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Raptor Use of Artificial Perches in California Rangelands in Fall

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ABSTRACT: Most raptor species rely on perches for hunting, resting, preening and roosting and in many agricultural areas the availability of adequate perches can limit raptor abundance and diversity. This has negative implications for both raptor conservation and the natural pest control services they can provide for farmers. Installing artificial perches on agricultural lands can therefore benefit both raptors and farmers. However, installing perches under current guidelines is difficult on California's 38 million acres of rangelands, where rocky soil can be restrictive to anchoring poles belowground. We developed a novel method for modifying existing fenceposts to support raptor perches. These raptor perches are relatively light, easy to construct, can be transported in multiple pieces and assembled in the field. We installed 16 artificial raptor perches in four representative habitats on a California ranch to 1) determine if raptors will use artificial perches in each habitat; 2) test raptor preferences for different perch configurations; and 3) observe which raptor species utilize perches. Here, we share our perch design as well as our results from monitoring perches between August and November 2017. We found that American kestrels, great horned owls, barn owls, and red-tailed hawks utilized perches, as did a number of non-raptor species. Perch use by raptors was highest in an irrigated pasture and at a mid-elevation grassland site located on a hill. Perches at a low-elevation, unirrigated pasture with no slope and perches located in higher elevation oak woodland sites were used significantly less. In all habitats raptors preferred to utilize 15-foot perches over 20-foot perches. Raptors rarely utilized a lower perch when two were available on a single pole, suggesting that this added feature is not necessary to attract the species we observed.

KEY WORDS: falcon, hawk, owl, pest control, perch, rangeland, raptor

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INTRODUCTION

Raptors provide economically beneficial rodent control services for farmers, although these services have only been quantified in a handful of cases (e.g., Kay et al. 1994, Van Vuren et al. 1998, Kross et al. 2016). However, many raptor species have suffered population declines (Butchart et al. 2004), largely as a result of habitat loss to agricultural conversion (Schmutz 1987, Sanchez-Zapata et al. 2003, Swolgaard et al. 2008) and secondary poisoning from pesticides (Erickson and Urban 2004, Stansley et al. 2014). Although agricultural land, including rangeland, can have high abundances of raptor prey species (including species that farmers consider pests), in many areas raptor use of these fields for foraging is limited by a lack of suitable perch and nesting sites (Preston 1990, Widen 1994). By providing artificial perches for raptors, farmers can attract more birds of prey to their land (Hall et al. 1981, Kay et al. 1994, Kim et al. 2003, Lynn et al. 2006, Witmer et al. 2008, Omeg 2012) and may benefit from increased predation pressure raptors have on vertebrate pests such as rodents (Kay et al. 1994).

Current NRCS practice standards in California include Specification 649L- Structure for Wildlife, Raptor Perch Pole, which provides farmers with guidance on erecting an artificial raptor perch made from 20 feet of 1.5-in-diameter galvanized steel poles or 3-4-in diameter wood poles and anchored at a depth of 3-6-ft using concrete to support the pole (NRCS 2015). These perches have a wood perch cross bar with rounded edges which must reach a height of 15-20 feet above the ground, and an optional but recommended perch located 3 feet below the top perch for raptors that prefer a perch below some kind of cover (NRCS 2015). Farmers across the state use this practice standard as a guideline for installing artificial perches for raptors. However, the need to anchor poles 3-6 feet into the ground can be a limiting factor on land that is difficult to dig in, such as the rangeland in the Sierra Nevada foothills. In addition, anchoring raptor perches in deep holes with concrete is a significant amount of work when installing many perches across a ranch. As a result, following the current raptor perch guidelines could be restrictive for ranchers in these areas, so alternative innovative practices need to be developed. One opportunity for such innovation is in the modification of existing fence lines to attach perches to fenceposts that can support their weight, such as posts that have been anchored with methods such as welded H-braces or rock-jacks (piles of rocks contained within a wire cage that is placed around the bottom of the post), or metal T-posts which have been driven into the ground using a post-driver. California ranchers own or manage approximately 38 million acres of rangelands (Larson-Praplan 2014), so developing raptor perches that are more practical and easy to install across these lands has the potential to significantly benefit raptors in California. We present a modified artificial perch design for use on existing fenceposts in rangeland habitat, as well as preliminary data on our results from monitoring perches in fall.

