

Songbird Nestbox Monitoring Report

Cache Creek Nature Preserve and Capay Open Space Park

2022

Submitted to:

The Cache Creek Conservancy

Submitted by:

Harnawaz "Twig" Boparai

boparai@cachecreekconservancy.org

Cache Creek Conservancy

34199 Co Rd 20

Woodland, CA 95695

Abstract

In 2022, the bird monitoring interns and I checked nestboxes located at Cache Creek Nature Preserve and Capay Open Space Park in Yolo County on a weekly basis collecting data on native cavity nesting songbird abundance and diversity at both sites. Our findings showed higher abundance yet lower diversity at Cache Creek Nature Preserve due to the strong presence of preferable habitat for Tree Swallows. Capay Open Space Park had lower abundance yet higher diversity due to the park's habitat conditions and had no dominant nesting species. Further restoration work should be done at Capay Open Space Park to improve habitat conditions for higher nesting abundance in the future.

Introduction

The Cache Creek Conservancy (CCC) has performed restoration work in the lower Cache Creek Watershed for more than 25 years. During that time numerous different restoration methods have been utilized to restore the biodiversity in the watershed. One such method that is rather inexpensive and effective is installing nestboxes for breeding birds. Nestboxes are a great tool as they provide breeding habitat for cavity nesting birds that have limited natural cavities (in the form of tree limbs breaking and woodpecker excavated holes on trees) due to forest loss by human activities (like forest cuttings), but also floods, droughts, and wildfires. There are different types of nestboxes ranging from small nestboxes meant for cavity nesting songbirds to larger nestboxes meant for owls, other raptors and waterfowl.

Across the lower Cache Creek Watershed, numerous nestboxes have been established by both private landowners (such as farmers) and by environmental conservation groups (like Yolo Audubon Society and the Cache Creek Conservancy). Two locations in the lower Cache Creek watershed that have a notable number of nestboxes established are the Cache Creek Nature Preserve (CCNP) and Capay Open Space Park (COSP). These nestboxes were established to promote native cavity nesting birds to breed in the lower Cache Creek Watershed. At the CCNP, there are several nestbox types established. There are currently 16 songbird nestboxes, 18 Wood Duck nestboxes, 6 Barn Owl nestboxes, and 1

flicker nestbox. At COSP, the only nestbox type present is songbird nestboxes. There are currently 15 songbird nestboxes established across COSP.

This paper specifically will be focusing on the songbird nestboxes at both CCNP and COSP, and analyze how much nesting activity occurred in these nestboxes during the 2022 breeding season. Past and present nestbox monitoring has shown native cavity nesting songbirds have bred and raised nestlings in these nestboxes during the breeding season. Species in Northern California that have been documented breeding in these nestboxes are: Tree Swallows (*Tachycineta bicolor*), Ash-throated Flycatchers (*Myiarchus crinitus*), House Wrens (*Troglodytes pacificus*), Western Bluebirds (*Sialia mexicana*), House Finches (*Haemorhous mexicanus*), White-breasted Nuthatches (*Sitta carolinensis*), and Oak Titmice (*Baeolophus inornatus*).

Birds are ideal indicators of healthy environments as it takes select resources in the environment (sufficient food, water, shelter, presence of other organisms, etc.) for many bird species to successfully thrive (Morrison 1986). With cavity-nesting songbirds, one factor is controlled with nestbox programs; the breeding habitat. The presence of cavity-nesting songbird species can give restoration and conservation groups a sense of what cavity-nesting songbird species are capable of breeding in the given environment.

