

# Responses of Rodent Populations to Wildfire and Prescribed Fire in Southern California Chaparral

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**Abstract.** I documented the response of rodent populations to fire in the chaparral for 80 months after a wildfire and for 44 months after both normal and hot prescribed fires. Deer mice and pocket mice survived prescribed fires, but no wood rats survived. Rodent biomass increased following wildfire, but returned to prefire levels after 70 months. Response to prescribed fires varied; only slight differences were noted between response to normal and hot prescribed fires. Recovery of chaparral rodent communities takes 4-6 years, with the exact pattern of recovery being dependent on prefire species composition and features of the prefire plant community and postfire plant succession that have not been delineated.

**Keywords:** Chaparral; deer mice; pocket mice; postfire succession; rodents.

## Introduction

The chaparral community of southern California is associated with nearly two million years of fire history (Hanes 1971). Postfire plant succession has been described by Patric and Hanes (1964), Hanes and Jones (1967), and Hanes (1971). Short-term effects of fire on birds and mammals have been reported by Lawrence (1966), Quinn (1979), and Wirtz (1977, 1979, 1981, 1988). Prescribed fire is regularly used as a management tool in this community, and anthropogenic fires are frequent. It is critical for management agencies to understand the impact of these fires on the natural community. This paper summarizes long-term successional changes in rodent populations after fires in southern California.

## Methods

Live-trap, mark-and-release techniques were used to document the response of rodent populations to fire in

the chaparral, for 80 months following a wildfire that occurred in November 1975 and for 44 months following prescribed fires in October 1984.

The wildfire burned 1619 ha in the San Dimas Experimental Forest, approximately 45 km east of Los Angeles. Following this fire, permanent study plots were established in 16 year old chaparral at 975 m (control), and in newly burned areas at 975 m and 1280 m (experimental) with the intention of documenting the postfire succession of rodents and birds for a long period. The control at 975 m was also used for the prescribed burns. Two pairs of watersheds were burned in the prescribed fires, a hot and a normal in each of two different drainages. Hot fires were created by hand-cutting brush in May and allowing it to dry in place until the October fires. Rodent populations were marked on all four areas prior to prescribed burns.

## Results

### Fire survival

No wood rats (*Neotoma fuscipes*) survived the prescribed burns. Nine (12.5%) mice of the genus *Peromyscus* survived normal fires, and one (1.4%) survived hot fires. Two (12.5%) pocket mice (*Perognathus californicus*) survived normal fires and two survived hot fires.

### Early postfire succession

Pocket mice and three *Peromyscus* species (*P. boylii*, *P. californicus*, *P. maniculatus*) were present on one hot burn by six months postfire, but no rodents were present on the other (Fig. 1). Pocket mice moved to the second hot burn by the seventh month, and two *Peromyscus* species were present by the ninth month. Pacific kangaroo rats (*Dipodomys agilis*) appeared on some burned areas by the eighth or ninth month (they are rare

