SMALL MAMMAL PRESENCE AMONGST SELECTIVELY GRAZED ANNUAL GRASSLAND HABITAT AT LOWER COTTONWOOD CREEK WILDLIFE AREA, 2005 - 2006

California Pocket Mouse. Photo by: Christina Sousa

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Abstract

We monitored six sites during 2005-2006 at Lower Cottonwood Creek Wildlife Area (LCCWA) to determine if grazing has any effect on small mammal populations. During years with adequate rainfall, LCCWA is selectively grazed during the winter months. Department personnel have constructed several fenced-in cattle exclusions on the wildlife area in order to protect portions of habitat from being grazed. We set up permanent grid sites and conducted small mammal trapping in both grazed and ungrazed plots. Our surveys targeted nocturnal species and we found that some had a higher catch per unit effort in grazed, where as others existed in higher densities in the ungrazed plots. For house mice, our only non-native species, we observed them in relatively equal densities amongst both sites. Grazing has been an important tool in aiding with both fire prevention and in controlling invasive grass species. We feel that continued use of cattle exclusions during grazing will promote more habitat diversity and thus benefit native wildlife. We also found no evidence that grazing or exclusion sites favored or inhibited the distribution of house mice.

Keywords: grazing, cattle exclusion, small mammal, mice, Sherman traps

Introduction

The California Department of Fish & Game manages and owns Lower Cottonwood Creek Wildlife Area (LCCWA), which is one of several properties that make up the Los Baños Wildlife Area Complex. LCCWA is located just to the east of the Coast Range foothills in Central California. During years with adequate rainfall, cattle grazing contracts for this property are formed between the Department and local cattlemen. Grazing not only assists in the control of non-native grasses, but also aids in fire prevention by reducing the amount of dry vegetation that will be present during the following summer. The Department has arranged the development of several cattle exclusion sites, which provide refuge to wildlife while grazing takes place. These exclusions also protect portions of grassland as well as other habitat, and provide diversity simply by way of grazed (740 ha) and ungrazed (129 ha) areas that are available across the property. LCCWA consists mostly of annual grassland, which supports populations of several small mammal species. We wished to learn if grazing was affecting small mammal populations and species distribution amongst either grazed or ungrazed (i.e. cattle exclusion) sites.

Cattle were placed on LCCWA during October of 2004 and 2005, and they continued to graze through the first week of the following January. After the October

2004 to January 2005 grazing was completed, we selected a total of three grazed and three ungrazed sites to monitor small mammal presence. We began trapping during the spring of 2005 and concluded prior to cattle being placed back onto the property that winter. During 2006, we repeated this process at the same six locations. However, a new fenced-in exclusion was built during late fall in 2005 and encompassed one of our monitoring sites. LCCWA has relatively limited habitat diversity and the purpose of the new cattle exclusion was to enclose an area containing coyote bush, *Baccharis pilularis*, in hopes that it would protect this small stand of shrubs. Because we still wanted to maintain our permanent grid sites for comparison of the data, this new exclusion resulted in us trapping a higher number of ungrazed areas during 2006. This occurrence was simply due to a lack of communication between the biological and management staff, since the fences were erected at a time when we were not actively trapping. Due to budgetary and personnel constraints, our surveys were only conducted for two seasons. However, we felt this information could be valuable in determining if cattle grazing might have an effect on small mammals (including native versus non-native species). Small mammal trapping for the purpose of a species inventory was conducted at LCCWA during 2004 (Connolly, et al. 2008), so we hoped to compare our species to that of the inventory results as well.

Study area

LCCWA (869 ha) lies within Merced County and is adjacent to both private land as well as property owned by California State Parks & Recreation. The wildlife area is bordered on the southwest by state highway 152 and is located near the O'Neill Forebay, west of the city of Los Baños (Figure 1). Elevation ranges from approximately 90-390 meters. The majority of habitat for this wildlife area can be described as California annual grassland, along with a small portion of mixed willow (Sawyer and Keeler-Wolf 1995). LCCWA is primarily influenced by the climate of the San Joaquin Valley, including hot, dry summers and relatively mild winters with an average rainfall of 28.6 cm per year (California Department of Fish & Game unpublished data 1970-2006). A few ephemeral stock ponds exist and recent development of some existing springs may now provide wildlife with limited year-round watering holes.

