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Bird Exclosures for Branches and Whole Trees

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EDITOR'S
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Abstract

Campbell, Robert W. Torolf **R.** Torgersen, Steven C. Forrest, and Lorna C. Youngs.
1981. Bird exclosures for branches and whole trees. **USDA** For. Serv. Gen. Tech. Rep. PNW 125, 10 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Two types of lightweight, portable bird exclosures are described. One is for individual branches or branch tips; the other is for whole trees **up** to 9 m tall. Several alternative configurations and uses of these exclosures are discussed.

Keywords: Birds, exclosures, defoliation damage, insect populations.

Introduction

Exclusion of selected groups of predators has sometimes been used to develop and test hypotheses about processes that determine population changes in forest-dwelling defoliators. Exclusion methods have included various sorts of barriers to keep predators away from the prey insects, structures that reduce the likelihood of contacts between predator and prey by modifying prey behavior, continuous trapping and removal of predators, and combinations of several methods (Campbell and Sloan 1977, Holmes et al. 1979, Smith and Lautenschlager 1979).

Lack of suitable exclosures has been a longstanding obstacle to empirical work on population dynamics of defoliators. Although many investigators have commented on the possible role or roles of avian predators in the population dynamics of forest-dwelling insects, few have used bird exclosures to provide empirical data. This is not surprising. Bird exclosures suitable for field studies have seldom been developed because of problems with cost of materials, weight, portability, and lengthy construction time. In this paper, we describe two kinds of bird exclosures that should help resolve these problems. One is for individual branches or branch tips up to 1 m long; the other is for whole trees up to 9 m tall.

Single-Branch Exclosures

In 1979, we experimented with single-branch bird exclosures as part of our continuing studies on the population dynamics of the western spruce budworm, *Choristoneura occidentalis* Freeman. For each population studied, budworm density and changes in that density can be inferred from the numerical patterns found in key portions of the crowns of host trees. We postulated that results derived from a series of single-branch bird exclosures in each of these key portions of the crown should yield data adequate for inferring the effects of avian predators on the population.

Frames for the exclosures are made of nominal ½-inch IPS, class 315 psi, polyvinylchloride (PVC) pipe. The top and bottom frames of a single-branch exclosure are made of four 1-m lengths of pipe joined by PVC elbow joints cemented with PVC adhesive primer. The uprights, ¾ m long, are nominal $^{3}/_{16}$-inch cold-rolled steel rods. The frame is covered with 1-cm X 2-cm polypropylene garden mesh attached to the frame with wire bag ties. Each branch exclosure assembly is held up by a wooden support 4 cm X 9 cm of the appropriate length (about 12- to 20-foot "2 X 4's") plus baling wire and stakes (fig. 1). In 1979, we placed 20 exclosures at about 2 m above ground and 20 at 4-5 m; in 1980, 60 cages were placed at about 2 m and **50** at **4-5** m.

To install exclosures, we first selected a branch, marked the appropriate cage height on a wooden support, and mounted an assembled exclosure there. The exclosure side opposite the support was left unsealed until after the exclosure had been placed around the branch. We used an 8.5-m aerial ladder mounted on a pickup truck for installing the exclosures that were **4-5** m above the ground.

About 1 worker-hour was required to assemble each exclosure. With the ladder truck, three people could install an average of about 20 exclosures per day. When necessary, we gained access to the branch inside an exclosure through a flap cut in the mesh which was reclosed with wire ties.

Figure 1.—Single-branch exclosure installed 2 meters above ground.

None of the 40 exclosures used in 1979 appeared to have been damaged in any way during about 7 weeks of continuous use. For winter storage, the exclosures were removed from the supports, the steel rod uprights removed, and the assemblies collapsed.

We estimate the total cost in 1980 averaged $23.47 per completed branch exclosure ($1.82 for PVC pipe; $1.20 for PCV elbows; $1.20 for steel rods; $1.50 for polypropylene mesh; $5.00 for 2 X 4 support; $.75 for stakes and wire; $3.00 to lease the aerial ladder; and $9.00 for labor).

After the 1979 season, we designed and built a prototype portable, lightweight exclosure suitable for keeping birds away from a tree up to 9 m tall. During 1980, we built and installed 32 of these exclosures.

