Raptor Surveys Conducted at Lower Cottonwood Creek Wildlife Area, 2007–2009

American kestrel. Photo by Tommy J. Grove.

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Abstract

Lower Cottonwood Creek Wildlife Area is a lower foothill property that is grazed annually to aid in fire prevention and to help control non-native grasses. The California Department of Fish and Wildlife built four cattle exclusions on this property to provide refuge for wildlife and to protect the small amount of riparian and shrubland habitat. Our objectives were to compare our raptor monitoring data with previous studies, monitor cattle grazing effects on raptor use, and to see if raptors prefer grazed or ungrazed habitat. When compared to former surveys, we detected more raptor species, which was likely due to improved survey techniques and the extended length of our study. Conversely, we found a lower abundance of raptors during our study, which may have been related to lower rainfall and prey abundance. When all raptor observations were analyzed, we found that birds utilized both grazed (1.1/100 ha) and ungrazed (1.2/100 ha) habitat almost equally. However, when we examined habitat use by species we found that certain raptors preferred grazed, such as American kestrel (*Falco sparverius*), while other species, like the great horned owl (*Bubo virginianus*), favored ungrazed habitat. We concluded that cattle grazing at Lower Cottonwood Creek Wildlife Area is providing habitat diversity that supports multiple raptor species and other wildlife. We recommend the continued use of the current cattle grazing regime combined with the provision of cattle exclusions.

Keywords: raptors, grazing, cattle exclusion, owls, Merced County, spotlighting

Introduction

The California Department of Fish and Wildlife (CDFW) owns and manages Lower Cottonwood Creek Wildlife Area (LCCWA), which is one of several properties that make up the Los Banos Wildlife Area Complex. This property is located in the foothills on the east side of the Coast Range in Central California and is dominated by California annual grassland. Wildfires are common to this area and in 2002 CDFW began utilizing annual cattle grazing contracts to reduce the amount of dry vegetation that provide fuel for fires. The grazing regime is typically implemented from October to January and is also intended to help control invasive species and to promote native grasses. In addition to fire suppression, cattle grazing increases habitat diversity by creating structural variety in vegetation, which may be beneficial to raptors (as well as other species). Balgooyen (1976) found that American kestrels (*Falco sparverius*) prefer to forage in sparse and open habitat, and Clayton and Schmutz (1999) observed that burrowing owls (*Speotyto cunicularia*) also favor this habitat for nesting and roosting. Areas that are ungrazed contain taller and thicker vegetation, creating habitat

that northern harriers (*Circus cyaneus*) prefer for nesting (Kantrud and Higgins 1992) and foraging (MacWhirter and Bildstein 1996). The CDFW was unclear how local wildlife would respond to the cattle grazing regime on LCCWA, so they built four cattle exclusions in order to help provide refuge for wildlife and to protect the limited riparian and shrubland habitat. In addition to the grazed California annual grassland, the exclusions increased habitat diversity by providing ungrazed grassland, riparian, and shrubland habitat. The CDFW wished to study the response of wildlife to cattle grazing and observe whether or not various species utilized the exclusions when livestock were both present and absent.

In 2005 the CDFW initiated two studies at LCCWA, including small mammal trapping and deer monitoring. The trapping study was conducted to examine the effects that cattle grazing may have had on rodent populations and their species distribution between grazed and ungrazed habitat. The deer study was initiated to monitor Columbian black-tailed deer (*Odocoileus hemionus columbianus)* response to cattle presence, and to see if they used the cattle exclusions. While conducting deer surveys, CDFW incidentally observed two nocturnal raptor species, the burrowing owl and short-eared owl (*Asio flammeus*), that had not been previously detected on the property and began recording all observed raptors in conjunction with these surveys. The CDFW began monitoring raptors in 2006, but due to a lack of funding, deer and raptor surveys ceased in December. The initial objectives in 2006 were to determine what species were present and to compare that with baseline inventory conducted in 2001, prior to the initiation of the cattle grazing contracts. Then in October 2007, we resumed deer and raptor surveys and altered the raptor protocol to not only record species presence, but also raptor age, sex, behavior, and habitat use. With this additional data, we hoped to better understand how cattle grazing may be influencing raptor use on LCCWA, and whether raptors showed a preference between grazed or ungrazed habitat.

