

2022 Breeding Bird and Avifauna Assessment of the Cache Creek Nature Preserve

Submitted to:
The Cache Creek Conservancy

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Introduction

The Cache Creek Nature Preserve (hereafter CCNP) is a 130-acre parcel of land situated next to the Cache Creek watershed near the city of Woodland. The preserve was established in 1999 and is managed by the Cache Creek Conservancy (hereafter CCC). Various restoration methods are utilized to manage and recover CCNP to a more natural state after being heavily mined for gravel and propagated with invasive non-native plants (such as *Arundo* and *Tamarix*). Once these restoration efforts are performed, monitoring must happen to see the progress of how biodiversity has changed from the restoration efforts.

One monitoring method that has been conducted since the inception of the CCNP is performing avian point count surveys in the riparian habitats and corridors. This monitoring method is cost-effective as each field visit may only consume several hours, can collect sufficient data in a short period of time, and focuses on one group of organisms for indicating the habitat's health.

Birds are an optimal group of organisms for measuring biodiversity success in riparian habitats due to how frequently migratory birds reside in riparian habitats rather than other dominant habitat types like woodlands and grasslands (Bryce et al. 2002). Riparian habitats are a unique habitat where aquatic abiotic and biotic features can overlap with terrestrial and sometimes arboreal abiotic and biotic features. Past studies in different parts of the world have shown bird communities are representative of riparian habitat health (Larsen et al. 2010). There are multiple reasons for this, but the two main reasons (which are applicable to CCNP) are riparian canopies are ideal for bird roosting and nesting, and a preferable habitat for many insects and other invertebrates that have an aquatic phase in their life stages (Darveau et al. 1995). These invertebrates are key prey items for many insectivorous birds during the breeding season at CCNP such as Tree Swallows (Mengelkoch et al. 2004). Overall, riparian habitats benefit bird species with food availability, cover, and breeding habitat.

Since CCNP's establishment in 1999, two avian point count survey studies occurred looking at the avian abundance and diversity in response to habitat restoration. The first study was performed in 1999 when CCC initiated an intensive *Tamarix* and *Arundo* eradication program at CCNP (Truan 2002). Conducted by the University of California, Davis Department of Wildlife, Fish, and Conservation Biology (hereafter UC Davis), the group performed avian point count surveys and vegetation physiognomy surveys at the riparian corridor of Cache Creek located on the south side of CCNP. These surveys occurred both before treatment (in the 1999 breeding bird season) and after treatment (in the 2001 breeding bird season). Their findings showed an immediate reduction in avian species richness and abundance following treatment. However, native plant recruitment increased due to the eradication of *Arundo*. The initial decline in avian diversity was expected. Overtime native plant recruitment would compensate and produce potential breeding bird habitat on par to pre-treatment conditions.

The second CCNP avian point count survey study happened in 2011 (DiGaudio 2011). Conducted by Point Reyes Bird Observatory (now known as Point Blue Conservation Science), the group performed two avian point count surveys on riparian zones located on both the north and south sections of CCNP. They also performed standardized area search avian surveys on two riparian zones off-site from but adjacent to CCNP. Approximately 50 species were detected at CCNP and the adjacent riparian zones. However, some species from the 2002 study were not detected in 2011 such as Spotted Towhees and Green Herons. Since 2011, no formal bird survey study has been conducted at CCNP.

In the late spring and early summer of 2022, a CCC biologist followed up to these prior studies and conducted standardized bird surveys to document and assess the breeding bird community of the CCNP riparian area.

Methods

A. Field Methods and Data Collecting

For surveying CCNP, I used standardized 10-minute variable circular plot point county surveys during the breeding season. Point count surveys are designed to assess landbird presence/absence, diversity, and abundance (Ralph et al. 1995). Eight point count stations/plots were established throughout

the riparian areas of CCNP. Five of the eight stations were also stations from the 2011 study. Three stations (all of which were established on the north side of CCNP) were each relocated 10 to 20 meters west from their 2011 locations. All eight stations' GPS coordinates are in the table below (Table 1). All stations were established at least 200 meters apart from each other to ensure independence of observations between points.