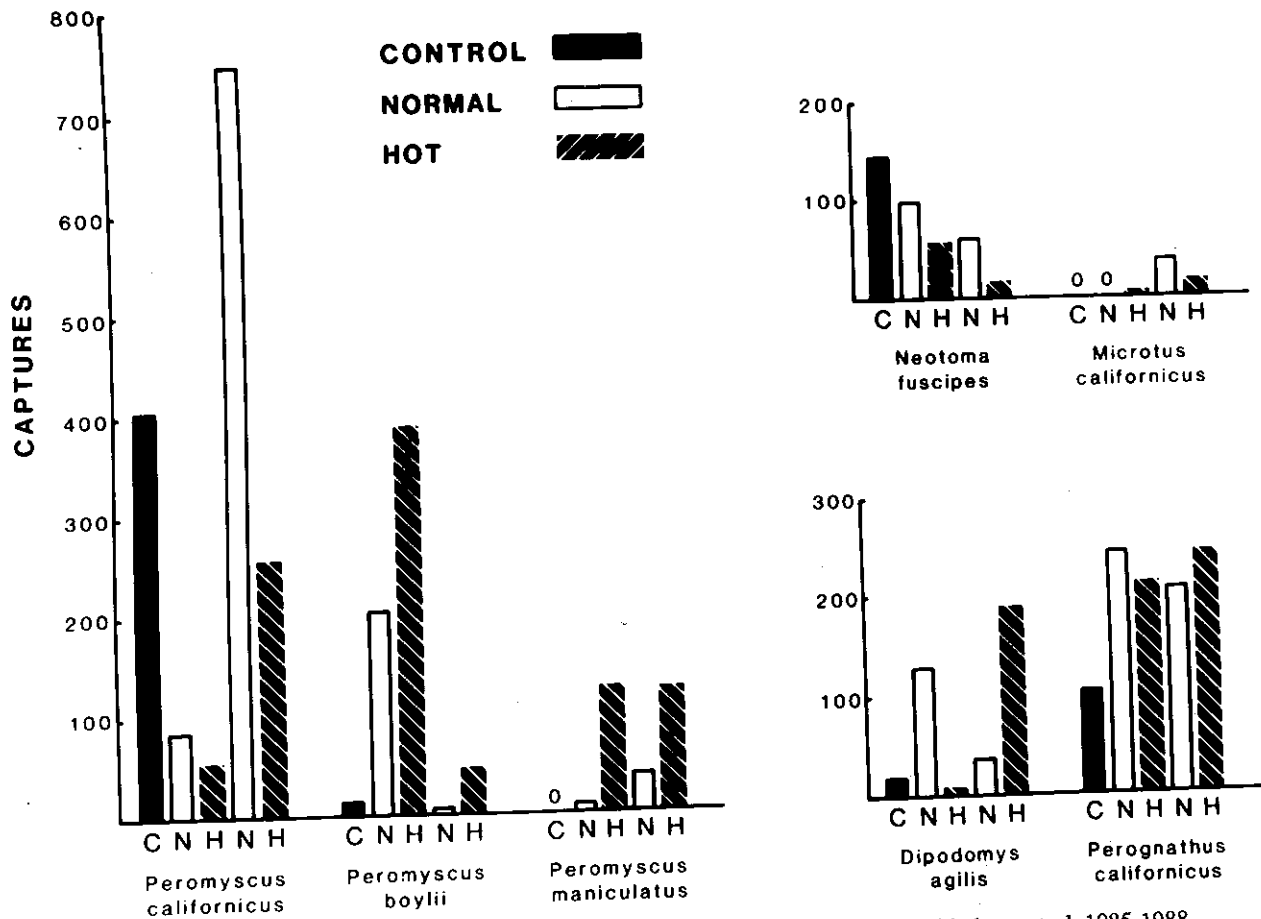


Figure 1. Captures of rodents on two hot and two normal prescribed burns, compared with the control, 1985-1988.

in mature chaparral). Wood rats appeared in burned areas 8-11 months postfire.

Comment should be made about the presence of deer mice (*Peromyscus maniculatus*) and California voles (*Microtus californicus*) in burned chaparral. Neither species has been taken on mature chaparral or prefire sites in this study. *Peromyscus maniculatus* has been taken on all burned study sites, with peaks of abundance by the second year and declining abundance by the fourth year.

#### Hot versus normal fires

Captures of California mice (*Peromyscus californicus*) postfire were greater on normal burns than on hot burns, and sometimes exceeded captures on the control (Fig. 1). Captures of brush mice (*P. boylii*) postfire were greater on both hot burns and on one normal burn than on the control, and captures on hot burns were greater than on normal burns. Deer mice (*P. maniculatus*) were not taken on the control; captures were greater on hot burns than on normal burns.

Captures of wood rats were less than controls on all burned areas. California voles (*Microtus californicus*) were not taken on the control; their presence on burned areas is dependent upon the amount of grass in the postfire plant succession. Kangaroo rats (*Dipodomys*) and pocket mice (*Perognathus*) were more prevalent postfire on burned areas than on the control.

#### Biomass

Total rodent biomass varied considerably on the control throughout these studies. After the 1975 wildfire, biomass was low on both burned plots for 12 months, increased rapidly from 15 to 30 months postfire, and by 34 months postfire had exceeded the maxima on the control (Fig. 2). In the fourth year postfire, biomass on burned and control areas started declining; this continued until about 65 months postfire. By this time both control and burned plots were similar in biomass to early postfire communities, and remained similar for the last 20 months of the study. By the time the prescribed burns were done, the control was 28

