



CALIFORNIA STATE UNIVERSITY, STANISLAUS

ENDANGERED SPECIES RECOVERY PROGRAM

SMALL MAMMAL MONITORING BITTER CREEK NATIONAL WILDLIFE REFUGE 2015

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Introduction

Live-trapping was conducted at Bitter Creek National Wildlife Refuge (BCNWR) in 2015 as part of a newly established small mammal monitoring program. This program will track annual trends in small mammal abundance at BCNWR and assess the relationship between small mammals and vegetation characteristics, including response to cattle grazing.

Methods

Fifteen small mammal monitoring plots were established at BCNWR in 2015. These plots were paired with existing vegetation monitoring transects to more effectively assess the response of small mammals to annual vegetation attributes. The plots were located in management units 9 Central, 9 West, 10A, 10B, and 12. The specific sites were:

10A-05	10A-Exclosure	9W-08
9C-06	10B-03	12-02
9C-08	10B-Exclosure	9W-Exclosure
9C-09	10B-06	12-Exclosure
9W-01	9C-Exclosure	9W-03

Per the selected monitoring design (Fig. 1), a Sherman aluminum box trap (7.6 cm x 9.5 cm x 30.5 cm) modified to prevent injury to long kangaroo rat tails was placed at each of 24 trap stations on a transect surrounding the vegetation monitoring plot. Each trap was provisioned with a handful (ca. 20 ml) of millet seed for bait and an unbleached paper towel or wad of cotton batting for bedding and thermal insulation. Traps were opened near dusk and checked beginning just before sunrise the next morning. All rodents captured were identified to species and marked ventrally with a non-toxic felt-tipped marker

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to identify recaptured animals within a trapping session. Sex, age, weight, and reproductive status also were recorded. Animals were then released at the capture site.