Materials and Methods

Restoration staff and interns conducted nestbox monitoring on the 16 songbird nestboxes at CCNP and the 15 nestboxes at COSP. Nestboxes were checked every week and a standard monitoring protocol was in place. Data was also collected during each monitoring session and recorded on data sheets. The data gathered from each monitoring session consisted of recording: the number of eggs laid, the temperature of the eggs, status and stage of the nest's development (if the nest was a Tree Swallow nest, the number of feathers making up the nest were also recorded with the nest stage value), the species nesting in the nestboxes, number of live and dead young in each nestbox, and status of parents (being near, in, or absent) when checking the nestbox, and the approximate age of the nestlings if applicable. Approximate age of nestlings is a valuable datum value as checking nestboxes with nestlings that are well-developed can result in the nestlings leaving the nest early, known as pre-mature fledging. Another outcome of checking nestboxes with well-developed nestlings is it can cause them to stress out and potentially die in the nestbox. To prevent these events from happening, the 2022 monitoring protocol would skip nestboxes that contained nestlings in their third week of development after hatching. The third week in nestling age is when nestlings get very restless and is typically when they start leaving the nest. After the third week passed, the staff and interns would check the nestbox on the fourth week to see if the nestlings successfully fledged (Graham 2006 and Truan 2021). If nestlings were still present in the nestbox and/or peeking their heads outside the nestbox after the third week, staff and interns would skip the nestbox again to not stress the nestlings.

Monitoring season for cavity nesting songbirds follows their breeding season starting in late February and ending in late July/early August. Both CCNP and COSP had weekly monitoring sessions for the entire breeding season in 2022. Each week, data from both sites recorded on their respective data

sheets was additionally digitized onto a Google Sheets document for further analysis. When the breeding season concluded in late July, all the data from the Google Sheets document was transferred to a Microsoft Excel document to calculate the total number of fledglings (nestlings that hatched and successfully left the nest) by species at both sites as well as the total number of fledglings at both sites with all species fledglings combined. With the total number of all fledglings, and total number of fledglings by species, the proportion of one species in a given location is calculated as:

$$P_i \text{ (proportion of a given species)} = \frac{\text{total number of individuals of the given species at the site}}{\text{the total number of all fledglings from the site}}$$

In this case, there are two study areas, CCNP and COSP. Each species with its number of fledglings was divided by the total number of fledglings from their respective site. Once all P_i values were calculated, they were plugged into a natural logarithmic formula to produce a value which was multiplied to the P_i again giving a species-specific diversity value as follows:

$$\text{Species- Specific Diversity} = P_i * \ln (P_i)$$

“ \ln ” is the natural logarithmic formula. After all the species-specific diversity values were calculated for a site, all these values were summed up together to give the Shannon-Weaver Diversity value. This value represents how diverse a given site is based on its species composition. The higher the value, the more species diverse the site is.

Another species value calculated following Shannon-Weaver Diversity was “Species Evenness” which measures how evenly species distribution at a site is. This was calculated for each site with the following formula:

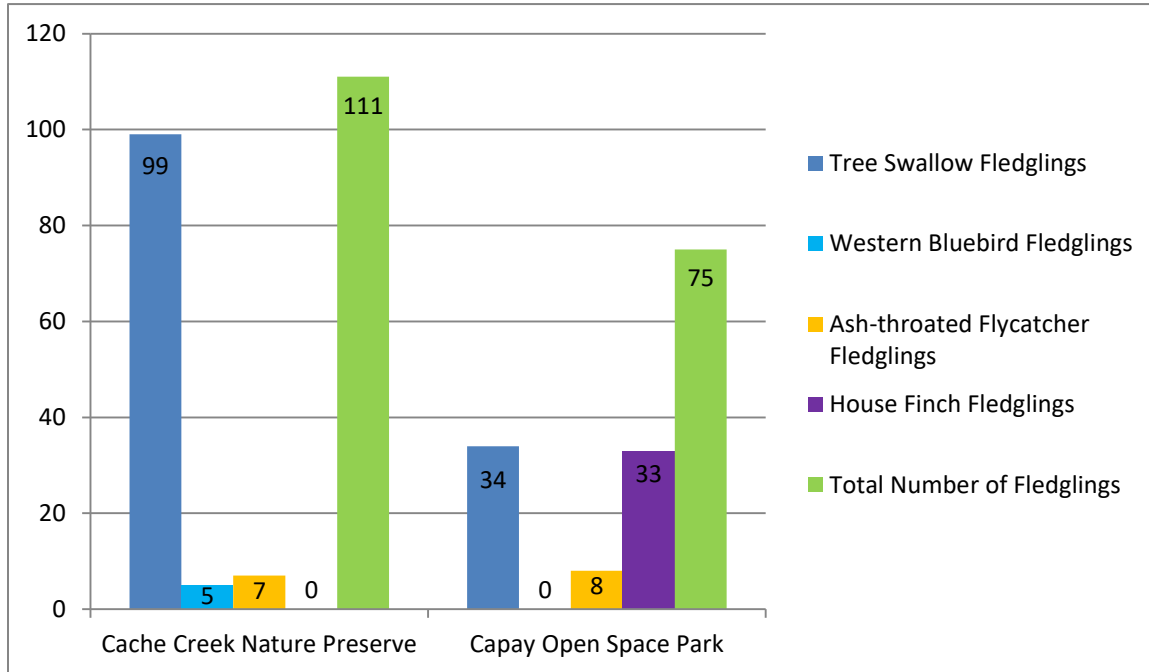
$$\text{Species Evenness} = \frac{\text{Shannon-Weaver Index}}{\ln (\text{total number of species from the site})}$$

