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The O. and C. Pine Survey and the Financial Analysis

by

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Introduction

The O. and C. Pine Survey is used in the location of areas for future blister rust control. All areas growing white pine species do not support enough trees of these species to make it financially possible to eradicate all the area so some method must be devised to secure this information. The method which the O. and C. has made into a workable system is the Pine Survey. The Pine Survey crew is the initial organization on the proposed area for the eradication of blister rust. This crew gathers all the field information on the area for the financial analysis to be made later.

The financial analysis is based on the following theory. Money tends to flow toward those investments which, having comparable risk, produce the greatest return. Similarly agriculture land is generally put to that use which shows greatest return to invested capital. This flow of capital toward investments netting higher return is commonly referred to as the "alternative use principle of capital investment."

The principle is quite applicable in ascertaining the desirability of Blister Rust Control. It might be stated as follows: Forest land should be used for the production of white or sugar pine so long as the net return on the

production of the white pine species exceeds the net return from the same land should the same land be used to grow another species.

Use of this principle is made in the analysis of blister rust control. They use a survey method to obtain the data to see if the area will support blister rust eradication.

This survey is important so that there will not be any area eradicated when the future crop of forest products will pay for the eradication.

Before going into the details of this method, it is advisable that a general sketch of Blister Rust, its life cycle and history, be given to furnish the reader with a background of this disease.

The fungosis disease of White Pine Blister Rust tends to destroy the western white pine of the Inland Empire and the sugar pine of California and southern Oregon. Contrary to some preceding ideas, this disease can be controlled. The fact that a secondary host plant is necessary to complete the life cycle of the fungus which causes the disease gives us a means for effective control. The rust cannot spread from pine to pine as it must go through a state of development on such intermediate host plants as currant or gooseberry bushes. While this disease can spread long distances from pine to Ribes, a common name for the foremen-tioned host plants known in control work, the spread from Ribes to pine can take place over relatively short distan-

ces varying from a few hundred yards up to one mile, according to the infecting power of the species of Ribes present. The fact that it is impossible for infection to spread from pine to pine, coupled with the short distance spread from Ribes to pine makes possible the control of this disease by the eradication of Ribes from within and around any stand of pine which warrants protection.

Blister rust is slow but sure in its action. While it may take twenty or thirty years to kill mature pine, the younger stands will be wiped out in a much shorter time unless control measures are applied. The rust first appears on pines as a yellowish discoloration of bark accompanied by a slight swelling. The canker continues to develop and spread until the trunk or branch is killed by girdling, and some branch cankers will spread to the bole and kill the tree. While this is taking place, the cankers are scattering Ribes infectins spores to the four winds through a fruiting process. Each spring small whitish sacs containing a reddish rust push their way through the diseased area of the bark and burst open, liberating millions of spores. These spores have relatively thick walls and live for a long time, infecting Ribes to a distance of two-hundred miles or more.

The rust appears on the under surface of the Ribes leaf as orange-colored pustules. This spring and early summer stage produces a spore which can spread from leaf to leaf or locally from brush to brush. Later in the summer

small hair-like structures grow from the diseased area of the leaf. These hair-like structures produce the only type of spore which can infect the pine. These spores have extremely thin walls and live for only a few minutes, which explains the short distance spread from Ribes to pine. The disease enters the pine through the needles and grows in the inner bark becoming visible from one and one-half to three years after infection.

Blister rust is commonly believed to have originated on Pinus Ambra in Siberia and was first discovered in the Baltic provinces of Russia in 1854 on both Ribes and pine. From there it spread generally over the range of pine in western Europe where during the middle of the 19th century the white pine of eastern America was used extensively in reforesting. Damage from blister rust has been so severe that the use of white pines in reforesting and the growing of white pines for profit has been largely given up.

While blister rust was taking such heavy toll in Europe, the planting of white pine in the eastern United States and Canada had increased so rapidly that our nurseries could not supply the demand. Through the importation of white pine nursery stock early in the present century, blister rust gained a foothold in eastern America. Since its discovery in 1909, blister rust has spread generally over the Northeastern states, the Southern Appalachian states, and the Lake states.

The spread of blister rust to the West from eastern infection centers was prevented by the strict enforcement of quanrantine laws which prohibited the shipment of host plants to points west of the Mississippi. The rust became established in the West, however, in the same way as in the East -- by importation of European nursery stock. Since its introduction, blister rust has spread eastward through the interior of British Columbia to the Inland Empire and southward through the coastal region of Washington, Oregon, and northern California.

