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Urbanization's Effect on a Coyote Population in Culver City

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Abstract

Due to the increased rates of urbanization in once biodiverse areas, it is now critical to study the effects of urbanization on species abundance and biodiversity. This study investigates the impact of urbanization in the Culver City area on coyote abundance. As part of a larger multi-year study, four sites across Culver City were studied and split into two groups, inner city, known as the urban area, and edge of city, known as the rural area. Coyote abundance was determined through the use of systematic camera trapping at each site for the year of 2020. A final total that accounts for all images collected containing coyotes at each site was analyzed and compared against the opposing locations and statistically analyzed using a t-test. In this analysis we found a decrease in coyote abundance in the urban areas as opposed to the more rural locations on the edge of town. The further understanding of urbanization's effect on coyote populations will help us to not only protect coyotes in present day, but also allows for better coyote management policies to be put in place prior to future urban expansion.

Introduction

Urbanization is a threat to species all around the globe. Increased human activity affects the amount and configuration of habitats¹. Even further, urbanization causes degrading impacts such as habitat fragmentation, loss, decreased biodiversity and species extinction². This destruction of rural greenspace forces larger animals from the natural environments, that would otherwise avoid human interaction, into human dominated areas.

These animals include coyotes, *Canis latrans*, which are known to be a highly adaptable species, however it has been proven that they will alter their activity to avoid human interaction⁶. Despite Coyotes diurnal nature they are found to be nearly two times less active in the day when close to developed areas⁸. Research also shows coyotes in urban areas also exhibit bolder and more exploratory behavior in that they are less likely to flee in risky situations and are more willing to engage in novel experiences³. Due to this forced relocation, coyotes are exhibiting such behavior in areas where humans are present leading to some unpleasant interactions between humans and coyotes. These interactions include attacks on pets such as dogs and outdoor cats and even the rare attack on a human. Coyotes have also adjusted their diets in urbanized areas, showing an elevated consumption of human related food items in areas with increased urbanization⁷. These items include trash, ornamental fruits, and domestic cats, *Felis catus*, a particularly controversial part of their diet as it leads to fear of the species and an increased desire for management⁷. Lethal management of predators is often proposed, although it has little to no evidence of efficacy with some researchers finding that it increases human-animal conflict⁴.

As urbanization continues and coyotes will be forced to continue to adapt to human dominated areas. To understand the extent of that adaptation and its effect on the city's residents, we must first understand the effects of urbanization on coyote abundance in urban vs. rural areas. To study this idea, Culver City, CA was chosen for a multi-year study that manages over 30 cameras and has captured over 2.5 million photos. Culver City is unique in that it has a large amount of rural space that surrounds it as well as smaller embedded green spaces that can be studied in contrast to the more rural areas.

This study will look at 4 of those cameras, 2 in a rural location and 2 in an urban location. I hypothesize that the rural locations will capture more photos containing coyotes than the urban locations due to the preference for coyotes to avoid human disturbance. I also hypothesize that the photos captured in the rural locations will contain more coyotes per photo than the urban areas. I believe this will occur due to the fact that coyote dens, if prevalent, would likely be positioned in an area where the adult coyotes feel safe, the rural areas. Due to this, photos capturing several individual coyotes would likely only be found in the rural areas where coyotes can exist more freely than in the urban areas. With a better understanding of where coyotes are most abundant in a city, and how they adapt to urban expansion, we can better understand their preferred habitat in the realm of a city. With this we can better impose policies to properly manage the animals as well as and the residents of the cities.