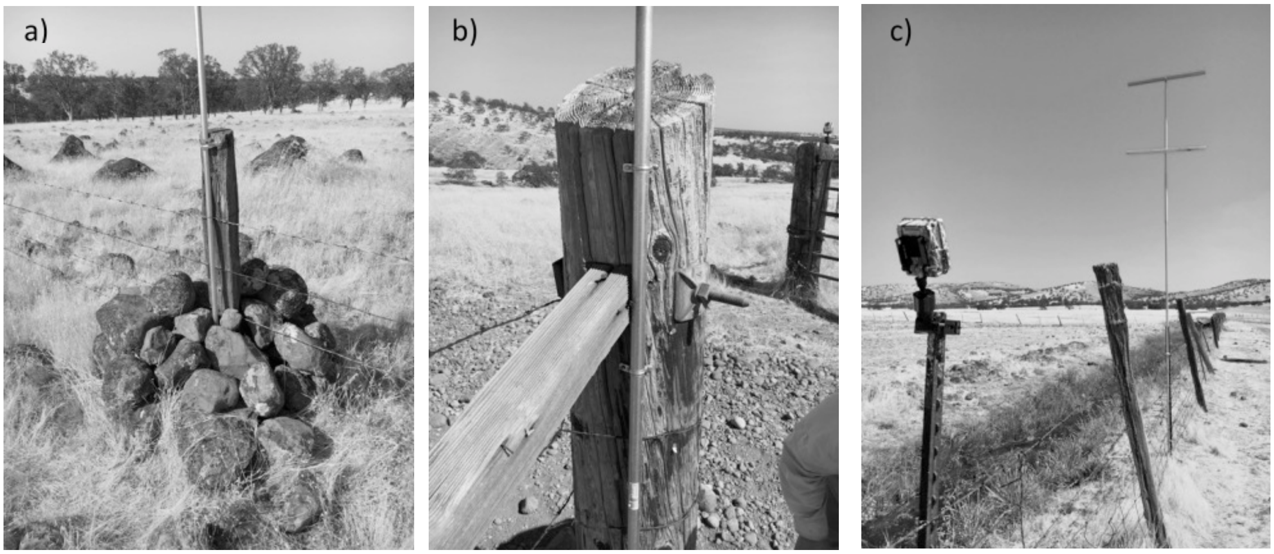

Figure 1. a) Attachment method at wooden fencepost with rock jack in the oak woodland habitat, b) attachment method at wooden corner-post in the upland grassland habitat, and c) trail camera in place to monitor a 15-foot, double-perch design in the dry pasture habitat.

METHODS

We installed artificial perches on Dye Creek Preserve near Los Molinos in Tehama County, CA. Dye Creek Preserve is managed by The Nature Conservancy and is a 37,540-acre property consisting mainly of grassland and oak woodland habitats that are representative of many rangeland habitats throughout the State. Dye Creek serves as both a preserve and as a working cattle ranch, so perches were trialed in realistic working conditions.

We adapted our artificial perch design as a modification of the NRCS standards in California (NRCS 2015). Land at our study site, in the foothills of Mount Lassen, is extremely rocky and difficult to drive posts into, which is common across many rangeland habitats in California. We therefore utilized existing fenceposts on the Dye Creek Preserve to anchor the artificial perches, and modified perch design to create lighter-weight perches that would put as little stress as possible on fences. Dye Creek Preserve, like many ranches in California, utilizes a number of different fencepost types depending on the soil type and use of each fence. These include metal T-posts which are driven into the ground, and wooden fenceposts supported by additional posts attached at 45-degree angles and/or supported by rock-jacks.