Each octagonal exclosure is built from 24 2-m X 3-m panels, made of lengths of PVC pipe, joined by PVC pipe T's cemented with PVC adhesive primer, and covered with polypropylene mesh. In the field, three of these panels are joined into a composite 2- X 9-m panel, or side, by tapping a removable 4-cm-long piece of PVC pipe (nipple) into adjacent pairs of T's. Mesh flaps are used to close the apertures between adjacent 2- X 3-m panels. For horizontal strength, the bottom 2- X 3-m panel has two intermediate crossbars, 1 m apart. Each upper panel has one intermediate crossbar.

Pairs of 2- X 9-m sides are joined along one edge by bailing wire. Two of these sets of double sides are then joined together and strengthened by wiring them to two 7.32-m wooden 2 X 4's (fig. 2). Before the assembled set of four sides is erected, guy wires are attached at each juncture between adjacent sides—one at 4.5 m, the other at 7.5 m. The four sides—which constitute half of an exclosure—are folded like an accordian and can easily be carried by four or five people (fig. 3).

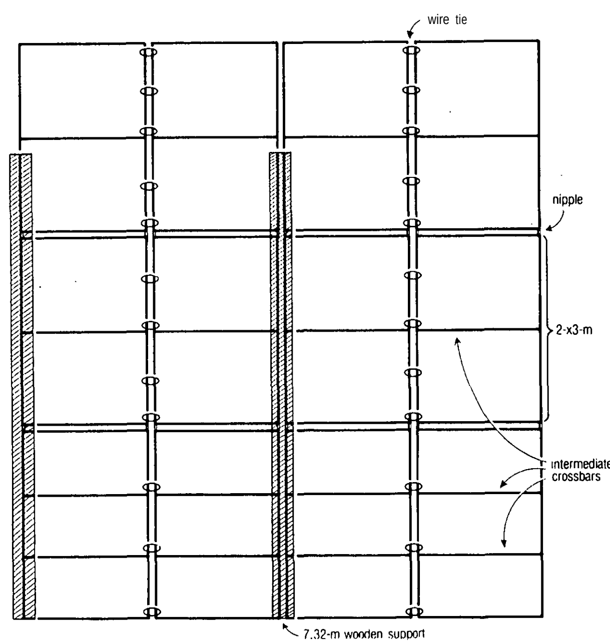
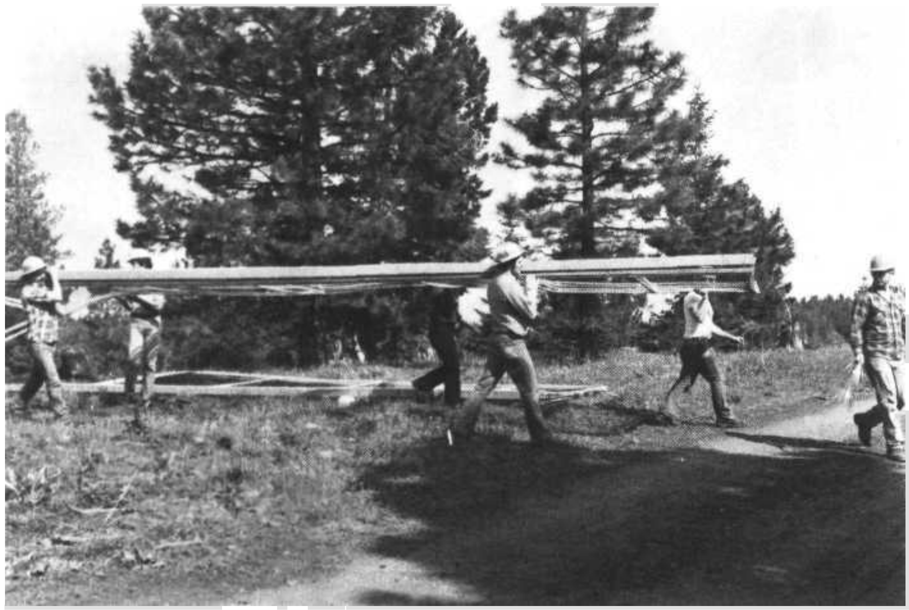


Figure 2.—Schematic view of a four-sided assembly used in construction of a whole-tree exclosure.



F 3.—Carrying an assembled set of four sides.

For erecting the exclosure, we used two aerial ladders or hydraulic lifts mounted on trucks (figs. 5, 7, and 9). Even with the 2 X 4's, the assembled 2- X 9-m sides are extremely flexible (fig. 4). Coordination is required between the aerial operators and the ground crew to erect, spread, guy, and tie together both of the four-sided assemblies that make up a complete exclosure (figs. 5-8). Finally, the aerial operators spread and tie down the polypropylene mesh top (fig. 9), and the exclosure is complete (fig. 10).

