

City of Austin 2022
Black-capped Vireo (*Vireo atricapilla*)
Monitoring and Management Program

Balcones Canyonlands Preserve Annual Report



Female Black-capped Vireo incubating nest on the Forest Ridge Tract – Sheila Ellwood

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Disclaimer: The data and information presented in this report are provisional and subject to revision.

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This report summarizes the results of the City of Austin’s 2022 black-capped vireo (*Vireo atricapilla*) species monitoring and habitat management program. The 2022 field season was the twenty-fifth year of monitoring this formerly endangered species (delisted in May 2018) on the City of Austin’s Balcones Canyonlands Preserve (COA BCP) tracts. We found twenty-four black-capped vireo males holding territories across the COA BCP. The Forest Ridge tract had thirteen territories, Cortaño had eight territories, and there was a single territory on each of the Kent Butler, Lime Creek and Vireo Preserve tracts. Pairing success was 96%, although at least one female nested with two of the 24 territorial males. Of the 34 nests observed, 53% failed due to predation, weather, or abandonment.

Additionally, this year COA BCP Staff initiated a new project examining genetics, juvenile survival, and dispersal patterns by banding 38 nestlings and collecting DNA from 35 nestlings from 11 nests. Additionally, DNA was collected opportunistically from two adult vireos. We also collected six eggs left in abandoned or already fledged nests for genetic analysis.

INTRODUCTION

Background

The black-capped vireo (hereafter vireo) is a neotropical migrant that breeds in portions of Oklahoma, Texas, and Mexico (Grzybowski 1995). The U.S. Fish and Wildlife Service listed this species as endangered in 1987 (USFWS 1987) due to habitat loss, habitat fragmentation, over-grazing/browsing, natural vegetation succession, and parasitism by brown-headed cowbirds (*Molothrus ater*; hereafter cowbirds). Rapid westward expansion of development from the City of Austin led to the creation of the Balcones Canyonlands Conservation Plan (a habitat conservation plan). The U.S. Fish and Wildlife Service issued a 10(a)(1)(B) permit to the City of Austin and Travis County in 1996, to mitigate for the incidental “take” of habitat loss due to development, and to facilitate the local recovery of the vireo and seven other endangered species (USFWS 1996). The permit requires a minimum of 12,300 hectares of endangered species habitat in western Travis County be set aside as a preserve (the BCP) for these species. The vireo was removed from the federal List of Endangered and Threatened Wildlife effective May 16, 2018, citing recovery of the species (USFWS 2018a). The U.S. Fish and Wildlife Service developed a post-delisting plan to monitor abundance and threats to ensure that the species does not decline (USFWS 2018b). Vireos and their habitat continue to be protected on the BCP as a condition of the conservation plan.

Prior to 2022, vireos had consecutively established territories and raised young on a few COA BCP tracts (City of Austin 2021). Though other areas on COA BCP have been managed to create or maintain vireo habitat, vireos had rarely (Bohls tract) or never (Lime Creek tract) been detected on them. One exception is a ridge in the center of the Cortaño tract where, starting in 2019, at least one male vireo attempted to establish a territory, and in 2020 and 2021 at least one pair successfully raised a brood. Other records for

vireos on the COA BCP tracts for the past decade include intermittent sightings of males on the Commons Ford, Reicher Ranch, Barton Creek Wilderness, Vireo Preserve, and Sam Hamilton West tracts.

Objectives

The Balcones Canyonlands Conservation Plan (USFWS 1996) states that “baseline monitoring will be gathered in accordance with the Land Management Plan Guidelines and approved land management plans, and should concentrate on determining basic population levels on preserve lands, key population parameters, and other ecological parameters that may affect the target species.” The Tier IIA-8 land management plan (BCP 2007) identifies “distribution, abundance, productivity, and recruitment” as key population parameters to monitor. The COA BCP vireo monitoring program continues to focus on estimating abundance, territory delineations, pairing, nesting, and productivity for all vireos detected each year.

The land management plan (BCP 2007) emphasizes vegetation management and monitoring to maintain vireo habitat. Within the BCP, vireo habitat typically occurs where oaks and other hardwoods re-sprout from well-established root systems. Because re-sprouting requires some form of disturbance (e.g., from fallen trees, mechanical manipulation, fire), restoration projects in conjunction with habitat monitoring are undertaken on various COA tracts to promote vireo habitat (see Black-capped Vireo Habitat Management), where such restoration will not conflict with managing for golden-cheeked warbler habitat.

