1992 UMATILLA AND WALLOWA-WHITMAN NATIONAL FORESTS

WESTERN SPRUCE BUDWORM SUPPRESSION PROJECT

LA GRANDE AND WALLA WALLA RANGER DISRICTS

JAMES S. HADFIELD
INCIDENT COMMANDER
USDA FOREST SERVICE - FOREST PEST MANAGEMENT
PORTLAND, OREGON

TABLE OF CONTENTS

1992 UMATILLA AND WALLOWA-WHITMAN NATIONAL FORESTS WESTERN SPRUCE BUDWORM SUPPRESSION PROJECT

LA GRANDE AND WALLA WALLA RANGER DISTRICTS

INTRODUCTION

Western spruce budworm (*Choristoneura occidentalis* Freeman) populations have been at outbreak levels on portions of the Umatilla and Wallowa-Whitman National Forests in northeast Oregon since the early 1980's. Defoliation caused by the budworm outbreaks, in combination with impacts from several other pests, severe drought, and other stress factors, has resulted in serious forest health decline over hundreds of thousands of acres of forests in the Blue Mountains of northeast Oregon and southeast Washington.

In 1990 and 1991, both National Forests established budworm analysis units to estimate budworm population levels, and assess the effects of the outbreaks and management alternatives on resource management. Biological evaluation of the budworm infestations in the analysis units done in the summer of 1991 predicted that population densities in 1992 would be high enough to cause moderate to severe defoliation (Scott, D.W., 1991 Biological evaluation of western spruce budworm in 1992 analysis units on the Umatilla and Wallowa-Whitman National Forests. Rep. BMZ-91-04, USDA-Forest Service, Wallowa-Whitman NF. La Grande, OR. 54 p.)

The two National Forests prepared a site-specific Environmental Assessment, "Umatilla and Wallowa-Whitman National Forests Western Spruce Budworm". The alternative selected in the EA was to suppress the budworm population on 185,373 acres in seven analysis units with the biological insecticide *Bacillus thuringiensis* variety *kurstaki* (Btk). A Decision Notice and Finding of No Significant Impact was signed by Forest Supervisors from both National Forests by December 3, 1991.

A decision was made to split the areas to be sprayed into two separately administered projects because of the distance separating the treatment areas. The La Grande project included the analysis units on the La Grande and Walla Walla Districts, the Enterprise project included analysis units on the Wallowa Valley District. This report describes the objective, location, organization, procedures, and results of the La Grande project. A separate report describes the Enterprise project.

OBJECTIVE

The objective of the suppression project was to safely, efficiently, and economically reduce the western spruce budworm populations within the treatment areas to levels that would not cause additional, unacceptable resource damage for several years. The suppression target goal for each analysis unit was to reduce the budworm population by 90 percent, unadjusted for natural mortality, in the time period from the prespray sampling to the postspray sampling.

PROJECT AREA

The suppression project was done in stands with large proportions of western spruce budworm host species on the La Grande and Walla Walla Districts. The project was separated into five analysis units for purposes of entomology sampling and analysis. The general vicinity map (Figure 1) shows the location of the analysis units. The following paragraphs describe the general location and characteristics of the analysis units:

- Mill: This analysis unit on the Walla Walla District is located approximately 15 miles southeast of Dayton, Washington. A total of 5,960 National Forest treatment acres was in this unit. Ski Bluewood, a commercial ski operation, is located within the treatment unit. More than 90 percent of the trees per acre in the treatment area are budworm host species.

- Thimbleberry: The unit is located approximately 15-20 miles northwest of Elgin, Oregon. It had 32,902 treatment acres of National Forest and 823 treatment acres of non-federal lands. About 88 percent of the trees per acre are budworm host species.

- Meacham-Trail: The analysis unit is located approximately 10 miles northwest of La Grande, Oregon, along Interstate 84N. There are 28,954 treatment acres, of which 22,335 are on National Forest. Eight non-federal landowners have stands that were sprayed. Nearly 70 percent of the trees per acre are budworm host species. The Oregon Trail passes through the treatment unit.

- Mt Emily: The unit is located about 5 miles north of La Grande, Oregon. There are 25,386 treatment acres, of which 24,804 are National Forest. Over 90 percent of the trees per acre are budworm host species.

- Indian Creek: The analysis unit is located approximately 10 miles southeast of Elgin, Oregon and 3 miles north and east of Cove, Oregon. There are 20,248 treatment acres, of which 18,818 are National Forest. Six non-federal landowners have parcels of stands that were sprayed. About 85 percent of the trees per acre are budworm host species.

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 2,800 to 7,000 feet above sea level.

The treatment units were divided into 209 spray blocks, based on topography and elevation.

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 63 Forest Service, Oregon Department of Forestry, and Bureau of Land management personnel worked on-site on the project. Resource orders for all personnel were issued by the Wallowa-Whitman National Forest Dispatch Office. The contractor had about 40 employees on site.

SPRAY OPERATIONS

Spray blocks were designated by the Forest Service as helicopter treatment only or treatment allowed by either helicopter or single engine, fixed wing aircraft. The basis for aircraft assignment was safety, and size and shape of blocks. Heli-Jet was responsible for assigning specific aircraft to the spray blocks.

Spray blocks were marked for spraying by placing bright orange, yellow-green, and white 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 used as aids in marking blocks. Heli-Jet also used large white retrievable hoops to mark some blocks to be sprayed by the airplanes. The hoops were more visible to the pilots than the streamers.

Spray aircraft were calibrated and characterized at four separate locations. A SwathKit was used to measure and analyze the spray patterns created during the characterization spray runs. The Hiller Soloys were calibrated for a swath width of 90 feet and a flow rate of 5.5 gallons per minute with the application speed of 60 MPH. Volume Median Diameter for spray drop patterns from the Soloys ranged between 132 and 241 microns for the four aircraft. All the Hiller Soloys were fitted with six Beecomist 360 atomizers. The Bell 205s and Bell 212 were calibrated for a swath width of 130 feet and a flow rate of 13.1 gallons per minute at the application speed of 92 MPH. Analysis of the characterization runs showed that all of these aircraft could produce a swath width of 140 feet. Volume Median Diameter for spray drop patterns from the four 205s and 212 ranged from 167 to 257 microns. All four of the helicopters were fitted with 8 Beecomist 360 atomizers. All were positioned at the same locations on the booms and all had the same size restrictor plates. The two Thrushes were calibrated for a swath width of 140 feet and a flow rate of 18.1 gallons per minute at an application speed of 135 MPH. Volume Median Diameter for spray drop patterns from the Thrushes ranged from 106 to 110 microns. The Thrushes were each fitted with 8 Micronair AU 5000 atomizers. All application aircraft were equipped with Crophawk flow meters.

