K. A. Gano

and

W. H. Rickard

Battelle Pacific Northwest Laboratories
Richland, Washington 99352

Small Mammals of a Bitterbrush-Cheatgrass Community

Abstract

Small mammals were live-trapped in burned and unburned segments of a bitterbrush-cheatgrass community during the years 1974-1979. Results indicate that the shrub-dominated unburned area supports about three times as many small mammals as the cheatgrass-dominated burned area. Species composition was similar in both areas with the exception of one ground squirrel (*Spermophilus townsendii*) captured on the unburned area. Other species caught were the Great Basin pocket mouse (*Perognathus parvus*), deer mouse (*Peromyscus maniculatus*), northern grasshopper mouse (*Onychomys leucogaster*), and the western harvest mouse (*Reithrodontomys megalotis*).

Introduction

The bitterbrush-cheatgrass community is located in the southeastern part of the Department of Energy's Hanford Site in Benton County, Washington, and occupies about 31,000 ha (Fig. 1). At the present time, the community is mostly undisturbed, but it was grazed by livestock prior to 1943. Large construction projects like the Fast Flux Test Facility (FFTF) and the commercial nuclear power projects of the Washington Public Power Supply System (WPPSS) have recently been constructed and now occupy a part of this community. In the absence of grazing livestock, wildfires make up the most drastic and widespread disturbance. Fire swept across the southeastern section of the Hanford Site in the summer of 1963, burning 4038 ha (O'Farrell *et al.*, 1971). The same area burned again in 1970 along with some additional, previously unburned land. Burning effectively kills the xerophytic shrubs, especially bitterbrush (*Purshia tridentata* (Pursh) DC.) and sagebrush (*Artemisia tridentata*, Nutt). Herbaceous understory plants consisting mostly of cheatgrass (*Bromus tectorum* L.) reinvade burned areas and dominate the vegetation for many years (Rickard and Sauer, in press). Bitterbrush and sagebrush, however, are very slow to reinvade, and the time required for these shrubs to attain their previous dominance is unknown.

This investigation compares small mammal populations trapped in the burned and the unburned parts of the bitterbrush-cheatgrass community. The study began in 1974 and live-trapping was conducted through the spring of 1979. The purpose was to establish species composition and relative abundance of small mammals in two adjacent but vegetatively different habitats.

Methods

Small mammal populations were investigated in recently burned and unburned parts of the bitterbrush-cheatgrass community using a live trap recapture method. Two study plots were established in the summer of 1974, each gridded with 100 traps