Genetic Analysis and Nestling Color Banding

In addition to monitoring abundance, territory delineations, pairing, nesting, and productivity, we would like to better understand the genetic health and viability of the population. We know very little about juvenile dispersal and site fidelity and have frequently observed clutches that have unhatched eggs which can be a sign of genetic incompatibility or high relatedness. Because we are already closely monitoring active nests and banding adult vireos, this component is easily added to our ongoing research.

METHODS

Sites and Survey Effort

Monitoring and color banding methods for vireos are similar to those for golden-cheeked warblers (hereafter warblers; see Methods in City of Austin and Travis County 2019). However, because the vireo population is much smaller than the warbler population on COA BCP properties, monitoring takes the form of a complete census rather than a sampling. There are no defined plots; COA BCP biologists search suitable habitat and monitor vireos where they are found for evidence of mated status and breeding success. Vireos are also not monitored as frequently as warblers, unless their territories are near a warbler study plot.

Monitoring typically begins when the vireos first arrive in late March or early April and continues at least through the end of June, or until breeding success has been determined. Territory delineations for vireos are similar to those for warblers, except observations before March 25 are excluded. There is no final date for observations to be included in territory delineations, though surveys generally cease by the end of July

when vireos become difficult to detect. Because fledgling vireos are difficult to observe in dense vegetation, a range of fledglings is presented for some territories. The lower number is the tally of fledglings actually observed, and the higher number is the maximum that may have fledged given the number of eggs or nestlings originally found in the nest, minus unhatched eggs or dead nestlings found after fledging. We assume a maximum of four fledglings for nests that were not found.

During the 2022 field season, biologists monitored vireos in six locations: within and adjacent to the warbler intensive monitoring plots on the Forest Ridge, Kent Butler, and Vireo Preserve tracts; in the shinnery of the northern Cortaño tract; in live oak savanna and shrubland on the central Cortaño tract; and in the vireo habitat creation area on the Lime Creek tract. In addition, biologists surveyed potential habitat on the Bohls tract and where vireos were observed in 2020 on the Barton Creek Wilderness tract. Any vireos encountered on other sites during warbler surveys were also recorded.

Vireos were first detected on the Forest Ridge warbler plot on March 30 and were surveyed at least twice each week till July 21. After the first vireo was detected on the Kent Butler warbler plot on April 23, vireos were monitored once or twice per week through June 14, then again on June 28 and July 6. Vireos were detected on the first survey of the northern Cortaño shinnery on April 6 and monitoring continued through July 28. The central Cortaño site was surveyed on April 8 and April 30, then on May 23 when a vireo was finally detected; biologists then monitored the site weekly until July 14, with a final visit August 2. A male vireo was first observed on the Vireo Preserve on May 17 and monitored once or twice a week through August 28.

Genetic Sampling and Banding of Nestlings

We began a two-year pilot study in 2022 to collect DNA from adult and nestling vireos and to color-band nestlings. When possible after banding the adult, a PrecisionGlide™ 30-gauge beveled needle was used to prick the brachial vein and a capillary tube was used to collect 15µL of blood (~2 drops). Blood samples were stored in a lysis buffer until DNA extraction. Before releasing the bird, a cotton ball was placed over the needle insertion point with the wing held gently closed with light pressure for 30-60 seconds. Kwik-Stop® styptic powder was on hand in case bleeding did not stop after 60 seconds. Nests were monitored for nestling age; age 6-8 days old was determined optimal, because handling too close to fledge date could unintentionally force-fledge them, but younger nestlings' legs are too short and/or thick for banding. If nestlings survived to day 6-8 and had long, thin enough legs, we banded and collected a blood sample from each nestling in the same manner as adults, and measured nestling weight. To reduce stress on the parents, we waited until they left the nest to forage and then only took half the brood at a time in case the parent returned while processing the nestlings. After the 2023 field season is complete, we will extract DNA from the blood samples and use microsatellites markers to examine paternity, relatedness, and effective population size. If the results of the pilot study provide useful information or warrant further research, we may continue this study for additional years.

Table 1. Summary of Black-capped Vireo Survey Effort on the Balcones Canyonlands Preserve, Travis County, Texas, Field Season 2022.

