AN ABSTRACT OF THE THESIS OF

Walter W. Schutt for the M. S. in Forest Management.
(Degree) (Major)

Date thesis is presented August 9, 1968

Title A PROPOSED SAMPLING TECHNIQUE AND ELECTRONIC DATA PROCESSING PROGRAM FOR REPRODUCTION SURVEYS IN FOREST PLANTATIONS.

Abstract approved Signature redacted for privacy.
(Major professor)

The purpose of this thesis is to determine if the Oregon State Forestry Department's stocking survey system can be applied to planted acres as well as to seeded acres. Two computer programs were developed into a primary program. One produced a new stocking curve adapted to hand planting patterns, and the other determined the stocking from this and a natural reforestation curve in relation to sampling data. Also developed was a three-plot sequential technique to modify any one sampling point. Answers include total number of trees per acre, separated into naturally seeded and planted trees, projecting the answer on a line basis, a 40-acre basis and a project basis. Results of the study showed that: a) erroneous estimates of trees per acre in forest plantations may result from application of the present survey system; b) the proposed survey system has certain advantages over the present system in determining the degree of success in forest plantations; c) by recognizing spacing interval, the proposed survey system brings accuracy to the level necessary to meet present-day planning requirements; d) the proposed survey system will permit construction of sufficiently detailed

mapping of voids due to mortality which may occur in forest plantations to develop reforestation plans; e) the proposed survey system will tend to estimate more correctly, where the present system tends to underestimate the number of surviving trees per acre in plantations having a high mortality rate; f) the proposed system permits using fixed radius plots, the radius of which is related to plantation spacing.

A PROPOSED SAMPLING TECHNIQUE AND ELECTRONIC DATA PROCESSING PROGRAM FOR REPRODUCTION SURVEYS IN FOREST PLANTATIONS

by

WALTER W. SCHUTT

A THESIS

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Typed by Betty Nelson

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A PROPOSED SAMPLING TECHNIQUE AND ELECTRONIC DATA PROCESSING PROGRAM FOR REPRODUCTION SURVEYS IN FOREST PLANTATIONS

INTRODUCTION

Reproduction Surveys and Management Planning

There is growing awareness of the need for more specific reforestation survey information concerning utilization of lands managed by the Oregon State Forestry Department. Forest Management Division program objectives now include intensive forest management practices. One important objective of intensive management is maximum return on capital invested. This implies the most complete financial and/or biological site utilization as is feasible.

Stocking and stand density definitions were reviewed (4, 5, 7, 8). In this thesis, stocking will be defined as a biological expression of site utilization. It is expressed as percentage of area occupied at a specific minimum number of trees per acre. Stocking is frequently analyzed in terms of management objectives and planning. Intensive management planning requires precise stocking estimates for reproduction lands.

The stocking survey system used by the department (1, 2, 3) was developed by the Research Section, Oregon State Board of Forestry, forerunner of the present Forest Research Laboratory, School of Forestry, Oregon State University. This system has been applied without change to: (1) planted lands, (2) naturally seeded lands, and (3) lands having both natural and seeded reproduction. The system as applied does not recognize that stocking estimates based upon a random distribution of natural

reproduction cannot correctly be applied to systematic spacing found in planted reproduction.

Survey information does not show specific locations requiring initial or supplemental planting. Stocking computations are based upon a series of plots established by a systematic grid. Attempts to establish boundaries of areas with different stocking levels have not been successful. No attempt is made to modify any one sampling point by (1) the adjacent plots one line, or (2) the overall average for the sampling area. As a result, present department surveys on forest plantations do not provide reliable or adequate information to: (1) appraise reforestation effectiveness, or (2) assess reforestation needs.

Purpose and Scope

The purpose of this thesis is to determine if the State Forestry Department's stocking survey system can be applied to planted areas as well as to naturally seeded areas. The present system is compared with a proposed system based upon the probability of seedlings occurring on a sample plot in a plantation. The proposed system is evaluated on the basis of field sampling tests.

BASIS FOR COMPARISON

An 8 x 8 foot spaced forest plantation was represented on cross section paper with a scale of 1 inch equals 4 feet. A transparent template of the same scale representing a 7.45-foot radius plot (four-milacres) was used to systematically "sample" the plantation. Separate tallies for nine sampling directions covering a 45 degree segment (Figure 1) recorded the number of times 1, 2, 3 or 4 quadrants of the 7.45-foot radius plot contained a "tree." A total of 2,376 four-milacre plots were tallied by taking plots at one-foot intervals. Figure 1 illustrates the technique of determining whether 1, 2, 3 or 4 trees are tallied on a given plot.

Individual tallies for each of the nine sampling directions were combined and converted to an 80-plot (320 quadrants) basis. The objective was to approximate the probability of selecting 1, 2, 3 or 4 "stocked" quadrants. Table I is a summary of the results.

Table I

Experimental Plot Tally
Theoretical 8 x 8 Spaced Forest Plantation

Quadrants Stocked	Plot Tally	Percent (Probability)
1	2	2
2	33	42
3	30	37
4	15	19
Total	80	100

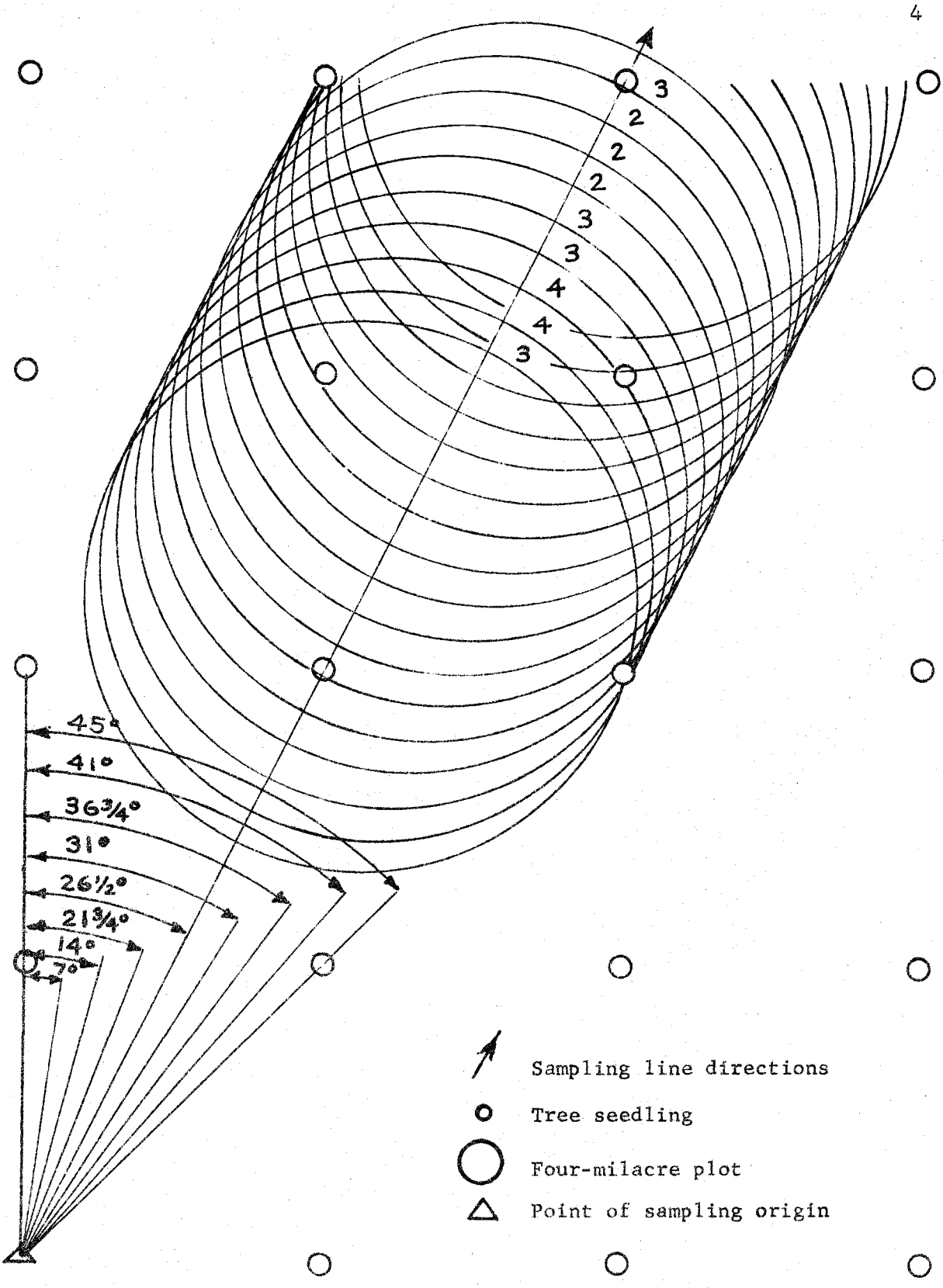

Figure 1. Experimental sampling design and example four-milacre plot counts - theoretical 8 x 8 spaced forest plantation.

Graphic Solution

A graphic solution to determine probabilities was also developed. An 8 x 8 foot spaced forest plantation was represented on cross section paper with a scale of 1 inch equals 2 feet. A compass representing a 7.45 radius was used to draw four arcs, one from each corner of a single 8 x 8 foot spacing set (Figure 2 illustrates the technique). The number of square inches within each figure thus created were determined by planimeter. Ratios of each figure representing the same number of tallied trees to the total area included within the 8 x 8 foot spacing set were determined. Table II is a summary of the results.

Table II

Graphic Solution
Theoretical 8 x 8 Spaced Forest Plantation

Quadrants Stocked	Square Inches	Ratio (Probability)
1 (total A_1)*	.34	.02
2 (total A_2)*	6.71	.42
3 (total A_3)*	6.02	.37
4 (total A_4)*	2.93	.19
Total	16.00	1.00

*See Figure 2

Mathematical Solution

Mathematical probability expressions were developed to facilitate computer solution for many possible planting spacings and plot radii. The Oregon State Highway Department was consulted (6) to obtain equations used in engineering design to compute areas of circular segments inscribed

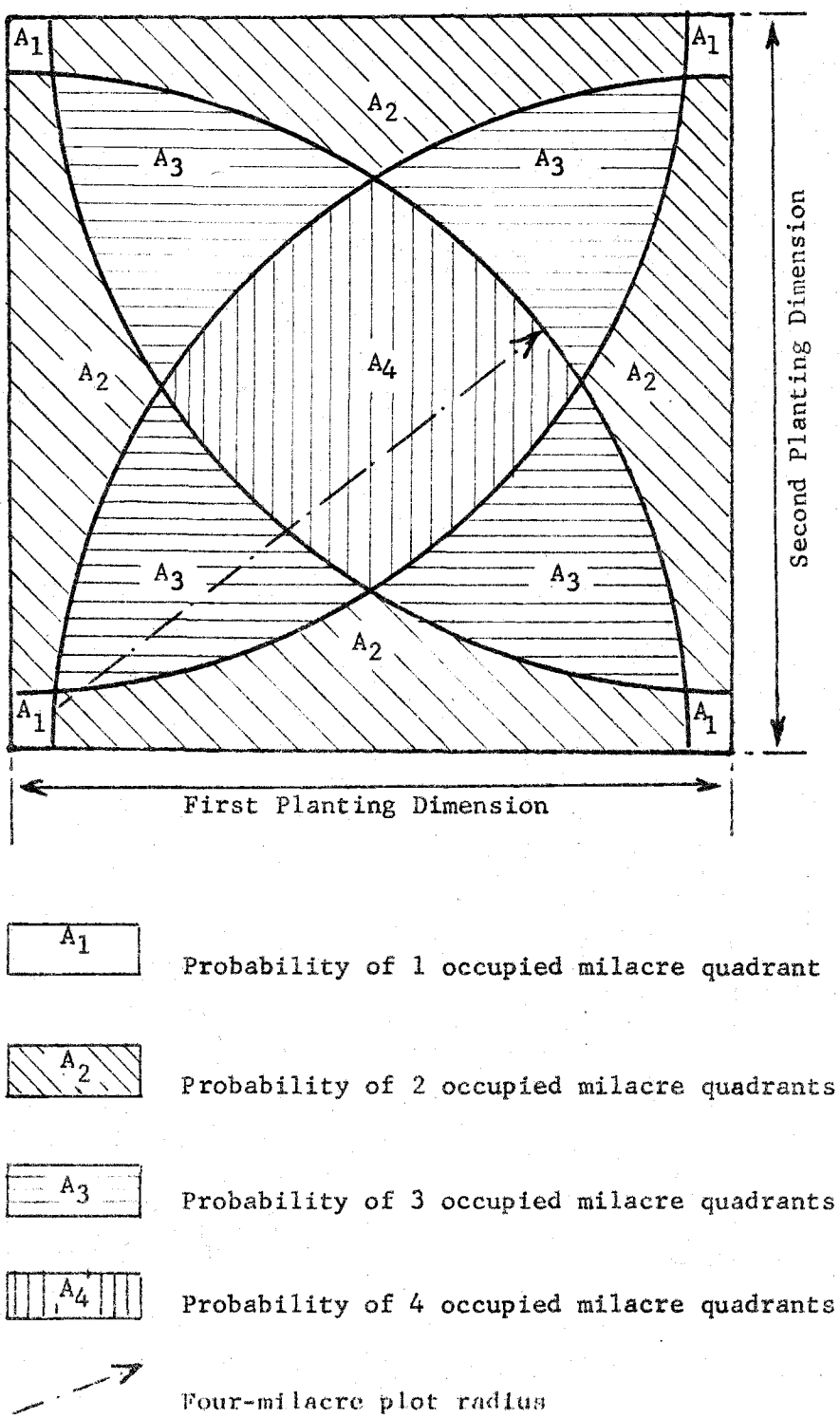

Figure 2. Graphic method of determining expected number of occupied milacre quadrants for four milacre plots - theoretical forest plantation.

within rectangles (Figure 3). Basic equations supplied by the Highway Department (Table III) were adapted to the problem of computing probabilities. Derivation of the final equations is found in Appendix III. A Probability Generator Computer Program (Appendix IV) was developed to compute probabilities for all possible planting dimension and plot radii combinations.

Table III

Area Equations For Circular Segments Within Rectangles*

Area	
A_1	$\left[\int_0^{xa} (b - \sqrt{r^2 - x^2})dx - \int_{xe}^{r} \sqrt{r^2 - x^2}\, dx\right]$
A_2	$2\ (1/4\pi r^2 - 1/4A_1 - 3/4A_3 - A_4)$
A_3	$8\int_0^{xj} (\sqrt{r^2 - x^2} - yj)dx$
A_4	$4\int_{xe}^{xh} (\sqrt{r^2 - x^2} - yh)dx$

*In the above equations A_{1-4} is area within 1, 2, 3 or 4 circles, r is circle radii, x and y are geometric distances, and b is dimension length.

Table IV is a summary of the mathematical computations for an 8 x 8 spaced forest plantation sampled with a four-milacre plot. Expected number of milacre quadrants for each four-milacre plot (column 4) is obtained by multiplying the number of milacres (column 1) times corresponding probability (column 3). The decimal ratio (column 5) is established as the full stocking base. Examples of computer output from the Probability Generator Program for several planting dimensions are shown in Appendix V.

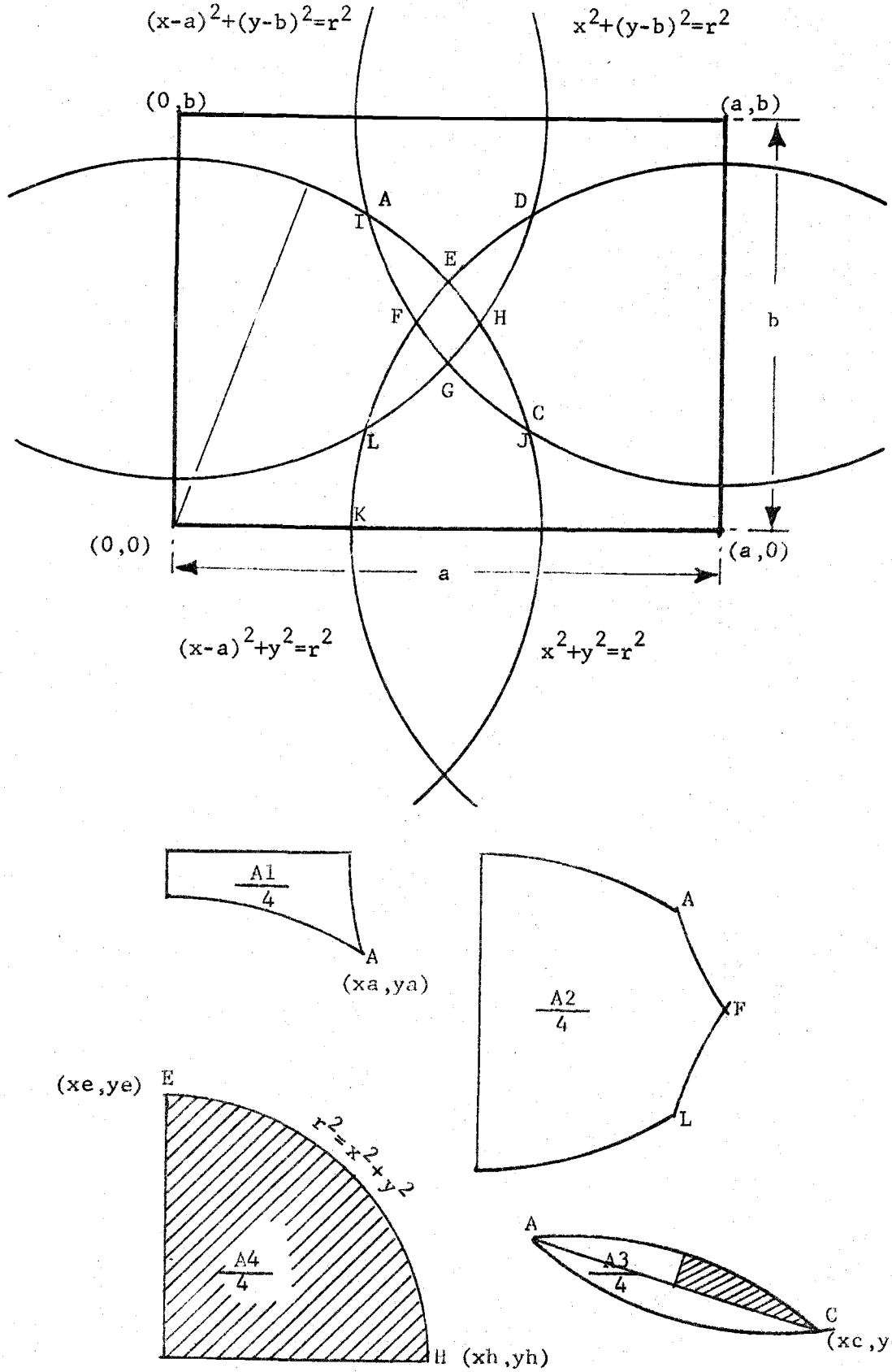

Figure 3. Areas of circular segments inscribed within rectangular figures.

