

Memorandum

February 14, 2020

Re: Update on Village H Wildlife Movement and Dog Waste Studies

This memo summarizes the status of the wildlife movement and dog waste studies being conducted by city staff, volunteers and Environmental Science Associates, which was presented in the 15th HMP Annual Report.

Wildlife Movement Studies

Wildlife movement across the landscape is an important component of a healthy ecosystem. In an urbanized preserve system, wildlife corridors can connect fragmented patches of habitat, allowing migration, dispersal, and gene flow of wildlife species. However, wildlife movement can become restricted when wildlife corridors are blocked by development such as houses or roads. The presence of people and dogs, such as along heavily used trails, can also restrict or deter wildlife movement through avoidance of an area or behavioral changes, including limiting movement to nighttime hours. The city's wildlife movement program, implemented through a partnership with HMP staff, preserve steward, preserve managers and volunteers, evaluates wildlife movement at selected locations throughout the city.

Village H Preserve and Open Space

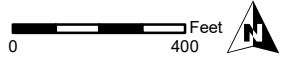
The Village H property, which consists of HMP hardline and non-hardline open space, is being considered for the installation of an off-leash dog park. To understand how wildlife is using this property and how an off-leash dog area might affect wildlife movement, three studies were initiated shortly after the property came under the city's ownership.

Wildlife Cameras

Wildlife cameras with motion detectors were installed at various locations throughout the property to determine the presence or absence of native wildlife, humans, dogs on-leash and dogs off-leash (Figure 1). The cameras were set to take 10-second videos each time they were triggered. By moving the cameras around to many different locations and collecting data for up to a year, this study will provide information about what species are using this property, and which locations are most heavily used by each species. This information, in turn, will allow us to infer how wildlife may be moving across the site and if the presence of humans and dogs may be deterring use by wildlife in some areas. Bobcats and coyotes were the focus of this analysis because they have larger home ranges than the other species.



- Camera Locations
- HMP Hardline Preserve
- Village H South Parcels
- Roadkill Study Area



Village H
Wildlife Camera Locations and Roadkill Study Area

Figure 1

Note that this is not a statically rigorous study; the purpose of this study is to get a general idea of how animals are using the site. It was not designed to make a definitive statement about how wildlife move through the site or how many individuals use the site. It is not possible to identify individual non-domestic species, and several cameras are likely to be triggered by the same individuals as they move through the site. The purpose is to get an understanding of the *relative* amount of activity of native wildlife vs. domestic dogs or people at each location and determine what time of day or night these areas are being used. We can then use this information to inform management decisions and compare changes in activity patterns that may occur with changes to land use on the site.

Figure 1 shows the 21 camera locations that have been used from June 2019 through February 2020. Sample photos taken during the study are included in Attachment 1. Because each camera has been in operation for a different number of days, the number of each species at each camera is given by the total number of “hits” divided by the total number of active camera days. If it is likely that a camera is picking up the same individual a few minutes apart, those individuals are only counted once. For example, bobcat cubs playing in front of the camera may show up in 4 videos several minutes apart. If a single video shows a maximum of two bobcats at a time, then these 4 videos would be counted as a total of two “hits.” “Camera day” is defined as a 24-hour period of active camera time at a specific location.

Table 1 summarizes the camera data from June 25, 2019 through January 17, 2020. Graphs of the relative numbers of species at each camera location are provided in Attachment 2. Bobcats, the species known to be the most sensitive to urbanization and habitat fragmentation, were most frequently observed at locations 1, 9, 13, 15 and 16, suggesting east-west movement along the northern side of Village H. Regular observations were also made at locations 8, 17 and 19 showing that they may also be moving north-south across the site. Coyotes and other mammals commonly seen on site are much more adapted to urbanization and the presence of people. For the most part, coyotes are more active in areas with less human activity (off the trail) although they have been observed at locations 2, 9, 13, and 18, which also show use by humans and dogs. Surprisingly, coyotes have not been observed using the undercrossings at locations 15/16 and 8.