Site	Observers	Survey Hours
Bohls	John Chenoweth	7
Cortaña - central	William Reiner, Darrell Hutchinson	21
Cortaña - north	William Reiner, Darrell Hutchinson	113.5
Forest Ridge	Jonathan Scalise, Laurel Moulton	146.75
Kent Butler	Jonathan Scalise, Laurel Moulton	13.5
Lime Creek	William Reiner	7.75
Vireo Preserve	Lisa O'Donnell, Jim O'Donnell, Gary Sertich, Sheila Ellwood	7.5
Total		317.0

RESULTS AND DISCUSSION

Territory Delineations

In 2022, biologists found twenty-four vireo males holding territories across the COA BCP tracts; Forest Ridge (thirteen territories), northern Cortaña (seven territories), central Cortaña (one territory), Kent Butler (one territory), Lime Creek (one territory), and Vireo Preserve (one territory). Biologists did not observe vireos on the Bohls tract this year. Figures A-G provide maps of the 2022 vireo observations on City of Austin BCP tracts.

Banding, Return Rates, and Genetic Sampling

Biologists color banded one female and four male vireos in 2022 (Table 2). Of the 16 banded adult male vireos on City BCP property in 2021 (including returns from previous years), eight returned in 2022 (a return rate of 47%). One female banded on Forest Ridge in 2021 returned in 2022. Additionally, a female banded on the Travis County BCP's Lucas tract in 2021, who dispersed and renested at Forest Ridge that same season, returned to Forest Ridge in 2022.

We color banded 38 nestlings from 11 nests (nine nests at Forest Ridge, one at Kent Butler, and one at northern Cortaña) and successfully collected blood samples from 35 of the nestlings. Additionally, we were able to collect six eggs from 3 different nests that did not hatch, or were abandoned. Two nestlings that were found dead were collected for DNA sampling (see Other Observations below).

Table 2. Summary of Black-capped Vireos Banded on the Balcones Canyonlands Preserve, Travis County, Texas, Field Season 2022. “L” = local (nestling), “SY” = second year, “ASY” = after-second year.

Date	Site	Color Band Combination	USGS Band Number	Sex	Age	DNA Sampled?
5/10/22	Forest Ridge	DG/SI:NB/DG	2590-26317	UK	L	Yes
5/10/22	Forest Ridge	DB/SI:YE/BK	2590-26318	UK	L	Yes