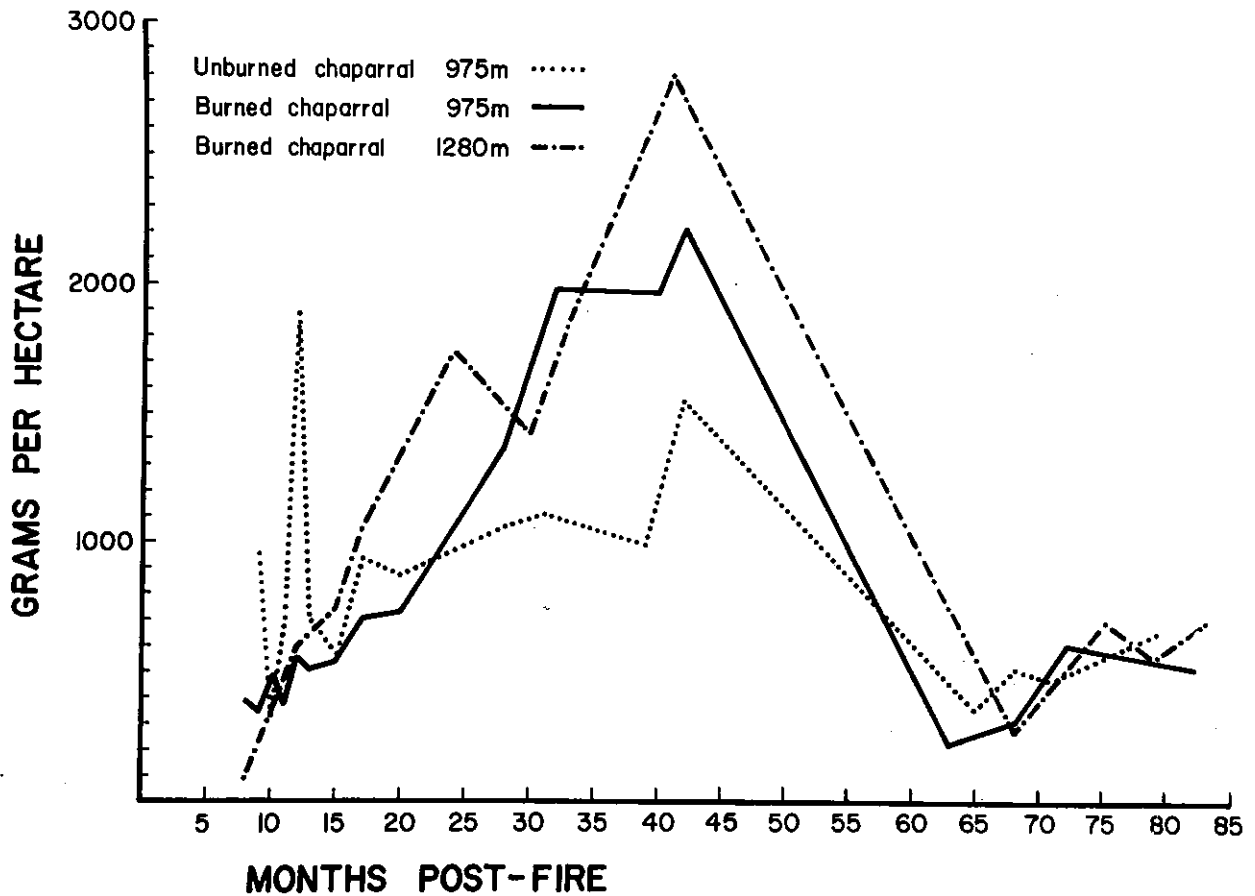


Figure 2. Biomass, grams per hectare, of rodents on control and two wildfire sites, 1976-1984.

years postfire. Biomass on the control during this period fluctuated, with a slight trend toward increase. Biomass on both hot and normal prescribed burns fluctuated in a manner similar to the control, also with a slight trend toward increase (Fig. 3).

**Discussion**

Deer mice and pocket mice survived prescribed fires, but no wood rats survived. After the wild fire, total rodent biomass varied considerably on the control plot. Biomass on control and experimental plots increased for 42 months postfire, but that on burned plots increased at a greater rate. By 34 months postfire, biomass on both burned plots exceeded maxima on the control. By 70 months postfire, biomass on all plots was less than 700 gm/ha, and that on burned plots was essentially the same as the control, now 22 years old. The pattern of postfire succession following the prescribed burn was similar to that following the wildfire,

but lacked the dramatic increases in density, and therefore in biomass, observed in the earlier study. Rodent populations took about four years to stabilize at essentially prefire levels following wildfire. Demographic response to prescribed fires varied, with some species reaching prefire densities in less than four years and others not yet reaching prefire densities at four years. Only slight differences were noted between rodent postfire succession on normal and hot burns, and these may be attributed to differences in the biology of individual species.

**Conclusions**

1. Fire may impact rodent species severely, chiefly through loss of resources, especially shelter and food.
2. Some individuals survive fire.