Although no serious attempt to control this disease has been made in Europe, practical and effective control measures have been instituted in all the valuable white pine stands in the United States. Several years of experimentation and development have resulted in practical control methods. The proper application of these methods and adequate follow-up maintenance work will result in protecting our valuable stands of white pine.

The Pine Survey

The unit for conducting pine surveys is the section in which the examining man usually works alone. Four strips are run in a cardinal direction through the section in the course of which the different timber types and site class for each timber type is determined. In addition, all sugar pine and associate seedlings and trees by eight diameter classes in 1/10 and 1/4 acre plots, taken every five chains are recorded. The total Ribes bushes found in the plots are also recorded. Distances are measured by pacing and courses are determined by a box compass. The strips are run at right angles to the drainages as near as a cardinal direction will permit in order to obtain a representative sample.

The first step which is taken in preparation for running a strip, the chief of the pine survey party, aided by the examiners, will locate some corner of the section and run out the section lines to the other corners. By doing this phase of the survey previous to running the strips, it hastens this work thereby giving the individual examiners no more time to run his strip and obtain the necessary information for his strip. It is necessary for the chief of the party to keep the section lines run out in advance of the crew to speed up the operation. White string is run between section corners to indicate the actual section line. All the corners must be found, if possible, and those that are found should be identified by posting with General Land

Office corner location notices. When a section corner cannot be found, an assumed corner may be used providing that it is thus marked.

In the field, the data to be taken should be the number of trees and reproduction in 1/10 and 1/4 acre plots by three-inch diameter classes. The seedlings in the 0-3 inch diameter class are to be counted and recorded in 1/10 acre plot only. Trees with diameters over three inches will be counted in the entire 1/4 acre plot.

A map will be made in the field showing the location of all the cultural features which are important, such as ridges, streams, trails, roads, and buildings. The timber types (1) will be mapped on during the process of running the strip. The site classes of these timber types will also be included on this map.

A total count of all Ribes bushes will be made and recorded of those Ribes found in the entire 1/4 acre plot. Special plots should be made at streams if no other plot is taken there.

A log quality analysis will be made of all sugar pine and associate species over 27-inch diameter breast high found in the 1/4 acre plot. The information to be obtained for all pine and white fir trees over 27 inches D.B.H. (diameter breast high) will include the diameter of the tree D.B.H., log analysis for each 16-foot log, and log height of tree up to an 8-inch top. For all other trees the informa-

(1) Appendix Table I.

tion required will be the same, except the log analysis will be made on the basis of a 32-foot log instead of the 16-foot log used for pine and white fir.

The plots will be taken every five chains on each strip, the first and last plots will be taken 2-1/2 chains from the section lines. This will make sixteen plots or four acresof plots to a continuous mile of strip. The plots are numbered consecutively one to eight for each half mile of strip. There will be four strips run on each section, twenty chains apart. The first strip will start ten chains from the section corner, the second thirty chains, and so on until all four strips are completed. Location tags will be placed at the beginning and end of each strip and in the center of each plot for future reference, if necessary.

The eight three-inch diameter classes which will be used in recording the data obtained from the 1/10 and 1/4 acre are as follows:

0 - 3" -- class to be counted and recorded on tally sheets in 1/10 acre plots only.

4 - 7" -- class to be counted and recorded on tally sheets in the 1/4 acre plot.

8 - 11" -- same as 4 - 7" class.

12 - 15" -- same

16 - 19" -- same

20 - 23" -- same

24 - 27" -- same

27" and up -- recorded on tally sheets according to the log quality analysis.

In the running of a strip an off-set of ten chains is made along the section line (string), then the first strip running in a cardinal direction and through the middle of the first tier of 40's is begun.

Before beginning the strip, the data sheet must be properly filled in to avoid mistakes in recording the information. The location tag is then filled in properly and attached to the section line, the string line run out previously. By taking a shot with the compass in a cardinal direction, 2-1/2 chains is paced to the first plot. A location tag is then placed in a position where it can be seen from the entire 1/4 acre plot which has a radius of 58.88 feet. All reproduction of from 0 - 3 inches in diameter within a radius of 37.24 feet or on the 1/10 acre plot is recorded on the data sheet. All reproduction or trees over 3 inches in diameter on the entire 1/4 acre plot is then recorded on the data sheet. Log analysis (1), tree diameter, and tree height to eight-inch top are obtained for all trees in the 1/4 acre plot over 27 inches D.B.H. Plot number two is located five chains farther on in the same direction. The same procedure is followed on the remaining plots in the strip.

