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A TRIAL OF DIRECT CONTROL OF PINE ENGRAVER BEETLES ON A SMALL LOGGING UNIT

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Laboratory tests and small-scale field trials have shown the insecticide lindane to be highly toxic to pine engraver beetles. 1/ On the basis of that information, the insecticide was applied to fresh logging slash heavily infested with pine engraver beetles at Challenge Experimental Forest in 1959. Costs were reasonable and no insurmountable problems were encountered.

1959 A GOOD YEAR FOR PINE ENGRAVERS

The winter of 1958-1959 was abnormally dry in California. Warm weather continued later in the fall and began earlier in the spring than usual. Spring rains were few and far between. These conditions made 1959 the worst in many years in terms of potential bark beetle damage to ponderosa pine, especially at the lower elevations.

Experimental cutting operations were begun March 31, 1959, on the Challenge Experimental Forest (average elevation 2,700 feet). Logging of about 39 acres of 90-year old young-growth was completed May 20, and large amounts of fresh slash were readily available for the unusually large overwintering bark beetle population to attack.

We were aware of the potential insect problem at Challenge, thanks to timely warnings from Station entomologists. 2/ Our normal precautions were intensified. Trees were utilized to 9 inches top

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1/ Lyon, R. L. Lindane--a better insecticide for pine engraver beetles. California Forest and Range Expt. Sta. Misc. Paper 29, 2 pp., illus.

2/ Anonymous. Timber or Snags in 1959? Pacific Southwest Forest and Range Expt. Sta. Misc. Paper 34, 4 pp., illus.

diameter inside bark, at most, and many to a 6-inch top. Branches were lopped from the remaining tops to expose the boles to direct sunlight. Any lopped pine branches which fell on the remaining trunk were thrown off. Once logging was completed, tops which had been rolled so that projecting limbs were shading the trunks were re-lopped.

In spite of all precautions, evidence of heavy insect activity in the slash became noticeable in early June 1959. In order to assess the potential danger of this activity, Station entomologist Ralph C. Hall inspected the 1959 logging area. He wrote: 3/

"Several portions of the 1959 spring logging area were examined. These ranged from a very lightly cut area to areas where the cut had been relatively heavy. In the lightly cut area on the east the majority of the trees cut were white fir and Douglas-fir so there was a relatively small amount of pine slash present. However, all the pine slash observed had been heavily attacked by the California five-spined engraver, and prolific broods were being produced. This was true even in the lopped tops because of the fact that very little direct sun penetrated to this material.

"In the heavier cutting on the west there was a high concentration of pine slash. This was also heavily infested, and heavy broods were successfully established. Lopping had also been done in this area but much of it had been ineffective from the standpoint of discouraging engraver beetle attacks. This was because of disturbances in skidding where lopped tops frequently had become shaded with miscellaneous logging debris.

"Brood stages varied mostly from small larvae to pupae and only one sample of about 50 taken contained callow adults. Both sugar pine and ponderosa pine slash appeared to be equally attacked.

" . . . A similar inspection of the 1958 logging areas (was made) about one year ago. At that time pine engraver attacks were generally light. Some tops were observed with no attacks at all. In contrast, in 1959 not a single top was examined which did not have heavy successful broods."

DIRECT CONTROL MEASURES TAKEN

The most promising direct control method appeared to be to spray with the residual type insecticide lindane. Speed was important, since the insecticide would have to be applied before adult insects emerged from the slash. Following instructions published by Station

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3/ Correspondence designated RX-PSW-INSECT SURVEY PROGRAM, General, Detection Report No. 223, Ground Appraisal, June 1959.

entomologists, 4/ we bought lindane and kerosene and started spraying on June 29, 1959. A 3-man crew completed the job in 4 days using 5-gallon, hand-pressurized backpack sprayers (fig. 1).