Methods

- Remote cameras were set up at four locations, 2 rural (Camera 33 and 13) and 2 urban (Camera 20 and 21). Motion sensor cameras were placed in the field for the year of 2020 and were consistently managed weekly or biweekly to replace batteries, collect SD cards, and to ensure there was no damage or removal of the camera from its post. Figure 1 denotes the locations of each camera in a red pin, Cameras 33 and 13 are located at Marycrest Manor, Camera 20 is located at Raintree Condominiums, and Camera 21 is located at Culver City Park.
- Files were then collected and stored electronically to be sorted. Dr. Weaver, along with her lab and student assistants, flagged any photos with a coyote, squirrel, bird, rabbit, cat, opossum, skunk, raccoon, rodent (mouse), or dog. If an animal of interest was detected it would be sorted based on the number of individuals in the photo.
- Once all files were sorted, further analysis on image totals and individual in the image totals were completed to determine the prevalence of coyotes in the urban vs. rural locations. Then a sample T-Test was run on the average of coyote photos captured in the rural vs. urban locations.

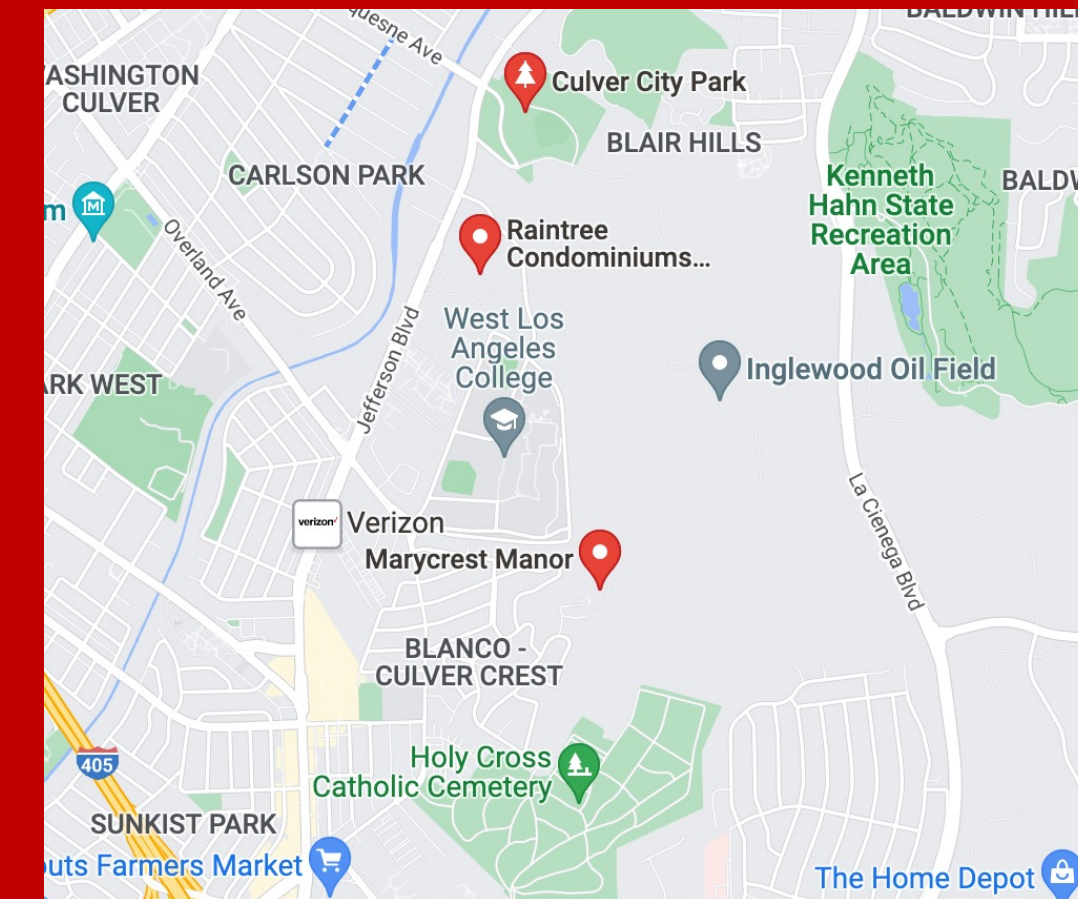


Figure 1.5



Camera 13.