When all the data has been taken in plot #8 and recorded, two and one half chains more is paced out. This point should be on the 1/4 section line. The place is marked and a careful note is made of the immediate vicinity so that the place may be found again. An offset of ten chains

(1) Appendix II.

is paced back and correction for alignment and distance are made and noted on the tally sheet in the lower left-hand corner.

Since only eight plots can be recorded on one tally sheet, a new tally sheet is used for the second half mile. When the last half mile of strip is completed, a tie in is made to the section corner with appropriate corrections made, if any are necessary. After the tie in has been made to the section corner, thirty chains is paced off and marked. Then ten more chains is paced along section line to the 1/4 corner, then the ten chains is paced back to the thirty-chain mark and a new strip is started. The second strip is twenty chains from the first and runs parallel to it. The data is recorded in the same as on the first strip. When the end of the second strip is reached, a tie is made to the 1/4 corner and correction, if any, is noted on the data sheet.

The total number of Ribes bushes found in each 1/4 acre plot are counted and recorded in a column provided for that purpose on the tally sheet. It is well that the examiner becomes acquainted with the different varieties of Ribes. At times it may be necessary to list all Ribes found in the plots by species.

Very few plots will actually fall on the streams, therefore, as these streams are crossed, notation will be made on the back of the tally sheet as to the population of Ribes by species found on the streams. If the plots fall on the

stream, this procedure will not be necessary.

In making the maps, a section corner which is found is marked with an "X" on the tally sheet and on the map a corner which is not found is marked with an "O". The different type boundries are observed along the strip and recorded lightly on the map in red. Quite often the timber types follow exposures and ridges. The cultural features such as main ridge tops, streams, roads, trails, etc., are recorded on the map as they are encountered on the strip. The type boundries and cultural features are connected up with the succeeding strips run in a section on a master map. Each strip has a number with an arrow indicating the direction in which the strip was run at the edge of the type map, and a corresponding arrow and number is placed on the tally sheet.

Before going into the field, if sections which adjoin the one you are assigned to have been completed, trace lightly upon your map the points at which type boundries, roads, trails, streams, etc., enter the section, and label these types. This will facilitate typing and aid greatly in the field work.

After the field work has been completed on several adjacent sections and the master maps made, there must be a jibe-matching of type boundries, roads, trails, streams, etc., between sections. This must be done as soon as adjacent sections are progressively worked and while the country is still fresh in the minds of the examiners.

In the determination of the site, the age and height of the dominate and the co-dominate trees must be known. The height can be measured by an abney level and the age can be determined by the use of an increment borer. This information is then plotted on a pre-drawn site curve corresponding to the same species and the site read off of the curve. This information is then placed on the field map for future reference.

In field checking and inspection each pine examiner's work will be checked progressively during the season. This work is usually assigned to the foreman in charge or a person specially fitted for the job. In addition to this the party foreman is responsible for assigning work to the members of the party, keeping the section lines run out in advance of the examiners, ordering food supplies, and the general administration of the camp and survey party.

It is important and essential that accurate field data is obtained. By using incorrect data the whole purpose of the pine survey is destroyed. The most frequent errors which occur are: using a circle which is too small or too large and under or over counting the small trees in the plots. It is necessary that each examiner learn the definition of types and symbols to prevent mistakes and also in learning to identify the species of Ribes.

Financial Analysis

After all the field work has been done it is then necessary to make an analysis of the area with reference to the value of the timber upon the land. This is the final aspect of this method as the decision on whether to work the area for blister rust or not.

The percentage of stocking is figured up by tabulating the number of trees in each diameter class. The average of the site classes is also determined. With these two figures obtained the M.A.I., mean annual increment, is figured out so that the value of the timber can be determined.

The growth information for sugar pine was found to be unavailable. It was therefore necessary to utilize growth information of a second species believed to have comparable growth characteristics. The species which was selected to use the comparable growth information was Ponderosa pine.

The species Douglas fir was used as the laternative species on the area. Any other species which might come in on the area concerned could have been used. In fact, this analysis to be complete should present data for each species which commonly grows in the mixed stand belt occupied by the sugar pine. The species which is apt to come in in place of sugar pine could then be used as the alternative species.

The lands concerned were assumed to have sufficient cover to permit continuous cutting. This does not mean that each acre is so conditioned, rather refers to the unit as a whole. (The resource survey information justifies this

assumption.)

Comparable costs for protection and administration were used for each species. Additional costs of $6 per acre for initial eradication and six cents per acre for maintenance were charged to sugar pine production. This analysis to be complete should consider other control and maintenance costs.

