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SUMMARY

Two western spruce budworm suppression projects were conducted in Oregon during June of 1987. Projects to reduce populations of western spruce budworm to less than 1.0 larva or pupa per 45-cm branch tip were carried out on the Wenatchee National Forest in Washington, around Rimrock Lake, and on the Malheur National Forest in Oregon, centered around John Day.

Analysis Units were treated with the biological insecticide, Bacillus thuringiensis, at the rate of 12 Billion International Units (BIU) in 96 ounces per acre. Populations over the 44,000-acre project at Rimrock Lake were reduced from 5.90 larvae per branch down to 0.89 larvae per branch. The less successful project on the Malheur NF reduced budworm levels from 6.7 larvae per branch down to an average of 1.8 larvae per branch, over the 94,000 acres treated.

Major factors contributing to the poorer results on the Malheur project include: (1) lateness in awarding the application contract; (2) uncertain and piecemeal funding from the Washington Office of the Forest Service; (3) defective insecticide formulation; (4) inadequate forest type data; and (5) advanced development of the target insect.

WESTERN SPRUCE BUDWORM SUPPRESSION PROJECTS IN OREGON

I. INTRODUCTION

A. 6+ million acres infested in PNW Region

- 1. Began in Blue Mtns. of NE Oregon in 1980

B. Treatment history of current outbreak

- 1. 1982 -- treated 178,549 acres of budworm outbreak w/carbaryl and acephate.

a. Results

- 1. Carbaryl reached target (below 7 larvae per 100 buds or ca 2.3 larvae/branch).
- 2. Acephate-treated areas did not.

- 2. 1983 -- treated 525,000 acres with carbaryl (and Bt and Mexacarbate on 10,000-12,000 acre blocks).

a. Results

- 1. 10 out of 14 units treated w/carbaryl reached target (less than or equal to 1.5 larvae/branch).
- 2. Operational Eval. comparing carbaryl, mexacarbate, and Bt indicated all were equally effective.

(Thuricide 32LV, 12 BIU in 9 oz/acre
 Sevin 4-Oil, 1 lbs AI in 1/2 gal/acre
 Mexacarbate w/diesel oil, 1/8 lbs AI in 1 gal/acre).

- 3. Bt effective as chemicals, Oper. Eval. of Bt planned for 1985.

- 3. 1984 -- No treatment conducted because of low stumpage values in sluggish PNW timber markets.

- 4. 1985 -- Operational Eval. of Bt on 41,000 acres

a. Results

- 1. All formulations reduced larval pop. to less than 1.0 larvae/branch.

D8L, 12BIU @ 24oz/acre, 80vmd, fixed wing

T48LV, 12BIU @ 32oz/acre, 80vmd, fixed wing
D8L, 12BIU @ 48oz/acre, 125vmd, helicopter
T32LV, 12BIU @ 96oz/acre, 125vmd, helicopter
T32LV, 16BIU @ 64oz/acre, 125vmd, helicopter

5. 1986 -- Treatment on up to 500,000 acres w/Bt proposed but not carried out due to lack of funding.

a. Environmental Analysis.

1. Regional Forester selected Bt alternative

a. Chemicals excluded -- variable results or potential hazard to human health. (EPA registered malathion, acephate, mexacarbate, and carbaryl).

b. Silviculture mgt. is long-term mgt. strategy. Will not reduce current outbreak. Coordinate and cooperate between land owners.

c. Pheromones, sterile male releases, and parasite and predator releases show inconclusive results in the past.

6. 1987 -- Treatment included a 44,000 acre project on the Wenatchee NF in Washington and a 200,000 acre project on the Malheur NF with Bt.

a. Objective.

1. To reduce budworm population levels to less than 1 larva or pupa per 45 cm branch tip.

2. Past experience suggests that at this level, populations will remain undamaging throughout the current outbreak period (6-10 years).

II. PROJECT SUMMARY

Analysis Unit (AU) - a geographic area which has resources that are expected to be adversely affected by the western spruce budworm.

A. Rimrock Project.

-- Successful project conducted on all 44,153 acres on the Wen. NF

-- All spray blocks were treated.

-- Budworm populations were reduced to targeted levels.

Costs:

<u>Total</u>	<u>Application</u>	<u>Project Operating</u>
\$853,477. (\$19.33/acre)	\$11.34/acre	\$7.99/acre

1. Application parameters.

a. Aircraft -- All helicopter (equipped w/pathlink recorders).

1. Application

3 Hiller 12E Soloy
1 Hughes 500D
1 Lama SA 315B (Aerospatiale)

2. Observation

3 Bell 206 Jet RangerIII
1 Bell 47 Soloy
1 Hughes 500D

b. Spray system

1. Tanks.

Hillers equipped w/Simplex belly tanks (model 4500)
Hughes 500 w/Isolair saddle tanks (model 3700)
Lama w/Simplex saddle tanks (model 4206)

2. Boom.

Hydraulically pressurized spray booms

3. Nozzles.

a. Beecomist model 360 rotary atomizers

Hillers w/4 each
Hughes 500 and Lama w/6 each

b. Characterization

Characterized at an average vmd of 83 microns; 20 drops/cm².