Lastly, two more data values were calculated. First was the occupancy rate of nestboxes for each site. This was calculated by dividing the number of active nestboxes (throughout the season) at a select site by the total number of nestboxes at the select site. Second was the re-nesting rate which was calculated by taking the number of nestboxes containing a second clutch of eggs for the season from a select site and dividing by the number of nestboxes with first nesting attempts from the select site.

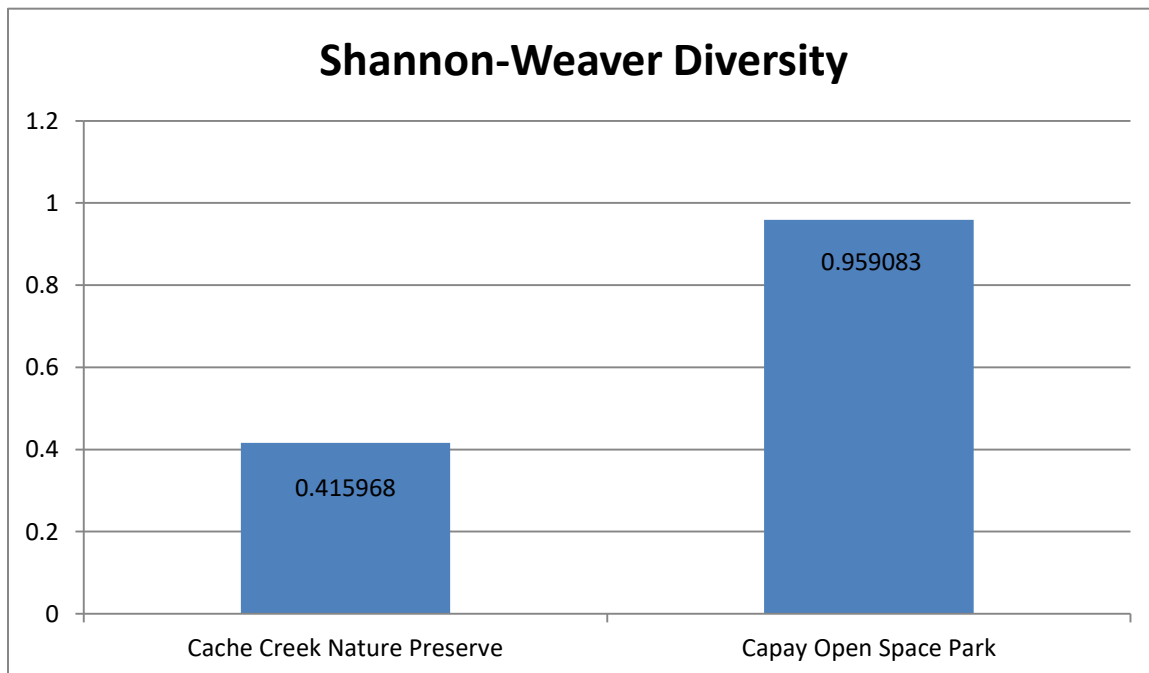
All these site specific data values were performed for both CCNP and COSP to compare and contrast the two sites, and make inferences about why the cavity nesting songbird community is currently in this given state, and what can be done to improve either or both sites to promote more cavity nesting songbird diversity.