Conservative prices per M were assumed to be $1.25 for Douglas fir and $4.00 for sugar pine. Raising or lowering of costs, which are comparable for each species, would not affect the determination of species to grow because, again, it is a comparison of values which is important.

The following examples illustrate how the financial analysis is figured out or determined. The answer arrived at, the land which will or will not be eradicated because of value, shows that the forest land will only be used for the production of the white pine timber only as long as the net returns in the production of the white pine species exceed the net return from the same land should such land be used to grow another species.

The prepared graph at the end shows approximately the stocking percentage required for the various site classes to justify blister rust work or eradication.

Site Index 60 - Rotation 200 Years

Stand Table

Diameter	100% stock	80% stock	60% stock	40% stock	20% stock
1- 3"	710	568	426	284	142
4- 7"	200	160	120	80	40
8-11"	70	56	42	28	14
12-15"	35	28	21	14	7
16-19"	15	12	9	6	3
20-23"	5	4	3	2	1
24-27"	1	1	1	-	-
over 27"	-	-	-	-	-

Value Computation

A. Sugar Pine

1. M.A.I./ac. trees 12" and larger 130 bd. feet (assumed P.P. comparable to S.P.)

2. Stumpage value sugar pine estimated to be $4.00 per M

3. Assumed 10¢/ac. cost of fire protection and administration.

4. Assumed $6 per acre initial eradication cost 6¢/ac. maintenance.

5. Present value:

a. 100% stocking: $Vo = \frac{(.130 \times \$4.00) - \$.16 \text{ adm.\& M}}{.03} - \$6.00 = \$6.00$

b. 80% stocking: $Vo = \frac{(.104 \times \$4.00) - \$.14 \text{ adm.\& M}}{.03} - \$6.00 = \$3.20$

c. 60% stocking: $Vo = \frac{(.078 \times \$4.00) - \$.12 \text{ adm.\& M}}{.03} - \$6.00 = \$ .40$

d. 40% stocking: $Vo = \frac{(.052 \times \$4.00) - \$.10 \text{ adm.\& M}}{.03}$

$-\$6.00 = -\$2.40$

e. 20% stocking: $Vo = \frac{(.026 \times \$4.00) - \$.08 \text{ adm.\& M}}{.03}$

$- \$6.00 = -\$5.20$

B. Douglas fir

1. M.A.I./ac. (Medium Site V at 160 yrs.) trees 12" and larger, 150 bd. feet; assumed 10¢/ac. adm. and protection.

2. Stumpage value assumed to be $1.25 per M.

3. Present value:

a. 100% stocking: $Vo = \frac{(.150 \times \$1.25) - \$.10 \text{ adm.}}{.03}$

$= \$2.92$

b. 80% stocking: $Vo = \frac{(.120 \times \$1.25) - \$.08 \text{ adm.}}{.03}$

$= \$2.33$

c. 60% stocking: $Vo = \frac{(.090 \times \$1.25) - \$.06 \text{ adm.}}{.03}$

$= \$1.75$

d. 40% stocking: $Vo = \frac{(.060 \times \$1.25) - \$.04 \text{ adm.}}{.03}$

$= \$1.16$

e. 20% stocking: $Vo = \frac{(.030 \times \$1.25) - \$.02 \text{ adm.}}{.03}$

$= \$ .58$

Site Index 100 - Rotation 120 Years

Stand Table

Diameter	100% stock	80% stock	60% stock	40% stock	20% stock
1- 3"	105	84	63	42	21
4- 7"	102	82	61	41	20
8-11"	55	45	34	22	11
12-15"	34	27	20	14	7
16-19"	18	14	11	7	4
20-23"	9	7	5	4	2
24-27"	2	2	1	1	-
over 27"	-	-	-	-	-

Value Computation

A. Sugar Pine

1. M.A.I./ac. trees 12" and larger, 370 bd. ft. (assumed ponderosa pine comparable to sugar pine).

2. Stumpage value sugar pine estimated to be $4 per M

3. Assumed 10¢/ac. cost of fire protection and administration.

4. Assumed $6 per acre initial eradication cost; 6¢/ac. maintenance.

5. Present value:

a. 100% stocking: $V_o = \frac{(.370 \times \$4) - \$.16 \text{ adm. \& M}}{.03} - \$6.00 = \$38.00$

b. 80% stocking: $V_o = \frac{(.296 \times \$4) - \$.14 \text{ adm. \& M}}{.03} - \$6.00 = \$28.80$

c. 60% stocking: $V_o = \frac{(.222 \times \$4) - \$.12 \text{ adm. \& M}}{.03} - \$6.00 = \$19.60$

d. 40% stocking: $Vo = \frac{(.148 \times \$4) - \$.10 \text{ adm. \& M}}{.03} - \$6.00 = \$10.40$

e. 20% stocking: $Vo = \frac{(.074 \times \$4) - \$.08 \text{ adm. \& M}}{.03} - \$6.00 = \$1.20$