Date	Site	Color Band Combination	USGS Band Number	Sex	Age	DNA Sampled?
5/10/22	Forest Ridge	DB/YE:NB/SI	2590-26319	UK	L	Yes
5/10/22	Forest Ridge	NB/SI:DG/MV	2590-26320	UK	L	Yes
5/18/22	Forest Ridge	DG/GR:NB/SI	2940-18401	UK	L	Yes
5/18/22	Forest Ridge	WH/SI:BK/WH	2940-18402	UK	L	Yes
5/18/22	Forest Ridge	YE/SI:DB/WH	2940-18403	UK	L	Yes
5/18/22	Forest Ridge	NB/WH:OR/SI	2940-18404	UK	L	Yes
5/21/22	Forest Ridge	BK/SI:DG/BK	2940-18405	UK	L	Yes
5/21/22	Forest Ridge	BL/SI:BL/WH	2940-18406	UK	L	No
5/21/22	Forest Ridge	NB/MV:MV/SI	2940-18407	UK	L	Yes
5/21/22	Forest Ridge	RD/RD:NB/SI	2940-18408	UK	L	Yes
5/24/22	Cortaña - central	DG/SI:BL/GR	2590-26372	M	SY	No
5/27/22	Kent Butler	YE/SI:GR/OR	2940-18409	M	SY	Yes
5/27/22	Kent Butler	BK/DG:DB/SI	2940-18410	UK	L	Yes
5/27/22	Kent Butler	WH/BL:YE/SI	2940-18411	UK	L	No
5/27/22	Kent Butler	BL/RD:BL/SI	2940-18412	F	ASY	Yes
5/27/22	Kent Butler	DB/BL:OR/SI	2940-18413	UK	L	Yes
5/27/22	Kent Butler	RD/SI:NB/WH	2940-18414	UK	L	Yes
5/28/22	Cortaña - north	BL/DB:OR/SI	2940-18415	UK	L	Yes
5/28/22	Cortaña - north	WH/SI:WH/MV	2940-18416	UK	L	Yes
5/28/22	Cortaña - north	YE/WH:BK/SI	2940-18417	UK	L	Yes
5/28/22	Cortaña - north	GR/DG:DB/SI	2940-28418	UK	L	No
6/2/22	Forest Ridge	DB/SI:GR/DG	2940-18419	UK	L	Yes
6/2/22	Forest Ridge	RD/BL:DB/SI	2940-18420	UK	L	Yes
6/2/22	Forest Ridge	BL/SI:OR/RD	2940-18421	UK	L	Yes
6/2/22	Forest Ridge	OR/OR:NB/SI	2940-18422	UK	L	Yes
6/22/22	Forest Ridge	DG/DG:NB/SI	2940-18423	UK	L	Yes
6/22/22	Forest Ridge	NB/WH:WH/SI	2940-18424	UK	L	Yes
6/22/22	Forest Ridge	NB/MV:BK/SI	2940-18425	UK	L	Yes
6/22/22	Forest Ridge	RD/SI:NB/GR	2940-18426	UK	L	Yes
6/22/22	Forest Ridge	NB/SI:BK/DB	2940-18427	UK	L	Yes
6/22/22	Forest Ridge	PI/YE:NB/SI	2940-18428	UK	L	Yes
6/24/22	Lime Creek	DG/GR:RD/SI	2590-26380	M	SY	No
6/27/22	Forest Ridge	DB/SI:RD/BL	2940-18429	UK	L	Yes
6/27/22	Forest Ridge	MV/SI:WH/GR	2940-18430	UK	L	Yes
6/27/22	Forest Ridge	OR/PI:WH/SI	2940-18431	UK	L	Yes
6/28/22	Cortaña - north	RD/DG:DG/SI	2590-26381	M	SY	No
6/30/22	Forest Ridge	BK/WH:NB/SI	2940-18432	UK	L	Yes
6/30/22	Forest Ridge	BL/YE:DB/SI	2940-18433	UK	L	Yes
7/4/22	Forest Ridge	YE/OR:DG/SI	2940-18434	UK	L	Yes
7/4/22	Forest Ridge	BL/SI:WH/RD	2940-18435	UK	L	Yes
7/4/22	Forest Ridge	MV/BL:GR/SI	2940-18436	UK	L	Yes

Pairing and Reproductive Success

At Forest Ridge, 13 territorial male vireos were observed on and adjacent to the warbler plot and all but one paired (Figure B). Biologists found 22 nests among all of the pairs (Table 3). Of the 22 nests, 59% failed due to predation, weather, or abandonment, and 41% successfully fledged at least one young. Of the 13 territories, eight pairs had one successful nest each. See Table 4 for a summary of reproductive success.

Kent Butler had one territory just outside the northeast corner of the warbler plot (Figure C). This male successfully paired, and biologists found one nest that successfully fledged at least two young (Tables 3 and 4).

In the shinnery at the north end of the Cortaña tract, all seven males that established territories successfully paired (Figure D). Biologists found nine active nests for six of the pairs and located one for the seventh pair after it had already fledged, with two unhatched eggs (Table 3). Of these ten nests, 60% fledged at least one young, and 40% failed due to predation.

Only one male vireo established a territory in central Cortaña (Figure E). He successfully paired, and biologists found an active nest, but it was predated (Table 3). No other nesting activity was detected after the first nest failed.

For the first year since the 1990s, a pair of vireos occupied a territory on the Vireo Preserve tract. The male was observed multiple times between May 17 and August 28. The female was seen July 6-12. An inactive and empty nest was later found, but no fledglings were detected for the pair.

Table 3. Summary of Black-capped Vireo Nests Found on the Balcones Canyonlands Preserve, Travis County, Texas, Field Season 2022.

