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MESSAGE SCAN FOR BRUCE B. HOSTETLER

To b.hostetler:r06c

From: Bruce B. Hostetler:R06F06D04A
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Subject: 1991 dftm

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1991 WALLOWA-WHITMAN NATIONAL FOREST DOUGLAS-FIR TUSSOCK MOTH SUPPRESSION PROJECT

ABSTRACT

INTRODUCTION

Pheromone traps deployed to detect increasing populations of Douglas-fir tussock moth (Orgyia pseudotsuga McDunnough) showed a substantial increase of trapped tussock moths in 1987 compared to previous years on portions of the Wallowa-Whitman National Forest. By 1990 the tussock moth populations had reached suboutbreak and outbreak levels on several thousand acres. Many of these stands had experienced several years of repeated defoliation by western spruce budworm, (Choristoneura occidentalis Freeman) and stress from prolonged drought.

Biological evaluation of the tussock moth infestation in the fall of 1990, using both pheromone traps and cocoon sampling, revealed population densities high enough to meet treatment tresholds historically used to initiate suppression efforts. The biological evaluation predicted serious resource damage was probable in many of the areas sampled if the outbreak was allowed to continue until it subsided from natural causes.

The Wallowa-Whitman National Forest prepared a site-specific Environmental Assessment, "Wallowa-Whitman National Forest Douglas-fir Tussock Moth". The alternative selected in the EA was to suppress the outbreak on 166,000 acres with the biological insecticide Bacillus thuringiensis (Bt). A Decision Notice and Finding of No Significant Impacts was signed by the Forest Supervisor on February 22, 1991.

This report describes the objective, location, organization, equipment and supplies, procedures, and results of the 1991 Wallowa-Whitman National Forest Douglas-fir tussock moth suppression project.

OBJECTIVE

The objective of the suppression project was to safely, efficiently, and economically reduce the Douglas-fir tussock moth populations within the treatment areas to levels that would not cause unacceptable resource damage within the current outbreak cycle. The suppression target goal was to achieve at least 80 percent reduction in the tussock moth population.

PROJECT AREA DESCRIPTION

The project was carried out in mixed fir stands on the Pine and LaGrande Ranger Districts, the Hells Canyon National Recreation Area, and intermingled private lands on the Wallowa-Whitman National Forest in northeastern Oregon (Figure 1).

Stands within the project area included nearly pure grand fir, mixed true fir and Douglas-fir, fir and pine mixes, and nearly pure pine. Nearly 50,000 acres were dropped from the originally contracted treatment acreage. Many of these areas were dominated by tree species not favored by tussock moth.

More than 20,000 acres originally contracted for treatment were in private ownership. Ultimately only 2100 acres of private lands were sprayed. The other private lands were not sprayed because tussock moth populations were not high enough to warrent treatment, or the private landowners declared their intention to not participate in the project.

Terrain in the project area is highly varied, ranging from large, relatively flat plateaus to very steep slopes, and narrow canyons. Elevation extends from approximately 3,000 to more than 7,000 feet above sea level.

The project area was divided into 188 spray blocks based on topography, elevation, and presence of tussock moth host trees.

PROJECT ORGANIZATION

An Incident Command System organization, modified to fit the needs of a forest defoliator suppression project, was used to manage the project. The organization is displayed in Figure 2. A total of 65 USFS, Bureau of Land Management, and Oregon State Department of Forestry personnel worked on the project. Resource orders for all personnel, except the locally hired entomology sampling crews, were provided to the Wallowa-Whitman dispatch center. Local Baker County residents employed for the entomology crews were hired by the Wallowa-Whitman through the Oregon State Department of Employment in Baker City. The contractor had 24 employees on site.

CONTRACTOR

Altair, Incorporated from Swanton, Vermont was the prime contractor.

The Forest Service used a Request For Proposals (RFP) to solicit, negotiate, and award the contract. Items contracted for were application aircraft and support equipment and personnel, sufficient Bt insecticide to spray 165,000 acres, marking of project block boundaries, application of insecticide, and observation helicopters and pilots certified to transport government employees. The RFP contained two bid items. One was for the Pine-Hells Canyon area which contained 125,000 acres for spraying and up to 50 hours of administrative flights. The other bid item was for the Catherine Creek area which contained 40,000 acres for spraying and up to 25 hours of administrative flights.

The Forest Service specified that any of four commercially available Bt products could be used on the project. The four products were Thuricide 32LV, Thuricide 48LV, Foray 48B, and Dipel 6AF. All application was to be at the rate of 16 BIU per acre, undiluted. For all products, except Thuricide 32LV, this equated to a volume of 1/3 gallon per acre.