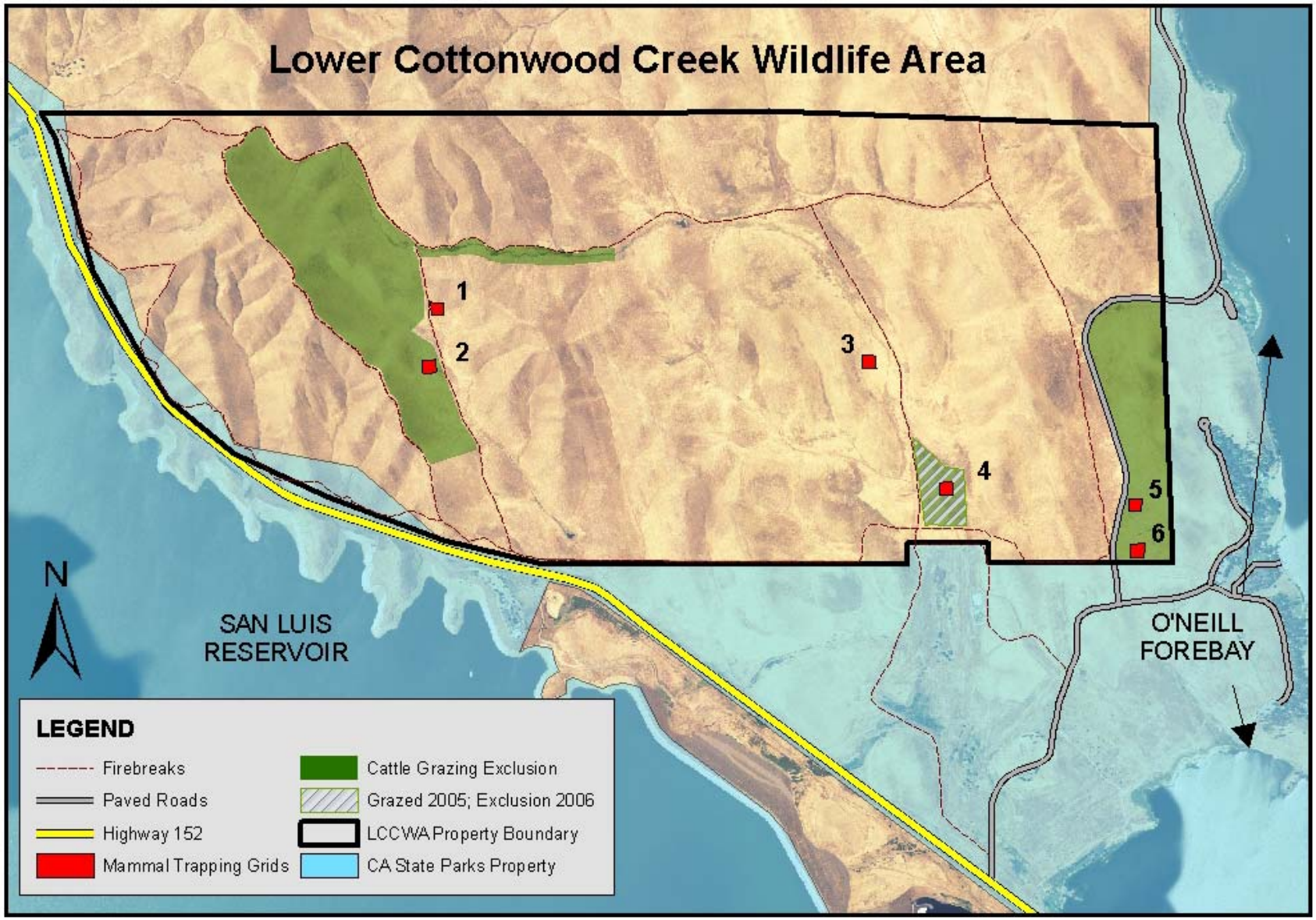

Figure 1. Small mammal trapping & monitoring sites at Lower Cottonwood Creek Wildlife Area, 2005-2006.

When selecting grid sites for this study, we chose locations that were in and amongst primarily grassland habitat (i.e. not containing or directly adjacent to other habitat types such as willow, which can have a variable understory of herbaceous vegetation species). We re-trapped at a few of the Department's former inventory sites, and added new grid locations in order to get a representative number of both grazed and ungrazed grassland habitat.