Table IV

Mathematical Solution Theoretical 8 x 8 Spaced Forest Plantation

1 Milacres Stocked	2 Area	3 Probability	4 Expected Milacres Per Four-milacre	5 Decimal Ratio
1	1.2416	0.019400	0.019400	
2	27.1262	0.423847	0.847694	
3	23.6569	0.369639	1.108916	
4	11.9753	0.187114	0.748454	
Total	64.0000	1.000000	2.724464	0.681116

The mathematical solution shown in Table IV is illustrated in Figure 4. Two other spacings (7.5 x 9.0 and 7.45 x 7.45) are also shown for comparison.

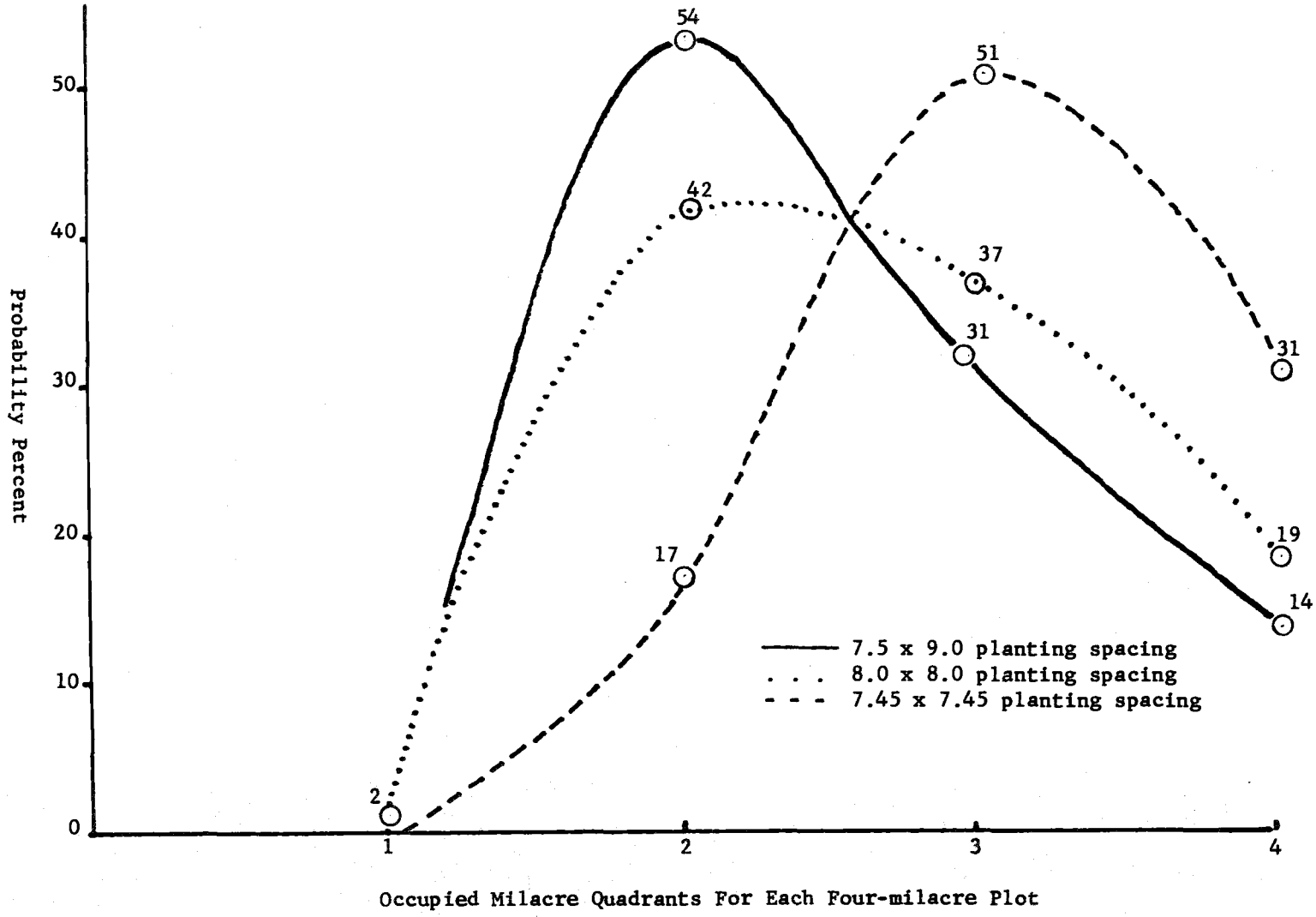

Figure 4. Graph showing mathematical probability solution for three planting dimensions - theoretical forest plantation.

STOCKING CURVES AND TABLES

Forest Plantation Stocking Regression

A plantation stocking equation was developed to compute the expected number of occupied quadrants for full stocking (no mortality). Probability percents for 7.45-foot radius plots and variable planting dimensions computed by the Probability Generator Program were subjected to a least squares regression program available at the Oregon State Highway Department. Table V lists the data used.

Table V

Planting Dimensions and Expected Full Stocking Percent

Planting Dimension (Feet)	Square Feet	Full Stocking (Percent)
8 x 8	64	68.11
8 x 9	72	60.54
8 x 10	80	54.49
8 x 11	88	49.54
9 x 9	91	53.82
9 x 10	90	48.43
9 x 11	99	44.03
10 x 10	100	43.59
10 x 11	110	39.63

The unweighted least squares solution for the data in Table V was:

$$S = 160.9894 - 1.9365 (D_1 \times D_2) + .0076 (D_1 \times D_2)^2$$

where S = full stocking percent

D_1 = first planting dimension in feet

D_2 = second planting dimension in feet.

Naturally Seeded Stocking Regression

A revised ratio of milacre stocking percent to number of trees per acre on naturally seeded acres (3, p. 7) is shown in Figure 5. This relationship was subjected to a least squares regression program and expressed mathematically as follows:

$$N = 95.30348 + .431258P + .450251P^2$$

where N = number of trees per acre

P = percent of milacre plots stocked.

Comparing Estimated Trees Per Acre

A series of computer programs were developed to further understand the problem of applying a survey system intended for naturally seeded lands to planted lands. The approach was to apply the two stocking equations to theoretical plantations of various planting dimensions and compare the two estimates of trees per acre. Appendix II presents a series of machine generated Forest Plantation Stocking Tables listing expected number of trees per acre by 20 percent stocking classes. Figure 6 illustrates the comparison for an 8 x 8 planting spacing.

An examination of the tables indicated the following general relationships:

a) In forest plantations with no mortality, the naturally seeded stocking regression overestimated the number of trees.

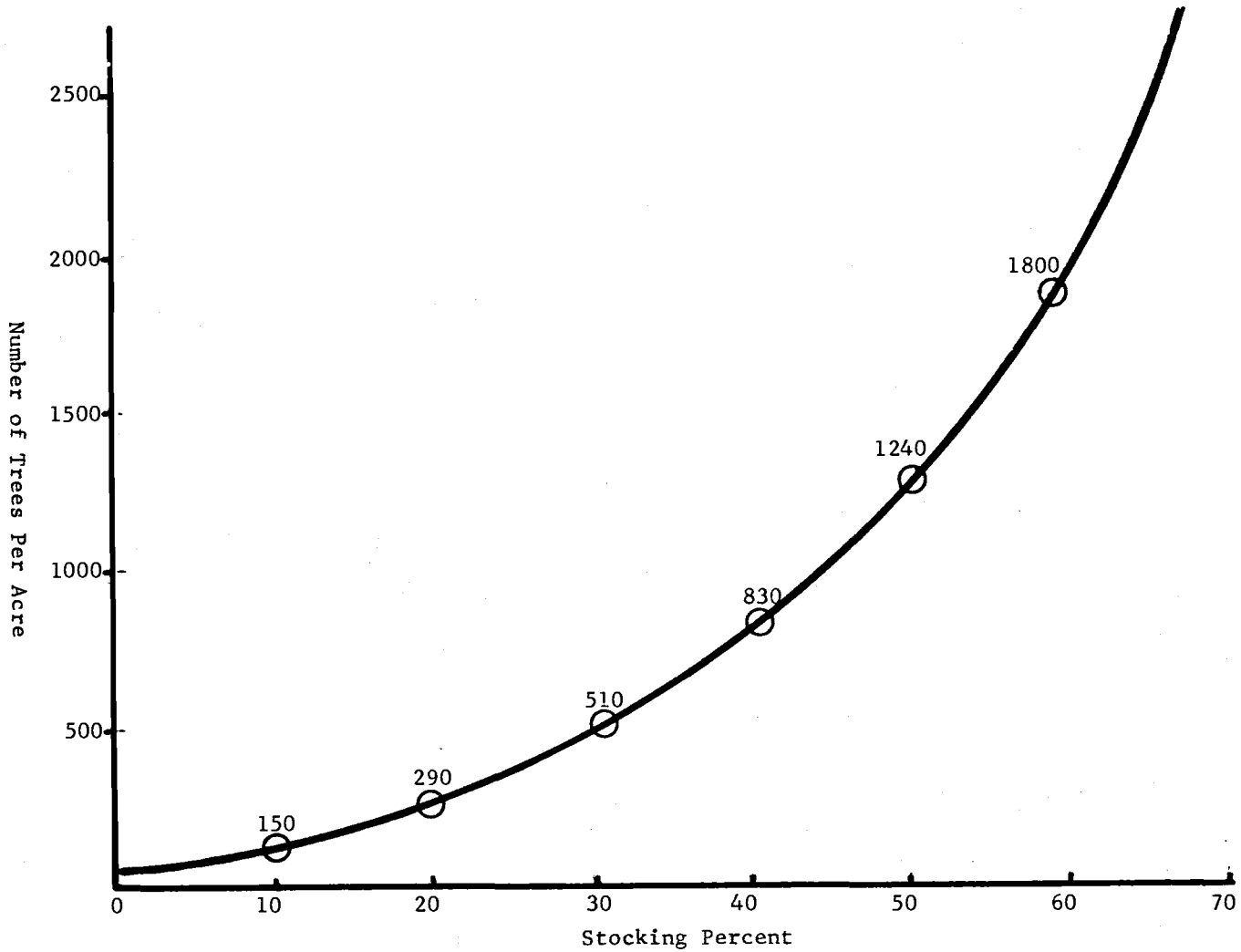

Figure 5. Ratio of milacre stocking percent to number of trees per acre on naturally seeded areas.

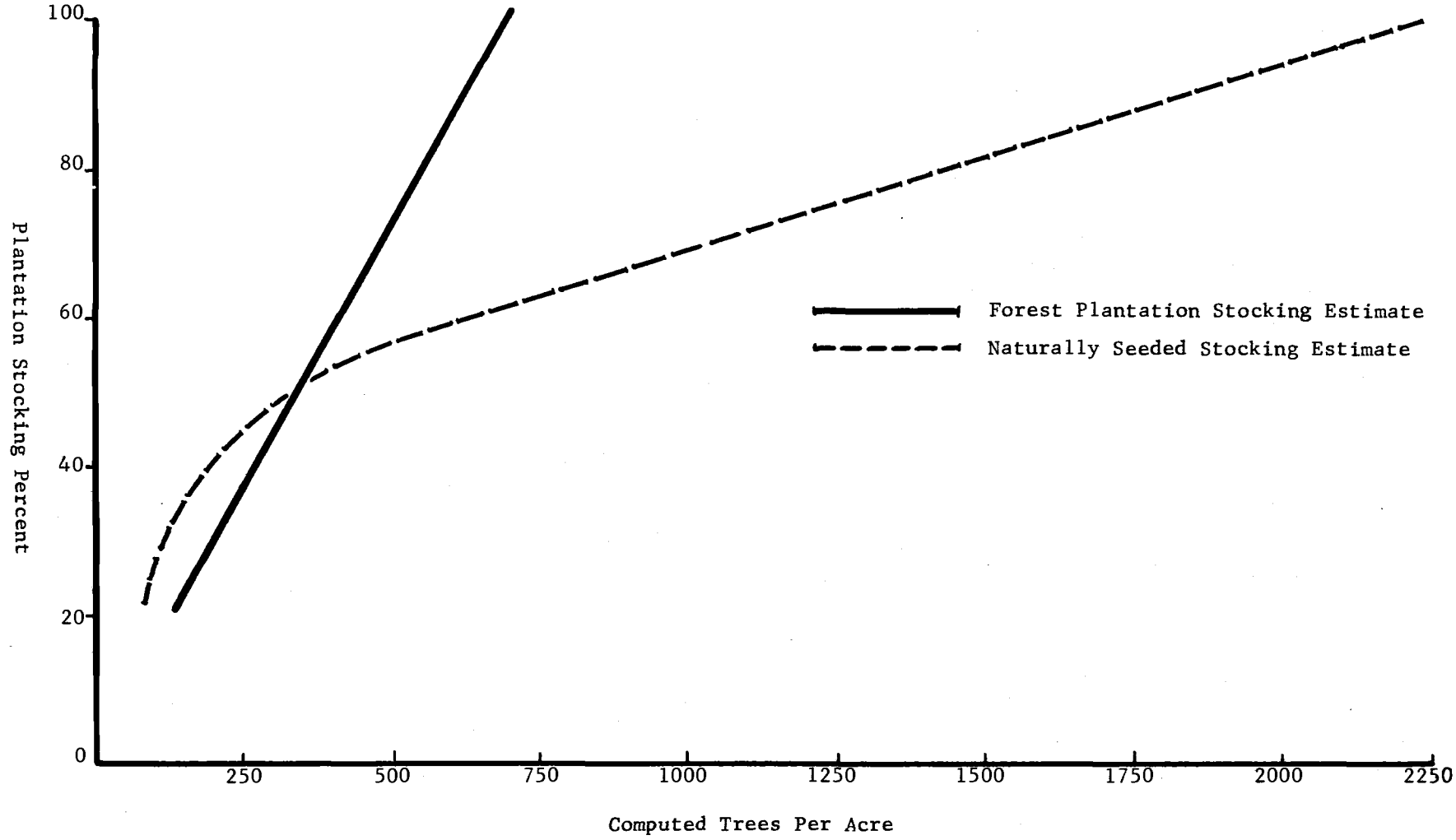

Figure 6. Graph comparing computed number of trees per acre - 8 x 8 planting dimension.

b) In forest plantations with 60 percent mortality, the naturally seeded stocking regression underestimated the number of trees.

c) In forest plantations with 80 percent mortality, a variable overestimate or underestimate occurred.

THE FIELD SURVEY

Effect of Adjacent Plots On Sample Plot

Present survey system analysis techniques are based upon a series of plots and a single stocking average determined for each 40-acre subdivision or project area. It is difficult to isolate small areas within subdivisions or areas in need of initial or supplemental planting. A three-plot sequential sampling technique (Figure 7) was developed to assist in locating "voids." Data collected from each sampling plot are averaged with the two associated plots. Plots next to sampling boundaries or non-sampled areas are averaged with the sampling unit's overall average. One stocked quadrant out of four was established as a minimum for the three-plot test. Two adjacent plots on the same line failing the sequential test constitutes a void.

Computer Programs

Computer programs were written to analyze field survey information. The following data analysis system was developed:

a) Compute stocking and number of trees per acre as presently done. No separation between natural and planted trees.

b) Separate natural and planted trees. Apply the plantation stocking curve to planted trees. Apply the presently used stocking curve to trees of natural origin. Compute an answer for each.

c) Summarize the total number of trees per acre and compare this result with (a).