Six aerial applicators responded to the RFP with technical and price proposals. Altair was awarded both bid items in the contract on the basis of the strenght of the technical approach and price. The price per acre for application was $9.27. The price for administrative flight hours was $287.00 per hour.

Under the original contract to spray 165,000 acres Altair agreed to provide 3 fixed wing airplanes and 5 helicopters for application. This was modified after 50,000 acres were removed from spraying. Altair provided one Air tractor 502, one Air Tractor 402, two UH1B-204s, and two Bell Saloys for application and three Bell 206s and one Hughes 500 for marking and inspection.

Altair supplied Thuricide 48LV obtained from Sandoz Crop Protection Corporation.

FACILITIES AND EQUIPMENT

Two project offices were established. The main administrative office and technical center for the Pine-Hells Canyon bid item was located in a hall rented from the Lion's Club in Halfway, Oregon. The Catherine Creek bid item was administered from Forest Service owned space on the Wallowa-Whitman warehouse compound in Baker City. Telephones and Data General computer systems were installed in both offices.

A large quantity of supplies and equipment needed for the project was resource ordered from the Forest Pest Management suppression cache and National Fire Equipment System cache at the Redmond Air Center. Several incidental supplies were purchased locally. A radio system was ordered from the Boise Inter-Agency Fire Center. It was installed and service by BIFC personnel.

Altair had offices in Halfway and Baker City. They leased space for helicopter staging and insecticide storage at Halfway and Pondosa. Altair obtained permission from Baker County to use a segment of unpaved road as a temporary airstrip for the fixed wing.

SPRAY OPERATIONS

Spray blocks were designated by the Forest Service as helicopter treatment only or treatment by either helicopter or single engine airplane. The basis for aircraft assignment was safety, probability of successful treatment, and size and shape of blocks. Altair was responsible for assigning specific aircraft to the spray blocks.

Spray blocks were marked for spraying by placing bright orange and yellow-green streamers in snags and tall trees along the boundaries. This was done by contractor personnel tossing markers from helicopters. Ground panels and distinctive ground features were also used to mark the blocks.

Spray aircraft were calibrated and characterized at the Baker airport. A SwathKit was used to determine drop density and size. The fixed wing were calibrated for a 150-foot swath. Their application speed was 140 MPH. Each was equipped with 8 Micronair AU 5000 miniatomizers. Volume output was 14.1 gallons of Bt per minute. Volume Median Diameter for the fixed wing was XXX microns for the 402 and XXX for the 502. The UH1B-204 helicopters were also calibrated for a 150-foot swath. Their application airspeed was 70 MPH. Each was equipped with 8 Beecomist 360A rotary atomizers. Volume output was 7.1 gallons per minute. VMD for one 204 was XXX microns and XXX microns for the second. The Bell Saloy helicopters were calibrated for a swath of 100 feet. They were initially calibrated for an application speed of 70 MPH but this was later reduced to 60 MPH when it was determined they could not maintain 70 MPH. The Saloys were each equipped with 6 Micronair AU 5000 atomizers with long blades. Volume output was 4 gallons per minute. VMD for one Saloy was XXX microns and XXX microns for the second. All aircraft were equipped with Crophawk flow meters.

ENTOMOLOGICAL SAMPLING METHODS

Analysis Units were delineated through the analysis process based in part on results of DFTM cocoon sampling in Fall 1990 (Scott et. al 1991) and in part on other factors such as vegetation, terrain, etc. Some of the areas within the AUs were thought to have low populations, and this became apparent when crews were trying to find egg masses to monitor timing of eclosion and larval dispersal. This prompted the initiation of cocoon sampling to gather more intensive population density information in areas which were suspected to have populations below the suboutbreak level of 2 larvae per 1,000 square inches of midcrown foliage. Areas with population levels below the suboutbreak threshold were excluded from the original analysis units. DFTM larval eclosion and dispersal from the egg masses were monitored, and larval development sampling was initiated in a spray block as soon as larval dispersal had occurred. When larval populations in a spray block were estimated to be at least 70% second instar, pre-treatment population density samples were taken and the block was released for insecticide treatment. Post-treatment larval population density sampling was conducted 21 days after treatment. In addition, in 1992 larval density samples on a subset of the original plots when the larvae were primarily in the second instar (about the same timing as a pre-treatment sample). Following are more details of each of these sampling schemes.

Larval Eclosion and Dispersal

At each of the two or three larval density plots established in each spray block, ten new DFTM egg masses were tagged and examined every two or three days to determine when eggs had hatched and when larval dispersal from the egg masses had occurred. If a crew of two people could not find ten egg masses to tag within 30 minutes, this was an indication that population densities were low and that cocoon density sampling should be initiated in that block. In blocks with adequate populations, larval development sampling was initiated after larvae had dispersed from at least half of the tagged egg masses.