Ponderosa and sugar pine tops and large limbs were sprayed on the entire 1959 cutting area. Large piles of slash and trash which had built up along skid trails and near landings were sprayed 100 percent in the hope of contacting any beetles emerging from tops buried within the piles. In the lightly cut compartment, Douglas-fir tops were also sprayed, since Hall had found Douglas-fir engraver beetles in several of the samples he examined.

Figure 1. --Spraying ponderosa pine top with lindane insecticide. Despite close utilization and top-lopping, this small top was infested with heavy broods of pine engravers.

4/ Lyon, Robert L. Directions for using lindane sprays to control pine engravers. Pacific Southwest Forest and Range Expt. Sta. Misc. Paper 33, 5 pp.

AREA TREATED

The 39-acre area treated is generally flat, but has several small draws. It is readily accessible from a main logging road and a spur road. The greatest distance the insecticide had to be carried from a road was about 264 yards, and the average distance was about 110 yards. A dense hardwood understory contained mostly tanoak and madrone, with scattered large California black oaks. Many hardwood stems were knocked down during falling and logging, thus adding to the debris on the ground and making foot travel through the area more difficult.

On the three heavily-cut compartments (29 acres), the original stand volume averaged 43,000 board feet per acre. About 34,000 board feet per acre was cut, including about 20,000 of pine. The total number of pine trees cut (and thus, tops requiring treatment) was 501, or 17.3 per acre.

On the lightly-cut compartment (10.4 acres), the original stand volume was 40,000 board feet per acre. About 11,000 board feet per acre was cut, including 8,700 of pine and Douglas-fir. The total number of pine and Douglas-fir trees cut (and thus, tops requiring treatment) was 58, or 5.6 per acre.

COST OF CONTROL MEASURES

The total cost of the spraying operation (exclusive of travel) was $273.40, about one-third in materials and two-thirds in application costs (table 1).

How useful our cost experience will prove in other areas is open to question. A lot of variables influence insect-control cost: terrain, accessibility, amount of material requiring treatment, total volume of timber cut, amount of logging debris, and density and type of understory. Some forest managers may prefer to consider the per-acre cost in relation to number of tops per acre. This was the only cost relationship which was consistent for all treated compartments and it closely approximated a straight line with the formula $Y = 0.87 + 0.43X$, with Y representing cost and X the number of tops (fig. 2).

Other managers may prefer to draw on averages compiled for the 3 heavily-cut compartments and for the lightly cut stands (table 2).

None of these cost figures includes travel costs to and from the job. This variable should be added when using these data in estimating costs.

Table 1. --Cost of lindane spraying on pine engraver beetle project, Challenge Experimental Forest, 1959

Item	Cost
	Dollars
Materials and preparation:	
Lindane (3 gallons) and kerosene (240 gallons)	$ 94.00
Mixing spray (10.5 man-hours) 1/	27.30
Sub-total	$121.30
Application of spray:	
Heavily-cut compartments (51 man-hours)	$132.60
Lightly-cut compartments (7.5 man-hours)	19.50
Sub-total	$152.10
Total project cost	$273.40

1/ Wage rate: $2.60 per hour (weighted average rate of spray-crew members).

Table 2. --Average cost of treating slash with lindane for heavily and lightly cut stands by various units of measure, Challenge Experimental Forest, 1959

Item	Heavy cut	Light cut
Area cut, acres	29.00	10.40
Pine volume cut, 1,000 bd. ft.	590.50	1/ 90.03
Tops treated, number	501.00	58.00
Total cost, dollars	238.34	35.06
Average cost in dollars per:		
Acre	8.22	3.37
1,000 bd. ft.	0.40	0.39
Treated top	0.48	0.60

1/ Douglas-fir included in lightly-cut stand volumes.