Table 1. Analysis of total Coyote photos captured based on the number of individuals in each photo.

# of Individuals	Camera 33*	Camera 13*	Camera 20	Camera 21
1	521	550	405	5
2	34	62	5	0
3	4	13	0	0
Total	559	625	410	5

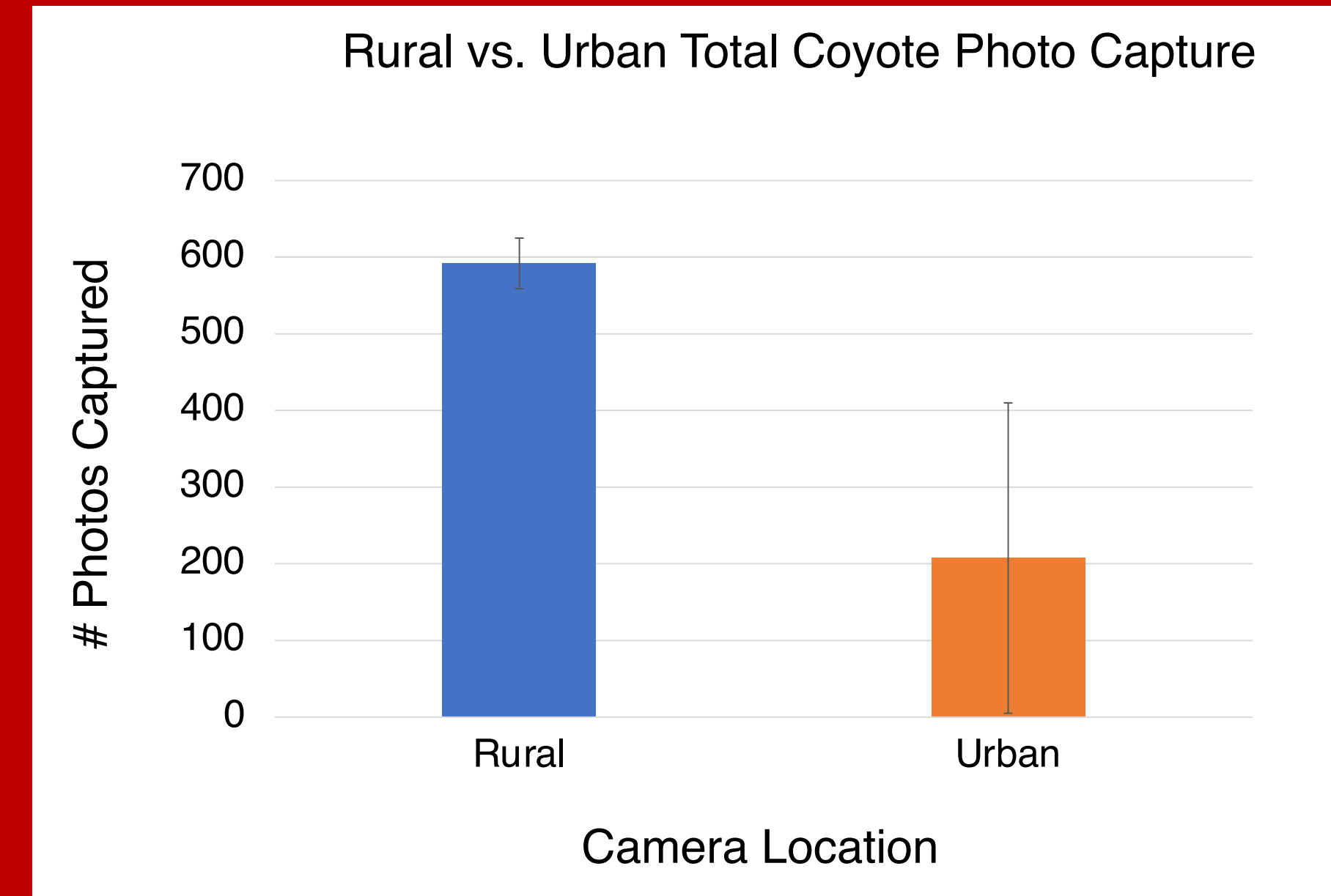


Figure 2.

