

# Needle Scorch and Condition Of Ponderosa Pine Trees In The Dalles Area



by

O. C. Compton  
L. F. Remmert  
J. A. Rudinsky  
L. L. McDowell  
F. E. Ellertson  
W. M. Mellenthin  
P. O. Ritcher

Miscellaneous Paper 120  
September 1961

Agricultural Experiment Station  
Oregon State University  
Corvallis



## NEEDLE SCORCH AND CONDITION OF PONDEROSA PINE TREES IN THE DALLES AREA

O. C. Compton, L. F. Remmert, J. A. Rudinsky, L. L. McDowell,  
F. E. Ellertson, W. M. Mellenthin and P. O. Ritcher\*

### SUMMARY

The findings of the survey of pine trees in The Dalles area were as follows:

1. Considerable injury from "blight," or needle scorch, was found.
2. There was no pathological, entomological, or soil condition that would account for the scorch of pine tree needles.
3. Scorched needles contained considerably more fluorine than unscorched needles and were typical of "ponderosa pine blight."
4. No scorch was found in samples outside The Dalles area, and these samples were low in fluorine content.

### INTRODUCTION

Early in 1961 the Oregon Agricultural Experiment Station, at the request of the Wasco County Court, agreed to study the reported injury to ponderosa pine trees in The Dalles area and to determine the cause or causes of the injury. The condition of greatest concern was first observed in 1959 and was similar to the descriptions given by Miller et al. (5) and Adams et al. (1) for "ponderosa pine blight." They reported (1,5) that the "blight" or needle scorch was characterized by a browning or reddening of the needles which progressed from the tip downward to the base. The scorch or injury was associated with abnormal concentrations of fluorine in the needles. This concentration as well as the amount of scorch increased with the concentration of fluorine found in the atmosphere (3,8).

The survey which was made May 31-June 1, 1961, was designed to determine the nature of the injury to pine trees growing in and around The Dalles. The results of this survey are reported below.

### METHODS

Thirteen sampling sites scattered inside and outside the area where pine "blight" was evident were selected. These sites were located from one half to 2 miles apart and represented the major stands of ponderosa pine in the area. Because of the extensive and dense stands and the apparent severity of the scorch about half of the sites were in the Chenoweth area (see Figure 1). A stand near the Mid-Columbia Branch Experiment Station at Hood River was used as a check site. From 5 to 10 trees were selected at each site and marked for ready reference. These trees were examined for presence of insects and diseases and for general tree condition.

---

\*Horticulturist, Chemist, Associate Forest Entomologist, Research Fellow in Plant Pathology, Assistant Entomologist at the Mid-Columbia Experiment Station, Superintendent of the Mid-Columbia Experiment Station, and Head, Department of Entomology, respectively, Oregon Agricultural Experiment Station.