Table 1. Geographic locations of avian point count stations

Station	Latitude	Longitude
1	38.691335	-121.876003
2	38.690730	-121.873480
3	38.690192	-121.870632
4	38.689022	-121.868258
5	38.688737	-121.870510
6	38.688785	-121.872912
7	38.688147	-121.874740
8	38.686733	-121.877083

Point count surveys began at sunrise and were completed within 3 hours of the start time. Each station was approached with caution and silence. Any flushed birds (from approaching the station) were included in the count. Each station was surveyed for 10 minutes, in which abundance and distance from observer were recorded for each species. Each bird detection was classified into a distance bin representing the distance away from the station the bird was first detected; the bin intervals were 0-50 meters and greater than 50 meters. Species and the number of individual birds (per species) detected in the 0-50 meters bin were included in the dataset analysis and complete listing of species. Species and individual birds detected in the greater than 50 meters bin were omitted from the dataset analysis, but were added to the complete listing of species detected at the CCNP.

Four point count surveys were performed during the 2022 breeding season on four separate dates: April 28th, May 9th, May 24th, and June 7th. To ensure temporal bias would not occur, each date had a different order the stations were surveyed. On April 28th, the stations were surveyed in this order: 1, 2, 3, 4, 5, 6, 7, and 8. On May 9th, the stations were surveyed in this order: 8, 7, 6, 5, 4, 3, 2, and 1. On May 24th, the stations were surveyed in this order: 3, 2, 1, 8, 7, 6, 5, and 4. And on June 7th, the stations were surveyed in this order: 4, 5, 6, 7, 8, 1, 2, and 3. The last temporal factor in the point count surveys was a wetland prescribed burn occurred on April 28th in the morning approximately 3 hours after sunrise time. The point count surveys on April 28th started prior to this event and were completed 30 minutes before the burn started. This ensured there was point count data prior to the burn. Only one point station had overlap with the burn area, station one and the damage that occurred there was minimal.

For each species detected, breeding status was another data value recorded. Breeding status involved any field observations of the given species breeding in CCNP during the 2022 breeding season. Examples of this include parent bird(s) incubating eggs or feeding young, finding a nest of the species with or without presence of the parents, seeing young traveling with their parents outside of the nest setting, witnessing a bird colony making nests (such as Cliff Swallow colonies), and looking at data from other studies and sites of the 2022 breeding season in the lower Cache Creek watershed to verify species breeding outside of visual observation accounts (such as the nestbox reports for CCNP and COSP). If species were confirmed breeding in CCNP during the 2022 breeding season, they were noted as a “yes” for their breeding status. Species that were not confirmed breeding at CCNP, but were breeding at other locations in the lower Cache Creek watershed and/or in previous breeding seasons at CCNP, were noted as “no” but had further explanation in parentheses about breeding records elsewhere and/or past breeding seasons.

Lastly, 12 species were noted if observed during point count surveys: Ash-throated Flycatcher, Black-headed Grosbeak, Common Yellowthroat, Nuttall’s Woodpecker, Lazuli Bunting, Least Bell’s

Vireo, Song Sparrow, Spotted Towhee, Yellow-breasted Chat, Yellow-billed Cuckoo, Yellow Warbler, and Swainson's Hawk (Central Valley Habitat Exchange 2022). According to Central Valley Habitat Exchange, these species are riparian focal species in the Central Valley and are of conservation concern. These species are ideal indicators of riparian habitat health in the Central Valley, so their presence, abundance, and breeding status are ideal to showcase the habitat quality CCNP can support.

B. Data Analysis

Data collected from all dates and stations were compiled using Microsoft EXCEL. For each species, an abundance index was calculated by dividing the total number of birds detected (for that species) by the sampling effort (which is four as it was four surveys for each station). This was done for each species at station. Therefore the total abundance index for each species is a sum of all eight point count stations' abundance indices for each species. As stated in the Field Methods section, all birds detected at all distances were included in the master species list (see table below), only birds detected within the 50 meter point count stations were included in the data analysis.

After species-specific abundance indices were calculated and breeding status for species were entered onto the master species list, station-specific abundances and species richness were calculated. Station-specific abundance was calculated by taking the sum of the total number of individual birds detected from each site across all four sites and dividing that by the sampling effort. Site-specific species richness was calculated by taking the sum of the total number of species detected from each site visit and dividing that by the sampling effort. Four remains the sampling effort for both calculations as that is the number of site visits to each station during the season. With these calculations, it can showcase which station(s) possess higher local avian abundance and species diversity. Sites with higher values in either or both data parameters are "hotspots" while those lower in abundance and species richness could be future targets for additional environmental enhancement.

