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PRELIMINARY YIELD TABLES FOR
SECOND-GROWTH REDWOOD

BY
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PRELIMINARY YIELD TABLES FOR SECOND-GROWTH REDWOOD

By DONALD BRUCE

The owner of timberland who is contemplating or attempting the placing of his holdings under a plan of forest management needs certain basic facts for his guidance. Among the most difficult of these facts to determine is the rate of growth which may be expected in the second growth stands on the cutover lands. Without information on this point the timber owner will be unable to determine whether his second crop will be of merchantable size and ready for cutting by the time he has exhausted his reserves of virgin timber, or whether it will be sufficient in quantity to supply his existing manufacturing plant. Without this information he will be unable to judge the financial expediency of various forestry measures. Precise answers to questions involving future rates of growth are impossible, but reasonably reliable figures can be predicted with the aid of what are known as yield tables. This bulletin presents preliminary tables of this sort for redwood (*Sequoia sempervirens* Endl.).

The tables are termed preliminary, partly because the values given in them will probably require minor modification when a larger mass of data has been secured, but more particularly because they do not deal with stands over 60 years of age and do not, as will be later explained, cover the poorest growing conditions. Furthermore, they give no detailed information concerning the effect of introducing other species into the redwood stands. They are published in this tentative form because they will answer with all essential accuracy many of the immediate questions of redwood forestry.

NOTE.—Mr. F. X. Schumacher of this University gathered a large part of the basic data for the tables and performed much of the computational work. Mr. V. B. Davis, Forester of the Union Lumber Company, and Mr. M. E. Krueger, Forest Engineer of the Pacific Lumber Company each contributed a considerable number of valuable data. Professor W. Metcalf and Professor E. Fritz of this university, and Mr. R. E. Burton of Santa Cruz assisted with additional material. To these men and to Major D. T. Mason, Forest Engineer, who has helped in many ways, appreciative thanks are extended.

DEFINITION OF YIELD TABLE

These yield tables state the amount of timber, together with its size, which can under good management be raised on lands of varying degrees of productivity. Two types of yield tables are recognized, *normal yield tables* which state the production possible under ideal conditions of stand establishment and care, and *empirical yield tables* which state the production actually occurring under existing conditions. In the case of redwood, empirical tables would predict how much timber will grow if no attempt is made either to secure proper stocking of the cutover lands with young trees, or to protect the land from fire. Normal tables, on the other hand, predict the result of securing full stocking by replanting¹ or other means, and then of properly caring for it until it is mature. Empirical tables are of little value, since existing conditions may be profoundly modified, as for example, through systematic fire protection, within a few years' time. The tables presented in this bulletin are of the other type, but do not contemplate intensive care, as for instance, properly conducted thinnings, which should materially increase the yield.

The tables, moreover, do not contain information concerning the quality of lumber which will be produced. An investigation of this phase of the problem is now being conducted.

EXPLANATION OF YIELD TABLES

The following explanations are necessary for the proper interpretation of the columns of the yield tables herewith presented and should be referred to in connection with pages 428-430.

Site.—In accordance with a well established forestry practice, redwood producing lands may be divided on the basis of their relative productive capacities (resulting from differences in climatic and soil conditions) into five classes known as *site classes*. Site I includes the most productive and site V the least productive areas. Although five divisions are recognized, tables are presented here for sites I, II, and III only, since adequate data on sites IV and V have not been secured. It is probable that the two lower sites lie chiefly toward the southern limit of the range of redwood and occur but rarely in the region of its optimum growth. They are therefore of little interest to redwood lumbermen. Site I, moreover, probably occurs on but a small percentage of the area of the redwood region, and a large part

¹ Sprouts develop with great vigor and profusion about recently cut stumps, but they are so poorly distributed that only a few are able to survive. In one instance it has been estimated that sprouts will stock the area to but about 25 per cent of its capacity.

of such Site I land as now exists may ultimately be used for agriculture, so that most of the land on which redwood timber will be raised in the near future falls into site classes II and III. How the site of any given tract may be determined is explained on pages 433-436.

Age.—Age should be figured from the time of logging the previous stand. It is true that when young trees are planted they may have had a start of 1, 2, or 3 years in the nursery, but on account of the setback which they receive on being transplanted, this advance growth should be disregarded.

Number of Trees Per Acre.—Under this heading two figures are given: (1) the number of all trees, and (2) that of the dominants and codominants. By 'all trees' is meant all over 2.6 inches in diameter when measured outside the bark at a height of 4.5 feet ('breast high') above the ground. This designation obviously includes practically all living trees except in the case of very young stands. The more significant figure is the number per acre of the larger trees, since these include nearly all the trees of potential economic value and since their volume constitutes some 80 per cent of the stand. The dominants and codominants are those trees the crowns of which form the general level of the forest canopy or extend above it. They are so named in contrast to the intermediate and overtopped trees. Both figures are only approximate, as the data obtained were very variable for reasons which are explained under 'Basal Area.'

*Average Height.*²—The height is measured from the average ground level to the tip of the tree.

Average D. B. H.—By d.b.h. is meant diameter breast high, or the diameter measured outside the bark 4.5 feet above the ground, a point which, since it is above the root swelling, and is conveniently reached, has become accepted as standard for studies such as this. As in the case of average height, an average d.b.h.³ value is given for all trees, and for the dominants and codominants only.

Basal Area.—By basal area is meant the sum of the cross-section areas in square feet, measured 4.5 feet from the ground, of all the trees on an average acre. Since it is calculated from the d.b.h. measurements it includes both wood and bark. Its significance lies in the fact that it is a value which has been found relatively insensitive to variations in stocking. An increase in the number of trees per acre results in a decrease in their average diameter, and vice versa, but unless the overcrowding or understocking is pronounced, the basal area for a given tract of land will not be much affected thereby.

² The "average height" is that of a tree of average basal area; see page 442.

³ The "average d.b.h." is that of a tree of average basal area.

TABLE 1.—NORMAL YIELD TABLE FOR REDWOOD; SITE I

Age	Number of Trees per Acre		Average Height		Average Diameter Breast High		Basal Area per Acre		Volume per Acre		Logs per M.B.M. Average Domi- nant and Co- domi- nant	Average Annual Growth		Board Foot Cubic Foot Ratio	Basis Number of Plots
	All Trees	Domi- nant and Co- dominant	All Trees	Domi- nant and Co- dominant	Inches	Inches	Square Feet	Square Feet	Cubic Feet	Board Feet		Cubic Feet	Board Feet		
Years			Feet	Feet											
20	898	435	51	56	7.8	9.8	299	220	6000	16400	42	300	820	2.7	0
25	695	345	62	68	9.7	12.2	357	272	8000	33000	31	320	1320	4.1	5
30	585	283	72	79	11.2	14.5	400	309	10200	50700	22	340	1690	4.9	5
35	496	236	83	91	12.6	16.4	430	332	12400	68300	17	354	1950	5.5	4
40	445	200	93	102	13.6	18.2	450	347	14500	85300	14	362	2130	5.9	6
45	405	175	103	112	14.5	19.8	465	357	16400	101000	11	364	2250	6.2	3
50	372	156	112	122	15.3	21.3	476	367	17900	116000	10	359	2320	6.5	2
55	347	145	121	132	16.0	22.5	484	375	19200	128000	9	350	2335	6.7	1
60	319	138	130	142	16.7	23.5	486	382	20200	139000	8	337	2310	6.8	26

TABLE 2.—NORMAL YIELD TABLE FOR REDWOOD; SITE II

Age	Number of Trees per Acre		Average Height		Average Diameter Breast High		Basal Area per Acre		Volume per Acre		Logs per M.B.M. for Average Domi- nant and Co- domi- nant	Average Annual Growth		Board Foot Cubic Foot Ratio	Basis Number of Plots
												All Trees	Board Feet		
	Domi- nant and Co- dominant	Domi- nant and Co- dominant	All Trees	Square Feet	Square Feet	Cubic Feet	Board Feet	Cubic Feet	Board Feet						
Years			Feet	Feet	Inches	Inches	Square Feet	Square Feet	Cubic Feet	Board Feet					
20	980	500	43	49	7.2	9.0	278	213	5100	7400	53	255	370	1.5	3
25	765	400	53	60	8.9	11.3	331	270	6800	22000	38	272	880	3.2	5
30	628	328	61	71	10.4	12.9	372	294	8700	37500	27	290	1250	4.3	7
35	543	270	71	80	11.6	15.1	399	319	10600	53000	20	303	1520	5.0	5
40	489	225	79	90	12.5	16.9	418	333	12400	68000	16	309	1700	5.5	7
45	447	196	87	100	13.3	18.4	431	343	13900	82200	13	310	1830	5.9	10
50	406	175	95	109	14.1	19.8	441	352	15300	94900	11	305	1900	6.2	10
55	374	160	103	118	14.7	20.8	449	361	16300	110000	10	297	1930	6.5	7
60	348	150	110	126	15.4	21.7	451	367	17100	115000	9	286	1920	6.7	54

TABLE 3.—NORMAL YIELD TABLE FOR REDWOOD; SITE III

Age	Number of Trees per Acre		Average Height		Average Diameter Breast High		Basal Area per Acre		Volume per Acre		Logs per M.B.M. for Average Domi- nant and Co- domi- nant	Average Annual Growth		Board Foot Cubic Foot Ratio	Basis Number of Plots
	All Trees	Domi- nant and Co- dominant	All Trees	Domi- nant and Co- dominant	All Trees	Domi- nant and Co- dominant	All Trees	Board Feet	Cubic Feet	Board Feet					
												Feet	Feet			Inches	Square Feet	Square Feet	Cubic Feet
Years			Feet	Feet	Inches	Inches	Square Feet	Square Feet	Cubic Feet	Board Feet	.....	Cubic Feet	Board Feet		
20	1020	560	38	43	6.9	8.0	266	204	4200	.....	.....	210	.....	.....	0
25	777	436	47	52	8.7	10.0	316	252	5700	13000	47	228	520	2.3	0
30	638	353	54	61	10.1	11.8	356	287	7300	26500	34	243	880	3.6	6
35	556	290	62	70	11.2	13.4	381	308	8900	40000	25	254	1140	4.5	3
40	500	240	70	78	12.1	15.0	400	322	10400	53100	20	260	1330	5.1	3
45	453	206	77	86	12.9	16.3	412	332	11700	65400	18	260	1450	5.6	0
50	412	182	84	94	13.7	17.5	422	340	12800	76300	15	256	1530	6.0	4
55	384	165	91	102	14.3	18.5	429	348	13700	85800	13	248	1560	6.3	0
60	356	155	98	109	14.9	19.3	431	354	14400	93000	12	240	1550	6.5	16

A comparison of the basal area of any given tract (unless it is considerably over dense, which rarely occurs in the case of redwood) with that given in the yield table for stands of the same age and site quality is therefore one of the best methods of determining its degree of density or stocking.