Study Area

LCCWA (869 ha) is located in Merced County approximately 24 km west of the city of Los Banos along Highway 152 (Figure 1). The CDFW provides public access to this property and it is used primarily for hunting of Columbian black-tailed deer, wild pig

(*Sus scrofa*), and mourning dove (*Zenaida macroura*). LCCWA is bordered by a privately owned ranch to the north and west and the San Luis Reservoir State Recreation Area to the south and east, which is managed by the California Department of Parks and Recreation (Parks). The California Department of Transportation (CalTrans) also owns a narrow strip of land between Highway 152 and the western edge of LCCWA. The wildlife area is in close proximity to two large bodies of water, including the San Luis Reservoir to the south and the O'Neill Forebay to the east. Elevation on LCCWA ranges from 90-390 m and vegetation consists primarily of California annual grassland, shrublands, and a small section of mixed willow riparian. The beginning of our survey route was located on Parks land, which contains a larger amount of riparian habitat than LCCWA. All land located south of Highway 152 was considered outside of the study area. LCCWA contains 763 ha of grazed habitat, while 106 ha (within the cattle exclusions) remain ungrazed. The properties surrounding LCCWA also contain both grazed and ungrazed habitat. The climate in this area includes hot, dry summers, and short, cool winters with an average rainfall of 24 cm per year (California Department of Water Resources 2012).

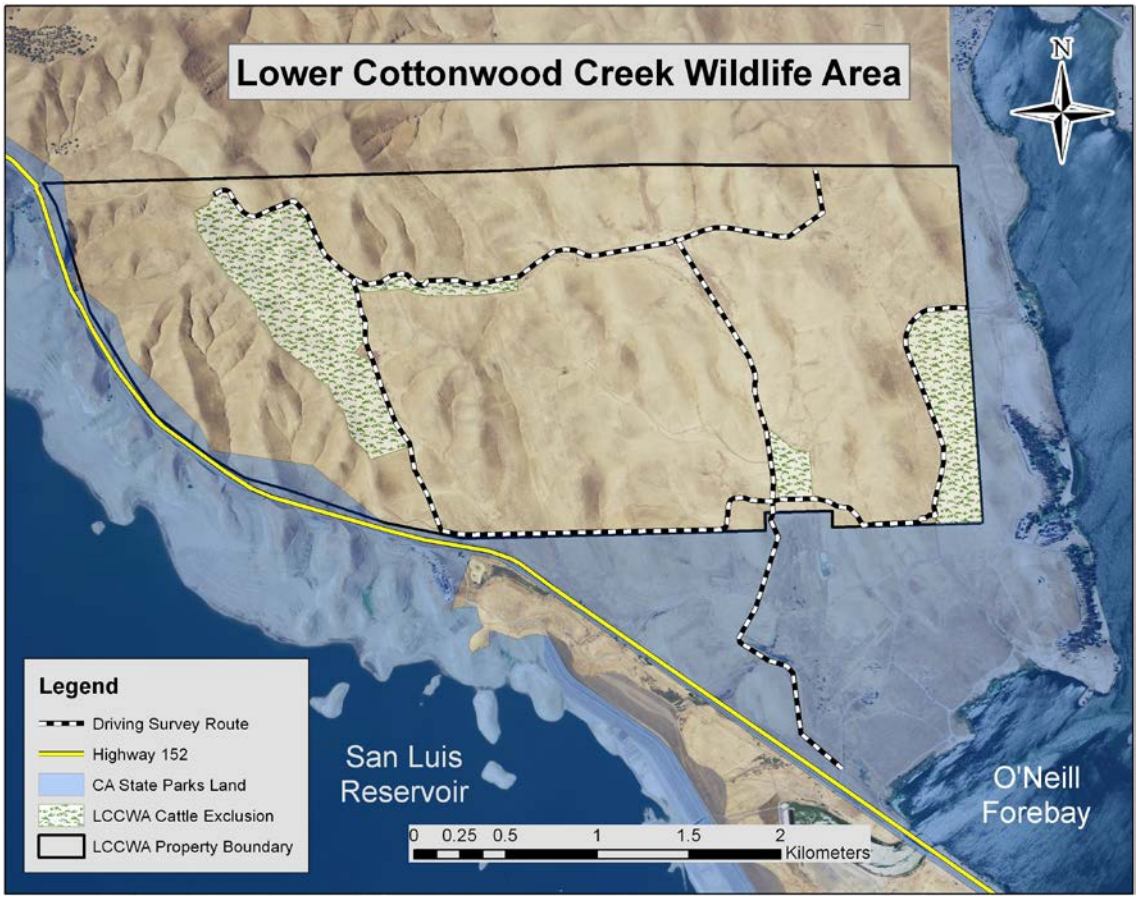

Figure 1. Lower Cottonwood Creek Wildlife Area, Merced County, California.