Results

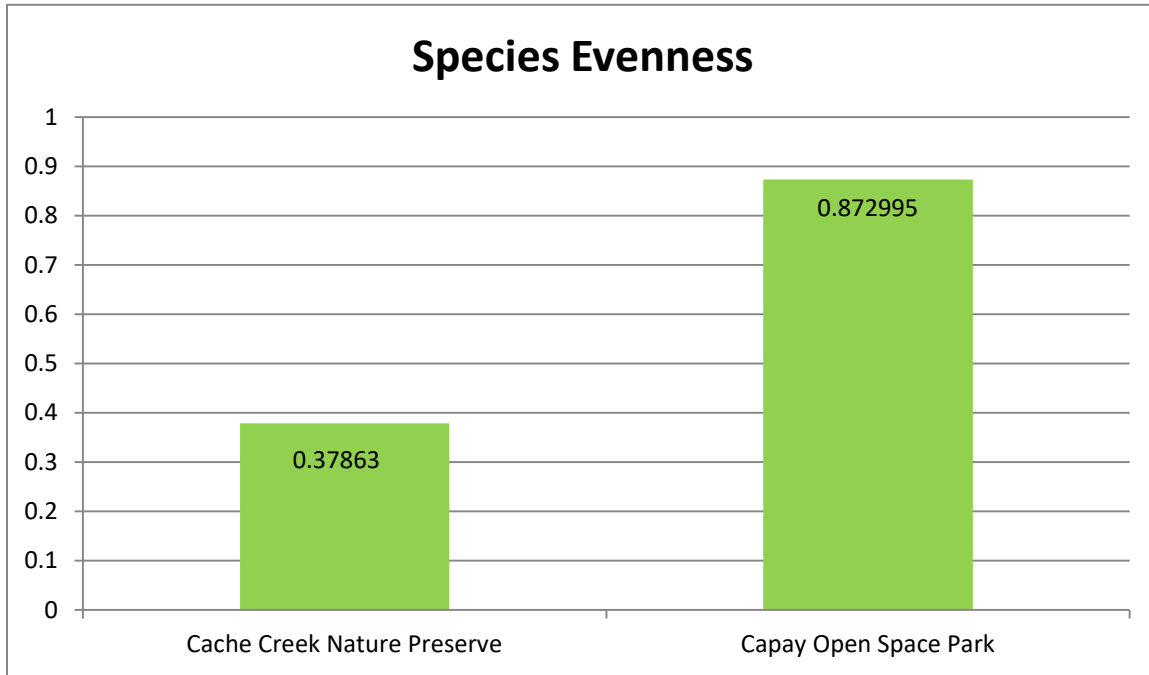
Number of Fledglings. In total, CCNP produced 111 songbird fledglings for the 2022 breeding season (99 Tree Swallow fledglings, 5 Western Bluebird fledglings, and 7 Ash-throated Flycatcher fledglings). COSP produced a total of 75 songbird fledglings for the 2022 breeding season (34 Tree Swallow fledglings, 8 Ash-throated Flycatcher fledglings, and 33 House Finch fledglings). This indicates CCNP had a larger overall abundance in total number of fledglings produced as well as producing a greater number of Tree Swallow and Western Bluebird fledglings than COSP. However, COSP did produce more House Finch and Ash-throated Flycatcher fledglings than CCNP.