Site	Male ID	Nest Substrate	Nest Fate	Number of Fledglings*
Cortaña - central	DG/SI:BL/GR	<i>Celtis laevigata</i>	Predated	
Cortaña - north	BK/YE:WH/SI	<i>Quercus sinuata</i>	Fledged	2
Cortaña - north	NB/SI:DB/GR	<i>Ulmus crassifolia</i>	Predated	
Cortaña - north	NB/SI:DB/GR	<i>Quercus sinuata</i>	Fledged	1
Cortaña - north	RD/DG:DG/SI	<i>Quercus sinuata</i>	Predated	4
Cortaña - north	RD/DG:DG/SI	<i>Quercus sinuata</i>	Predated	
Cortaña - north	RD/PI:WH/SI	<i>Quercus sinuata</i>	Fledged	2
Cortaña - north	UBCTA	<i>Quercus sinuata</i>	Fledged	1-3
Cortaña - north	UBCTB	<i>Celtis laevigata</i>	Fledged	3-4
Cortaña - north	YE/SI:PI/YE	<i>Diospyros texana</i>	Predated	
Cortaña - north	YE/SI:PI/YE	<i>Francula caroliniana</i>	Fledged	2-4
Forest Ridge	UK	<i>Dermatophyllum secundiflorum</i>	Abandoned	
Forest Ridge	BK/SI:OR/GR	<i>Dermatophyllum secundiflorum</i>	Fledged	2-4
Forest Ridge	BK/SI:OR/GR	<i>Dermatophyllum secundiflorum</i>	Fledged	1-3
Forest Ridge	BL/PI:WH/SI	<i>Dermatophyllum secundiflorum</i>	Weather / Abandoned	
Forest Ridge	BL/PI:WH/SI	<i>Quercus sinuata</i>	Fledged	2-4
Forest Ridge	OR/SI:DB/BL	<i>Quercus buckleyi</i>	Fledged	3-4
Forest Ridge	OR/SI:DB/BL	<i>Garrya ovata</i>	Predated	
Forest Ridge	RD/PI:DB/SI	<i>Dermatophyllum secundiflorum</i>	Predated	
Forest Ridge	RD/PI:DB/SI	<i>Dermatophyllum secundiflorum</i>	Fledged	3-4
Forest Ridge	RD/PI:DB/SI	<i>Garrya ovata</i>	Predated	
Forest Ridge	UBFRA	<i>Diospyros texana</i>	Predated	
Forest Ridge	UBFRA	<i>Garrya ovata</i>	Predated	
Forest Ridge	UBFRA	<i>Quercus sinuata</i>	Fledged	2-3
Forest Ridge	UBFRB	<i>Dermatophyllum secundiflorum</i>	Fledged	4
Forest Ridge	UBFRB	<i>Quercus buckleyi</i>	Predated	
Forest Ridge	UBFRC	<i>Diospyros texana</i>	Predated or Abandoned	
Forest Ridge	UBFRC	<i>Sideroxylon lanuginosum</i>	Fledged	3-4
Forest Ridge	UBFRE	<i>Ptelea trifoliata</i>	Predated	
Forest Ridge	UBFRF	<i>Ilex vomitoria</i>	Predated	
Forest Ridge	UBFRG	<i>Dermatophyllum secundiflorum</i>	Fledged	1-2
Forest Ridge	UBFRH	<i>Dermatophyllum secundiflorum</i>	Predated	
Forest Ridge	UBFRI	<i>Cercis canadensis</i>	Predated	
Kent Butler	YE/SI:GR/OR	<i>Sideroxylon lanuginosum</i>	Fledged	2-4
34 total nests: 18 predated, destroyed by weather, or abandoned (53%); 16 successful (47%)				

* Fledgling vireos were difficult to observe in dense vegetation, so a range of fledglings is listed for some nests. The lower number is the tally of fledglings actually observed. The higher number is the maximum that may have fledged given the number of eggs/chicks originally found in the nest, minus unhatched eggs or dead nestlings found after fledging.

Table 4. Summary of Black-capped Vireo Reproductive Success per Site on the Balcones Canyonlands Preserve, Travis County, Texas, Field Season 2022.

Site	No. of Territories	No. of Territories w/ Female	Pairing Success	No. of Territories Producing ≥ 1 Young	Breeding Success	Total No. of Fledglings*	Productivity*	Productivity Per Successful Territory*
Cortaña - central	1	1	100%	0	0%	0	0.0	NA
Cortaña - north	7	7	100%	6	86%	11-16	1.6-2.3	1.8-2.7
Forest Ridge	13	12	92%	8	62%	21-30†	1.6-2.3	2.6-3.8
Kent Butler	1	1	100%	1	100%	2-4	2.0-4.0	2.0-4.0
Lime Creek	1	1	100%	0	0%	0	0	NA
Vireo Preserve	1	1	100%	0	0%	0	0	NA
All Sites	24	23	100%	14	63%	34-50†	1.8-3.1	2.3-3.3

* Ranges indicate fledglings actually observed vs. maximum possible (see note with Table 3). We assume a maximum of 4 fledglings for nests that were not found.