Thuricide 48LV was delivered to the contractor in bulk truck tanker shipments. No dye was added to the insecticide, except for the characterization inspections. Insecticide was metered by the contractor and monitored by the Forest Service when it was pumped from storage tanks or batch trucks into the application aircraft. The contractor was paid on the basis of gallons of insecticide pumped into the aircraft and then applied as called for in contract specifications.

Application and observation pilots and Forest Service aerial inspectors flew over the spray blocks prior to their scheduled treatment to familiarize themselves with block features and determine spray tactics.

The application aircraft flew in teams of two or solo, accompanied by a single observation helicopter. Spraying was allowed only when observation helicopters were present. Spray and observation aircraft, ground equipment, and personnel were formed into teams that operated together throughout most of the project. The spray airplanes flew from the La Grande airport and Meacham airstrip. The spray helicopters operated out of temporary helispots located throughout the project area.

The two Districts requested that some areas be sprayed twice to provide extra protection to important visual resources. One of the areas was located in the Meacham analysis unit at the site being developed for the Oregon Trails Intrepretive Wayside. Fifteen budworm density sampling plots were established in the double spray area. This was the only area sprayed twice.

Larval and tree development were monitored to determine when individual spray blocks met release criteria. Blocks were released for spraying when the first sixth instar larva was seen and at least 95 percent of all new shoots had unfurled (i.e., the budcap was gone and the new shoots elongated so the needles were no longer bunched). In most cases, sixth instar larvae were found before 95 percent of the new growth had unfurled, so the blocks were not released until shoot development progressed. Development monitoring involved assessing larvae sampled in lower crowns and shoots by visual estimate within each accessible spray block. Monitoring was prioritized by looking at low elevations, southern exposures first and high elevations, northern exposures last. Those blocks with no road access were released for spraying when adjacent blocks with the same elevation and aspect met release criteria and a visual survey from a helicopter by the project entomologist confirmed foliage readiness.

Different spray block release criteria were used for the portion of the Meacham analysis unit sprayed twice than were used for the blocks sprayed once. Blocks were released for the first spray by the project entomologist 5 to 10 days in advance of when he felt at least 95 percent of the shoots would be unfurled and the first sixth instar would be seen. They were released for the second spray when they met the criteria used to release blocks to be sprayed once.

Budworm density sampling plots in released spray blocks were sampled within 24 hours of release, using lower crown sampling procedures. Three, approximately 18 inch long branch tips from each of the five plot trees were beaten over a standard beating cloth/frame, then they were cut and discarded to prevent their being sampled again. All budworms on the cloth were counted and the instar of each determined. If a block was not sprayed within 72 hours of this sample the plot was resampled.

The postspray budworm density sample was taken in each evaluation plot when the first pupa was observed, but no sooner than 14 days and no later than 21 days after the block had been sprayed. The sampling procedure was the same as that used for the prespray sampling.

All lower crown population sample data were converted to mid-crown branch tip equivalents using the equation $Y = .3513 + .6781X$ where Y = mid-crown branch tip budworm density and X = budworm density of the 3 branch lower crown sample (Torgersen,T.R., D.W. Scott, T.F. Gregg, and K.P. Hosman [In Preparation] Sampling western spruce budworm, *Choristoneura occidentalis* Freeman [Lepidoptera: Tortricidae] by lower-crown beating after treatment with *Bacillus thuringiensis* Berliner).

SPRAY OPERATIONS ACCOMPLISHMENTS

Analysis unit treatment data are displayed in Table 1 (Appendix). A total of 116,344 acres was sprayed. Approximately 500 acres scheduled to be sprayed in the Indian Creek analysis unit were not sprayed because of insufficient insecticide. Insecticide application began on May 30 and was completed on June 18. Four days were not suitable for spraying because of rain and fog. Low relative humidity limited the time available for spraying several mornings.

The two Thrushes sprayed 32,816 acres. They averaged 514 acres per hour per aircraft. The four Hiller Soloys sprayed 31,564 acres and averaged 311 acres per hour per aircraft. The three Bell 205s sprayed 41,892 acres and averaged 619 acres per hour. The Bell 212 sprayed 10,072 acres, averaging 907 acres per hour.

A total of 521.7 flight hours were flown on the project.

Seventy four card lines, with a total of 647 spray cards, were placed in 66 spray blocks. Spray drops were seen on 92 percent of the cards and drop density averaged 15 drops per square centimeter. The percentage of cards with measured spray was slightly higher in spray blocks sprayed by airplanes than those sprayed by helicopters. The average spray drop density was greatest on cards in the airplane sprayed blocks.

No handling problems were experienced with the insecticide.

ENTOMOLOGY SAMPLING RESULTS

A total of 165 5-tree budworm density plots were established for prespray and postspray sampling. Not all these plots were used for sampling. Some were dropped if the areas they were in were excluded from spraying.

Population sampling results are displayed for the analysis units in Tables 2 and 3 (appendix) and Figure 3. Population reductions, unadjusted for natural mortality, based on mid-crown branch tip densities, did not reach 90 percent in any of the analysis units. Graphic displays of prespray and postspray population densities from the lower crown branch sampling for each analysis unit are shown in Figures 4 to 9. All project entomology data are on file at the Forest Pest Management office in Portland, Oregon.

The first spray block (Indian Creek H-0) was released on May 29 for spraying on May 30. On the same date, portions of Meacham blocks MF-1, MF-2, MH-1, and MH-2 selected for double treatment were released to receive the first spray application. By May 31, 21 blocks had been released, with indications of large numbers of blocks meeting release criteria over the next few days. From June 1 to 3, an additional 107 spray blocks were released. The remaining blocks were released between June 4 and June 8.