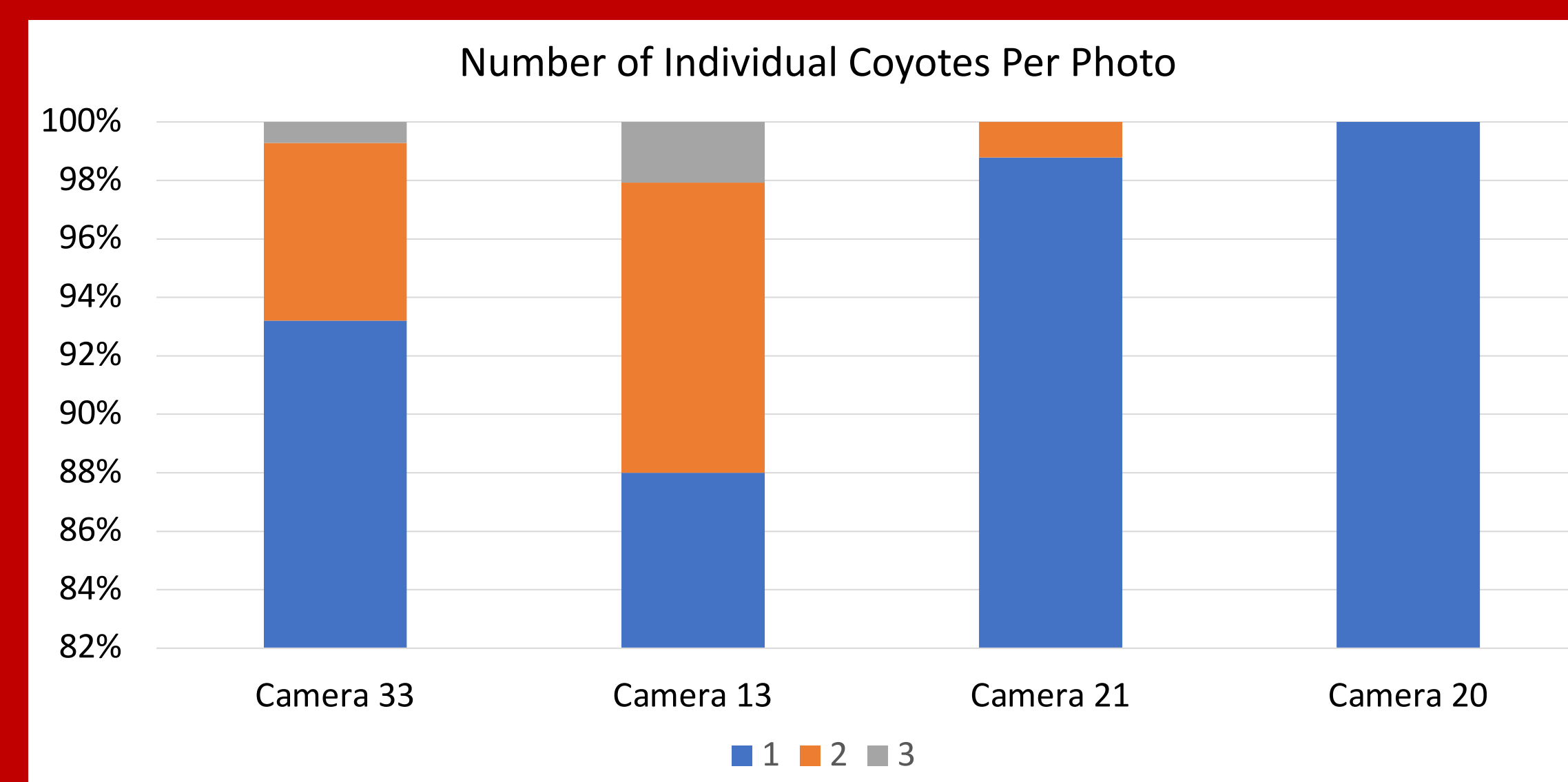


Figure 3.