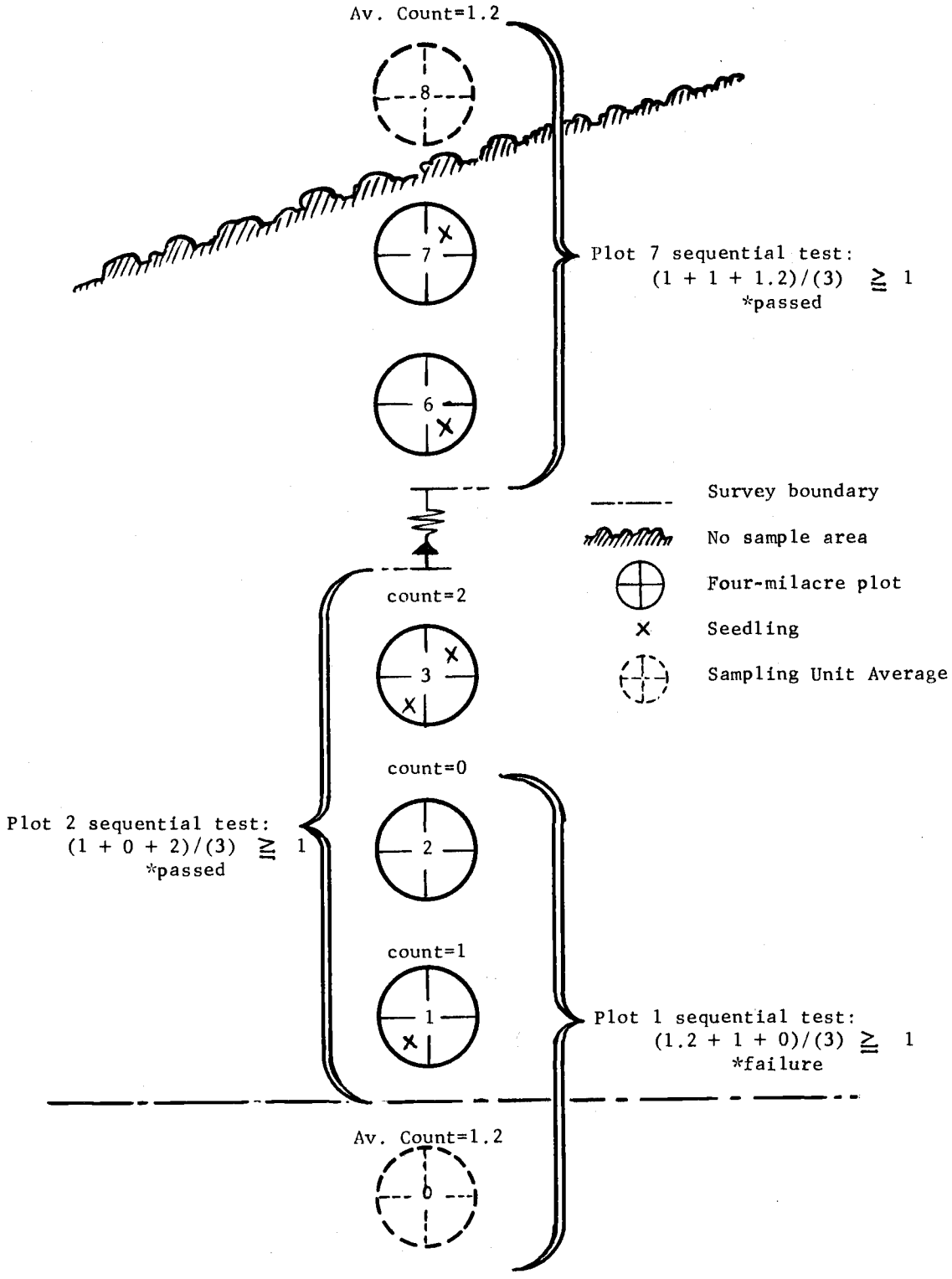

Figure 7. Illustration of the three-plot sequential sampling technique.

d) Repeat (a) through (c) on a line basis, a forty basis, and a probject basis.

e) Report survey results. Report locations not meeting the minimum requirement of one stocked quadrant out of every four for the three-plot sequential test.

Survey Test Area

A 200-acre tract in Township 5 North, Range 8 West, Clatsop County, Oregon, was selected to test the proposed stocking survey system. The area contained three to five-year old planted and natural seedlings.

Survey Instructions

Survey data were taken from equidistant (66 feet) four-milacre plots along four sampling lines running east and west and four sampling lines running north and south. Each 40-acre subdivision contained 160 plots. Field survey procedures and tally cards are presented in Appendix VI.

DISCUSSION

The standard of adequate stocking chosen by the Amended Conservation Act of 1947 was "300 established live seedlings per acre which are sufficiently spaced for individual normal growth and development and 100 of which are well distributed over the acre". The stocking survey system devised by the Oregon State Forestry Department (1,2) was developed to determine the degree of stocking in logged-off areas. The law required a decision be made as to when harvested lands were in need of reforestation. The system provides for tabulation of stocking by both milacre quadrants and four-milacre sample plots. Percentages derived are converted to number of trees per acre using stocking curves (3,p.7).

The department has applied the system without change to planted lands, naturally and artifically seeded lands, and lands having both natural and seeded reproduction. The system has frequently over-estimated trees per acre when applied to forest plantations with low mortality and underestimated trees per acre when applied to forest plantations with high mortality. The present survey system based upon a random distribution found in natural reproduction cannot correctly be applied to systematic spacing found in planted reproduction.

One of the problems of the forest administrator is to remain informed as to the growing stock status of his lands. A reliable stocking survey system is required to determine and describe the condition of denuded and restocking areas. An electronic computer was utilized to determine the

effectiveness of the State Forestry Department's stocking survey system. Phase I of the study developed theoretical Forest Plantation Stocking Tables (Appendix II) based upon the probability of selecting occupied milacre quadrants in variable spaced forest plantations. The naturally seeded stocking estimate (present system) was compared to the revised forest plantation stocking estimate. The present system overestimated the number of trees in low mortality plantations and incorrectly estimated the number of trees in high mortality plantations. Example comparisons of the two estimates are shown in Table VI. Comparisons for other planting spacings are found in Appendix II.

Table VI

Present and Revised Estimates of Trees per Acre in Forest Plantations

Planting Dimension	Mortality (Pct.)	Milacre Stocking (Pct.)	Trees Per Acre	
			Present System	Plantation System
8 x 8	0	68.18	2218	681
	20	54.54	1458	544
	40	32.72	592	408
	60	13.09	178	207
	80	2.61	100	136
9 x 9	0	54.99	1431	538
	20	43.19	954	430
	40	25.91	408	323
	60	10.36	148	215
	80	2.07	98	108
10 x 10	0	43.33	960	435
	20	34.67	651	348
	40	20.80	299	261
	60	8.32	130	174
	80	1.66	77	87

A proposed survey system using an electronic computer was developed in Phase II of the study. This system provides for simultaneous but separate field recording of natural and planted trees on each milacre quadrant of the four-milacre sampling plot. It can be applied to naturally seeded lands, to planted lands, or lands having both natural and planted seedlings. System design provides for separate as well as combined field data analysis. Natural reproduction estimates are based upon the presently used milacre stocking curve. Planted reproduction estimates are based upon the plantation stocking curves. Natural and planted quadrant tallies are then combined and analyzed on the basis of presently used milacre stocking curve. The three-plot sequential sampling technique is optional.

The proposed stocking survey system was field tested in January, 1965. Survey data were processed at the Oregon State Highway's computer installation in March, 1965. Computer reports are shown in Appendix I. The Rehabilitation Stocking Survey-Stocking Summary Report illustrates the three-plot sequential sampling analysis (7777 code indicates a void) and lists the computed trees per acre and stocking percents for each 40-acre subdivision

The Field Data Listing Report lists survey plot card tallies and indicates reproduction distribution for each 40-acre subdivision.

Survey results indicate the estimated number of trees per acre is (1) less if natural and planted seedlings are computed separately (each with the appropriate stocking curve), or (2) greater if natural and planted seedlings are combined and computed as presently done. The two methods are compared in Table VII.

Table VII

Comparison of Computed Trees
Per Acre on the Stocking Survey Test Area

Forty Number	Proposed System Estimate[1] (Trees/Acre)	Present System Estimate[2] (Trees/Acre)	Difference (Pct.)
1	394	609	54.6
9	336	415	23.5
10	408	585	43.4
11	709	1138	60.5
12	423	539	27.4
Project Average	445	663	48.9

1) (natural trees by naturally seeded stocking regression) plus (planted trees by plantation stocking regression)

2) Determined without classification by naturally seeded stocking regression.

CONCLUSIONS

Reforestation survey methods used by the State Forestry Department are valid only if applied to naturally or artificially seeded lands. Stocking estimates based upon a random distribution of natural or seeded reproduction cannot correctly be applied to systematic spacing found in planted reproduction. From the results of this study it is concluded that:

(a) Erroneous estimates of trees per acre in forest plantations may result from application of the present survey system. Such estimates vary inversely with uniformity of spacing.

(b) The proposed survey system has certain advantages over the present system in determining the degree of success of forest plantations.

(c) By recognizing spacing interval, the proposed survey system brings accuracy to the level necessary to meet present-day planning requirements.

(d) The proposed survey system will permit construction of sufficiently detailed mapping of voids due to mortality which may occur in forest plantations to develop reforestation plans.

(e) The proposed survey system will tend to estimate more correctly, where the present system tends to underestimate the number of surviving trees per acre in plantations having a high mortality rate. This is important on areas which must conform to the 300 tree per acre standard of the Oregon Forest Conservation Act.

(f) The proposed system permits using fixed radius plots, the radius of which is related to plantation spacing. This is in contrast to the present survey system, which has a plot size related only to a specified stocking standard. Computer programs developed in this study can permit investigation of other size plots.

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APPENDICES

APPENDIX I

FIELD SURVEY RESULTS

STATE OF OREGON-DEPARTMENT OF FORESTRY REHABILITATION STOCKING SURVEY-STOCKING SUMMARY REPORT

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

STOCKING SECTION NUMBER	SURVEY FORTY NUMBER	LOCATION LINE NUMBER	PLOT NUMBER	STOCKING SURVEY ANALYSIS BY STOCKING PERCENT AND NUMBER OF SEEDLINGS: NATURALLY SEEDED REPRODUCTION PERCENT STOCKED	NATURALLY SEEDED REPRODUCTION SEEDLINGS PER ACRE	PLANTED REFORESTATION PERCENT STOCKED	PLANTED REFORESTATION SEEDLINGS PER ACRE	OVERALL REPRODUCTION PERCENT STOCKED	OVERALL REPRODUCTION SEEDLINGS PER ACRE	TOTAL SEEDLINGS PER ACRE
14	9	1	1 TO 10		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	9	1	11 TO 20	18 %	265	27 %	245	35 %	681	510
14	9	2	1 TO 10		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	9	2	11 TO 11	13 %	178	15 %	138	13 %	178	316
14	9	2	12 TO 12	777 %	7777	777 %	7777	777 %	7777	7777
14	9	2	13 TO 16	777 %	7777	777 %	7777	777 %	7777	7777
14	9	2	17 TO 20	35 %	661	0 %	0	35 %	661	661
14	9	3	1 TO 10		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	9	3	11 TO 11	777 %	7777	777 %	7777	777 %	7777	7777
14	9	3	12 TO 14	25 %	387	0 %	0	25 %	387	387
14	9	3	15 TO 17	777 %	7777	777 %	7777	777 %	7777	7777
14	9	3	18 TO 20	25 %	394	7 %	69	25 %	394	463
14	9	4	1 TO 10		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	9	4	11 TO 17	777 %	7777	777 %	7777	777 %	7777	7777
14	9	4	18 TO 19	37 %	744	0 %	0	37 %	744	744
14	9	4	20 TO 20	777 %	7777	777 %	7777	777 %	7777	7777
14	9	5	1 TO 20		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	9	6	1 TO 2	8 %	133	29 %	269	25 %	396	402
14	9	6	3 TO 3	777 %	7777	777 %	7777	777 %	7777	7777
14	9	6	4 TO 20		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	9	7	1 TO 7	12 %	172	36 %	333	40 %	861	505
14	9	7	8 TO 8	777 %	7777	777 %	7777	777 %	7777	7777
14	9	7	9 TO 12	777 %	7777	777 %	7777	777 %	7777	7777
14	9	7	13 TO 18	28 %	485	14 %	130	37 %	737	615
14	9	7	19 TO 20	777 %	7777	777 %	7777	777 %	7777	7777
14	9	8	1 TO 10	20 %	294	29 %	266	43 %	957	560
14	9	8	11 TO 15	777 %	7777	777 %	7777	777 %	7777	7777
14	9	8	16 TO 18	33 %	609	0 %	0	33 %	609	609
14	9	8	19 TO 20	777 %	7777	777 %	7777	777 %	7777	7777
14	9									
FORTY 9 TOTALS AND AVERAGES		8 LINES	83 PLOTS	16 %	221	12 %	115	26 %	415	336

PAGE 001

STOCKING SUMMARY REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

COUNTY - CLATSOP PROJECT - 26 TOWNSHIP 5 N RANGE 8 W PLANTING DIMENSIONS 6.0 BY 8.0 FT.

STOCKING SECTION NUMBER	SURVEY FORTY NUMBER	LOCATION LINE NUMBER	PLOT NUMBER	STOCKING SURVEY ANALYSIS BY STOCKING PERCENT AND NUMBER OF SEEDLINGS: NATURALLY SEEDED REPRODUCTION PERCENT STOCKED	NATURALLY SEEDED REPRODUCTION SEEDLINGS PER ACRE	PLANTED REFORESTATION PERCENT STOCKED	PLANTED REFORESTATION SEEDLINGS PER ACRE	OVERALL REPRODUCTION PERCENT STOCKED	OVERALL REPRODUCTION SEEDLINGS PER ACRE	TOTAL SEEDLINGS PER ACRE
14	9									
FORTY 9 TOTALS AND AVERAGES		8 LINES	83 PLOTS	16 %	221	12 %	115	26 %	415	336
14	10	1	1 TO 1	16 %	221	48 %	437	41 %	879	658
14	10	1	2 TO 7	777 %	7777	777 %	7777	777 %	7777	7777
14	10	1	8 TO 20	11 %	157	40 %	365	39 %	826	522
14	10	2	1 TO 4	777 %	7777	777 %	7777	777 %	7777	7777
14	10	2	5 TO 15	0 %	0	37 %	337	31 %	564	337
14	10	2	16 TO 17	777 %	7777	777 %	7777	777 %	7777	7777
14	10	2	18 TO 20	26 %	432	31 %	285	39 %	810	717
14	10	3	1 TO 12	17 %	247	41 %	373	44 %	1018	620
14	10	3	13 TO 15	777 %	7777	777 %	7777	777 %	7777	7777
14	10	3	16 TO 20	5 %	110	40 %	366	34 %	648	476
14	10	4	1 TO 5		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	10	4	6 TO 6	16 %	221	48 %	437	41 %	879	658
14	10	4	7 TO 8	777 %	7777	777 %	7777	777 %	7777	7777
14	10	4	9 TO 11	0 %	0	58 %	530	50 %	1242	530
14	10	4	12 TO 20	777 %	7777	777 %	7777	777 %	7777	7777
14	10	5	1 TO 3	39 %	810	16 %	152	45 %	1052	962
14	10	5	4 TO 4	777 %	7777	777 %	7777	777 %	7777	7777
14	10	5	5 TO 6	777 %	7777	777 %	7777	777 %	7777	7777
14	10	5	7 TO 8	777 %	7777	777 %	7777	777 %	7777	7777
14	10	5	9 TO 11	-13 %	0	3 %	35	3 %	101	35
14	10	5	12 TO 14	777 %	7777	777 %	7777	777 %	7777	7777
14	10	5	15 TO 20		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	10	6	1 TO 6		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
14	10	6	7 TO 11	22 %	324	30 %	278	38 %	788	602
14	10	6	12 TO 12	777 %	7777	777 %	7777	777 %	7777	7777
14	10	6	13 TO 20	9 %	137	43 %	391	42 %	926	528
14	10	7	1 TO 15	14 %	196	35 %	319	41 %	873	515
14	10	7	16 TO 17	777 %	7777	777 %	7777	777 %	7777	7777

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STOCKING SUMMARY REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

COUNTY - CLATSOP PROJECT - 26 TOWNSHIP 5 N RANGE 8 W PLANTING DIMENSIONS 6.0 BY 8.0 FT.