Methods

We collected raptor data while also performing deer surveys along an established route of 15.6 kilometers (Figure 1). We conducted four driving surveys per month, which consisted of two morning and two night surveys, with a minimum of one full day between surveys. However, we canceled some dates because of poor visibility or road conditions when it was densely foggy, wet, or windy. We began morning surveys 30 minutes prior to sunrise, and if overcast weather made visibility difficult, we waited until we could see without using vehicle headlights. Night surveys commenced one hour after sunset and observers used vehicle high-beam headlights and one-million candle power hand-held spotlights to scan the visible area along the route for animal eyeshine. We conducted every survey with a minimum of two people, and drove between 16-24 kilometers per hour while each person scanned their side of the route. When we sighted a raptor (at any distance as long as it was within the study area), we

stopped the vehicle and both observers used binoculars to identify it. We also took special care not to count the same birds twice since raptors did not always remain in the same area and because some sections of the route required us to double back from a dead end.

At the start and end of each survey we wrote down the time, temperature, weather, and wind speed (according to the Beaufort scale). We documented all raptors that we were able to identify and recorded their species, age class, and sex. The land ownership (CDFW, Parks, CalTrans, or private property) where the individual was detected was also documented, as well as if that location was grazed or ungrazed. Furthermore, we recorded raptor behavior as: soaring, foraging, displaying, interacting with another bird, flying, a high flyover, food handling, nesting, audio observations, perched, or other. When raptors were perched, we documented the structure they were sitting on such as a telephone pole, fence line, tree, etc. Whenever we observed raptors that were perched on fence lines dividing grazed and ungrazed habitat, we recorded the habitat type as the one in which the bird was facing. Later, we omitted the fence line data from our habitat analysis because it was not a sound method for determining habitat use.

All of our data was entered into a Microsoft Access database and we used Microsoft Excel for analysis. Since the amount of habitat that we were able to see during morning and night surveys was different, we used the calculations from Sparks (2013) to determine what our visible search area was during those times. We also used those calculations to determine raptor densities between grazed and ungrazed habitat.

Results

We conducted raptor surveys monthly on LCCWA from October 2007 to December 2009. We performed a total of 69 driving surveys consisting of 36 in the morning and 33 at night. We recorded 15 species and a total of 669 raptor observations (Table 1), with 536 seen during the morning and 133 at night. The raptors we observed included 11 diurnal and four nocturnal species; however, the relative abundance of these species was not evenly distributed, with 59% of all raptors consisting of red-tailed hawks (*Buteo jamaicensis*) and American kestrels.

Table 1. The number of raptor observations on grazed and ungrazed areas from 2007-2009 at Lower Cottonwood Creek Wildlife Area, Merced County, California.

Species	*Number Observed*	*Grazed*	*Ungrazed*
Red-tailed Hawk Buteo jamaicensis	245	116	115
American Kestrel *Falco sparverius*	153	90	45
Barn Owl *Tyto alba*	65	25	33
Northern Harrier *Circus cyaneus*	57	49	5
Burrowing Owl *Speotyto cunicularia*	38	34	3
Great Horned Owl *Bubo virginianus*	35		34
Golden Eagle Aquila chrysaetos	28	23	4
Turkey Vulture *Cathartes aura*	20	18	2
Prairie Falcon *Falco mexicanus*	8	4	4
Short-eared Owl *Asio flammeus*	7	5	1
Bald Eagle *Haliaeetus leucocephalus*	4	3	1
Sharp-shinned Hawk *Accipiter striatus*	4	1	3
White-tailed Kite *Elanus leucurus*	3	2	1
Cooper's Hawk *Accipiter cooperii*	1		1
Merlin *Falco columbarius*	1		
Total	669	370	252

Note: Raptors observed perched on fence lines between habitat types were not included in the grazed and ungrazed totals.

