

Glenn L. Crouch

Forestry Sciences Laboratory
Pacific Northwest Forest and Range Experiment Station
Forest Service, U.S. Department of Agriculture
Olympia, Washington

Susceptibility of Ponderosa, Jeffrey, and Lodgepole Pines to Pocket Gophers

Pocket gophers (*Thomomys* spp.) occupy many acres of wild land in the western states, and much has been written about their activities on meadows and rangelands (Ellison and Aldous, 1952; Hansen and Ward, 1966; Howard and Childs, 1959; Julander *et al.*, 1959; Moore and Reid, 1951). Gophers are also widely distributed on western forests and are known to damage and kill several conifer species (Barnes *et al.*, 1970; Dingle, 1956; Hermann and Thomas, 1963; Moore, 1940; Tevis, 1956).

Relatively little is known about gophers on forest land, or their response to environmental modifications resulting from wildfire or timber management practices. Hermann and Thomas (1963) reported that gophers were a major cause of losses in a ponderosa pine (*Pinus ponderosa*) plantation in southern Oregon. Recently, intensified observations by foresters have confirmed that gophers are severely damaging seedlings and saplings on many national forests in the Pacific Northwest (Crouch, 1969). Part of this apparent increase in gopher damage is a consequence of more frequent and systematic plantation examinations. Also important is the recognition that some of the damage to smaller trees formerly attributed to porcupines (*Erethizon dorsatum*) may have been caused by gophers (Crouch, 1969).

Operational efforts to protect conifers from gophers have been limited to reduction of animal numbers by trapping or poisoning. Trapping appears impractical considering the vast acreages needing protection, and application of poisoned bait by hand is slow and results are variable. Moreover, frequent treatment appears necessary since repopulation is virtually certain (Dingle, 1956; Hermann and Thomas, 1963). A mechanical bait-dispenser is now being tested (Barnes *et al.*, 1970; Canutt, 1970); but, even if judged effective, this too will undoubtedly require repeated use and be limited in applicability by edaphic and topographic site factors. Long-lasting protection, preferably without harming animals or their habitat, is needed.

Some foresters working in south-central Oregon observed that ponderosa pines seemed to be more heavily damaged by gophers than Jeffrey pines (*P. jeffreyi*) or lodgepole pines (*P. contorta*). If these observations could be substantiated, then the less-susceptible species might be planted in gopher-infested areas where the ecological requirements of the tree were met. The purpose of this study was to determine relative preferences of gophers for the three pine species on one area where damage by gophers was known to occur.

Study Area and Methods

The study was conducted on a portion of the Cave Mountain Burn, near the town of Chiloquin, in south-central Oregon. The site, located about 4000 ft. in elevation, had been well stocked with ponderosa pine and bitterbrush (*Purshia tridentata*) until the pines and most of the shrubs were destroyed by wildfire in 1959 (Fig. 1). During the study, vegetation was dominated by western needlegrass (*Stipa occidentalis*), with lesser amounts of other grasses and a few forbs and shrubs, totaling about 40 percent crown cover (Fig. 2).

Ponderosa pines were planted on most of the burn in 1962 and 1963, but few remained by 1966, mainly because of intensive gopher depredations. Many of the survivors bore scars from gopher gnawing, and freshly killed seedlings were readily observed (Fig. 2). Gopher mounds were abundant, and the upper soil layers were mined with burrows.



Figure 1. Patch of unburned timber near the study area, July 1970. This site was probably swept by ground fire in 1959.



Figure 2. Typical burned area adjacent to the study site, March 1966. Trees marked by cards were planted in 1962, damaged by gophers during the 1965-66 winter, and subsequently died.

For this study, 90 seedlings—30 each of ponderosa, Jeffrey, and lodgepole pine—were randomly planted in each of four adjacent blocks. All trees were 2-0 stock grown at the U.S. Forest Service nursery at Bend, Oregon. Seeds for the ponderosa and lodgepole pines had been locally collected, but the Jeffrey pine seed source was many miles southwestward, across the crest of the Cascade Range. The 360 seedlings were auger-planted at 8-by-8-ft. spacings and individually marked with wooden stakes. Trees were planted in March 1966 and examined in April, July, and September each year through 1969.

Results and Discussion

Losses to gophers began almost immediately—several trees were pulled into burrows within three hours after planting. By September 1969, two-thirds of all trees had been destroyed by gophers (Table 1). Losses among species were nearly identical. Survival

of undamaged seedlings of all species was high, but nonanimal losses might have been greater if gophers had not decimated the stock.

Although gophers killed trees during all seasons, the major losses occurred during winter, presumably under snow (Table 2). Two midwinter examinations were made

TABLE 1. Mortality of planted ponderosa, Jeffrey, and lodgepole pines, March 1966 through September 1969.

