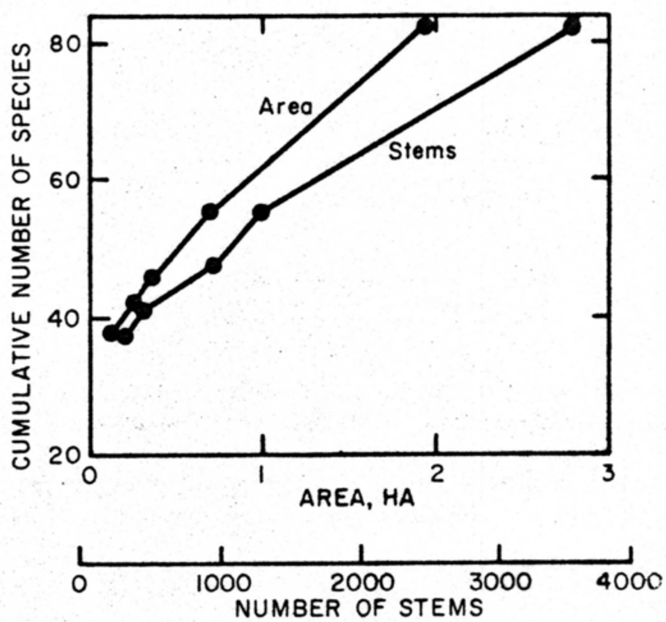

Fig. 5 — Number of species plotted as a function of area and as a function of the number of stems.

Table 4

RANKING OF SPECIES BY DENSITY, BASAL-AREA DOMINANCE, AND VOLUME OF TREES*

Scientific name	Density	Basal-area dominance†	Volume†
Dacryodes excelsa	1	1	1
Euterpe globosa	2	2	2
Sloanea berteriana	3	9	9
Cordia borinquensis	4	26	26
Manilkara bidentata	5	10	10
Didymopanax morototoni	6	7	8
Cecropia peltata	7	5	5
Micropholis garciniaefolia	8	3	3
Calycogonium squamulosum	9	15	14
Quararibaea turbinata	10	23	23
Miconia prasina	11	27	27
Ormosia krugii	12	4	4
Psychotria grandis	13	30	30
Ocotea moschata	14	13	13
Matayba domingensis	15	12	12
Micropholis chrysophylloides	16	6	6
Croton poecilanthus	17	20	21
Hirtella triandra	18	24	24
Tetragastris balsamifera	19	11	11
Alchornea latifolia	20	19	19
Meliosma herbertii	21	18	18
Alchorneopsis portoricensis	22	22	22
Inga vera	23	16	17
Guarea guidonia	24	21	20
Tabebuia heterophylla	25	14	15
Drypetes glauca	26	28	28
Buchenavia capitata	27	8	7
Andira inermis	28	25	25
Cordia sulcata	29	29	29
Inga laurina	30	17	16

*Based on 1946 measurements.

†Comparative rank within the 30 species of highest density only. Other species exceed ranks 9 and lower by basal area rank 7 and lower by volume.

