

R (O)
Fire Studies,
Damage to Yellow Pine.

Pinus ponderosa

Progress Report¹

YELLOW PINE FIRE DAMAGE

Deschutes National Forest.

By M. L. Merritt

There has been much discussion among the yellow pine owners and others interested regarding the actual damage which is done to yellow pine timber by fires, even where they are severe enough to kill the foliage. Many practical timbermen hold the opinion that a large majority of the trees so injured will ordinarily recover. Since a large fire occurred on the Deschutes National Forest during the season of 1915 which killed the foliage on a large number of trees, it was believed advisable to undertake a study in order to secure some definite information bearing on this problem.

1. Purpose.

To determine the extent of damage done to yellow pine timber by severe surface and crown fires, especially where all foliage is killed, the most important specific problem undertaken being to determine approximately what per cent of mature trees die as a result of having all of their foliage killed by the fire.

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2. Use of Results.

The information secured will be used in local propaganda work and in technical and trade journals. It will also be useful in preparing fire protection plans for yellow pine Forests.

3. Place.

The area to be studied is on the Deschutes National Forest in T 23 S., Rs. 14 and 15 E. on what is locally known as the South Ice Cave burn which occurred beginning August 29, 1915. This fire was an unusually severe one for yellow pine timber, the foliage on many mature trees being entirely killed—in a few places over areas as large as four or five hundred acres. In other places the fire was not so severe, so that the effect of different degrees of damage may be observed.

4. Assignment.

Local Forest officers working under the direction of the District office.

5. Method

Three typical plots were selected on the area as follows:

Plot 1: A strip along the north side of the road passing through Sec. 24, T. 23 S., R. 14 E. On this area the fire had burned with a maximum severity, killing the foliage on practically all of the trees and stripping it from a few. In most places, however, the foliage still remains but was turned entirely brown without any green needles remaining at the extreme top of the trees. Small trees and reproduction were often, in fact usually, stripped of foliage; all ground cover was entirely destroyed. The boles of the mature trees were blackened for a portion of their length as though these portions had actually been on fire. Even this portion of the forest, however, does not appear to have been burned by a true crown fire in most places, the flames apparently having been fed mainly from surface needles, litter, brush, bunch grass and reproduction. It is probable, however, that in a great many places the flames actually reached far above the treetops.

On this plot 100 trees were selected and marked with tin tags numbered serially from 1 to 100. All trees over about 4" in diameter were marked on the area covered, so that the plot comprises all timber on that particular area and is therefore representative. The tags were placed approximately at breast height, all on the wagon road side of the trees so that they are easily visible from the road. The diameter breast height of trees was taken with a diameter tape and notes made regarding the condition of each tree. These data are given in the attached tabulated statements. In these statements, however, no mention is made of the condition of the inner bark. Several trees were examined to determine its condition and in practically every case it was found that the cambium layer was apparently uninjured. The exceptions are all noted in the tabulated statements so far as it was possible to determine them.

Plot 2: Plot 2 is located along the north side of the NW $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 19, T 23 S., R 15 E. This area is similar in nearly every way to No.1, except that the fire did not burn so severely, but left some of the trees with a few green needles toward the top. A considerable per cent, however, as will be shown by the appended table, had their foliage entirely killed.

On this plot also 100 trees were selected comprising all of the larger trees standing so that it is fairly representative. These were labeled with tin tags numbered serially from 101 to 200, and notes were taken as for plot 1.

Plot 3: This plot is located along the west side of the SW $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 18, T. 23 S. , R 15 E. and is in a pure stand of yellow pine timber similar to plots 1 and 2, except that the fire was slightly less severe than in either. As is plots 1 and 2, 100 trees were selected and labeled with tin tags numbered serially from 201 to 300. Notes were taken as in the previous cases.

6. Future Work.

Since it is the aim to determine what trees ultimately recover, observations must be continued for two or three years, or until it is evident that results are conclusive. It is proposed to examine and note the condition of every tree in the spring of 1916 soon after the trees in that region leaf out, again in the fall after the close of the growing season, and once each year thereafter for as long a time as is necessary.

7. Report.

When conclusive results have been obtained a report should be prepared summarizing the work done, describing the burn, its general appearance at different times throughout the life of the experiment and giving a description of the region etc. It should also include a tabulated statement of results showing per cent of loss of different classes of injuries and estimated actual total loss by fire, probably based on table in this outline. Conclusions should be drawn and their application to the fire protection plan discussed.