Results

After analysis and sorting of the photos was complete photo totals were summarized in Table 1. The table shows the detailed analysis of the total photo captures, denoting how many individual coyotes were in each photo for each camera. Here we see the two rural cameras (denoted *) captured more photos containing coyotes than the two urban cameras. Despite these totals, due to the extremely small data size, difference was only weakly significant between rural (M=592, SD=46.67) and urban (M=207.5, SD= 286.38); t(2)=1.87, p=0.10. We see the rural mean is much higher than the urban mean (Figure 2). Figure 3 shows that rural cameras had the most diversity in individual coyote number with 6.8% and 12% respectively, of the total number of coyote photos containing more than 1 coyote as opposed to Cameras 21 and 2 with 1.2% and 0% respectively.

Conclusion

The results signal the importance of the size of the data set when interpreting results. Having four cameras limited the statistical analysis although trends emerged. Looking at Figure 2, we see that the mean total number of coyote photos for the rural locations is nearly double that of the urban location. This suggests a higher abundance of coyotes in rural areas as opposed to the more urban, as predicted. Even more important than sheer number of captured photos is the demographic data embedded in the photos. In Figure 3 we see that in cameras 33 and 13 have notably more photos that captured more than one individual coyote as opposed to the nearly 0% in the urban cameras. Coyotes live in family groups which can contain several adults as well as several puppies, however they will stray off alone to hunt or travel. With this in mind the data suggest that the coyotes captured in the urban areas are singletons, foraging away from their familial unit. The locations where more individual coyotes were captured at one time suggests that the family unit is likely near that area. This conclusion, if supported with complete analysis of the larger dataset, would confirm the majority of coyotes have dens outside of the human dominated areas.

Although, as urbanization continues to rise and educe rural habitat areas in the city, we will continue to force coyotes into anthropogenic spaces, increasing human and coyote interaction. This trend is revealed with the data collected from Camera 20, located in Culver City Park. This camera although classified as *urban* due to its location being in a heavily human occupied park, still falls near a more rural outer edge of the city at the Baldwin Scenic Overlook. This overlook would provide a more isolated area for coyotes to live, with the next closest green space for them to travel to, being the Culver City Park. Although we see a relatively high total of photos captured as opposed to the other urban location, 98.9% of those photos included just one coyote, again suggesting that those photos capture a lone coyote traveling from their den to hunt and explore. The result of having such a greenspace next to the rural edge of town is that as humans dominate the area, so do their dogs on and off leash, their small kids, and their outdoor cats. If coyotes are traveling from den sites, they will likely try to interact with humans in parks.

Anthropogenic green spaces that are right on the edge of a city bordering a largely rural area, should have rules and warnings available to keep the public safe. This understanding also aids the future city planning committees in that it should suggest that parks intended for human and pet use only be more central in the inner-city area as the traffic and many roads it would take to get there would likely deter the coyotes from frequenting such an area. Suggestions can also be put in place for homes in the area to prevent coyote attraction.

In terms of rural conservation, this data provides another solid reason for the importance of maintaining and preserving such spaces. If we continue to urbanize and diminish these areas, we are only encouraging coyotes and other animals like them to adapt to urban conditions and feel more comfortable living amongst humans. Coexistence is not meant to mean co-living with these wild animals, and in stripping them of their natural habitat we are leaving them no choice but to inhabit human dominated areas. A peaceful coexistence can occur with the proper understanding of how these animals work however it will not work with the unjust anger and fear we as a society have toward the animals at this time.

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Camera 13.