BUDGET

Cost of the project was $1,964,028. Cost per sprayed acre averaged $16.88. A breakdown of costs is shown in Table 4. The contract accounted for $13.84 per acre, with administrative costs being $3.04 per acre. All costs of spraying National Forests were paid by the Federal government. Cost of spraying 11,454 acres of non-federal lands were shared with the owners. Individuals or businesses owning less than 500 acres sprayed paid 50 percent of the cost. Those with more than 500 acres paid 66 percent of the cost. State agencies paid 75 percent of the cost of spraying lands they owned.

SAFETY

There were no reported accidents, injuries, or spills on the project. Driving on dusty roads in the dark was one of the most hazardous activities on the project. Approximately 50,000 miles were driven by project personnel.

DISCUSSION

The short term goal of achieving a 90 percent population reduction, unadjusted for natural mortality, was not met on any of the five analysis units using the converted mid-crown branch budworm densities as the comparison unit. The populations declined by a low of 79 percent on the Thimbleberry analysis unit to a high of 87 percent on Indian Creek. The population reduction measured is a result of a combination of insecticidal effects and natural mortality. No attempts were made to quantify the contributions of various mortality components.

The postspray population density is a better indication of short-term project success than percent population decline. Recent western spruce budworm suppression projects done by the Forest Service in Oregon and Washington have had a goal of reducing the budworm population to 1 or less larva and/or pupa per 18 inch midcrown branch in the postspray analysis unit samples. This target was not used for this project. None of the 5 analysis units had a postspray budworm density of 1 or less, although Indian Creek was close with 1.1. The Mill unit, with a postspray density of 3.4 probably has the greatest potential for the fastest budworm population resurgence for all the sprayed units.

Postspray density measured in the double sprayed area in the Meacham unit was higher than three analysis units that received a single insecticide application. The budworm population sampled declined by 77 percent from the first prespray sample to the postspray sample. Defoliation intensity in the double spray area was compared to that seen in adjacent single spray areas during aerial surveys in August by an experienced aerial observer. There were no obvious differences in the intensity of defoliation between the double sprayed and single sprayed areas. A July hail and rain storm that covered large areas of northeast Oregon and southeast Washington knocked off much of the dried, shrivelled red foliage, reducing the reddish brown appearance caused by budworm feeding. It appears that double spraying did not achieve the intent of extra foliage protection.

APPENDIX

Table 1. 1992 Walla Walla and La Grande Districts western spruce budworm suppression project analysis unit treatment information.

Analysis Unit	Number Spray Blocks	Acres Sprayed
Indian Creek	28	19,748
Meacham Single spray	36	28,954
Meacham Double spray	4*	2,571
Mill	19	5,960
Mt. Emily	46	25,386
Thimbleberry	76	33,725
Total	209	116,344

* Portions of 4 spray blocks in the Meacham analysis unit were sprayed twice.

Table 2. 1992 western spruce budworm population densities for the La Grande and Walla Walla District analysis units.

Analysis Unit	No. Plots	*Budworm Density (mean + SE)** Budworms per 3-branch Lower crown sample	Budworms per 18-inch Mid-crown Branchtip**
PRESPRAY			
Indian Creek	30	11.5 + 1.0	8.2
Meacham	29	17.4 + 1.6	12.1
Mill	30	26.9 + 2.5	18.6
Mt. Emily	31	15.3 + 1.7	10.7
Thimbleberry	30	18.4 + 1.3	12.8
POSTSPRAY			
Indian Creek	27	1.0 + 0.3 (91)***	1.1 (87)
Meacham	29	2.5 + 0.4 (86)	2.1 (83)
Mill	30	4.5 + 0.8 (83)	3.4 (82)
Mt. Emily	31	2.3 + 0.4 (85)	1.9 (82)
Thimbleberry	30	3.5 + 0.7 (81)	2.7 (79)

* Standard Errors (SE) could not be reported for converted midcrown means.

** Budworms per 18 inch mid-crown branch tip converted from lower crown sample using the equation Y = .3513 + .6781X. (Torgersen et.al. In Preparation)

*** Numbers in the parenthesis are percent population declines estimated from prespray sampling to postspray sampling.

Table 3. 1992 western spruce budworm densities for the Meacham double spray block.

Sample Type	Date Sampled	No. Plots	*Budworm density (mean + SE)** BW per 3-branch Lower Crown	BW per 18-inch Mid-crown Branchtip**
1st Prespray	5/29	15	16.5 + 2.1	11.5
2nd Prespray	6/5	15	11.2 + 1.0	7.9
Postspray	6/21	15	3.3 + 0.7 (80)***	2.6 (77)

* Standard Errors (SE) could not be reported for converted mid-crown means.
** Budworms per 18 inch mid-crown branch tip converted from lower crown sample using the equation Y = .3513 + .6781X. (Torgersen et.al. In Preparation).
*** Numbers in the parenthesis are percent population decline estimated from the first prespray sampling to the postspray sampling.

Table 4. Budget for the 1992 Walla Walla and La Grande Districts western spruce budworm suppression project.

Salaries and Per Diem	$267,714
Application contract	$1,610,698
Vehicles	$34,923
Supplies and equipment	$12,493
Forest overhead	$37,200
Total	$1,964,028