Volume in Cubic Feet.—The volume in cubic feet includes the entire stem of the tree from the ground to the extreme tip, but does not include either the limbs or the bark.

Volume in Board Feet.—This is the most important figure in the tables from the standpoint of the present day forest owner. Since second growth stands can hardly be marketed for some years to come, it has been computed on the basis of closer standards of utilization than are today practicable, but which in all probability are justified in conservative anticipation of the methods of manufacture which will be current by the time second growth stands are being manufactured into lumber on a large scale. An allowance of 1.5 feet has been made for stumps, while the use of logs as small as 5 inches in diameter inside the bark has been contemplated. The logs have been scaled according to the so-called International log rule. This rule⁴ is based on the sawing of square edged lumber $1\frac{7}{16}$ inch thick in the rough (thus allowing $\frac{1}{16}$ inch for shrinkage) with a saw kerf of $\frac{1}{8}$ inch, and on the utilization of boards as short as 4 feet. No deductions have been made for defects (which, however, should be almost negligible in properly tended young stands), nor for breakage in logging. Obviously no overrun should be figured above these values, and the conservative owner will doubtless wish to deduct a small per cent to allow for unavoidable losses. (See page 436.)

Average Annual Growth.—The average annual growth (which is expressed both in cubic feet and in board feet) is obtained for any given age by dividing the yield at that age by the age itself. It is a value which increases rapidly during the youth of a stand, reaches a maximum, and then falls off more slowly. The maximum volume production is obviously obtained by allowing the stand to grow to the age which gives the maximum average annual growth. In the present instance this age is apparently 55 years (for lumber), but the falling off at the age of 60 years is slight and data beyond that age are lacking. It is therefore probable that the data used in preparing the present table are not sufficient to justify placing great reliance on this 55-year maximum.

⁴ The International rule may be found printed in full in H. S. Graves, "Forest Mensuration," pages 36-37.

Board Foot—Cubic Foot Ratio.—This column shows the average number of board feet of lumber which can be obtained per cubic foot of wood in stands of different ages. The increase in values as the stand grows older indicates the reduction in the percentage of waste as the trees increase in size. It will be noted that this increase becomes less rapid after about 45 years of age.

Basis, Number of Plots.—This column gives the number of sample plots which were actually measured in each site and age class and which form the basis for the table. It indicates the relative reliability of the various figures given. It will be observed that the table for site II has a much stronger basis than either that for site I or that for site III and that the values for the younger age classes (which are, however, of minor importance), are less well established.

Effect of Presence of Trees Other Than Redwood.—While the values given in the tables represent approximately what may be expected if pure redwood stands are produced, the data on which they are based are taken from areas which actually contained about 15 per cent⁵ of associated species, chief among which are Douglas fir (*Pseudotsuga taxifolia*, Britt.), white fir (*Abies grandis*, Lindl.), and Sitka spruce (*Picea sitchensis*, Carr.). Such species are included in the total basal areas and are therefore represented in the average diameters. They are also included in the volumes. The average heights given in the tables are, however, for redwood only.

One of the reasons for terming these tables 'preliminary' is that the data collected are insufficient to permit of a precise determination of the effect of a variation in the proportion of those species present. In general, it appears that as this proportion increases the basal area of the stand decreases,⁶ but that both the average height⁷ and the average form factor⁸ increase, so that the volume is not materially affected.

EXPLANATION OF STAND TABLE

Table 4 gives a more detailed picture of a characteristic stand about 50 years of age growing on site II. It has been prepared by averaging all the data obtained in stands on that site and between 45 and 55 years of age, the actual average age being 48 years. In it will be found the approximate number of trees which may be expected in each diameter class, their average heights, and the per cent of the total board foot volume included in successive 5-inch diameter classes. The

⁵ Stands are usually considered 'pure' if they contain 20 per cent or less of the associated species.

⁶ See pages 450-451.

⁷ See pages 449-450.

⁸ See page 440.

average heights given are for redwood; for the relation between these heights and those of other species see pages 449–450.

Some conception of the character of stands of the same age on other sites may be gained by a comparison of this table with the yield tables. It will be observed, for example, that on site III the average dominant and codominant is about 2 inches smaller in diameter, and 15 feet shorter.

TABLE 4.—TYPICAL STAND TABLE FOR SITE II, 50 YEAR AGE CLASS

Diameter Breast High: Inches	Number of Trees per Acre	Average Height of Redwood: Feet	Per cent of Total Volume, Feet B.M.
3	25	31	
4	37	36	
5	35	41	
6	33	47	
7	31	54	
8	29	61	} 2.9
9	27	67	
10	26	73	
11	24	78	
12	23	83	
13	21	88	}16.6
14	19	92	
15	18	96	
16	16	100	
17	15	103	
18	13	105	}28.3
19	12	108	
20	11	110	
21	9	112	
22	8	114	
23	7	116	}29.0
24	6	118	
25	5	119	
26	4	120	
27	3	121	
28	2	122	}18.2
29	2	123	
30	1	124	
31	1	125	
32	1	125	

THE APPLICATION OF THE TABLES

Site Determination.—To apply these tables to a concrete problem requires, first of all, a more or less intensive field examination of the cut-over land in question in order to permit its classification into site classes, and a determination of the number of acres available in each. This can best be done by a sampling process in which the

site is determined at a number of points scattered throughout the tract. If the site numbers are then entered on a map (preferably one showing the topography by means of contours), zone lines indicating the approximate limits of the classes present can be drawn, and the area of each site computed in any convenient manner. Too great refinement is probably not justifiable in this work, and the method of locating the samples will depend on the degree of accuracy sought and on other practical considerations involved in each particular case. The method of determining the site for a specific sample must, however, be understood.

There are two alternative plans possible. The first involves laying out sample plots similar to those which form the basis for the yield tables. If this method (described fully on page 442) is followed the age of the existing stand and the average height of its dominant and codominant trees are first determined. The values obtained should then be plotted on figure 1, page 435, by entering a small cross vertically above the determined age and horizontally opposite the calculated average height. It will be observed that the figure is divided by curves into 5 zones, each allotted to a given site class. The zone in which the cross falls is the site class of the sample investigated.

While the method just described is the more accurate, it is laborious and will often prove too expensive. Moreover, most of the cut-over land existing today is not fully stocked, and in such stands it is sometimes difficult to decide what trees should be classified as dominants and codominants. In many cases, therefore, another method is preferable. The second process consists of determining the age of each stand and then measuring the height of the tallest tree in each of several well defined clumps of sprouts and computing the average. (Stunted or otherwise abnormal clumps should not be included.) The resulting average should be reduced by 6 per cent,⁹ and the result entered on figure 1 as before.

This rule applies, however, only to stands which are fairly well stocked. In very open stands it has been found that the clumps of sprouts do not reach their normal height.¹⁰ In such cases a correction for density should be made by adding 13 per cent to the average height obtained. Where the two corrections are both required they may be combined and 6 per cent added; $(.94 \times 1.13 = 1.06)$. If a factor of conservatism is desired in classifying the site this correction may be ignored.

⁹ The statistical basis for this figure is given on page 447.

¹⁰ This statement is in conflict with the theories of some writers, but the evidence for it seems conclusive. See pages 447-449.

FIG. 1—HEIGHT CURVES USED IN DETERMINING SITE.

In some instances stands will be encountered in which such species as Douglas fir, white fir, or Sitka spruce, are predominant, and redwood is not present in sufficient amounts to make the procedure just described practicable. In such a case the former alternative must be adopted and the average height of the dominant and codominant tree of the principal species should be determined. Since all three of the species mentioned above are taller than redwood at the ages dealt with in the yield table, it is then necessary to apply a reduction factor to this value. This factor is 16 per cent for Douglas fir and white fir and 20 per cent for spruce.¹¹ The modified value thus obtained is the approximate average height which would have been attained by dominant and codominant redwoods on the same soil, and may therefore be plotted in figure 1 as previously described.

The use of associated species in this manner to determine site class cannot be considered rigorously accurate and the method should never be used except in the case of land which is obviously suited to the growth of redwood.

Where redwood, fir, and spruce are all present in considerable numbers it is well to strengthen the accuracy of the site classification by using each species in turn and averaging the results.

Determination of Stocking Factors.—By some one of the foregoing methods the number of acres of land of each site class on a given tract may be determined. These values multiplied by the appropriate values selected from the yield tables will give the productive capacity of the tract. It is improbable, however, that the full amount of timber thus estimated can actually be obtained. Sprouts alone will probably never result in full stocking, and even under the best possible conditions and with the best care that is economically justifiable, there will be some failures in the replanting of the cut-over lands, some damage from fire during the life of the stand, some defect found in the final product, and some unavoidable breakage in felling, etc. Just how much will be lost from all these causes can only be conjectured, since experience to guide us in our estimates is of course as yet entirely lacking. It seems probable, however, that conservative timber owners will wish to discount the final yield by at least 10 to 20 per cent.

In the case of second growth stands already established, and where planting is impracticable, a far heavier reduction figure will usually be necessary. Such stands are rarely fully stocked and may be very scantily stocked. In such instances it will be necessary to

¹¹ See pages 449-450 for the statistical basis for these figures.

determine the per cent of stocking now on the ground. This may be effected by a sampling process, representative strips or plots being laid out and the trees therein carefully measured and recorded. The basal area per acre should then be computed and compared with that given in the yield table for stands of the same age and site, the ratio between the two figures being the stocking factor. The final yield for the given site should then be reduced by multiplying it by this factor. It should be noted that this procedure gives somewhat conservative results, since the fact is well established that where existing trees are well distributed the stocking factor improves with age. This increase will tend to compensate for the reduced height growth in open stands.