4. Aircraft speed and swath width

<u>Aircraft</u>	<u>Speed</u>	<u>Swath Width</u>
Hillers	60 MPH	100 FT.
Hughes	80 MPH	120 FT.
Lama	80 MPH	150 FT.

c. Pesticide.

1. Formulation.

Thuricide 48 LV (Aqueous Concentrate)

2. Potency and application rate

-- 12 BIUs in 96 oz (3/4 gal) per acre.

-- Mixed w/water in 2:1 ratio (2 parts water to 1 part aqueous concentrate).

d. Spray block release and treatment summary.

<u>Ave time from Release to Start of Spray (days)</u>	<u>Ave time from Start of Spraying to Finish (days)</u>	<u>Percent 5th+ Instar at Release</u>	<u>Percent Budburst at Release</u>	<u>Average Instar at Release</u>
0.78	0.72	57.0	98.7	4.5

e. Spray assessment results.

<u>Spray Assessmt. Method</u>	<u>No. Cards</u>	<u>Ave. Drop Density (drops/cm²)</u>	<u>Target Drop Density (drops/cm²)</u>
Line/Grid	2,295	16.65	20
Eval. Grid	216	14.80	20

2. Population levels.

a. Pre-treatment larval densities.

1. Averaged 5.90 ± 0.82 larvae/45-cm branch.

2. Qualification for treatment = 4 larvae/45-cm branch.

b. Post-treatment larval or pupal densities.

- 1. Averaged 0.89 ± 0.10 budworm/45-cm branch.
- 2. Treatment objective: less than 1.0 budworm/45-cm branch.

c. Post-treatment collected and reared larvae.

<u>Larvae</u> Collected <u>Alive</u>	<u>Percent</u> Overall <u>Mortality</u>	<u>Percent of total mortality due to</u>	
		<u>Parasitism</u>	<u>Other (eg.latent Bt)</u>
486	43	23	20

3. Factors contributing to successful project.

a. Cooperative spray weather.

- 1. Began spraying June 1.
- 2. Finished spraying June 12.
- 3. Only part of 1 day was lost due to rain.

b. Responsive and cooperative contractor.

1. Contractor worked with us, as part of the team, was flexible and willing to shut down when our aerial observers felt we could no longer operate effectively or safely, as conditions dictated.

2. Minor repairs were made quickly to minimize down time.

c. Good insecticide formulation

1. Had do problems with mixing, flow, application, deposit, or efficacy.

d. Excellent project personnel.

1. Many experienced individuals.

2. Excellent training provided for newcomers as well as "old-hands."

3. All were dedicated to doing the best job possible.

4. Many District and Forest personnel on project, who had a good deal of "ownership" in the operation.

e. Excellent project management.

1. Experienced and decisive Project Director.

f. Good support from the Wenatchee National Forest.

1. Forest personnel showed interest and support but did not interfere with project.

g. Application contract awarded in a timely manner.

1. Award was made 2 weeks before treatment was scheduled to begin.

h. Sufficient funding.

1. Were not constantly being squeezed to cut every corner to save dollars, as some projects in the past have operated.

i. Supportive public, active public awareness plan, and good press.

**j. Excellent project entomologist who stayed on top of insect development and released spray blocks for treatment in a timely manner.

B. Malheur Project

-- Composed of 6 Analysis Units comprising about 200,000 acres.

-- Partly treated only 4 AUs and about 94,500 acres (ca 47% of contracted acreage).

-- Budworm populations were not reduced to targeted levels of less than 1.0 budworm/45-cm branch.

Project Costs:

<u>Total</u>	<u>Application</u>	<u>Project Operating</u>
ca \$1.78 Million (\$18.87/acre)	\$11.55/acre	\$7.32/acre

1. Application parameters.

$\$18.87/ac * 94,500 ac = \$1,783,215$

	ac	% of total ac	\$
Dixie	18,145	16.08	286,741
Plat	47,794	42.35	755,192
Canyon	22,826	20.22	360,566
Lost C	23,764	21.06	375,545
Starr	333	0.30	5,358
	<u>117,862</u>	<u>100.01</u>	<u>(1,783,391)</u>

a. Aircraft -- Helicopter and fixed-wing (helicopters w/Pathlink).

Application

- 4 Bell 205
- 1 Turbine Agcat
- 2 Turbo-Thrush

Observation

- 6 Bell 206 Jet RangerIII
- 1 Hughes 500D

b. Spray systems

1. Tanks.

(unknown)

2. Nozzles.

a. Helicopters equipped with Beecomist model 360 rotary atomizers and hydraulically pressurized boom.

b. Fixed wing

1. Agcat equipped w/Beecomist nozzles.

2. Turbo-thrushes equipped w/Micronair wind-driven rotary atomizers.

c. Characterized at 130-150 vmd.