Methods

Our trapping was conducted using Sherman extra-long live traps, which we placed in seven parallel lines (each line containing seven traps) in order to form a 49-trap grid. After researching the small mammal species potentially found in our area, we selected a grid size that we felt would encompass the home range of those species, as well as one that could be operated by a single person if necessary. We set up grids by using a compass and walking in the four cardinal directions, while pacing the distance between traps (approximately 10 meters). While setting up each grid, we used a GPS (global positioning system) as well as pin flags to mark individual traps. Habitat specifics such as grass type, height, density, etc. were not recorded due to a lack of time and available personnel having little botanical experience. However, common wild oat, *Avena fatua*, is the dominant grass in most locations and is known as a non-native species that out competes other natives.

Our goal was to trap a total of three sessions or replicates per year and to avoid inclement weather, which may harm trapped mammals. We chose a four-day session for ease of scheduling it into a normal week of work (i.e. one day for setup, followed by four days of checking traps). We baited traps inside and out with a small amount of birdseed and placed polyester batting inside traps to provide insulation and nesting material. We opened traps before sunset and checked them shortly after sunrise; due to often excessive heat, traps remained closed during the day.

On our data sheets (Appendix A), we recorded the time, temperature, and weather conditions for each grid. When processing the captured small mammals, we recorded all necessary measurements on our data sheets in order to identify each animal to species, and we took additional pictures if necessary. We also weighed and sexed each new animal, and made note of his or her reproductive status. To aid in us

distinguishing recaptured animals later in the trapping session, we fur-clipped each new animal we captured. Using scissors, we clipped a section of guard hair from either the right or left hind quarters of the animal. We alternated clipping fur from the left to the right side for each replicate session. This was to prevent confusion in the instance that we captured the same animal during two consecutive sessions. Whenever a previously captured individual was trapped (i.e. fur-clipped), we made note that it was a recapture and promptly released it after identifying it to species; no other measurements were taken. Animals showing any signs of serious distress such as dampened fur, a sign of heat exhaustion for example, were identified to species and we immediately released them without recording any further information. We also recorded any dead or injured animals, which were a direct result of our trapping efforts. When animals appeared to be sluggish due to cold temperatures, we warmed them for a few minutes prior to release. In addition to recording animal conditions, we made note of traps that were sprung but empty, so that these could later be subtracted from our total number of trap nights. Our personnel followed basic regional guidelines for disinfection of trapping materials and Hanta virus prevention (Appendix B).

Results

Approximately 400-500 cattle grazed at LCCWA from October 1st, 2004 through the first week of January 2005, and again during this same period from 2005-2006. We began trapping during the spring following both of these grazing periods and operated each of our six grids during approximately March, June, and September. We selected these months in an effort to avoid extreme temperatures or heavy rains. Occasionally we were forced to close traps for one to two nights during a trapping session due to inclement weather. We conducted our study for a total of 3,123 trap nights during 2005 (1,561 trap nights in grazed plots and 1,562 in ungrazed plots), and 3,203 trap nights during 2006 (1,067 trap nights in grazed plots and 2,136 in ungrazed plots). We calculated the number of trap nights by multiplying the number of working traps (e.g. traps that were found to be closed yet empty were omitted) by the number of nights per session. Out of our total number of new captures, recaptures, and any unidentified escapees, we found that 1.49% during 2005 and 1.25% during 2006 resulted in either dead or injured animals. We captured a total of six small mammal species at LCCWA

and calculated the catch per unit effort (CPUE) for each (Table 1). For this, we divided the number of individuals captured by the total number of trap nights. We used a fur-clipping method of marking, which only informs us that the animal was previously captured, unlike tagging or other unique forms of marking that allows one to determine the number of times each individual was captured. Because some animals (and species) may have a higher recapture rate than others, we omitted all recaptures and used only the number of new captures in an effort to standardize and avoid inflated CPUE values.

Table 1. Small mammal species detected and catch per unit effort (CPUE) for each on grazed and ungrazed grassland plots at Lower Cottonwood Creek Wildlife Area, 2005-2006.

Species	2005			2006		
	Total # of Individuals	CPUE Grazed	CPUE Ungrazed	Total # of Individuals	CPUE Grazed	CPUE Ungrazed
Botta's Pocket Gopher *Thomomys bottae*	-	-	-	1	-	0.000
California Pocket Mouse *Chaetodipus californicus*	85	0.033	0.022	99	0.052	0.021
California Vole *Microtus californicus*	2	-	0.001	3	-	0.001
Deer Mouse *Peromyscus maniculatus*	27	0.004	0.013	99	0.006	0.044
House Mouse[1] *Mus musculus*	2	-	0.001	925	0.288	0.289
Western Harvest Mouse *Reithrodontomys megalotis*	7	0.002	0.003	272	0.030	0.112

[1] = Non-native species.