B. Douglas fir (High Site IV at 140 years)

1. M.A.I./ac. trees 12" and larger 430 bd. ft. (Site Index 120)

2. Assumed 10¢/ac. administration and protection.

3. Assumed stumpage value to be $1.25 per M

4. Present Value:

a. 100% stocking: $Vo = \frac{(.430 \times \$1.25) - \$.10 \text{ adm.}}{.03} = \$14.44$

b. 80% stocking: $Vo = \frac{(.344 \times \$1.25) - \$.08 \text{ adm.}}{.03} = \$11.66$

c. 60% stocking: $Vo = \frac{(.258 \times \$1.25) - \$.06 \text{ adm.}}{.03} = \$8.75$

d. 40% stocking: $Vo = \frac{(.172 \times \$1.25) - \$.04 \text{ adm.}}{.03} = \$5.83$

e. 20% stocking: $Vo = \frac{(.086 \times \$1.25) - \$.02 \text{ adm.}}{.03} = \$2.92$

Site Index 140 - Rotation 100 years

Stand Table

Diameter	100% stock	80% stock	60% stock	40% stock	20% stock
1- 3"	31	25	19	12	6
4- 7"	85	68	51	34	17
8-11"	75	60	45	30	15
12-15"	56	45	34	22	11
16-19"	36	29	22	14	7
20-23"	20	16	12	8	4
23-27"	8	6	5	3	2
over 27"	2	2	1	1	-

Value Computation

A. Sugar Pine

1. M.A.I./ac. trees 12" and larger 700 bd. ft. (assumed ponderosa pine comparable to sugar pine)

2. Stumpage value sugar pine estimated to be $4 per M

3. Assumed 10¢/ac. cost of fire protection and administration.

4. Assumed $6 per ac. initial eradication cost; 6¢/ac. maintenance.

5. Present value:

a. 100% stocking: $Vo = \frac{(.700 \times \$4) - \$.16 \text{ adm. \& M}}{.03} - \$6.00 = \$82.00$

b. 80% stocking: $Vo = \frac{(.560 \times \$4) - \$.14 \text{ adm. \& M}}{.03} - \$6.00 = \$64.00$

c. 60% stocking: $Vo = \frac{(.420 \times \$4) - \$.12 \text{ adm. \& M}}{.03} - \$6.00 = \$46.00$

d. 40% stocking: $Vo = \frac{(.280 \times \$4) - \$.10 \text{ adm. \& M}}{.03} - \$6.00 = \$28.00$

e. 20% stocking: $Vo = \frac{(.140 \times \$4) - \$.08 \text{ adm. \& M}}{.03} - \$6.00 = \$10.00$

f. 10% stocking: $Vo = \frac{(.070 \times \$4) - \$.07 \text{ adm. \& M}}{.03} - \$6.00 = \$1.00$

B. Douglas fir

1. M.A.I./ac. (Medium Site II at 100 years; tree 12" and larger, 900 bd. ft.)

2. Assumed 10¢/ ac. administration and protection.

3. Stumpage value assumed to be $1.25 per M

4. Present value:

a. 100% stocking: $Vo = \frac{(.900 \times \$1.25) - \$.10 \text{ adm.}}{.03} = \$34.16$