STOCKING SECTION NUMBER	SURVEY FORTY NUMBER	LOCATION LINE NUMBER	PLOT NUMBER	STOCKING SURVEY ANALYSIS BY STOCKING PERCENT AND NUMBER OF SEEDLINGS: NATURALLY SEEDED REPRODUCTION PERCENT STOCKED	NATURALLY SEEDED REPRODUCTION SEEDLINGS PER ACRE	PLANTED REFORESTATION PERCENT STOCKED	PLANTED REFORESTATION SEEDLINGS PER ACRE	OVERALL REPRODUCTION PERCENT STOCKED	OVERALL REPRODUCTION SEEDLINGS PER ACRE	TOTAL SEEDLINGS PER ACRE
14	10	7	16 10 17	777 %	7777	777 %	7777	777 %	7777	7777
14	10	7	18 70 20	20 %	295	53 %	484	58 %	1641	779
14	10	8	1 13 20	6 %	116	41 %	380	38 %	768	496
14	10									
FORTY 10 TOTALS AND AVERAGES		3 LINES	43 PLOTS	7 %	125	31 %	283	32 %	585	408
14	11	1	1 10 5	37 %	731	19 %	172	41 %	880	903
14	11	1	6 10 7	777 %	7777	777 %	7777	777 %	7777	7777
14	11	1	8 10 9	777 %	7777	777 %	7777	777 %	7777	7777
14	11	1	10 70 11	777 %	7777	777 %	7777	777 %	7777	7777
14	11	1	12 70 20	-4 %	0	38 %	347	32 %	591	347
14	11	2	1 70 5	62 %	1858	9 %	84	62 %	1858	1942
14	11	2	6 70 6	777 %	7777	777 %	7777	777 %	7777	7777
14	11	2	7 70 20	23 %	347	38 %	351	51 %	1312	698
14	11	3	1 10 10	47 %	1132	15 %	142	49 %	1232	1274
14	11	3	11 10 14	777 %	7777	777 %	7777	777 %	7777	7777
14	11	3	15 10 18	18 %	261	21 %	198	37 %	744	459
14	11	3	19 10 20	777 %	7777	777 %	7777	777 %	7777	7777
14	11	4	1 10 1	23 %	361	27 %	252	23 %	361	613
14	11	4	2 10 2	777 %	7777	777 %	7777	777 %	7777	7777
14	11	4	3 70 4	777 %	7777	777 %	7777	777 %	7777	7777
14	11	4	5 70 12	28 %	471	7 %	69	37 %	754	540
14	11	4	13 10 15	777 %	7777	777 %	7777	777 %	7777	7777
14	11	4	16 10 20	45 %	1044	9 %	84	45 %	1044	1128
14	11	5	1 70 20	52 %	1337	31 %	287	67 %	2204	1624
14	11	6	1 10 2	24 %	369	47 %	433	49 %	1207	802
14	11	6	3 70 4	777 %	7777	777 %	7777	777 %	7777	7777
14	11	6	5 10 19	49 %	1167	35 %	318	68 %	2227	1485
14	11	6	20 70 20	777 %	7777	777 %	7777	777 %	7777	7777
14	11	7	1 10 1	23 %	361	42 %	385	36 %	705	746
14	11	7	2 10 2	777 %	7777	777 %	7777	777 %	7777	7777

STOCKING SUMMARY REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

COUNTY - CLATSOP PROJECT - 26 TOWNSHIP 5 N RANGE 8 W PLANTING DIMENSIONS 6.0 BY 8.0 FT.

STOCKING SECTION NUMBER	SURVEY FORTY NUMBER	LOCATION LINE NUMBER	PLOT NUMBER	STOCKING SURVEY ANALYSIS BY STOCKING PERCENT AND NUMBER OF SEEDLINGS: NATURALLY SEEDED REPRODUCTION PERCENT STOCKED	NATURALLY SEEDED REPRODUCTION SEEDLINGS PER ACRE	PLANTED REFORESTATION PERCENT STOCKED	PLANTED REFORESTATION SEEDLINGS PER ACRE	OVERALL REPRODUCTION PERCENT STOCKED	OVERALL REPRODUCTION SEEDLINGS PER ACRE	TOTAL SEEDLINGS PER ACRE
14	11	7	2 70 2	777 %	7777	777 %	7777	777 %	7777	7777
14	11	7	3 70 18	4 %	107	54 %	497	50 %	1242	604
14	11	7	19 10 20	777 %	7777	777 %	7777	777 %	7777	7777
14	11	8	1 10 13	48 %	1155	24 %	225	60 %	1771	1380
14	11	8	14 70 14	777 %	7777	777 %	7777	777 %	7777	7777
14	11	8	15 10 20	21 %	304	53 %	488	53 %	1394	792
14	11									
FORTY 11 TOTALS AND AVERAGES		3 LINES	60 PLOTS	29 %	463	27 %	246	47 %	1138	709
14	12	1	1 10 7	53 %	1424	19 %	173	60 %	1748	1597
14	12	1	8 70 10	777 %	7777	777 %	7777	777 %	7777	7777
14	12	1	11 10 12	25 %	387	14 %	132	37 %	744	519
14	12	1	13 70 16	777 %	7777	777 %	7777	777 %	7777	7777
14	12	1	17 10 19	16 %	227	29 %	265	25 %	387	492
14	12	1	20 10 20	777 %	7777	777 %	7777	777 %	7777	7777
14	12	2	1 70 7	777 %	7777	777 %	7777	777 %	7777	7777
14	12	2	8 70 11	777 %	7777	777 %	7777	777 %	7777	7777
14	12	2	12 10 14	6 %	116	36 %	332	39 %	821	448
14	12	2	15 10 15	777 %	7777	777 %	7777	777 %	7777	7777
14	12	2	16 70 19	25 %	387	51 %	464	50 %	1242	851
14	12	2	20 70 20	777 %	7777	777 %	7777	777 %	7777	7777
14	12	3	1 10 4	31 %	546	7 %	65	31 %	546	611
14	12	3	5 70 5	777 %	7777	777 %	7777	777 %	7777	7777
14	12	3	6 70 8	777 %	7777	777 %	7777	777 %	7777	7777
14	12	3	9 10 15	777 %	7777	777 %	7777	777 %	7777	7777
14	12	3	16 70 20	0 %	0	18 %	166	19 %	281	166
14	12	4	1 70 16	777 %	7777	777 %	7777	777 %	7777	7777
14	12	4	17 70 19	8 %	130	29 %	265	33 %	609	395
14	12	4	20 70 20	777 %	7777	777 %	7777	777 %	7777	7777
14	12	5	1 10 9	40 %	856	44 %	406	60 %	1774	1258
14	12	5	10 70 10	777 %	7777	777 %	7777	777 %	7777	7777

STOCKING SUMMARY REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

COUNTY - CLAYSOP PROJECT - 26 TOWNSHIP 5 N RANGE 8 W PLANTING DIMENSIONS 6.0 BY 8.0 FT.

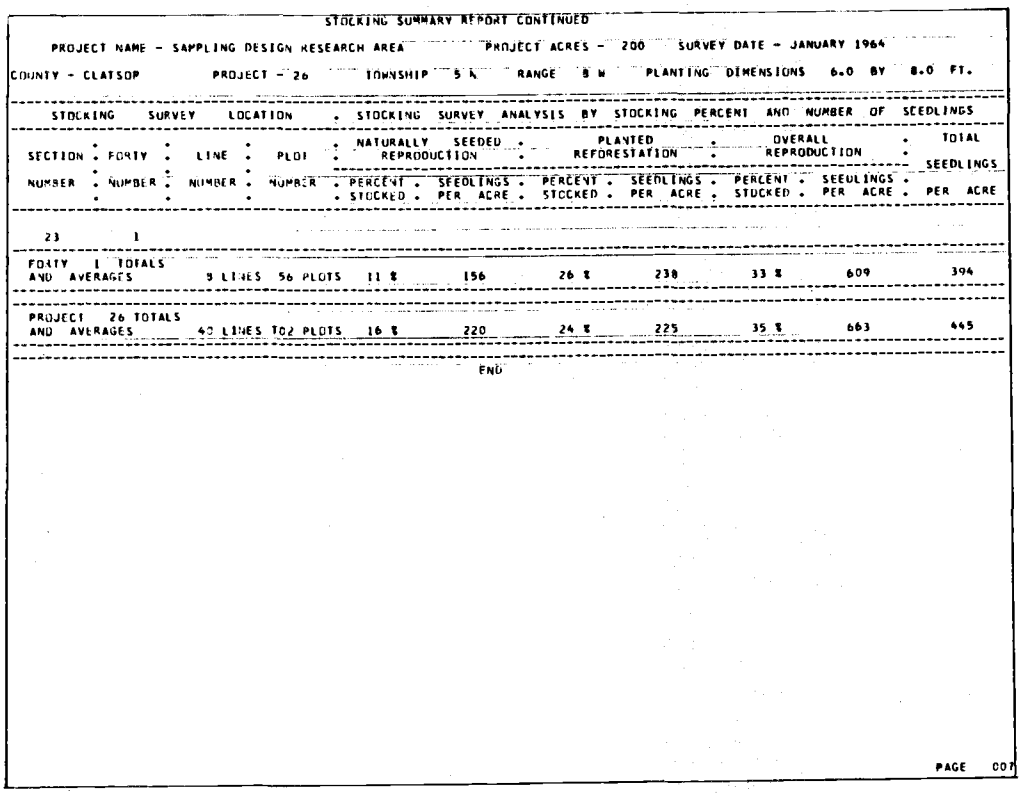
STOCKING SECTION NUMBER	SURVEY FORTY NUMBER	LOCATION LINE NUMBER	PLOT NUMBER	STOCKING SURVEY ANALYSIS BY STOCKING PERCENT AND NUMBER OF SEEDLINGS: NATURALLY SEEDED REPRODUCTION PERCENT STOCKED	NATURALLY SEEDED REPRODUCTION SEEDLINGS PER ACRE	PLANTED REFORESTATION PERCENT STOCKED	PLANTED REFORESTATION SEEDLINGS PER ACRE	OVERALL REPRODUCTION PERCENT STOCKED	OVERALL REPRODUCTION SEEDLINGS PER ACRE	TOTAL SEEDLINGS PER ACRE
14	12	5	10 T0 10	777 %	7777	777 %	7777	777 %	7777	7777
14	12	5	11 T0 16	41 %	894	29 %	265	50 %	1242	1159
14	12	5	17 T0 18	777 %	7777	777 %	7777	777 %	7777	7777
14	12	5	19 T0 20	35 %	671	12 %	109	35 %	671	780
14	12	6	1 T0 6	47 %	1121	26 %	236	54 %	1451	1357
14	12	6	7 T0 7	777 %	7777	777 %	7777	777 %	7777	7777
14	12	6	8 T0 11	37 %	744	29 %	265	62 %	1880	1009
14	12	6	12 T0 12	777 %	7777	777 %	7777	777 %	7777	7777
14	12	6	13 T0 20	6 %	115	26 %	242	25 %	402	357
14	12	7	1 T0 1	777 %	7777	777 %	7777	777 %	7777	7777
14	12	7	2 T0 13	16 %	261	34 %	309	43 %	975	570
14	12	7	14 T0 16	777 %	7777	777 %	7777	777 %	7777	7777
14	12	7	17 T0 20	6 %	115	53 %	489	46 %	1075	604
14	12	8	1 T0 3	777 %	7777	777 %	7777	777 %	7777	7777
14	12	8	4 T0 10	14 %	193	58 %	530	53 %	1410	723
14	12	8	11 T0 14	777 %	7777	777 %	7777	777 %	7777	7777
14	12	8	15 T0 20	11 %	160	38 %	349	40 %	837	509
14	72									
FORTY 12 TOTALS AND AVERAGES		8 LINES	60 PLOTS	16 %	228	21 %	195	30 %	539	423
23	1	1	1 T0 2	27 %	454	12 %	117	27 %	454	571
23	1	1	3 T0 8	777 %	7777	777 %	7777	777 %	7777	7777
23	1	1	9 T0 16	21 %	320	10 %	99	31 %	548	419
23	1	1	17 T0 20	777 %	7777	777 %	7777	777 %	7777	7777
23	1	2	1 T0 10	3 %	100	61 %	562	53 %	1384	662
23	1	2	11 T0 17	777 %	7777	777 %	7777	777 %	7777	7777
23	1	2	18 T0 20	39 %	817	17 %	154	45 %	1060	971
23	1	3	1 T0 2	777 %	7777	777 %	7777	777 %	7777	7777
23	1	3	3 T0 8	0 %	0	48 %	442	41 %	894	442
23	1	3	9 T0 9	777 %	7777	777 %	7777	777 %	7777	7777
23	1	3	10 T0 20	11 %	155	34 %	316	38 %	768	471

STOCKING SUMMARY REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

COUNTY - CLATSOP PROJECT - 26 TOWNSHIP 5 N RANGE 8 W PLANTING DIMENSIONS 6.0 BY 8.0 FT.

STOCKING SECTION NUMBER	SURVEY FORTY NUMBER	LOCATION LINE NUMBER	PLOT NUMBER	STOCKING SURVEY ANALYSIS BY STOCKING PERCENT AND NUMBER OF SEEDLINGS: NATURALLY SEEDED REPRODUCTION PERCENT STOCKED	NATURALLY SEEDED REPRODUCTION SEEDLINGS PER ACRE	PLANTED REFORESTATION PERCENT STOCKED	PLANTED REFORESTATION SEEDLINGS PER ACRE	OVERALL REPRODUCTION PERCENT STOCKED	OVERALL REPRODUCTION SEEDLINGS PER ACRE	TOTAL SEEDLINGS PER ACRE
23	1	3	10 T0 20	11 %	155	34 %	316	38 %	768	471
23	1	4	1 T0 2	11 %	155	61 %	559	52 %	1372	714
23	1	4	3 T0 4	777 %	7777	777 %	7777	777 %	7777	7777
23	1	4	5 T0 15	0 %	0	45 %	409	38 %	784	409
23	1	4	16 T0 16	777 %	7777	777 %	7777	777 %	7777	7777
23	1	4	17 T0 20	777 %	7777	777 %	7777	777 %	7777	7777
23	1	5	1 T0 1	777 %	7777	777 %	7777	777 %	7777	7777
23	1	5	2 T0 8	0 %	0	45 %	416	39 %	807	416
23	1	5	9 T0 9	777 %	7777	777 %	7777	777 %	7777	7777
23	1	5	10 T0 11	777 %	7777	777 %	7777	777 %	7777	7777
23	1	5	12 T0 17	2 %	99	22 %	206	27 %	454	305
23	1	5	18 T0 18	777 %	7777	777 %	7777	777 %	7777	7777
23	1	5	19 T0 20	11 %	155	51 %	471	44 %	1003	626
23	1	6	1 T0 1	29 %	490	10 %	176	29 %	490	666
23	1	6	2 T0 2	777 %	7777	777 %	7777	777 %	7777	7777
23	1	6	3 T0 5	0 %	0	29 %	265	25 %	387	265
23	1	6	6 T0 9	777 %	7777	777 %	7777	777 %	7777	7777
23	1	6	10 T0 13	0 %	0	29 %	265	25 %	387	265
23	1	6	14 T0 14	777 %	7777	777 %	7777	777 %	7777	7777
23	1	6	15 T0 20	15 %	209	26 %	239	33 %	609	448
23	1	7	1 T0 1	777 %	7777	777 %	7777	777 %	7777	7777
23	1	7	2 T0 8	28 %	475	16 %	151	39 %	807	626
23	1	7	9 T0 13	777 %	7777	777 %	7777	777 %	7777	7777
23	1	7	14 T0 20	22 %	341	30 %	276	44 %	1017	617
23	1	8	1 T0 8	50 %	1284	10 %	98	56 %	1555	1382
23	1	8	9 T0 10	777 %	7777	777 %	7777	777 %	7777	7777
23	1	8	11 T0 16	26 %	415	47 %	429	58 %	1652	844
23	1	8	17 T0 20		NO ESTIMATE		NO ESTIMATE		NO ESTIMATE	UNKNOWN
23	1									
FORTY 1 TOTALS AND AVERAGES		8 LINES	56 PLOTS	11 %	156	26 %	238	33 %	609	394



STOCKING SUMMARY REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

COUNTY - CLATSOP PROJECT - 26 TOWNSHIP 5 N RANGE 8 W PLANTING DIMENSIONS 6.0 BY 8.0 FT.