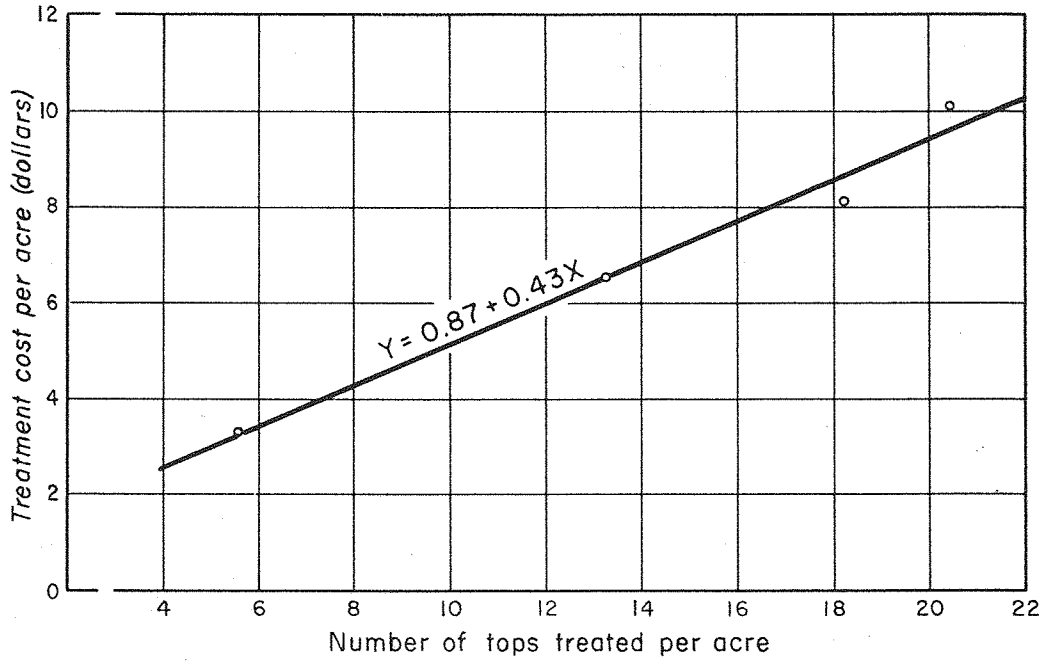

Figure 2. --Per-acre cost of spraying slash with lindane, as related to number of tops sprayed per acre, Challenge Experimental Forest, 1959.

WAS CONTROL ACHIEVED?

Because the trial contained no untreated check areas and no replications, we cannot say positively that the treatment was effective. However, only 1 pole-sized tree in the treated area was killed even though heavy broods were present in the slash. A small group of trees, all under 20 inches in diameter, was killed in a nearby area, probably by beetles from a small amount of untreated road-construction slash. None of the top-killing frequently associated with pine engraver attacks was visible by early winter. In contrast, extensive engraver damage followed other 1959 spring logging on sites at low elevations where slash was not treated. Outbreaks were reported in Amador, El Dorado, Nevada, Placer, Plumas, Shasta, and Yuba counties, among others. Groups of 4 to 60 trees were killed, including trees up to 36 inches in diameter. The tops of even larger trees were damaged.

MINOR PROBLEMS ENCOUNTERED

Two problems cropped up during the operation. We found it difficult to keep backpack spray containers from leaking. The use of a sprayer with a positive leak-proof top is essential for safety and comfort. We also found it difficult to keep track of the areas which had been sprayed. The kerosene evaporates quickly, and the residue of lindane is invisible unless the sun happens to strike the crystals just right. We were reluctant to add coloring for fear of altering the crystalline structure of the lindane residue., This problem has been called to the attention of the entomologists who tested this insecticide. If they can recommend a coloring agent which will not affect the lindane residue, future spraying jobs can be done more efficiently.

CONCLUSIONS

Lindane proved economical and practical to apply. The evidence of its effectiveness is meager but favorable: after spraying, little subsequent damage occurred in the residual stand despite proximity to heavily infested fresh logging slash. This residual-type insecticide may provide a valuable tool for forest managers to use in preventing heavy losses from pine engraver build-ups.