To understand raptor preferences for habitat and for different perch configurations, we erected four artificial perches in each of four representative habitats. Each site had two 15-ft perches, one with a single redwood crossbeam (hereafter referred to as 15×1) and the other with two redwood crossbeams (15×2). The remaining two perches were 20’ in height; one with a single redwood crossbeam (20×1) and the other with two redwood crossbeams (20×2). Each perch was built using two pieces of ¾-in galvanized steel pipe for the upright portions of perches, which were then joined using a 2-ft section of 1-in galvanized steel pipe as a sleeve to connect the two upright lengths of ¾-in pole. The lower section on all perches was 10’ long, and the upper portion was 5-ft long on the 15-ft perches and 10-ft long on the 20-ft perches. We drilled holes into the top and bottom of the sleeve, and into the underlying upright poles and connected them with bolts. The crossbeams upon which raptors actually perched were made from redwood blocks with rounded edges and were attached to the upright metal pole using a steel T-plate. Starting in a workshop, we cut all pieces of pipe, pre-drilled holes for attachment methods, and attached all of the redwood crossbeams to the upper sections of the perches. We then transported the perches using a Kawasaki Mule™ and assembled all pieces on site in the field.

We determined that a beside-the-post mount was easiest to install, put less stress on existing fenceposts, and had the most flexibility for use on a variety of fenceposts. Metal T-posts are common along the fence lines we are studying at the Dye Creek Preserve and are often the most stable fencepost available. We selected upright T-posts and used a hand-held post-driver to further ensure the post was secure in the ground. We detached the fence line from the T-post, and slid the raptor perch pole into place immediately against the T-post. We then used an adjustable pipe-clamp to attach the raptor perch pole to the upper section of the T-post, and used baling wire to re-attach the fence line to both the T-post and the raptor perch pole. Wooden Fenceposts are also common along the fence lines we are studying at the Dye Creek Preserve. If the wooden fencepost was secure in the ground, we attached the raptor perch pole using conduit clamps and baling wire. If a rock-jack (a pile of rocks around the base of a fencepost in areas where posts cannot be driven into the ground) was already in place, we moved rocks as needed to slide the raptor perch pole into place alongside the wooden fencepost, and then added more rocks as needed to ensure stability (Figure 1a). In some cases, where the wooden fencepost was not stable, we

Table 1. Total number of complete days of photo monitoring between August 14 and November 8, 2017 at each perch in each of four rangeland habitats.

Habitat	Perch Configuration (height ft × # crossbeams)				Total days
	15 × 1	15 × 2	20 × 1	20 × 2	
Oak Woodland	82	84	83	60	309
Upland Grassland	85	85	85	86	341
Dry Pasture	57	86	57	49	249
Irrigated Pasture	70	32	31	18	151
Total days	294	287	256	213	

attached a raptor perch using an additional metal T-post. In these locations, we drove in a T-post, attached the raptor perch pole to the T-post using a pipe-clamp, and attached both the T-post and raptor perch to the fence line using baling wire. Wooden corner-posts were only present at one of our study locations on the ranch. This very sturdy and large wooden post provided an easy and stable attachment location, and we used a series of conduit clamps to attach the raptor perch pole (Figure 1b). In normal circumstances, where ranchers only want to attach a handful of perches across a ranch, utilizing this method is very fast and secure.

The four habitats tested were upland oak woodland (elevation 350 m), upland grassland (elevation 155 m), low elevation dry pasture (elevation 100 m), and irrigated pasture (elevation 87 m). The oak woodland habitat contains scattered oak trees along with rocky soil and abundant larger boulders on the surface. The upland grassland habitat is located at the top of a steep hill near the ecotone with an oak woodland habitat. The low elevation dry pasture habitat is not irrigated but does have a small irrigation channel running along its fenceline. The irrigated pasture is irrigated 6-8 months per year and the fenceline upon which perches were installed is also parallel to a small irrigation channel. The order in which perches were erected along each fenceline was randomized, and perches within each habitat were erected near to one another (approximately 5-10 m apart) to avoid major differences in surrounding habitat or prey availability for each individual perch. In total, 16 artificial perches were installed.

We attached trail cameras (Strikeforce HD Pro; Browning Arms Company, Morgan UT) to an adjacent unmodified fencepost next to each of the 16 perches and angled upward at an approximately 45- to 60-degree angle (Figure 1c). Cameras were checked and data downloaded monthly from August 14 to November 8, 2017. Monitoring has continued beyond November 2017 but is not presented here. Cameras were programed to take photos every second of any movement in the area on, or near the perches, 24 hours per day. Cameras monitored perches for a total of 1,050 days (Table 1). Cameras in the irrigated pasture had the fewest monitoring days (151 total) because of interference from cattle. This site had cattle in it throughout the study period, whereas the other habitats did not.