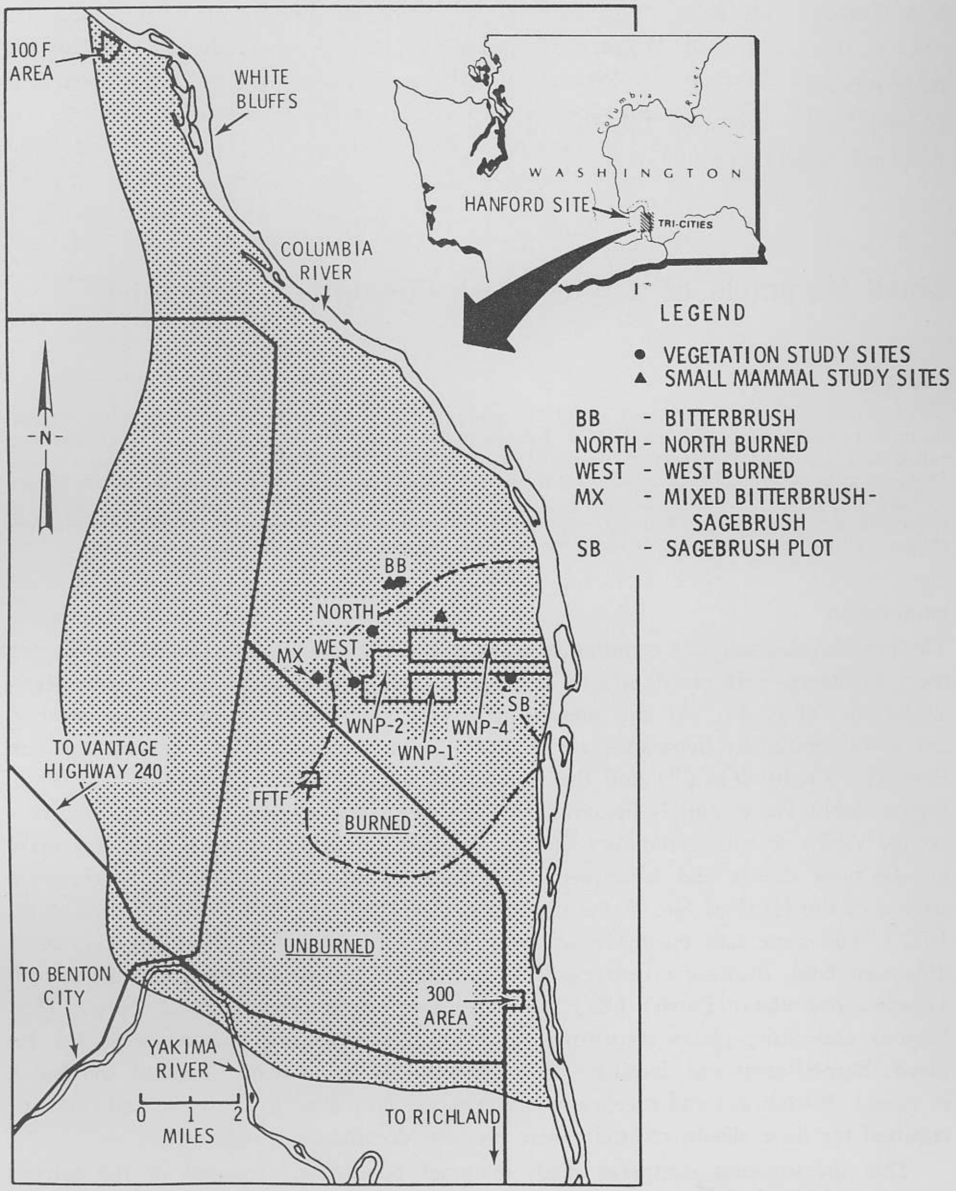

Figure 1. Southeastern part of the U.S. DOE Hanford Site showing the extent of the Bitterbrush-Cheatgrass community, shaded; the location of the WPPSS (Washington Public Power Supply System) property, and the location of the study plots.

spaced at 10 m intervals. One plot was located in a relatively undisturbed stand representative of the unburned community, and the other was located in an area that had burned in 1970. Both plots were a mile or more from the WPPSS construction site. We believe mammal behavior was unaffected by construction noises and dust.

Trapping was conducted according to the method employed by O'Farrell (1975).

Sherman live traps were placed one to a grid point and shielded by a large metal can (10 x 10 x 30 cm). A 24-gauge galvanized steel tent 30 cm wide, 40 cm long, and 25 cm high at the peak shielded the can and the trap, providing protection from heat, wind, and rain. Each trap was supplied with enough seeds to prevent animal torpor and contained some soft fiber for nesting during overnight confinement. Both plots were serviced for three consecutive days during each trapping session by the same pair of investigators. During the first year, trapping sessions were conducted monthly to establish the yearly cycles of small mammal activity. Trapping effort in the following years was reduced to a minimum of two sessions per year. Trapping was conducted in spring to record peak activity during the breeding season and again in late summer to record any recruitment of young into the population. Mice were individually marked by toe amputations and released near the point of capture. Individual animals were weighed alive using a spring tension scale accurate to 0.5 g.

Results and Discussion

In the period 1974 to 1979, 12,200 trap nights were recorded. Five hundred sixty-one individual animals representing five species were trapped, marked, and released. The great basin pocket mouse (*Perognathus parvus*) was the most abundant animal trapped, with 469 individuals captured. Second was the deer mouse (*Peromyscus maniculatus*), with 68 individuals. The northern grasshopper mouse (*Onychomys leucogaster*) was represented by only 15 individuals, the western harvest mouse (*Reithrodontomys megalotis*) by eight individuals, and the Townsend ground squirrel (*Spermophilus townsendii*) by one individual. There were more animals trapped in the unburned community than in the community with a recent fire history (Table 1).

TABLE 1. Total number of individual small mammals captured and released on burned and unburned parts of the bitterbrush-cheatgrass community 1974-1979.

Species	Unburned Plot	Burned Plot	Total
Pocket mouse	362	107	469
Deer mouse	54	14	68
Grasshopper mouse	10	5	15
Harvest mouse	6	2	8
Townsend ground squirrel	1	0	1
Total	433	128	

TABLE 2. Spring and summer catch of pocket mice in unburned and burned communities during the years 1974 to 1979.