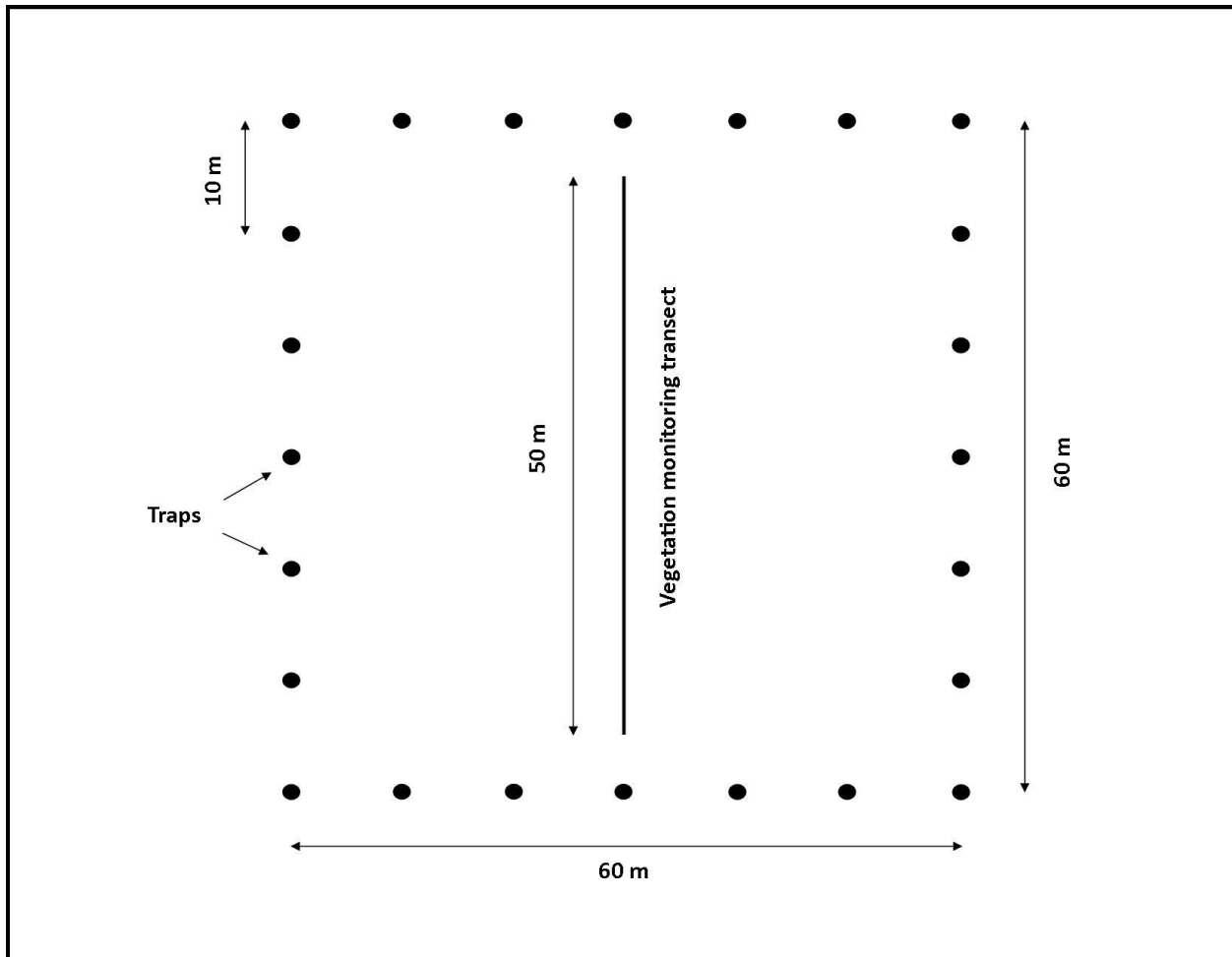


Figure 1. Small mammal live-trapping transect configuration at vegetation monitoring sites, Bitter Creek National Wildlife Refuge.

Results

In 2015, trapping was conducted by ESRP and BCNWR staff during 15 September and 2 October (Table 1). Trapping was conducted on 5 plots each week. The number of unique individuals caught on plots ranged from 7-31. Four species were captured: Heermann's kangaroo rat (*Dipodomys heermanni*), San Joaquin pocket mouse (*Perognathus inornatus*), California pocket mouse (*Chaetodipus californicus*), and deer mouse (*Peromyscus maniculatus*). Deer mice were the most frequently captured species (147 individuals) and were recorded on all 15 plots. For California pocket mice, 60 individuals were captured on 12 plots, and for San Joaquin pocket mice, 46 individuals were captured on 12 plots. Seven Heermann's kangaroo rats were captured on 5 plots. Capture rates on the plots varied from 0.07-

0.33 individuals per trap-night (Table 1). The mean number of species per plot was 2.9. A Shannon diversity index was calculated for each plot and ranged from 0.38 to 1.09 (Table 1).

In fall 2015, vegetation attribute data were collected by BCNWR staff on each of the 15 small mammal monitoring plots (Table 2). Multiple regression analyses were conducted to determine whether the total number of small mammal individuals, total number of deer mice, total number of pocket mice (San Joaquin and California combined), capture rates, or diversity indices were related to percent vegetation cover, vegetation height, current year's growth, or total (current plus previous years') biomass. Small mammal capture rates and percent vegetation cover were arcsin-transformed prior to the analyses. P-values for all analyses ranged from 0.17-0.99 indicating that there was no evidence of significant relationships between vegetation attributes and small mammal population attributes. Although none of the relationships were significant, least squares trend lines indicated that most small mammal population attributes generally exhibited a declining trend as vegetation attributes increased (Fig. 2).

In summary, a small mammal monitoring program was designed and implemented on BCNWR in 2015. Small mammal live-trapping transects were established in association with 15 existing vegetation monitoring transects, and this will permit a robust intra-annual and inter-annual assessment of the relationship between vegetation attributes and small mammal population attributes on the 15 monitoring sites. This assessment will include the ability to evaluate the effects of cattle grazing, which will be facilitated by the fact that 5 of the monitoring sites are in cattle exclosures. In 2015, no evidence of significant relationships between vegetation attributes and small mammal population attributes was detected. This may simply indicate that the vegetation attributes were not sufficiently extreme (e.g., vegetation was not sufficiently dense or sparse) to significantly influence small mammal populations. The next monitoring session is scheduled to be conducted in Fall 2016.

Table 1. Small mammals captured on monitoring plots at Bitter Creek National Wildlife Refuge, 2015. Counts are numbers of unique individuals.