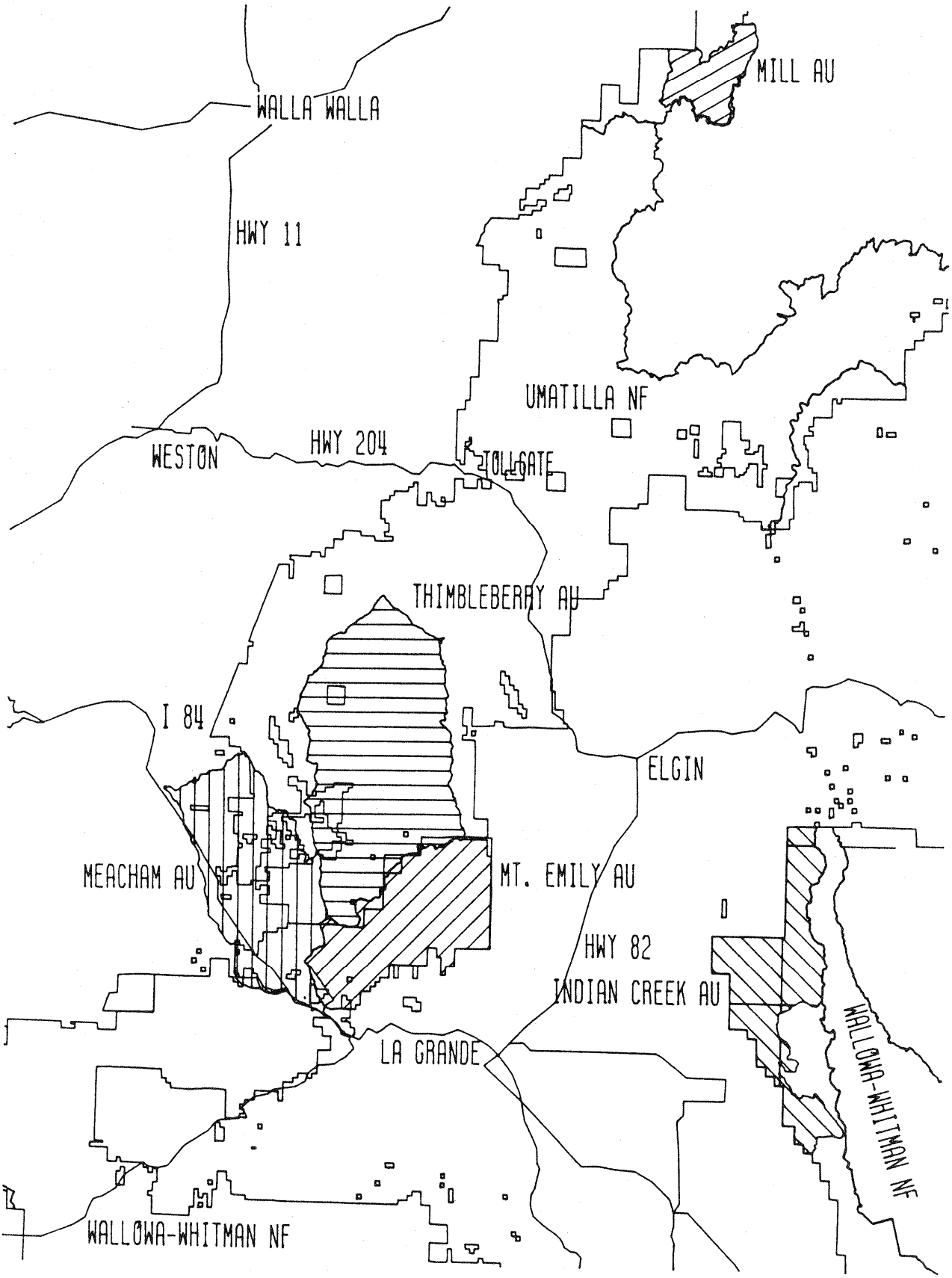

Figure 1. 1992 La Grande and Walla Walla Districts western spruce budworm suppression project analysis unit locations.

Figure 2. 1992 La Grande and Walla Walla District Western Spruce Budworm Project Organization

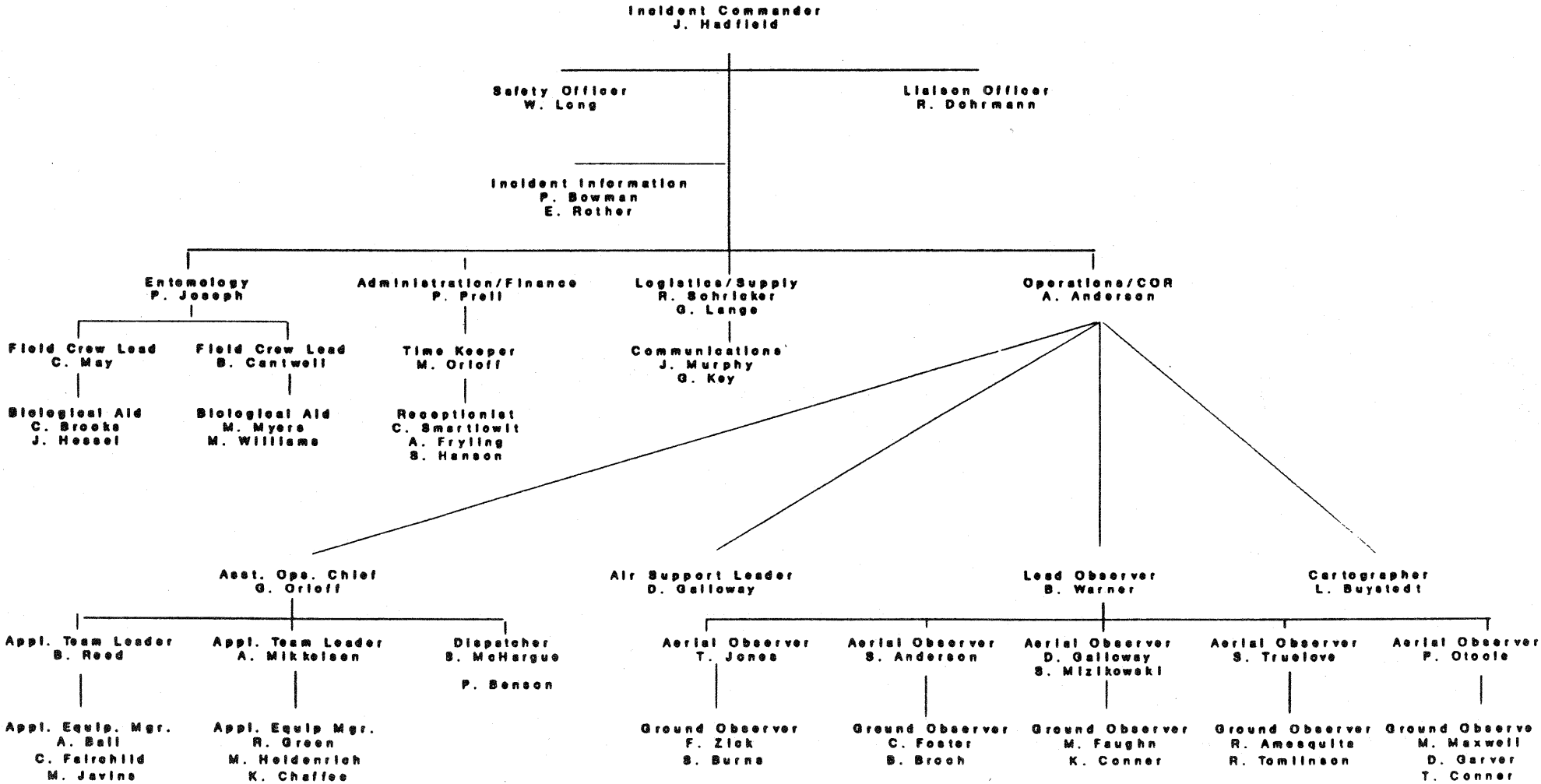

Figure 3. Projected western spruce budworm mid-crown branch densities for the 1992 La Grande and Walla Walla district analysis units.