AN ILLUSTRATIVE EXAMPLE OF THE USE OF THE TABLES

The various steps described above may be better understood in connection with the following hypothetical computation.

Assume a tract of 1500 acres which on examination is found to be sub-divided as follows:

Virgin timber on river flats	200 acres
35-year-old second growth on river flats	300 acres
Virgin timber on uniform easterly slopes	600 acres
25-year-old second growth on similar slopes	400 acres
<hr/>	
Total	1,500 acres

The average height of the tallest tree in each of a considerable number of clumps of redwood sprouts on the river flats is found to be 81 feet. Since the stand is very open this is increased by 6 per cent (see page 434), thus becoming 86 feet. This value plotted on figure 1 over an age of 35 years indicates the site class of the river flat to be II. The 200 acres of virgin timber is assumed to stand on a similar site.

The slopes are largely covered with Douglas fir and the average height of dominant and codominant fir is found to be 60 feet. The corresponding value for redwood should be 16 per cent less, or 50 feet, and this value plotted on figure 1 over 25 years indicates that the slopes are on site III. Again the corresponding virgin timber is assumed to be of the same site.

When the virgin timber is cut the land is to be replanted and protected from fire, and the second growth is to be allowed to grow for 50 years. Its theoretical yield for the flat should then be 200

acres times 95 m.b.m. per acre (the yield table value for 50 years on site II), which equals 19,000 m.b.m. Applying a reduction factor of 10 per cent to allow for unavoidable damage, etc., a yield of 19,000 m.b.m. minus 1900 m.b.m., or 17,100 m.b.m. is anticipated.

In a similar way the slopes in virgin timber are calculated to yield 41,000 m.b.m. 50 years after cutting:

$$(600 \times 76 \text{ m.b.m.} = 45,600 \text{ m.b.m.})$$

$$45,600 \text{ m.b.m.} \times 90\% = 41,040 \text{ m.b.m.})$$

The existing second growth on the flat is found to have an average basal area of 240 square feet per acre. The corresponding value from the table for site II at 35 years is 399 square feet per acre. The stocking factor is therefore 240 divided by 399, or 60 per cent. This is again reduced by 5 per cent to allow for breakage in logging, or to 57 per cent ($.95 \times .60 = .57$), and the expected yield 15 years hence, or at 50 years of age, is:

$$300 \times 95 \text{ m.b.m.} \times .57 = 16,245 \text{ m.b.m.}$$

The existing second growth on the slope has, on the other hand, an average basal area of but 70 square feet per acre as compared with the 316 given by the table for site III at 25 years of age. Its stocking factor is therefore:

$$70 \div 316 = 22\%.$$

If this is also reduced by 5 per cent it becomes 21 per cent, and the expected yield 25 years hence is

$$400 \times 76 \text{ m.b.m.} \times .21 = 6,384 \text{ m.b.m.}$$

To summarize, the yield to be anticipated is as follows:

River flats now covered with second growth, 16,245 m.b.m., 15 years hence.

Slopes now covered with second growth, 6,384 m.b.m., 25 years hence.

River flats now covered with virgin timber, 17,100 m.b.m., 50 years after cutting.

Slopes now covered with virgin timber, 41,040 m.b.m., 50 years after cutting.

THE BASIS FOR THE YIELD TABLES

The data on which these yield tables are based were collected coöperatively by two of the principal operating lumber companies in Mendocino and Humboldt counties (the Union Lumber Company and the Pacific Lumber Company), and the Division of Forestry of the University of California.¹² They consist of detailed measure-

¹² More detailed information concerning these data will be found on pages 451 ff. of the appendix.

ments on a series of over 100 sample plots well distributed throughout the range of the species. The method of selecting the plots, and the figures recorded for each, were as follows:

Plot Selection.—Since the general principle underlying a yield study is to base predictions of what will occur in the future on what has happened in the past, and since no managed forests yet exist, it was necessary to locate the plots in stands which, through a fortunate combination of circumstances, had fortuitously become fully stocked. This condition is encountered but rarely and then only in small areas in any one locality. A thorough search was therefore necessary in order to locate desirable material for study. When the material was found a plot was laid out, its boundaries carefully marked and surveyed and its area determined. Very small plots were avoided wherever possible, except in the case of the younger age classes; other considerations, however, often made small plots inevitable. For example, it was aimed to locate the plot boundaries inside the area of fully stocked timber, as their proper location was thereby much simplified; yet this practice of course decreased the possible size of the plot. Where the loss in plot area seemed too serious and it was necessary to include the whole area of fully stocked growth within the plot, care was taken to so locate the boundaries as to include at least the whole crown area of the trees standing within the plot. A rectangular shape was not adhered to, since to do that would have reduced either the plot areas or their completeness of stocking more than was desired. However, triangular shapes in particular and acute angles in general were avoided. Surveys were made with staff compass, and tape.

The difficulty experienced in finding fully stocked stands and the small size of such areas as were found indicate that only by planting and adequate protection can the maximum productivity of the land be obtained.

Age Determination.—Ages were determined by ring counts made with the aid of increment borers. In some instances freshly cut stumps in the neighborhood were used to supplement or replace these borings, while historical confirmation was sought whenever possible from local residents who remembered the date at which logging took place. Since the borings were made at breast height, allowance had to be made for the time required by the young tree to reach this height. In the case of sprout redwood the allowance was one year, while for Douglas fir, white fir, and spruce seven years were added, the values being determined by an examination of a considerable number of young saplings of these species.

Plots which were not essentially even aged were not used. Where there was a small range of ages the highest number of years found was the age assigned to the plot.

Diameter Measurements.—The diameter of every tree over 2.6 inches on the plot was measured with a diameter tape and recorded to the nearest inch according to its crown class (i.e., dominant, codominant, etc.). Wherever possible the measurement was taken 4.5 feet from the ground, but in fairly numerous instances trees grew so close together in clumps as to make this impracticable. The measurements which, as a result, were taken higher up the trunk introduce a slight factor of conservatism at this point.

Height Measurement.—The heights of a dozen or more trees of each important species were measured by either the Forest Service hypsometer or the Faustmann hypsometer, the distance of the observer from the tree being obtained by means of a light cord of known length. The trees selected for measurement were representative and covered the range of diameters present. Their heights when plotted on cross section paper established a curve from which could be read the average height of trees of any required diameter on the plot.

Computations.—The computations required are self-evident with the exception of those for volume. The volume in board feet was obtained by means of the diameter tally, the height diameter curve, and a volume table.¹³ The volume in cubic feet was obtained by the formula $V = B A \times H \times F$:

Where V = volume of any crown class, BA = basal area in square feet, H = height in feet of average tree, and F = form factor of average tree. The following form factors, deduced from 941 tree measurements taken by the U. S. Forest Service (see Bulletin 334 mentioned above) were used.

No volume tables or form factors were available for the three principal associated species, Douglas fir, white fir, and spruce, and it was therefore necessary to compute their volumes by means of the redwood tables. The bark of all these species is much thinner than that of redwood so that the results obtained by this method were undoubtedly too low. Correction factors of 5 per cent for Douglas fir and white fir, and 10 per cent for spruce, based on a comparatively small number of tree measurements and a somewhat limited study of bark thickness were therefore added. These values are considerably lower than those indicated by the data available and are probably ultra-conservative.

¹³ Bruce, Donald. Preliminary Volume Tables for Second Growth Redwood, Bull. No. 334, of this series, October, 1921.

TABLE 5.—FORM FACTORS FOR REDWOOD

D.B.H.	Form Factor
3 inches.....	.45
4 inches.....	.43
5 inches.....	.41
6 inches.....	.39
7 inches.....	.37
8 inches.....	.36
9 inches.....	.35
10-11 inches.....	.34
12-14 inches.....	.33
15-18 inches.....	.32
19-40 inches.....	.31

(These form factors are the ratios between the volume of the stem of the tree without bark and the volume of a cylinder of the same height and of a diameter equal to its d. b. h., outside the bark.)

Treatment of Veterans on Plots.— Sometimes, though not frequently, it was found necessary to include within the plot boundaries one or more trees which were obviously left uncut at the time of logging and which were therefore considerably older than the main second growth stand. It is evident that the full volume of trees such as these cannot be credited to a plot. On the other hand, to leave it out altogether is ultra-conservative, since they have been occupying a considerable portion of the plot area, which in their absence could have been filled by one or more additional second growth trees. For each of the original trees, therefore, was substituted one tree of a size equal to that of the average dominant on the plot. This procedure probably errs considerably on the side of conservatism.

The identification of these veteran trees, which were sometimes only slightly larger than the true second growth, was less difficult than might have been supposed, for three characteristics were available: (1) the bark texture of young trees is quite different from that of veterans; (2) the branching habit of young trees which have many long laterals close to the ground (these persist as dead branches many years after the foliage has died from lack of sufficient sunlight) is distinctive; (3) veterans left in a young stand almost inevitably project well above it in height.

SAMPLE PLOTS FOR DETERMINING THE STOCKING FACTOR

The owner of timberland who wishes to determine the stocking factor for his land must follow very much the same procedure as that outlined above. In this case, however, the plots should represent average density rather than full stocking and should be located with this end in view. Attainment of this object is easier if relatively large plots are selected and the proper location of boundaries, if this is done, involves little difficulty. If, as suggested on page 431, the basal area be used as a stocking index, the volume computations described above are obviously superfluous.

SAMPLE PLOTS FOR SITE DETERMINATION

Such plots may also be used for site determination, but in some cases special plots selected for this purpose only may be desirable. In such instances the procedure may be somewhat modified and materially abridged. Quite small plots are entirely satisfactory and their area need not be determined. The age should be carefully ascertained, but only the dominants and codominants need be measured for height and diameter. The computation of the average height of dominants and codominants is as follows: (1) compute the total basal area¹⁴ of dominants and codominants; (2) divide this value by the number of dominant and codominant trees to obtain the average basal area; (3) calculate the diameter of a tree having this average basal area; (4) look up the corresponding height in the height diameter curve; (5) modify this value by the proper correction factor if the stand is understocked (see pages 447–449) or if a species other than redwood is being used (see pages 449–451).

