Measuring Raven and Coyote Predation of Desert Tortoises: Phase 1

By William I. Boarman, Ph.D.

Conservation Science Research & Consulting
2522 Ledgeview Place
Spring Valley, California 91977

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Introduction

Subsidized predators, predatory animals whose populations benefit from human-provided food, water, and refugia, are increasing in frequency. In the Mojave Desert of southern Nevada, common ravens (*Corvus* corax) and coyotes (*Canis latrans*) are the predominant subsidized predators. Their presence has become a problem for desert tortoise (*Gopherus agassizii*) populations, a threatened species. Ravens in particular are known to prey on tortoises in large numbers and coyotes eat them also. Whereas the extent and effect of raven predation on tortoises is fairly well known (Boarman 2003), the impact of coyote predation is much less so. It is known that coyotes prey on tortoises and that the predation is greatest near human habitations (Esque et al. 2010), but whether this predation affects the demography of tortoise populations is unknown. Furthermore, the effect of coyote predation likely varies with annual rainfall amounts; lower rainfall causing coyotes to switch from preferred rodents and lagomorphs to less preferred tortoises. The study reported herein was intended to take an initial look at raven and coyote impacts on the tortoise population at the Boulder Cite Conservation Easement (BCCE), to provide a baseline to compare to for monitoring the effectiveness of any mitigation measures that may be implemented to reduce the effects, and to recommend how the County should proceed from here.

In Phase One of the study we conducted two reconnaissance visits to collect initial data on raven and coyote populations to determine the need and efficacy of a more in depth study to test for effects ravens and coyotes may have on tortoise populations. We also identified several sites that could be used as raven survey points, and tested motion-detection, infrared sensitive cameras for monitoring coyote presence at various points within the BCCE. We accomplished three primary objectives: A.) identify possible study sites, B.) determine ease of access for surveys, and C.) collect preliminary data. Herein we report on the results of these objectives, evaluate the need for further studies, and make recommendations on what that study should consist of.

Methods

Four site visits were made to the BCCE (Fig. 1). Two visits were to evaluate the BCCE, survey ravens and nests, and locate potential future survey sites. These were on 9/13-16/2013 and 11/10-12/2013. Two additional visits were made to check three cameras we deployed to survey for coyote activity. These were on 11/30-12/2/2013 and 1/11/2014. Most roads within the BCCE were driven both to look for ravens and their nests and to evaluate them for future surveys.

To evaluate coyote use of the BCCE, we decided to test motion triggered, infrared sensitive cameras (Cuddeback, Attach IR, Model 1156) rather than track, scat, and spotlighting surveys. We deployed three cameras that can record visible and infrared light and placed them at three different locations. The cameras are powered by D-cell batteries and store digital photographs on memory cards. They can last for 6 to 12 months on one set of batteries and can store up to 50,000 images. We attached each camera to a 4-foot long green t-bar, which we then sunk approximately 6 to 9-inches onto the ground (Fig. 2). A closed can of cat food was staked to the ground with a 10-inch nail driven through its center to serve as bait, as well as several drops of a strong, putrid-smelling product called canine call. We visited the cameras twice after approximately 1 month to ensure they were working and to upload any images taken.

Results

Approximately 215 miles of roads were driven in search of ravens, nests, and potential survey routes and points (Fig. 1). There were 17 sightings of ravens, which represented a total of 53 ravens (mean of 3.1 ravens per sighting). The Boulder City sewage ponds had ravens most consistently, but the highest count was 18 socializing on the ground at the north end of the dry lake early in the morning. Virtually all raven sightings were from the area immediately south of Boulder City in the vicinity of the municipal sewage treatment plant, and near the north part of Hwy 95. The second most common raptor was the red-tailed hawk (*Buteo jamaicensis*), which were seen 8 times (1 pair, 8 singles) mostly in the south half; followed by prairie falcons (*Falco* mexicanus; single birds seen twice); and American Kestrels (*Falco* sparverius; one pair seen one time). No raptor nests were found on the BCCE and one unoccupied nest was found at Nelson's Landing at the east end of Hwy 165. The nest was probably that of a raven.