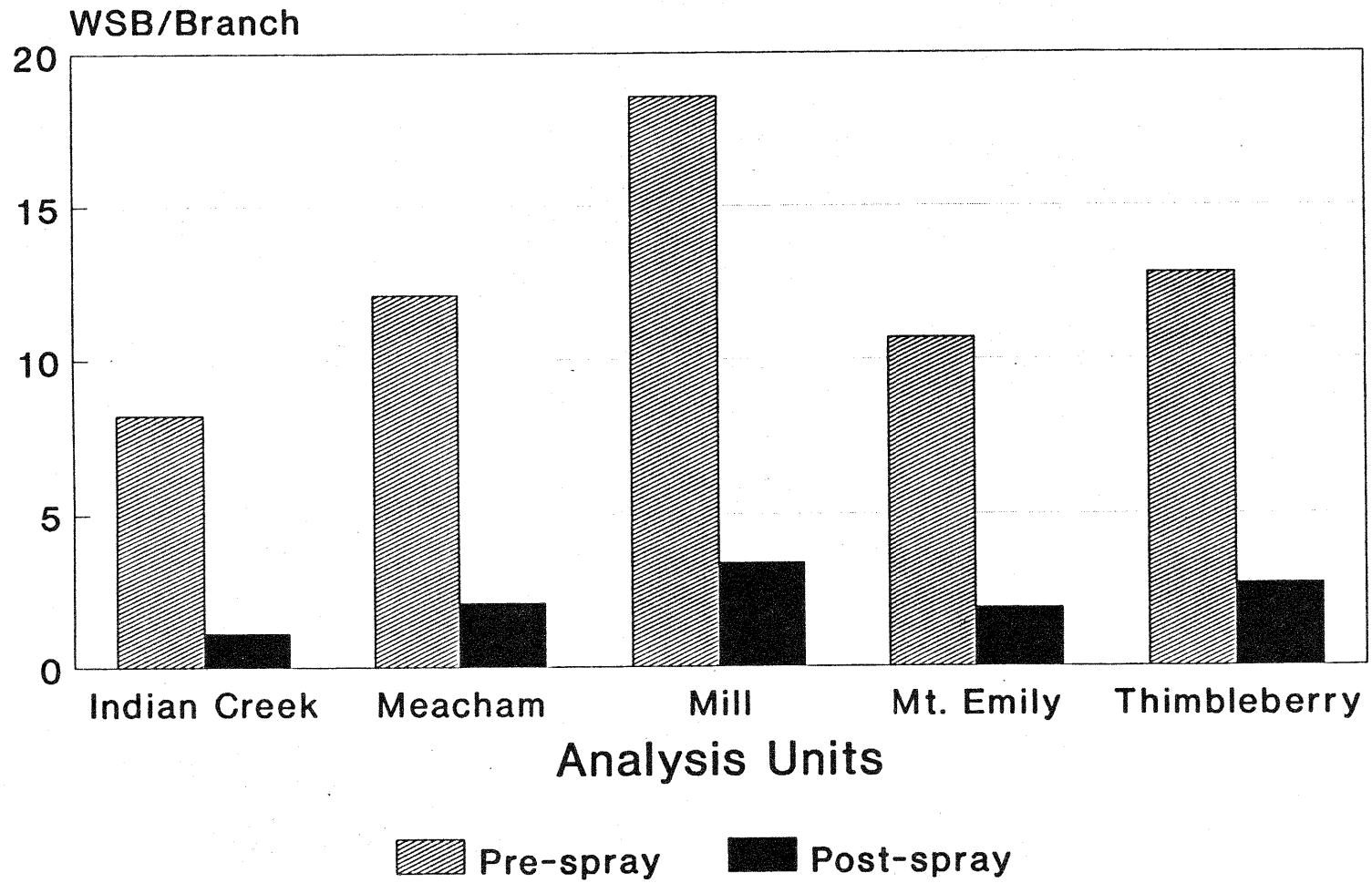

Figure 4. Western spruce budworm plot densities from lower crown branch samples in the Indian Creek analysis unit