CONCLUSION

Only one familiar with the yield tables for other species will appreciate the full significance of the remarkable figures for redwood presented here. It is therefore desirable to cite a few instances for purposes of comparison. One of the standard European yield tables is that of Schwappach for Norway spruce, one of the fastest growing species used by German foresters. At 60 years of age on the best site this species is assigned a basal area of 231 square feet

¹⁴ Gallaher, W. H., "Secondgrowth Yellow Pine." *Forest Quarterly*, vol. XI, circles, such as is given in H. S. Graves, "Forest Mensuration," pages 376–385, and H. H. Chapman, "Forest Mensuration," pages 480–491. Slightly less convenient tables may be found in any engineering handbook.

per acre and a volume of 8,798 cubic feet. Redwood at the same age and on the best site has a basal area of 486 square feet and a volume of 20,200 cubic feet per acre. Western yellow pine on the best site in the Sierra Nevada produces, according to Gallaher,¹⁵ a volume of 52 m.b.m. (International rule) per acre at 60 years of age while the comparable figure from the redwood table is 139 m.b.m. One of the most rapid growing conifers in the eastern United States is the white pine, which at 50 years of age, and again on site I, yields 55 m.b.m.¹⁶ Redwood, it will be seen, exceeds this by 111 per cent.

On poorer sites the growth of redwood is equally remarkable. Basal area in particular, while less on the poor sites than on the good, is, as compared with that of other species, exceptionally insensitive to site conditions. As to volume, it should be noted that the yields of redwood on site III far exceed those of the above mentioned three species on site I.

The low age at which redwood reaches a size which would be considered merchantable in most forest regions is also of interest. Norway spruce, according to the Schwappach tables, has its maximum average annual volume growth at about 80 years of age on site III, and at this age the average tree is only 8.5 inches in diameter and 69 feet tall. In the case of redwood, equal diameters can be obtained at 25 years, and equal heights at 40. On site I, at the exceedingly low age of 20 years, the average redwood is 8 inches d.b.h. and 50 feet high; the comparable figures for Norway spruce are 2.6 inches and 20 feet.

It is unnecessary to multiply instances. Suffice it to say that the redwood has apparently the most rapid growth of all the conifers, and that it can be raised on the shortest rotation. This fact coupled with the comparative ease of reproduction and the relatively low fire risk make it perhaps our most attractive species for forest management.

¹⁵Gallaher, W. H., "Secondgrowth Yellow Pine." *Forest Quarterly*, vol. XI, no. 4, pages 531 ff., December, 1913.

¹⁶From "Forest Mensuration of the White Pine in Massachusetts," by H. O. Cook.

APPENDIX

BASIC DATA

The basic data for this study, summarized in table 9, pages 452 to 467, consist of 136 plots of which 34 were measured by the forestry departments of the Union Lumber Company and the Pacific Lumber Company and the remainder by the staff and assistants of the Division of Forestry of the University. Their location by counties is as follows:

Mendocino.....	55
Humboldt.....	52
Sonoma.....	13
Santa Cruz.....	10
Del Norte.....	3
Alameda.....	1
Butte ¹⁷	1
	<hr/> 135

Of these plots 96 were used in the tables, 15 (plots nos. 3, 10, 16, 51, 53, 65, 74, 89, 90, 91, 97, 118, 120, 121, 122) were unavailable for this purpose because redwood was not present in appreciable quantities and 24 were discarded for the following reasons:

Understocked.....	12 (plots nos. 25, 30, 35, 66, 67, 69, 82, 103, 107, 132, 133, 134)
Plot boundaries possibly located too close to trees within plot.....	5 (plots nos. 83, 84, 101, 102, 119)
Uneven aged.....	2 (plots nos. 85, 113)
Over-dense.....	2 (plots nos. 34, 80)
Plantation outside natural range of redwood.....	1 (plot no. 124)
Sites IV and V.....	2 (plots nos. 125, 135)

In discarding plots, all those which had a basal area 25 per cent above or below the average for their site and age were critically examined, the relative number of trees on them and their average d.b.h., as well as the description of the plot itself being taken into consideration in deciding whether or not they could be used. It should be noted that in the group thus indicated as apparently overstocked were a number of the surest plots measured, i.e., those of good size, with ideal distribution and density, and with boundaries which were located without difficulty or danger of error. This fact would appear to indicate that throughout the study the words ‘fully stocked’ had been so liberally interpreted that the resulting tables should be conservative.

¹⁷ An interesting and successful plantation at Chico. See table 9, plot No. 124.

The distribution according to site and age class of the 96 plots (with 2 additional plots from sites IV and V) is as follows:

TABLE 6.—DISTRIBUTION OF PLOTS ACCORDING TO SITE AND AGE CLASS

Age Class	Site					Total
	I	II	III	IV	V	
	Number of Plots					
20-24.....	....	3	....	....	....	3
25-29.....	5	5	....	....	....	10
30-34.....	5	7	6	....	....	18
35-39.....	4	5	3	....	....	12
40-44.....	6	7	3	....	....	16
45-49.....	3	10	....	....	....	13
50-54.....	2	10	4	....	1	17
55+.....	1	7	....	1	....	9
	—	—	—	—	—	—
Total.....	26	54	16	1	1	98

The relationship between the physiographic location of the plots and their site classification is given in table 7.

TABLE 7.—RELATION BETWEEN SITE AND PHYSIOGRAPHIC LOCATION

County		Site Class	Physiographic Location				Total
			Alluvial Flat	Slope	Bench	Ridge	
			Number of Plots				
Del Norte and Humboldt	I	.....	13	1	.....	14	
	II	.....	21	9	3	33	
	III	.....	5	1	2	8	
	IV	.....	.....	.....	.....	.....	
	V	.....	.....	.....	.....	.....	
Total.....		.....	39	11	5	55	
Average site.....		.....	1.8	2.0	2.4	1.9	
Mendocino, Sonoma, Alameda, Santa Cruz	I	10	4	.....	.....	14	
	II	18	13	.....	4	35	
	III	6	10	.....	5	21	
	IV	1	3	.....	.....	4	
	V	.....	.....	.....	2	2	
Total.....		35	30	.....	11	76	
Average site.....		1.9	2.4	.....	3.0	2.3	
All counties combined	I	10	17	1	.....	28	
	II	18	34	9	7	68	
	III	6	15	1	7	29	
	IV	1	3	.....	.....	4	
	V	.....	.....	.....	2	2	
Total.....		35	67	11	16	131 ¹⁸	

¹⁸ The remaining 4 plots for various reasons could not be assigned with certainty to a site class.

The table indicates: (a) that while the physiographically favorable locations average higher in site, yet there is a wide range of sites within each (see, however, page 449) ; (b) that similar locations average better in site in the two northern counties than they do in Mendocino county or farther south. This difference is consistent with the character of the stands of virgin timber in the two regions.

Table 8 gives information concerning the areas of the plots. Most of the smaller plots occurred in the younger age classes.

TABLE 8—AREAS OF PLOTS

Size Class	Number of Plots
.06 — .15 acres.....	28
.16 — .25 acres.....	33
.26 — .35 acres.....	18
.36 — .45 acres.....	9
.46 — .55 acres.....	2
.56 — .65 acres.....	1
.66+ acres.....	5
Average area per plot 0.265 acres.	96

THE EFFECT OF PLOT AREA

Since, as indicated in the preceding table, and for reasons already explained (page 439), a considerable number of the plots taken were small in area, an investigation was made to see if there was any evidence of the introduction of an error into the tables from this cause. On comparing the basal area of each plot with the tabular basal area for its site class and age, it was found that the 39 plots having an area less than .2 acre averaged 5 per cent above the figures given in table. This discrepancy might be taken to mean that the boundaries of the small plots had been located a little, though not seriously, too close to the trees included in them. A more probable explanation is that, in the effort to secure plots as large as possible, areas which were not fully stocked were often accepted and that this tendency was more marked in the case of plots of larger size. In either case the discrepancy is too small to be important.

THE RELATION BETWEEN AVERAGE HEIGHT OF DOMINANTS
AND CODOMINANTS AND AVERAGE HEIGHT OF
CLUMPS OF SPROUTS

This relationship, knowledge of which is needed for the reasons stated on page 434, was determined from the measurements of the height of 60 plots taken by both methods. The results obtained are shown graphically in figure 2. A straight line through the origin expresses the results quite satisfactorily. Its slope indicates that the mean extreme height of the clumps as determined by the method

outlined on page 434 exceeds the mean height of dominants and codominants on the average by 6.7 per cent.

FIG. 2.—RELATION BETWEEN AVERAGE MAXIMUM HEIGHT OF CLUMPS AND AVERAGE HEIGHT OF DOMINANTS AND CODOMINANTS.

THE EFFECT OF DENSITY ON HEIGHT GROWTH

The method of site determination by height growth described on pages 433–436 is one which has been quite generally adopted by American foresters. It is based on the theory that height growth is either unaffected by variations in density or is at least relatively insensitive to them. It seemed necessary to check this assumption in the case of redwood, a species which has been very little investigated. Data were collected in the following manner. Wherever possible several clumps of sprouts were found in close proximity to each plot which were (a) of the same age, (b) on apparently the same site, and (c) in a much more open stand. The tallest tree in each was selected and its height and d.b.h. measured. A count of the

trees around it (usually on a one-quarter acre circle) was made. These three values, height, d.b.h., and number of trees per acre, were then averaged and compared with similar figures taken within the plot.

Such measurements were taken on 28 plots. (In a large number of cases, of course, suitable material could not be found.) When averaged the results obtained are as follows:

	Average Number of Trees per Acre	Average D.B.H.	Average Height
Within the plots.....	487	19.0 inches	95 feet
In open stands outside the plots.....	201	21.1 inches	84 feet

FIG. 3.—RELATION BETWEEN AVERAGE HEIGHT OF CLUMPS IN NORMAL DENSITY AND IN POOR DENSITY STANDS.

The average height within the plots (i.e., in fully stocked stands) exceeds that of the open stands by 13 per cent. It should be noted moreover, that in only two out of twenty-eight instances did the

heights within individual plots show a relationship in the reverse direction. There were in addition, however, two plots in which height growth was distinctly and obviously stunted by overcrowding. Figure 3 indicates that the value obtained (13 per cent) is approximately the same for short or tall stands.