One of the most obvious patterns that emerges from the data is that people and dogs are clearly most active during the day (defined as when it is light outside), whereas wildlife are most active during the night (Figure 2). In a natural setting, coyotes and bobcats tend to be more active during the day and at dawn and dusk (Tremore et al. 2017). It is likely that coyotes and bobcats have changed their natural activity pattern to be more nocturnal to avoid contact with people and dogs. It is well-documented that recreational use (hiking, biking, dog walking) negatively affects wildlife by causing them to avoid or restrict their movements or to become less active during the day in areas of high use by people and dogs (George and Crooks 2006, Jennings and Lewison 2013, Ruell et al 2002).

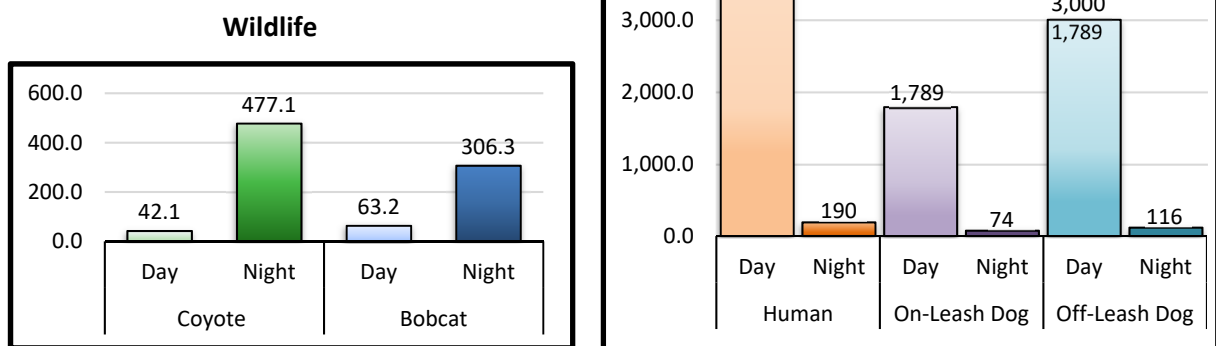
Table 1. Summary of Wildlife Camera Data (No. Hits/No. Camera Days) June 25, 2019 - Jan. 17, 2020

