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# Plastic Cages To Protect Douglas-Fir Seedlings From Animal Damage in Western Oregon

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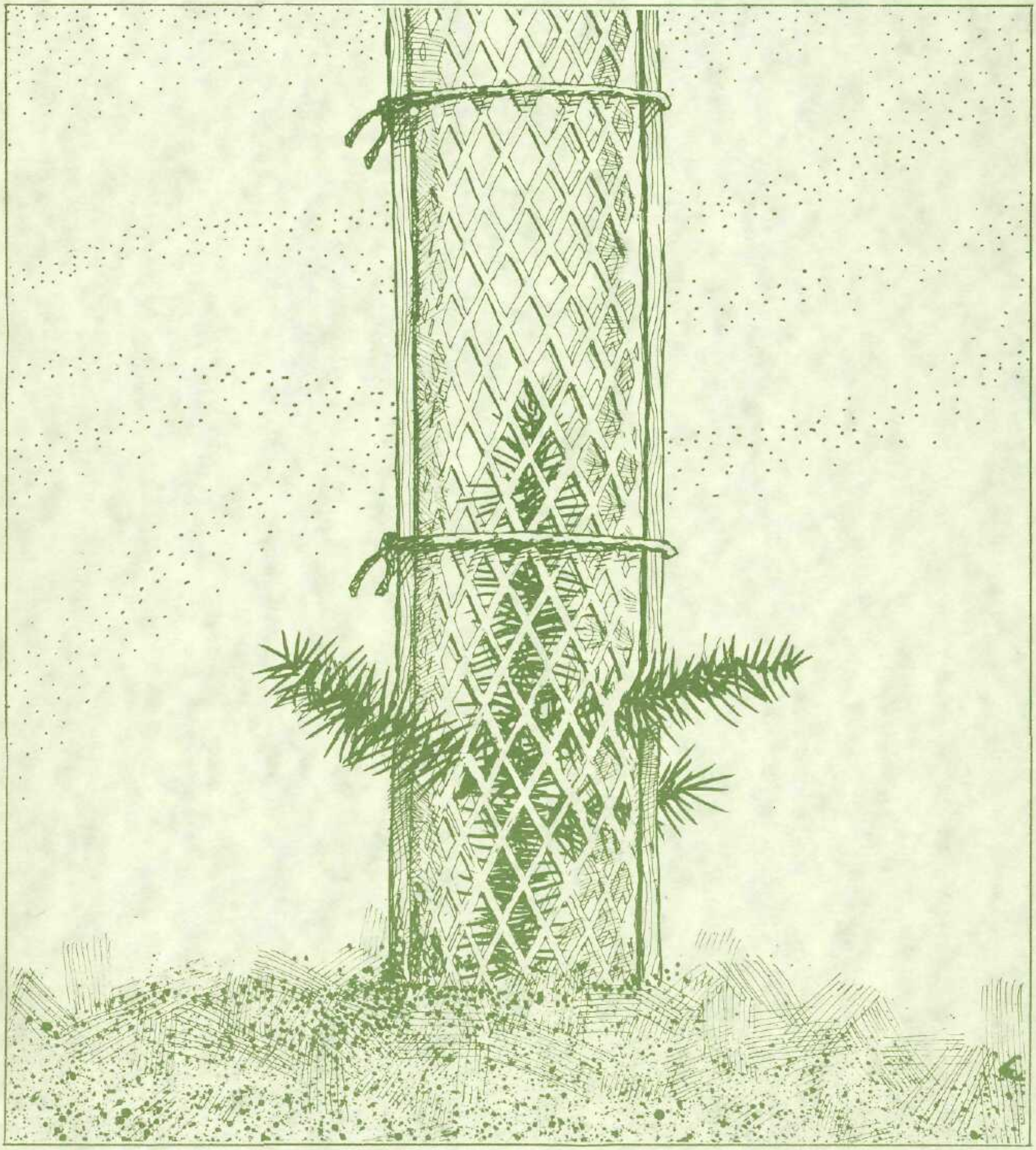

# Contents



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# Plastic Cages To Protect Douglas-Fir Seedlings From Animal Damage in Western Oregon

## Reference Abstract


Crouch, Glenn L.
1980. Plastic cages to protect Douglas-fir seedlings from animal damage in western Oregon. USDA For. Serv. Res. Pap. PNW-271, 6 p., illus. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Effects of plastic mesh cages designed to protect Douglas-fir seedlings from animals were evaluated in western Oregon. In two tests over 5-year periods, caging increased survival by 0 and 13 percent and increased height growth by 0.8 and 1.2 feet compared with uncaged trees. Benefits from caging might have been greater if damage had been more prevalent during the tests.