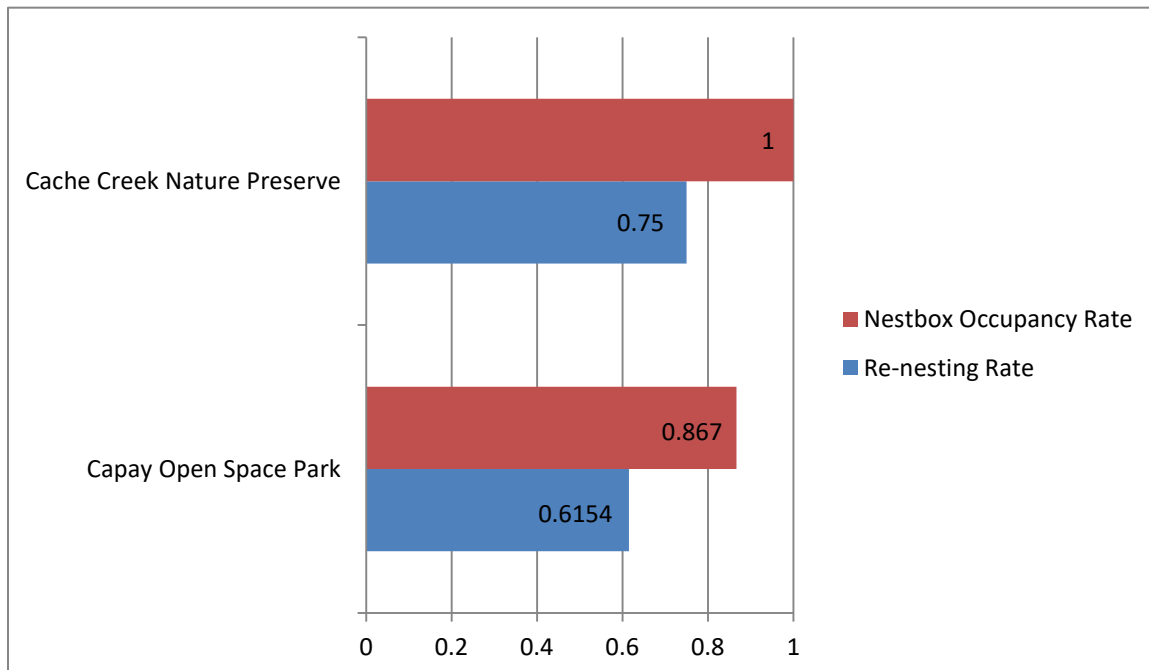
Species Diversity. For CCNP, the diversity value produced was 0.415968. COSP scored a larger diversity value at 0.959083; indicating COSP held a greater diversity in cavity-nesting songbirds for the 2022 breeding season than CCNP.



Species Evenness. CCNP scored a lower value of 0.37863 for species evenness. COSP scored a higher value of 0.872995 indicating COSP to have a more even distribution in its cavity nesting songbird community than CCNP.



First Nest Detections and Re-nesting Detections. CCNP had all 16 nestboxes occupied during the 2022 breeding season (a 100 percent occupancy rate). From those 16 nestboxes, 12 witnessed re-nesting attempts (75 percent re-nesting rate). COSP had 13 nestboxes occupied during the 2022 breeding season (an 86.7 percent occupancy rate). From those 13 nestboxes, 8 witnessed re-nesting attempts (61.54 percent re-nesting rate).



Discussion and Conclusion

Prior to the 2022 breeding season, CCNP would always yield Tree Swallows making up most of the cavity nesting songbird nestbox activity. The reasoning is nestbox placement. Of the 16 songbird nestboxes at CCNP, 12 are located near a body of water (whether it is a wetland, creek, large puddles, sloughs, etc.). Having water and easy access to water are the key components for Tree Swallows when nesting because nestlings are primarily fed aquatic insects during their development (Robertson and Rendell 1990). There are numerous water-rich localities located throughout CCNP: a large wetland on the northwest side, Cache Creek located on the south side, and two seasonal sloughs that flow on the north side. The overall habitat and nestbox placement at CCNP is more preferable for Tree Swallows than other cavity nesting songbirds.

Other species documented at CCNP during the 2022 breeding season (Western Bluebirds and Ash-throated Flycatchers) saw less breeding activity due to three factors: habitat placement, spacing, and time of breeding relative to Tree Swallows.



Left to Right: Tree Swallow nest (from CCNP), Western Bluebird nest (from COSP), Ash-throated Flycatcher nest (from COSP). Photos by Harnawaz Boparai.

Breeding time period is a significant factor to the reduced reproduction from Western Bluebirds and Ash-throated Flycatchers in 2022 at CCNP. Overall, bird breeding season in Northern California extends from February to the end of July. Species-specific breeding seasons do not encompass this entire time period. For example, Ash-throated Flycatchers are late arrivals coming from Neotropical America and typically arrive mid-April at the earliest. Tree Swallows have been documented (both from monitoring in lower Cache Creek and other studies elsewhere in the United States) starting their nests as early as late-February/early-March. Evidence of this from the 2022 breeding season occurred in late

February; one of the 16 nestboxes at CCNP already had a Tree Swallow nest fully lined ready for eggs to be laid. The following week, 5 Tree Swallow eggs were laid in the nestbox. Western Bluebirds also tend to breed later than Tree Swallows starting around mid-April.