About 20 worker-hours are required to assemble the 24 2- X 3-m panels used in one whole-tree exclosure, and to attach the polypropylene mesh. In the field, three people can assemble the eight 2- X 9-m sides needed to build one whole-tree exclosure in about 1 hour. A seven-person crew working with two aerial lifts can install four whole-tree exclosures per 8-hour working day, if total travel time between set-ups does not exceed about 1 hour. Thus an average of 37 worker-hours is required to assemble and install one whole-tree exclosure.

We estimate the total cost in 1980 averaged $425.63 per completed whole-tree exclosure ($66.50 for PVC pipe; $24.00 for PVC pipe T's; $72.00 for polypropylene mesh; $28.00 for 2 X 4's; $3.00 for stakes and wire; $65.63 to lease two aerial lifts mounted on trucks; $166.50 for labor). During subsequent years, average seasonal costs per exclosure will drop, because we anticipate using these exclosures each field season for the next several years.

Figure 4. — Erecting a four-sided assembly; note rope to aerial operator.

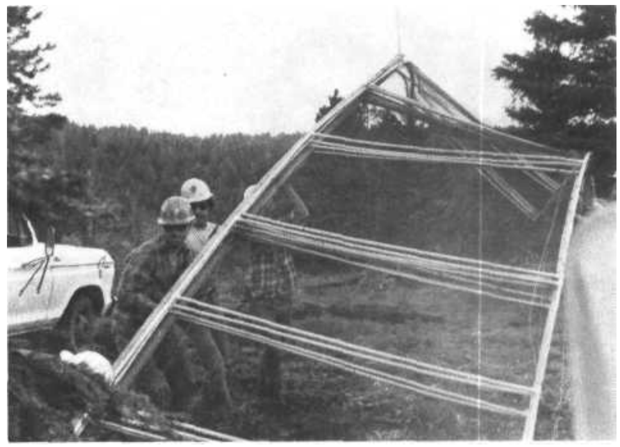
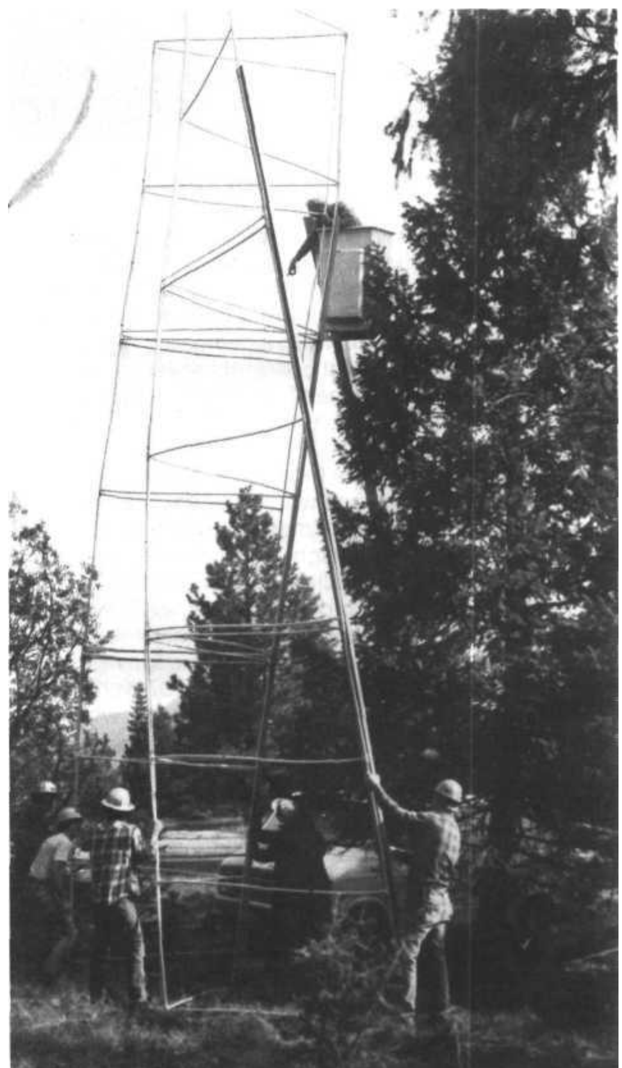


Figure 5. — An erect four-sided assembly.