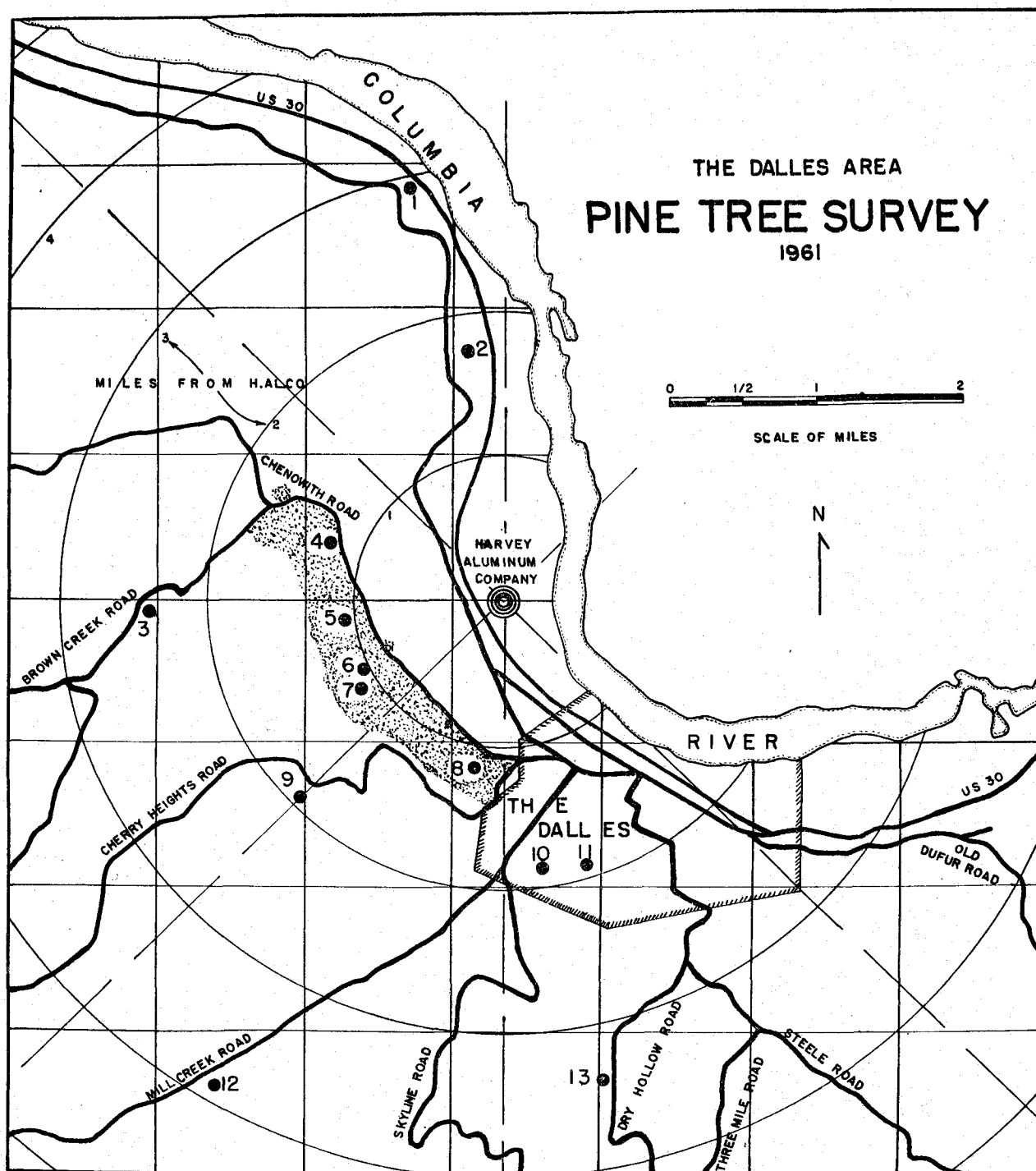


Figure 1. Map of sampling locations. Pine needle scorch was most severe in shaded area.

### Needle sampling

From 5 to 10 branches were clipped off each of the trees selected and composited into a single sample for the site. The needles were stripped from the branches of each sample and mixed. Appropriate subsamples were withdrawn for determination of percentage of scorch and fluorine content. The amount of scorch was determined by measuring the length of the burned or scorched portion of 100 needles; the percentage based on the total length of these needles. All samples used for fluorine analysis were treated with lime after they were chopped and placed in large cellophane bags. Fluorine contents were determined by the method reported by Remmert and Parks (6).

### Determination of sapwood resin pressure

The physiological condition of the trees was studied by measuring the sapwood resin pressure of one or more representative trees at several locations near The Dalles and at one location near Hood River. This pressure reflects the water balance of the trees. It was measured by sealing the stems of pressure gauges into holes bored into the tree trunks. The gauges were installed May 31, 1961, and read early the next morning. These gauges were installed along Chenoweth road in pine trees that were severely scorched, in pines showing low vigor growing along U. S. 30 about 2 miles north of The Dalles city limits, in vigorous healthy pines located about 4 miles southwest of The Dalles, and in healthy pines at the check site near Hood River.