† Includes all fledglings found, including those from second broods.

Other Observations

Parasitism and Interaction with Predators

No cowbirds were observed during vireo surveys on the Forest Ridge, Cortaña, or Kent Butler tracts. No vireos were observed tending cowbird fledglings. BCP biologists have seen no evidence of nest parasitism since ceasing the trapping of cowbirds in 2013. Biologists will continue to monitor vireo territories for the presence of cowbirds, and the BCP remains committed to reducing or eliminating the threat of cowbird parasitism on vireo nests if needed.

No interactions with predators were observed this season.

Non-Viable Eggs

Of the 33 nests observed, five contained unhatched eggs. Some nests were predated or abandoned prior to hatching and are not included in this tally. Unhatched eggs may be a sign of genetic incompatibility or high relatedness between the parents.

Injuries and Deaths

No injuries were observed among vireos this year. On Forest Ridge, one nest contained an egg that was noticeably smaller than the other three eggs. The hatchling, presumably from this egg, lagged developmentally and appeared to be much smaller than the rest of the brood (see photos below). We suspect limited food availability from the summer drought may have impacted the egg's development.

At Forest Ridge, we observed two nestlings that died in the nest. One dead nestling was found alone in the nest on May 25, after a hailstorm the previous night. All four nestlings were alive during the previous nest check on May 23 and had been banded on May 21. The dead nestling appeared to be fully developed, and two of its banded nestmates were later observed as fledglings. We suspect hail may have directly killed the nestling via impact or may have collected in the nest and killed the nestling via exposure to cold. In another

nest, four nestlings were observed on June 24 and estimated to be five days old. At the next monitoring event on June 27, one of the four nestlings was found dead and slightly desiccated at the bottom of the nest. We suspect the heat and drought may have caused it to receive less food than its nestmates and/or overheat.



Black-capped Vireo nest with one egg smaller than others



Black-capped Vireo nestmates with one smaller and developmentally delayed compared to other

Nest Construction

Three nests at Forest Ridge were found to have eggs on the ground below the nests. This year was particularly windy, and the winds may have knocked eggs out of these nests, causing the nests to be abandoned by the vireos. One of the three nests was built using mountain laurel leaves as the substrate as opposed to sturdier shrub stems, and this may have caused the nest to be less stable in the high winds.

Pair Relations

A banded female (YE/SI:BL/DB) successfully nested with and raised young with a banded male (BK/SI:OR/GR) at Forest Ridge. She was later discovered nesting with an unbanded male that had previously been un-paired. The banded fledglings from her first nest were seen foraging with banded fledglings from the nest of a neighboring unbanded female and banded male (BL/PI:WH/SI). Banded male BK/SI:OR/GR then paired with an unbanded female and successfully raised a second brood. We believe the consistent mingling of these banded fledglings suggests that the unbanded female that renested with BK/SI:OR/GR was the former mate of BL/PI:WH/SI.

Dispersals

A male banded at Lime Creek on July 24, 2022 was last seen on site on June 30. He moved and was detected at the Cortaño shinnery from July 12 to July 28.

A male banded on the Travis County BCP's Vireo Ridge tract in 2021, returned to Vireo Ridge in 2022, paired and nested, but the nest was predated as of May 13. Though not visually confirmed, he was last detected there on June 16, and on June 26 he was found at Forest Ridge.

BLACK-CAPPED VIREO HABITAT MANAGEMENT

The Balcones Canyonlands Conservation Plan (USFWS 1996) requires maintaining or creating 810 hectares (2,000 acres) of vireo habitat within the BCP, and the land management plan (BCP 2007) provides additional, general guidelines to help achieve this goal. The Balcones Canyonlands Conservation Plan recommends focusing potential vireo management areas in portions of the BCP that are not currently occupied by the warbler. Focal areas for vireo habitat management on City of Austin BCP lands include parts of the Cortaño tract, infrastructure corridors (Kent Butler tract), Vireo Preserve, and Bohls tract. Previous management activities on these tracts are summarized in City of Austin (2016). With the abundance of shin oak (*Quercus sinuata* var. *breviloba*) acorns available in the mast year of 2022, staff were able to plant approximately 8,300 acorns to initiate new habitat patches on the JJ&T and Lime Creek tracts and the southern portion of the Cortaño tract and to augment existing habitat.