Pine species ¹	Mortality cause		Total
	Gophers	Other	
	Percent of trees planted		
Ponderosa	67.5 ²	2.5 ²	70.0 ²
Jeffrey	66.7	7.5	74.2
Lodgepole	65.0	9.2	74.2

¹ One-hundred and twenty trees of each species were planted.

² Species means are not significantly different at the 5 percent probability level.

TABLE 2. Seasonal pattern of gopher mortality in planted ponderosa, Jeffrey, and lodgepole pines, March 1966 through September 1969.

Time interval	Mortality from gophers ¹	
	Percent of trees remaining	Cumulative percent of trees planted
March 1966 - April 1966	5.8	5.8
May 1966 - Sept. 1966	1.8	7.5
Oct. 1966 - April 1967	40.9	44.2
May 1967 - Sept. 1967	5.3	46.9
Oct. 1967 - April 1968	38.7	65.6
May 1968 - Sept. 1968	1.8	66.1
Oct. 1968 - April 1969	1.0	66.4
May 1969 - Sept. 1969	0.0	66.4

¹ Three-hundred and sixty trees were planted.

during snow-free periods. By late December 1966, about one-quarter of the total winter damage sustained that year had occurred. By February 1968, gophers had taken two-thirds of the total number of trees destroyed during the 1967-68 winter. Periodic inspections from June through September each year indicated that summer damage was about evenly distributed through the season.

The same seasonal damage patterns were observed each year, but the relative intensities of losses varied from year to year. Gophers destroyed 44 percent of the seedlings during the first year after planting, 41 percent of the remainder the second year, but only 3 percent of surviving trees in the third year.

During the study, three kinds of pocket gopher damage were observed: (1) Trees missing from their planting site accounted for 76 percent of the losses. Excavation at or near the planting hole nearly always revealed a main gopher burrow or lateral tunnel through which the tree had been removed. (2) Tops were removed at or just below the soil surface in 14 percent of the losses. (3) Roots were severed and removed and the rootless tops left standing in 10 percent of the gopher-killed trees. All seedlings injured by gophers subsequently died. Excavation of a sample of surviving trees at the final examination revealed no root damage.

No more than six adjacent trees were taken by gophers during one season of any year. The animals appeared to harvest seedlings singly or in small groups.

Results showed that planting one pine species instead of another did not reduce gopher predation. The findings also clearly demonstrated that gophers damaged conifers predominantly during the winter which suggests that efforts to control damage by reducing gopher numbers should be scheduled just before winter. Finally, the loss rate to gophers over the three-year study confirms the prediction by others that unless trees are protected from these animals, plantations infested with them are probably doomed (Dingle, 1956; Hermann and Thomas, 1963).

Literature Cited

- Barnes, V. G., Jr., P. Martin, and H. P. Tietjen. 1970. Pocket gopher control on Oregon ponderosa pine plantations. *J. Forest.* 68(7): 433-435.
- Canutt, P. R. 1970. Development and operation of the forestland burrow builder, p. 77-79. *In Wildlife and Reforestation in the Pacific Northwest Symp. Proc. Ore. State Univ., Corvallis, Ore.*
- Crouch, G. L. 1969. Animal damage to conifers on National Forests in the Pacific Northwest Region. *Pac. Northwest Forest & Range Exp. Sta., U.S.D.A. Forest Serv. Resource Bull. PNW-28.* 13 p.
- Dingle, R. W. 1956. Pocket gophers as a cause of mortality in eastern Washington pine plantations. *J. Forest.* 54(12): 832-835.
- Ellison, L., and C. M. Aldous. 1952. Influence of pocket gophers on vegetation of subalpine grassland in central Utah. *Ecology* 33(2): 177-186.
- Hansen, R. M., and A. L. Ward. 1966. Some relations of pocket gophers to rangelands on Grand Mesa, Colorado. *Colo. Agr. Exp. Sta. Tech. Bull.* 88. 20 p.
- Hermann, R. K., and H. A. Thomas. 1963. Observations on the occurrence of pocket gophers in southern Oregon pine plantations. *J. Forest.* 61(7): 527-529.
- Howard, W. E., and H. E. Childs, Jr. 1959. Ecology of pocket gophers with emphasis on *Thomomys bottae Mewa.* *Hilgardia* 29(7): 277-358.
- Julander, O., J. B. Low, and O. W. Morris. 1959. Influence of pocket gophers on seeded mountain range in Utah. *J. Range Manage.* 12(5): 219-224.
- Moore, A. W. 1940. Wild animal damage to seed and seedlings on cutover Douglas-fir lands of Oregon and Washington. *U.S. Dep. Agr. Tech. Bull.* 706. 28 p.
- _____, and E. H. Reid. 1951. The Dalles pocket gopher and its influence on forage production of Oregon mountain meadows. *U.S. Dep. Agr. Circ.* 884. 36 p.
- Tevis, L., Jr. 1956. Pocket gophers and seedlings of red fir. *Ecology* 37(2): 379-381.

Received February 26, 1971.

Accepted for publication June 2, 1971.