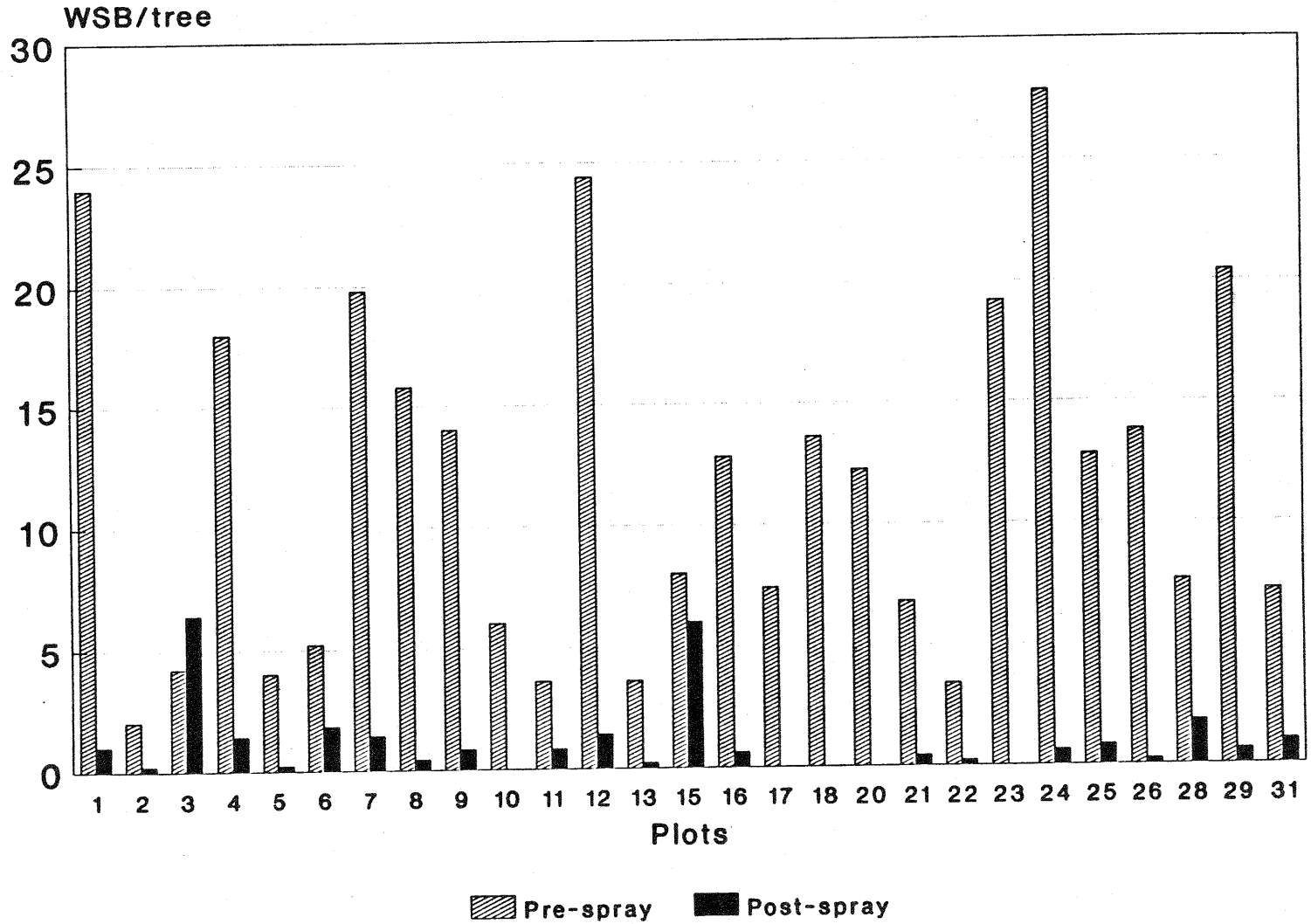

Figure 5. Western spruce budworm plot densities from lower crown branch samples in the Meacham single spray analysis unit.

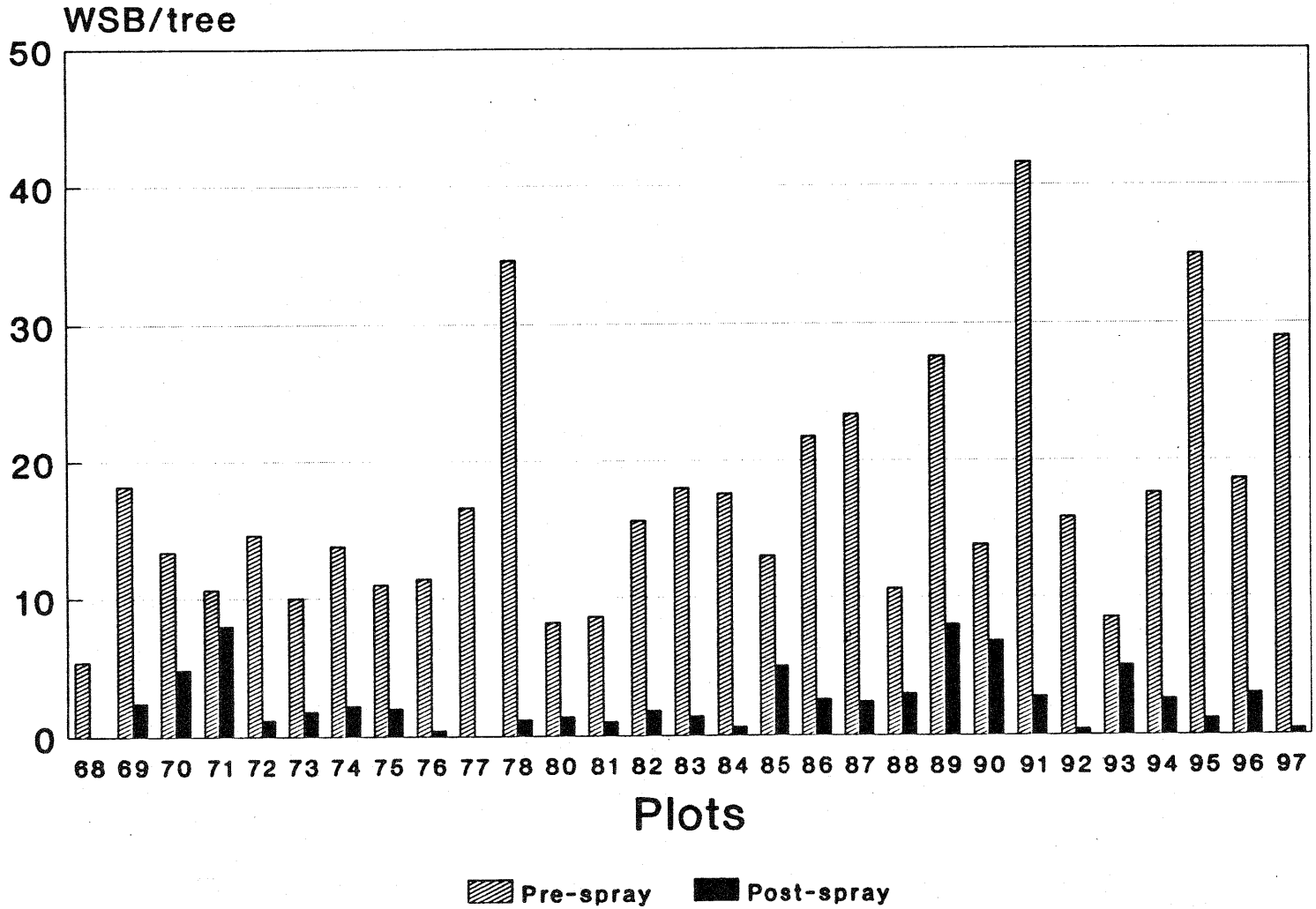

Figure 6. Western spruce budworm plot densities from lower crown branch samples in the Mill analysis unit.

