

SURVIVAL AND GROWTH OF PONDEROSA PINE SEEDLINGS INJURED BY POCKET GOPHERS

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Height growth of ponderosa pine seedlings that survived injury by pocket gophers was comparable to that of undamaged seedlings.

Damage to conifers by pocket gophers (*Thomomys* sp.) is an important cause of reforestation loss in parts of the Pacific Northwest (1), (2). Gophers can influence regeneration for 10 or more years (4), (5), but most seedling mortality occurs the first 2 years after planting (3), (6). There is little documentation of the effect of gopher injury on survival and growth of seedlings in older plantations. This report quantifies survival and growth of ponderosa pine (*Pinus ponderosa*) injured by gophers 2 ½ to 3 years after planting.

Study Area and Methods

Data were collected from two 6-ha plantations on the Deschutes National Forest in central Oregon. Study sites were about 16 km southwest of Bend, Oreg., and approximately 3 km apart; both were in a ponderosa pine-shrub association. The sites had been mechanically scraped (windrowed) before planting to remove competing vegetation; then auger planted at 3-m spacing with 3-0 ponderosa pine in spring 1968. Unpublished Forest Service records (Bend Ranger District, Deschutes National Forest) indicated that gopher damage was light the first 2 years after planting. Considerable stem barking by gophers was observed in spring 1971 and was the basis for this study.



Figure 1.—Feeding injuries inflicted by gophers were the primary cause of irregular stocking in this central Oregon ponderosa pine plantation.

Seedling damage, survival, and height growth in each plantation were sampled with 15 randomly selected transect lines of 10 consecutive trees; the 30 transects were examined each spring and fall from April 1971 to April 1974.

Pocket gopher damage was of particular interest and was examined in detail. Gopher injury was classed according to the

average percent of main stem circumference that had been debarked and length of injury was recorded as a percent of total seedling height. Mean height increments of gopher-damaged and undamaged seedlings, excluding trees damaged after April 1971, were subjected to paired t-test analysis.

Results and Discussion

Pocket gophers caused two-thirds of the damage and almost all mortality of sample trees (table 1). Nearly all of the gopher damage occurred from fall 1970 to spring 1971, when seedlings were at a mean height of 42 cm. The injuries inflicted by gophers caused 52 percent seedling mortality and, in the most heavily damaged plantation, left sizable areas unstocked (fig. 1). Fortunately, gopher baiting operations prevented heavy seedling mortality in later years.

The presence of winter casts around injured trees indicated that virtually all gopher damage was done by animals burrowing through snow. With the exception of one root-pruned tree, seedlings were damaged by the clipping of lateral branches and gnawing on the main stem (fig. 2). Fifty-six percent of the injured seedlings were debarked around more than half the stem circumference; 89 percent of these seedlings died. In contrast, mortality was only 11 percent when less than half the stem perimeter was affected. Mortality also was high (80 percent) when length of injury exceeded 25 percent of seedling height.

At the final examination in 1974, 67 percent of the original sample remained undamaged. Height growth of these undamaged seedlings was 53 cm over three growing seasons (1971-73),