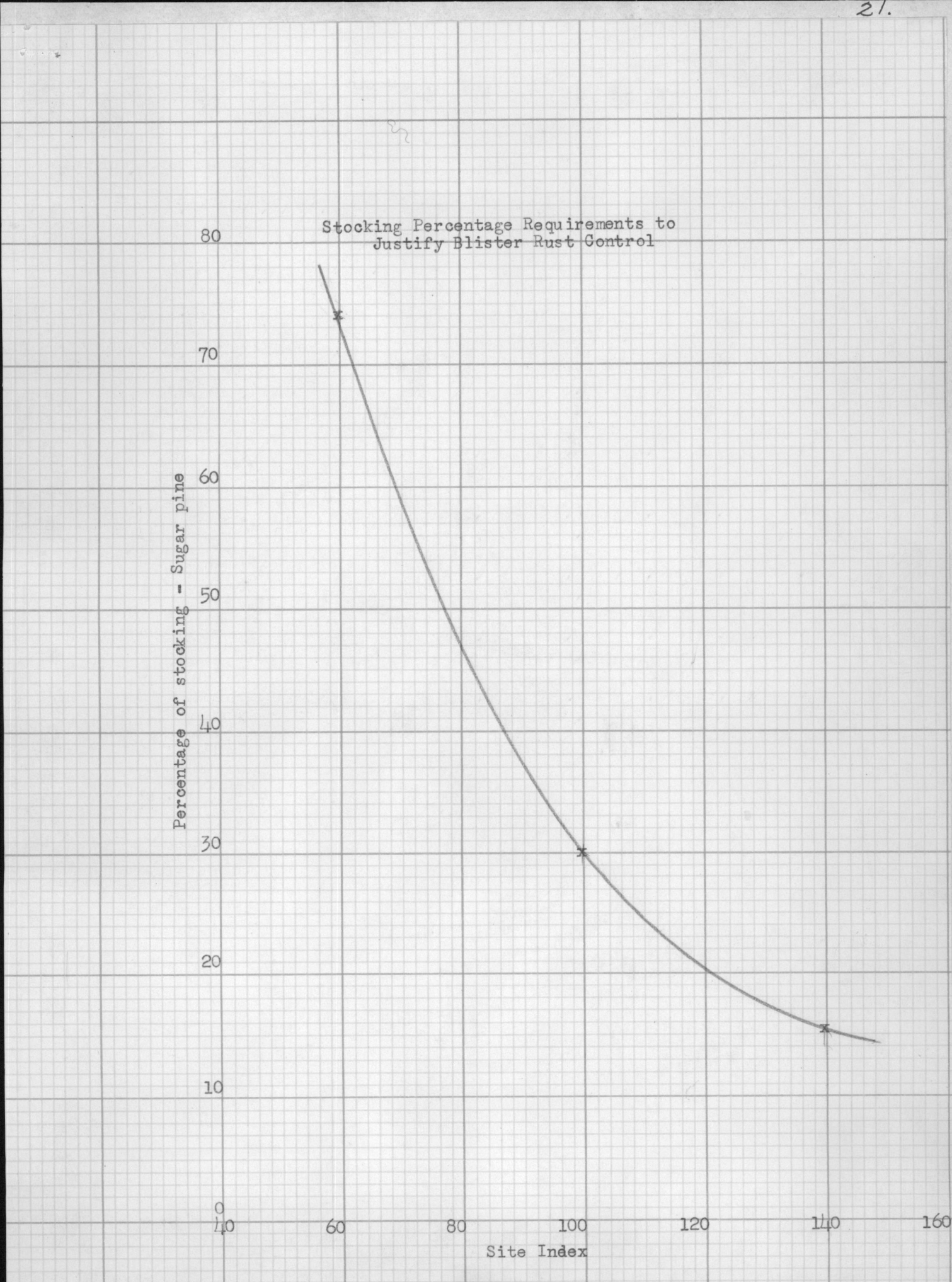
b. 80% stocking: $Vo = \frac{(.720 \times \$1.25) - \$.08 \text{ adm.}}{.03} = \$27.33$

c. 60% stocking: $Vo = \frac{(.540 \times \$1.25) - \$.06 \text{ adm.}}{.03} = \$20.50$

d. 40% stocking: $Vo = \frac{(.360 \times \$1.25) - \$.04 \text{ adm.}}{.03} = \$13.66$

e. 20% stocking: $Vo = \frac{(.180 \times \$1.25) - \$.02 \text{ adm.}}{.03} = \$6.83$

f. 10% stocking: $Vo = \frac{(.090 \times \$1.25) - \$.01 \text{ adm.}}{.03} = \$3.42$


Stocking Percentage Requirements to
Justify Blister Rust Control
Percentage of stocking - Sugar pine
80
70
60
50
40
30
20
10
0
40
60
80
100
120
140
160
Site Index

Conclusion

As I have stated before, blister rust disease can be controlled. This brings into the picture the valuable stands of Western White Pine and Sugar Pine stand in danger of being entirely eliminated by this nemis of white pine. As it is impossible to eradicate all the Ribe bushes, why not go on the principal of eradicating the Ribes bushes within the area of these valuable timber stands and in the immediate vicinity of these stands? In this way we can save our present stands and also provide for future sustaining yield forests.

The pine survey method and the financial analysis explained in the text show how only areas which will support the cost of eradication will be the ones selected to be cleansed of this destructive disease. In other words, no eradication will be done on any area which in the long run will not pay for the initial cost of eradication.