KEYWORDS: Barriers (-animal damage control, animal damage control, seedling survival.

# Research Summary
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Many species of mammals damage young planted conifers in the Douglas-fir region. Foresters have tried various measures to protect trees from a variety of animals, including repellants, poisons, traps, hunting, fences, and wire cages. One area with persistent problems is west of Corvallis, Oregon, in the Alsea Ranger District of the Siuslaw National Forest. Since large-scale clearcutting was begun there about 1958, foresters have tried various fencing and caging procedures to protect trees, but most efforts were abandoned because of high costs of materials, installation, and maintenance, and questionable benefits.

In the late 1960's, an effective plastic cage was developed by the DuPont Company and the Fish and Wildlife Service, U.S. Department of the Interior. Installation of these cages was soon begun on a large scale in the Alsea District. Although many small-scale tests of the cages had been conducted by researchers, there were no adequate evaluations underway or planned in 1972 when this study was started.

The evaluations reported here were conducted to compare survival and height growth of protected and unprotected, newly planted Douglas-fir seedlings. In the study, performance of seedlings protected by two types of the plastic cages was compared with that of uncaged trees.

In the two tests, after 5 years, caging increased seedling survival by 0 and 13 percent, compared with uncaged samples. Caged trees were 0.8 and 1.2 feet taller than their uncaged companions. In both tests, caging was judged relatively unimportant to establishment of the stand because survival of uncaged trees was 80 percent or more. Although caged trees grew better than uncaged trees, maximum benefits from caging were not attained because the cages or their installation interfered with height growth of 50 percent of the caged samples.

During the study, annual incidence of terminal injuries to uncaged trees by animals was moderate, averaging about 33 percent. A higher incidence of injury would probably have resulted in greater benefits from caging in both survival and growth.

# Introduction

Many species of mammals damage young planted conifers in the Douglas-fir region of the Pacific Northwest (Black et al. 1969, Crouch 1969). Foresters have tried various measures, including repellants, poisons, traps, hunting, fences, and wire cages to protect trees from elk (Cervus canadensis roosevelti Merriam), black-tailed deer (Odocoileus hemionus columbianus Richardson), snowshoe hare (Lepus americanus Erxleben), and rabbits (Sylvilagus spp.), mountain beaver (Aplodontia rufa Rafinesque), and voles (Microtus spp.). Damage by these animals occurs periodically in many parts of the region, but one well-known area with persistent problems is west of Corvallis, Oregon, in the northern half of the Alsea Ranger District of the Siuslaw National Forest. Here, foresters have planted and replanted many clearcut blocks over the past 20 years, but regeneration is still poor on many acres because of mortality or slowed growth. On some areas, elk, deer, hare, and mountain beaver may damage trees on the same acre. Cattle also graze on some of these sites, but browsing by them has not been detected.

Alsea foresters tried various fencing and caging procedures to protect their trees (Mealy 1969), but most efforts were abandoned because of high costs of materials, installation, and maintenance, and questionable benefits. Moreover, most fences and wire cages had to be removed as trees enlarged, or they interfered with growth. Removal was another costly procedure.

In the late 1960's Campbell (1969) reported on the value of plastic caging material to protect trees. This product, Vexar ®,[1] was developed cooperatively by the DuPont Company and the Fish and Wildlife Service, U.S. Department of the Interior. After much experimentation with cage composition and structure and field tests of effectiveness, a standardized cage was developed in the early 1970's. The cages are described in detail by Campbell (1969) and Campbell and Evans (1975); in general, they are lightweight polypropylene mesh tubes. They are mass produced and are photodegradable in 3 to 5 years, which precludes the need for removal as the trees grow. The cages are costly, installation can be difficult, and there is a tendency for some tree leaders to become entangled in the mesh, resulting in deformed trees.

Foresters in the Alsea District began large-scale installation of plastic cages in 1971. Shortly thereafter, cages were placed on trees on more than 1,000 acres annually; and for a short period in the mid-1970's, 100 or more trees were caged on virtually every acre planted. During this time, various numbers of trees per acre were planted and caged throughout the District, but the kinds of protectors and method of installation were similar on all areas.

Although many small-scale tests of the cages had been conducted by researchers, there were no adequate evaluations of the operational practice underway or planned in 1972 when this study was begun. The investigation was designed to compare survival and height growth of protected and unprotected Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) seedlings planted and caged by the USDA Forest Service or by contract workers. To preclude special treatment I did not select study sites until after trees had been planted and cages installed.