Species	Location	Number of Individuals ("Hits") per Total Number of Camera Days*																			TOTALS
		1	2	3	4	5	6	7	8	9	10	13	14	15	16	17	18	19	20	21	
		#Cam Days	136	42	44	11	177	99	174	198	106	14	98	20	112	112	112	49	16	49	
Coyote	Day	0.7	2.4	4.5	0.0	0.0	7.1	8.6	0.5	7.5	0.0	1.0	0.0	0.0	0.0	1.8	0.0	0.0	2.0	5.9	42.1
	Night	8.8	54.8	9.1	9.1	1.1	0.0	80.5	5.1	71.7	7.1	115.3	5.0	3.6	0.0	13.4	42.9	37.5	12.2	0.0	477.1
Bobcat	Day	47.1	0.0	0.0	0.0	0.0	1.0	1.7	1.5	0.9	0.0	2.0	0.0	2.7	1.8	4.5	0.0	0.0	0.0	0.0	63.2
	Night	206.6	0.0	0.0	0.0	0.0	9.1	4.0	4.0	12.3	0.0	19.4	0.0	19.6	17.0	8.0	0.0	6.3	0.0	0.0	306.3
Skunk	Day	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Night	8.1	0.0	0.0	0.0	0.0	7.1	9.2	1.0	1.9	0.0	3.1	0.0	70.5	75.9	14.3	0.0	6.3	0.0	0.0	197.3
Rodents, Rabbits, Raccoons	Day	11.8	11.9	0.0	0.0	0.0	7.1	0.0	0.0	0.0	4.1	0.0	3.6	1.8	1.8	0.0	0.0	0.0	0.0	0.0	42.0
	Night	3.7	19.0	0.0	0.0	1.1	4.0	2.9	23.7	0.0	0.0	17.3	0.0	27.7	33.9	29.5	0.0	0.0	10.2	0.0	173.1
Bird	Day	20.6	0.0	2.3	0.0	0.0	3.0	1.1	5.1	3.8	7.1	21.4	0.0	8.0	6.3	0.0	0.0	0.0	0.0	0.0	78.7
	Night	4.4	0.0	2.3	0.0	0.6	1.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	1.8	2.0	0.0	0.0	0.0	18.7
TOTAL WILDLIFE	Day	80.1	14.3	6.8	0.0	0.0	18.2	11.5	7.1	12.3	7.1	28.6	0.0	14.3	9.8	8.0	0.0	0.0	2.0	5.9	226.0
	Night	231.6	73.8	11.4	9.1	2.8	21.2	96.6	33.8	92.5	7.1	155.1	5.0	121.4	126.8	67.0	44.9	50.0	22.4	0.0	1,172.5
Human	Day	208.8	350.0	1434.1	2563.6	0.6	1.0	0.6	20.2	98.1	35.7	64.3	0.0	5.4	8.9	13.4	1838.8	75.0	44.9	0.0	6,763.4
	Night	2.9	9.5	13.6	81.8	0.0	0.0	0.0	6.6	0.0	0.0	1.0	0.0	2.7	0.0	0.0	71.4	0.0	0.0	0.0	189.6
On-Leash Dog	Day	19.1	73.8	288.6	763.6	0.0	0.0	0.0	0.0	5.7	0.0	1.0	0.0	0.0	0.0	0.0	628.6	6.3	2.0	0.0	1,788.7
	Night	0.0	4.8	9.1	27.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.7	0.0	0.0	0.0	73.8
Off-Leash Dog	Day	299.3	171.4	600.0	954.5	0.0	0.0	0.0	0.0	150.9	14.3	174.5	5.0	0.0	0.0	0.0	542.9	50.0	34.7	2.9	3,000.4
	Night	7.4	9.5	2.3	54.5	0.0	0.0	0.0	0.5	0.0	0.0	5.1	0.0	0.0	0.0	0.0	36.7	0.0	0.0	0.0	116.0
TOTAL HUMANS + DOGS	Day	527.2	595.2	2322.7	4281.8	0.6	1.0	0.6	20.2	254.7	50.0	239.8	5.0	5.4	8.9	13.4	3010.2	131.3	81.6	2.9	11,552.6
	Night	10.3	23.8	25.0	163.6	0.0	0.0	0.0	7.1	0.0	0.0	6.1	0.0	2.7	0.0	0.0	140.8	0.0	0.0	0.0	379.4

*Cameras 11 and 12 were stolen, so there is no data for these cameras.

Figure 2. Activity Patterns: Day vs. Night

Target wildlife species (coyotes and bobcats) are compared to humans and domestic dogs, measured by (total “hits”)/(total number of camera days). Note that the scales are not equal, so the actual difference between wildlife and humans/dogs is even more pronounced than what appears on the graphs.



Roadkill

A roadkill study was conducted by Environmental Science Associates biologists, HMP staff and volunteers along the roads surrounding Village H (portions of Tamarack Avenue, Carlsbad Village Drive and Glasgow Avenue) to determine if animals are being hit by cars trying to cross the road between the northern and southern portions of Village H (Figure 3). Roadkill monitoring began on July 25, 2019 and will continue for up to one year. An average of three surveys per week was conducted initially, and later reduced to once per week. Roadkill logs kept by the city were also reviewed regularly to capture any roadkill that might have been picked up by the city’s contractor. As of January 31, 2020, the following species have been recorded as roadkill on Carlsbad Village Drive between Tamarack Avenue and Glasgow Drive: three skunks, two opossums, one hawk and one dog. The remaining five roadkill observations were rabbits at scattered locations along the roads in the study area.