Lastly, species richness was compared to the two prior studies from 2002 and 2011 to see long-term trends in avian diversity at CCNP. Two separate bar plots were made. One containing the masters species list for each of the three studies, and the other containing only the species detected within the point count stations. This information can show the long-term trend in bird species utilizing CCNP as a potentially valuable location during the breeding season.

Results

Species richness for the 2022 breeding season yielded 71 species across all distances at CCNP (see master species list provided in the following two pages). Within the point count stations, a total of The most common species detected were both year-round resident species (such as Mourning Doves, House Finches, and Red-winged Blackbirds) and swallow species that utilize CCNP during the breeding season (such as Tree Swallows and Cliff Swallows). With the exception of a few species, most of the species detected were generalists that are found frequently in other parts of Yolo County. Also, most species detected were not ground-based nesting birds. The only ground-nesting species detected that were confirmed breeding were California Quail and Killdeer. 12 species were confirmed breeding at CCNP throughout the 2022 breeding season (Wood Duck, California Quail, Killdeer, Swainson's Hawk, Nuttall's Woodpecker, Black Phoebe, Ash-throated Flycatcher, Tree Swallow, Barn Swallow, Cliff Swallow, Bushtit, and Western Bluebird).

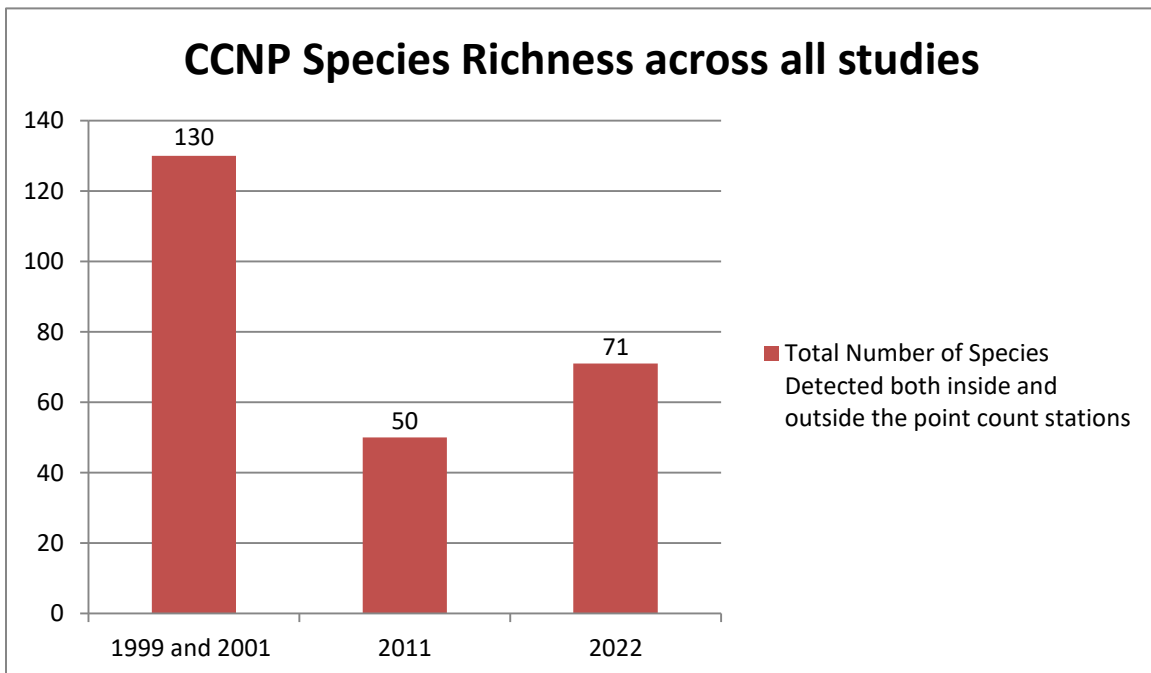
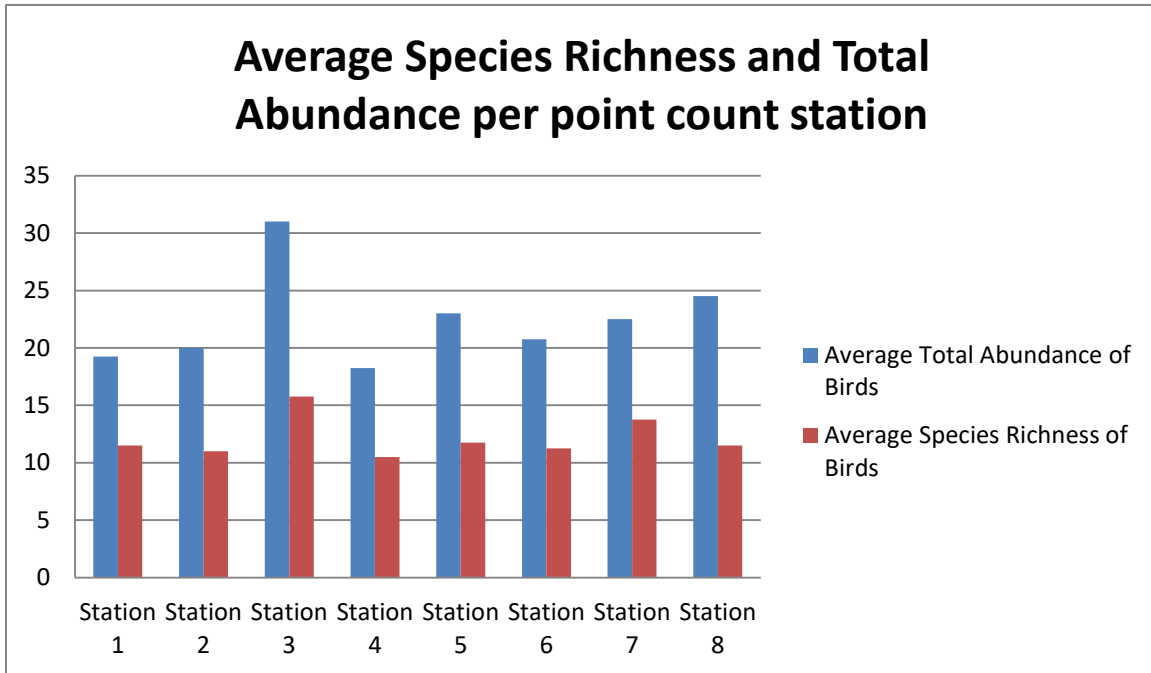
Of the 71 species detected, eight are species of significant conservation interest according to the Central Valley Habitat Exchange. These species are bolded in the table below (Swainson's Hawk, Nuttall's Woodpecker, Ash-throated Flycatcher, Common Yellowthroat, Yellow Warbler, Spotted Towhee, Song Sparrow, and Black-headed Grosbeak).