The average rainfall during July through June of 2004-2005 and of 2005-2006 was approximately 46 cm and 35.7 cm respectively. During recent years in the past (2000-2004), rainfall averaged just 22.7 cm per year (California Department of Fish and Game unpublished data 1970-2006). During our second season, we experienced an overall increase in the small mammal population with a total of 202 captures (including recaptures) during 2005, and 1,840 total captures during 2006. House mice, which are considered an invasive species, increased in number during 2006 more drastically than any other species we captured. We trapped them equally on both grazed and ungrazed grids and often had multiple animals per trap during that year. However, the influx in

numbers for this species did not preclude us from capturing native species as well, and all species showed an increase in population size during 2006.

During both trapping seasons, we sexed all newly captured animals and recorded their reproductive status (Figures 2 and 3). We did not do this for a limited number of animals including the pocket gopher, escapees, or animals found dead within the traps. Non-reproductive animals represent a combination of both juveniles, as well as adults that were not in a reproductive state at the time of capture. During 2005 we captured over twice as many male deer mice as females, and during 2006 observed almost twice as many female California pocket mice as males. We incidentally captured a limited number of California voles during both years, which included only males. All other species during both trapping seasons were relatively equal in the number of males and females captured.

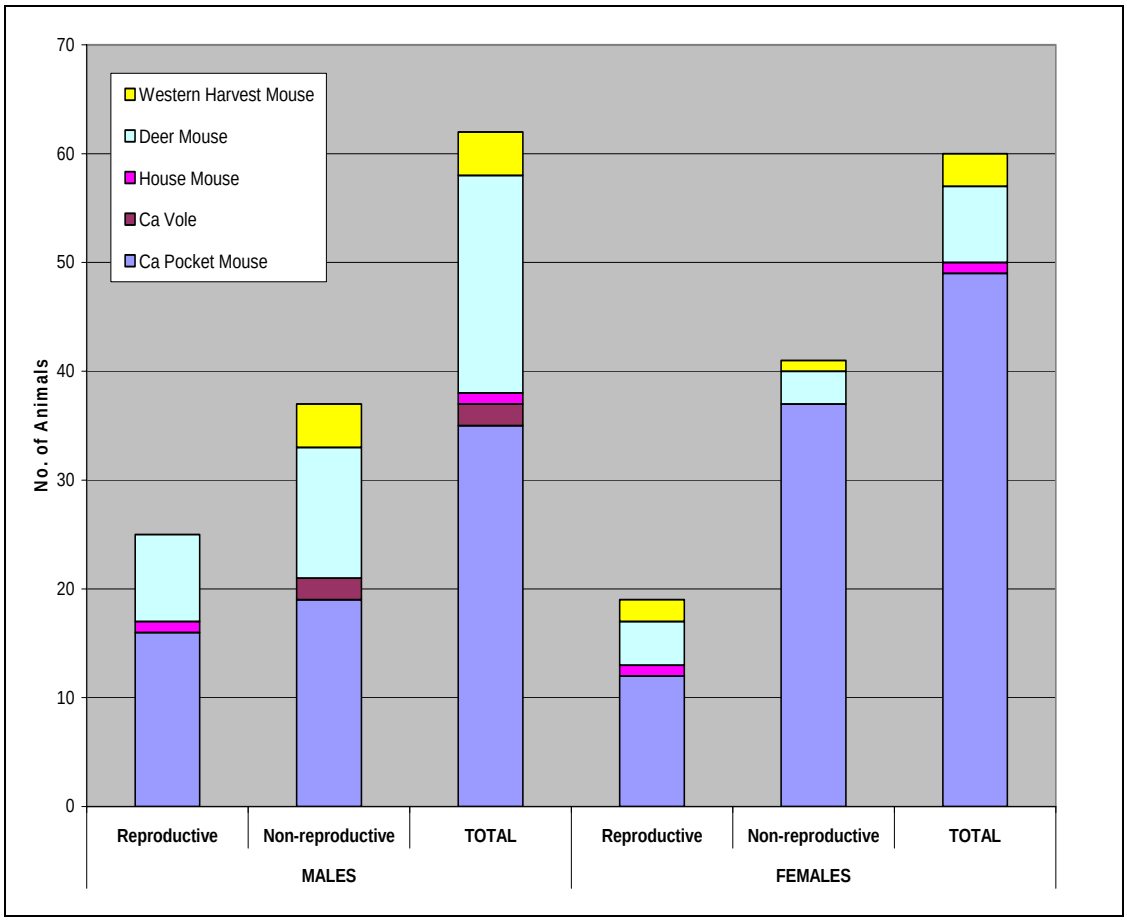

Figure 2. 2005 reproductive and sex ratios amongst small mammals captured at Lower Cottonwood Creek Wildlife Area.

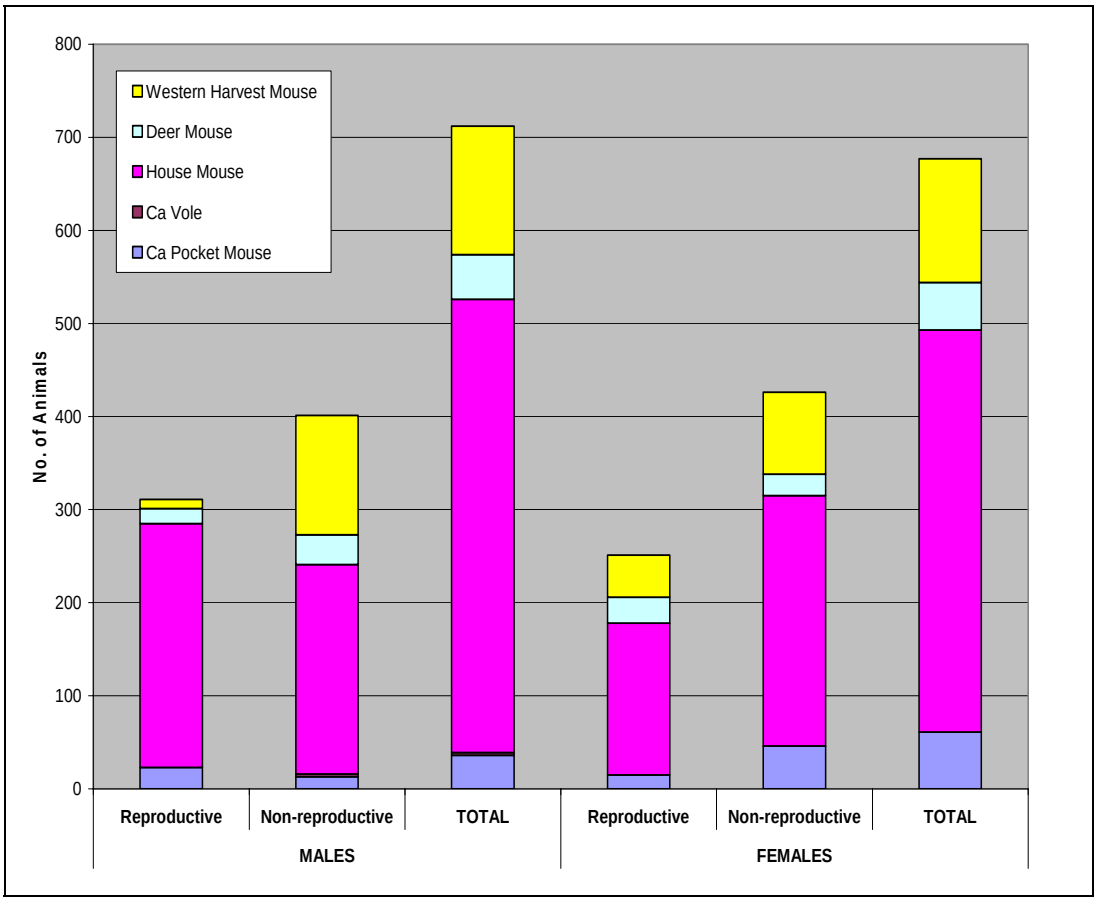

Figure 3. 2006 reproductive and sex ratios amongst small mammals captured at Lower Cottonwood Creek Wildlife Area.