Dog Waste

Because Village H has been used by residents as an off-leash dog area for many years before becoming the city’s property, a study was conducted to determine how much dog waste was on the ground before and after the official city trail opened. Off-leash dogs are not allowed on city trails or HMP Hardline or other open space. They are only allowed within a formal dog park. Once the city trail formally opened, several dog waste stations were available to users of the trail. During each site visit, Environmental Science



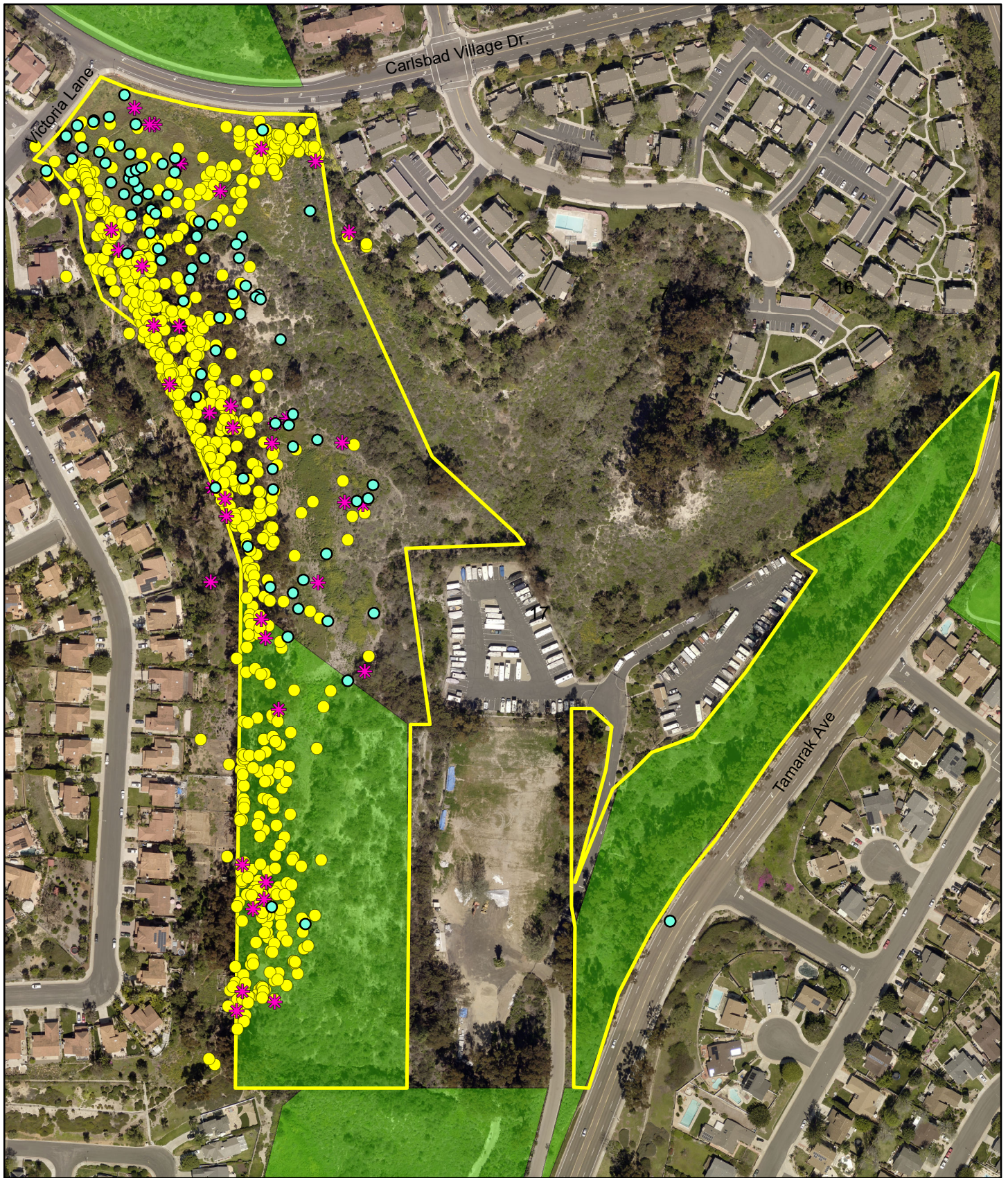
Associates biologists, HMP staff and volunteers collected Global Positioning System (GPS) coordinates for each pile of dog waste, coyote/bobcat scat, and tennis ball or other dog toys using the ArcGIS Collector mobile application. Waste and trash was collected and disposed of at the end of each day. Prior to disposal, the dog waste was weighed and recorded. Surveys started on August 28, 2019, and were initially conducted approximately every other week and then reduced to once per month. The study will continue for up to one year.