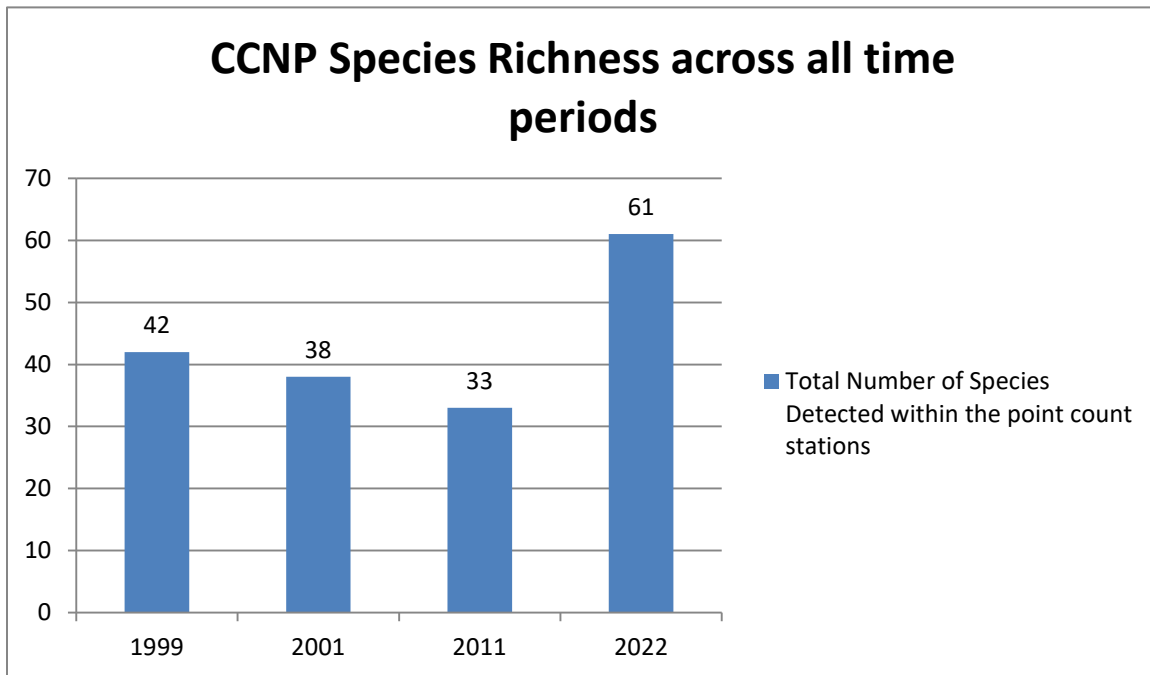
Species from the 2022 Avian Point Counts	2022 Abundance Index	Confirmed Breeding at CCNP in 2022
Canada Goose	-	No
Wood Duck	0.75	Yes
Mallard	0.5	No
California Quail	5.75	Yes
Wild Turkey	-	No
Pied-billed Grebe	0.75	No (but have bred at CCNP in the past)
Rock Pigeon	-	No
Eurasian Collared-Dove	2	No
Mourning Dove	9.5	No (but were breeding in other parts of the watershed)
Anna's Hummingbird	4	No
Black-chinned Hummingbird	0.25	No
Common Gallinule	0.75	No (but have bred at CCNP in the past)
Killdeer	0.25	Yes
Spotted Sandpiper	0.25	No
Double-crested Cormorant	0.25	No
Great Blue Heron	-	No
Snowy Egret	-	No
Great Egret	-	No
Turkey Vulture	0.25	No
Northern Harrier	0.25	No
Red-shouldered Hawk	-	No
Swainson's Hawk	0.5	Yes
Red-tailed Hawk	-	No (but were breeding in other parts of the watershed)
Belted Kingfisher	1	No
Nuttall's Woodpecker	6	Yes
Downy Woodpecker	0.75	No
Northern Flicker	2.5	No
American Kestrel	-	No
Black Phoebe	3.25	Yes
Ash-throated Flycatcher	6.25	Yes
Western Kingbird	2.25	No (but have bred at CCNP in the past)
California Scrub-Jay	8.25	No
American Crow	-	No
Common Raven	1.25	No
Tree Swallow	10.75	Yes
Barn Swallow	3.75	Yes
Northern Rough-winged Swallow	2.75	No (but were breeding in other parts of the watershed)