Cocoon Density

Cocoon densities estimated in the fall can be used to predict the following year's early larval densities (Mason et al. 1993). There are no equations for predicting larval densities based on spring cocoon sampling; however, due to the lack of any better estimating procedure, spring cocoon sampling was initiated in those blocks where we suspected that populations were below suboutbreak levels.

Initially, cocoon density sampling was conducted at each of the two or three larval development sampling sites in blocks where few egg masses were found. Three 45-cm lower crwon branch tips were examined on each of 20 trees at each site. After it became evident that plots in some areas had very few cocoons, a more intensive sampling plan was devised for blocks suspected of having low population densities.

Ten plots of 20 trees each were sampled in each of these spray blocks. Three 45-cm lower crown branch tips were examined on each tree, and the number of 1991 cocoons as well as the number of 1991 egg masses were recorded. These numbers were then summarized and used in the larval density prediction equations developed by Mason et al. 1993. If the predicted larval density was at or below two larvae per 1,000 square inches of midcrown foliage for a block, and there were several blocks with predicted low level populations, these blocks were excluded from the treatment area.

Larval Development

Each block accessible by road had two or three larval development plots located to represent the elevational differences with in the block. Each plot consisted of five host trees of the predominate species at that site, with three lower crown 45-cm branch tips sampled on each tree using standard lower crown beating methods. These plots were sampled every two or three days until at least 70% of the larvae collected on the same day in that block were second instar or later. At this time the pre-treatment larval samples were collected (either the same day or the following day) and the block was released for insecticide treatment.

Pre-treatment Larval Density

Two or three larval density plots were established in each block accessible by raod. Five host trees of the predominate species at each site were flagged and tagged. The only sampling done on these plot trees was pre-treatment and post-treatment larval sampling. Each tree was 15 to 45 feet tall and relatively open grown. Three lower crown 45-cm branch tips were sampled on each tree within 72 hours of treatment using standard lower crown beating methods. Both DFTM and western spruce budworm (WSB) larvae were counted and recorded by instar.

Post-treatment Larval Density

Post-treatment larval samples were collected from the same five trees that had been flagged previously in each plot. Sampling procedures were the same as those used for pre-treatment larval sampling. Again, both DFTM and WSB larvae were counted and recorded by instar, even though some of the WSB were in the pupal or adult stage at this time.

ENTOMOLOGICAL RESULTS

Larval Eclosion and Dispersal

At each of the two or three larval density plots established in each spray block, ten new DFTM egg masses were tagged and examined every two or three days to determine when eggs had hatched and when larval dispersal from the egg masses had occurred. If a crew of two people could not find ten egg masses to tag within 30 minutes, this was an indication that population densities were low and that cocoon density sampling should be initiated in that block. In blocks with adequate populations, larval development sampling was initiated after larvae had dispersed from at least half of the tagged egg masses.

Newly hatched larvae were first observed on June 12 in three blocks in the Pine Analysis Unit between elevations of 3,520 to 5,000 feet. As larval eclosion occurred, the egg masses were monitored to determine when larval dispersal from the egg masses had occurred and when to began larval development sampling in each spray block.

Cocoon Density

Cocoon density sampling was initiated at the larval development plot sites on April 29, with one 20-tree plot at each site. More intensive cocoon sampling (10 20-tree plots per block) was initiated on May 28 to help determine which areas had low DFTM populations and would be excluded from original designated treatment area. There was a need to determine the number of acres to be excluded from the original treatment area by June 8 so the contractor could adjust the insecticide order.

On June 8, based on the cocoon sampling, a decision was made to eliminate about 35,000 acres from the original treatment area. On June 10, another 15,000 acres were eliminated for a total reduction in the original treatment area of about 50,000 acres. Additional plots sampled between June 10 and 16 resulted in no further reductions in the treatment area. Information from a total of about 850 20-tree plots sampled in the project area was used to help delineate the new treatment area boundaries.

Larval Development

Blocks were released when DFTM larvae collected in development samples were at least 75% second instar or later. Instar determinations also were made for all larvae, both DFTM and WSB, collected in pre-treatment samples. Instar distribution estimated from pre-treatment smples showed 20 of 136 blocks with less than 75% of the larvae in second instar or later. Nine of these 20 blocks had low numbers of larvae collected making the estimate less reliable than those with higher numbers of larvae. More than half of the plots had WSB pupae present at the time of pre-treatment sampling, a condition that was expected when timing the insecticide application for optimum effects on DFTM.

Pre-treatment Larval Density

The first pre-treatment samples were collected on the Mt. Emily block on June 28. The next samples were collected from four spray blocks in the Pine AU on July 5.