Habitat is another component working against Western Bluebirds as they prefer open grasslands and woodlands more than riparian zones and waterways. Ash-throated Flycatchers are more flexible with habitat selection. They are known to nest near water (like Tree Swallows), but also riparian zones, deserts, open country, woodlands, and parks. So habitat would not be a factor preventing numerous Ash-throated Flycatchers nesting at CCNP.

The final factor owing to fewer Western Bluebirds and Ash-throated Flycatchers nesting at CCNP is intraspecific territoriality and competition (meaning animals being competitive and territorial with other members of the same species). Tree Swallows are a unique cavity nesting songbird species as they are not significantly territorial to other Tree Swallows. Nestboxes with Tree Swallows present can be 35 feet apart, and nesting pairs will not become aggressive with neighboring breeding pairs. Western Bluebirds and Ash-throated Flycatchers are harsher and more territorial with nearby conspecifics. Western Bluebird nests have to be at least 215 feet apart to ensure breeding pairs don't become aggressive to neighboring bluebirds. Similarly, Ash-throated Flycatcher nests have to be at least 200 feet apart to ensure minimal territoriality between neighboring nesting animals.

In conclusion, nestbox placement near water sources, the species-specific time of breeding, and intraspecific territoriality are the key factors promoting Tree Swallows to be the dominant native species breeding at the CCNP's songbird nestboxes in 2022.

COSP represents a unique data set in regard to species. COSP has no dominant native species occupying most of the nestboxes. The number of Ash-throated Flycatcher nests and fledglings is similar to CCNP. Tree Swallows are not as abundant there (both from the number of nests and fledglings) when compared to CCNP. Tree Swallow nesting abundance is rivaled by House Finch nesting abundance at COSP. House Finch nesting activity in nestboxes is not a regular occurrence nor is it a rare occurrence. It is typically not expected as House Finches normally nest in plants (like conifers, cacti, and palms), manmade structures, or a combination of the two (ivy on buildings and hanging planters). Studies across North America have documented House Finches on occasion nesting in nestboxes, but in Yolo County records of House Finch nestbox activity are rare. Putah Creek's songbird nestbox program (led by the UC Davis Museum of Wildlife and Fish Biology) has documented one House Finch nest in their study over the last 20 years across from more than 500 nestboxes in the Putah Creek watershed. Factors contributing to the significant presence of House Finches at COSP are: the habitat conditions of COSP for other cavity nesting songbirds and the natural history of House Finches.

For habitat conditions of COSP compared to CCNP, multiple differences arise, perhaps the largest being the area. CCNP is approximately 130 acres in area while COSP is approximately 41 acres in area. In general, there is one nestbox every 8 acres at CCNP while there is approximately one nestbox every 2.5 acres at COSP. Nestboxes at COSP are spaced much closer together than at CCNP. This makes COSP not a preferred habitat area for large numbers of highly territorial, native songbird species such as

Western Bluebirds and Ash-throated Flycatchers. This doesn't mean these species won't breed at this location (as the data supports otherwise). It means there won't as many breeding there in large numbers. This explains why 1-2 nests for both Ash-throated Flycatchers and Western Bluebirds each were present throughout the entire 2022 season at COSP. Much like Tree Swallows, House Finches are not significantly territorial with members of their own species. In fact, most House Finches that occupied nestboxes at COSP were chronologically next to each other. This makes sense as House Finches live in flocks outside the breeding season and typically birds pair up with conspecifics within the flock.

Another habitat condition of COSP contrasting it from CCNP is fewer habitat types. CCNP possesses Cache Creek, a wetland, oak woodland area, open grassland, riparian forests, and a human parking lot and office area. COSP possesses only an open area with a few scattered trees (of which a couple are mature) and a human parking lot area. Cache Creek is directly south of COSP and partly east of COSP. There are also two lakes north of COSP further in a mining area directly north of COSP. So water is nearby, but not as near the nestboxes as they are at CCNP. This partially explains why fewer Tree Swallows were nesting at COSP. Because of the fewer habitat types at COSP, the park is preferable for native songbirds (like House Finches) that are tolerant of recently disturbed and restored areas.