8. History of Burn.

The burn on which this study is being made occurred between August 29 and September 14. The location is shown on the enclosed map.

The following table gives area covered by the fire:

	<u>Acres</u>
National Forest land, timbered,	8,206
“ “ “ open,	100
Private land inside Forest, timbered	939
Area outside National Forest, nearly all timbered,	<u>755</u>
	10,000

The following table gives the estimated damage to yellow pine timber based on a strip examination covering approximately 2½% of the entire area.

ESTIMATED DAMAGE

	Tops Green or Partly Green after Fire			Tops Brown after Fire			Tops Stripped or Trees Burned by Fire, Down	Snags – No.		
	12" or Over - Ft B.M	No of Trees		12" or over – Ft. BM.	No. of Trees			12: or over – ft. B.M.	Standing	Down
		4-7 in diam.	8-11 in diam.		4-7 in diam.	8-11 in diam.				
N.F. Land	45,967,135	13,068	8,498	18,643,413	26,679	12,412	2,583,533	2,256	12,448	
Pat. Land Inside N.F.	5,848,852	905	862	3,152,201	2,238	1,745	243,135	576	2,554	
Outside N.F.	3,972,254	820	816	182,100		25	78,260	76	525	
Total Est.	55,788,241	14,793	10,176	21,977,714	28,917	14,182	2,904,948	2,908	15,527	

In addition, approximately 450,000 feet B.M. of lodgepole pine 12" and over in diameter was destroyed. The trees burned down were counted as snags.

From the above tabulated statement it is seen that 4-% was killed outright, that 27+ % had the tops entirely browned and are liable to die, while 69+%, at least, will probably recover.

The region burned over is covered with a pure stand of yellow pine, with the exception of a very small area toward the northeast corner which is covered with a pure stand of lodgepole pine. In common with all of the east and southeast slope of the Paulina Mountains, this area has a soil covering of pumice and sandy loam, through which water seeps rapidly so that there is no surface water, with one or two minor exceptions, in the whole area. As a result, stock has never used the region for range so that needles and debris have accumulated for an indefinite time in the past. A good stand of reproduction and a scattering growth of chamise and bunch grass furnished additional fuel. The season of 1915 had been unusually dry and the day when the fire started was exceptionally windy. The combination was such that the fire spread with remarkable rapidity and was not controlled entirely until the third night. It is probably as severe a burn as can reasonably be expected in the leveler yellow pine regions.

As implied above, the burned area is located on the southeastern slope of the Paulina Mountains. It is comparatively level, with a very few small hills toward the northeastern portion.

The following tabulated statements describe each tree by number. In describing trees the appearance of the foliage was regarded as a criterion of its condition and will be one of the chief factors to be observed in the future. Sufficient additional observations were made to determine whether or not the cambium layer was killed. As already stated, portions of the trunks of mature trees were blackened as though these parts had actually been on fire. Notes were made and recorded of this condition.

M.L Merrit
Forest Examiner.

Plot No. 1.

No. of Tree	D.B.H. inches	Portion of Foliage Browened	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles browened remained on trees.)
1	28	All	1/2	Flat top Y.P. No fire scar.
2	22	All	2/3	Flat top young tree; bottom whorl of branches stripped of needles; not fire scar.
3	25½	All	1/2	No fire scar.
4	28	All	1/2	Old tree; no fire scar.
5	21	All	2/5	Young tree; no fire scar.
6	31½	All	1/3	Old tree
7	30	All	1/3	Flat top old tree; 1 sq. ft. ground fire scar N.E. side tree.
8	25½	All	-	Small fire scar N.E. side tree.
9	28	All	-	Small fire scar all round old Y.P; spike top; needles remain on upper half of tree.
10	32½	All	1/2	Fire scar 12" at base, scarred all round; old tree.
11	38	All	1/3	Two-prong old tree; no scars.
12	32½	All	1/3	No fire scar.
13	24½	All	-	Old spike top; badly scarred 1 ft. N. & S. sides.
14	8	All	-	Healthy young tree; in open group of 16 trees over 4" diam. & about 20 smaller; Needles off of lower branches; no ground scar.
15	12	All	-	Healthy young tree, same lot as No. 14; lower 4 ft. branches needles stripped; No ground scars.
16	8	All	-	Healthy young tree, same lot as No.14; No ground scars; lower needles 1/2 burned.
17	10	1/2	-	Same lot as No. 14; lower branches stripped of bark; no ground scar.
18	12½	All	-	Healthy young tree; no ground scar
19	7	1/2	-	Same as No. 18; 2 ft. dist to S. E.
20	8½	All	-	Healthy young Y.P.; no fire scar
21	7	All	-	1 ft. west of No. 20; same lot as No.14; No fire scar.
22	43	All	1/3	Old tree, flat top burned black and bare; Top needles on; no fire scar.
23	32½	-	1/3	Old flat top tree; practically all needles on; no ground scar; Nos. 22 & 23 six feet apart away from nearby trees.