Raptor use of grazed and ungrazed habitat varied between species. The area surveyed along our route included 583 ha ungrazed and 1007 ha grazed habitat. We found that 59% of our raptor observations were in grazed habitat and 41% were in ungrazed. Golden eagles, turkey vultures, northern harriers, and burrowing owls showed a strong preference for grazed areas, whereas great horned owls were frequently seen on ungrazed habitat. Red-tailed hawks and barn owls were commonly found on both grazed and ungrazed habitat. Although we surveyed more grazed habitat

than ungrazed, the density of raptors in grazed (1.1/100 ha) and ungrazed (1.2/100 ha) areas were very similar.

We classified 11 types of behavior during the three years of observations. The most commonly documented behavior was perched (52%), which was chiefly made up of red-tailed hawks and American kestrels. Raptor perches included fence posts, fence lines, telephone poles, high tension towers, and trees. Due to the number of surveyors used throughout this study and inconsistent survey techniques, the type of perch was not recorded for 29% of our observations. The second most common behavior was flying (26%) and those seen most frequently flying were American kestrels, red-tailed hawks, barn owls, and northern harriers. Conversely, we seldom documented raptors foraging or handling food, which comprised 8% of our total observations and were primarily American kestrels and northern harriers. The least common behavior types were audio, interaction with another bird, high flyovers, soaring, and nesting.

We found that certain raptor species showed consistent, seasonal use patterns at LCCWA while others did not. For example, many species declined in number during the spring and early summer months, but peaked in the fall and early winter months (Figure 2 and Figure 3). Although barn owl numbers were fairly low during our study, they appear to peak during the fall months (Figure 3).

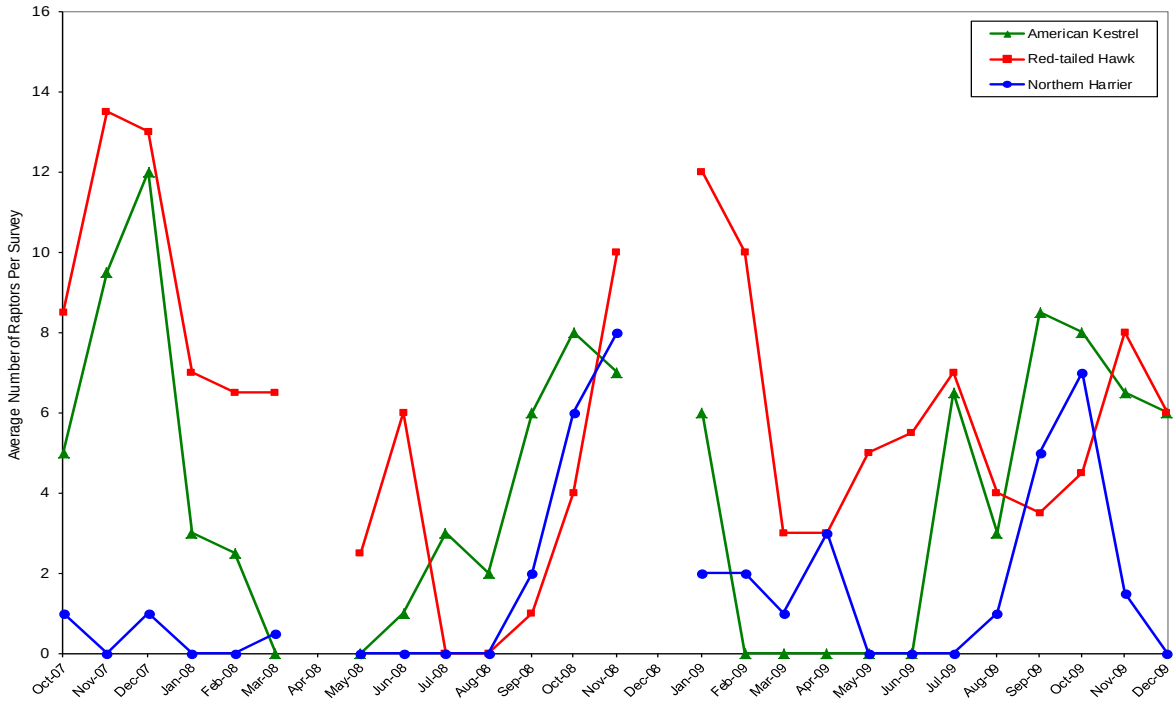

Figure 2. Average number of raptors for the three most common species observed during morning surveys at Lower Cottonwood Creek Wildlife Area, Merced County, California, 2007-2009. Surveys were not conducted in April or December 2008.