We analyzed photos by viewing them individually on a standard laptop. For each photo containing any bird species in them we entered data including the time each photo was taken, the temperature, whether the bird perched or was simply caught flying, and how long each bird was caught on camera. We also noted any camera failures and the likely cause of a failure. Data was then standardized as number of perching events per day of working camera monitoring. We ran separate one-way ANOVAs with post-hoc Tukey honest significant difference tests to test for differences in combined perch use for all four perches across each of the four habitats, and to test for perch configuration preferences within each of the four habitats. We used R v.3.3.1 to perform all of our statistical tests (R Core Development Team 2017), results are presented ±1 standard error of the mean.

RESULTS

During this initial four-month monitoring period perches performed well under the environmental conditions. We would expect perches to last years, so ongoing monitoring will be required to understand the longevity of our modified perch design. This is especially important because the perches are attached to existing fencelines and if they fall over there is a chance that they can bring down part of a fence with them. In this initial monitoring period, we did notice that the baling wire used to attach perches to the existing T-posts started to rust, so a more robust galvanized steel wire will be recommended for future artificial perches attached to fenceposts.

We observed American kestrel (*Falco sparverius*), red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), barn owl (*Tyto alba*), European starling (*Sturnus vulgaris*), common raven (*Corvus corax*), western bluebird (*Sialia mexicana*), and belted kingfisher (*Ceryle alcyon*) using the perches. Only data from birds that were identified as raptors were included in this analysis (kestrel, hawk, and owls). Of a total of 770 perching events where a raptor could be positively identified to species; 550 (71%) were American kestrels, 190 were great horned owls (25%), 18 were barn owls, and 12 were red-tailed hawks. American kestrels were predominantly

Table 2. Number of perching events positively identified to raptor species at raptor perches in four rangeland habitats between August and November 2017.

Species	Habitat				Total	Percent of total perching events
	Irrigated Pasture	Dry Pasture	Upland Grassland	Oak Woodland		
American kestrel	264	16	268	2	550	71.43
Great horned owl	48	108	34	0	190	24.68
Barn owl	10	2	0	6	18	2.34
Red-tailed hawk	8	0	4	0	12	1.56

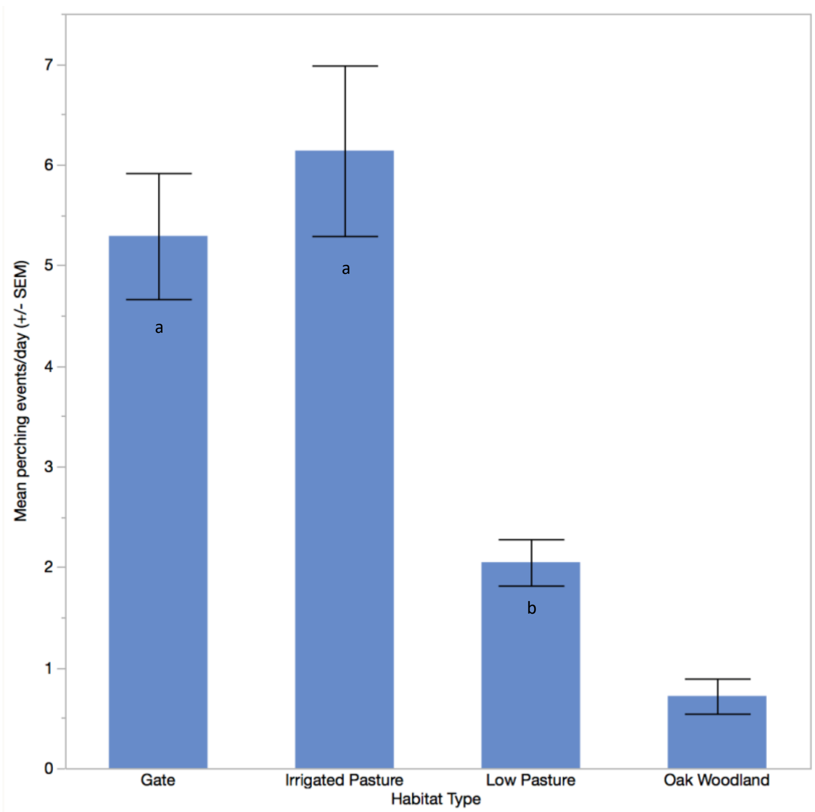

Figure 2. Mean number of perching events per day of monitoring across all four perch configurations in each of four rangeland habitats from August to November 2017. Means sharing the same letter do not differ significantly at the 95% confidence level based on the Tukey mean comparison method. (note "gate" is equivalent to "upland grassland" type)