Overlap of Golden-cheeked Warbler and Black-capped Vireo Habitat

In some areas, vireo habitat may progress to warbler habitat through natural succession. Likewise, natural or anthropogenic disturbance patterns may convert warbler habitat to the early successional stage preferred

by the vireo. These habitat types tend to overlap within the COA BCP. As in previous years, territorial warblers and vireos were observed in the same or neighboring areas on the Forest Ridge, Kent Butler, and Cortaña tracts in 2022. The Forest Ridge warbler plot supports a dense understory of vegetation that is used by both species. On the Kent Butler tract, four electric transmission lines cross the tract at the north edge of the warbler plot. Vireos were detected using the shrubby growth within the utility corridors, where vegetation has been trimmed short in some places, to prevent damage to the electric wires. Warblers occupy habitat on both sides of the utility corridors, and in a wooded strip between them. On the northern end of the Cortaña tract, warblers occupy steep, wooded canyons on three sides of the shinnery, as well as a low, wooded knoll in the middle of the shinnery. Warblers were occasionally observed in the shinnery (especially hatching year birds), and vireos were often observed within the edges of the mature forest.

Expanding Vireo Habitat – Kent Butler

Mechanically manipulated habitat on the Kent Butler tract had a vireo pair nest in it again, after a hiatus in 2021 (City of Austin 2016). Prior to the 2021 breeding season, at least one pair had used one of the three mechanically treated areas for 9 consecutive years.

Staff planted approximately 100 shin oak acorns (collected on Cortaña) in a patch of juniper die-off along one of the transmission line access roads. This patch is currently warbler habitat but likely trending towards vireo habitat.

Maintenance and Expansion of Occupied Habitat – Northern Cortaña

With the recolonization of the northern portion of the Cortaña tract by vireos (City of Austin 2016), further habitat manipulation has been postponed. However, biologists have harvested acorns of shin oaks from trees within the existing shinnery for use in habitat restoration. Some of these have been planted on a ridge immediately south of the shinnery that was cleared of most trees in 2005. Approximately 100 acorns were planted on this site in 2022.

Habitat Creation – Central Cortaña

Between 2003 and 2006, City of Austin staff coordinated mechanical clearing of junipers (*Juniperus ashei*) on 14.5 hectares in the center of the Cortaña tract, approximately 1.5 miles south of the existing shinnery. The intention was to create vireo habitat, but few suitable shrubs were growing on the site at the time. The resulting habitat has been a live oak savanna.

Biologists have planted shin oak acorns on the central Cortaña site, as they have been available for harvest from the north Cortaña shinnery and elsewhere on the BCP. Acorns are planted beneath established woody plants, especially junipers, to minimize desiccation and deer browse. A biologist planted 400 more acorns in the area in 2022.

Habitat Creation – South Cortaña

With the surplus of acorns available, staff attempted creation of a new habitat patch near a ridgetop powerline corridor, around clearings where drought had killed some of the peripheral junipers. Staff planted approximately 540 acorns on the site.

Restoring and Creating Habitat – Vireo Preserve

Efforts continue to protect and rebuild soils and promote native plant diversity. The Vireo Preserve supports many of the habitat types observed throughout the BCP, so lessons learned at this site should be applicable to other areas (City of Austin 2016, Travis County and City of Austin 2018). Taking full advantage of the 2022 mast year, staff collected several thousand shin oak acorns from the Vireo Preserve and planted approximately 2,000 of those in other areas on the Vireo Preserve and on other tracts.

Habitat Creation – Bohls

City of Austin (2016) summarizes mechanical and prescribed burn treatments conducted at this site.

Staff have established photo points and vegetation transects on the above tracts in order to track changes to habitat over time. Monitoring of these sites takes place before and after habitat manipulation events, and otherwise when feasible. No photo point monitoring was conducted in 2022.

Habitat Creation – JJ&T

In January, staff planted hundreds of seeds that had been scarified and/or stratified in upland sites on the JJ&T tract that are currently not habitat for the warbler or vireo. Seeds included flameleaf sumac (*Rhus lanceolata*), Mexican plum (*Prunus mexicana*), wafer ash (*Ptelea trifoliata*), and Carolina buckthorn (*Frangula caroliniana*). During the fall, staff planted approximately 4,500 shin oak acorns on upland sites.