No. of Tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
				Chemise under preceding trees, medium density and rather small; needles probably pretty fair on preceding trees; bole blackened on east, highest side; west side less than 1/2 as high as east; burn not quite so bad as some places.
24	28	All	1/2	Young bull pine; stripped down 10 ft.; no ground scars; bole black higher on E. side.
25	21	All	2/3	Bull pine; lower 1/2 of tree about 1/2 of needles scorched.
26	10	All	2/3	Bull pine.
27	5	-	2/3	Lower 1/2 of needles stripped; no ground scar.
28	12½	-	2/3	Twin tree with No. 27; stripped of needles 3/4 ht.; top needles withered; no ground scar.
29	19	-	2/3	Stripped of needles except top 10 ft. at S.E. of group of young trees; no ground scar.
30	17	-	2/3	Bull pine; stripped of needles except upper 12 feet.
31	11	-	2/3	Bull pine; stripped of needles except upper 9 feet.
32	18	-	2/3	Stripped of needles except upper 15 ft.; Bull pine; no ground scar.
33	17	All	2/3	Old small tree; stripped of ½ branches on S.E. side and needles except top 15 ft.; no ground scar.
34	30	All	2/3	Needles stripped from branches except top 1/2 of tree; no ground scar; med. old tree.
35	12½	All	2/3	Twin tree with No. 36; stripped 1/2; top needles badly brownd.
36	20½	2/3	2/3	Bull pine; Nos. 24-36 a moderately thick group of bull pines principally, with group of saplings N. & W. they are burned as badly as most of the trees on worst parts of fire. Ground cover of needles was evidently very heavy. This group black on 2/3 ht.
37	10	All	-	Same as 36; tree stripped of needles except top 6 ft.
38	16½	All	-	Medium old Y.P. needles on top 1/3 of tree all brown and gone below.
39	23	All	-	Bull pine; top 2/3 needles on.
40	7	-	-	Top burned out except last whorl at top.
41	5½	-	-	Top burned out; bark apparently killed
42	7	-	-	Few needles left at top.

No. of Tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
43	9	-	-	Fire scar 1 ft. high; some needles at top (About 6 ft. down.)
44	10	-	-	Needles at top 1/4 down
45	7	-	-	Top stripped
46	6	-	-	Top stripped
47	4	-	-	All needles on; bark dead. (Nos. 42 to 47 group rep.)
48	42	-	-	All needles on; fire scar 6" on E. side; Bark blackened 1/2 on East, 1/3 on West .
49	25 1/2	-	(1/2 E. (1/3 W.	All needles on.
50	30 1/2	-	(1/2 E. (1/3 W	All needles on.
51	28	-	(2/3 E. (1/2 W.	Needles on except few at bottom.
52	7	-	All	Needles on.
53	19	-	(2/3 E. (1/2 W.	Needles partly burned on E.
54	11	-	All	Needles on.
55	25	-	1/2	Needles on.
56	9	-	2/3 E.	Needles on.
57	18	-	(1/2 E. (1/3 W.	Needles on.
58	18	-	(1/2 E. (1/3 West	Needles on.
59	16	-	(2/3 E. (1/2 W.	Needles on.
60	18	-	(2/3 E. (1/2 W.	Needles on.
61	25 1/2	"	(1/2 E. (1/3 W.	Needles on.
62	23	-	(1/2 E. (1/3 W.	Needles on. (Nos. 48 to 61 group standing close.)
63	18	-	3/4	1/4 top burned.