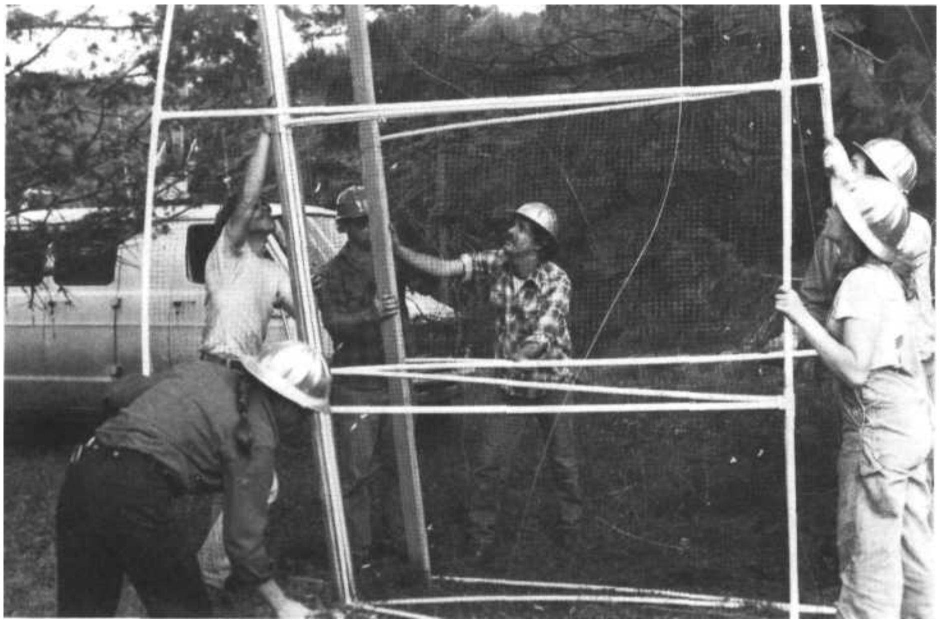


Figure 6.—Spreading the first half-exclosure.

Figure 7.—First half-exclosure in place.

Figure 8.—Spreading the second half.

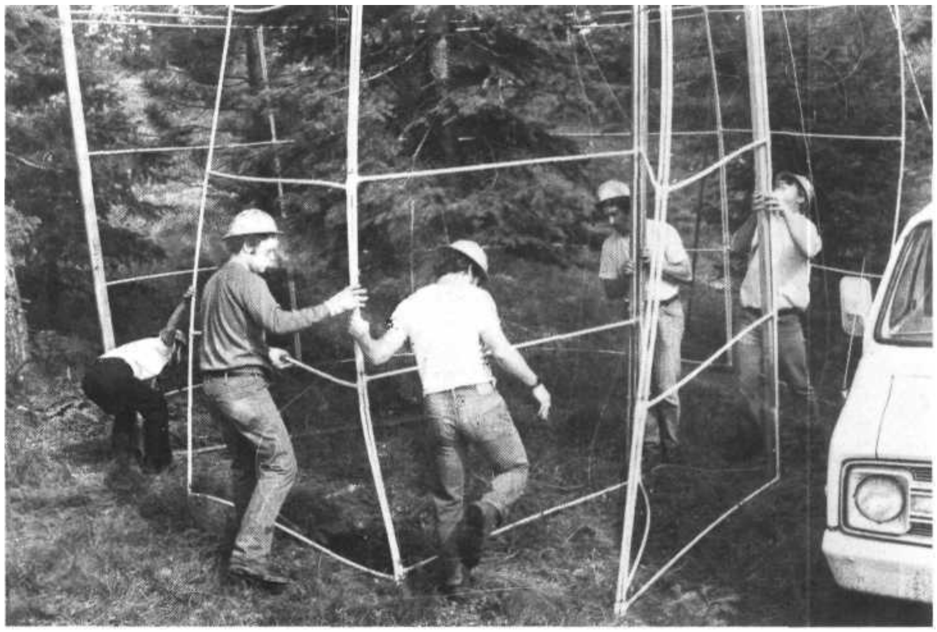
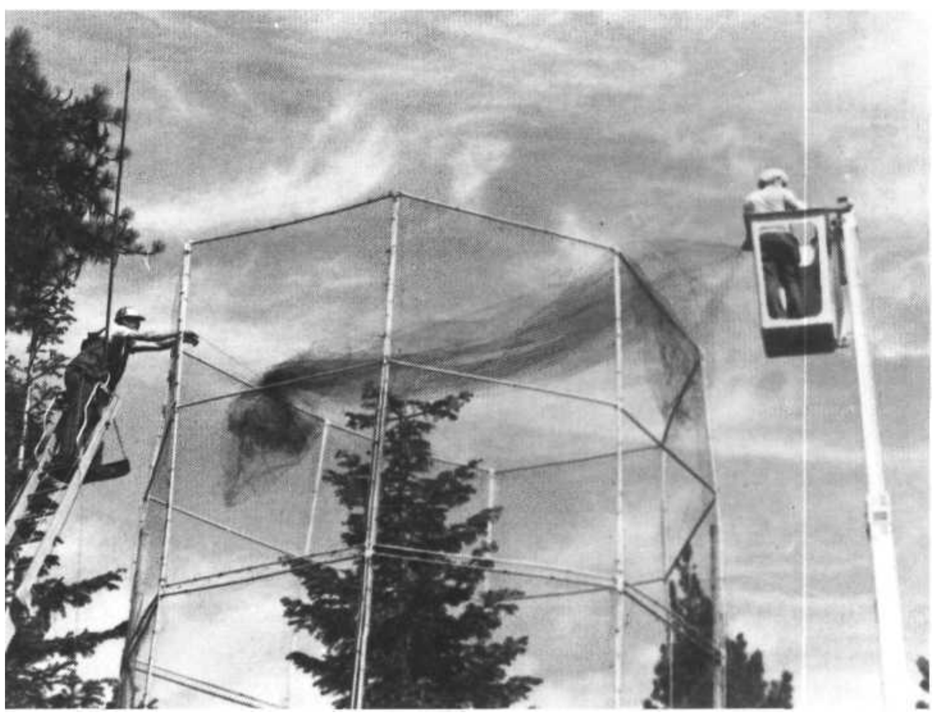