observed using perches in the irrigated pasture and upland grassland habitats, whereas great horned owls were seen most often in the low elevation dry pasture habitat (Table 2). Barn owls and red-tailed hawks had too few observations to describe general habitat preferences.

Daily perch visits across all habitats, perch types, and throughout the monitoring period (August-November) ranged from 0 to a maximum of 17 perching events on a given day (24-hour period) on a single perch. The mean number of raptor visits to artificial perches differed significantly between habitats ($F = 24.42$, $p < 0.001$; Figure 2). The irrigated pasture (mean 6.14 ± 0.85) and upland grassland (mean 5.30 ± 0.63) habitats on average had more perching events per day than all other habitats (Figure 2) but did not differ significantly from one another ($p = 0.67$). The oak woodland (mean 0.72 ± 0.17) and low elevation dry pasture habitats (mean 2.05 ± 0.23) had significantly fewer perching events per day compared to the irrigated pasture and upland grassland sites (all comparisons $p < 0.001$) but did not differ significantly from one another ($p = 0.25$).

Perch preferences differed within each habitat. Generally, raptors appeared to prefer the 15-foot perches over the 20-foot perches (Figure 3). In the irrigated pasture, upland grassland and oak woodland habitats, the 15 × 1 perch had the highest visitation rates; whereas in the low elevation dry pasture habitat the 15 × 1 perch had the lowest visitation rates and the 15 × 2 perch had the highest vis-