Figure 3 shows the results of the study through January 31, 2020. The initial site visit documented 290 piles of dog waste, which weighed 16 pounds (Table 2), and 48 tennis balls (dog toys). Because of the extensive tree trimming, chipping, and mulching that was conducted prior to the official trail opening, most of the old waste piles were impossible to see. Although there is still a significant number of dog waste that is not being picked up, mostly from unleashed dogs, the amount has slowly decreased over time, as have the number of tennis balls and other dog toys (Figures 4 and 5).

Table 2. Dog Waste Study Results

Date	Pounds of Dog Waste	Number of Waste Piles	Number of Tennis Balls
Pre-Study Clean Up			
8/28/2019	16	290	48
Long-Term Study Period			
9/11/2019	5.5	84	41
9/25/2019	10	141	15
10/8/2019	4	53	5
10/23/2019	3.2	65	3
11/6/2019	5.3	80	7
12/18/2019	6	67	11
1/15/2020	4.6	49	2
TOTAL FOR STUDY PERIOD¹	38.6	539	84

¹ Study period is September 11, 2019 – January 15, 2020



HMP Hardline Preserve
 Village H South Parcels

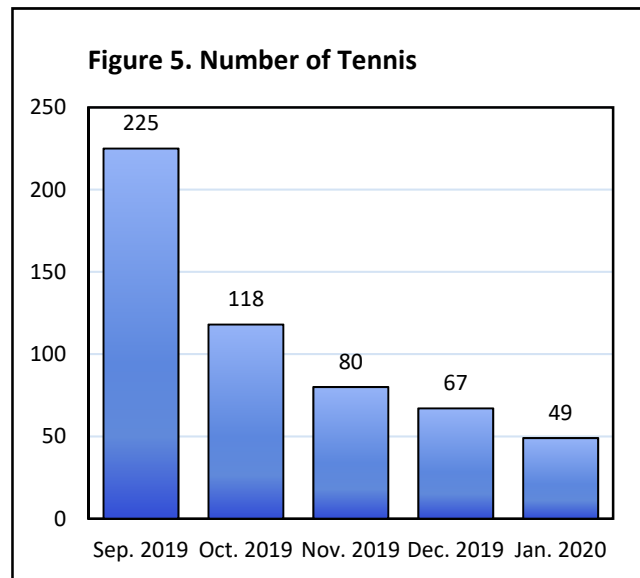
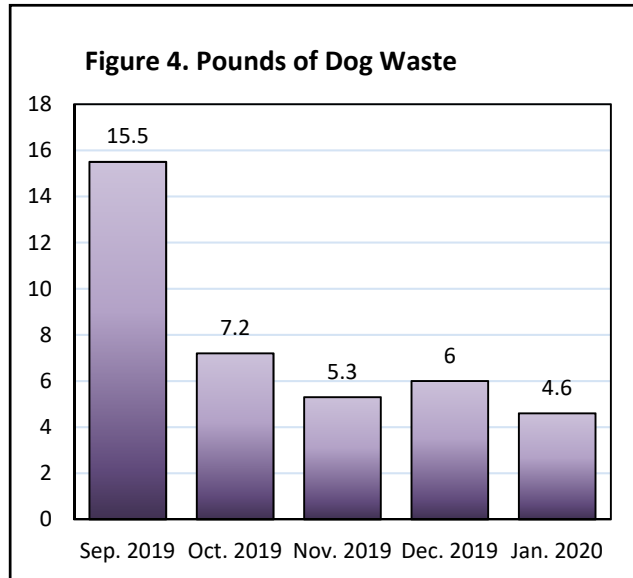
Tennis Ball
 Dog Waste