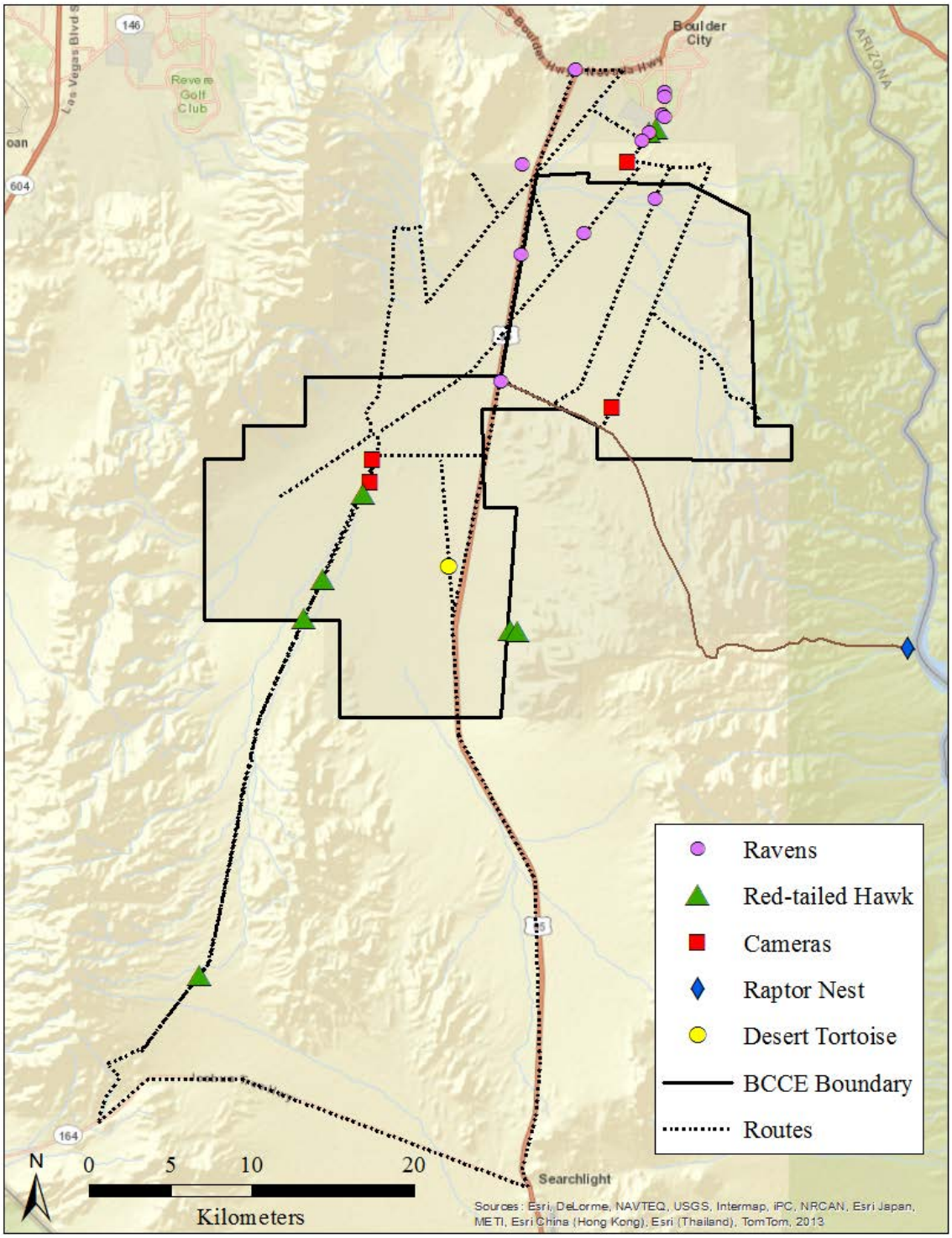

Figure 1. Map of the Boulder City Conservation Easement showing locations of routes driven, coyote cameras, and observations of animals and nests of species of particular interest.

Between November 12, 2013, and January 10, 2014, the coyote cameras (Figs. 1 and 2) yielded 275 photographs of coyotes (Appendix). All of the photos but one

contained a single coyote. The one exception has of what appeared to be an adult and a young. A total of 95% (261/275) of the photos were from the camera placed near the 2° sewage runoff wetlands just south of Boulder City sewage treatment plant, the remaining came from a camera placed 0.9 mi south of the El Dorado Substation in the southwestern section of the BCCE. In addition, there were 63 photographs of Desert Cottontail Rabbits (*Sylvilagus audubonii*), 9 Greater Roadrunners (*Geococcyx californianus*), 9 of two people in one instance, 5 of 2 dogs (*Canis lupus familiaris*) on one day, and 2 of a raccoon (*Procyon lotor*).

Figure 2. Photograph of the motion-triggered camera used to monitor coyote presence on the BCCE.