Table 5

TOTAL VOLUME INSIDE BARK (CUBIC METERS) OF TABONUCO FOREST TYPE IN THE CARIBBEAN NATIONAL FOREST, P. R.*†

Dbh, cm	Total height, m																		
	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
10	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03										
15	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08										
20		0.12	0.12	0.13	0.13	0.13	0.14	0.14	0.15	0.15	0.16								
25			0.20	0.20	0.21	0.21	0.22	0.23	0.23	0.24	0.25	0.25	0.26	0.27					
30				0.30	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39					
35				0.41	0.42	0.43	0.44	0.46	0.47	0.48	0.50	0.51	0.53	0.54					
40				0.54	0.55	0.57	0.58	0.60	0.62	0.64	0.66	0.68	0.69	0.72					
45					0.70	0.72	0.75	0.77	0.79	0.81	0.84	0.86	0.89	0.91					
50					0.88	0.90	0.93	0.96	0.98	1.01	1.04	1.07	1.10	1.14					
55					1.07	1.10	1.13	1.16	1.20	1.23	1.27	1.31	1.34	1.38					
60					1.28	1.32	1.36	1.40	1.44	1.48	1.52	1.57	1.61	1.66	1.71	1.76	1.81	1.86	1.92
65					1.51	1.56	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.96	2.02	2.08	2.14	2.20	2.26
70					1.76	1.81	1.87	1.92	1.98	2.04	2.10	2.16	2.22	2.28	2.35	2.42	2.49	2.56	2.64
75					2.03	2.09	2.16	2.22	2.28	2.35	2.42	2.49	2.56	2.64	2.71	2.79	2.87	2.96	3.04
80					2.33	2.39	2.46	2.54	2.61	2.69	2.76	2.85	2.93	3.01	3.10	3.19	3.29	3.38	3.48
85					2.64	2.72	2.80	2.88	2.96	3.05	3.14	3.23	3.32	3.42	3.53	3.62	3.73	3.84	3.95
90					2.97	3.06	3.15	3.24	3.33	3.43	3.53	3.63	3.74	3.85	3.96	4.08	4.20	4.32	4.44
95					3.32	3.42	3.52	3.62	3.73	3.84	3.95	4.07	4.18	4.31	4.43	4.56	4.70	4.83	4.97
100					3.70	3.80	3.92	4.03	4.15	4.27	4.39	4.52	4.65	4.79	4.93	5.07	5.22	5.38	5.53
105					4.09	4.21	4.33	4.46	4.59	4.72	4.86	5.00	5.15	5.30	5.46	5.62	5.78	5.95	6.12
110					4.51	4.64	4.77	4.91	5.06	5.20	5.36	5.51	5.67	5.84	6.01	6.18	6.36	6.55	6.74
115					4.94	5.09	5.23	5.39	5.54	5.71	5.87	6.04	6.22	6.40	6.59	6.78	6.98	7.18	7.39
120					5.40	5.56	5.72	5.88	6.06	6.23	6.42	6.60	6.80	6.99	7.20	7.41	7.62	7.85	8.08
125					5.88	6.05	6.22	6.40	6.59	6.78	6.98	7.19	7.40	7.61	7.84	8.06	8.30	8.54	8.79
130					6.37	6.56	6.75	6.95	7.15	7.36	7.58	7.80	8.02	8.26	8.50	8.75	9.00	9.27	9.54
135					6.89	7.10	7.30	7.52	7.74	7.96	8.19	8.43	8.68	8.93	9.19	9.46	9.74	10.02	10.31
140					7.43	7.65	7.87	8.10	8.34	8.58	8.84	9.09	9.36	9.63	9.91	10.20	10.50	10.81	11.12
145					8.00	8.23	8.47	8.72	8.97	9.23	9.50	9.78	10.07	10.36	10.66	10.97	11.29	11.62	11.96
150					8.58	8.83	9.09	9.35	9.63	9.91	10.20	10.49	10.80	11.12	11.44	11.77	12.12	12.47	12.84

*Revised September 1966.

†Utilization, to the 1-in. point on all branches. Basis, 429 trees of 41 species in the Mameyes, Sabana, Espiritu Santo, and Rio Grande valleys: *Alchornea latifolia*, 20; *Alchorneopsis portoricensis*, 16; *Cecropia peltata*, 25; *Dacryodes excelsa*, 22; *Didymopanax morototoni*, 27; *Miconia prasina*, 10; *Micropholis garciniaefolia*, 39; *Ormosia krugii*, 22; *Sloanea berteriana*, 25; *Tabebuia pallida*, 47; and other species, 176. Formula, log V = 0.048394 total height (meters) + 2.075850 log dbh (centimeters) − 8.424670. Also, log V = 2.2676 log dbh (in.) + 0.4566 log height (ft) − 1.8922.

Table 6

PALM VOLUMES (CUBIC METERS)
TABONUCO FOREST TYPE IN THE CARIBBEAN NATIONAL FOREST, P. R.*†

Dbh, cm	Stem height, m																		
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
6					0.01	0.02	0.04	0.05	0.07	0.08	0.10	0.11	0.13	0.14	0.16	0.17	0.19	0.20	0.22
8				0.01	0.02	0.04	0.05	0.07	0.08	0.10	0.11	0.13	0.14	0.16	0.17	0.19	0.20	0.22	0.23
10			0.01	0.02	0.04	0.06	0.07	0.08	0.10	0.12	0.13	0.15	0.16	0.18	0.19	0.21	0.22	0.24	0.25
12		0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.16	0.17	0.18	0.20	0.22	0.23	0.24	0.26	0.28
14	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.15	0.17	0.18	0.20	0.21	0.23	0.24	0.26	0.27	0.29	0.30
16	0.06	0.08	0.09	0.11	0.12	0.14	0.15	0.17	0.18	0.20	0.22	0.23	0.24	0.26	0.28	0.29	0.31	0.32	0.34
18	0.10	0.12	0.13	0.15	0.16	0.18	0.19	0.21	0.22	0.24	0.25	0.27	0.28	0.30	0.31	0.33	0.34	0.36	0.37
20	0.14	0.16	0.17	0.19	0.20	0.22	0.23	0.25	0.26	0.28	0.29	0.31	0.32	0.34	0.35	0.37	0.38	0.40	0.41
22	0.19	0.20	0.22	0.23	0.25	0.26	0.28	0.29	0.31	0.32	0.34	0.35	0.37	0.38	0.40	0.41	0.43	0.44	0.46
24	0.24	0.25	0.27	0.28	0.30	0.31	0.33	0.34	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.46	0.48	0.49	0.51

*Revised September 1966.

†Basis, 40 trees in the Espiritu Santo and Mameyes valleys. Formula, $V = 0.015126$ total height (meters) $+ 0.000539$ dbh^2 (centimeters) $- 0.104042$.