Cliff Swallow	30.25	Yes
Bushtit	4	Yes
White-breasted Nuthatch	0.25	No (but were breeding in other parts of the watershed)
House Wren	3.75	No (but were breeding in other parts of the watershed)
Bewick's Wren	6.5	No
Western Bluebird	1.25	Yes
Swainson's Thrush	0.25	No
Hermit Thrush	1.5	No
American Robin	0.25	No
Northern Mockingbird	0.5	No
California Thrasher	0.25	No
European Starling	9.75	No (but have bred at CCNP in the past)
Cedar Waxwing	1.5	No
Phainopepla	0.75	No
House Sparrow	0.75	No
House Finch	9	No (but were breeding in other parts of the watershed)
American Goldfinch	1.75	No
Lesser Goldfinch	4.25	No
Common Yellowthroat	0.25	No
Yellow Warbler	0.25	No
Yellow-rumped Warbler	0.5	No
Townsend's Warbler	0.25	No
Wilson's Warbler	0.5	No
Spotted Towhee	0.5	No
California Towhee	3	No (but have bred at CCNP in the past)
Grasshopper Sparrow	0.25	No
Song Sparrow	1.5	No
Western Tanager	0.5	No
Black-headed Grosbeak	1.5	No
Red-winged Blackbird	11.75	No
Brewer's Blackbird	0.5	No
Brown-headed Cowbird	5.25	No
Great-tailed Grackle	0.25	No
Bullock's Oriole	1.5	No
71 species	179.5	12 species total

Eight species were common at all point count stations in 2022: Eurasian Collared-Dove, Ash-throated Flycatcher, California Scrub-Jay, Tree Swallow, Cliff Swallow, Bewick's Wren, European Starling, and California Towhee.

From the 8 point count stations surveyed, the average species richness (number of species detected per point) was 12.13 species. For average total abundance (total number of birds detected per point), 22.41 birds per point was calculated. Nearly all point count stations had a similar range of values for average total abundance (18 to 25 individual birds) and species richness (10 to 15 species) except station 3 (yielding an average total abundance of more than 30 individual birds and an average species richness of more than 15 species).