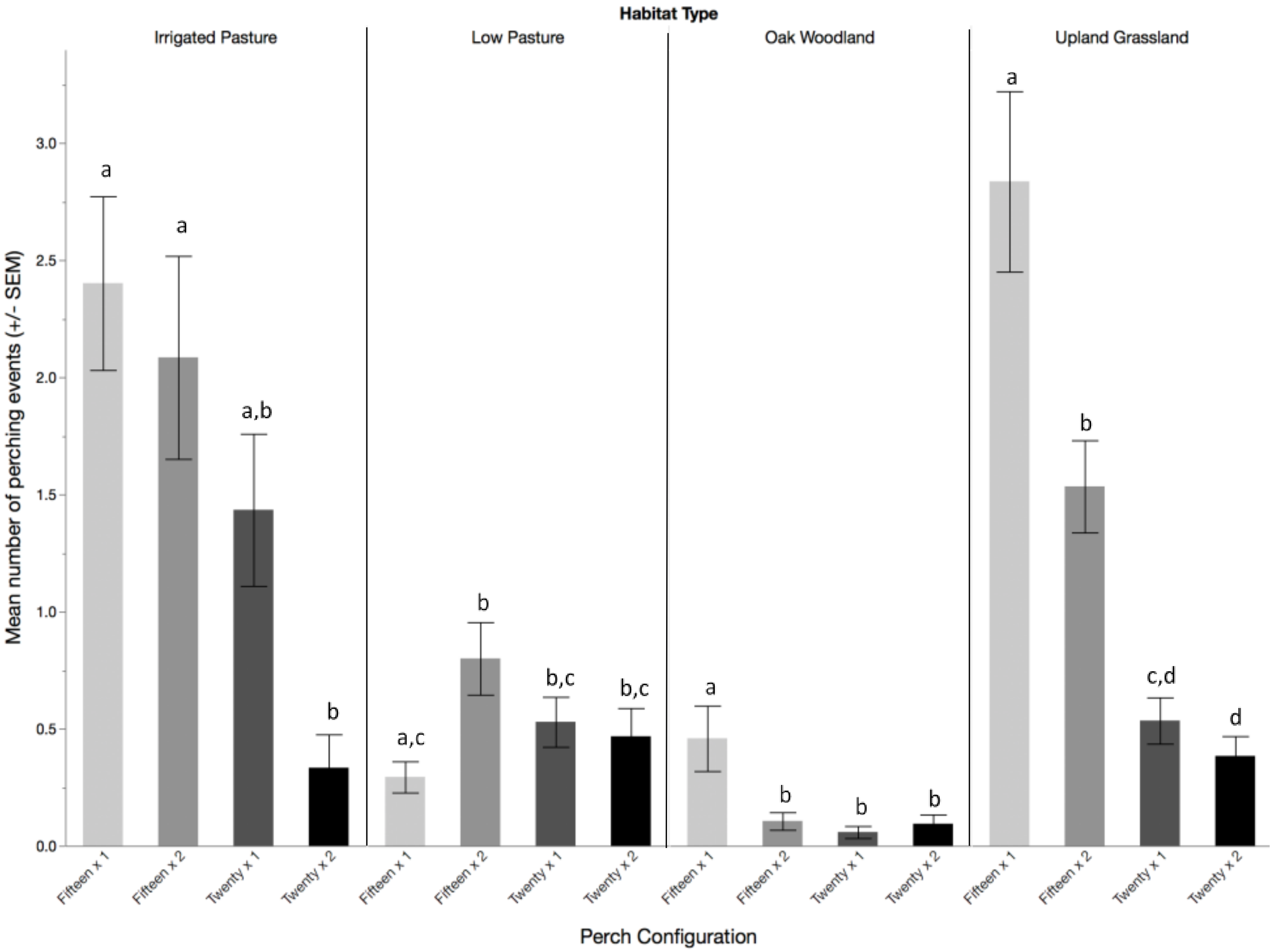

Figure 3. Mean number of perching events per day of observation at four different raptor perch configurations (perch height in feet × number of crossbars for perching on) within four different rangeland habitats. Comparisons are shown for mean perching events per perch configuration within each habitat type, means sharing the same letter do not differ significantly at the 95% confidence level based on the Tukey mean comparison method.

itation rates (Figure 3). The 20 × 1 and 20 × 2 perches had the lowest visitation rates in the irrigated pasture, oak woodland, and upland grassland habitats (Figure 3).

When two crossbeams were provided for raptors to perch upon, raptors almost always chose to use the upper perch. Across all habitats, for the 15 × 2 perches, birds used only the top perch in 96% of perching events, used only the bottom perch in 0.7% of the perching events, and used both perches (landed on one and then flew to the other) in 2.7% of perching events. Similarly, for the 20 × 2 perch type, birds used only the top perch in 77% of perching events, used only the bottom perch in 19% of perching events, and used both perches in 2.9% of perching events.

DISCUSSION

We found that artificial raptor perches were used most often in an irrigated pasture and on a non-irrigated grassland habitat near the top of a hill. Fifteen-foot perches were used more often than 20-foot perches, and raptors rarely used a lower crossbeam on perches when one was available. These results indicate that if ranchers want to get the most use of artificial perches, they should be installed in open areas on hillsides or along irrigated fields. Our results also indicate that shorter, simpler perches are preferred by raptors.

Our modified artificial raptor perch design is lightweight and easy to construct and therefore proved easy to attach to pre-existing fenceposts in the rocky soil at our study site. Throughout this initial monitoring period, perches performed well. However, artificial perches should ideally last many years, so ongoing monitoring of the performance of our perches will continue to understand longevity and maintenance milestones.

Raptor use of perches in the different habitats is likely to reflect raptor abundance, prey availability, and/or availability of natural perches in each habitat. We found that the oak woodland habitat had the fewest visits per day as compared to the other habitats. A majority of raptors utilize tall objects such as trees or perches to hunt from (Reinert 1984, Pandolfino and Smith 2011). The utilization of oak trees rather than artificial perches in the oak woodland habitat may be the reason for the low rate of raptor perch usage in the oak woodland habitat. Since our monitoring only took place from Aug-Nov (end of summer through fall) the significant differences between habitats could be due to observing only one season. We were also unable to identify individual birds in our analyses, so our data may actually be a reflection of the behavioral patterns of only a few individual birds that repeatedly utilized the perches in each habitat. Our preliminary analysis does not include data on prey availability, so our results may differ from other sites if prey abundance is the main driver of raptor use of perches.