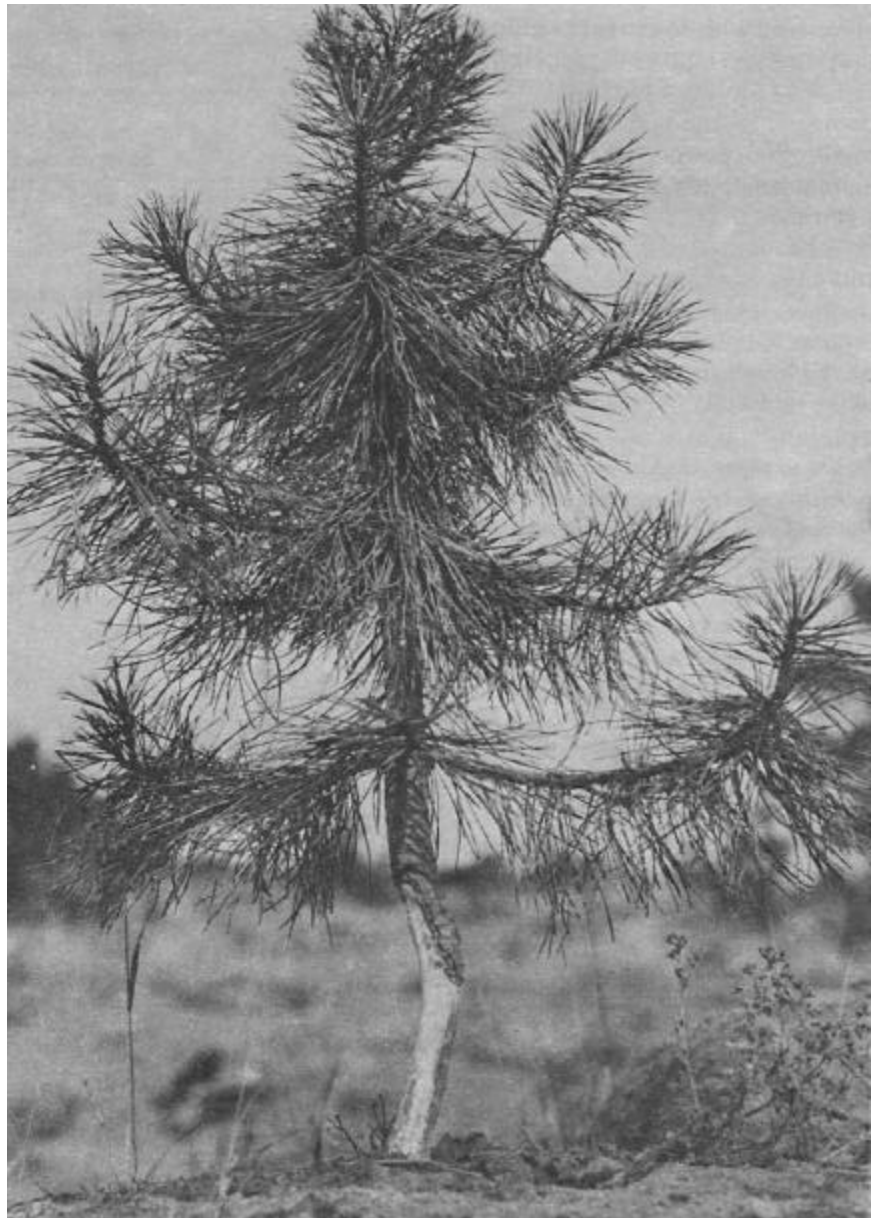


Figure 2.—Gophers. typically gnawed lower portions of the main stem; most seedlings died when more than half of the stem circumference was debarked.

compared with 48 cm for seedlings that survived injury by gophers (fig. 3). For 14 plots in which both damaged and undamaged seedlings occurred, difference in annual height increment was not significant ($P > .1$).

The unimpaired growth of surviving trees can be attributed to the low incidence of terminal injuries. Gophers usually gnawed on the lower stem of seedlings; when terminal clipping did occur it generally was in addition to stem injury and resulted in mortality.

Although the sample is small, the findings are clear evidence that the impact of gopher depredation becomes less severe as pine seedlings grow larger. Other studies have revealed that gopher damage to small seedlings is virtually synonymous with mortality (3), (6). Small seedlings are particularly vulnerable to gopher attack because their stems can be completely severed with one or just a few bites. As seedlings grow, more feeding must occur before fatal injury is sustained. Thus, probability for survival increases. Furthermore, depressed growth is unlikely unless additional damage occurs. Other relationships, such as the effect of gopher injury on disease susceptibility, are unknown.

Intensive forest management requires accurate assessment of factors detrimental to regeneration. This study suggests that assessment of gopher

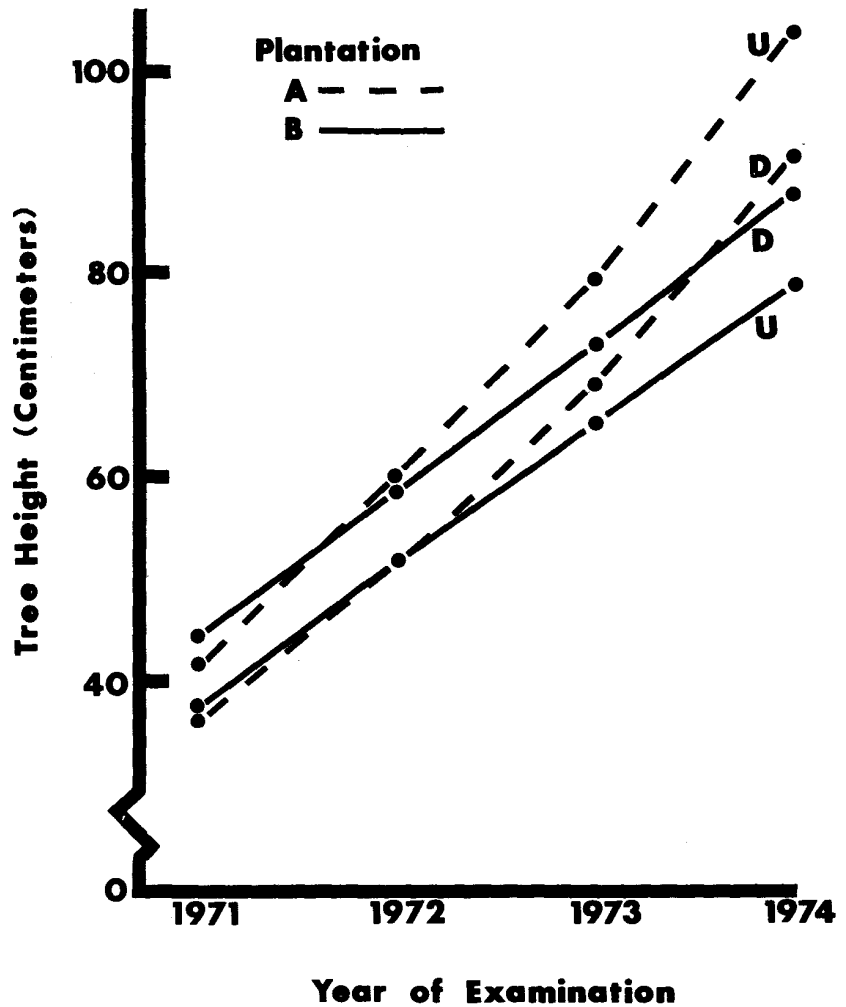


Figure 3.—Height of undamaged ponderosa pine seedlings (U) compared with that of seedlings (D) that survived injury by pocket gophers.

Table 1.—Fate of 300 ponderosa pine seedlings on two central Oregon plantations from third through sixth year after planting

Seedling condition	Number of seedlings	Percent survival
Injured by gophers	67	48
Injured by porcupine	12	100
Snow damage	9	100
Other damage	11	91
Undamaged	201	100
TOTAL	300	88

depredation should consider both the incidence of damage and size of seedlings. Results could be useful in determining whether control is justified and in establishing priorities for control work.

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