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ELIMINATING BLISTER RUST CANKERS

FROM SUGAR PINE BY PRUNING

by

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Well-stocked patches of vigorous advance reproduction are found in many deteriorating old-growth stands in southwestern Oregon. If carefully released from the overstory, this reproduction can shorten the rotation length of the next crop by many years. Often sugar pine is the fastest-growing component of the reproduction, but it is frequently infected with blister rust. Should a sanitation pruning be made to save these trees within areas being managed for sugar pine? A 1952 survey on the South Umpqua Experimental Forest in 1952 indicated that the number of sugar pine crop trees could probably be increased by removing cankered branches. Two subsequent projects demonstrated that such pruning was feasible.

THE SURVEY

Stand structure, degree and distribution of rust infection, and present and probable future stand composition with and without sanitation pruning were determined for five representative stands of advance reproduction on the experimental forest (fig. 1). It was assumed in the survey that the tallest and most vigorous tree on each 4-milacre quadrat would be a crop tree for at least part of the ultimate rotation, and that rust infection after pruning could be prevented

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Figure 1. --A vigorous patch of advance reproduction on the South Umpqua Experimental Forest. Most dominants are sugar pine; the largest are about 40 years old and 70 to 90 feet tall.

by effective Ribes eradication. The following data were collected on each of the 106 quadrats examined:

1. Total number of trees of each species.
2. Species and height of crop tree if blister rust were not a factor.
3. Species and height of crop tree assuming that all sugar pines with live cankers were unsuitable.
4. Species and height of the best crop tree that could be developed by canker removal, or release, or both. A sugar pine was favored whenever it had a reasonable chance of becoming a crop tree.
5. The treatment, if any, needed to develop the sugar pine crop tree under item 4.
6. The number of cankers at different heights on all infected sugar pines.
7. The number of pines fatally infected or already killed by the rust.

STAND COMPOSITION

Stands of advance reproduction were found to be densely stocked with a mixture of species and sizes. All quadrats examined were stocked. The average quadrat contained 45.9 trees-the equivalent of 11,469 per acre. On the average, 36.3 Douglas-firs, 6.5 sugar pines, 2.5 grand firs, 0.2 incense cedar, 0.2 western hemlock, and 0.2 ponderosa pine were growing on each quadrat.

In numbers, sugar pine comprised only 14.1 percent of the stands, yet 69 percent of the quadrats were found to be dominated by sugar pine (table 1). Douglas-fir comprised 79.3 percent of the stands yet dominated only 18 percent of the quadrats. The remaining 13 percent were dominated by either grand fir, western hemlock or ponderosa pine.

If present rust infections were allowed to take their toll, sugar pine would dominate only 45 percent of the quadrats and average height of all crop trees would be reduced 3 feet. Douglas-fir crop

Table 1. -- Probable effect of cultural treatment on future crop tree composition and height in five representative stands on the South Umpqua Experimental Forest

Species	Present		Future crop trees without treatment		Future crop trees with treatment	
	Compo-	Average	Compo-	Average	Compo-	Average
	sition	height	sition	height	sition	height
	Percent	Feet	Percent	Feet	Percent	Feet
Sugar pine	68.9	18.7	45.3	15.8	81.1	16.3
Douglas-fir	17.9	20.0	34.9	15.9	12.3	21.7
Grand fir	7.6	16.8	12.2	15.2	3.8	22.5
Western hemlock	4.7	19.6	5.7	18.7	2.8	19.3
Ponderosa pine	.9	25.0	1.9	16.0	0	--
Total	100.0		100.0		100.0	
Average (wtd)		18.9		16.0		17.3

trees would increase to 35 percent, and all other species together to 20 percent. Almost two-thirds of the present sugar pine dominants would be replaced by other species or by smaller, uninfected sugar pines.

Sugar pine could be increased to 81 percent of the probable future crop trees by removing cankered branches of salvable trees and by releasing a few promising sugar pines from slightly larger trees of other species. Sanitation pruning alone would be necessary on 29 percent of the quadrats, release alone on 9 percent, and both cultural measures on 11 percent. No treatment would be necessary on 51 percent of all quadrats. By removing cankered branches, 67 percent of the infected sugar pine dominants could be saved. Pruning and release would also regain more than a foot of average height for all future dominants.

NUMBER AND DISTRIBUTION OF CANKERS

Blister rust infection has become widespread and plentiful in the South Umpqua drainage since it was first reported almost 20 years ago. Of 687 living pines examined, 10.6 percent had cankers in the main stem and were considered unsalvable, and an additional 18.5 percent had branch cankers that could be eliminated by pruning. Sugar pines already dead from infection averaged 28 per acre. Among infected crop trees, 33 percent were unsalvable. Surprisingly, an impressive 70.9 percent of all sugar pines were still free of infection. However, many of these were small, suppressed, or thin-foliaged, and not considered suitable for crop trees.

Infected trees averaged 2.8 live cankers each (table 2). An additional 0.4 canker per tree had started on branches that died before infection reached the trunk. Only 8 percent of infected trees contained more than 6 cankers, but one had 19.

Cankers were distributed throughout the length of the crowns, but 85 percent were within 12 feet of the ground and all but 2.8 percent were within 20 feet. Although most infections were within easy pruning height, not all tall trees could be freed of cankers by pruning to a height of 20 feet. The pattern of infection suggested that the number of cankers at any height was roughly proportional to the number of needles at that height during years when infection waves took place. Most cankers were under 20 feet because most trees were less than 20 feet tall when infected.