Discussion

The riparian habitat and associated bird community at CCNP has improved over the last decade since the last avifaunal study in 2011. Certain species that were absent in the 2011 study (but present in the 2022 study) were detected in this study such as Spotted Towhees and American Goldfinches. There are still some species that have not been detected since the 2002 study. For example, some species of flycatchers (such as Pacific-slope Flycatcher and Western Wood Pewee) and Loggerhead Shrikes prefer wooded areas that CCNP possesses.

The overall abundance index value is the largest to date since the founding of the CCC with an estimated 179.5 abundance index. The next largest avifaunal abundance index value was from the 1999 point count surveys before *Arundo* treatment (that value was 106.33). The most likely reason why the 2022 abundance value is statistically large is due to confirmed breeding species having large species-specific abundance values. For example, Cliff Swallows have the largest species-specific abundance value at 30.25. There is strong evidence for this value being large due to the presence of two large Cliff Swallow colonies (one located on a county road bridge near station 4 and another located on a former conveyer bridge near station 8) at CCNP; both containing colony numbers of at least 100 animals.

Another supporting example is Tree Swallows that utilize the songbird nestboxes installed at CCNP. Another CCNP study conducted during the 2022 breeding bird season looked at the cavity nesting songbird activity occurring at CCNP's songbird nestboxes and estimated 131 Tree Swallow eggs were produced and 99 successfully fledged (Boparai 2022). This data supports the Tree Swallow abundance value being 10.25 for this study. The same can be said for the abundance values of Western Bluebirds and Ash-throated Flycatchers; with the 2022 nestbox data supporting the estimated species-specific abundance values presented here. Overall, 2022 bird breeding activity and success does support this study's species-specific abundance values, and showcases breeding birds to be the main contributors to the cumulative abundance.

Successful bird breeding activity can also be correlative for breeding site fidelity; meaning the species is more likely to return to a designated site if they achieved reproductive success in prior breeding seasons (Bollinger et al. 1989). The Cliff Swallow colonies are an example of this as one of the two colonies (located on the county road bridge near station 8) was present during the 2011 study's point count surveys (DiGaudio 2011). At the time, they estimated at least 100 pairs were present in the colony. Some species (like swallows and cavity-nesting birds) have breeding-site fidelity towards CCNP and other parts of the lower Cache Creek watershed due to numerous years of reproductive success.

Station 3 contains the highest avian abundance and species richness of all the point count stations. The reasoning is it is an ideal location and refuge for avian offspring in their post-fledgling life stage. Recent studies looking at songbird offspring leaving the nest show they prefer to be in dense canopy areas as it reduces potential predation (Jones et al. 2017 and Trumbo et al. 2019). Station 3 has more closed and dense vegetative canopy compared to other point count stations (with the exception of station 4). And on three of the four survey dates, I detected fledglings flying within station 3's 50 meter radius. On April 28 2022, a recently fledged Tree Swallow clutch was detected there (consisting of 6 animals). On May 9 2022, a recently fledged Black Phoebe clutch was detected there (consisting of 5 animals). And on June 7 2022, both a recently fledged Nuttall's Woodpecker clutch (consisting of 4 animals) and Western Bluebird clutch (consisting of 5 animals) were detected at station 3 as well. The Western Bluebird clutch is significant as a Western Bluebird clutch of 5 fledged from a nestbox (between May 21 2022 and May 28 2022) over 180 meters away. Likely the fledged clutch observed at station 3 is the same clutch that fledged from the nestbox.

Station 3 serves as a refuge for birds during their post-fledging stage as post-fledging groups of birds were not detected at the other seven point count stations throughout the 2022 breeding season. The combination of dense vegetation from the oak woodland and riparian habitats also make it ideal for numerous species of different habitat preferences. Evidence supporting this claim is the presence of the Western Bluebird fledglings as Western Bluebirds' preferred habitat are open grasslands and oak woodlands (Wightman and Germaine 2006).