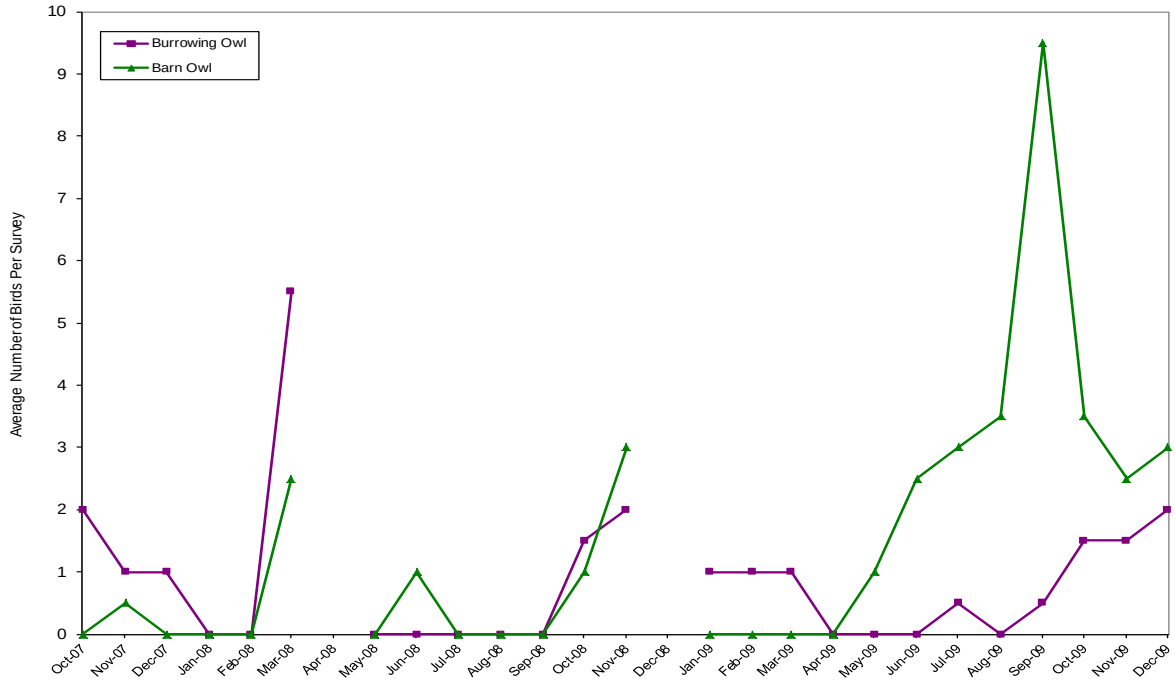

Figure 3. Average number of raptors for the two most common species observed during night surveys at Lower Cottonwood Creek Wildlife Area, Merced County, California, 2007-2009. Surveys were not conducted in April or December 2008.

Discussion

We detected more raptor species than past studies conducted on LCCWA, which is likely due to improved methodology and longer duration. In 2001, CDFW conducted monthly walking-transect surveys to inventory wildlife present on the property and detected nine raptor species (California Department of Fish and Game 2001). In 2006, CDFW began surveying for raptors in conjunction with deer surveys and identified a total of 12 raptor species (Sousa 2008a). Then from 2007 to 2009 we detected 15 species of raptors, but the previous studies differed from ours in methodology and duration, which may have resulted in our higher number of species. For instance, the 2001 transect surveys were walked and were only within CDFW property. During our study, we drove the survey route and assessed a larger amount of habitat including LCCWA, Parks, CalTrans, and private property. Also, the 2001 transect surveys were only conducted during the morning hours, which decreased the probability of detecting nocturnal raptor species. Furthermore, the 2001 inventory study and the 2006 raptor surveys were performed for one year, whereas our study was conducted over a three year period, allowing us more time to detect raptors that perhaps do not frequent LCCWA on an annual basis. By driving the survey route and expanding the duration of the study we were able to detect more species and have a better understanding of which raptors utilize LCCWA.