No. of Tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
64	25½	-	3/4	2/3 top burned
65	23	-	7/8	1/2 top burned; small scar south side.
66	19	-	7/8	2/3 top burned.
67	18	-	7/8	2/3 top burned.
68	14	-	7/8	1/2 top burned.
69	23	-	(1/2 E. (1/3 W.	1/4 top burned.
70	25½	-	(2/3 E. (1/2 W.	1/3 top burned.
71	7.9	-	All	Top 3/4 burned.
72	8½	-	3/4	Top 1/2 burned.
73	5	-	All	Bark and top 2/3 burned.
74	11½	-	2/3	Top 1/2 burned.
75	11½	-	3/4	Top 1/3 burned.
76	8	-	3/4	Top 1/3 burned.
77	20½	-	2/3	Few needles off at bottom on E.
78	8	-	2/3	Few needles off at bottom
79	5½	-	2/3	Bark killed; ½ top burned
80	19	-	(1/2 E. (1/3 W.	Needles on.
81	30	-	(1/2 E. (1/4 W.	Few needles off at bottom
82	6	-	-	Bark apparently killed; top 7/8 burned.
83	8	-	-	Bark apparently killed; few needles off at bottom.
84	5	-	-	Bark apparently killed; few needles off at bottom.
85	11½	-	1/2	Bark apparently killed; needles on.
86	29	-	1/2	Needles on; fire scar on east.
87	31	-	1/3	Needles on; fire scar in fork 10 feet up.
88	28	-	1/2	Needles on.
89	24	-	1/2	Needles on.
90	32½	-	1/2	Needles on.
91	11	-	1/2	Top 1/3 burned.
92	20½	-	All	Top 7/8 burned.

No. of Tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
93	16½	-	All	Top all burned.
94	18	-	All	Top all burned.
95	22	-	All	Top all burned.
96	9	-	-	Bark apparently killed; top 9/10 burned.
97	13½	-	All	Top all burned.
98	9	-	All	Top 9/10 burned. Bark apparently killed.
99	19	-	All	Top all burned.
100	16	-	All	Top all burned.

Plot No. 2.

No. of tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
101	34	1/3	1/4	
102	23	2/3	1/3	
103	17	9/10	1/2	
104	23	1/2	1/2	
105	18	19/20	2/3	
106	23	-	All	Tree stripped of needles.
107	10	1/2	1/3	
108	8	2/3	1/2	
109	12	2/3	1/4	
110	5	All	1/2	
111	9	2/3	2/3	
112	6	3/4	1/3	
113	5	All	1/3	
114	14	1/3	1/3	
115	33	1/3	1/8	
116	27	1/20	1/8	
117	14	All	1/4	Large cat face.

No. of tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
118	10	9/10	1/3	Large cat face.
119	20	1/2	1/8	
120	16	2/3	1/4	
121	12	9/10	1/3	
122	17	1/2	1/4	
123	14	2/3	1/3	
124	9	All	2/3	
125	24	2/3	1/5	
126	27	3/4	1/4	Small fire scar.
127	24	All	1/3	
128	27	3/4	1/4	
129	19	1/2	1/8	
130	18	1/4	1/6	
131	20	2/3	1/3	
132	14	All	1/2	
133	26	19/20	1/3	
134	25	9/10	1/4	
135	23	1/8	1/8	Large cat face.
136	20	1/3	1/5	
137	20	1/10	1/20	
138	12	2/3	1/3	
139	12	1/2	1/3	
140	16	3/4	1/4	
141	16	1/4	1/4	
142	17	1/10	1/4	
143	22	1/8	1/4	Small cat face.
144	13	1/4	1/4	
145	24	1/3	1/4	
146	29	1/8	1/8	
147	32	1/50	1/10	
148	38	1/20	1/20	Cat face and fire scar.

No. of tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
149	15	1/6	1/50	
150	16	1/10	1/50	
151	13	1/5	1/3	
152	18	1/4	1/3	
153	22	1/5	1/3	
154	24	1/4	1/3	
155	14	19/20	1/2	Top partly stripped.
156	20	2/3	1/3	
157	6	All	9/10	Top partly stripped.
158	10	2/3	1/3	
159	6	3/4	1/3	
160	8	1/2	1/3	Cat face.
161	10	1/3	1/3	
162	31	1/50	1/4	Badly fire scarred. Spike top.
163	31	1/50	1/4	Badly fire scarred. Spike top.
164	20	3/4	1/3	
165	31	1/4	1/50	
166	34	1/8	1/4	
167	19	1/50	1/50	
168	27	1/50	1/10	
169	25	1/5	1/4	
170	23	1/5	1/3	
171	14	3/4	1/3	Small fire scar.
172	21	1/3	1/3	Very small fire scar.
173	20	3/4	1/3	
174	22	3/4	1/3	
175	24	1/3	1/3	Large cat face.
176	20	2/3	1/3	Swell butt – fire scar.
177	27	3/4	1/8	
178	26	1/10	1/15	
179	37	1/2	1/3	