Figure 9.—Installing the top.



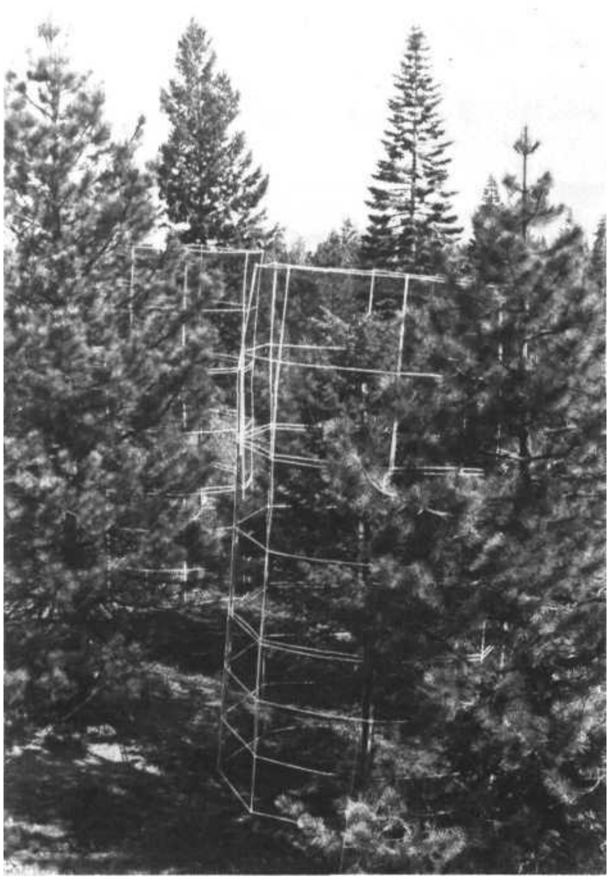


Figure 10.—A complete whole-tree exclosure. Note the second exclosure in the background.

Discussion

Because of their modular construction, the whole-tree exclosures described here can be modified in many ways. For example, the panels could easily be adapted to enclose a larger number of shorter trees. Similarly, a smaller sized mesh could be used to exclude flying invertebrates, such as parasites. The exclosures could also as readily serve as enclosures, depending on the objectives of the work in progress.

In conjunction with other techniques, such as barriers to prevent walking invertebrate predators from reaching host insects, the exclosures can be used to unravel the possibly confounding effects of two or more natural enemy guilds.

We designed these exclosures for use in the relatively open conifer forests that are characteristic of much of the interior West. We are confident, however, that they could also be modified for use in both hardwood forests and more dense stands.

We think it unlikely that the exclosures will result in substantial modifications in the microclimate within, because of the large mesh size. We intend to monitor the microclimate inside and outside several exclosures to resolve this question.

Acknowledgment

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