The data available did not permit of a more detailed analysis of the effect of density on height growth and no answer could be obtained to the question of how much it may vary before the height growth will be affected. It seems possible, however, that variations in the degree of stocking may be in part responsible for the apparently wide range of sites encountered under similar physiographic conditions (see page 445). This possibility is, however, more interesting than important, for if in using the tables the same methods of site determination as were used in constructing them are employed no serious error will result.

RELATION BETWEEN HEIGHT OF THE ASSOCIATED SPECIES AND
OF REDWOOD

The data available for investigating this relationship were found in the plots on which Douglas fir, white fir, and spruce were present in material proportions, the numbers being respectively 39 for Douglas fir, 31 for white fir, and 8 for spruce. It was first necessary to determine whether or not any strong correlation existed between the heights of the various species under similar conditions. Using the Karl Pearson coefficient of correlation the following values were obtained:

Douglas fir and redwood	.85 ± .03
White fir and redwood	.85 ± .12
Spruce and redwood	.87 ± .06

These figures mark the correlation as exceedingly strong.¹⁹

It was noted that where Douglas fir and white fir occurred simultaneously their values were essentially the same. For the 14 plots where this was the case the average height of Douglas fir was 110.1 feet and that of white fir 109.3 feet, a difference of less than 1 per cent. Since the data were somewhat scanty it seemed both desirable and permissible to treat the two species as one. Spruce, however, was materially different from either of the others.

Figure 4 is a graphic summary of this relationship. It seems to justify the statement made on page 436 that the height of redwood can be deduced with reasonable assurance from that of its associated species if values for fir are reduced by 16 per cent and those for

¹⁹ In interpreting these coefficients of correlation it is customary to consider that values over .50 indicate strong correlation, provided the coefficient is at least six times the probable error. Perfect correlation is indicated by 1.00.

spruce by 20 per cent. It should be noted that these percentages would not be accurate for very young stands (where sprout redwood exceeds all its associates in height growth), nor for very old stands. In virgin timber, redwood is of course by far the tallest species present.

FIG. 4—RELATION BETWEEN AVERAGE HEIGHT OF DOMINANTS AND CODOMINANTS OF REDWOOD AND OF ASSOCIATED SPECIES.

EFFECT OF VARIATIONS IN COMPOSITION ON YIELD

The preceding paragraphs indicate that all three of the principal associated species attain greater heights than redwood at the greater ages under investigation. Their effect on basal area was investigated by classifying all the plots in groups within which the percentage of redwood present (computed by basal area) ranged from 100 to 80, from 79 to 60, from 59 to 40, etc. The ratio between the basal area of each plot and that given in the yield table for its site class and age was then determined, and an average value for each of the above described composition classes was computed. The results are given graphically in figure 5.

It is evident that a decrease in the percentage of redwood present is accompanied by a decrease in the basal area. If redwood is completely absent, the basal area falls to 76 per cent of that given in

the table, while if it is the only species present the basal area rises to 5 per cent above that of the table. (It must be remembered that the table itself is based on stands only about 84 per cent pure). Intermediate proportions give an average of these extremes weighted by the percentages of redwood and of associated species present.

FIG. 5.—EFFECT OF COMPOSITION ON BASAL AREA.

The volume of a stand (in cubic feet) is its basal area times its average height, times its form factor. As has been mentioned on page 440 the form factors of the associated species are higher than those of redwood by at least 5 per cent for fir and 10 per cent for spruce. Combining these values with those already given for height and basal area, the effect of the presence of an associated species on volume appears to be from:

$$1.05 \times .76 \times 1.16 = .93 \text{ for fir, to}$$

$$1.10 \times .76 \times 1.20 = 1.00 \text{ for spruce.}$$

The higher value for spruce is based on insufficient evidence, for all species have necessarily been treated as one in analyzing the effect of basal area.

Since the values used for the form factors are probably ultra-conservative, the statement seems justified that the presence of associated species, at least in moderate proportions, does not materially affect the volume.

The average d.b.h., also, will apparently not be greatly modified by variations in composition, although the evidence was found to be inadequate for a precise determination of this point.

PLOT DATA

Table 9 gives the detailed plot data on which the tables are based.

7	Arcata	Slope	.350	41	II	Rw. D.F. Sp.	52 3	23	33	55	101.24 8.73	19.85	18.91	11.73	92 113	76	67	50	2980 306	513	443	229	16240 1935	2545	2078	457
										1				.14				46				3				
8	Arcata	Slope	.279	31	II	Misc. Rw.	1 45	25	30	48	.66 74.94	19.71	14.08	8.61	73	60	51	38	1751	402	259	131	8971	1637	905	250
9	Arcata	Slope	.089	28	I	Rw. Misc.	22 1	14	21	39	13.64 .55	4.61	4.49	3.51	78	73	66	58	371 15	125	116	88	2005 82	415	126	41
10	Arcata	Bench	.717	55	III	Sp.	87	30	28	1	185.10	29.98	18.41	.27	138	121	111	95	7920	1197	715	10	53265	7591	4862	
11	Arcata	Slope	.198	48	II	Rw. Sp. W.F.	12 3 19	5	17	24	26.67 8.40 37.33	5.38	10.41	4.87	119 144 136	106	93 111 110	72	984 375 1625	188	339	137	6228 2641 10626	1167	1999	471
12	Arcata	Ridge	.101	34	III	Rw. D.F. Sp. W.F. Others	6 4 2 4	2	12	15	5.70 5.19 .99 3.24	1.45	4.09	2.26	67 82 84 84	65	53	32	130 138 29 93	32	80	30	593 735 151 522	142	181	40
										2				.10								1				
13	Arcata	Slope	.419	52	III	Rw. W.F. D.F. Misc.	24 23	8	14	22	46.63 64.55	11.82	15.17	13.52	92 122	88	78	62	1372	333	391	233	7578	1746	2330	1661
										3				.87	95	95	60	44	2440	143	58	15	15829	1004	333	26
										4			.55		60		60				12			45		
										6		.97	.27								12	2		20		
14	Arcata	Slope	.266	50	III	Rw. W.F. D.F.	27 9 1	9	8	13	61.09 21.82	9.98	6.61	6.10	110 115	93	85	69	2083	369	191	151	13035	1892	1111	740
												1.07							778	31			5099	178		
											1.23			94				38				200				
15	Arcata	Slope	.235	50	II	Rw. W.F. D.F. Misc.	19 3 2	4	2	14	61.80 14.22	6.37	2.65	5.22	104 148	82	76	46	1995	167	64	89	13011	954	332	424
										1		1.23		.14	147	128		42	653	52		2	4350	328		
										3	6.83			.26					310			3	1930			

TABLE 9.—BASIC DATA BY SAMPLE PLOTS—(Continued)

Plot No.	Locality	Situ- ation	Area Acres	Age	Site Class	Spe- cies	No. of Trees according to Crown Class				Basal Area according to Crown Class				Average Height according to Crown Class				Volume according to Crown Class							
							Dom.	Co- dom.	Int.	Sup.	Dom.	Co- dom.	Int.	Sup.	Dom.	Co- dom.	Int.	Sup.	Dom.	Co- dom.	Int.	Sup.	Dom.	Co- dom.	Int.	Sup.
16	Arcata	Slope	.264	50	II	W.F.	24	12	7		49.56	11.67	3.42		140	128	98		2220	508	120		14507	3077	698	
						Rw.	8	6	10	17	14.69	5.63	3.84	3.58	106	87	66	56	497	166	94	78	3002	956	361	273
						D.F.	2				3.96				140				177				1151			
						Misc.			2					.49								9				44
17	Freshwater Creek	Ridge	.228	51	III	Rw.	5	12	18	61	10.91	13.13	13.36	13.76	104	95	89	47	352	412	359	252	2023	2385	2331	902
						D.F.	17	7	7	8	28.17	5.61	3.32	2.37	120	108	95	81	1110	206	114	73	6852	1285	649	292
18	Freshwater Creek	Ridge	.303	50	II	Rw.	6	10	19	76	9.40	22.23	24.94	16.27	97	102	95	60	292	703	758	374	1771	4407	4524	1223
						D.F.	12	1	4		26.23	1.07	2.61		126	111	103		1025	39	94		6584	238	474	
						W.F.	3	5	4	2	9.69	6.90	6.60	.40	130	116	119	80	390	256	251	12	2509	1591	1566	
						Misc.	1		1		2.41		3.49						85		9		566		44	
19	Freshwater Creek	Slope	.303	50	II	Rw.	13	9	17	39	32.08	18.60	16.83	17.99	111	108	95	78	1104	643	538	512	6839	3880	3085	2542
						D.F.	9	6	5	2	19.97	6.47	2.28	.71	129	115	96	90	797	248	79	24	5361	1602	519	109
						W.F.	2	2	7	3	4.17	2.32	4.74	.53	130	120	106	77	168	92	176	16	1111	544	1118	
20	Freshwater Creek	Slope	.229	47	I	Rw.	7	9	15	23	15.55	19.02	20.21	10.59	119	119	108	75	574	701	698	286	3647	4460	4274	1476
						D.F.	4	5	4	2	8.80	4.33	2.31	.58	129	109	98	82	352	161	79	17	2216	1034	499	88
						W.F.	3	1	1		7.49	.44	.55		139	104	109		310	17	21		2075	109	127	
21	Freshwater Creek	Slope	.342	47	I	Rw.	16	14	28	40	40.36	27.90	30.08	29.00	117	114	106	101	1369	1018	1051	1002	9116	6178	6415	5848
						D.F.	2	1			3.95	1.23			152	144			192	58			1220	360		
22	Freshwater Creek	Slope	.301	46	I	Rw.	12	12	35	59	28.93	23.38	43.51	19.71	125	116	105	71	1122	868	1509	518	6914	5412	9066	2499
						D.F.	10		3	1	26.81		2.00	.35	133		105	92	1105		73	12	7262		413	74
23	Freshwater Creek	Slope	.209	50	II	Rw.	6	13	20	93	10.47	19.93	12.88	16.40	106	104	86	56	356	654	388	364	2097	3960	2105	648
						D.F.	4		3	3	9.93		1.77	.75	140		105	79	432		66	22	2783		475	74
						W.F.	9	4	2	1	20.70	5.33	1.36	.14	139	125	101	69	893	213	48	414	5722	1347	298	