Year	Unburned (Control) Spring	Unburned (Control) Summer	Burned Spring	Burned Summer
1974	—	46	—	29
1975	36	27*	27	13*
1976	52	53	8	2
1977	43	30	7	14
1978	15	56	1	5
1979	64	—	9	—
Average	42	42	10	13

*Trapping session conducted in July

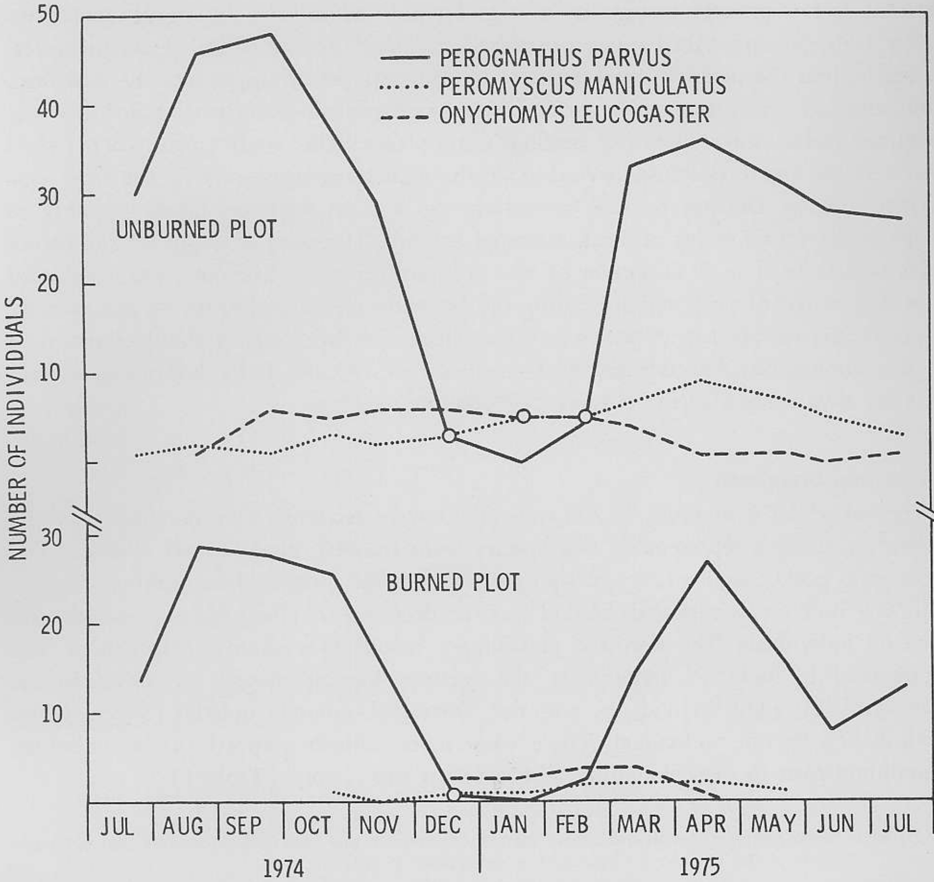

Figure 2. Comparison of seasonal fluctuations of small mammal populations 1974 and 1975 in burned and unburned bitterbrush-cheatgrass communities.

The most abundant small mammal trapped in the bitterbrush-cheatgrass community was again the pocket mouse. The yearly cycle of activity for the pocket mouse begins in March and early April as adults emerge from winter torpor to breed (O'Farrell *et al.*, 1975). A second population peak is usually observed in late summer with the recruitment of young into the population (Fig. 2). The trap catches made during these two peak seasonal activity periods during the years 1974 to 1979 are summarized in Table 2.

These data provide an estimate of the number of pocket mice active on the study plots at the time of trapping. Assuming that the effective area of a trapping grid was one hectare and that the vulnerability of pocket mice to trapping was high, we estimated that the pocket mouse population was about three times more dense on the unburned plot than on the burned plot. The population showed greater year to year fluctation on the burned plot than on the unburned plot. The spring catch of pocket mice was lowest in 1978 when only 15 animals were trapped in the unburned plot and only one on the burned plot. This small catch may have been the result of the severe drought and resulting low plant productivity of the 1977 growing season. Only 3.07

cm of rain fell between October 1976 and April 1977, with only 10 $g/m^2/yr$ of herbaceous phytomass produced (Rickard and Sauer, in press). Nevertheless, the pocket mouse population quickly recovered, as 56 animals were trapped on the unburned plot in late summer of 1978. Forty-four of the animals captured were classified as young of the year. This increase was apparently in response to the higher precipitation (14.35 cm) and resulting higher phytomass of the 1978 growing season. The average rainfall for the growing season (October to May) at the Hanford Site is 13.0 cm (Stone *et al.*, 1972). The high correlation between autumn-spring precipitation and pocket mouse abundance has been pointed out by O'Farrell *et al.* (1975) and Dunigan *et al.* (1980).