STOCKING SECTION NUMBER	SURVEY FORTY NUMBER	LOCATION LINE NUMBER	LOCATION PLOT NUMBER	STOCKING SURVEY ANALYSIS BY STOCKING PERCENT AND NUMBER OF SEEDLINGS: NATURALLY SEEDED REPRODUCTION PERCENT STOCKED	NATURALLY SEEDED REPRODUCTION SEEDLINGS PER ACRE	PLANTED REFORESTATION PERCENT STOCKED	PLANTED REFORESTATION SEEDLINGS PER ACRE	OVERALL REPRODUCTION PERCENT STOCKED	OVERALL REPRODUCTION SEEDLINGS PER ACRE	TOTAL SEEDLINGS PER ACRE
23	1									
FORTY 1 TOTALS AND AVERAGES		9 LINES	56 PLOTS	11 %	156	26 %	238	33 %	609	394
PROJECT 26 TOTALS AND AVERAGES		49 LINES	702 PLOTS	16 %	220	24 %	225	35 %	663	445

END

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STATE OF OREGON--DEPARTMENT OF FORESTRY REHABILITATION STOCKING SURVEY--FIELD DATA LISTING REPORT

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

PN RU OM JB EE CR T	C O U N T Y	T W N S M P .	R A N G E	S P A C I N G	PLANT SPACE 1 2	SN EU CM TB IE OR N	FN OU RM YE R	LN LU NM E R	BC ED AO RE N G	PN LU ON TB E R	NAT. QUAD 1234	PLT. QUAD 1234	PN LU DM TB E R	NAT. QUAD 1234	PLT. QUAD 1234	PN LU IM TB E R	NAT. QUAD 1234	PLT. QUAD 1234	PN LU OM TB E R	NAT. QUAD 1234	PLT. QUAD 1234	PN LU DM TB E R	NAT. QUAD 1234	PLT. QUAD 1234	CC AD RO DE
026	04	05N	08W	1	060	080	14	09	01	2000	11		1 1	12		1	13		1	14		1 1	15		1	1
026	04	05N	08W	1	060	080	14	09	01	2000	16		1	17	11 1	1	18			19	11 1		20	1		1
026	04	05N	08W	1	060	080	14	09	02	5000	11			12		1 1	13			14	1		15	1		1
026	04	05N	08W	1	060	080	14	09	02	5000	16			17	1		18	1 1		19	1111		20			1
026	04	05N	08W	1	060	080	14	09	01	2000	11	1		12			13	1 1		14	1		15	1		1
026	04	05N	08W	1	060	080	14	09	01	2000	16			17			18	1		19	1 1		20			1
026	04	05N	08W	1	060	080	14	09	04	5000	11			12			13	1		14			15			1
026	04	05N	08W	1	060	080	14	09	04	5000	16			17			18	1 1		19	1		20			1
026	04	05N	08W	1	060	080	14	09	06	6000	01		1 1	02			03		1							1
026	04	05N	08W	1	060	080	14	09	07	1000	01	1	11	02		11 1	01		11	04			05		1 1	1
026	04	05N	08W	1	060	080	14	09	07	3000	06	11		07			08		1	09	1		10	1		1
026	04	05N	08W	1	060	080	14	09	07	1000	11			12			13			14	111	11	15	1		1
026	04	05N	08W	1	060	080	14	09	07	1000	16			17	11	1	18	1	1	19			20			1
026	04	05N	08W	1	060	080	14	09	08	6000	01	1 1		02		1 1	03		1	04	11	1	05	1 11		1
026	04	05N	08W	1	060	080	14	09	08	6000	06			07		1 1	08		11	09		1	10		1 1	1
026	04	05N	08W	1	060	080	14	09	08	6000	11			12			11			14			15			1
026	04	05N	08W	1	060	080	14	09	08	6000	16	1		17	1 1		18	1		19			20			1
026	04	05N	08W	1	060	080	14	10	01	5000	01		11	02			01			04			05			1
026	04	05N	08W	1	060	080	14	10	01	5000	06	1		07		1	08			09		11	10		1	1
026	04	05N	08W	1	060	080	14	10	01	5000	11	1 1 1		12		1	13		1	14		11	15	1	1	1
026	04	05N	08W	1	060	080	14	10	01	5000	16	1	1 1	17		1 1 1	18		1 1	19		1	20		1 1	1
026	04	05N	08W	1	060	080	14	10	02	2000	01			02			01		1	04			05		1	1
026	04	05N	08W	1	060	080	14	10	02	2000	06		1 1	07			08		1	09		1 1	10		1	1
026	04	05N	08W	1	060	080	14	10	02	2000	11		1	12		1 1	13		1	14		1 11	15		1	1
026	04	05N	08W	1	060	080	14	10	02	2000	16			17			18			19	1	1 11	20	11		1
026	04	05N	08W	1	060	080	14	10	01	5000	01		1 1	02		1	03		1	04	1 1	11	05			1
026	04	05N	08W	1	060	080	14	10	03	5000	06		1 1	07		111	08	1111	11	09	11	1	10		1	1
026	04	05N	08W	1	060	080	14	10	01	5000	11		1	12		1	13		1	14			15			1
026	04	05N	08W	1	060	080	14	10	01	5000	16		1	17		1	18		11	19		1 1	20		1	1
026	04	05N	08W	1	060	080	14	10	04	2000	06		11	07			02						10		111	1
026	04	05N	08W	1	060	080	14	10	04	2000	11		1	12		1	13			14			15			1
026	04	05N	08W	1	060	080	14	10	04	2000	16			17		1	18			19			20			1
026	04	05N	08W	1	060	080	14	10	05	3000	01	1111		02	1	1	03			04	1	1	05			1
026	04	05N	08W	1	060	080	14	10	05	1000	06	1	1	07			08		1	09			10		1 1	1
026	04	05N	08W	1	060	080	14	10	05	1000	11		1 1	12			13			14						1
026	04	05N	08W	1	060	080	14	10	06	6000	07	1		08	11	1 1	09		11	10		1	11	1		1
026	04	05N	08W	1	060	080	14	10	06	6000	12		1	11			14		1 1	15		111	16	1		1
026	04	05N	08W	1	060	080	14	10	06	6000	17		11 1	18	1		19		111	20		1				1
026	04	05N	08W	1	060	080	14	10	07	3000	01	1	1	02	111		01		11	04	1	111	05	1		1
026	04	05N	08W	1	060	080	14	10	07	3000	06		1 11	07		11	08	1	1	09		1	10			1

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FIELD DATA LISTING REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

PN RU OM JB EE CR T	C O U N T Y	T W N S M P .	R A N G E	S P A C I N G	PLANT SPACE 1 2	SN EU CM TB IE OR N	FN CU RM TB YE R	LN LU NM E R	BC ED AO RE N G	PN LU ON TB E R	NAT. QUAD 1234	PLT. QUAD 1234	PN LU DM TB E R	NAT. QUAD 1234	PLT. QUAD 1234	PN LU OM TB E R	NAT. QUAD 1234	PLT. QUAD 1234	PN LU OM TB E R	NAT. QUAD 1234	PLT. QUAD 1234	PN LU DM TB E R	NAT. QUAD 1234	PLT. QUAD 1234	CC AD RO DE
026	04	05N	08W	1	060	080	14	10	07	3000	11	1	1	12		1	13			14		11	15		1	1
026	04	05N	08W	1	060	080	14	10	07	3000	16			17			18	11		19		111	20		1 11	1
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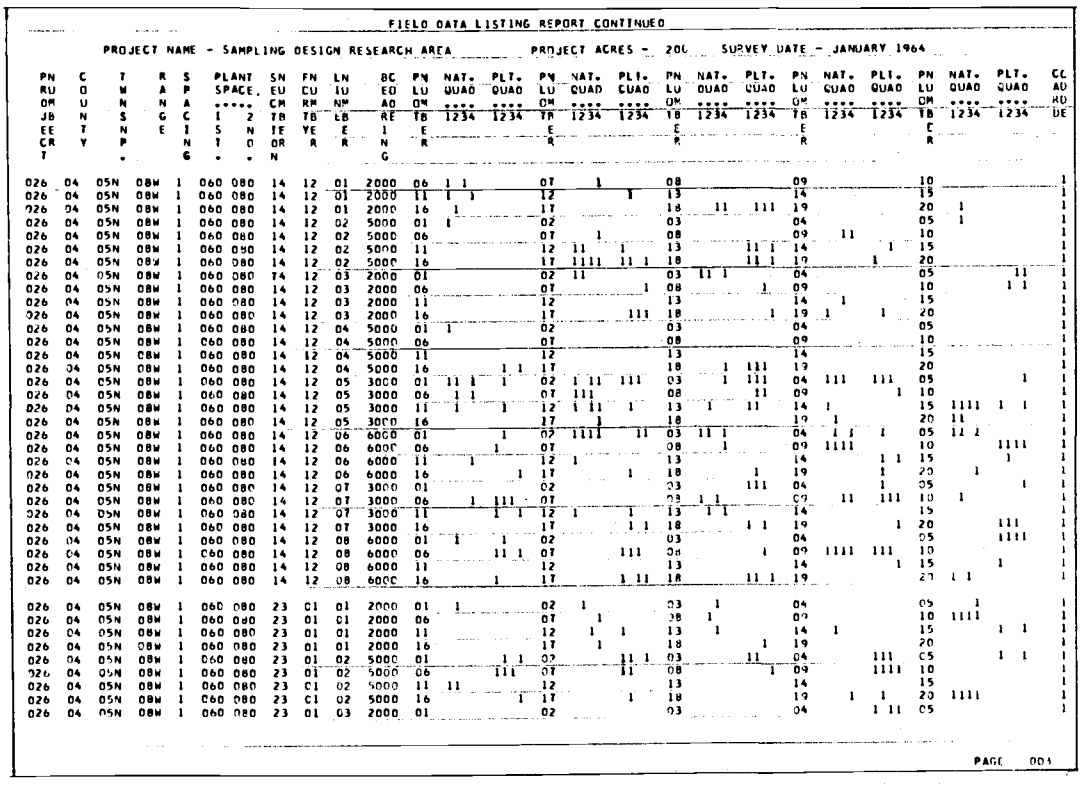

FIELD DATA LISTING REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

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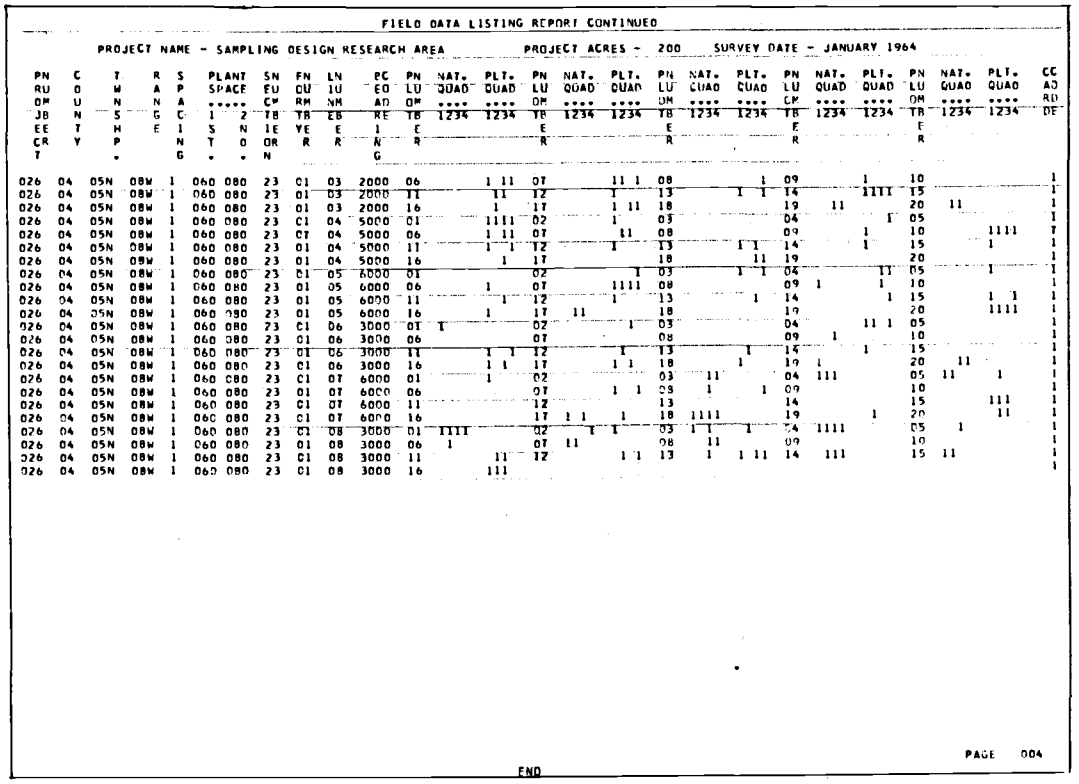

FIELD DATA LISTING REPORT CONTINUED

PROJECT NAME - SAMPLING DESIGN RESEARCH AREA PROJECT ACRES - 200 SURVEY DATE - JANUARY 1964

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END

APPENDIX II

FOREST PLANTATION STOCKING TABLES

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
7.5 BY 7.5	56.25	774.40	774.40	3.04432	76.10	100.00	2735.89	1961.49
			619.52	2.43546	60.88	80.00	1790.53	1171.01
			464.64	1.46127	36.53	60.00	711.88	247.24
			309.76	.58451	14.61	40.00	197.73	-112.02
			154.88	.11690	2.92	20.00	100.40	-54.47
7.5 BY 8.0	60.00	726.00	726.00	2.88637	72.15	100.00	2470.60	1744.60
			580.80	2.30910	57.72	80.00	1620.47	1039.67
			435.60	1.38546	34.63	60.00	650.34	214.74
			290.40	.55418	13.85	40.00	187.69	-102.70
			145.20	.11083	2.77	20.00	99.95	-45.24
7.5 BY 8.5	63.75	683.29	683.29	2.71697	68.42	100.00	2232.60	1549.31
			546.63	2.18958	54.73	80.00	1467.89	921.26
			409.97	1.31374	32.84	60.00	595.10	185.12
			273.31	.52549	13.13	40.00	178.67	-94.64
			136.65	.10509	2.62	20.00	99.54	-37.11
7.5 BY 9.0	67.50	645.33	645.33	2.59612	64.90	100.00	2019.72	1374.39
			516.26	2.07690	51.92	80.00	1331.41	815.14
			387.19	1.24614	31.15	60.00	545.67	158.47
			258.13	.49845	12.46	40.00	170.58	-87.54
			129.06	.09969	2.49	20.00	99.17	-29.89
7.5 BY 9.5	71.25	611.36	611.36	2.46382	61.59	100.00	1829.93	1218.57
			489.09	1.97106	49.27	80.00	1209.72	720.62
			366.82	1.18263	29.56	60.00	501.59	134.77
			244.54	.47305	11.82	40.00	163.37	-81.17
			122.27	.09461	2.36	20.00	98.84	-23.43
7.5 BY 10.0	75.00	580.80	580.80	2.34007	58.50	100.00	1661.33	1080.53

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
7.5 BY 10.0	75.00	580.80	464.64	1.87206	46.80	80.00	1101.59	636.95
			348.48	1.12323	28.08	60.00	462.41	113.93
			232.32	.44929	11.23	40.00	156.94	-75.37
			116.16	.08985	2.24	20.00	98.54	-17.61
7.5 BY 10.5	78.75	553.14	553.14	2.22487	55.62	100.00	1512.12	958.97
			442.51	1.77990	44.49	80.00	1005.90	563.39
			331.88	1.06794	26.69	60.00	427.72	95.84
			221.25	.42717	10.67	40.00	151.25	-70.00
			110.62	.08543	2.13	20.00	98.27	-12.35
7.5 BY 11.0	82.50	528.00	528.00	2.11822	52.95	100.00	1380.63	852.63
			422.40	1.69458	42.36	80.00	921.57	499.17
			316.80	1.01674	25.41	60.00	397.14	80.34
			211.20	.40669	10.16	40.00	146.22	-64.97
			105.60	.08133	2.03	20.00	98.04	-7.55
7.5 BY 11.5	86.25	505.04	505.04	2.02012	50.50	100.00	1265.35	760.30
			404.03	1.61610	40.40	80.00	847.61	443.58
			303.02	.96966	24.24	60.00	370.31	67.29
			202.01	.38786	9.69	40.00	141.81	-60.20
			101.00	.07757	1.93	20.00	97.83	-3.17
7.5 BY 12.0	90.00	484.00	484.00	1.93057	48.26	100.00	1164.83	680.83
			387.20	1.54446	38.61	80.00	783.13	395.93
			290.40	.92667	23.16	60.00	346.92	56.52
			193.60	.37067	9.26	40.00	137.96	-55.63
			96.80	.07413	1.85	20.00	97.64	.84
8.0 BY 8.0	64.00	680.62	680.62	2.72731	68.18	100.00	2217.65	1537.03
			544.50	2.18185	54.54	80.00	1458.31	913.81

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
8.0 BY 8.0	64.00	680.62	408.37	1.30911	32.72	60.00	591.63	183.25
			272.25	.52364	13.09	40.00	178.10	-94.14
			136.12	.10472	2.61	20.00	99.51	-36.60
8.0 BY 8.5	68.00	640.58	640.58	2.57799	64.44	100.00	1993.13	1352.54
			512.47	2.06239	51.55	80.00	1314.36	801.89
			384.35	1.23743	30.93	60.00	539.50	155.14
			256.23	.49497	12.37	40.00	169.57	-86.65
			128.11	.09899	2.47	20.00	99.12	-28.98
8.0 BY 9.0	72.00	605.00	605.00	2.43839	60.95	100.00	1794.58	1189.58
			484.00	1.95071	48.76	80.00	1187.04	703.04
			363.00	1.17042	29.26	60.00	493.37	130.37
			242.00	.46817	11.70	40.00	162.02	-79.97
			121.00	.09363	2.34	20.00	98.78	-22.21
8.0 BY 9.5	76.00	573.15	573.15	2.30851	57.71	100.00	1619.71	1046.55
			458.52	1.84681	46.17	80.00	1074.91	616.38
			343.89	1.10808	27.70	60.00	452.74	108.84
			229.26	.44323	11.08	40.00	155.36	-73.90
			114.63	.08864	2.21	20.00	98.47	-16.16
8.0 BY 10.0	80.00	544.50	544.50	2.18837	54.70	100.00	1466.40	921.90
			435.60	1.75070	43.76	80.00	976.58	540.98
			326.70	1.05042	26.26	60.00	417.09	90.39
			217.80	.42016	10.50	40.00	149.50	-68.29
			108.90	.08403	2.10	20.00	98.19	-10.70
8.0 BY 10.5	84.00	518.57	518.57	2.07795	51.94	100.00	1332.66	814.09
			414.85	1.66236	41.55	80.00	890.79	475.94