SANITATION PRUNING

The survey indicated that a substantial increase in number of sugar pine crop trees could be achieved by removing a moderate number of cankers from vigorous sugar pines. Accordingly, cankers were pruned from selected trees in 13 patches of reproduction.

The pruning work was contracted after initial trials provided experience on which to base contract requirements. A short test showed that the time required to move between trees and climb the larger ones, search a tree for cankers from top to bottom, remove infected branches, and prune all lower branches averaged roughly, 2.5, 7.8, 17.4 and 32.0 minutes for tree size classes 0-4, 5-8, 9-12, and 13-20 inches d.b.h., respectively (fig. 2). Since branches could be cut from a tree as fast as they could be examined for

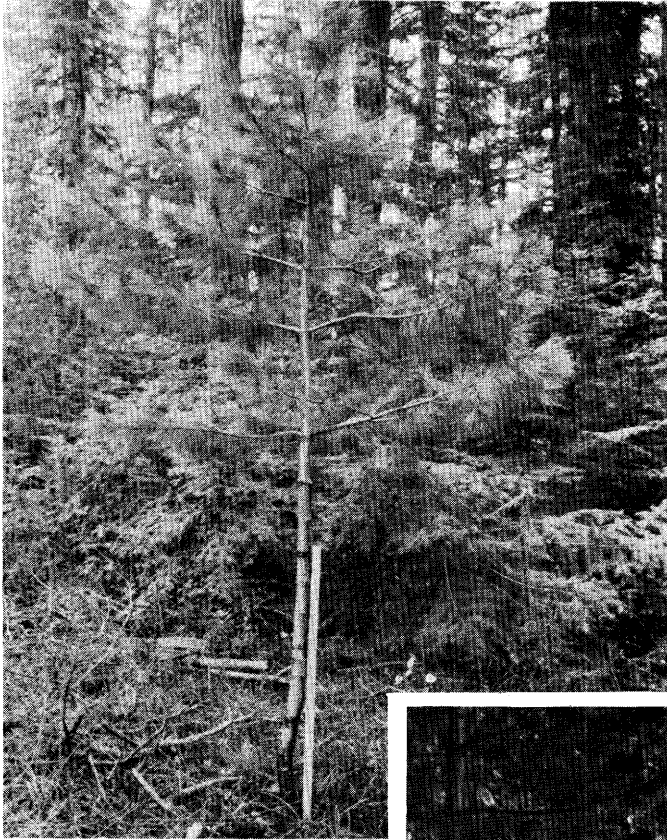
Table 2. -- Number of living blister rust cankers on sugar pines,
by tree height class and height of canker aboveground^{1/}

Tree : Infected :		Height of canker above ground (ft.)							
height :	sugar :								All
class :	pinos :	0-2 :	3-4 :	5-8 :	9-12 :	13-20 :	21+ :		heights
(feet) :									
Number		Average number per tree-----							
0-2	7	1.71							1.71
3-4	25	.96	0.56						1.52
5-8	52	.33	1.40	0.62					2.35
9-12	28	.14	.75	1.72	0.39				3.00
13-20	57	0	.19	1.11	1.37	0.40			3.07
21-30	19	0	.21	1.26	1.10	1.16	0.16		3.89
31-40	7	0	0	0	.86	2.71	1.43		5.00
41+	1	0	0	0	1.00	1.00	2.00		4.00
Total 196									
Average									
(wtd)		0.29	0.63	0.85	0.60	0.33	0.08		2.78

^{1/} Based on five representative stands on the South Umpqua Experimental Forest.

cankers, all lower branches were pruned to a height of 18 feet, provided that no more than one-third of the live crown length was removed. To reduce the chance of losing pruned trees by fire, pruning slash was scattered four feet or more from the trunk. At least 95 percent of the pruned trees had to be free of visible cankers following treatment for acceptable performance under the contract.

Two consecutive pruning contracts were let. Under the first, 3,784 trees were pruned in 12 patches totaling about 28 acres. Bid prices were \$0.15, 0.25, 1.00, and 1.50 per tree for the four size classes. In the second contract, covering 819 trees in one 8.8 acre patch, prices were the same except for the 5-8 inch class. Experience had shown that the first bid price was too low for the long, slim-crowned trees in that class, and the price was doubled to \$0.50 per tree.



A. Sapling in
the 0-4 inch
size class.

B. Three trees
in the 13-20 inch
size class, at
center; and two
in the 5-8 inch
class, at right
and left.



Figure 2. --Sugar pines, 3 years after pruning.

Under the first contract, between 100 and 200 crop trees per acre, depending on size, were marked for pruning. However, marking time proved to be excessive because each tree had to be examined carefully for stem cankers to determine its suitability for a crop tree. Since searching could be done more effectively by a worker from a vantage point when climbing and pruning an adjacent crop tree, contractors were allowed to select crop trees under the second contract. They were instructed in selection criteria, and with but few exceptions their choices proved to be satisfactory. Any disadvantages of a few poor selections were far outweighed by the saving made in eliminating marking costs.

The sanitation pruning achieved its objectives at reasonable cost. Contractors were able to meet contract specifications and earn a satisfactory daily wage. After they had gained some experience, they consistently cleaned 95 percent or more of the pruned trees of visible infection. Hence, it apparently is possible to avoid the loss in growing time and space represented by many infected sugar-pine dominants, save the larger trees in the stand, and improve quality.