Coyote Scat

0 200 Feet

Village H
Dog Waste Collected Since August 2019

Figure 3



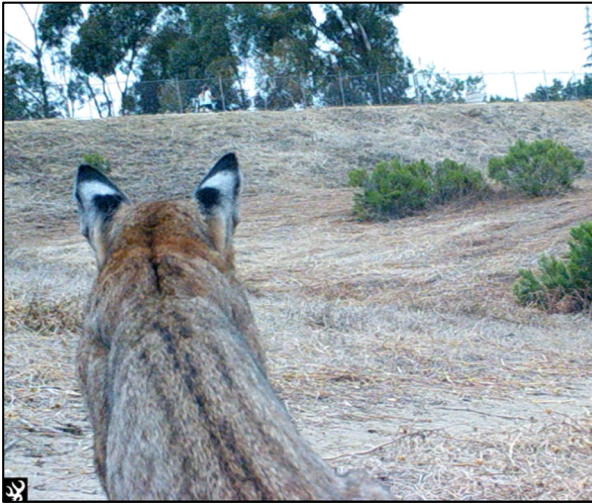
Management implications

Habitat fragmentation, roads and human use are major threats to wildlife by reducing suitable habitat and functional connectivity (movement of organisms across the landscape between core habitat areas). Functional connectivity allows for genetic flow between populations, preventing harmful genetic effects that may happen in small, isolated populations, and increases an animal's ability to adapt to environmental change. Bobcats, and to a lesser degree coyotes, are especially vulnerable to these effects. Although there is evidence that bobcats and coyotes may become habituated to the presence of humans and dogs and may learn to move through urbanized areas in coastal areas of Southern California, they may still be at risk in the long-term through reduced survival, reproduction, genetic variability and opportunities for dispersal into new areas (George and Crooks 2006, Jennings and Lewison 2013, Ruell et al 2002). Therefore, it will be important to continue to monitor movement through Village H and other key areas of the city and reduce barriers to movement whenever possible.

Besides affecting the ability for mammals to move across the landscape, the presence of dogs on Village H has resulted in a significant amount of dog waste left behind. As the data shows, even though there are several dog waste stations onsite, many dog owners do not pick up after their pets, and many dogs are unleashed so the waste ends up well beyond the trail. Unlike wildlife waste, dog waste carries many types of bacteria, parasites, viruses and other diseases that can be transmitted to humans (Center for Disease Control 2019). Some of these microorganisms can survive in the soil for up to four years if the waste is not picked up (Baechler 2018). Dog waste also contains excess nutrients, which can cause algal blooms when draining into streams and ponds, depleting the water of oxygen that is vital for the survival of fish and other aquatic life. Some dog owners put their dog waste into plastic bags, but leave the bags on the ground (10 percent of the waste collected on Village H was bagged). This causes the additional problem of creating bits of microplastics as the bag breaks down over time. Plastic does not biodegrade, and the waste ends up in the soil anyway.

Attachment 1
Wildlife Captured by Trail Cameras on Village H Property (2019)

Photos 1-6: Bobcats. Top left – bobcat watching joggers up on sidewalk at VH1; top center and top right – two juvenile bobcats playing together at VH7; bottom left – bobcat crossing under Tamarak west to east just one day after gate was opened at VH6; bottom center – three young bobcats crossing under Tamarak east to west at VH16; bottom right – bobcat traveling north along concrete v-ditch.