The sparse mature tree canopy at COSP is another condition to consider; as songbirds need cover from potential predators throughout the year (not just the breeding season). COSP possesses two mature oaks, and one mature cottonwood on the northwest side. There are several smaller trees spread throughout (such as redbud, elderberry, and some pine), but none of these small trees are large enough to be sufficient cover for songbirds when evading potential predators like birds of prey. Large trees also provide significant shade and heat relief for animals. This is important for songbirds as breeding season pushes into summer throughout June and July (when heat sharply increases). Having large trees provides heat relief both for parents and fledglings. This may lead to preference with nestbox selection as songbirds will select nestboxes closer to trees and other forms of cover rather than nestboxes with no potential cover nearby. Songbirds nesting in areas with less cover are more at risk of fledgling mortality. This is prominent in the COSP 2022 data as two Western Bluebird nests (at separate times of the season) raised nestlings, but the nestlings died in their second week of development. The nestbox was located in an open grassy area of COSP approximately 90 feet away from the nearest tree.

With all the conditions COSP possesses, it has a higher species evenness value and diversity value than CCNP. The reason for this is there is no dominant songbird species occupying most of the nestboxes; unlike CCNP where Tree Swallows are dominant due to habitat diversity and easier access to water. COSP is less preferable for Tree Swallows, thus there are more nestboxes available for other species to utilize during the early months of the breeding season. This statement should be further examined in future seasons when water is more abundant in the lower Cache Creek watershed to assess if Tree Swallows will utilize more nestboxes at COSP during that time. The reduced number of Tree Swallows also can be a contributor to the reduced re-nesting rate calculated for COSP. Tree Swallows frequently re-nest and have a second brood of eggs and nestlings following their first clutch. Western Bluebirds can re-nest as well, but not as frequently as Tree Swallows. Ash-throated Flycatchers rarely re-nest as they are late arrivals in the breeding season, and can only raise one brood of eggs.

House Finch nesting behavior and natural history is unique compared to the other songbird species found in the nestboxes. The best example of this is the number of broods/clutches they can have in a single season. One House Finch nesting pair can have more than three broods in one breeding season, and can have a couple of clutches they are simultaneously tending to at a time (Evenden 1957). They also have no particular habitat preference for breeding, often being found in urban cities and parks (Graham 1988). And unlike Tree Swallows, Ash-throated Flycatchers, and Western Bluebirds (which all mainly feed on insects), House Finches are very herbivorous feeding on seeds, buds, and berries. Occasionally they will feed on insects, but not the types of insects which other cavity nesters feed on. House Finches prefer small insects like aphids. Tree Swallows prefer aquatic based insects like mosquitoes and moths. Ash-throated Flycatchers prefer flying insects like flies, beetles, and wasps. Western Bluebirds mainly feed on insects during the breeding season; especially ground-based insects such as grasshoppers, ants, and beetles. House Finches face little competition with the other species from a feeding perspective. Perhaps their habitat requirements and resources (access to water, food availability, amount of cover, etc.) are more satisfactory at COSP than they are for the other species coupled with their tendency to not be territorial to other House Finches. This is apparent with how sparse the ground vegetation community is at COSP. There are fewer ground level plants (that are active year around) compared to CCNP. Future restoration efforts at COSP involving additional plantings could make the habitat more preferable for other songbird species coupled with additional tree canopy cover if applicable.



House Finch nest at COSP from the 2022 breeding season
Photo by Harnawaz Boparai

In conclusion, CCNP yielded more fledglings, nests, re-nesting attempts, and showcased Tree Swallows to be the dominant species utilizing the nestboxes for the 2022 breeding season. COSP had fewer nests, fledglings, and re-nesting attempts, but it had a greater diversity and even number of

breeding species distributed over the course of the 2022 breeding season. Further restoration work at COSP (in the form of increased plantings and canopy cover) could yield more fledglings and species and become a prime location for cavity nesting songbirds in the future.

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