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LITERATURE CITED

Butchart, S. H. M., A. J. Stattersfield, L. A. Bennun, S. M. Shutes, H. R. Akcakaya, J. E. M. Baillie, S. N. Stuart, C. Hilton-Taylor, and G. M. Mace. 2004. Measuring global trends in the status of biodiversity: red list indices for birds. PLoS Biology 2:2294-2304.

Erickson, W., and D. Urban. 2004. Potential risks of nine rodenticides to birds and nontarget mammals: a comparative approach. U.S. Environmental Protection Agency, Washington, D.C.

Hall, T. R., W. E. Howard, and R. E. Marsh. 1981. Raptor use of artificial perches. Wildlife Society Bulletin 9:296-298.

Kay, B. J., L. E. Twigg, T. J. Korn, and H. I. Nicol. 1994. The use of artificial perches to increase predation on house mice (*Mus domesticus*) by raptors. Wildlife Research 21:95-106.

Kim, D. H., F. Chavez-Ramirez, and R. D. Slack. 2003. Effects of artificial perches and interspecific interactions on patch use by wintering raptors. Canadian Journal of Zoology 81:2038-2047.

Kross, S. M., R. P. Bourbour, and B. L. Martinico. 2016. Agricultural land use, barn owl diet, and vertebrate pest control implications. Agriculture, Ecosystems & Environment 223:167-174.

Larson-Praplan, S. 2014. History of rangeland management in California. Rangelands 36:11-17.

Lynn, S., J. A. Martin, and D. K. Garcelon. 2006. Can supplemental foraging perches enhance habitat for endangered San Clemente loggerhead shrikes? Wilson Journal of Ornithology 118:333-340.

NRCS. 2015. Structures for wildlife, raptor perch pole (649L). Natural Resources Conservation Service - CA, US Department of Agriculture, Sacramento, CA.

Omeg, M. 2012. Rodent control in orchards using raptors. Final report to the Sustainable Agriculture Research & Education Program, U.S. Department of Agriculture.

Pandolfino, E. R., and Z. Smith. 2011. Perch selection and the influence of weather on raptor behavior. Central Valley Bird Club Bulletin 14:54-65.

Preston, C. R. 1990. Distribution of raptor foraging in relation to prey biomass and habitat structure. Condor 92:107-112.

R Core Development Team. 2017. R Foundation for Statistical Computing, Vienna, Austria.

Reinert, S. E. 1984. Use of introduced perches by raptors: Experimental results and management implications. Journal of Raptor Research 18:25-29.

Sanchez-Zapata, J. A., M. Carrete, A. Gravilov, S. Sklyarenko, O. Ceballos, J. A. Donazar, and F. Hiraldo. 2003. Land use changes and raptor conservation in steppe habitats of Eastern Kazakhstan. Biological Conservation 111:71-77.

Schmutz, J. K. 1987. The effect of agriculture on ferruginous and Swainson's hawks. Journal of Range Management 40: 438-440.

Stansley, W., M. Cummings, D. Vudathala, and L. A. Murphy. 2014. Anticoagulant rodenticides in red-tailed hawks, *Buteo jamaicensis*, and great horned owls, *Bubo virginianus*, from New Jersey, USA 2008-2010. Bulletin of Environmental Contamination and Toxicology 92:6-9.

Swolgaard, C. A., K. A. Reeves, and D. A. Bell. 2008. Foraging by Swainson's hawks in a vineyard-dominated landscape. Journal of Raptor Research 42:188-196.

Van Vuren, D., T. G. Moore, and C. A. Ingels. 1998. Prey selection by barn owls using artificial nest boxes. California Fish and Game 84:127-132.

Widen, P. 1994. Habitat quality for raptors – a field experiment Journal of Avian Biology 25:219-223.

Witmer, G., M. Pipas, P. Burke, D. Rouse, D. Dees, and K. Manci. 2008. Raptor use of artificial perches at natural areas, city of Fort Collins, Colorado. Prairie Naturalist 40:37-42.