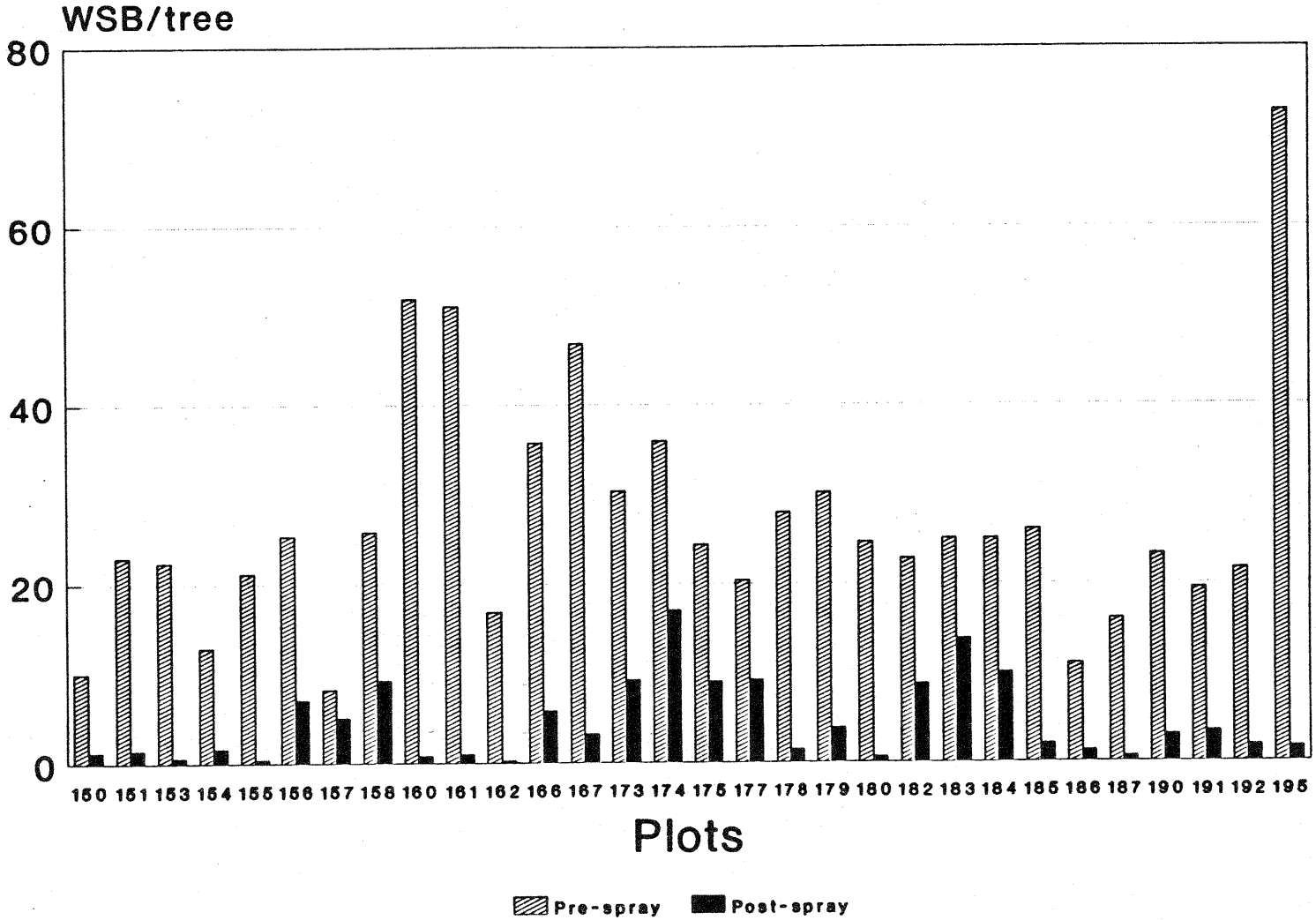

Figure 7. Western spruce budworm plot densities from lower crown branch samples in the Mt. Emily analysis unit.