Discussion

We recorded both native and non-native small mammal species in grazed plots as well as ungrazed plots during our two year study. During 2006, there was a much higher population of all species, which may be due to optimal habitat conditions resulting from above average rainfall in recent years, or simply due to the cyclical nature of small mammal populations. Though all species increased in population size during 2006, house mice demonstrated the most drastic change in numbers. This is likely because this species is known throughout its range for being highly adaptable and able to thrive in multiple habitat types. The 2006 data allowed us to look at results for the only non-native species we have present, the house mouse, as we only captured two individuals during the previous year. We found that house mice were equally abundant

in grazed and ungrazed grassland. The California pocket mouse was captured more frequently during both years on grazed plots. This animal has a larger body size and sturdier frame than some of the other small mammal species, and perhaps simply prefers less thickly vegetated areas for ease of movement. Deer mice are known as one of the most widespread and generalized of all North American rodents (Baker 1968), and in other studies have been shown to have no significant differences in population densities between grazed and ungrazed plots (Bock et al. 1984). However, we observed them in higher numbers on ungrazed plots during our study. Grid 4 did yield deer mice during 2005, even though it was not developed into an exclusion site until just prior to our 2006 trapping season. However, portions of this site contain coyote brush and though there were no live shrubs at our grid site, low remnants of older shrubs were present in a few locations. If deer mice tend to prefer areas that are ungrazed, then perhaps their continued presence at grid 4 is due to cattle spending more time grazing in open grassland versus an area with surrounding shrubs. We did not capture any deer mice during either year in grid 3, and in fact this grid produced the lowest number of animals during both years of our trapping. This grid site however, appeared to have a more hardpan substrate and a seemingly lower density of grass present. The amount of available food and a limited ability for mammals to dig burrows in this substrate may have precluded animals from frequenting this area. Though we did observe western harvest mice in both grazed and ungrazed grid locations, they also appear to exist in higher numbers in ungrazed sites, and during 2006 were found to be most numerous in grids 5 and 6. Those grids differ from our other sites in that they are not fenced-in exclusions, but in fact are separated from the rest of the wildlife area by a paved road that leads to a state parks campground (Figure 1). Therefore, grids 5 and 6 are located in an area that never has cattle directly adjacent to them and thus western harvest mice may prefer areas with less disturbance.

Though California voles and Botta's pocket gophers are wide spread in our range, we captured an extremely limited number, which is likely due to the type of trapping we conducted. Pocket gophers are more fossorial in nature and are not frequently captured in Sherman traps. During former Department surveys on LCCWA and nearby wildlife areas, we found that both of these species were more readily captured by way of pitfall trapping (Connolly et al. 2008). Since our trapping targeted

nocturnal species, voles were also not highly expected since they tend to be active during the day. However, we began checking traps near sunrise and it is possible that these individuals were simply captured during the late morning hours while still checking traps. Although we did have over 100% trap success on a few grids during our 2006 season (due to having multiple animals per trap and largely due to the high number of house mice that year), we never observed a grid that had every trap closed upon checking. Therefore, a small chance still existed for diurnal species and lower density nocturnal species to enter the traps.

Overall we feel that not only the presence of cattle exclusions, but the act of grazing itself allows for a greater diversity of both plants and animals at LCCWA. Often a negative connotation follows the idea that grazing is disturbance and is therefore negative to all existing fauna and flora, but some studies have actually shown little or no impact from livestock (Ballinger & Jones 1985; Heske & Campbell 1991, Joern 1982). Former studies have also found that grazing can actually benefit species such as passerines, which showed a higher density in grazed sites during summer months, but that providing exclusions can be important in the development of shrub and herbaceous habitats (Bock et al. 1984). We have monitored raptor populations here in the past and have found several species that use this property for foraging (Sousa 2008), thus managing this wildlife area in a way that supports diverse small mammal populations benefit raptors as well. In addition, LCCWA is used by the public for both bird and mammal hunting, including deer. Department personnel monitoring deer herds here in the past have found that they continue to use the property even while cattle are present and that deer are able to utilize exclusion sites, which provide more cover (Bernal and Sparks 2008). In a larger sense, grazing as a whole can help protect all habitats of the wildlife area by reducing fire hazards in a geographic location where extreme heat during the summer months frequently results in grassland fires.