Pre-treatment DFTM and WSB larval densities for the analysis units are shown in Table ?? and Figure ??. The Untreated AU was the only one with population levels categorized as outbreak (i.e., larval densities greater the 20 larvae per 1,000 sq. in. of midcrown foliage). All other units had population densities that were classified as suboutbreak (2 to 20 larvae per 1,000 sq. in.). The assumption was that these populations were still at the release phase in 1990 and that the would be at the peak phase in 1991, and that the peak phase would have populations at levels high enough to cause tree mortality in some stands.

Post-treatment Larval Density

Post-treatment DFTM larval densities ranged from 0.4 to 1.0 larvae per 1,000 sq. in. of midcrown foliage in the treated AUs and 4.9 in the Untreated AU. The estimated population reduction of 85.4 percent in the Untreated AU was similar to those in the treated AUs which ranged from 84.9 to 94.2 percent. Treated population reduction percentages were not corrected to account for natural mortality because of the substantial differences in pre-treatment population densities and the distances of two of the three treated analysis units from the untreated unit.

DISCUSSION AND RECOMMENDATIONS

In 1991, 30 percent of the area originally designated for treatment in the Environmental Assessment (USDA Forest Service 1991) either had low level population densities and/or had very little host type. The three units that were treated had pre-treatment population densities classified as sub-outbreak, with two of the unit densities falling at the lower end of the sub-outbreak range of 2 to 20 larvae per 1,000 sq. in. of midcrown foliage (Table ??). The only unit that had populations high enough to be classified as outbreak was the Untreated AU. It appears from 1991 and 1992 data gathered in the untreated areas, accompanied with additional ground observations and aerial survey maps, that the DFTM population was in its peak phase in 1991 and not the release phase, as was expected, and that populations would have declined in all areas without significant adverse effects on the resources.

There was no indication from population data that were gathered in the area that this was the case, based on information from Oregon (1971-1974 outbreak) and Arizona (1967-1970 outbreak). In addition, cocoons sampled in Fall 1990 had a very low incidence of infection by the nucleopolyhedrosus virus (NPV) which is known to cause rapid declines in DFTM population levels.

The DFTM population dynamics model which was built around data from previous outbreaks and upon which all tree effects estimates were based, also projected the three different population levels that were simulated (2, 10, and 18 larvae per 1,000 sq. in. of midcrown foliage) to go to outbreak levels in 1992. Apparently there are some key parameters missing from the model of the population dynamics of this insect.

Another factor which no doubt has some influence on the survivorship of the DFTM is the simultaneous outbreak of WSB in the same areas. This was not a factor during the DFTM outbreak of the seventies, but it was a factor during the small population increase and subsequent decrease in the early eighties. We do know that WSB and DFTM compete for the same resource (i.e., current year's foliage) when DFTM are in the early instars, so it seems that WSB would have an adverse influence on the DFTM populations, and data did point to an inverse relation between DFTM and WSB population levels (Table ??).

MESSAGE SCAN FOR BRUCE B. HOSTETLER

To b.hostetler:r06c

From: Bruce B. Hostetler:R06F06D04A
Postmark: 21 Sep 95 14:15 Delivered: 21 Sep 95 14:01

Subject: 1991 dftm results

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Unofficial preliminary results of 1991 Douglas-fir tussock moth suppression project, Wallowa-Whitman National Forest, Halfway, Oregon. (11DEC91)

AU	TYPE	N	DFTM/TR	S.E.	DFTM/MCF	WSB/TR	S.E.	WSB/MCB **
PIN	PRE	193	7.1	.55	16.0	14.8	.94	10.4
	POST	193	.7	.10	.9			
CAT	PRE	57	2.9	1.05	6.4	29.8	2.57	20.5
	POST	57	.7	.62	1.0			
HEC	PRE	39	3.0	1.04	6.9	18.0	2.02	12.5
	POST	39	.3	.11	.4			
UN	PRE	31	13.7	1.61	33.6	6.4	.64	4.7
	POST	31	3.9	1.05	4.9			

AU = Analysis Unit
DFTM/TR = Douglas-fir tussock moth larvae per lower crown beating sample per tree (three 45-cm branch tips).
WSB/TR = Western spruce budworm per lower crown beating sample per tree.
UN = Untreated
MCF = 1000 sq. in. of midcrown branch foliage
MCB = Midcrown 45-cm branch tip
** NOTE: Since a significant number of western spruce budworms were pupae or adults when the post-treatment lower crown beating samples were collected, the larval densities do not represent the budworm population densities and, thus, are not presented here.

	PERCENT DFTM MORTALITY	
AU	UNADJUSTED	ABBOTT'S ADJUSTMENT FOR NATURAL MORTALITY
PIN	94.1	59.7
CAT	84.9	0.0
HEC	94.2	60.3
UN	85.4	

unpub. report: post-spray = 21 days after treatment