air STRIKING the Hemlock

Helicopters were a distinct aid in the vast hemlock looper control project in Washington.

By TOM BURRIER

AERIAL surveys of evergreen timber in southwest Washington State brought Federal, State and private officials into emergency session: a hemlock looper infestation of epidemic proportions had been found and mapped. Unless the looper was controlled or eliminated, billions of lumber board-feet would go down the waste chute.

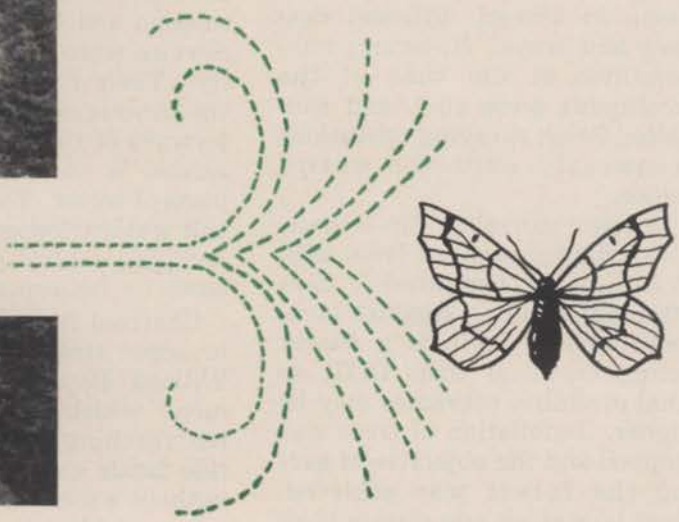
At stake was 71,000 acres of prime timber, chiefly hemlock. It was owned by U. S. and State agencies, three large private timber companies, and more than a hundred small-plot owners. Value of standing timber was estimated at $121\frac{1}{2}$ million; the end product value of the huge tract at $104 million.

The hemlock looper (*Lambdina fiscellaria lugubrosa* Hulst) is a very destructive defoliator periodically appearing in the spruce and hemlock forests along the coasts of Oregon, Washington, and British Columbia. During the past 75 years six major epidemics and several minor ones have been logged. Hemlock is the preferred host, but during epidemics any "growing green" is devoured.

Adult loopers are fragile, buff-colored moths about $1\frac{1}{2}$" from wing tip to tip. Their larvae move by grasping with the rear legs while extending their body forward, then holding with the front legs while "looping" to bring up the rear. They're also called spanworms, inch worms, and measuring worms.

From mid-September to mid-October females lay eggs almost anywhere, but mainly on moss, lichens, trees, and underbrush. The eggs overwinter. Hatching begins late in May and the larvae crawl upward, eating as they go. They feed first on lower vegetation, but later concentrate on conifers, chiefly hemlock. By

ooper



mid-July results of the larval feeding are quite conspicuous.

The exact cause of outbreaks is unknown, but opinion concensus is that unusual climatic conditions favor looper development. Or perhaps conditions unfavorable to their natural enemies may cause an epidemic. Parasites usually control the looper, aided by predators and disease. A real epidemic may last several years, with usually three years of heavy tree defoliation, during which vast amounts of timber may be killed.

"Our only solution is to spray-kill this looper outbreak, before it can spread further," the administrators and foresters decided.

Spraying from the air, a course unavailable in previous major looper outbreaks, was decided upon. DDT, a known saturation killer of the pest, was discussed as the pesticide to be used. But from many sources opposition to DDT spraying was immediate and vigorous.

Hundreds of creeks and streams in the infested area form rivers flowing into Willapa Bay, where commercially important oyster beds and hatcheries are long established. The oyster men feared pollution and kill of their product. Sportsmen's groups protested that spraying might kill heavy populations of salmon and trout fingerlings in the lakes and streams of this premier vacationland. Wildlife organizations feared for survival of birds and animals in the heavily forested spraying areas.

After hearings were concluded, the State Department of Natural Resources, supervising the combined-forces project, selected helicopters to do the spraying. Because of their ability to "hover" and pinpoint spraying areas, the "choppers" would leave untouched a green belt along each bank of every stream and lake in the area. Spraying would *not* be done when wind velocities touched five mph, to eliminate excessive drift of the selected pesticides.

State Fisheries men would install monitoring weirs in streams leading to salt water Willapa Harbor. Aided by private company entomologists, effect of the spraying on fish and other aquatic life would be thoroughly checked on all streams. During the operation, this was done hourly in some instances. Test fingerlings were given "before and after" checks. Every physical safeguard possible was incorporated into the Department's final plan for the Willapa Project.

About June 1 a final survey of the looper larvae was made by both air and ground teams. From these reports, it appeared July spraying would achieve maximum kill results. Two private helicopter firms, their personnel long experienced in spray operations, contracted for the job. Their combined equipment was capable of spraying 6,000 acres per day, averaging four hours of flight time daily for nine machines. This performance estimate assumed ideal weather-flight conditions.