Recommendations:

Department personnel are further developing water sources as well as performing restoration to the limited riparian habitat at LCCWA. The recent construction of the latest exclusion site will hopefully promote the growth of coyote brush, which is limited on this property. Though this shrub species is known to sometimes spread

across grassland habitat and cattle have been shown to effectively control this encroachment, primarily by way of trampling (McBride and Heady 1968), the LCCWA site is virtually the last remaining concentration of these shrubs and the enclosed area makes up only a fraction of the total acreage of the wildlife area. We recommend further monitoring of both fauna and flora at this property in order to provide more insight for future management practices, and in an effort to sustain the needs of public users, local cattleman, and the wildlife inhabitants. A more intense and long-term study could provide the ability for statistical analysis and perhaps a better understanding of the direct relationship between small mammals and grazed versus ungrazed habitat. However, due to frequent state budgetary constraints, a long-term monitoring project may not be possible or could require alternate funding. To better understand the entire rodent population, surveying with both pitfall and Sherman traps has been conducted by some (Taylor 1999), and may be necessary to avoid targeting only nocturnal species. When comparing our results with that of former inventory work done on LCCWA during 2004, which also used Sherman traps, we did detect the same species and are unable to show if any are increasing or declining in population size due to grazing efforts. However, we recommend that cattle exclusions continue to be utilized when grazing takes place and efforts to further develop more habitat diversity at this wildlife area continue. Some of the limited riparian habitat at this wildlife area is being protected from cattle and should continue to be protected from grazing. We also suggest the inception of photo points at various sites to allow us to compare vegetation and habitat changes during years to come, especially since current habitat restoration is underway.

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APPENDIX A

Small Mammal Trapping Datasheet

Page _____ of _____

Date _____ Site / Property _____ Grid size_____
Observers _____ Check Time: AM / 2300 / 0300 (circle one) Rained since last trap check? (y/n) _____
Start Time _____ End Time _____ Wind _____
Start Temp _____ End Temp _____ Cloud Cover _____

						Weight (g)												
Time	**Grid/ Transect #**	**Trap #**	**Fate**	**Animal Cond.**	**Species**	bag w/ animal	bag w/out animal	**Animal Weight**	**Sex**	**Reprod status**	**Hind Foot (mm)**	**Tail (mm)**	**Body (mm)**	**Ear (mm)**	**Handler**	**Recorder**	**Comments**

Additional Notes:

Wind (Beaufort Scale): 0=smoke rises vertically; 1=rising smoke drifts; 2=tree leaves rustle/can feel wind on your face; 3 = leaves and twigs move / lightweight flag extends; 4=thin branches move/raises dust and paper; 5=small trees in leaf sway; 6=large tree branches move/whistling in wires

Cloud cover: 1 = 0 - 5%; 2=5 - 25%; 3=25 - 50%; 4=50 - 75%; 5=75 - 100% **Reproductive Status codes**: SCR (scrotal); +/- SCR (pre/post scrotal); LAC (lactating); +/- LAC (pre/post lactation); PRE (pregnant); NON

Fate: 1 = New capture; 2 = Recapture; 3 = Escape; 4 = Trap failure

Animal Condition: 1 = Normal; 2 = Injured (describe in comments); 3 = Sluggish/Slow; 4 = Dead

APPENDIX B

CLEANING TRAPS, BATTING, AND HANDLING BAGS:

The traps, batting and handling bags must be disinfected before being used at another study area.

Make sure all the seed and batting material is out of the traps and soak them in a 10% bleach solution for 5-10 minutes. Rinse the traps with water and allow them to air dry.

If the batting is going to be reused, it needs to be disinfected as well. The batting can be washed in the lingerie bags in a laundry machine with bleach and dried in a dryer. It can also be soaked in a 10% bleach solution, rinsed and allowed to air dry.

The handling bags should be washed or soaked in a bleach solution, rinsed and allowed to dry. The bags can also be washed in a laundry machine with bleach.

HANTAVIRUS PROTECTION:

Hantavirus is a respiratory virus carried by deer mice, and passed on via their dry feces. There are precautions we can take to reduce your exposure to the virus:

- Don't touch your face during trap checks or when baiting traps
- Use antibacterial gel on your hands after handling a deer mouse, after handling a trap that has housed a deer mouse, and after the end of a trap-checking session (can't be too safe…).

The symptoms of Hantavirus are typically described as "flu-like", including fever, headaches, and respiratory irregularities. Symptoms develop within a couple weeks after exposure. If you start to experience these symptoms, do not delay in seeing a doctor, and tell them that you have been exposed to wild deer mice.