Some additional insight concerning the population dynamics of the pocket mouse population can be obtained by noting the number of marked individuals recaptured after emerging from winter dormancy. Table 3 shows the number of individuals recaptured on both plots after one or two winters. The greatest number of spring recaptures came from the 1974 catch with 42 percent recaptured on the unburned plot and 18 percent on the burned plot after the first winter. However, only 8 percent (unburned) and 4 percent (burned) of the original 1974 catch were captured after the second winter. The only other year class for which recaptures in two successive years were obtained was that of 1976, in which only 2 percent recaptures after the second winter were obtained in the unburned plot.

TABLE 3. Total number of pocket mice marked and retrapped after 1-2 winters.

		1974	1975	1976	1977	1978	1979
1974	Unburned	48	20(42%)	4(8%)			
	Burned	28	5(18%)	1(4%)			
1975	Unburned		22	5(23%)			
	Burned		11	1(9%)			
1976	Unburned			99	18(18%)	2(2%)	
	Burned			7	1(14%)		
1977	Unburned				49	8(16%)	
	Burned				18	—	
1978	Unburned					60	19(32%)
	Burned					6	3(50%)
1979	Unburned						45
*	Burned						6

*Trapping data represents 1 trap session in spring.

These recapture percentages are probably conservative estimates of survival because only two trapping sessions per year were used. Although the two peak activity periods for pocket mice were used, spring (April-May) and late summer (August-September), recapture percentages could be much greater than indicated; nevertheless, no marked animals were recaptured after three winters.

On the average, more males than females were caught, a possible indication of the male's slightly greater mobility (O'Farrell *et al.*, 1975). Male pocket mice on the average weighed more than females (Table 4). When comparing burned and unburned

TABLE 4. Live weights of pocket mice (gm) in unburned and burned communities during the Spring Season.

	Unburned				Burned			
	Males		Females		Males		Females	
	n	x̄ +SE	n	x̄ +SE	n	x̄ +SE	n	x̄ +SE
1975	28	18.5± .3	8	14.4± .2	13	17.0± .5	14	14.3± .3
1976	23	18.4± .4	29	17.6± .5	5	18.1± .6	3	17.0±1.3
1977	25	19.0± .4	18	15.2± .3	5	19.0± .8	2	18.5±0
1978	9	20.5± .5	6	17.8±1	No Captures		1	15.5
1979	30	18.5± .4	34	16.8± .3	4	19.4± .4	5	16.1± .5

communities, a Student's t-test showed no significant differences in weights of like sexes.

Deer Mouse Populations

Deer mouse populations were much lower than pocket mouse populations. Nevertheless, the unburned community yielded about three times more deer mice than the burned community. The spring catch of deer mice was consistently greater than the summer catch with no deer mice captured on the burned community during summer trapping. Assuming an effective trapping area of one hectare and a high trap efficiency for deer mice, we estimated that about six deer mice per hectare were present on the unburned bitterbrush-cheatgrass community and only two per hectare on the burned community.

The small mammal species composition of the bitterbrush-cheatgrass community is like communities elsewhere on the Hanford Site (Kritzman, 1970). O'Farrell *et al.* (1975) used a stochastic model to estimate the pocket mouse population in a sagebrush-cheatgrass community. Over a five year period (from 1967-1971), the April population ranged between 20 and 75 mice per hectare. Hedlund *et al.* (1975) estimated the trappable pocket mouse population of a cheatgrass community at 30 per hectare during April 1974.

Summary

The findings of our investigation indicate that the cheatgrass-dominated plant community does not support as dense a population as the shrub community. According to Battelle researchers at the Arid Lands Ecology Reserve, small mammal populations in sagebrush-bluebunch wheatgrass communities (*Artemisia tridentata-Agropyron spicatum*) are relatively unaffected when fire removes the shrub cover. The role that shrubs play in providing "prime" habitat for pocket mice has not been investigated. Shrubs may play an important role by providing protection from vertebrate predators. The role that herbaceous vegetation structure plays in impeding overground movements of pocket mice likewise has not been investigated. Uniformly dense stands of cheatgrass may deter pocket mice from using such an area by hindering their aboveground movements. If mobility of the mice is reduced, breeding success might also be reduced, resulting in a smaller population. Possibly the population estimate may be inherently low on the cheatgrass plot because of the conceivable difficulty animals may have in finding the traps in dense herbaceous vegetation.

The ecological role of small mammals in the bitterbrush-cheatgrass community is that of prey for higher trophic level animals such as the gopher snake, coyote, badger, and raptorial birds. A comparative diet study of cheatgrass and shrub-dominated communities may help answer the question, "Why are there fewer small mammals in the cheatgrass community?" In addition, an energetics study comparing the two communities and available energy sources (food items) to small mammals could help explain the difference in population density.

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