The project staff, taking cognizance of the public hearings and protests, selected the insecticide Sevin for use on the bulk of the project. It had never been used on the looper on a wide scale, but laboratory tests, and application on similar pests,

Weirs like this were used to check for fish damage.

indicated it would control the looper. Sevin had been extensively tested by the U. S. Fish and Wildlife Service and declared "safe." It had also been applied experimentally on oyster beds to control predators. As far as effect on young salmon, Sevin had been proved 18 times safer than DDT.

In addition to Sevin and DDT, two other materials were scheduled for test against the hemlock looper, on carefully controlled test plots. The helicopters' precision work made these pilot tests possible. One of the compounds was *Phosphamidon*. Like *Sevin*, it had low residual properties and was rated less toxic to fish and wildlife than DDT.

The second experimental material was *Baccillus thuringiensis*, an insect virus. This material, nicknamed "BT," was sprayed on an isolated 300 acres on an island in Willapa Bay itself. This application was supervised by technicians from the U. S. Forest Service. Long-range outcome could be of considerable significance, in showing the way toward long-sought biological control of harmful insects.

To complete spraying quickly as possible once begun, 41 separate fueling and pesticide-supply points were established. Often during the operational spraying, which began in July, the helicopters could work but an hour or so per day, due to adverse wind and weather conditions. More than 60 men were engaged full time on the project, plus dozens of "interested observers" from a variety of organizations.

By the end of July, actual spraying was completed. Field crews of entomologists and laboratory technicians kept careful tally of looper mortality in the different-insecticide areas, while other crews checked effects on fish and wildlife, and tested dozens of creeks for residual traces of spray.

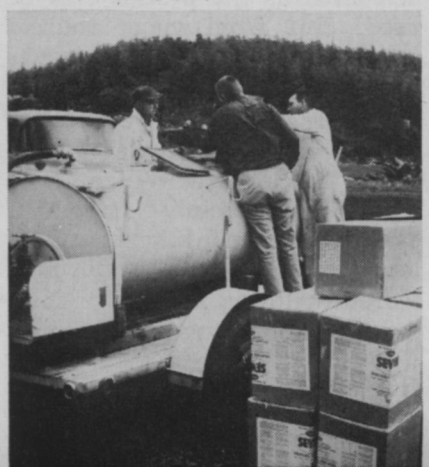
In the project's first spraying, some 12,000 acres not draining into Willapa Bay were treated with DDT. Numerous field checks seven days later showed 99.7% looper mortality. Preliminary figure for the Phosphamidon experimental application, on 2,250 acres, indicated a 75.9% looper kill. These figures were not deemed conclusive, however, until longer time-period checks could be made.

Interest in the Sevin-sprayed acreage was, of course, the greatest, since here was a pesticide said to be practically harmless to shellfish and wildlife. Project technicians applied Sevin in several different dosages and ways. However, temperatures at the time of the treatments were cool, and rain halted Sevin spraying operations frequently over the entire region.

Looper mortality in Sevin-sprayed areas ranged from 80% to 87%, when measured 13 days after application. Against hemlock loopers, Sevin is a slower acting chemical than DDT, so final mortality estimates may be higher. Defoliation of trees was stopped and the objective of saving the forest was achieved. Over-wintering egg counts have just been completed, and in the majority of areas treated, egg populations were significantly reduced.

Although Sevin was giving sufficient kill to be used on more than 40,000 acres of the infested forest, private foresters decided to use DDT for looper control on 14,000 acres of timber company land to utilize the compound's proven performance and faster kill.

Typical mixing station on site of the hemlock looper spray project.



Most heartening were the fish and wildlife reports.

Pollution Control Commission officials who headed the water monitoring activity reported little if any side effects on stream life in any area, regardless of spray type. No observable damage was noted in fish, crayfish, or caddis fly larvae in either DDT or Sevin sections, where water monitoring was most intense. There was damage to young mayfly larvae in DDT-sprayed areas, but the adult mayfly was unaffected.

Frequent staff meetings between private timber company technicians, and staff members of the Pollution Control Commission and U. S. Public Health Service were a continuing activity. Their reports showed that the concentration of DDT in waterways of the project never exceeded ½ part DDT per billion parts of water. This excellent result was attributed to the precise spraying control and care exercised by helicopter pilots.

Charcoal filters were installed in some streams flowing into Willapa Bay; another "experiment" which proved that all water reaching oyster production tide lands could be purified, without excessive cost, of residual pesticides.

The lumber and timber industry in British Columbia, Washington and Oregon is one of the region's basic industries; employing many thousands of men, and turning out products worth hundreds of millions of dollars annually. It seems certain that periodic epidemics of tree-destroying insects will continue to plague the evergreen forests for some time to come.

The value of the Willapa Project—aside from saving the growing timber—is in furnishing proof that large-scale control of these insect epidemics is possible, *without* disturbing the other positive values of our wild forest land.