Table 7

CHANGES DURING THE PERIOD OF MEASUREMENT
FOR TREES 10+ CM DBH

Property	Cutover lots	Undisturbed lots
Number of trees		
Number/ha (1946)	422	683
Mortality (1946–1956), %	11	11
Ingrowth (1946–1956), %	16	23
Number/ha (1956)	444	764
Net change (1946–1956), %	+5.2	+11.9
Mortality (1956–1966), %	26	12
Ingrowth (1956–1966), %	37	22
Number/ha (1966)	493	842
Net change (1956–1966), %	+11.0	+10.2
Net change (1946–1966), %	+16.8	+22.7
Basal area		
Basal area/ha (1946), m^2	16.68	39.76
Mortality (1946–1956), %	11	26
Ingrowth (1946–1956), %	50.5	32.2
Basal area/ha (1956), m^2	23.28	43.39
Net change (1946–1956), %	+43.2	+9.1
Mortality (1956–1966), %	6	7
Ingrowth (1956–1966), %	26.2	12.1
Basal area/ha (1966), m^2	26.78	45.60
Net change (1956–1966), %	+15.0	+5.1
Net change (1946–1966), %	+60.6	+14.7

Table 8

TREES ALIVE IN 1956 IN ALL PLOTS

	Crown position				
Dbh, cm	Dominant	Codominant	Intermediate	Overtopped	Total
<5			19	385	404
5–10	1	3	307	1043	1354
10–15	7	17	329	272	625
15–20	21	64	275	61	421
20–25	9	56	86	3	154
25–30	18	52	40	5	115
30–35	12	28	11	1	52
35–40	18	18	12		48
40–45	19	18	2		39
45–50	12	12	1		25
50–55	12	6	1		19
55–60	5	5		1	11
60–65	5	6	2		13
65–70	2	5			7
70–75	4	1			5
75–80	4	1			5
80–85	4				4
85–90	1				1
90–95	3				3
95–100					
100–105		1			1
105–110	1				1
Total	158	293	1085	1771	3307

Table 9

MORTALITY IN PERCENTAGE BY 1956 DIAMETER AT BREAST HEIGHT AND CROWN POSITION, 1956–1966

	Crown position				
Dbh, cm	Dominant	Codominant	Intermediate	Overtopped	Total
<5			32	27	29
5–10		33	21	26	25
10–15	29	23	17	22	19
15–20	33	23	16	8	17
20–25	33	5	10	33	10
25–30	55	21	12	20	23
30–35	25	11	36	100	21
35–40	33	28			23
40–45	32	5			18
45–50	17		100		12
50–55	8		100		10
55–60					
60–65		17			8
65–70		20			14
70–75					
75–80					
80–85					
85–90					
90–95					
95–100					
100–105					
105–110					
Total	25	15	18	25	22

Table 10

NUMBERS OF TREES IN 1956 AND 1956–1966
MORTALITY PERCENTAGE BY CANOPY POSITION

	Understory		Overstory	
Dbh, cm	No. trees 1956	Mortality, %	No. trees 1956	Mortality, %
<5	96	42	104	18
5–10	278	26	341	25
10–15	67	39	135	27
15–20	21	5	68	16
20–25	3	33	50	2
25–30	4		34	9
30–35	1		23	4
35–40			23	13
40–45			23	22
45–50			20	5
50–55			12	
55–60			10	
60–65			9	11
65–70			6	7
70–75			5	
75–80			5	
80–85			4	
85–90			1	
90–95			3	
95–100				
100–105				
105–110			2	

on the undisturbed plots was more than expected. This growth probably represents recovery from earlier natural disturbances, especially the hurricane of 1939.

MORTALITY

The number of trees on all plots combined in 1956 is given in Table 8 by crown position and diameter at breast height class. The second 10-year period was chosen to minimize effects of mortality associated with the cutting operations. Mortality percentage is shown in Table 9.

Crown position appears to be a poor indicator of mortality, and the relation of mortality to diameter at breast height is not straightforward. Instead, survival seems to increase with diameter up to 25 cm (Table 10); then the relation appears to begin afresh and continue as before.

Segregation of overstory species and understory species fails to clarify the relation. Although mortality of understory species is virtually all in the smaller diameter classes as expected, overstory species still exhibit an inexplicably high percentage of mortality in trees 35 to 50 cm dbh. This anomaly may be peculiar to the particular sample; only further studies can determine whether the apparent relation does in fact exist.

VOLUME OF WOOD

The changes in calculated wood volumes were essentially the same as those for basal areas since both volumes and basal areas were treated as functions of diameter. Volumes are as follows:

Year	Cutover plots, m³/ha	Undisturbed plots, m³/ha
1946	121.6	300.5
1956	178.0	332.1
1966	208.5	345.7

The volume tables for the Tabonuco type considered as a single population are given as Tables 5 and 6.

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