Although we found an increase in raptor diversity, we saw lower abundances from 2007 to 2009. During 2006, the average number of raptors per survey at LCCWA was 22.2 birds (Sousa 2008a), whereas the averages from 2007 to 2009 were 14.1, 8.2, and 9.8 birds per survey respectively. This decrease in raptors could be indirectly related to changes in annual rainfall, which in turn can effect small mammal abundance (the primary food source for most raptor species). For example, there was average rainfall in the 2003-2004 water year (21 cm), but the 2004-2005 and 2005-2006 water years were above average with 36 cm and 29 cm respectfully (California Department of Water Resources 2012). Conversely, rainfall amounts during our study were primarily low with 12 cm in 2007, 19 cm in 2008, and average rainfall in 2009 with 24 cm. Several studies have found small mammal populations to be positively correlated to

rainfall (Windberg 1998, Thibault et al. 2010). For example, Windberg found that in a semiarid region of Texas, the herbivorous hispid cotton rat (*Sigmodon hispidus*) population increased dramatically in one season following high rainfall. In Arizona, Thibault et al. observed granivorous and folivorous rodent numbers increased one season following high rainfall, whereas insectivorous rodents had a two season delay. Both of these studies incidentally witnessed raptor numbers increase following these peaks in small mammal populations. Similarly, the small mammal trapping conducted at LCCWA demonstrated a dramatic increase in rodent captures from 2005 to 2006 (Sousa 2008b), which was one year after above-average rainfall. This rise in the number of prey species may explain the greater abundance of raptors recorded in 2006. Although we did not conduct small mammal trapping during our study period, the low rainfall that occurred from 2007 to 2009 could have caused declines in the rodent populations at LCCWA. With a decrease in prey, raptors may have moved to a different location for better foraging, resulting in lower abundances recorded during our surveys compared to that found during 2006.

Our data showed seasonal patterns in bird use each year. Red-tailed hawks, northern harriers, and burrowing owls increased during the fall and early winter each year, and decreased during the late winter to early spring (Figure 2 and Figure 3). These fluctuations are likely due to juvenile birds leaving their natal territories in the fall and arriving at LCCWA to spend the winter. Raptors may then be departing LCCWA in the late winter or early spring to seek out suitable breeding habitat elsewhere. For instance, we found that American kestrels were present during most of the year but were absent each spring (Figure 2). These birds seek out breeding habitat where they nest in tree cavities during the spring (Johnsgard 1990, Balgooyen 1976), so they may be absent at LCCWA during that time because it has a limited amount of riparian habitat. Then in the early summer, adults may be returning to LCCWA from their breeding territories to find additional foraging habitat, while juveniles also gradually arrive from their natal territories. The fluctuations that we found in this study are likely due to seasonal movements of raptors that are specific to the biology of each species.

Body size of certain raptor species may be influencing these birds and their use of grazed and ungrazed habitat on LCCWA. We found American kestrels and

burrowing owls predominantly within grazed habitat, which corresponds to other studies that have shown that American kestrels (Balgooyen 1976) and burrowing owls (MacCracken et al. 1985, Dechant et al. 1999) prefer short and sparse vegetation for foraging. The small size of both of these species might make them more inclined to utilize grazed habitat where vegetation is shorter and prey is easier to catch. Conversely, we commonly found red-tailed hawks in both grazed and ungrazed habitat. These raptors are not limited by their body size and are versatile enough to exploit a large variety of prey that reside in multiple habitat types (Beebe 1974). Unfortunately, we did not measure vegetation and as a result we cannot conclude how it differed between habitats or if vegetation was a limiting factor.

