

Within Stand Variability

Plantation Management Research Cooperative

Technical Report 1984-2

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January 1984

Variation in site prepared slash pine plantations

The southeast Georgia - north Florida terrain is so flat and homogeneous that it is often called "flatwoods." Underlying this uniform topography, however, are many different soil types. It would be difficult to find more variability in soils in a smaller area than exists in this region.

Forest managers in the flatwoods typically plant trees in stands of 100 acres or more. In plantations of this size overlying such variable soils, it is not surprising that site quality and stocking are quite variable. Most forestry records are kept at the stand level and usually only one value is retained for site index and stand density.

Stand level information is utilized by yield programs to predict expected volume from a stand. Typical inputs are age, site index and stems per acre. In 1980 the Plantation Management Research Cooperative installed a study to provide information on the amount of variability present in typical flatwoods plantations, and to determine if one value for site index and density gave valid estimates for stand yields.

Description and Design of the Study

Ten plots were established in each of eleven stands located throughout the flatwoods region. Each company in the coastal plain cooperative supplied one plantation for sampling. The stands were all at least seventeen years old and plots within stands were located randomly. Plots were rectangular and were designed to enclose approximately 64 planting locations. If planting rows were not evident, plots were established as .1 acre squares. Diameters at breast height were measured on each tree with a diameter tape and a subsample of

heights were measured with Blumleiss hypsometers. Crown class was recorded on height trees for site index determination.

Analysis

Within stand means, standard deviations and ranges were calculated for site index, basal area, actual total volume and average diameter from the plot values for each variable (Table 1a-1d). As expected, there is considerable variability in all of the variables. A mean separation test conducted on each variable within each stand indicated that in a vast majority of the cases the means differed significantly.

This amount of variability in stand variables would seem to indicate that an average of 10 separate yield estimates using the separate ages, site indices and densities from each plot would provide a better estimate of stand yield than one yield estimate using the average age, average site index and average density from all plots. To test this hypothesis, a separate yield estimate was made for each plot. These estimates were averaged within stand to obtain a final estimate of yield per acre for the stand. This average yield value was compared to a yield estimate obtained from the yield model with the average of age, site index and density from all plots within a stand. All yield estimates were made using the PMRC S1982II average current model for slash pine plantations. The comparisons are shown in Table 2. There is little difference between the estimates. A paired t test confirms the visual impression that the two methods are not significantly different ($t=.83578$ n.s.)

Conclusions

Significant local variability in stand attributes commonly exists within slash pine plantations. This variability should be recognized when determining appropriate sampling density for estimating stand attributes.

Stand yield which is estimated from the average attributes of 10 randomly located plots with 50+ trees gives estimates as reliable as the average of 10 separate yield estimates; one for each plot.

Table 1a. Within stand means, standard deviations and ranges for site index over eleven stands.

<u>Stand</u>	<u># Plots</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Range (min-max)</u>
1	10	62.3	3.09	59.0 - 69.2
2	9	33.0	2.97	28.0 - 36.5
3	10	57.6	3.74	50.7 - 61.6
4	10	48.7	4.22	43.2 - 57.2
5	10	63.4	4.03	56.8 - 69.1
6	10	54.8	1.79	52.6 - 57.3
7	10	43.7	3.35	37.7 - 49.6
8	10	52.5	4.88	44.9 - 59.5
9	10	62.7	0.90	61.7 - 64.6
10	10	54.9	5.57	48.5 - 65.1
11	<u>10</u>	47.0	7.87	38.5 - 61.2
Totals	109			

The mean range of SI values within a stand is 11.75 ft.

Table 1b. Within stand means, standard deviations and ranges for basal area per acre over eleven stands.

<u>Stand</u>	<u># Plots</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Range (min-max)</u>
1	10	80.1	11.49	65.4 - 104.6
2	9	15.2	5.30	9.2 - 26.5
3	10	85.6	8.52	72.8 - 99.9
4	10	61.1	10.96	48.3 - 84.7
5	10	85.4	14.99	53.7 - 106.9
6	10	64.1	16.44	40.5 - 87.8
7	10	71.2	20.39	40.7 - 116.9
8	10	83.6	9.82	68.8 - 98.6
9	10	104.7	16.53	66.3 - 118.4
10	10	86.0	13.73	60.6 - 101.2
11	<u>10</u>	75.1	23.77	49.9 - 114.8
Totals	109			

The mean range of BA/ac values within a stand is 44.01 ft².

Table 1c. Within stand means, standard deviations and ranges for actual total volume (o.b.) in cubic feet over eleven stands.

<u>Stand</u>	<u># Plots</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Range (min-max)</u>
1	10	1909.3	371.38	1082.8 - 2546.1
2	9	60.4	72.37	0.0 - 184.8
3	10	2027.9	226.86	1702.4 - 2337.0
4	10	1006.1	338.71	581.2 - 1719.4
5	10	1956.7	371.17	1216.4 - 2473.8
6	10	1455.3	345.33	918.1 - 1898.2
7	10	1010.3	379.97	560.2 - 1844.0
8	10	1779.9	329.71	1225.9 - 2340.5
9	10	2315.4	387.50	1422.4 - 2708.0
10	10	1604.4	418.76	852.2 - 2227.3
11	<u>10</u>	1250.9	778.71	418.6 - 2721.9
Totals	109			

The mean range of total vol/ac values within a stand is 1183.71 cu. ft./ac.

Table 1d. Within stand means, standard deviations and ranges for average diameter (dbh) over eleven stands.

<u>Stand</u>	<u># Plots</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Range (min-max)</u>
1	10	7.1	1.69	6.5 - 7.8
2	9	3.0	1.07	2.3 - 4.0
3	10	7.0	1.49	6.8 - 7.7
4	10	4.8	1.38	4.3 - 5.7
5	10	6.9	1.37	6.2 - 7.4
6	10	6.9	1.59	6.3 - 8.8
7	10	4.8	1.33	4.1 - 5.5
8	10	6.0	1.29	5.2 - 7.0
9	10	6.0	1.22	5.8 - 6.2
10	10	5.2	1.19	4.6 - 6.8
11	<u>10</u>	4.9	1.33	3.5 - 6.2
Totals	109			

The mean range of avg. DBH values within a stand is 1.59 inches.

Table 2. Comparison of actual yield with two methods of predicting yields.

<u>Stand</u>	<u># Plots</u>	(Total OB) cu. ft.) <u>Actual Volume</u>	<u>Average of Stand Variables Volume</u>	<u>Average of Predicted Plot Volumes</u>
1	10	1909	2196	2232
2	9	60	145	149
3	10	2028	1622	1612
4	10	1006	982	984
5	10	1957	1799	1838
6	10	1455	1184	1144
7	10	1010	990	971
8	10	1780	1512	1532
9	10	2315	2138	2090
10	10	1604	1642	1611
11	10	<u>1251</u>	<u>1044</u>	<u>1083</u>
Means		1488.6	1386.7	1386.0