24	Freshwater Creek	Slope	.398	56	II	Rw. D.F. W.F.	10 12 10	12 6 7	29 4 5	150 1 1	27.40 28.13 17.86	14.32 7.28 8.33	20.08 3.15 2.19	34.77 .35 .44	122 147 131	107 130 124	91 120 101	65 100 101	1038 1280 749	506 314 340	638 129 77	859 13 16	6587 8732 4780	3013 1976 2127	3843 894 445	2744 92 109
25	Freshwater Creek	Slope	.212	45	II	Rw. D.F. W.F. Misc.	6 4 5	7 3 1	20 6 1 2	31 1	9.70 6.34 8.89	9.15 3.82 1.23	15.90 4.58 .81	7.63 .27 .35	96 120 133	91 111 90	81 106 88 68	57 85 88	299 243 378	274 146 36	438 161 11 24	165 9 2456	1743 1508 74	1637 907 200	2350 992 63	549
26	Freshwater Creek	Slope	.233	55	II	Rw. D.F.	18 1	21 1	12 1	62 1	51.15 2.41	20.05 11.77	11.77 19.16 .27	19.16 .27 128	112 128	100 83	96 83	75 83	1775 93	884 8	380 8	532 8	11174 626	5202 2153	2214	
27	Freshwater Creek	Slope	.263	55	II	Rw. D.F. W.F.	19 3 2	18 2 2	18 1	58 2	41.85 7.47 2.65	30.59 18.14 1.71	18.14 13.10 .35	13.10 .46 114	109 128 114	106 108	98 89	64 83	1411 286 97	1037 63	587 11	332 15	8694 1937 614	6213 3456 373	977	
28	Freshwater Creek	Slope	.103	46	II	Rw.	10	9	8	24	15.79	10.08	4.57	5.23	96	90	79	55	484	299	126	112	2812	1729	736	433
29	Freshwater Creek	Ridge	.270	46	II	Rw. D.F.	35 3	36 1	28	78	53.72 2.93	36.09 .44	16.53 18.22	18.22 111	113 111	106 98	92	56	1942 111	1261 16	532	398	11767 694	7584 3159	1344	
30	Freshwater Creek	Slope	.195	44	II	Rw. D.F. W.F.	13 1 4	5 1 2	19	50	18.76 1.40 7.17	4.41 1.84	9.89 8.77	8.77 .20	92 119 122	86 110	74	52	552 53	127 69	259 6	177 3088 334	667 1182	461		
31	Freshwater Creek	Slope	.282	44	II	Rw. D.F. W.F.	11 14 11	11 2 5	10 3 9	66 5 4	26.43 19.88 16.37	14.17 .99	7.19 1.69	17.20 .90	106 119 120	91 102 110	73 102 94	55 55 84	870 756 629	421 35 179	183 60 102	359 20 24	5249 4837 3990	2347 236 1134	990 312 384	1376 74
32	Freshwater Creek	Slope	.245	46	II	Rw. D.F. W.F. Sp.	15 1 4 1	4 2 1	19 1 1	53 2	29.81 2.41 15.84 3.14	6.08 2.62	15.44 .35	15.13 1.05	111 122 144 130	108 112	97 79 99	72 94	1058 88 709 127	210 93	509 10 17	414 35	6217 566 5587 813	1275 562 127	3026 58	1895 163
33	Freshwater Creek	Slope	.109	32	II	Rw. D.F.	4 11	6 5	9 6	35 2	4.76 12.12	3.24 2.76	2.67 1.26	5.36 .35	91 91	80 83	69 73	56 73	143 368	91 81	70 36	123 10	782 2066	463 440	220	113

TABLE 9.—BASIC DATA BY SAMPLE PLOTS—(Continued)

Plot No.	Locality	Situation	Area Acres	Age	Site Class	Species	No. of Trees according to Crown Class				Basal Area according to Crown Class				Average Height according to Crown Class				Volume according to Crown Class										
							Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.
34	Freshwater Creek	Slope	.156	43	III	Rw. D.F.	17 2	15 1	24	71	18.55 3.16	8.72 1.23	5.92	7.83	74 83	67 81	58	42	453 84	202 33	130	141	2275 427	890 169	216	64			
35	Freshwater Creek	Slope	.322	44	II	Rw. W.F. D.F.	8 13 1	10 5 1	25 4 2	74 1	16.13 25.62 1.97	16.56 5.84 .55	17.15 1.88 .79	15.65 .14	101 120 110	103 111 86	90 94 82	67 78	547 985 69	546 214 16	540 64 23	409 4	3255 6163 414	3317 1312 103	2886 312 127	1138			
36	Freshwater Creek	Slope	.143	28	I	Rw.	16	14	19	53	23.08	12.60	7.07	9.90	83	78	62	49	613	339	166	198	3388	1688	717	546			
37	Freshwater Creek	Slope	.254	36	I	Rw. D.F. Misc.	20 5 1	16 3 1	7 3 1	46 2	39.24 6.69 1.40	23.39 2.62 1.07	4.04 1.89	12.81 .53	96 104	93 96	83 90	70 72	1203 224 40	695 86 30	117 60	341 14	7060 1348 226	4082 458 178	657 317	1375 58			
38	Freshwater Creek	Slope	.267	34	I	Rw. D.F. W.F. Misc.	13 9 3	12 4 2	21 4 4	36 3 7	32.69 14.75 4.08	19.83 .87 1.57	14.91 .26 1.54	7.49 1.21 .14	91 93 113	86 104	71 62 89	45 50 64	923 438 148	545 56	371 21 51	131 5 32	5562 2629 965	3062 326	1782 221	378 74			
39	Freshwater Creek	Slope	.143	36	I	Rw. D.F. W.F.	14 5 2	6	9 1 8	17 3 4	24.77 5.00 2.79	7.45 3.10	7.43 .55 2.11	3.77 .42 .68	103 95 121	96	86 84 100	61 61 77	816 159 108	236	217 16 67	90 10 20	4847 907 668	1337 670	1201 82 222	186			
40	Freshwater Creek	Slope	.137	31	II	Rw. D.F. W.F.	4 1 11	5 13	13 1 9	18 4	5.87 1.40 12.78	2.99 .55 5.89	5.99 .58	3.44 2.16	85 96 94	66 83	62 85 77	50 69	159 43 396	69	134 16 63	67 16	892 262 2216	338 103 929	548 103 185	134			
41	Ryan's Slough	Slope	.177	29	II	Rw. Misc.	26	14	18 3	20 2	35.02	10.29	5.80 .19	2.58 .10	80	62	44	31	897	217	94 2	33 1	4875 936	254	26				

42	Ryan's Slough	Slope	.068	27	I	Rw.	13	10	13	23	12.60	5.33	4.15	3.78	76	66	60	46	326	123	92	73	1687	567	267	127
43	Ryan's Slough	Slope	.143	29	I	Rw. Misc.	27 5	14 1	25	58	25.36 2.98	7.27 .35	7.40	7.39	79	70	63	56	681 76	178 9	177	166	3455 366	814 44	496	115
44	Ryan's Slough	Slope	.109	43	III	Rw. Sp. W.F. D.F.	11 2 2 1	8	11	25	20.88 3.00 4.59 2.89	9.69	9.82	5.87	90 120 130 140	80	73	46	602 115 179 109	256	244	103	3444 729 1194 815	1336	1193	253
45	Ryan's Slough	Slope	.248	40	I	Rw. D.F. Sp. W.F. Misc.	30 3 1 2 2	16 2 2 1	21 2	73	63.96 8.59 1.58 4.41 2.69	20.56 .49	13.58 1.21	14.39 .69 .44	106 113 110 120	94	78	54	2100 300 56 164 83	638	371	303	12877 2181 335 1069 487	3618	1897	1054
46	Eureka	Bench	.178	33	II	Rw. Misc.	27 3	16 2	23 1	62	30.61 2.55	10.81 1.21	7.41 .27	6.82 .05	90	76	62	44	909 71	288 31	170 6	126	5159 394	1483 160	474	32
47	Eureka	Bench	.328	40	I	Rw. Sp. Misc.	33 1 5	16	9	46	75.77 3.98 9.83	19.37	6.92	11.27 .14	107 118	88	78	56	2520 146 321	563	184	240	16123 938 1919	3282	990	781
48	Eureka	Bench	.106	45	II	Rw. W.F. Sp. D.F. Misc.	10 4 2	5	16 1	38	11.17 8.96 1.73	2.96	4.78	5.66 .35	83 124 117	75	63	50	306 345 69	78	114	116	1654 2194 452	480	360	222
49	Eureka	Bench	.247	37	I	Rw. W.F. Sp. D.F.	11 2 8 7	9 5 2	14 3 1	23	18.77 8.30 23.59 13.95	8.61 4.45 2.14	7.20	2.87 .56 .35	111 143 136 128	93	75	44	667 368 994 571	272	189	53	4249 2482 6604 3676	1552	999	44

TABLE 9.—BASIC DATA BY SAMPLE PLOTS—(Continued)