Since this last summer, a new type of data sheet has been set up which I believe will increase the efficiency and accuracy of the field work. Instead of just numbering from 1 - 8 for the various diameter classes, each class has been typed on the sheet so reference to another sheet for the diameter limitations will not be necessary. This will speed up the work somewhat and also be another measure insuring the accuracy of the work. Another place has been added and that

is a space for the Ribes bushes so that they correspond to the plot in which they were found.

Last summer I gained a great deal of my knowledge and information about this survey by being the foreman of the pine survey crew operating out of Medford, Oregon. The rest of my information came from the O. and C. office in Portland from Mr. Ross A. Younglord.

Appendix I

Pine Survey Types

A. Non-forest lands types

1. (a) Barrens: An area too rocky, too soilless, or too exposed to support a vegetative cover of either trees, shrubs, or herbs.
2. (b) Grassland: Includes grassland other than meadow. Perennial grasses predominate.
   (c) Meadow: Includes areas where sedges, rushes, and moisture-enduring grasses predominate.
   (d) Brush: This type includes all untimbered lands where brush or shrubby species predominate.
3. Cultivated: An area cleared and/or cultivated for agriculture use including pasture.
   (a). Stump pasture: Logged-off or burned-off land, part of which operating farm units now chiefly devoted to grazing and from which stumps have not been removed.

B. Woodland types

4. Oak madrona: A stand containing approximately 60 percent or more by volume of any species of western oaks or madrona or any other combination of these.

C. Timberland types

I. Douglas fir: A stand containing approximately 60 percent or more by volume of Douglas fir. The type will be divided into size classes as follows:

6. Douglas fir A: Stands where the majority of the volume is over 40 inches D.B.H.
7. Douglas fir B: Stands where the majority of the volume is in trees 22 to 40 inches D.B.H. old growth, fine-grained timber that will cut a high percentage of upper-grade lumber.
8. Douglas fir C: Stands where the majority of the volume is in trees 22 to 40 inches, inclusive, D.B.H. young growth, coarse-grained timber that will cut only a small percent of the upper grades of timber. Usually less than 120-200 years old and making good growth.
9. Douglas fir D: Stands in which most of the volume is in trees 6-20 inches D.B.H.
10. Douglas fir E: Stands in which most of the trees are 6 inches and under in diameter.

II. Ponderosa Pine: Forests containing approximately 50 percent or more by volume of ponderosa pine, sugar pine, or Jeffrey pine or any combination of these species, except those in which sugar pine is the key tree in which the stands are continuous in contrast to the more open ponderosa pine woodland type. Three size classes are recognized:

20. Ponderosa pine, large: Forests in which the dominent stand averages more than 22 inches D.B.H., so-called "yellow pine" (about 150-200 years old), no material part of which has been cut. Includes occasional stands of mature or over-mature ponderosa pine that averages smaller than 22 inches D.B.H.

20.5 Pure ponderosa pine, large: Forests containing approximately 80 percent or more, by volume, of ponderosa pine.

20. (a) Ponderosa pine - sugar pine mixture, large: Forests with more than 50 percent ponderosa pine, by volume, and 20 percent or more of sugar pine, in which most of the volume is in trees more than 22 inches D.B.H.

20. (b) Sugar pine mixture, large: Forests containing 20 percent or more, by volume, of sugar pine and less than 50 percent of ponderosa pine, usually in mixture with Douglas fir, ponderosa pine, or white fir, in which most of the volume is in trees more than 22 inches D.B.H.

20. (c) Sugar pine mixture, large: Forests containing 20 percent or more of sugar pine, by volume, and less than 50 percent of Douglas fir, usually in mixture with Douglas fir, white fir, etc., in which most of the volume is in trees over 22 inches D.B.H.

20.(d) Douglas fir - sugar pine mixture, large: Forests containing 50 percent or more by volume of Douglas fir and 20 percent or less of sugar pine in which the volume of trees is over 22 inches D.B.H.

20. (e) White fir - sugar pine mixture, large: Forests containing 50 percent or more by volume of white fir and 20 percent or less of sugar pine in which the volume of trees is over 22 inches D.B.H.

21. Ponderosa pine, small: Either (a) selectively cut stands of any age in which the volume of ponderosa pine trees 17" or more D.B.H. is 1,000 board feet or more peracre, or (b) immature stands, so-called "bullpine" (less than 150-200 years old), of 1,000 board feet

or more per acre, usually with the greater part of volume in ponderosa pine trees from 12 to 22 inches in D.B.H., but including the occasional immature stands in which the trees exceed 22 inches D.B.H.