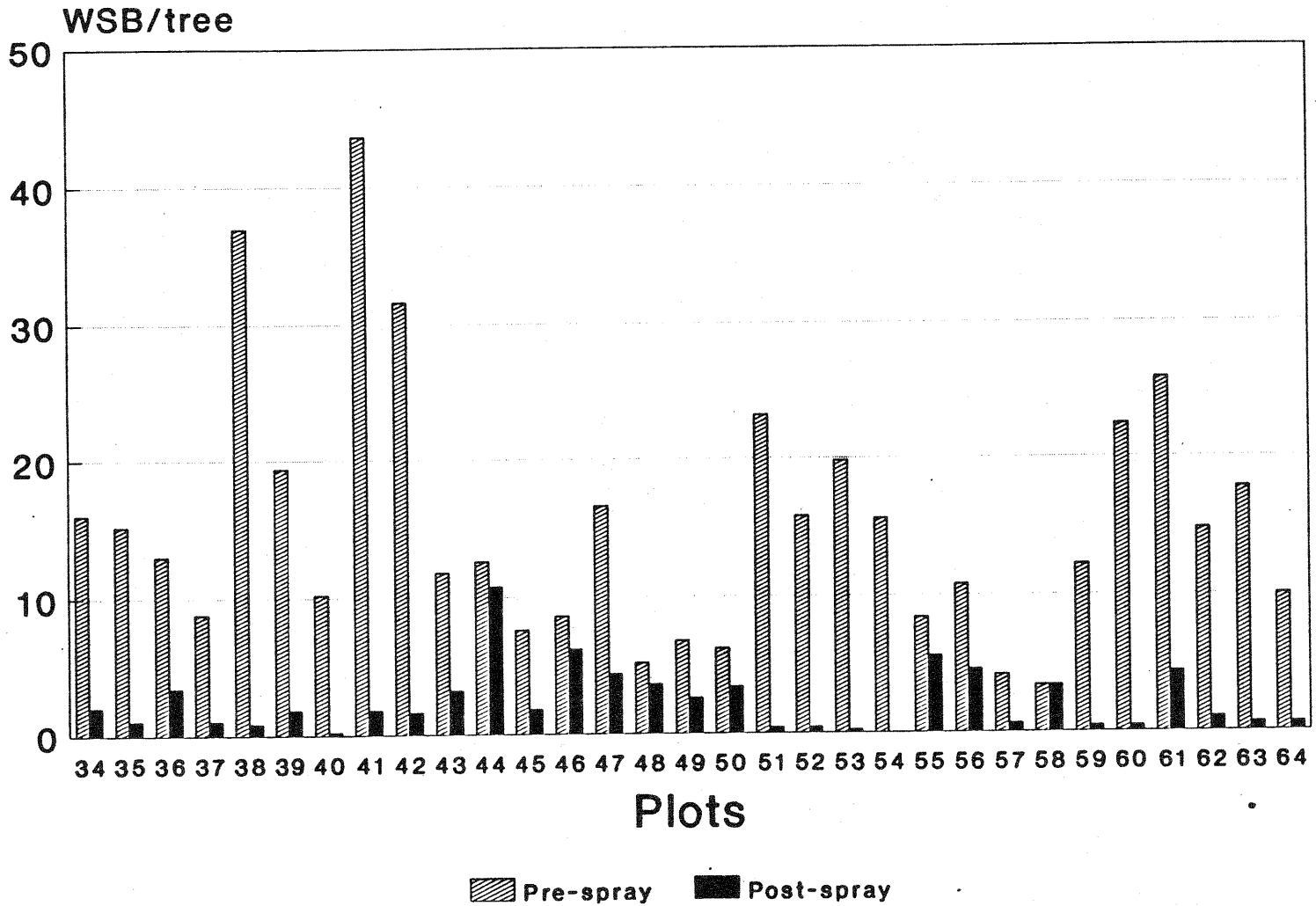

Figure 8. Western spruce budworm plot densities from lower crown branch samples in the Thimbleberry analysis unit.

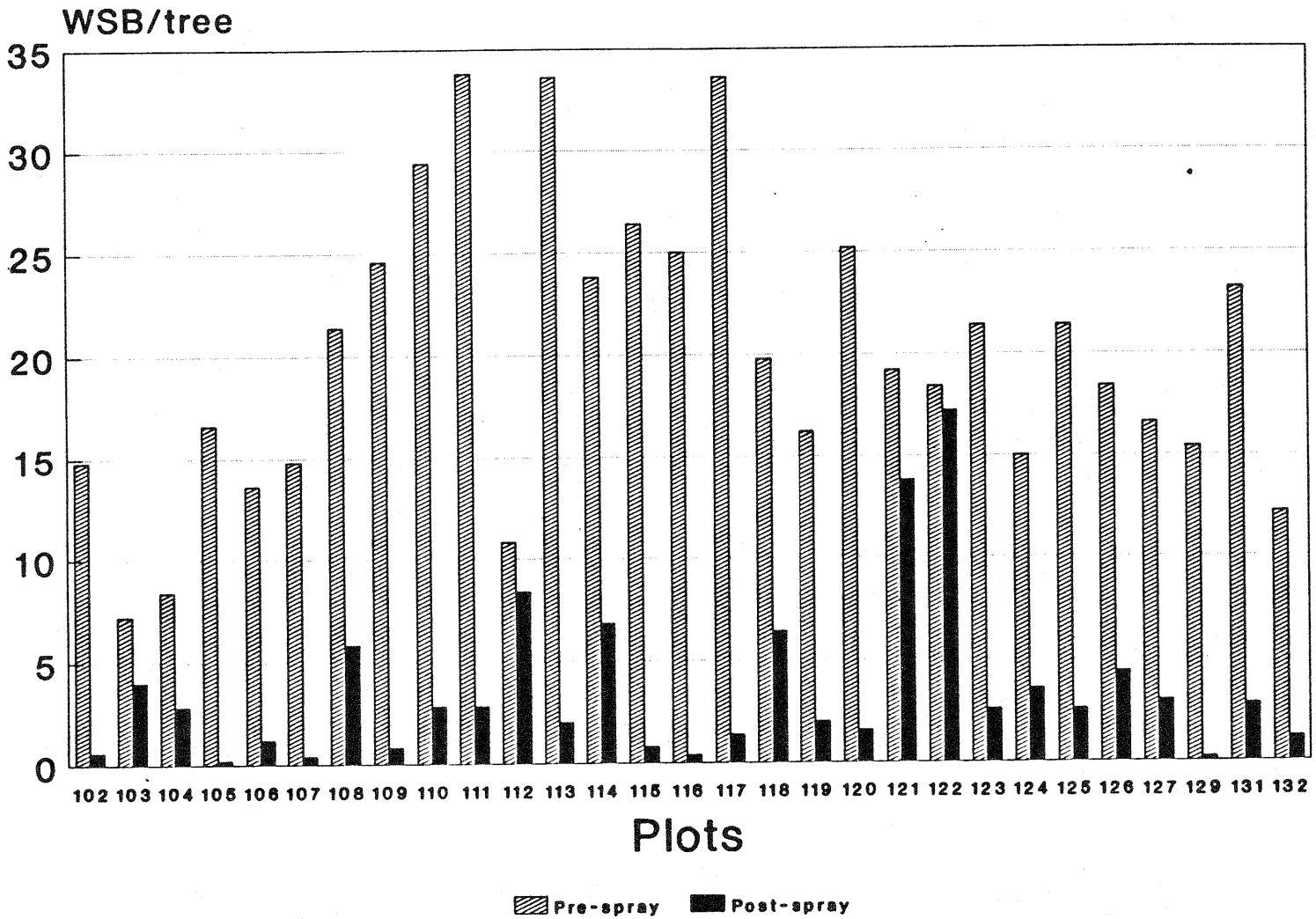

Figure 9. Western spruce budworm plot densities from lower crown branch samples in the Meacham double spray treatment unit.