Plot No.	Locality	Situation	Area Acres	Age	Site Class	Species	No. of Trees according to Crown Class				Basal Area according to Crown Class				Average Height according to Crown Class				Volume according to Crown Class							
							No. of Trees according to Crown Class				Basal Area according to Crown Class				Average Height according to Crown Class				Cubic Feet				Board Feet			
							Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.
50	Eureka	Bench	.131	45	II	Rw. W.F. Sp. D.F.	9 15 2 4	7 4 1	2 7	8 2	16.43 21.70 3.74 5.17	8.38 2.53 .79	1.58 2.58	2.50 .29	113 114 120 110	104 96 98	93 86	66 72	600 771 144 188	288 79 26	50 69	61 4	3583 5066 883 762	1664 547 163	305 283	308
51	Eureka	Bench	.196	42	II	Rw. W.F. D.F. Sp.	4 14 3 1	2 12 2 1	3 8 3 1	12	8.27 21.83 5.41 1.97	2.76 8.77 2.15 .79	1.65 3.35 1.76 .44	3.38	105 128 128 132	97 110 116 112	78 98 101 100	64	269 894 222 83	86 328 82 30	45 118 62 16	82	1625 5859 1421 414	502 2275 520 138	248 836 386 69	323
52	Eureka	Bench	.246	37	II	Rw. Sp. D.F. W.F. Misc.	24 2 1 1 1	9 1 1	17 1	36	46.97 3.20 3.14 1.23 3.14	9.28 .14 .79	7.86 5.77	5.77	89 106 101 78	73	57 40	41	1338 109 98 32 76	224 2	161	97	7501 596 582 169 582	1116	573	166
53	Eureka	Bench	.149	55	II	Rw. W.F. D.F. Sp.	3 17 4 6	1 2 3 1	3 2 2 1	16	6.23 29.71 6.98 18.65	1.53 2.02	3.22 1.01 1.21 .55	3.85 .55 1.69 .35	126 128 130 150	112 111	94 92 94 94	48 92 92 84	243 1217 290 727	51 74 40 18	100 32 40 18	70 18 54 11	1497 7937 1919 5765	335 473	598 206 251 103	211 103 324 58
54	Eureka	Bench	.229	53	II	Rw. D.F. Sp.	10 8 9	2 2 4	4 5 2	16 4 5	25.38 16.23 28.94	7.84 1.62 4.95	4.34 2.67 .82	4.56 1.32 1.16	107 128 141	92 96 114	85 84 85	52 70 70	842 665 1270	84 53 186	122 79 25	190 34 32	4944 4217 8432	507 320 1207	705 440 103	390 113 103
55	Eureka	Bench	.218	47	II	Rw. Sp. D.F. W.F. Misc.	7 11 7 6	3 2 4	5 3 1 2	37 2 1 2	16.79 17.87 12.02 8.28	4.38 1.57 2.41	4.32 1.23 .20	6.59 .39 .20 .27	118 128 129	100 114 110	84 101 80	50 80 80 77	615 732 496 265	140 61 93	123 45 6	132 12 6 9	3933 4735 3192 1548	822 380 664	693 322	377

TABLE 9.—BASIC DATA BY SAMPLE PLOTS—(Continued)

Plot No.	Locality	Situation	Area Acres	Age	Site Class	Species	No. of Trees according to Crown Class				Basal Area according to Crown Class				Average Height according to Crown Class				Volume according to Crown Class												
							Dom.			Co-dom.	Int.		Sup.	Dom.		Co-dom.	Int.		Sup.	Dom.		Co-dom.	Int.		Sup.	Dom.		Co-dom.	Int.		Sup.
64	Noyo River	Slope	.105	50	II	Rw. W.F. D.F. Misc.	8 9 1 4	4 6	2 2	15	16.79 21.57 .79 .62	6.52 7.73	.99 .69	3.85	106 126	96 110	65 74	47	552 843 22 9	200 281	23 19	69	3222 5326 113	1180 1693	88 103						
65	Noyo River	Slope	.131	33	II	Rw. D.F. W.F. Misc.	4 11 4 5	3 2 8	3 6 4	3 4 4	3.72 13.20 2.78 1.87	2.49 1.34 3.14	.46 1.96 .56	28 35 51	63 83 81	60 74 72	58	80 362 79 42	51 35 84	5 45 13	5 5 9	343 1890 405 149	207 173 334	136							
66	Noyo River	Ridge	.102	46	III	Rw. D.F. Misc.	5 10	1	3 3	3 4	8.40 25.33	1.40	3.18 2.24 .74	39 72	84 114	95	74 72	224 895	43	78 56	11 12	1298 5589	226 281	404 20							
67	Noyo River	Slope	.243	33	II	Rw. D.F. Misc.	11 20 1	8 9 4	9 7 10	10 10	10.03 22.49 1.40	7.06 4.03 .63	4.74 2.93	38 40	61 100	58 73	47 54	208 742 39	139 106 9	77 62	97 1	861 4517 226	645 541 20	324 434							
68	Noyo River	Slope	.380	52	II	Rw. W.F. D.F. Misc.	17 21 2	7 17	5 5 1	8 2	42.59 46.14 5.38	11.34 20.72	5.26 3.39 .66 .91	65 109 127	129 150 152	117 136	98 125 127	1705 2146 237	425 927	175 148 29	57 26 24	10955 14286 1667	2575 5843	1074 994 187	162 100						
69	Noyo River	Ridge	.186	26	II	Rw. D.F. W.F.	10 5 12	5 2 5	7 1 1	6 1 5	9.64 4.50 7.15	2.90 .71 2.24	2.18 .09 .14	34 42 39	70 74 69	66 60 59	55 46	229 113 173	65 16 49	43 2 3	12 2 7	1127 536 846	280 38 127	142							

70	Noyo River	Slope	.146	29	II	Rw. W.F. D.F. Misc.	21 2 6	22	19	24	20.74 1.71 6.02	12.60	5.06 .09 .09	3.73 .09 1.46	73 72 75	68	52 42 49	42 42 49	515 49 149	300	100	64	2594 192 767	1273	260	120
71	Noyo River	Slope	.088	26	II	Rw. D.F. W.F. Misc.	15 5 1	9 2	3 2	15 1	16.50 3.77 .79	7.28 .39	1.28 .53	2.14 .09 .10	69 87 83	63 61	52 67	33 44	376 112 22	156 9	24 14	29 2	1829 599 113	661 69	74	40
72	Noyo River	Ridge	.152	24	II	Rw. D.F. W.F. Misc.	23 6	18 6 1	11 2 1	22 1	19.45 5.04	9.14 1.82 .20	4.16 .39 .66	2.28 .09 .80	58 61	51 45 38	44 40 26	25 31	384 105	163 31	72 1	25 3	1657 399	486 50	153	12
73	Casper River	Slope	.357	44	II	Rw. D.F. W.F. Misc.	48 6 2 4	26 1	11	34	92.42 20.46 6.05 14.33	31.61 .79	5.03	9.08	92 106 104	88 84	80	74	2721 673 195 476	918 23	145	255	16001 4323 1080 2690	5279 138	696	970
74	Casper River	Slope	.625	51	III	W.F.	72	28	24		134.12	28.02	11.65		114	108	97		4900	1014	402		30126	6194	2535	
75	Casper River	Ridge	.376	38	III	Rw. D.F. W.F. Sp. Misc.	34 12 8 1	22 1 1	15 3 1	18 1	55.84 23.96 19.32 .92	16.26 .55 .55	6.77 .93 .20	4.17 .09	78 80 96 82	68 62 76	60 52 64	44 35	1394 613 556 26	376 12 15	146 18 5	70	7489 3436 3493 104	1793 45 82	603	228
76	Big River	Flat	1.000	58	I	Rw. Misc.	121		56 6	86 3	412.16		91.75 5.31	54.47 2.26	142		110	79	18100	3230 159	1510 63		113072	21109	8370	913 334
77	Little River	Slope	.128	41	III	Rw. D.F. Misc.	20 6	9 2	7 3 3	23 1 9	28.30 8.31	7.24 1.10	3.04 .69 .41	5.27 .05 .60	82 91	67 81	52 74	38 60	743 242	165 31	57 20 4	78	4175 1378	793 166	188	58

87	Greenwood Creek	Ridge	.070	31	III	Rw.	18	4	4	15	18.58	2.44	1.32	2.03	64	56	44	30	392	48	22	25	1701	175	60	20
88	Garcia River	Slope	.305	34	III	Rw. W.F. D.F. Misc.	34 17 5 5	20 8 6 6	22 6 2 8	28 13 2 2	34.66 16.58 5.63 1.52	12.48 3.48 1.33	8.73 1.47 1.17	4.64 1.11 .23 .18	60 76 66	52 60	44 51 40	36 38 40	686 428 123 23	227 73 18	138 29 14	66 18 2	3027 2126 577 70	810 274	371 32	68
89	Garcia River	Slope	.185	37	III	Rw. D.F. W.F. Misc.		2 17 38	1 34 1 2	13 23 4 23		1.09 6.10	.35 7.59 .14 .49	1.60 2.82 .27 1.86		52 66	46 54 56	30 40 48		20 149 747	6 160 3 12	20 47 6 18		60 678 272	20	20
90	Garcia River	Slope	.214	37	I	Rw. D.F. W.F. Misc.	7 3 23	3 1 7	5 6	12 4 2	8.29 4.75 42.16	1.25 .79 5.64	2.05 3.58	2.08 1.20 .29	86 92 120	70 79 92	70 82	62 58	228 140 1619	32 21 166	52 103	49 26	1339 894 10255	151 113 1041	248 592	104 84
91	Garcia River	Slope	.324	45	II	Rw. W.F. D.F. Misc.	6 49 1 1	5 14	3 2	8 2 2	7.99 82.23 2.64 1.77	4.38 10.72	2.24 1.34	1.79 .71 .41	88 124 140	78 93	74 88	46 70	186 3264 107 45	116 339	56 41	32 18	1322 21331 489 329	579 1854	281 220	63 69
92	Garcia River	Flat	.244	40	I	Rw. W.F. Misc.	42 13	16 1	19	26 3	68.92 25.70	13.50 .66	8.89	8.57 .41	104 123	91 78	70	58	2290 831	418 18	224	184 4	13760 6440	2365 150	419	810
93	Garcia River	Flat	.346	27	II	Rw. D.F.	46 11	31 2	28 3	34 4	43.42 10.88	14.82 .62	7.91 .80	4.98 .41	63 80	54 62	46 59	39 46	930 287	288 14	138 18	80 8	4084 1337	982 44	264 52	40
94	Garcia River	Flat	.331	27	I	Rw. D.F.	50	21	29	40 1	83.35	17.04	11.81	6.39 .14	76	60	46	34 32	2027	348	196	89 2	10135	1457	533	34
95	Garcia River	Flat	.569	35	I	Rw. Misc.	59 3	14	24 13	29 20	179.81 4.83	13.92	9.84 3.39	4.85 1.97	94	68	50	36	5250 105	312	177 51	70 62	30815 500	1479 535	64	40

TABLE 9.—BASIC DATA BY SAMPLE PLOTS—(Continued)