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[1] **The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others which may be suitable.**

# Study Area and Methods

The evaluation was conducted near Harlan, Oregon, in an area under intensive forest management. Large-scale clearcutting on National Forest land was begun there about 1958. By 1965, it was apparent that animals were responsible for poor stocking and suppressed height growth of planted seedlings on many acres. A few trees that had been protected by wire cages were more than three times as tall as nearby unprotected trees.

Foresters began placing plastic protectors on trees in 1972 in the Harlan area, and seedlings planted and caged on three typical clearcut blocks were selected for study in that year (test A). In 1973, a somewhat different cage was used, but the method of installation was the same as in the previous year. Trees on three of the newly treated blocks were added to the study in 1973 (test B).

Both years, 30-inch cages of 2-inch diameter were installed. In 1972, cages were of 1/2-inch diamond mesh and designed to disintegrate in 3 or 4 years. Those applied in 1973 were of 3/8-inch mesh and somewhat more resistant to breakdown. Protectors were placed over newly planted seedlings and sandwiched between two sharpened 36-inch long laths that were driven about 6 inches into the ground. Cages and laths were then tied together near the top and midway with 1/8-inch rope.

For each test, three replications of 20 protected and 20 unprotected trees each were selected and marked on the three clearcut blocks each year. These 180 protected trees of each cage type and unprotected trees were compared. Trees were measured when they were marked and were examined in April and September for 5 succeeding years. Data from each test were analyzed separately by analysis of variance at P=0.05.

# Results

## Survival

Test A. --After five growing seasons, survival was not significantly different between caged and uncaged trees (table 1). More than 85 percent of all trees planted were alive at that time. Comparisons among individual clearcut blocks also showed no difference in survival. Most mortality of both caged and uncaged trees occurred within the first 3 years after planting. Table 2 show that caging was responsible for the loss of 4 percent of the caged trees, but this amount had little bearing on the lack of advantage for caging. Animals caused 5-percent mortality of uncaged trees but killed no caged seedlings.

Table 1—Survival and heights of caged and uncaged Douglas-fir seedlings 5 years after planted in western Oregon[1]

| Test | Survival | Height |
|---|---|---|
| | Percent | Feet |
| Test A: | | |
| Caged seedlings | 86a | 3.8a |
| Uncaged seedlings | 88a | 3.0b |
| Test B: | | |
| Caged seedlings | 93a | 4.5a |
| Uncaged seedlings | 80b | 3.3b |

[1]Trees in test A were planted and caged in winter 1971-72 and those in test B in winter 1972-73. Means within tests and attributes followed by the same letter are not significantly different (P=0.05).

Table 2--Mortality to Douglas-fir seedlings planted in western Oregon, by cause[1]

| Test | Caging procedure | Animals | Other | Total |
| --- | --- | --- | --- | --- |
| | Percent | | | |
| Test A: | | | | |
| Caged seedlings | 4 | 0 | 10 | 14 |
| Uncaged seedlings | -- | 5 | 7 | 12 |
| Test B: | | | | |
| Caged seedlings | 0 | 1 | 6 | 7 |
| Uncaged seedlings | -- | 5 | 15 | 20 |

[1]Trees in test A were planted and caged in winter 1971-72 and those in test B in winter 1972-73.

Test B.—Survival of caged trees was significantly greater than that of uncaged seedlings (table 1). More than 90 percent of the caged trees were alive after 5 years, whereas survival of uncaged trees averaged 80 percent. Most mortality occurred within 3 years after planting. No mortality of caged trees was attributed to caging. Animals were responsible for a 5-percent loss of uncaged trees and 1 percent of caged trees.

## Height Growth

Test A.—Caged trees were significantly taller than uncaged trees after five growing seasons (table 1). The difference amounted to about 0.8 foot. Cages, or the installation procedure, interfered with the height growth of 55 percent of the caged trees (table 3). Trees so affected were no taller than uncaged trees, whereas those unencumbered by cages were more than a foot taller than the uncaged or entangled ones. Caged trees were noticeably taller after the 2d year; they achieved their maximum height advantage over the uncaged trees in the 4th and 5th years.

Table 3—Interference of caging with height growth of Douglas-fir seedlings surviving for 5 years after planting in western Oregon[1]

| Category | Test A | Test B |
| --- | --- | --- |
| | Percent of trees | |
| Cause of interference: | | |
| Tree terminal deformed in cage or grown through mesh | 32a | 30a |
| Installation of cage--supporting stakes or fastenings broken; cage and tree on ground, or cage not on tree | 23b | 20b |
| | Height of trees (feet) | |
| Effect of caging trees: | | |
| No interference | 4.3a | 5.0a |
| Interference | 3.3b | 3.9b |
| Uncaged trees | 3.0b | 3.3c |

[1]Treesin test A were planted and caged in winter 1971-72 and those in test B in winter 1972-73. Means within tests and categories followed by the same letter are not significantly different (P=0.05).