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
8.0 BY 10.5	84.00	518.57	311.14	.99742	24.93	60.00	385.98	74.84
			207.42	.39896	9.97	40.00	144.39	-63.03
			103.71	.07979	1.99	20.00	97.95	-5.75
8.0 BY 11.0	88.00	495.00	495.00	1.97727	49.43	100.00	1216.68	721.68
			396.00	1.58181	39.54	80.00	816.40	420.40
			297.00	.94909	23.72	60.00	358.99	61.99
			198.00	.37963	9.49	40.00	139.94	-58.05
			99.00	.07592	1.89	20.00	97.74	-1.25
8.0 BY 11.5	92.00	473.47	473.47	1.88631	47.15	100.00	1116.82	643.34
			378.78	1.50904	37.72	80.00	752.33	373.54
			284.08	.90542	22.63	60.00	335.73	51.65
			189.39	.36217	9.05	40.00	136.11	-53.27
			94.69	.07243	1.81	20.00	97.56	2.86
8.0 BY 12.0	96.00	453.75	453.75	1.80507	45.12	100.00	1031.57	577.82
			363.00	1.44406	36.10	80.00	697.63	334.63
			272.25	.86643	21.66	60.00	315.87	43.62
			181.50	.34657	8.66	40.00	132.83	-48.66
			90.75	.06931	1.73	20.00	97.40	6.65
8.5 BY 8.5	72.25	602.90	602.90	2.42998	60.74	100.00	1782.98	1180.07
			482.32	1.94399	48.59	80.00	1179.61	697.28
			361.74	1.16639	29.15	60.00	490.68	128.94
			241.16	.46655	11.66	40.00	161.58	-79.57
			120.58	.09331	2.33	20.00	98.75	-21.82
8.5 BY 9.0	76.50	569.41	569.41	2.29296	57.32	100.00	1599.41	1030.00
			455.52	1.83437	45.85	80.00	1061.89	606.36
			341.64	1.10062	27.51	60.00	448.02	106.37

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
8.5 BY 9.0	76.50	569.41	227.76	.44025	11.00	40.00	154.58	-73.17
			113.88	.08805	2.20	20.00	98.43	-15.44
8.5 BY 9.5	80.75	539.44	539.44	2.16693	54.17	100.00	1439.89	900.44
			431.55	1.73354	43.33	80.00	959.57	528.02
			323.66	1.04012	26.00	60.00	410.92	87.26
			215.77	.41605	10.40	40.00	148.49	-67.28
			107.88	.08321	2.08	20.00	98.14	-9.73
8.5 BY 10.0	85.00	512.47	512.47	2.05187	51.29	100.00	1302.07	789.60
			409.97	1.64150	41.03	80.00	871.17	461.19
			307.48	.98490	24.62	60.00	378.86	71.38
			204.98	.39396	9.84	40.00	143.22	-61.76
			102.49	.07879	1.96	20.00	97.89	-4.59
8.5 BY 10.5	89.25	488.06	488.06	1.94780	48.69	100.00	1183.82	695.75
			390.45	1.55824	38.95	80.00	795.31	404.86
			292.84	.93494	23.37	60.00	351.34	58.50
			195.22	.37397	9.34	40.00	138.68	-56.53
			97.61	.07479	1.86	20.00	97.68	.07
8.5 BY 11.0	93.50	465.88	465.88	1.85470	46.36	100.00	1083.21	617.33
			372.70	1.48376	37.09	80.00	730.76	358.06
			279.52	.89026	22.25	60.00	327.91	48.38
			186.35	.35610	8.90	40.00	134.82	-51.52
			93.17	.07122	1.78	20.00	97.49	4.32
8.5 BY 11.5	97.75	445.62	445.62	1.77259	44.31	100.00	998.52	552.90
			356.50	1.41807	35.45	80.00	676.42	319.92
			267.37	.85084	21.27	60.00	308.17	40.80

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
8.5 BY 11.5	97.75	445.62	178.25	.34033	8.50	40.00	131.56	-46.68
			89.12	.06806	1.70	20.00	97.34	8.21
8.5 BY 12.0	102.00	427.05	427.05	1.70147	42.53	100.00	928.23	501.17
			341.64	1.36117	34.02	80.00	631.31	289.66
			256.23	.81670	20.41	60.00	291.78	35.55
			170.82	.32668	8.16	40.00	128.85	-41.96
			85.41	.06533	1.63	20.00	97.20	11.79
9.0 BY 9.0	81.00	537.77	537.77	2.15985	53.99	100.00	1431.20	893.42
			430.22	1.72788	43.19	80.00	954.00	523.78
			322.66	1.03673	25.91	60.00	408.90	86.24
			215.11	.41469	10.36	40.00	148.16	-66.94
			107.55	.08293	2.07	20.00	98.13	-9.42
9.0 BY 9.5	85.50	509.47	509.47	2.03906	50.97	100.00	1287.18	777.70
			407.57	1.63124	40.78	80.00	861.62	454.04
			305.68	.97874	24.46	60.00	375.40	69.71
			203.78	.39149	9.78	40.00	142.65	-61.13
			101.89	.07829	1.95	20.00	97.87	-4.02
9.0 BY 10.0	90.00	484.00	484.00	1.93057	48.26	100.00	1164.83	680.83
			387.20	1.54446	38.61	80.00	783.13	395.93
			290.40	.92667	23.16	60.00	346.92	56.52
			193.60	.37067	9.26	40.00	137.96	-55.63
			96.80	.07413	1.85	20.00	97.64	.84
9.0 BY 10.5	94.50	460.95	460.95	1.83440	45.86	100.00	1061.91	600.96
			368.76	1.46752	36.68	80.00	717.10	348.33
			276.97	.88051	22.01	60.00	322.94	46.37
			184.38	.35220	8.80	40.00	134.00	-50.37

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
9.0 BY 10.5	94.50	460.95	92.19	.07044	1.76	20.00	97.45	5.26
9.0 BY 11.0	99.00	440.00	440.00	1.75053	43.76	100.00	976.42	536.42
			352.00	1.40043	35.01	80.00	662.23	310.23
			264.00	.84025	21.00	60.00	303.02	39.02
			176.00	.33610	8.40	40.00	130.71	-45.28
			88.00	.06722	1.68	20.00	97.29	9.29
9.0 BY 11.5	103.50	420.86	420.86	1.67898	41.97	100.00	906.60	485.73
			336.69	1.34319	33.57	80.00	617.43	280.73
			252.52	.80591	20.14	60.00	286.74	34.22
			168.34	.32236	8.05	40.00	128.01	-40.32
			84.17	.06447	1.61	20.00	97.16	12.99
9.0 BY 12.0	108.00	403.33	403.33	1.61975	40.49	100.00	850.98	447.64
			322.66	1.29580	32.39	80.00	581.73	259.06
			241.99	.77748	19.43	60.00	273.77	31.77
			161.33	.31099	7.77	40.00	125.87	-35.46
			80.66	.06219	1.55	20.00	97.06	16.39
9.5 BY 9.5	90.25	482.65	482.65	1.92490	48.12	100.00	1158.63	675.97
			386.12	1.53992	38.49	80.00	779.15	393.02
			289.59	.92395	23.09	60.00	345.47	55.87
			193.06	.36958	9.23	40.00	137.72	-55.34
			96.53	.07391	1.84	20.00	97.63	1.10
9.5 BY 10.0	95.00	458.52	458.52	1.82447	45.61	100.00	1051.59	593.06
			366.82	1.45958	36.48	80.00	710.47	343.65
			275.11	.87574	21.89	60.00	320.54	45.42
			183.41	.35029	8.75	40.00	133.60	-49.80

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
9.5 BY 10.0	95.00	458.52	91.70	.07005	1.75	20.00	97.44	5.73
9.5 BY 10.5	99.75	436.69	436.69	1.73775	43.44	100.00	963.73	527.04
			349.35	1.39020	34.75	80.00	654.10	304.74
			262.01	.83412	20.85	60.00	300.06	38.05
			174.67	.33364	8.34	40.00	130.22	-44.45
			87.33	.06672	1.66	20.00	97.27	9.93
9.5 BY 11.0	104.50	416.84	416.84	1.66476	41.61	100.00	893.06	476.22
			333.47	1.33180	33.29	80.00	608.74	275.26
			250.10	.79908	19.97	60.00	283.58	33.48
			166.73	.31963	7.99	40.00	127.49	-39.23
			83.36	.06392	1.59	20.00	97.14	13.77
9.5 BY 11.5	109.25	398.71	398.71	1.60548	40.13	100.00	837.87	439.16
			318.97	1.28438	32.10	80.00	573.32	254.34
			239.23	.77063	19.26	60.00	270.71	31.48
			159.48	.30825	7.70	40.00	125.36	-34.12
			79.74	.06165	1.54	20.00	97.03	17.29
10.0 BY 10.0	100.00	435.60	435.60	1.73357	43.33	100.00	959.60	524.00
			348.48	1.38686	34.67	80.00	651.44	302.96
			261.36	.83211	20.80	60.00	299.10	37.74
			174.24	.33284	8.32	40.00	130.06	-44.17
			87.12	.06656	1.66	20.00	97.26	10.14

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
10.0 BY 10.5	105.00	414.85	414.85	1.65787	41.44	100.00	886.55	471.69
			331.88	1.32630	33.15	80.00	604.56	272.67
			248.91	.79578	19.89	60.00	282.06	33.15
			165.94	.31831	7.95	40.00	127.24	-38.69
			82.97	.06366	1.59	20.00	97.13	14.15
10.0 BY 11.0	110.00	396.00	396.00	1.59737	39.93	100.00	830.48	434.48
			316.80	1.27790	31.94	80.00	568.57	251.77
			237.60	.76674	19.16	60.00	268.98	31.38
			158.40	.30669	7.66	40.00	125.07	-33.32
			79.20	.06133	1.53	20.00	97.02	17.82

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
8.0 BY 7.5	60.00	726.00	726.00	2.88637	72.15	100.00	2470.60	1744.60
			580.80	2.30910	57.72	80.00	1620.47	1039.67
			435.60	1.38546	34.63	60.00	650.34	214.74
			290.40	.55418	13.85	40.00	187.69	-102.70
			145.20	.11083	2.77	20.00	99.95	-45.24
8.5 BY 7.5	63.75	683.29	683.29	2.73697	68.42	100.00	2232.60	1549.31
			546.63	2.18958	54.73	80.00	1467.89	921.26
			409.97	1.31374	32.84	60.00	595.10	185.12
			273.31	.52549	13.13	40.00	178.67	-94.64
			136.65	.10509	2.62	20.00	99.54	-37.11
8.5 BY 8.0	68.00	640.58	640.58	2.57799	64.44	100.00	1993.13	1352.54
			512.47	2.06239	51.55	80.00	1314.36	801.89
			384.35	1.23743	30.93	60.00	539.50	155.14
			256.23	.49497	12.37	40.00	169.57	-86.65
			128.11	.09899	2.47	20.00	99.12	-28.98
9.0 BY 7.5	67.50	645.33	645.33	2.59612	64.90	100.00	2019.72	1374.39
			516.26	2.07690	51.92	80.00	1331.41	815.14
			387.19	1.24614	31.15	60.00	545.67	158.47
			258.13	.49845	12.46	40.00	170.58	-87.54
			129.06	.09969	2.49	20.00	99.17	-29.89
9.0 BY 8.0	72.00	605.00	605.00	2.43839	60.95	100.00	1794.58	1189.58
			484.00	1.95071	48.76	80.00	1187.04	703.04
			363.00	1.17042	29.26	60.00	493.37	130.37
			242.00	.46817	11.70	40.00	162.02	-79.97
			121.00	.09363	2.34	20.00	98.78	-22.21
9.0 BY 8.5	76.50	569.41	569.41	2.29296	57.32	100.00	1599.41	1030.00

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
9.0 BY 8.5	76.50	569.41	455.52	1.83437	45.85	80.00	1061.89	606.36
			341.64	1.10062	27.51	60.00	448.02	106.37
			227.76	.44025	11.00	40.00	154.58	-73.17
			113.88	.08805	2.20	20.00	98.43	-15.44
9.5 BY 7.5	71.25	611.36	611.36	2.46382	61.59	100.00	1829.93	1218.57
			489.09	1.97106	49.27	80.00	1209.72	720.62
			366.82	1.18263	29.56	60.00	501.59	134.77
			244.54	.47305	11.82	40.00	163.37	-81.17
			122.27	.09461	2.36	20.00	98.84	-23.43
9.5 BY 8.0	76.00	573.15	573.15	2.30851	57.71	100.00	1619.71	1046.55
			458.52	1.84681	46.17	80.00	1074.91	616.38
			343.89	1.10808	27.70	60.00	452.74	108.84
			229.26	.44323	11.08	40.00	155.36	-73.90
			114.63	.08864	2.21	20.00	98.47	-16.16
9.5 BY 8.5	80.75	539.44	539.44	2.16693	54.17	100.00	1439.89	900.44
			431.55	1.73354	43.33	80.00	959.57	528.02
			323.66	1.04012	26.00	60.00	410.92	87.26
			215.77	.41605	10.40	40.00	148.49	-67.28
			107.88	.08321	2.08	20.00	98.14	-9.73
9.5 BY 9.0	85.50	509.47	509.47	2.03906	50.97	100.00	1287.18	777.70
			407.57	1.63124	40.78	80.00	861.62	454.04
			305.68	.97874	24.46	60.00	375.40	69.71
			203.78	.39149	9.78	40.00	142.65	-61.13
			101.89	.07829	1.95	20.00	97.87	-4.02
10.0 BY 7.5	75.00	580.80	580.80	2.34007	58.50	100.00	1661.33	1080.53

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
10.0 BY 7.5	75.00	580.80	464.64	1.87206	46.80	80.00	1101.59	636.95
			348.48	1.12323	28.08	60.00	462.41	113.93
			232.32	.44929	11.23	40.00	156.94	-75.37
			116.16	.08985	2.24	20.00	98.54	-17.61
10.0 BY 8.0	80.00	544.50	544.50	2.18837	54.70	100.00	1466.40	921.90
			435.60	1.75070	43.76	80.00	976.58	540.98
			326.70	1.05042	26.26	60.00	417.09	90.39
			217.80	.42016	10.50	40.00	149.50	-68.29
			108.90	.08403	2.10	20.00	98.19	-10.70
10.0 BY 8.5	85.00	512.47	512.47	2.05187	51.29	100.00	1302.07	789.60
			409.97	1.64150	41.03	80.00	871.17	461.19
			307.48	.98490	24.62	60.00	378.86	71.38
			204.98	.39396	9.84	40.00	143.22	-61.76
			102.49	.07879	1.96	20.00	97.89	-4.59
10.0 BY 9.0	90.00	484.00	484.00	1.93057	48.26	100.00	1164.83	680.83
			387.20	1.54446	38.61	80.00	783.13	395.93
			290.40	.92667	23.16	60.00	346.92	56.52
			193.60	.37067	9.26	40.00	137.96	-55.63
			96.80	.07413	1.85	20.00	97.64	.84
10.0 BY 9.5	95.00	458.52	458.52	1.82447	45.61	100.00	1051.59	593.06
			366.82	1.45958	36.48	80.00	710.47	343.65
			275.11	.87574	21.89	60.00	320.54	45.42
			183.41	.35029	8.75	40.00	133.60	-49.80
			91.70	.07005	1.75	20.00	97.44	5.73
10.5 BY 7.5	78.75	553.14	553.14	2.22487	55.62	100.00	1512.12	958.97
			442.51	1.77990	44.49	80.00	1005.90	563.39

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
10.5 BY 7.5	78.75	553.14	331.88	1.06794	26.69	60.00	427.72	95.84
			221.25	.42717	10.67	40.00	151.25	-70.00
			110.62	.08543	2.13	20.00	98.27	-12.35
10.5 BY 8.0	84.00	518.57	518.57	2.07795	51.94	100.00	1332.66	814.09
			414.85	1.66236	41.55	80.00	890.79	475.94
			311.14	.99742	24.93	60.00	385.98	74.84
			207.42	.39896	9.97	40.00	144.39	-63.03
			103.71	.07979	1.99	20.00	97.95	-5.75
10.5 BY 8.5	89.25	488.06	488.06	1.94780	48.69	100.00	1183.82	695.75
			390.45	1.55824	38.95	80.00	795.31	404.86
			292.84	.93494	23.37	60.00	351.34	58.50
			195.22	.37397	9.34	40.00	138.68	-56.53
			97.61	.07479	1.86	20.00	97.68	.07
10.5 BY 9.0	94.50	460.95	460.95	1.83440	45.86	100.00	1061.91	600.96
			368.76	1.46752	36.68	80.00	717.10	348.33
			276.57	.88051	22.01	60.00	322.94	46.37
			184.38	.35220	8.80	40.00	134.00	-50.37
			92.19	.07044	1.76	20.00	97.45	5.26
10.5 BY 9.5	99.75	436.69	436.69	1.73775	43.44	100.00	963.73	527.04
			349.35	1.39020	34.75	80.00	654.10	304.74
			262.01	.83412	20.85	60.00	300.06	38.05
			174.67	.33364	8.34	40.00	130.22	-44.45
			87.33	.06672	1.66	20.00	97.27	9.93
10.5 BY 10.0	105.00	414.85	414.85	1.65787	41.44	100.00	886.55	471.69
			331.88	1.32630	33.15	80.00	604.56	272.67