Plot No.	Locality	Situation	Area Acres	Age	Site Class	Species	No. of Trees according to Crown Class				Basal Area according to Crown Class				Average Height according to Crown Class				Volume according to Crown Class							
							Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.	Cubic Feet				Board Feet			
																			Dom.	Co-dom.	Int.	Sup.	Dom.	Co-dom.	Int.	Sup.
96	Garcia River	Flat	.249	34	III	Rw. Misc.	38	17	12	17	81.26	10.80	4.88	2.08	74	54	47	30	1860	204	83	26	9343	768	264	
									3	1			.97	.05							16					
97	Garcia River	Slope	.113	44	III	Rw. D.F. Misc.	6 10	9 5	1 7	8 11	4.02 12.63	3.75 2.47	.14 1.70	.93 .78	70 106	60 89	38 70	34 34	99 442	81 77	2 45	13 12	470 2573	297 491	116	
										8			.44								4					
98	Gualala River	Flat	.899	52	III	Rw. Misc.	99 8	40	31 5	79 3	271.92 11.79	55.67	30.58	30.13	101	90	80	54	8520 305	1605	833 40	602 4	50453 1772	9038 179	4459	2568
99	Gualala River	Flat	.200	41	II	Rw.	31	13	11	17	72.98	16.33	10.08	5.00	90	74	66	38	2035	399	226	72	11881	2021	1089	220
100	Gualala River	Flat	.662	46	II	Rw. D.F. Misc.	94 2	31	31 1	61 19	187.28 4.18	35.65	23.22	12.59	114 114	96	82 71	44	6832 153	1126	647 14	216 80	41137 939	6605 63	3463	489
101	Gualala River	Flat	.215	40	III	Rw. Misc.	56 1	17	22 6	45 13	76.86 .55	12.72	10.37	8.66	80	67	56	32	1970 11	290	209 37	108 37	9806 90	1321	742	151 46
102	Gualala River	Flat	.166	40	II	Rw.	41	18	9	25	72.06	17.58	4.34	5.69	89	84	66	46	2050	502	96	102	11544	2651	416	236
103	Gualala River	Flat	.243	45	IV	Rw. Misc.	32 11	12 3	5	10 4	79.76 5.79	11.72	2.15	2.26	70	56	43	36	1675 93	217 113	33	32	9274 266	947	83	30
104	Gualala River	Flat	.297	40	I	Rw. Misc.	48 4	23 1	12 3	13 2	100.51 5.13	25.82	8.23	3.95	108	92	80	55	3370 135	785 12	231 15	83 4	19851 717	4453 45	1202	264
105	Gualala River	Flat	.208	40	I	Rw. Misc.	33 1	15	13	14	70.70 .79	16.86	8.28	3.33	110	93	80	56	2411 23	517	232	71	15062 113	2970	1305	151

106	Gualala River	Flat	.185	33	I	Rw. D.F. Misc.	38	18	24	23	49.90	11.83	9.07 .27 .09	2.93	92	79	67 60	47	1470	328	215 6 2	58	7448	1620	906
107	Gualala River	Flat	.104	20	I	Rw. Misc.	30	19	17 4	10 4	12.17	4.31	2.51 .24	.76 .20	59	56	49	39	258	94	50 3	13 3	940	70	32
108	Gualala River	Flat	.120	33	I	Rw. Misc.	23	15	11 6	14	36.91	13.32	6.64 .29	4.27	92	83	75	56	1087	376	175 3	91	6220	2022	862 394
109	Gualala River	Flat	.244	43	I	Rw.	55	24	30	33	99.78	25.34	19.95	10.43	101	88	78	62	3167	736	545	239	18924	4075	2693 886
110	Gualala River	Flat	.246	45	II	Rw. D.F. Misc.	49 1	10	9 3	24	106.95 2.64	11.20	5.50	6.32	98 103	83	74	64	3249 79	307	143	154	20159 489	1684	688 396 52
111	Gualala River	Flat	.249	43	III	Rw. D.F. Misc.	41 3	25	27 1	25	61.97 4.29	19.70	14.62 .20	3.96 .60	80 79	68	62	47	1586 109	456	317	74	8832 607	2312	1340 208
112	Gualala River	Flat	.182	40	II	Rw. Misc.	42	12	14	21 2	64.09	8.25	7.37	3.44 .19	89	74	68	44	1820	214	175	62 3	9846	1241	827 60
113	Gualala River	Flat	.160	40	II	Rw. Misc.	33 10	16 2	21 1	52	40.36 7.60	10.73	9.15 .20	6.83	94 85	82	72 49	35	1250 220	308	237 4	98	5509 1186	1698 82	1050 168
114	Gualala River	Flat	.193	35	II	Rw. D.F. Misc.	48	21	20 10	33 1 5	69.39	14.24	7.34 1.74	4.96 .14 .40	70	61	53	37 36	1550	304	144	75 2 5	7592	1282	433 20 58
115	Gualala River	Flat	.094	32	I	Rw. Misc.	30	15	13	26 1	31.74	7.53	4.82	3.21 .20	86	73	65	38	902	192	116	50 3	4877	1005	448

TABLE 9.—BASIC DATA BY SAMPLE PLOTS—(Continued)

Plot No.	Locality	Situ- ation	Area Acres	Age	Site Class	Spe- cies	No. of Trees according to Crown Class				Basal Area according to Crown Class				Average Height according to Crown Class				Volume according to Crown Class							
							No. of Trees according to Crown Class				Basal Area according to Crown Class				Average Height according to Crown Class				Volume according to Crown Class							
							Dom.	Co- dom.	Int.	Sup.	Dom.	Co- dom.	Int.	Sup.	Dom.	Co- dom.	Int.	Sup.	Dom.	Co- dom.	Int.	Sup.	Dom.	Co- dom.	Int.	Sup.
116	Gualala River	Slope	.142	34	III	Rw. Misc.	45	13	14	7	45.24	7.70	5.13	.74 .00	61	54	46	26	910	146	87	8 1	3932	524	242	
117	Gualala River	Flat	.046	24	II	Rw.	28	21	18	25	11.32	5.13	2.89	2.27	61	53	48	42	249	103	57	41	889	128	32	
118	Finber Cove	Ridge	.142	60	V	D.F. Misc.	20	8	5	9	23.71	4.49	2.07	1.68 1.65	63	53	48	36	516	83	36	24	2490	284	120	20
119	Finber Cove	Slope	.156	54	IV	Rw. Misc.	27	15	18	32	54.83	20.99	19.04	11.94 1.85 .30	81	80	77	48	1370	537	484	212 41	7024	2815	2390	933
120	Sea View	Slope	.306	60	III	D.F. Misc.	25	7	7	13	77.70	11.87	8.64	7.02 .41	119	106	97	72	2910	404	28	18	18056	2412	1589	926 84
121	Sea View	Slope	.192	67	IV	D.F. Misc.	20	7	5	7	61.05	12.23	3.58	2.85 3.94	104	87	62	47	1940	341	76	48 53	12189	1861	294	124 124
122	Ft. Ross	Slope	.386	55	III	D.F. Misc.	32	15	6	10	87.37	25.81	4.04	4.83 .44	134	113	94	83	3320	975	133	153 12	23169	4790	783	846 58
123	Russian River	Flat	.250	47	II	Rw. Misc.	20	14	11	18	67.22	25.02	14.87	7.62 1.23 2.94	116	92	85	54	2420	736	404 35	148 47	15571	4495	2468	670 200
124	Chico	Flat	.223	30	I	Rw. Misc.	19	6	4	6	45.48	3.65	2.39	1.61	88	53	57	40	1201 63	74	48	25	7030 384	297	210	70
125	Redwood Pk.	Ridge	.218	50	V	Rw.	62	31	34	63	47.21	15.09	9.68	7.66	43	37	30	22	690	205	110	69	1726	383	72	

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126	Powder Flat	Flat	.398	57	II	Rw. D.F. Misc.	27 4 6	19 4 1	14 1 1	19 108.16 14.96 .71	44.53 17.35 1.58 .27	8.34	134 129	110	75 94	35 598 13	4500 598 13	1470 62 3	430 62 3	105 3986	30200 12800 2300 254	460
127	Powder Flat	Flat	.730	57	II	Rw. D.F. Misc.	45 2 3	10 1 1	12	201.79 10.18 10.43	19.74 4.91	14.89 10.73	140 167 125	116 135	100	71 343 306	8750 343 306	756 205	492	267	58631 3570 2600 1298	4579 2871 1412
128	Powder Flat	Flat	.484	57	II	Rw. D.F. Misc.	49 1 3	10 1 1	12	164.35 7.88 7.07	16.50 14.15 15.14	132 189	109 189	109	100	76 53	6720 5970 397 275	576 424 21	467 403 1	403	43638 3240 1694 44	3506 2637 2252
129	Powder Flat	Flat	.387	57	II	Rw. Misc.	26 7	5 3 1	9 1	116.93 10.08	11.40 .98 12.23 .05	5.21	140	120	103	53	5970 397	424 21	403 1	102	33924 2552	2707 2029 46 737
130	Porter Gulch	Slope	.375	39	II	Rw. Misc.	39	21 25	16	109.53 20.13 2.95	10.25 11.44	94	94	64	54	24	3180	439 28	194	107	19403 1891 631 60	30
131	Stafford's Gulch	Slope	1.360	51	I	Rw. Misc.	132	33 1	24 10 6	420.23 2.64	46.99 1.64 27.01 .71	33.55	133	96	82	30	17300	14.43 65	731 23	383	110216 8483 4489 1338	357 131
132	Rincon	Slope	.494	52	II	Rw. D.F. Misc.	26 4	18 1 6	14 2 6	85.74 18.26	32.36 1.23 11.95 1.01 2.91	9.72	121	109	90	52	3210 700	1130 40	365 27 68	187	19909 4344 379	6826 2042 129 838
133	Rincon	Slope	1.57	53	II	Rw. D.F. Misc.	70 36	24 9 37	29 2 37	240.48 118.85	46.90 10.13 1.58 18.11	48.30	122 122	112 96	100 88	58 36	9100 3625	1681 321	1224 47 443	1037 6 10	56248 27827	10029 1878 2949 5764 32 32
134	Laveaga Park	Slope	.271	48	II	Rw. Misc.	18	14	18	58.25 19.20 16.40 .91 2.64	7.75	114	77	58	28	2060	470	320 9	80	11469	2139 1456 248 18	
135	Blackburn Gulch	Slope	.483	62	IV	Rw.	95	52	29	136.48 49.93 19.73 25.44	96	96	79	61	31	4200	1340	442	300	22533	6317 1798 1029	

Volume of associated species is based on redwood form factor and volume table. To get corrected volume, add 5% to volume of Douglas fir and white fir, and 10% to volume of spruce.

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