## RESULTS

Two kinds of needle injury were found in The Dalles area. The first one involved whole clusters of needles located a few inches back of the growing point. This condition was associated with symptoms of cold injury. Growth of the current or previous season was not involved. This kind of injury has been observed by most of the above authors on pines growing in several localities in Oregon other than The Dalles. This condition did not appear to be of any serious consequence in The Dalles.

The other kind of needle injury was similar to that described by Adams et al. (1) and Miller et al. (5) and termed by them as "ponderosa pine blight." This "blight" or scorch is characterized by a browning or reddening of the needles, the scorch progressing from the tip downward to the base. The scorch was most severe in an area roughly 2 miles long by 1/2 mile wide lying between Chenoweth road and the bluff to the west and south and extending from the junction of Chenoweth and Brown Creek roads on the north to the Cherry Heights road to the southeast (see Figure 1).

Neither one of the above described needle injuries was associated with the presence of pathogens.

### General insect condition

Bark beetles. There was no active bark beetle infestation in the stands visited either within or outside the city of The Dalles. In a few old trees cut for firewood and in old slash there was evidence of galleries of the red turpentine beetle (Dendroctonus valens) and the engraver beetle

(Ips oregoni). These beetles are so-called secondary beetles and seldom increase into outbreaks sufficient to kill trees. No active infestation nor any evidence of older kill or invasion by the western pine beetle (D. brevicornis) or by the mountain pine beetle (D. monticolae) were observed in the area. These two beetle species are the most destructive on ponderosa pine.

Scale insects. The black pine leaf scale (Nuculaspis californica) was found on individual scattered trees throughout the observed area. Concentration of scales in these trees was either very heavy or heavy and in one instance (Station 1) caused death of a tree. In the very heavy infestation, counts revealed 41 scales per linear inch; in heavy infestation, 12 scales per inch. The very heavily infested needles were considerably shorter, i.e., 4 to 5 inches; the heavily infested 6 to 7 inches long; whereas uninfested needles measured from 8 to 12 inches. Very heavy infestation was found on a few scattered trees at stations 1, 7, and 9. Pine needles even very heavily infested with scale were almost always green to their tips. It was clear that there was no connection between the burning of the needles and forest insect activity.

#### Sapwood resin pressure

The sapwood resin pressure of the pines showing the most severe needle scorch (Station 4) was higher than that of the normal trees at Hood River; 140 pounds per square inch (psi) for the scorched trees versus 90 psi for the check trees. These results may be rationalized by assuming that in trees with scorched needles the transpiration rate is reduced, while the roots are not injured and still functioning; this combination might lead to an abnormal increase in the pressure of the water in the stem.

#### Scorch and fluorine content of pine tree needles

The amount of scorch and fluorine content of the samples of needles collected in the survey are presented in Table 1. In The Dalles area the percentage of scorch in 1960 needles varied from 0.9% at Station 12 which was 4 miles south of the aluminum factory to 67.7% at Station 4 which was 1.2 miles W N W of the factory. The fluorine contents were 23 and 98 parts per million respectively. The check samples at Hood River showed no scorch and contained less than 10 ppm fluorine in the 1960 needles. Generally, the greater amount of scorch was associated with higher fluorine content. The correlation coefficient between scorch and fluorine content was +.50 and was significant at the 5% probability level. The data presented are for fluorine levels in 1960 needles sampled May 31-June 1, 1961, some 10 months after these needles had fully expanded. Adams (2) reported that ponderosa pine needles when partially expanded develop scorch at 15-20 ppm fluorine in the tissue, that newly and completely expanded needles will develop scorch at 30-35 ppm, and that needles which have been fully expanded for 3 months will not develop scorch at levels up to 80 ppm. On May 31, 1961, new needles at Station 4 were scorched to varying degrees. These needles were about 2 inches long and contained 17-20 ppm fluorine (see Table 1).