Test B.—Caged trees were 1.2 feet taller than the uncaged trees after 5 years (table 1). The cages or their supports interfered with the growth of nearly one-half the caged trees, but those affected were, nonetheless, significantly taller than the uncaged trees (table 3). Trees growing without interference were more than a foot taller than those affected by the cages or their installation. Protected trees were taller by the 2d year and showed their greatest advantage over the uncaged trees in the 5th year after planting.

## Animal Damage

Mean annual incidence of animal damage to terminal shoots is shown in table 4. Although variations occurred from year to year, the mean is nearly identical in both tests.

Deer were the most frequent cause of injury, followed by elk, hare, and mountain beaver (table 5). More than 80 percent of the uncaged trees in test A and more than 90 percent of those in test B sustained damage to terminal shoots. Among caged trees, incidence of damage was 20 and 30 percent in test A and test B.

**Table 4—Incidence of animal damage to terminal shoots of caged and uncaged Douglas-fir seedlings surviving for 5 years after planting in western Oregon [1]**

| Test | Years after planting 1 | 2 | 3 | 4[2] | 5[2] | Annual mean |
|---|---|---|---|---|---|---|
| | Percent | | | | | |
| Test A: | | | | | | |
| Caged | 1 | 0 | 2 | 11 | 13 | 5 |
| Uncaged | 26 | 23 | 46 | 28 | 42 | 33 |
| Test B: | | | | | | |
| Caged | 0 | 0 | 13 | 11 | 7 | 7 |
| Uncaged | 23 | 79 | 30 | 27 | 8 | 33 |

[1]Trees in test A were planted and caged in winter 1971-72 and those in test B in winter 1972-73.
[2]Most damage to caged trees occurred on terminals that had grown beyond the cages.

**Table 5—Animals damaging terminal shoots of caged and uncaged Douglas-fir seedling surviving for 5 years after planting in western Oregon[1]**

| Animal | Test A Caged | Test A Uncaged | Test B Caged | Test B Uncaged |
|---|---|---|---|---|
| | Percent[2] | | | |
| Black-tailed deer | 15 | 66 | 22 | 89 |
| Roosevelt elk | 5 | 11 | 11 | 17 |
| Snowshoe hare | 1 | 11 | 0 | 3 |
| Mountain beaver | 1 | 8 | 0 | 0 |
| All animals[3] | 20 | 82 | 30 | 93 |

[1]Trees in test A were planted and caged in winter 1971-72 and those in test B in winter 1972-73.
^Of trees damaged at least once.
[3]Values are not totals of damage by individual species. Some trees were damaged by more than one kind of animal.

# Discussion

Cages did not affect survival in test A but resulted in about 13 percent more live trees after 5 years in test B. Part of this gain may have resulted from selection of better trees by the cage installers. For test A, we had no difficulty choosing uncaged trees to pair with those that were caged. For test B, the following year, comparable uncaged seedlings were much more difficult to find.

In all blocks studied, continued high survival of caged and uncaged trees is expected and should provide stocking that will require precommercial thinning 10 to 15 years after planting. Thus, on these study areas, caging appears to have had little survival benefit to the future timber crop.

Protection improved height growth in both tests, although results suggest that maximum benefits may have been attained by the 5th year. Measurements after 6 years on test A trees showed a smaller difference in height between caged and uncaged trees than was found in year 5. Most injuries to caged trees occurred after they had outgrown their cages. By the 5th year, more than 80 percent of the caged trees were taller, than their cages. Perhaps cages should be taller, or extensions might be added to prolong the period of protection.

Caged trees in test B grew better than those in test A, but growth of uncaged trees was similar. Selection of better trees by the cage installers may account for part of the gain in test B.

The high incidence of cage interference resulting in substantial reduction in growth of caged trees appears to justify periodic maintenance of cages, if use of the described cages and installation procedures are continued.

In this study, the annual incidence of terminal injury to uncaged trees by animals was moderate, averaging about 33 percent over 5 years. More important, the incidence was low in the critical 1st year after planting in both tests. Higher levels of injuries would probably have resulted in greater benefits from protection in both survival and growth.

Costs for protection of trees must be repaid as economically meaningful increases in timber production. Caging was costly and appeared to result in marginal benefits on the areas studied here. The key to successful use of this procedure is proper installation and maintenance, but only on sites where forest managers are reasonably sure that gains from protection will more than offset costs.

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