Discussion

Our attempt to determine the extent of raven and coyote predation on desert tortoises involved several steps:

A.) identify study sites
B.) determine ease of access for surveys
C.) collect preliminary data
D.) need for further studies
E.) study recommendations

Identify Study Sites and Ease of Access.—After driving 215 miles in and near the BCCE, we have identified a series of points that could make good spots for point counts. These sites can be grouped into three categories: 1.) attraction sites, which contain various characteristics that might attract ravens to them such as food, water, or nest substrate; 2.) human-altered landscapes, which consist of areas with human developments (e.g., solar generation, mines, recreation); and 3.) desert sites that are away from human developments. We also identified easily accessible roads through various landscapes that could serve as locations for driving surveys (versus point-count surveys).

Preliminary Data.—Fifty-three ravens were observed on 17 occasions. Several of the sightings consisted of single birds, but we also saw a number of groups of birds, particularly in and near the Boulder City sewage treatment facility. We also observed 18 birds one morning on the ground at the northwest end of the dry lake on the BCCE. These birds likely came to the dry lake from an unidentified roost that we suspect is on the powerlines near Hwy 95 northeast of the dry lake. On three occasions we saw bird flying towards that area at or slightly after sunset, which is the time of the day they enter their communal night roosts (Chamblin and Boarman 2004). Ravens were also seen along Hwy 95, near the solar facilities, perching on power towers or distribution poles, and along Buchanan Blvd. in Boulder City.

Only one raptor nest was found and it was outside of the BCCE at the eastern terminus of Hwy 165 at the Colorado River. Since it was the fall, we were unable to identify what species used the nest, but, based on appearance and location, it was likely a raven nest. This should be checked during the spring. Other nests are likely to be found during the spring within or near the BCCE when nests can be found based on raven behavior (pers. obs.). Cliffs and power towers should be checked carefully.

Two the motion triggered cameras (Fig. 2) took 275 photographs of coyotes (Appendix) with 95% of them being from the camera placed alongside the 2° sewage runoff wetlands just south of Boulder City. This both indicated that coyotes do inhabit the area and that the Attack IR cameras work well for detecting coyote presence both during the day and night. All coyote images were obtained near human-dominated areas (Boulder City sewage treatment near 2° sewage treatment

water wetlands and solar developments). The camera placed more in the open desert (but, near a power tower) took no photographs of coyotes during its 41 days of deployment.

Need for Further Studies and Recommendations.—This study did document that ravens and coyotes are found within the BCCE. From other studies (and we made one observation) we know that desert tortoises occur in the BCCE, therefore the possibility exists for ravens and coyotes to impact tortoise populations. To determine definitively the effect ravens and coyotes are having on tortoise populations is very difficult; it involves intense surveys of the tortoise population coupled with studies of mortality of radio-transmittered tortoises and predator populations. Short of that are less definitive and more indirect measures, but they do give some indication of the impact. These include measures of the spatial and temporal patterns of predator abundance relative to tortoise populations, actual predation on tortoises as measured through scat and searches for prey remains, and surrogate measures of spatial and temporal patterns in predation pressure. If Clark County wants to know if there is a predation problem and how to reduce those problems, these measures need to be taken if it is not able to fund a more direct measure that focuses intense study of the BCCE tortoise population and more in-depth study of predator population foraging behavior.

An intensive study of the effects of coyote and raven predation would include several tasks. Tortoise surveys in multiple years of several 1 km^2 plots with 200% cover would provide estimates of tortoise mortality and recruitment potential to see if predation is preventing younger animals from attaining reproductive age (aka. recruitment). Radio transmitters would be attached to juvenile, immature, and subadult tortoises to determine causes and frequency of predation and other sources of mortality. The raven and coyote populations would concomitantly be surveyed for size, distribution, and predation.

A less intensive, more indirect study would involve measures of predator populations and foraging behavior. Line transects and point counts plus motion-detection infra-red cameras would be used to measure raven and coyote abundance and distribution. Raven nest surveys would provide additional essential information. Collections of scat and pellets along the line transects, survey points, beneath nests and roosts, and at other locations would provide information on incidents of tortoises and other species being preyed upon by the target predatory species. Finally, non-tortoise food items and replicas of food items can provide estimates of predation pressure and risk that would yield a more concrete picture of the impact raven and coyote predation may be having on the BCCE tortoise population.

Literature Cited

Boarman, William I. 2003. Managing a subsidized predator population: reducing common raven predation on desert tortoises. Environmental Management. 32:205-217.

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Appendix

Example of photographs taken by the Cuddeback Attack IR Cameras.


Attack IR
11/17/2013 5:36 PM
Cuddeback


Attack IR
12/8/2013 9:21 PM ID:3
Cuddeback


Attack IR
12/15/2013 1:42 PM ID:3
Cuddeback


Attack IR
12/19/2013 8:36 AM ID:3
Cuddeback


Attack IR
11/15/2013 5:08 PM
Cuddeback