22. Ponderosa pine, seedlings, saplings, andpoles: Forests on old burns or heavily cut-over land in which most of the trees are less than 12 inches D.B.H. and the stand of saw timber, if any, amounts to less than 1,000 board feet per acre.

22.1 Sugar pine, seedlings, saplings, and poles: Same as 22 only for sugar pine.

III. White fir: Usually a mixed stand found in the range of western yellow pine and sugar pine and characteristic of southern Oregon and northern California; consists of 50 percent or more abies grandis or concolor.

29. White fir, large: Stands where most of the dominant trees are over about 20 inches D.B.H.

30. White fir, small: Stands where most of the dominant trees are under 20 inches D.B.H.

33. Subalpine: Stands at upper limits of tree growth and usually unmerchantable because of poor form and small size. Its principal components, besides alpine fir, are mountain hemlock, shasta fir, lodgepole pine, whitebark pine, western white pine, and alpine larch.

37. Deforested burns: Lands not cutover on which the stand has been killed by fire and which are not satisfactorily restocking.

38. No commercial timber, rocky areas: Areas within the range of commercial timber and below the limits of the subalpine type which are too rocky, too steep, or too sterile to produce a stand of commercial size, density, and quality. The timber may consist of any species; but it is not, and is not likely to be, of commercial value because of difficult logging conditions and low quality, poor form, and low volume.

All types are placed on the field maps within their respective boundries and are designated by the proper type symbol. A pure stand is one in which a single species constitutes over 80 percent of the dominant cover.

Appendix II

Log Grade Descriptions

Grade #1:

Shall be smooth and surface clear without indications of knots near the surface, privided, however, that one pin knot is permissable any place on the log.

Grade #2:

Shall be smooth and surface clear on three faces, but with knots permissable on the fourth face, or shall be smooth and surface clear on the lower three-fourths of the length, above which a few knots are permissable; or shall be smooth and surface clear to within 2 feet of the upper end, above which any number of knots are permissable. In any case, one pin knot is permissable on any portion of the log.

Grade #3:

Shall display knots which may vary from small black knots to large sound or unsound knots but which are spaced at least three feet apart (longitudinally) when the knots are staggered or six feet apart when they are in solid whorls. The surface clear areas must aggregate at least 60 percent of the total surface of the log.

Appendix III

Plot Dimensions

1. 1 acre side of sq. = 208.71 ft. = 3.162 chs. = 12.65 rods
   radius of circle = 117.75 ft. = 1.784 chs.

2. 1/2 acre side of sq. = 147.57 ft. = 2.236 chs.
   radius of circle = 83.26 ft. = 1.262 chs.

3. 1/4 acre side of sq. = 104.35 ft. = 1.58 chs.
   radius of circle = 58.88 ft. = 0.892 chs.

4. 1/5 acre side of sq. = 93.34 ft. = 1.414 chs.
   radius of circle = 52.66 ft. = 0.798 chs.

5. 1/10 acre side of sq. = 66 ft. = 1 ch.
   radius of circle = 37.24 ft. = 0.564 chs.

6. 1/40 acre side of sq. = 33 ft. = 0.5 chs.
   radius of circle = 18.62 ft. = 0.282 chs.

Surveyors Square Measure

1. 1 acre = 43,560 sq. ft. = 10 sq. chs.

2. 1 section = 1 sq. mile = 640 acres = 16 forties.

3. 1 township = 36 sections = 23,040 acres.

Appendix IV

Equipment

1. Box or woodsman compass

   A. Quadrant compass

      1. Graduated circle runs from 0^{o} - 90^{o}
      2. 0^{o} points are at north and south
      3. 90^{o} points are at east and west.

   B. Asimuth compass

      1. Graduated circle runs from 0^{o} - 360^{o}
      2. 0^{o} at north, 90^{o} at east, 180^{o} at south, 270^{o} at west.

   C. Used for directing your course on your strip.

2. Abney level

   A. Percent Abney

      1. Rise and fall in elevation for 100 feet stations.

   B. Topog Abney

      1. Rise and fall in elevation for 1 chain or 66 feet.

   C. Measures the tree height.

3. Increment borer

   A. An increment borer used in the determination of the age of the tree by using the annual rings on the core obtained.

4. Diameter tape

   A. A diameter tape is used to obtain the diameter of a tree. Diameter (D.B.H.) is measured at a point 4.5 feet above the ground.