Another considering factor is an ordinance went into effect earlier in the 2022 breeding season (around late March) prohibiting the recreational usage of OHVs (off-highway vehicles) in the lower Cache Creek watershed. This ordinance can be another key factor contributing to the increased avian abundance as stations 4, 5, 6, 7, and 8 were all adjacent to or near OHV pathways. OHV activity is environmentally detrimental in numerous ways. First, they frequently drive on paths in the watershed hindering native plant recruitment, damaging beaver dams in the creek, and crushing wildlife that can't move out of the way quickly. Another detriment they have is noise pollution in the sound of the motor engines travelling throughout the watershed. This is a very crucial factor during the bird breeding season as this is when birds (particularly males) are most vocal. And numerous studies looking at human-impacted landscapes show birds resort to vocalizing at higher volumes and frequencies to compensate for the noise pollution which costs more energy for the birds (Brumm 2004).

Noise pollution also reduces breeding species richness meaning fewer birds will breed in areas with high noise pollution (Francis et al. 2009). To date, the number of species confirmed breeding at CCNP in the 2022 breeding season is the largest number of confirmed breeding species to date in the CCC's records. This can be a result of the OHV ordinance; however a future study is needed to confirm this as the case (preferably another breeding bird survey in the next year or two).

Finally another key restoration practice happening at the CCNP on a more frequent basis (since 2011) to improve habitat quality are prescribed burns and cultural burns. Burning is an effective restoration tool as it can deplete some non-native plant species and improve habitat quality for native plant species (Grace et al. 2000). Regarding bird communities, some species not only respond to but prefer areas that witness high severity burns for breeding purposes like the Black-backed Woodpecker (Stillman et al. 2019). Some species have mixed responses to burns depending on the habitat. Spotted Towhees are an example of this, and perhaps can explain why they were present in the 2022 breeding season.

Other bird species can be negatively impacted by fires as it can reduce potential cover and food resources (Mendelsohn et al. 2008). An example of this at Cache Creek is Anna's Hummingbirds relying mainly on the non-native tree tobacco *Nicotiana glauca* for pollination. Tree tobacco is abundant across the entire lower Cache Creek watershed, but is not a fire adapted species. Thus, loss of tree tobacco would reduce food availability for Anna's Hummingbirds. There are three components necessary for native birds to persist and be abundant in areas of regular burning which are: 1) unburned cover near treatment sites, 2) the habitat remains suitable after the fire, and 3) the bird species are very mobile and can relocate themselves depending on the severity of the burn(s).

In the case of CCNP, the prescribed wetland fire (on April 28 2022) impacted only one point station, station 1. As stated in the methods, the point count surveys on April 28 were finished 30 minutes prior to the start of the burn, so the avian abundances and diversity values for April 28 were not affected by the burn. However it is likely that the data from May 9, May 24, and June 7 for all eight point count stations were affected by the burn. With the point count stations being situated in riparian corridors, vegetation and habitat quality were not affected within each count circle by the burn. The key variable is avian movement after the burn with avifauna seeking the nearest location from the burn site to offer cover, which in this case are the riparian corridors as they surround the CCNP's wetland area. But the data shows otherwise as daily abundance and species richness for each point count station are stable and consistent with all other dates for any select point count station; meaning the burn did not cause an increase in birds being found in riparian corridors. The wetland fire's effect(s) on the CCNP riparian bird community (at the moment) appears to be minimal. However this can only be further supported with future studies at CCNP by continuing to perform avian point count surveys both prior to and after burn treatments.

The final variable to address with prescribed burns is the timing of prescribed burn events relative to the breeding bird season. There is a knowledge gap in the literature on whether to preferably burn outside the breeding bird season or within the breeding bird season. In environmental restoration and policy, the typical burn window in California is from October to March. This time frame practically avoids overlap with the breeding bird season.

Conclusion and Recommendations

The 2022 breeding bird and avifauna assessment data shows continued bird diversity and abundance recovery ever since the beginning of restoration work at CCNP in 1999. With over 70 species detected and an abundance diversity value of 179.5, the overall riparian bird community at CCNP is healthy and growing. More species than previously recorded are using CCNP for breeding, including species of conservation concern such as the Swainson's Hawk. Some of the recent restoration tools being utilized (such as the OHV ordinance in the watershed and performing prescribed burns) may also be contributing factors to improving the CCNP's habitat quality for birds during the breeding season. However due to how recent these restoration tools have been implemented, studies like this should be continued for each breeding season over the next several years to see how banning of OHVs and the practice of prescribed burns continue to affect riparian bird communities over longer periods of time. While studies have shown that fires can and do enhance breeding bird habitat, this does not mean it is encouraged to perform burns during the breeding bird season as it could cause nest abandonment and less reproductive success.

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