No. of tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
180	31	1/8	1/4	Large fire scar.
181	13	19/20	2/3	
182	20	19/20	2/3	
183	17	All	2/3	
184	26	1/3	1/5	Large cat face
185	21	2/3	1/3	
186	30	1/3	1/4	
187	19	All	1/2	Spike top, fire scars.
188	27	1/5	1/8	
189	20	1/4	1/4	Fire scar, large.
190	28	1/5	1/4	Fire scar, large.
191	19	1/8	1/4	
192	25		1/5	Top all green. Small fire scar.
193	25	1/20	1/5	Fire scars.
194	22	9/10	1/5	
195	18	All	1/3	Large cat face.
196	16	1/5	1/3	
197	12	All	1/3	Large cat face.
198	11	All	1/3	Large cat face.
199	22	9/10	1/3	Small fire scar. Swell butt.
200	27	14/15	2/3	

Plot No. 3

No. of Tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
201	30	1/3	1/5	
202	27	All	1/5	Small fire scar.
203	35	All	1/8	
204	22	All	1/3	

No. of Tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
205	26	All	1/3	Small fire scar.
206	33	All	1/4	
207	15	All	1/3	
208	22	All	1/5	
209	28	19/20	1/4	
210	16	9/10	1/10	
211	16	9/10	1/10	
212	16	1/2	1/10	
213	9	9/10	1/4	
214	19	9/10	1/5	
215	28	9/10	1/5	
216	32	All	1/10	
217	18	All	1/2	
218	18	All	1/3	
219	26	9/10	1/4	
220	27	1/4	1/3	
221	20	All	1/2	Spike top, fire scar.
222	19	1/10	1/3	Small fire scar.
223	23	1/3	1/5	
224	28	3/4	1/4	
225	16	4/5	1/3	
226	33	1/8	1/15	Fire scar, spike top.
227	7	1/3	1/5	
228	13	3/4	1/4	
229	15	3/4	1/4	
230	11	All	1/5	
231	8	All	1/4	
232	30	2/3	1/5	Small fire scar.
233	31	1/3	1/20	Fire scar.
234	8	9/10	1/4	
235	12	9/10	1/3	

No. of Tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
236	11	1/2	1/4	
237	15	All	1/4	Large cat face.
238	6	All	1/4	
239	8	All	1/2	
240	11	1/4	1/2	
241	8	9/10	1/2	
242	8	9/10	1/2	
243	10	9/10	2/3	
244	10	All	2/3	
245	10	All	1/2	
246	6	All	1/3	
247	5	All	1/3	
248	12	9/10	1/4	
249	30	All	1/15	Small fire scar.
250	18	All	1/2	
251	16	1/2	1/2	
252	18	1/2	1/2	
253	21	1/3	1/3	
254	9	All	2/3	Partly stripped.
255	10	1/2	1/3	
256	6	All	1/3	
257	9	1/2	1/3	
258	13	1/2	1/4	
259	14	2/3	1/3	Spike top.
260	23	1/20	1/15	
261	25	1/15	1/10	
262	22	1/10	1/10	
263	9	1/3	1/8	
264	12	1/2	1/8	
265	18	1/15	1/8	
266	21	1/20	1/8	

No. of Tree	D.B.H. inches	Portion of Foliage Brownd	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles brownd remained on trees.)
267	7	1/10	1/10	
268	24	1/15	1/15	
269	10	9/10	1/8	
270	14	7/8	1/5	
271	14	2/3	1/4	
272	17	1/2	1/15	
273	10	9/10	1/4	
274	15	1/8	1/20	
275	8	1/2	1/8	
276	12	1/4	1/10	
277	13	1/20	1/8	
278	15	1/20	1/10	
279	8	1/8	1/8	
280	9	1/10	1/8	
281	8	1/8	1/15	
282	14	1/8	1/10	Crooked.
283	6	9/10	None	
284	4	1/8	1/10	
285	8	2/3	1/15	
286	9	3/4	1/15	
287	13	1/3	1/10	
288	9	1/5	1/4	
289	13	1/5	1/4	
290	8	2/3	1/2	
291	14	1/2	1/8	
292	11	9/10	1/4	
293	15	9/10	1/4	Fire scar.
294	24	1/2	1/15	
295	20	2/3	1/5	
296	15	1/4	1/5	
297	37	1/15	1/4	

No. of Tree	D.B.H. inches	Portion of Foliage Browned	Portion of Bole Blackened	Notes. (Unless otherwise stated, needles browned remained on trees.)
298	17	9/10	3/4	Partly stripped.
299	9	All	3/4	Partly stripped.
300	12	All	3/4	Partly stripped.