Plot	Dates	DIHE ¹	PEIN ²	CHCA ³	PEMA ⁴	Diversity Index (H') ⁵	Total individuals	Trap Nights	Capture rate (ind/trap night)
10A-05	09-15-15 to 09-18-15	1	1	2	12	0.83	16	96	0.17
10A-Ex	09-15-15 to 09-18-15	0	4	8	10	1.04	22	96	0.23
10B-03	09-15-15 to 09-18-15	0	3	1	3	1.00	7	96	0.07
10B-06	09-15-15 to 09-18-15	0	2	20	9	0.81	31	94	0.33
10B-Ex	09-15-15 to 09-18-15	0	11	2	9	0.92	22	96	0.23
9C-06	09-22-15 to 09-25-15	0	0	3	12	0.50	15	96	0.16
9C-08	09-22-15 to 09-25-15	0	0	4	11	0.58	15	96	0.16
9C-09	09-22-15 to 09-25-15	1	7	1	9	1.05	18	96	0.19
9C-Ex	09-22-15 to 09-25-15	0	1	1	12	0.51	14	96	0.15
9W-01	09-22-15 to 09-25-15	1	5	1	7	1.09	14	96	0.15
9W-03	09-29-15 to 10-02-15	3	8	0	13	0.97	24	96	0.25
9W-08	09-29-15 to 10-02-15	0	1	6	7	0.89	14	96	0.15
9W-Ex	09-29-15 to 10-02-15	0	1	0	7	0.38	8	96	0.08
12-02	09-29-15 to 10-02-15	1	2	11	16	1.00	30	96	0.31
12-Ex	09-29-15 to 10-02-15	0	0	0	10	-	10	96	0.10

¹ Heermann's kangaroo rat (*Dipodomys heermanni*)

² San Joaquin pocket mouse (*Perognathus inornatus*)

³ California pocket mouse (*Chaetodipus californicus*)

⁴ Deer mouse (*Peromyscus maniculatus*)

⁵ Shannon diversity index: $H' = (N \log N - \sum n_i \log n_i) / N$

Table 2. Vegetation attribute data collected on small mammal monitoring plots by BCNWR staff in fall 2015.

Transect ID	Management Unit	Observation Date	¹ Vegetation Estimates				
			² Cover (%)	³ Height (inches)	⁴ Current Year's Growth (grams)	⁵ Accumulated Biomass (grams)	⁶ Net Biomass (grams)
EX09C	9 Central	9/17/2015	83.33	4	4.17	8.17	12.33
09C06	9 Central	9/21/2015	90.00	0.75	3.33	26.33	29.67
09C08	9 Central	9/21/2015	75.00	3.67	11.67	19.33	31
09C09	9 Central	9/21/2015	98.33	4.75	14	35.67	49.67
EX09W	9 West	9/25/2015	98.33	7.25	7.33	19.33	26.67
09W01	9 West	9/22/2015	83.00	4.5	3.67	7.17	10.38
09W03	9 West	9/24/2015	50.00	1.21	2.67	5	7.67
09W08	9 West	9/24/2015	53.33	4.42	4.33	18	22.33
EX10A	10A	9/14/2015	83.33	2.96	4	13.33	17.33
10A05	10A	9/18/2015	8.33	0.33	1	0.67	1.67
EX10B	10B	9/14/2015	80.00	3.04	5.33	13	18.33
10B03	10B	9/11/2015	85.00	4.04	9.67	15.33	25
10B06	10B	9/29/2015	53.33	2.92	2.67	3.33	6
EX12	12	9/17/2015	63.33	0.25	0.17	1.83	2
1202	12	9/28/2015	93.33	4.34	4.33	22	23

¹Estimates represent the average value of three subsamples collected at each transect.

²Cover = visual estimate of % soil surface obscured from perpendicular view by vegetation. 0% = bare soil. 100% = complete vegetation cover.

³Height = vegetation height in inches measured within each of the 4 corners of the sampling frame.

⁴Current Year's Growth = vegetation < 1 year of age. The average amount of herbaceous plant material in grams produced during the current growing season.

⁵Accumulated Biomass = vegetation > 1 year of age. The average amount of older herbaceous plant material in grams produced during previous growing seasons. Also referred to as thatch or mulch.