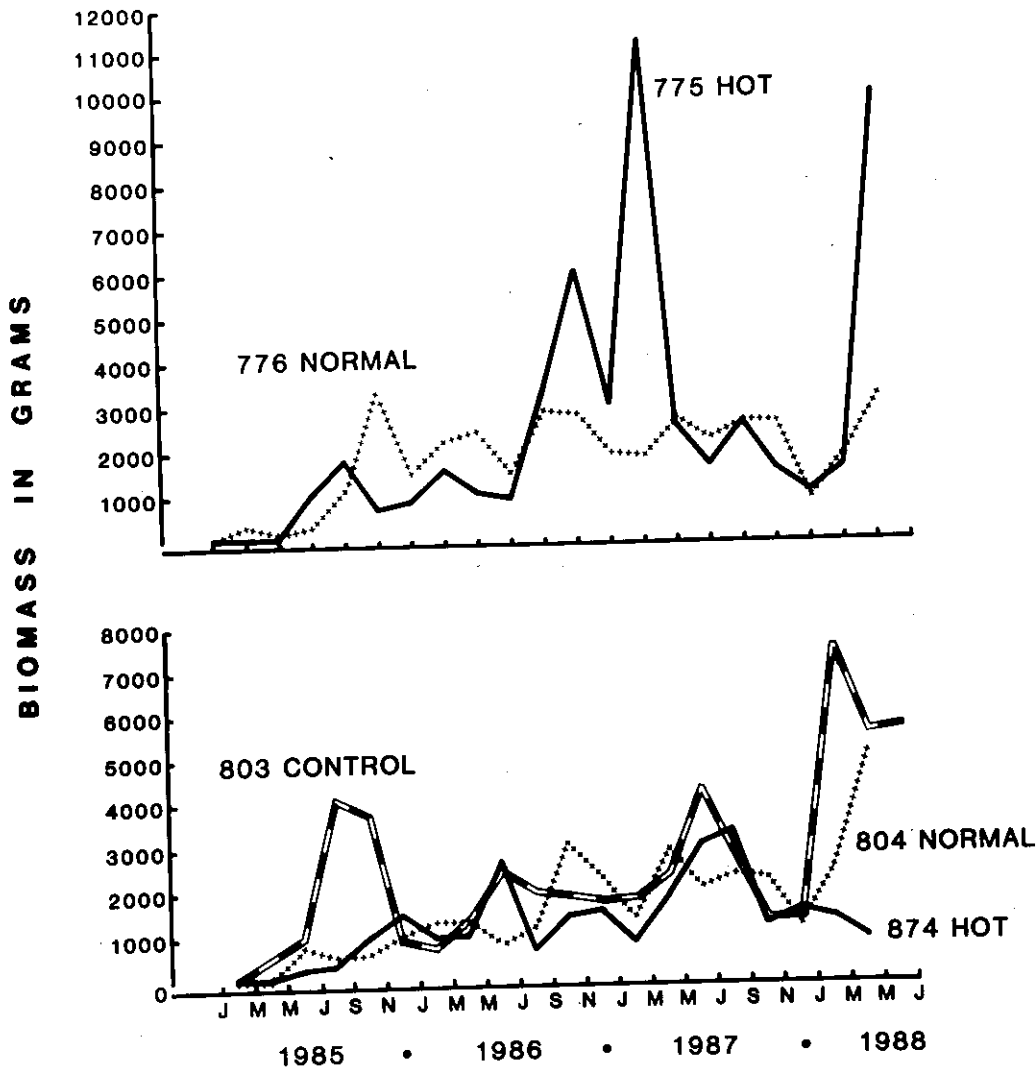


Figure 3. Total biomass of rodents on control (same control as Fig. 2), and hot and normal prescribed burns, 1985-1988.

3. Colonization from adjacent habitats may be rapid.
4. Postfire succession is somewhat dependent on prefire species composition in the area.
5. In southern California, at least two species, the deer mouse and the California vole, are fire specialists, entering the system only for relatively short periods of the postfire succession.
6. Species requiring brush for cover and/or food, like wood rats and California mice, are most severely impacted by fire, and require the longest time to recover to prefire densities.
7. There is no clear-cut difference in rodent succession following normal and hot fires.
8. Postfire succession is characterized by increases in successionaly-adapted species, with declines in those species for which essential habitat features are lacking.
9. Recovery of the rodent community to its prefire condition probably takes four to six years, with the exact pattern of recovery being dependent on prefire species composition and features of the prefire plant community and postfire plant succession that have not been delineated.

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