3. Aircraft speed and swath width.

<u>Aircraft</u>	<u>Speed</u>	<u>Swath width</u>
Bell 205	92 MPH	180 FT.
Agcat	120 MPH	140 FT.
Turbo-Thrushes	120 MPH	140 FT.

c. Pesticides.

1. Formulation.

- Dipel 6L (Oil Formulation)
- Dipel 6AF (Aqueous Concentrate)

Thuricide 48LV (Aqueous Concentrate).

2. Potency and application rate.

- 12 BIUs in 96 oz (3/4 gal) per acre.
- Mixed w/water in a 2:1 ratio (2 parts water to 1 part Bt).

d. Spray block release and treatment summary.

- Time from date of first block release until sprayed averaged 5 days.

<u>Percent Budburst at Release</u>	<u>Percent 5th Instar or Greater at Release</u>	<u>Mean Instar at Release</u>	<u>Percent 5th Instar or Greater at Start of Spraying</u>	<u>Mean Instar at Start of Spraying</u>
98.2	63.1	4.7	81.7	5.1

e. Spray assessment results.

<u>Spray Assessmt. Method</u>	<u>No. of Cardline/ Cardgrids</u>	<u>Average Drop Density (drops/cm²)</u>	<u>Target Drop Density² (drops/cm²)</u>
Cardlines	2,897	5.25 ± 0.22	20
Eval. Plot Grids	945	5.42 ± 0.21	20

2. Population levels.

a. Pre-treatment larval densities.

1. Averaged 6.7 larvae/45-cm branch.
2. Qualification for treatment: 4 larvae/45-cm branch.

b. Post-treatment budworm densities.

1. Averaged 1.8 budworm/45-cm branch (treated).
2. Averaged 3.13 budworm/45-cm branch (untreated).
3. Treatment objective: less than 1.0 budworm/branch.

c. Post-treatment collected and reared larvae or pupae.

	<u>Larvae Collected Alive</u>	<u>Percent Overall Mortality</u>	<u>Percent of Total Mortality Due to</u>	
			<u>Parasitism</u>	<u>Other (eg. latent Bt)</u>
Dipel	979	59	26	33
Thuricide	669	56	22	34
Check	1,698	57	27	30

3. Factors contributing to less than successful project.

a. Lateness in awarding contract.

1. Award was made May 27 and June 1. Did not provide the contractor enough time to mobilize when blocks were ready for treatment, resulting in lost spray days.

-- In some cases, insects advanced beyond a treatable stage.

b. Uncertain and piecemeal funding from WO.

1. Contributed in delays in awarding contracts.

2. Had to trim acreage and renegotiate contract when total allocation--\$4.3 million--was less than expected for both projects (\$5.7 million).

3. Biol. crews brought on late to save money. Project unable to collect early biol. info. resulting in releasing large numbers of blocks for treatment that could not be done in time.

c. Quality of insecticide.

1. Dipel 6L formulation was defective.

a. Formulation thickened up and separated in tanks, becoming the consistency of mayonnase, in time.

b. Formulation wouldn't mix and flow through the spray booms.

c. When it was pumped out and atomized, they would get strange-appearing drops (four different types) none of which looked like typical Bt.

- 1. A white flat spot.
- 2. A silvery black, flat spot.

3. A black spot w/a gelatinous matter in the center.

4. A black spot with a crystal-like object sticking up in the center.

d. A company chemist added a surfactant, but that only resulted in finer atomization, small droplets, and increased drift.

e. Forest Service ordered contractor to stop using the Dipel. Contractor purchased Thuricide 48LV, but had problems with evaporation when the relative humidity dropped below 65%.

d. Inadequate forest type data.

1. Malheur Forest provided incorrect AU boundaries which included over 80,000 acres of non-host pine type.

2. Project personnel had to retype alot of the area. This delayed issuing contracts because we didn't have final acres. We re-negotiated with the contractor 3 times.

e. Delays resulted in many insects growing beyond a point where treatment would be effective.

III. SUMMARY.

A. The Rimrock and the Malheur each were completed after spraying 12 days.

B. In addition to advanced insect development, low relative humidities on the Malheur resulted in reaching marginal spray conditions quickly, thereby limiting treatment time.

C. Project objectives of reducing budworm levels to below 1.0 larva/branch were met on the Rimrock project but not on the Malheur.

D. Both projects lost 1 spray day due to rain.

E. Barring formulation problems, if the Malheur project could have begun 1-2 weeks earlier, we would have been more successful in lowering population levels. Almost all budworm were in 5th and 6th instars when treated.

F. A lot of acreage was lost (untreated) due to advanced insect development.

IV. QUESTIONS