⁶Net Biomass = combined weights of Current Years Growth and Accumulated Biomass in grams. This metric provides a total measure of the average amount of all herbaceous biomass present on transects.

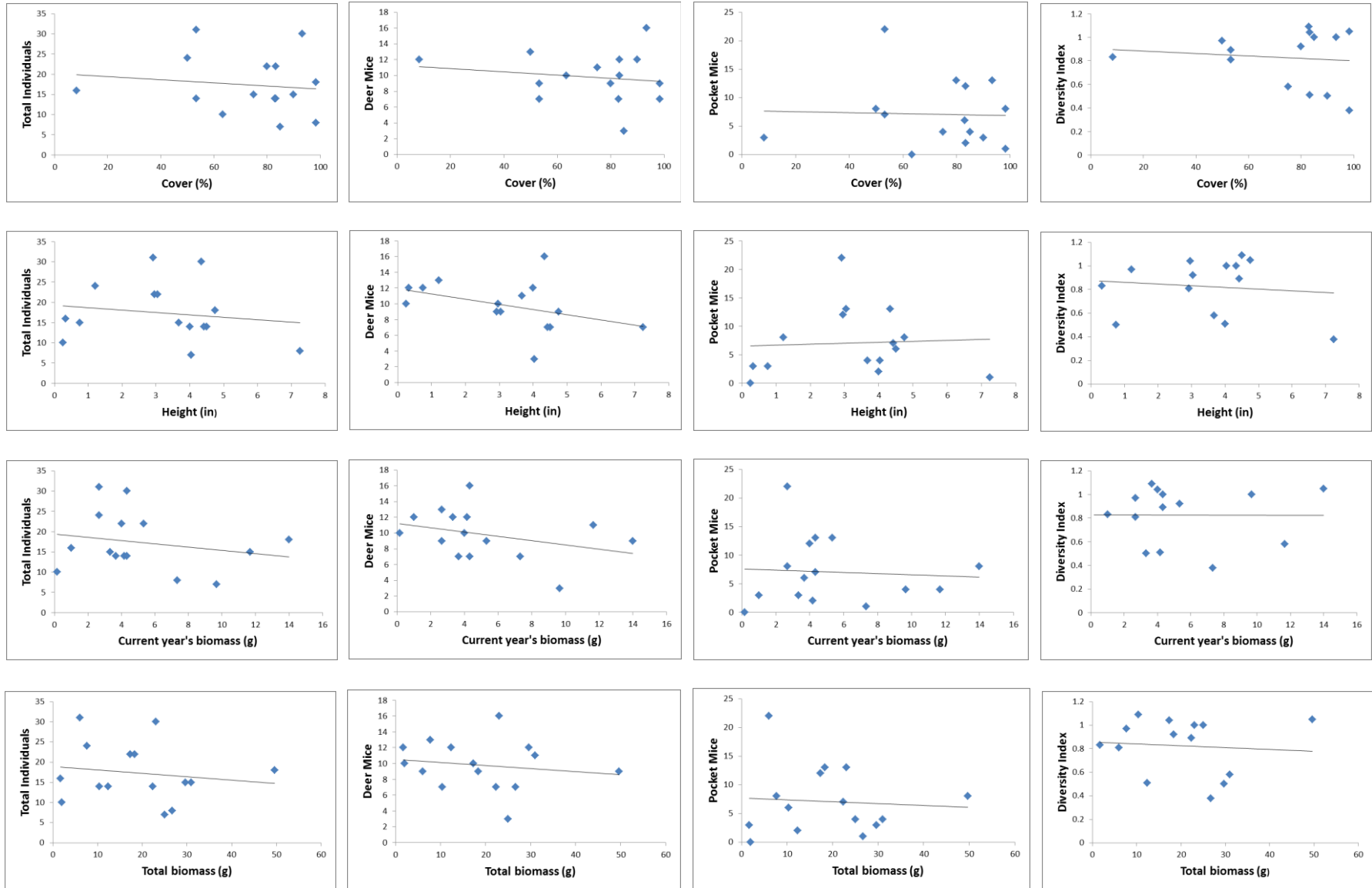


Figure 2. Least squares trend lines for relationships between vegetation attributes and small mammal population attributes on 15 monitoring plots at BCNWR in fall 2015.