One characteristic of the pines in The Dalles where needle scorch was found was the extreme variability at any one site in the severity of scorch among trees of comparable size. For instance at Station 7, 1.2 miles SW of the factory, needle scorch varied from mild to severe among the dominant size group. Young trees in the open were usually more severely scorched than older trees. Several older trees were heavily infested with black pine leaf scale yet the needles showed no scorch. Other examples are noted in Table 1. There appeared to be no one soil condition such as presence of rock, dry exposure, etc., that would account for the needle injury. At some sites many trees in the most favorable situations showed the most severe needle scorch. At other sites just the reverse was true.

The severely affected trees may eventually die of starvation because of the greatly reduced leaf area as Adams et al. (1) have reported.

The results of this survey show that scorched pine needle samples contained considerably more fluorine than samples collected outside of The Dalles area. There was no pathological, entomological, or soil condition that would account for the needle scorch found in the area.

#### LITERATURE CITED

1. Adams, D. F. et al. 1952. Atmospheric pollution in the ponderosa pine blight area. Ind. Eng. Chem. 44: 1356-1365.
2. Adams, D. F. 1956. The effects of air pollution on plant life. A. M. A. Arch. Indust. Health 14: 229-245.
3. Adams, D. F. et al. 1956. Relationship of atmospheric fluoride levels and injury indexes on gladiolus and ponderosa pine. Agr. and Food Chem. 4: 64-66.
4. Compton, O. C., L. F. Remmert and W. M. Mellenthin, 1960. Comparison of fluorine levels in crops before and after aluminum factory operations in The Dalles area. Oregon Agr. Exp. Sta. Misc. Paper 95.
5. Miller, V. L. et al. 1952. The effect of atmospheric fluoride on Washington agriculture, in Air Pollution, Proc. United States Tech. Conf., N. Y., McGraw-Hill Book Company, Inc. Chap. 11
6. Remmert, L. F. and T. D. Parks. 1953. Determination of fluorine in plant materials. Anal. Chem. 25: 450-453.
7. Rochon, C. A. Chief Chemist, Harvey Aluminum Inc., The Dalles, April 27, 1959. Private communication.
8. Shaw, C. G. et al. 1951. Fluorine injury to ponderosa pine. Abstract. Phytopath. 41: 943.

Table 1. Amount of scorch and fluorine content of ponderosa pine needles; pine tree survey, The Dalles, May 31-June 1, 1961

Location	Distance and direction from factory	Age of needles, year of growth	Average length of needles	Amount of scorch, percent of total needle length	Fluorine content, dry weight
	<u>Miles</u>		<u>cms.</u>	<u>%</u>	<u>ppm</u>
1	2.8 N	1960	19.9	5.4	79.3
2	1.7 N	1960	20.6	20.2	67.0
3	2.4 W	1960	20.5	1.4	1.7*
3	2.4 W	1960	20.4	38.8	4.5*
4	1.2 WNW	1960	17.5	49.7	121.
4	1.2 WNW	1960	19.3	67.7	97.7
4	1.2 WNW	1961	6.3	8.0	17.0
4	1.2 WNW	1961	5.8	14.2	20.2
5	1.1 WSW	1960	20.6	17.9	120.
6	1.0 SW	1960	21.6	27.0	107.
7	1.2 SW	1960	19.3	39.5	71.9
8	1.3 S	1960	21.7	6.3	82.8
9	1.8 SW	1960	23.0	7.7	63.0
10	1.9 S	1960	18.6	4.6	42.4
11	2.1 SSE	1960	19.4	1.4	36.6
11	2.1 SSE	1960	21.1	16.9	44.5
12	4.0 S	1960	20.0	0.9	23.3
13	3.4 SSE	1960	24.6	15.2	36.8
14	20. W	1960	23.7	0.0	6.5
14	20. W	1961	5.9	0.0	19.3

\* Loss of fluorine from samples indicated may have occurred, due to a furnace failure during the analysis.