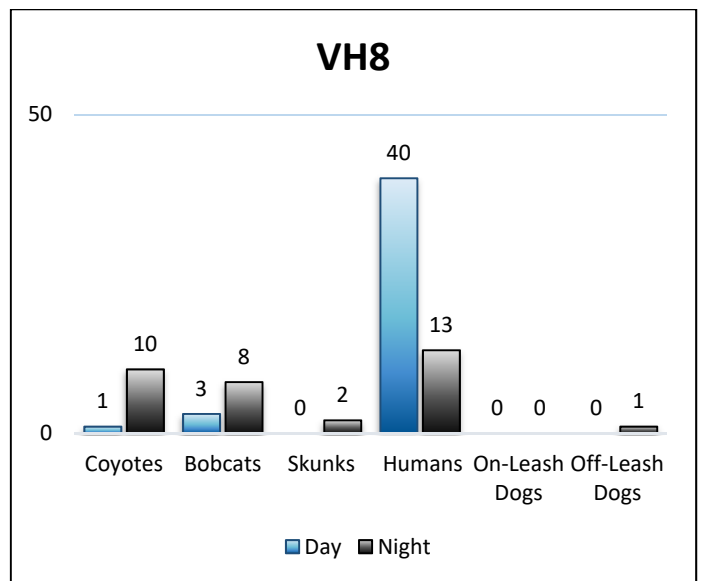
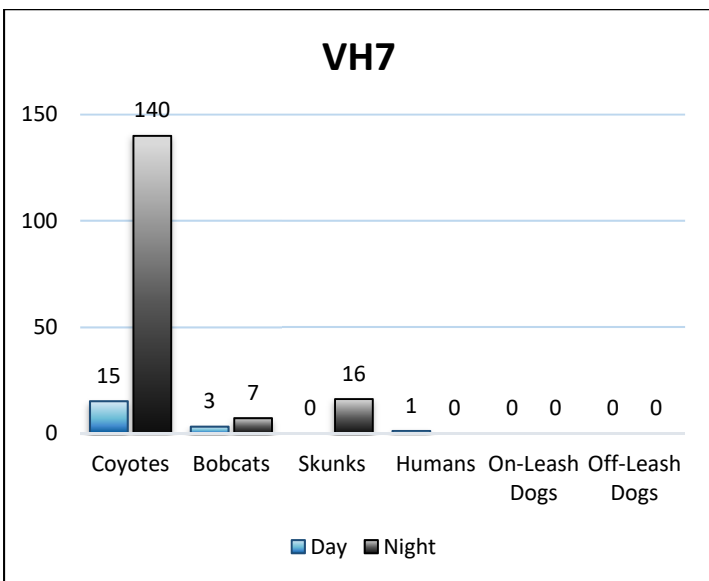
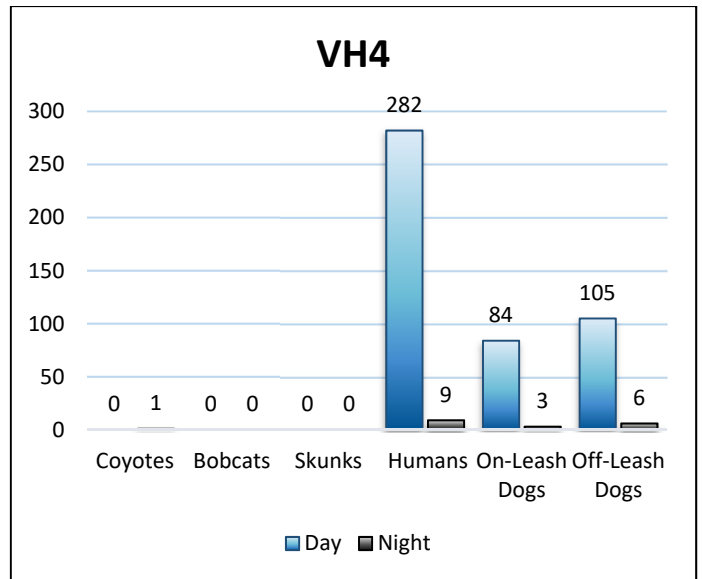
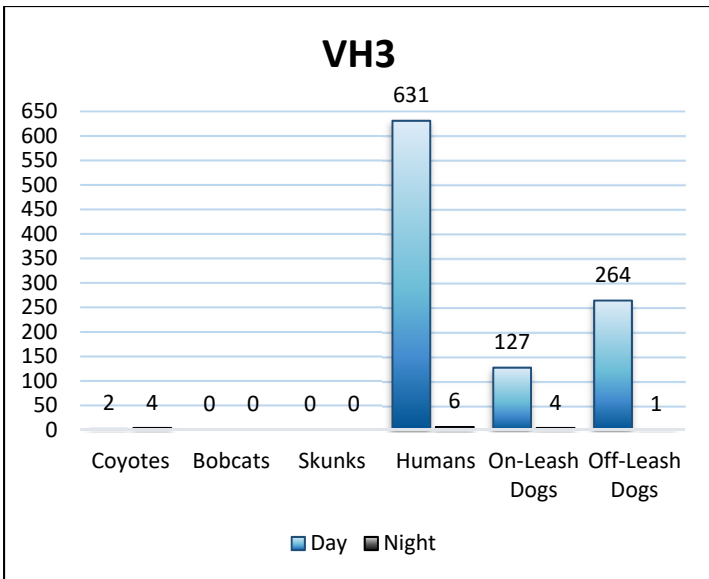
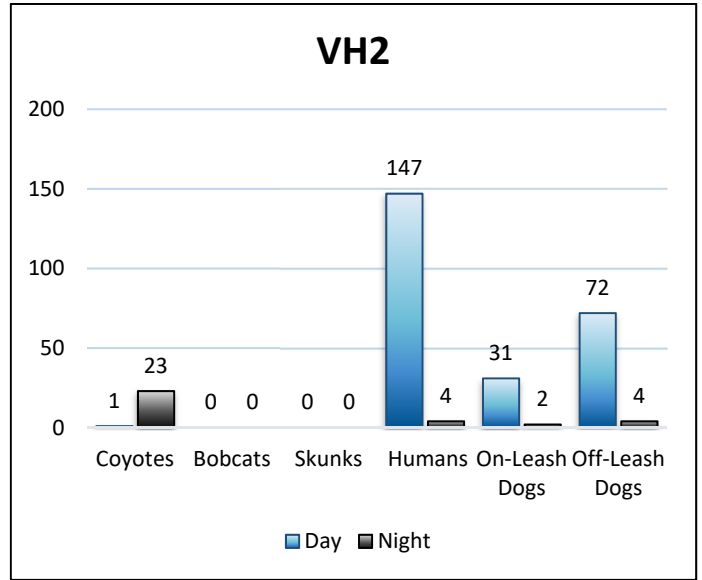
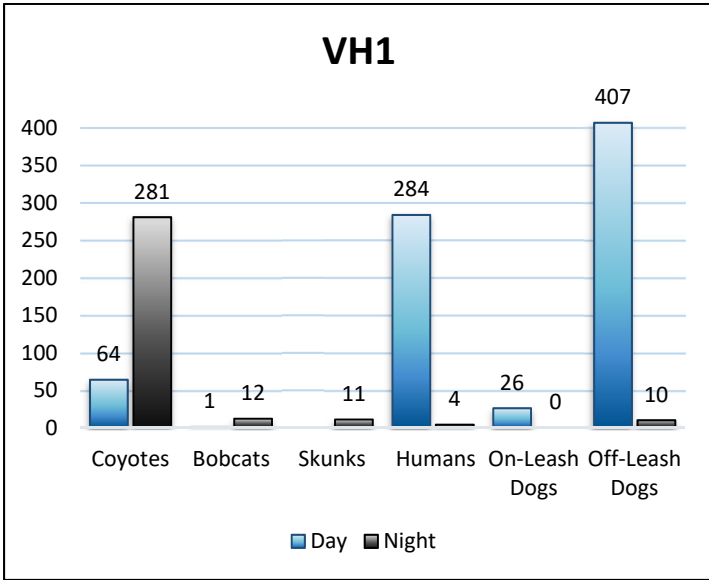
Wildlife Captured by Trail Cameras on Village H Property (2019)



Photos 7-8, coyotes: top left VH13, top right VH1. Photos 9-10, raccoons: middle left VH7, middle right VH17. Photos 11-12, striped skunks: bottom left VH15, bottom right VH7. Photos 13-14, great-horned owls: center right and bottom right VH1.



Relative Number of Wildlife, Humans and Dogs at Selected Locations



Relative Number of Wildlife, Humans and Dogs at Selected Locations