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
10.5 BY 10.0	105.00	414.85	248.91	.79578	19.89	60.00	282.06	33.15
			165.94	.31831	7.95	40.00	127.24	-38.69
			82.97	.06366	1.59	20.00	97.13	14.15
11.0 BY 7.5	82.50	528.00	528.00	2.11822	52.95	100.00	1380.63	852.63
			422.40	1.69458	42.36	80.00	921.57	499.17
			316.80	1.01674	25.41	60.00	397.14	80.34
			211.20	.40669	10.16	40.00	146.22	-64.97
			105.60	.08133	2.03	20.00	98.04	-7.55
11.0 BY 8.0	88.00	495.00	495.00	1.97727	49.43	100.00	1216.68	721.68
			396.00	1.58181	39.54	80.00	816.40	420.40
			297.00	.94909	23.72	60.00	358.99	61.99
			198.00	.37963	9.49	40.00	139.94	-58.05
			99.00	.07592	1.89	20.00	97.74	-1.25
11.0 BY 8.5	93.50	465.88	465.88	1.85470	46.36	100.00	1083.21	617.33
			372.70	1.48376	37.09	80.00	730.76	358.06
			279.52	.89026	22.25	60.00	327.91	48.38
			186.35	.35610	8.90	40.00	134.82	-51.52
			93.17	.07122	1.78	20.00	97.49	4.32
11.0 BY 9.0	99.00	440.00	440.00	1.75053	43.76	100.00	976.42	536.42
			352.00	1.40043	35.01	80.00	662.23	310.23
			264.00	.84025	21.00	60.00	303.02	39.02
			176.00	.33610	8.40	40.00	130.71	-45.28
			88.00	.06722	1.68	20.00	97.29	9.29
11.0 BY 9.5	104.50	416.84	416.84	1.66476	41.61	100.00	893.06	476.22
			333.47	1.33180	33.29	80.00	608.74	275.26
			250.10	.79908	19.97	60.00	283.58	33.48

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
11.0 BY 9.5	104.50	416.84	166.73	.31963	7.99	40.00	127.49	-39.23
			83.36	.06392	1.59	20.00	97.14	13.77
11.0 BY 10.0	110.00	396.00	396.00	1.59737	39.93	100.00	830.48	434.48
			316.80	1.27790	31.94	80.00	568.57	251.77
			237.60	.76674	19.16	60.00	268.98	31.38
			158.40	.30669	7.66	40.00	125.07	-33.32
			79.20	.06133	1.53	20.00	97.02	17.82
11.5 BY 7.5	86.25	505.04	505.04	2.02012	50.50	100.00	1265.35	760.30
			404.03	1.61610	40.40	80.00	847.61	443.58
			303.02	.96966	24.24	60.00	370.31	67.29
			202.01	.38786	9.69	40.00	141.81	-60.20
			101.00	.07757	1.93	20.00	97.83	-3.17
11.5 BY 8.0	92.00	473.47	473.47	1.88631	47.15	100.00	1116.82	643.34
			378.78	1.50904	37.72	80.00	752.33	373.54
			284.08	.90542	22.63	60.00	335.73	51.65
			189.39	.36217	9.05	40.00	136.11	-53.27
			94.69	.07243	1.81	20.00	97.56	2.86
11.5 BY 8.5	97.75	445.62	445.62	1.77259	44.31	100.00	998.52	552.90
			356.50	1.41807	35.45	80.00	676.42	319.92
			267.37	.85084	21.27	60.00	308.17	40.80

FOREST PLANTATION STOCKING TABLES

PLANTING DIMENSIONS IN FEET	NUMBER OF SQUARE FEET	THEORITICAL NUMBER OF TREES/ACRE	PLANTED SEEDLING ESTIMATE				NATURAL SEEDLING ESTIMATE	
			COMPUTED TREES/ACRE	AV. COUNT PER 4 QUADS	QUADS PERCENT	STOCK PERCENT	COMPUTED TREES/ACRE	DIFFERENCE TREES/ACRE
11.5 BY 8.5	97.75	445.62	178.25	.34033	8.50	40.00	131.56	-46.68
			89.12	.06806	1.70	20.00	97.34	8.21
11.5 BY 9.0	103.50	420.86	420.86	1.67898	41.97	100.00	906.60	485.73
			336.69	1.34319	33.57	80.00	617.43	280.73
			252.52	.80591	20.14	60.00	286.74	34.22
			168.34	.32236	8.05	40.00	128.01	-40.32
			84.17	.06447	1.61	20.00	97.16	12.99
11.5 BY 9.5	109.25	398.71	398.71	1.60548	40.13	100.00	837.87	439.16
			318.97	1.28438	32.10	80.00	573.32	254.34
			239.23	.77063	19.26	60.00	270.71	31.48
			159.48	.30825	7.70	40.00	125.36	-34.12
			79.74	.06165	1.54	20.00	97.03	17.29
12.0 BY 7.5	90.00	484.00	484.00	1.93057	48.26	100.00	1164.83	680.83
			387.20	1.54446	38.61	80.00	783.13	395.93
			290.40	.92667	23.16	60.00	346.92	56.52
			193.60	.37067	9.26	40.00	137.96	-55.63
			96.80	.07413	1.85	20.00	97.64	.84
12.0 BY 8.0	96.00	453.75	453.75	1.80507	45.12	100.00	1031.57	577.82
			363.00	1.44406	36.10	80.00	697.63	334.63
			272.25	.86643	21.66	60.00	315.87	43.62
			181.50	.34657	8.66	40.00	132.83	-48.66
			90.75	.06931	1.73	20.00	97.40	6.65
12.0 BY 8.5	102.00	427.05	427.05	1.70147	42.53	100.00	928.23	501.17
			341.64	1.36117	34.02	80.00	631.31	289.66
			256.23	.81670	20.41	60.00	291.78	35.55
			170.82	.32668	8.16	40.00	128.85	-41.96
			85.41	.06533	1.63	20.00	97.20	11.79

APPENDIX III

DERIVATION[1/] OF PROBABILITY EQUATIONS

1. The integrals of the area equations (Table III) are as follows:

$$A_1 = 4bx - 2\left[x\sqrt{r^2 - x^2} + r^2 \sin^{-1}\left(\frac{x}{r}\right)\right]_0^{xa} - 2\left[x\sqrt{r^2 - x^2} + r^2 \sin^{-1}\left(\frac{x}{r}\right)\right]_{xc}^{r}$$

$$A_3 = 4\left[x\sqrt{r^2 - x^2} + r^2 \sin^{-1}\left(\frac{x}{r}\right)\right]_0^{xj} - 8yj\,x\Big|_0^{xj}$$

$$A_4 = 2\left[x\sqrt{r^2 - x^2} + r^2 \sin^{-1}\left(\frac{x}{r}\right)\right] - 4yh\,x\Big|_{xe}^{xh}$$

2. The two curve equations for A_1 (figure 3) are:

$$x^2a + y^2a = r^2$$

$$(xa - a)^2 + (ya - b)^2 = r^2$$

After substituting $ya = \sqrt{r^2 - xa^2}$ into the second expression and substituting S for $a^2 + b$, xa can be expressed as:

$$\frac{aS \pm \sqrt{a^2S^2 + S\,(4b^2r^2 - S^2)}}{2S}$$

Points xa and xc can now be stated as:

$$xa = \frac{a}{2} - \frac{1}{2}\sqrt{a^2 + \frac{4b^2r^2}{S} - S}$$

$$xc = \frac{a}{2} + \frac{1}{2}\sqrt{a^2 + \frac{4b\,r^2}{S} - S}$$

Assign the following:

$$Q = \frac{1}{2}\sqrt{a^2 + \frac{4b^2r^2}{S} - S}$$

Then by substitution

$$xa = xe - Q$$
$$xc = xe + Q$$
where $xe = a/2$

1/Source, 6.

The following points are noted:

$$xh = \frac{1}{2}\sqrt{4r^2 - b^2}$$

$$xj = \frac{1}{2}\sqrt{4r^2 - S}$$

$$yh = b/2$$

$$yj = S/2$$

3. Assign the following:

$$F = x\sqrt{r^2 - x^2} + r^2 \sin^{-1}\left(\frac{x}{r}\right)$$

Area equation can now be stated as follows:

$$A_1 = 4bx \Big|_0^{xa} - 2F \Big|_0^{xa} - 2F \Big|_{xe}^{r}$$

$$A_2 = 1/2\left(\pi r^2 - A_1 - 3A_3 - 4A_4\right)$$

$$A_3 = 4F \Big|_0^{xj} - 4yj\ x \Big|_0^{xj} - 2A_4$$

$$A_4 = 2F \Big|_{xe}^{xh} - 4yh\ x \Big|_{xe}^{xh}$$

APPENDIX IV

FOREST PLANTATION PROBABILITY GENERATOR PROGRAM

```
FORTRAN IV G LEVEL 1, MOD 1          MAIN          DATE = 68149          15/42/05          PAGE 0001

                C                    WALTS  PLANTATION SURVEY PLOT PROBABILITY  GENERATOR
                C       VARIABLE     DEFINITION
                C       --------     ----------
                C       PRAD         RADIUS OF ROUND PLOT IN FEET
                C       FACT1        4 X PLOT RADIUS SQUARED
                C       FACT2        PLOT RADIUS SQUARED
                C       DIAG         DIAGONAL * IS SQ. RT. OF FACT1
                C       FACT3        MAXIMUM DIAGONAL OF PLANTING SPACING
                C       ------------------------------------------------------
0001                    COMMON PRAD
0002                    JOUNT=0
0003                    KOUNT=0
                C       READ PARAMETER CARD
0004            999     READ(5,1,END=2000)JIA1,JIA2,JINC,JLT1,JLT2,JLTIC
0005            1       FORMAT(6(I5))
0006                    IF(JIA1)2000,2000,9999
                C       DIA1 IS FIRST PLANTING DIMENSION
                C       DIA2 IS SECOND PLANTING DIMENSION
                C       DIAC  IS PLANTING DIMENSION INCREMENT
                C       PLT1  IS STARTING PLOT SIZE
                C       PLT2  IS STOPPING  PLOT SIZE
                C       PLTIC IS PLOT RADIUS INCREMENT
                C       ------------------------------
0007            9999    WRITE(6,1008)
0008                    WRITE(6,1010)
0009                    KOUNT=2
                C       --------------------------------
0010                    DO 1200 LIM=JLT1,JLT2,JLTIC
0011                    PRAD=LIM
0012                    PRAD=PRAD/100.
                C       --------------------------------
0013                    DO 1200 LLIM=JIA1,JIA2,JINC
0014                    KK=LLIM
0015                    KKK=JIA2
                C       --------------------------------
0016                    DO 1200 LLLIM=KK,KKK,JINC
0017                    IF (JOUNT-50)2,999,999
0018            2       JOUNT=JOUNT+1
0019                    A=LLIM
0020                    B=LLLIM
0021                    A=A/100.
0022                    B=B/100.
                C       NOW TEST PARAMETERS AND REJECT INCORRECT DIMENSIONS.
0023                    IF(A-PRAD)6,5,5
0024            5       IF(B-PRAD)6,8,8
0025            6       WRITE(6,1000)
0026                    WRITE(6,71)A,B,PRAD
0027            7       FORMAT('0',2HA=,F7.2,2X,2HB=,F7.2,31HA AND B MUST BE EQL OR GTR TH
```

```
FORTRAN IV G LEVEL 1, MOD 1          MAIN          DATE = 68149          15/42/05          PAGE 0002

                1AN,2X,F7.2)
0028                    KOUNT=KOUNT+3
0029                    IF(KOUNT-50)1200,71,71
0030            71      WRITE(6,1008)
0031                    WRITE(6,1010)
0032                    KOUNT=2
0033                    GO TO 1200
0034            8       S=A**2 + B**2
0035                    SRT=SQRT(S)
0036                    FACT1=4.*(PRAD*PRAD)
0037                    FACT2=PRAD*PRAD
0038                    FACT3=2*PRAD
0039                    IF(SRT-FACT3)11,11,9
0040            9       WRITE(6,1000)
0041                    WRITE(6,91)A,B,PRAD
0042            91      FORMAT(' ',3HA= ,F8.4,2X,3HB= ,F8.4,2X,12HPLOT RADIUS=,F8.4)
0043                    WRITE(6,10)SRT,FACT3
0044            10      FORMAT(' ',10HDIAGONAL =,F8.4,15HMUST NOT EXCEED,2X,F8.4)
0045                    KOUNT=KOUNT+4
0046                    IF(KOUNT-50)1200,101,101
0047            101     WRITE(6,1008)
0048                    WRITE(6,1010)
0049                    KOUNT=2
0050                    GO TO 1200
0051            11      XF=.5*A
0052            12      Q=.5*SQRT(A**2 + FACT1*B**2/S - S)
0053                    XA=XF-Q
0054                    XC=XF+Q
0055            13      XH=.5*SQRT(FACT1-B**2)
0056            14      XJ=.5*SQRT(FACT1-S)
0057            15      A1=4.0*B*XA - 2.0*(AREA(XA,A)-AREA(0.0,A1)
                2-2.0*(AREA(PRAD,A1-AREA(XC,A))
0058            16      A4=2.0*(AREA(XH,A)-AREA(XF,A)) - 2.0*B*(XH-XF)
0059            17      A3= 4.0*(AREA(XJ,A)-AREA(0.0,A1) -4.0*SRT*XJ-A4-A4
0060            18      A2=(3.14159270*FACT2-A1-3.0*A3-4.0*A4)/2.0
0061            19      TOT=A1+A2+A3+A4
0062            20      AB=A*B
0063                    ERR=(AB-TOT)*100.0/AB
                C       R1-4 ARE PROBABILITIES
0064                    R1=A1/TOT
0065                    R2=A2/TOT
0066                    R3=A3/TOT
0067                    R4=A4/TOT
0068                    TOTR=R1+R2+R3+R4
                C       POINTS X PROBABILITIES
0069                    PXP1=R1
0070                    PXP2=2.*R2
0071                    PXP3=3.*R3
```

```
FORTRAN IV G LEVEL 1, MOD 1            MAIN              DATE = 68149        15/42/05              PAGE 0003

0097                PXP4=A4,*R4
0098                SUMP=PXP1+PXP2+PXP3+PXP4
0099                AVPCT=SUMP/4.
0100          C     PRINT OUT SECTION ------------------------------------------------
0101                WRITE(6,1000)
0102          1000  FORMAT(' ',66H----------------------------------------------------
                   1----------)
0103                WRITE(6,1001)PRAD,A,B
0104          1001  FORMAT(' ',15HPLOT RADIUS IS ,1X,F6.2,2X,24HPLANTING DIMENSIONS AR
                   1E ,2X,F6.2,1X,2HBY,1X,F6.2)
0105                KOUNT=KOUNT+2
0106                WRITE(6,1002)
0107          1002  FORMAT('0',66HPTS   TOTAL AREA  PROBABILITY  PTS X PROBABILITY  PR
                   10BABILITY PCT.)
0108                J=1
0109                WRITE(6,1004)J,A1,R1,PXP1
0110          1004  FORMAT(' ',I2,3X,F11.5,2X,F9.6,8X,F10.6)
0111                J=2
0112                WRITE(6,1004)J,A2,R2,PXP2
0113                J=3
0114                WRITE(6,1004)J,A3,R3,PXP3
0115                J=4
0116                WRITE(6,1004)J,A4,R4,PXP4
0117                WRITE(6,1006)TOT,TOTR,SUMP,AVPCT
0118          1006  FORMAT('0',5HTOTAL,F11.5,2X,F9.6,8X,F10.6,8X,F11.6)
0119                WRITE(6,1000)
0120                KOUNT=KOUNT+10
0121          C     ------------------------------------------------------------------
0122                IF(KOUNT-50)1200,1007,1007
0123          1007  WRITE(6,1008)
0124          1008  FORMAT('1',9X,46HREPRODUCTION SURVEY PLOT PROBABILITY GENERATOR)
0125                WRITE(6,1010)
0126          1010  FORMAT(' ',9X,46H**********************************************)
0127                KOUNT=7
0128          1200  CONTINUE
0129          3000  GO TO 999
0130          2000  WRITE(6,2002)
0131          2002  FORMAT('0',16H***END OF JOB***)
0132                STOP
0133                END
```

```
FORTRAN IV G LEVEL 1, MOD 1            AREA              DATE = 63140        15/42/05              PAGE 0001

0001                              FUNCTION  AREA  (X,A)
0002                COMMON PRAD
0003                RSQ=PRAD*PRAD
0004          100   IF(X)2,1,2
0005              1 AREA=0.0
0006                RETURN
0007          2     Z=X/PRAD
0008          3     AREA=X*SQRT(RSQ-X*X)+RSQ*ATAN((1.0-SQRT(1.0-Z*Z))/Z)*2.
0009                RETURN
0010                END
```

APPENDIX V

EXAMPLE COMPUTER OUTPUT - FOREST PLANTATION PROBABILITY GENERATOR PROGRAM

REPRODUCTION SURVEY PLOT PROBABILITY GENERATOR
****

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.00 BY 8.50

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	2.43579	0.035820	0.035820	
2	34.53426	0.507857	1.015713	
3	21.25786	0.312616	0.937847	
4	9.77208	0.143707	0.574828	
TOTAL	67.99998	1.000000	2.564207	0.641052