Raptor habitat use may have been influenced by requirements specific to each species. For example, we found great horned owls exclusively on ungrazed habitat and nearly all of those observations were in trees or near riparian areas. This is likely because great horned owls hunt from a perch, as well as nest and roost in trees, and all of the riparian habitat along our survey route is located in ungrazed areas. Conversely, we found northern harriers utilized grazed habitat more frequently, which contradicts some studies that have found these birds prefer dense or ungrazed vegetation (Preston 1990, MacWhirter and Bildstein 1996). Our results may have differed from these studies because northern harriers have also been documented to prefer open terrain such as prairies, marshes, and uplands (MacWhirter and Bildstein 1996). Most of the flat, open area in our study is grazed habitat, while the ungrazed habitat is located on a hillside or contains trees or brush. Another reason we may have observed more northern harriers in grazed habitat is because the majority of our sightings were of adult males (30 out of 57), which may prefer to forage in shorter vegetation. For example, Preston (1990) found that adult male northern harriers spent 14-18% less time foraging in thick vegetation (wetlands) and were found more often in short and sparse vegetation (corn stubble) when compared to juveniles and adult females.

Raptor use of grazed and ungrazed habitats may also be influenced by the abundance of rodents in these habitat types. Although we observed more raptors in grazed areas, raptor density was slightly higher in ungrazed habitat, though not significantly. Johnson and Horn (2008) had similar observations and found that raptors

were utilizing ungrazed habitat in slightly higher numbers. In their study of grazing effects on rodents and raptors in a mesic grassland habitat, they concluded that the increase in raptor use of ungrazed habitat may have been influenced by a higher population of rodents in that location. Another study, conducted in a semidesert grassland, also had a higher capture rate of rodents in ungrazed habitat but raptor presence was rare during their project (Bock et al. 1984). The small mammal trapping conducted on LCCWA in 2005 and 2006 had a higher capture rate in grids located within the ungrazed areas, but certain species of rodents appeared to prefer one type of habitat over the other (Sousa 2008b). Sousa found house mice (*Mus musculus*) to be common in both grazed and ungrazed areas, while other species such as deer mice (*Peromyscus maniculatus*) and western harvest mice (*Reithrodontomys megalotis*), were more prevalent in ungrazed habitat. Although we did not sample the small mammal populations during our study, the ungrazed habitat within LCCWA likely continued to support an abundant prey base for raptors, possibly resulting in the higher density of hawks we found in this habitat type.

Although this study provided some insights into raptor use at LCCWA, there were issues with the methodology that prevented us from making some definitive conclusions when analyzing our data. For example, our data was collected in conjunction with deer surveys, and thus we were only able to record what the raptor appeared to be doing when we first observed it, but then we had to move on. Raptors should be observed for a longer period of time to truly assess their behavior. In addition, there were nine different surveyors with varying skill levels, creating bias during data collection. For example, a less skilled surveyor could mistake the behavior of certain raptor species that hunt from the wing and record it as flying rather than foraging. Furthermore, the multiple surveyors over the course of our project led to observer error as some staff failed to record the items that raptors were perched on. Since we were unable to differentiate between fence line data or those perched in trees, it prevented us from using this data in our habitat use analysis. Additionally, we did not conduct any concurrent vegetation or small mammal surveys, which would have given us information on the vegetation height, density and species composition, as well as rodent species and population distribution within grazed and ungrazed habitats. As a result, we were

only able to extrapolate information from past studies for comparison with our raptor use data.

If the CDFW wishes to further increase its understanding of raptor habitat use at LCCWA, more extensive monitoring techniques will be required. We recommend that raptor data should not be collected during other surveys but instead, should be its own independent study. Surveys should be performed by trained staff with knowledge of raptor identification and behavior to help ensure accurate and consistent data collection. We also recommend a protocol change from driving routes to using counting stations for monitoring raptors. Johnson and Horn (2008) used counting stations in their study and were able to record precise observations on raptor foraging behavior. By following this method, we may be able to better correlate raptor behavior with the use of different habitat types on LCCWA. However, conducting night surveys from counting stations would be impractical without specialized equipment. Separate vegetation and small mammal studies should also be conducted at the same time as raptor surveys. This would allow a better understanding of how vegetation height and density effect rodent and raptor use on LCCWA, and may provide better insight as to the influence of precipitation in relation to these factors. Furthermore, we propose that these studies be conducted for more than three years, since we were not able to establish any trends from our study. Finally, we advise that the funding for this project come from a secure source to help reduce staff turnover and prevent gaps in the study period, as was the case from 2006 to 2007. Although we did not find any significant differences in raptor use of grazed and ungrazed habitat, we recommend continuing the current grazing regime in conjunction with the cattle exclusions since this practice is providing habitat diversity that benefits an assorted group of raptors and other wildlife.

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