

Pocket Gophers Girdle Large True Firs in Northeastern California

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Serious damage to trees by pocket gophers is thought to be limited to those less than 5 inches (12.7 cm) in diameter at breast height (d.b.h.). This article reports the first known instance of high mortality of large true firs—up to 36.9 inches (93.7 cm) d.b.h.—caused by pocket gophers and evidence of heavy and repeated feeding on major roots of mature trees.

Pocket gophers (*Thomomys* spp.) can be a serious problem in forest environments, especially at higher elevations in the Western United States, where they are frequently a major cause of mortality in young plantations (1). Gophers feed heavily on trees when their preferred foods—various roots, tubers, bulbs, and herbage—are not available, usually in winter. Serious damage by gophers generally is limited to below ground portions of trees, except where the winter snowpack allows the rodents to travel aboveground through tunnels dug in the snow. Damage then is deep gnawing of branches and stems (2). Although large trees suffer a low level of root loss, serious damage by pocket gophers is generally believed to be limited to trees less than 5 inches (12.7 cm) in diameter at breast height (d.b.h.) (3).

This article reports the first known instance of mortality in large (up

to 36.9 inches (93.7 cm) d.b.h.) true fir (*Abies* spp.) resulting from pocket gophers.

Situation

Damage to trees was discovered surrounding and within a 4-acre (1.7 ha) upland meadow adjacent to the southwestern side of a 23-year-old, 19-acre (7.7 ha) clearcut strip, 330 feet (101 m) wide and 2,470 feet (753 m) long. The clearcut and meadow are located at a 6,100-foot (1,859 m) elevation on the USDA Forest Service's Swain Mountain Experimental Forest in northeastern California. A young-to-mature, virgin stand of California red fir (*A. magnifica* A. Murr.) and California white fir (*A. concolor* var. *lowania* [Cord.] Lemm.) surrounds the meadow on three sides. The meadow contains a rich variety of grasses and forbs dominated by lupine (*Lupinus* spp.). The clearcut contains a mixture of grasses; woody brush; and young red fir, white fir, and Sierra lodgepole pine (*Pinus contorta* var. *murrayana* [Grey. & Balf.] Engelm.). The meadow, originally about 3.5 acres (1.4 ha), expanded slightly into the clearcut and now includes some residual trees, submerchantable at the time of harvest. Meadow boundaries are delineated sharply, and vegetation changes to forest or clearcut are abrupt. Abundant gopher burrows, fan-shaped mounds, earthen plugs, and winter casts (dirt cores through

the snow) from tunnels provided ample evidence of gopher activity in the meadow.

Observations

In 1978, two small (less than 6 inches (15.2 cm) d.b.h.) residual trees died. A few small trees died in each of the next 2 years. In 1981, several apparently healthy, large trees suddenly faded and died. Preliminary excavations with a shovel indicated the cause of death to be girdling, probably by gophers.

In September 1981, a sample of trees, including apparently healthy, fading, and dead trees was excavated. All trees except one had suffered some loss of living tissue from root crowns and major roots (table 1). At least four trees had been girdled for more than 90 percent of their circumference, but still appeared green and healthy in September, indicating that feeding was recent. Damage was limited to the zone from just below the forest floor where the thick, furrowed bark of the stem turned into the thin, succulent bark of the roots, to the depth where roots penetrated a layer of large stones. Callus tissue on major roots of several large trees clearly indicated that these feeding attacks had occurred for many years (fig. 1). The number of trees killed and the area affected expanded in 1982.

Several apparently healthy, if slow-growing, residual trees in the clearcut blew over during winter

Table 1—Damage by pocket gophers to large true firs on edges of meadow and old clearcut, Swain Mountain Experimental Forest, Calif.

Species	Diameter at breast height	Amount of tree base excavated	Portion of phloem missing in excavated area	Color of foliage ¹
	<i>in</i>		%	
Red fir	36.9	50	50	Green
Red fir	28.7	50	100	Brown
Red fir	25.4	100	100	Green
White fir	24.7	100	70+	Green
Red fir	21.7	100	90	Green
Red fir	21.2	100	95+	Green
Red fir	19.4	50	100	Brown
Red fir	19.0	30	100	Brown
Red fir	17.5	100	100	Green
Red fir	16.2	30	100	Brown
White fir	16.2	30	85	Green
Red fir	16.0	100	None	Green
Red fir	15.7	50	100	Green
Red fir	15.4	50	100	Brown
Lodgepole pine	15.4	50	45	Green
Red fir	15.2	100	5	Green
Red fir	11.8	50	100	Green
White fir	7.7	100	100	Brown
White fir	6.2	50	100	Brown
Red fir	5.8	50	100	Green

¹At time of excavation in September 1981.

1981-82. Little was left of structural roots except a strip of living tissue along the top of otherwise heavily decayed exposed wood.

Although no pocket gophers were observed or trapped, physical evidence available indicated that they had caused the damage. An extensive, typical, pocket-gopher burrow system throughout the loose soil above a layer of large stones; burrows immediately adjacent to recently gnawed tree roots; one burrow plugged with fresh bark strips; and marks typical of gopher teeth on the stripped tree roots were observed.

Two species of gopher possibly could have been responsible, although the 6,200-foot (1,890 m) elevation strongly implies that the mountain pocket gopher (*Thomomys monticola*) was the damaging agent. The other possi-



Figure 1—Bark and phloem tissue have been eaten by pocket gophers in the base of this large (36.9 inches (93.7 cm) d.b.h.) red fir. The edge of the newly gnawed callus tissue that has partially healed, shown at the right, indicates a previous episode of feeding. (Photo by D. F. Paul)

bility, Botta's pocket gopher (*Thomomys bottae*), usually is found only below a 5,000-foot (1,524 m) elevation (4).

Conclusions

The apparently isolated occurrence of gopher damage to trees

between 5.8 and 36.9 inches (14.7 and 93.7 cm) d.b.h. on Swain Mountain Experimental Forest does not necessarily indicate serious problems elsewhere, but it demonstrates that pocket gophers can cause costly local damage to crop trees far beyond the regeneration stage. Removal of living root

tissue over large areas of major structural roots may lead to massive infection by pathogenic and saprophytic fungi in exposed heartwood. Repeated feeding on tissue of major, first-order roots may also lead to significant growth losses on large trees.

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