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.00 BY 9.00

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	3.77838	0.052478	0.052478	
2	41.81964	0.580829	1.161656	
3	18.65927	0.259157	0.777470	
4	7.74268	0.107537	0.430149	
TOTAL	71.99997	1.000000	2.421751	0.605438

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.00 BY 9.50

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	5.34380	0.070313	0.070313	
2	48.84898	0.642750	1.285500	
3	15.90428	0.209267	0.627801	
4	5.90289	0.077670	0.310679	
TOTAL	75.99995	1.000000	2.294291	0.573573

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.00 BY 10.00

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	7.21431	0.090179	0.090179	
2	55.47549	0.693443	1.386886	
3	13.04015	0.163002	0.489005	
4	4.27011	0.053376	0.213505	
TOTAL	80.00006	1.000000	2.179573	0.544893

REPRODUCTION SURVEY PLOT PROBABILITY GENERATOR
****

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.50 BY 8.50

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	4.64363	0.064272	0.064272	
2	40.91525	0.566302	1.132603	
3	18.87216	0.261207	0.783620	
4	7.91889	0.108220	0.432880	
TOTAL	72.24994	1.000000	2.413372	0.603343

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.50 BY 9.00

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	7.01027	0.091637	0.091637	
2	47.15295	0.616378	1.232756	
3	16.29735	0.213037	0.639111	
4	6.03949	0.078947	0.315790	
TOTAL	76.50006	1.000000	2.279292	0.569823

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.50 BY 9.50

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	9.61426	0.119062	0.119062	
2	53.10518	0.657649	1.315297	
3	13.58092	0.168185	0.504554	
4	4.44971	0.055105	0.220419	
TOTAL	80.75006	1.000000	2.159329	0.539832

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.50 BY 10.00

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	12.54379	0.147574	0.147574	
2	58.61328	0.689568	1.379135	
3	10.77605	0.126777	0.380331	
4	3.06693	0.036081	0.144326	
TOTAL	85.00005	1.000000	2.051364	0.512841

REPRODUCTION SURVEY PLOT PROBABILITY GENERATOR
****

A= 7.00 B= 7.00A AND B MUST BE EQL OR GTR THAN 7.45

A= 7.00 B= 7.50A AND B MUST BE EQL OR GTR THAN 7.45

A= 7.00 B= 8.00A AND B MUST BE EQL OR GTR THAN 7.45

A= 7.00 B= 8.50A AND B MUST BE EQL OR GTR THAN 7.45

A= 7.00 B= 9.00A AND B MUST BE EQL OR GTR THAN 7.45

A= 7.00 B= 9.50A AND B MUST BE EQL OR GTR THAN 7.45

A= 7.00 B= 10.00A AND B MUST BE EQL OR GTR THAN 7.45

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 7.50 BY 7.50

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	0.00717	0.000128	0.000128	
2	11.31559	0.201171	0.402341	
3	27.97595	0.497362	1.492085	
4	16.95000	0.301340	1.205360	
TOTAL	56.24870	1.000000	3.099914	0.774978

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 7.50 BY 8.00

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	0.12364	0.002061	0.002061	
2	19.72252	0.328712	0.657423	
3	25.81566	0.430265	1.290794	
4	14.33763	0.238963	0.955851	
TOTAL	59.99944	1.000000	2.906129	0.726532

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 7.50 BY 8.50

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	0.31359	0.004919	0.004919	
2	28.14061	0.441422	0.882845	
3	23.41124	0.367236	1.101707	
4	11.88441	0.186423	0.745690	
TOTAL	63.74985	1.000000	2.735161	0.683790

REPRODUCTION SURVEY PLOT PROBABILITY GENERATOR
****

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 7.50 BY 9.00

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	0.66640	0.009576	0.009576	
2	36.44640	0.539946	1.079891	
3	20.80232	0.308182	0.924546	
4	9.60501	0.142296	0.569185	
TOTAL	67.50012	1.000000	2.583197	0.645799

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 7.50 BY 9.50

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	1.19330	0.016748	0.016748	
2	44.51236	0.624735	1.249470	
3	18.02908	0.253040	0.759120	
4	7.51523	0.105477	0.421908	
TOTAL	71.24997	1.000000	2.447244	0.611811

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 7.50 BY 10.00

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	2.03242	0.027099	0.027099	
2	52.20143	0.696019	1.392037	
3	15.13371	0.201783	0.605348	
4	5.63245	0.075099	0.300397	
TOTAL	75.00000	1.000000	2.324881	0.581220

PLOT RADIUS IS 7.45 PLANTING DIMENSIONS ARE 8.00 BY 8.00

PTS	TOTAL AREA	PROBABILITY	PTS X PROBABILITY	PROBABILITY PCT.
1	1.24162	0.019400	0.019400	
2	27.12627	0.423847	0.847694	
3	23.65595	0.369639	1.108916	
4	11.97530	0.187114	0.748454	
TOTAL	64.00014	1.000000	2.724464	0.681116

APPENDIX VI

PROPOSED STOCKING SURVEY SYSTEM FIELD INSTRUCTIONS

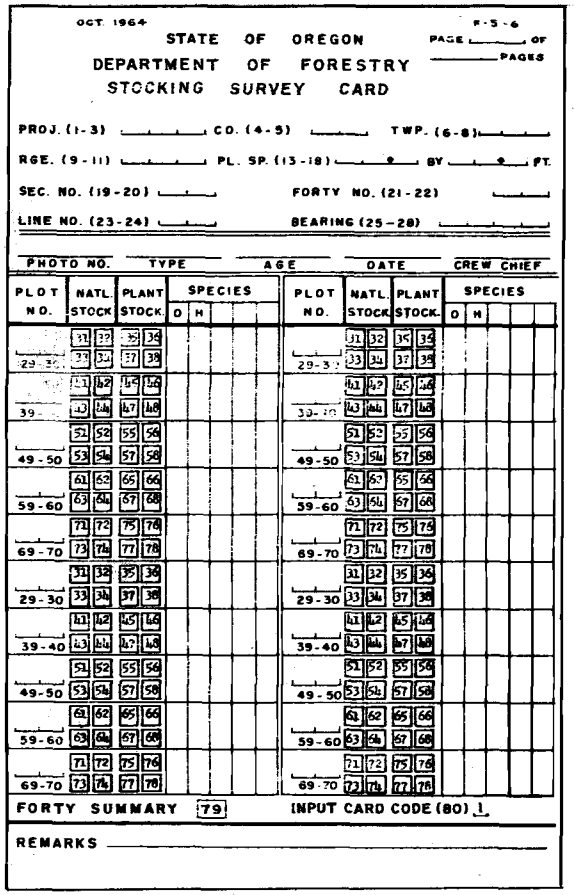
In order to maintain a more accurate plantation inventory, a survey system was developed utilizing a data analysis based on a sequential sampling. The field survey employs a four-milacre (7.45-foot radius) circular plot that is divided into milacre quadrants. The plots are spaced at one chain intervals along a paced line and the normal survey intensity is two lines per forty-acre subdivision; however, provisions were made in the computer program to process as many as eight lines.

This survey system is designed to enable the field data to be readily analyzed by an I.B.M. Computer System. The field cards are designed to be easily read by the key punch operator and to facilitate the transfer of data to I.B.M. punch cards. In order to eliminate punch errors, the survey personnel must carefully fill out the field forms using the rules and instructions itemized in the General Rules, Stocking Survey Card Heading Instructions and Stocking Survey Card Plot Information.

General Rules

1. All numbered spaces must be filled in with either a number or letter. Zeros should be used to fill in spaces in front of one or two-digit numbers used in a multiple space blank. An example of this would be the number 1 should be written as 01 to fill in two spaces or 001 to fill in three spaces.

2. In each 40-acre subdivision the north - south survey lines will be numbered from 1 to 4 starting at the northwest corner and moving to the east. The east - west lines are numbered from 5 to 8 starting at the northwest corner and numbering to the south. See Diagram B (Figure 8).



OCT. 1964

STATE OF OREGON

DEPARTMENT OF FORESTRY

STOCKING SURVEY CARD

F-5-6

PAGE ____ OF ____ PAGES

PROJ. (1-3) ____ CO. (4-5) ____ TWP. (6-8) ____

RGE. (9-11) ____ PL. SP. (13-18) ____ BY ____ FT.

SEC. NO. (19-20) ____ FORTY NO. (21-22) ____

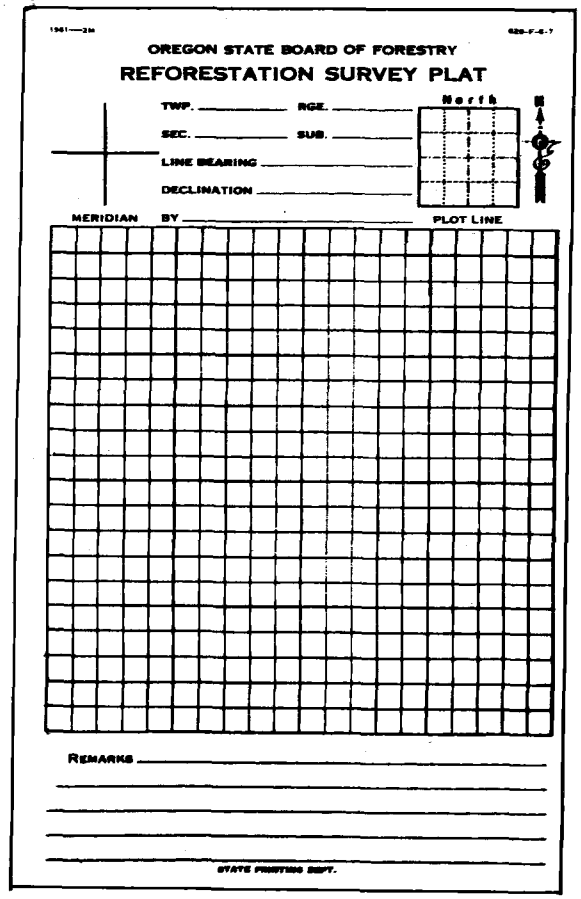
LINE NO. (23-24) ____ BEARING (25-28) ____

PHOTO NO. ____ TYPE ____ AGE ____ DATE ____ CREW CHIEF ____

PLOT NO.	NATL. STOCK	PLANT STOCK	SPECIES D	SPECIES H	PLOT NO.	NATL. STOCK	PLANT STOCK	SPECIES D	SPECIES H
	31 32	35 36				31 32	35 36		
29-30	33 34	37 38			29-30	33 34	37 38		
	41 42	45 46				41 42	45 46		
39-40	43 44	47 48			39-40	43 44	47 48		
	51 52	55 56				51 52	55 56		
49-50	53 54	57 58			49-50	53 54	57 58		
	61 62	65 66				61 62	65 66		
59-60	63 64	67 68			59-60	63 64	67 68		
	71 72	75 76				71 72	75 76		
69-70	73 74	77 78			69-70	73 74	77 78		
	31 32	35 36				31 32	35 36		
29-30	33 34	37 38			29-30	33 34	37 38		
	41 42	45 46				41 42	45 46		
39-40	43 44	47 48			39-40	43 44	47 48		
	51 52	55 56				51 52	55 56		
49-50	53 54	57 58			49-50	53 54	57 58		
	61 62	65 66				61 62	65 66		
59-60	63 64	67 68			59-60	63 64	67 68		
	71 72	75 76				71 72	75 76		
69-70	73 74	77 78			69-70	73 74	77 78		

FORTY SUMMARY 79 INPUT CARD CODE (80) 1

REMARKS ____



1961—2M 628-F-6-7

OREGON STATE BOARD OF FORESTRY

REFORESTATION SURVEY PLAT

TWP. ____ RGE. ____

SEC. ____ SUB. ____

LINE BEARING ____

DECLINATION ____

North

MERIDIAN BY ____ PLOT LINE

REMARKS ____

STATE PRINTING DEPT.

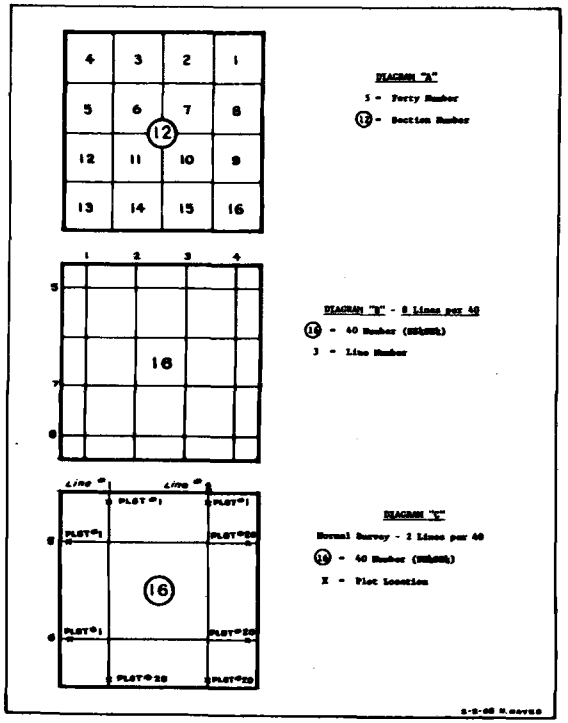


Figure 8. Field survey cards.

3. The normal survey of two lines per 40-acre subdivision will use numbers 1 and 2 for the north - south lines or 5 and 6 for east - west lines. See Diagram C (Figure 8).

4. Forties will be numbered consecutively starting at the NE¼NE¼ as number 1 then across the section to number 4 (NW¼NW¼) continuing down and across the section through all forties to number 16 (SE¼SE¼). See Diagram A (Figure 8).

5. All lines will originate at the north or west edge of the area to be surveyed; therefore, plot number 1 for each line will also be at the north or west edge of the survey area or 40-acre subdivision. See Diagram C (Figure 8).

6. A map sheet (Form F-6-7) will be used for each 40-acre subdivision surveyed. In addition a stocking survey card Form F-5-6 (Figure 8) will be used for each line in the 40-acre subdivision. A normal survey (two lines per 40) would consist of one Form 629-F-6-7 and two F-5-6 forms.

7. When surveying irregular areas, be sure to record all known information about the area location such as township, range, section and the true bearing of the plot line. Use the numbers 17 - 99 for the forty number (21-22).

Stocking Survey Card Heading Instructions

1. Page: To be filled out in the office after completion of each project.

2. Proj. (1-3): The forester in charge of surveys will assign a project number to each project. The field personnel must fill in the spaces (1 to 3) with the proper number. Example: number 15 would be written as 015 in order to fill all spaces.

3. Co. (4-5): Leave blank.

4. Twp. (6-8): Township examples are: T1N would be 01N; T21S would be 21S. Complete in the field.

5. Rge. (9-11): Range blank would be completed in the same manner as Twp.

6. Pl. Sp. (13-18): Planting spacing. Spacing will be determined and written in by office personnel. Spacing dimensions are obtained by using the actual trees per acre planted and matching the spacing measurements to fit the trees per acre actually planted. All measurements are written to the nearest tenth of a foot. Examples: 681 trees per acre would be 08.0 by 08.0 ft. 363 trees per acre could be written as 10.0 by 12.0 ft.

7. Sec. No. (19-20): Section number to be completed by field personnel. Example: Sections 1 to 9 would be written 01 or 09; all other section numbers utilize both spaces in the blank.

8. Forty No. (21-22): To be completed by field personnel. Numbers are assigned to each forty as per Diagram A. Example: 40-acre subdivision number 4 is the NW¼NW¼ and would be written as 04 to fill both spaces in the blank.

9. Line No. (23-24): Line number is predetermined by the system described in General Rules - Diagram B and C. Both spaces in the blank must be filled in by field personnel. Example: line 2 would be written as 02.

10. Bearing (25-28): Bearing is the true bearing of the line recorded in the usual form except that with single digit bearings a zero will precede the digit. Example: N8E would be N08E. To be filled in by field personnel.

11. Photo No.: This space can be filled in either by office or field personnel whenever photos are available.

12. Type: Use inventory type designation such as D1, S1 or NF1. Example: D1 would be Douglas fir reproduction 0" to 5" D.B.H. This space to be completed in the office.

13. Age: The date the plantation was established is to be recorded in this space. Example: a plantation that was established in the 1961-62 season would be 1962. This space to be completed in the office.

14. Date: Date the survey line is run. Field personnel.

15. Crew Chief: Name of the person who is actually running the survey line.

Stocking Survey Card Plot Information

1. Plot numbers will be recorded using both blank spaces provided; single digit numbers will be preceded by a zero. Example: plot number 6 will be recorded as 06.

2. Pencil marks for stocking must remain inside the quadrant boxes. Use an "X" mark to indicate a stocked quadrant. Record natural or planted stocking and species. If there is both natural and planted trees in the same quadrant, mark both on the card.

3. Plots that are located in roads, rock outcrops or other non-planted areas should not be recorded. A number should be assigned but not written in; therefore, only marks should be a dash in the species column and be used to keep count of the plots and distance paced along the line.

4. Non-stocked plots should be numbered and a line drawn through the species column to indicate no stocking present and that the plot has been completed.

5. Forty Summary (79)

   To be marked (x) if a forty summary is to be included in the I.B.M. report.

6. Input Card Code (80)

   Machine code information.

7. Remarks: Space for comments about survey or area such as animal damage, brush encroachment, etc.