Habitat Creation – Lime Creek

Staff, with the help of volunteers, also planted approximately 700-850 shin oak acorns in a plateau-top “dead zone” of the Lime Creek tract where past drought had killed many junipers.

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FIGURES

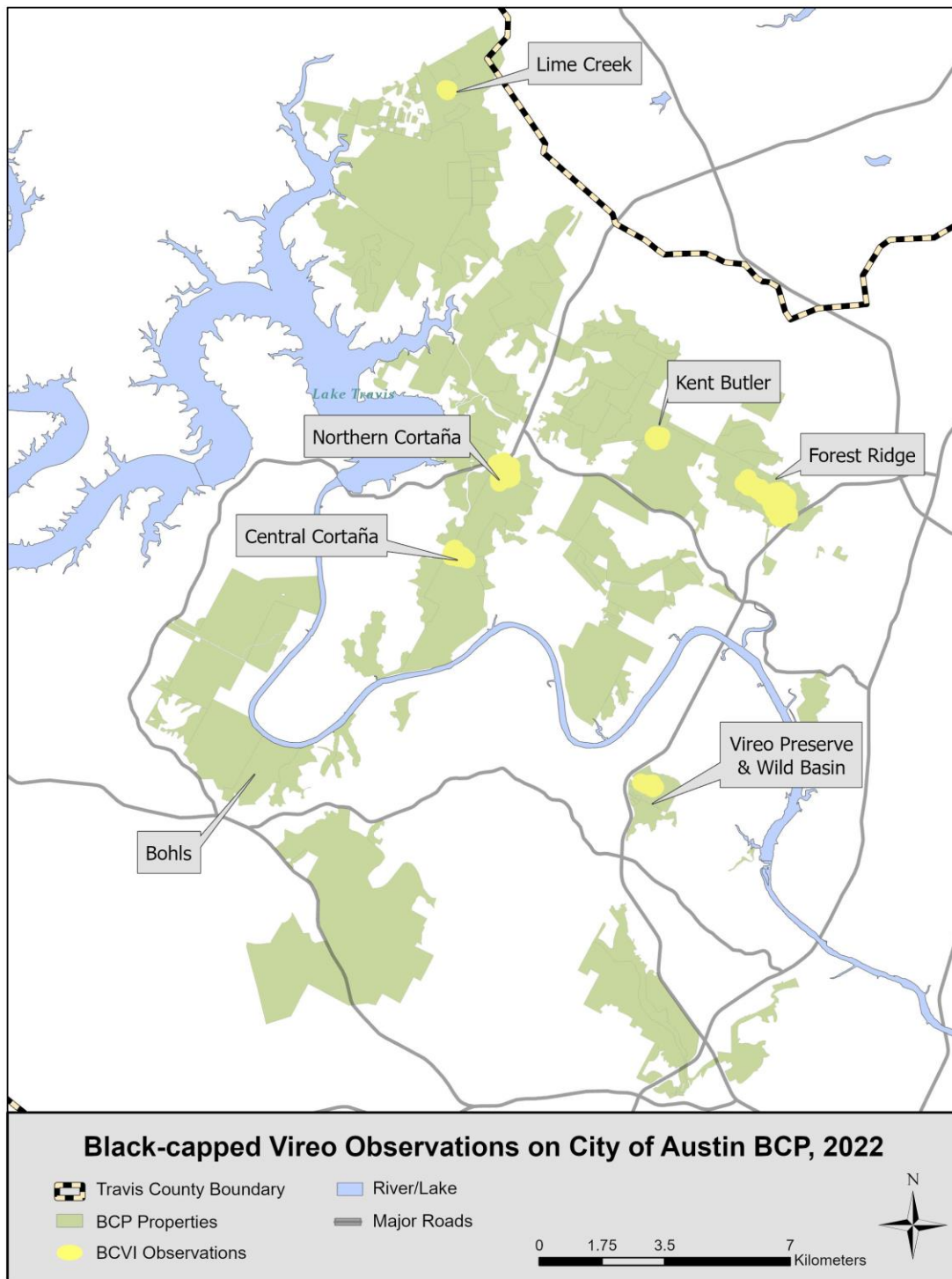


Figure A. Sites Where Black-capped Vireos were observed on City of Austin BCP Tracts, 2022.

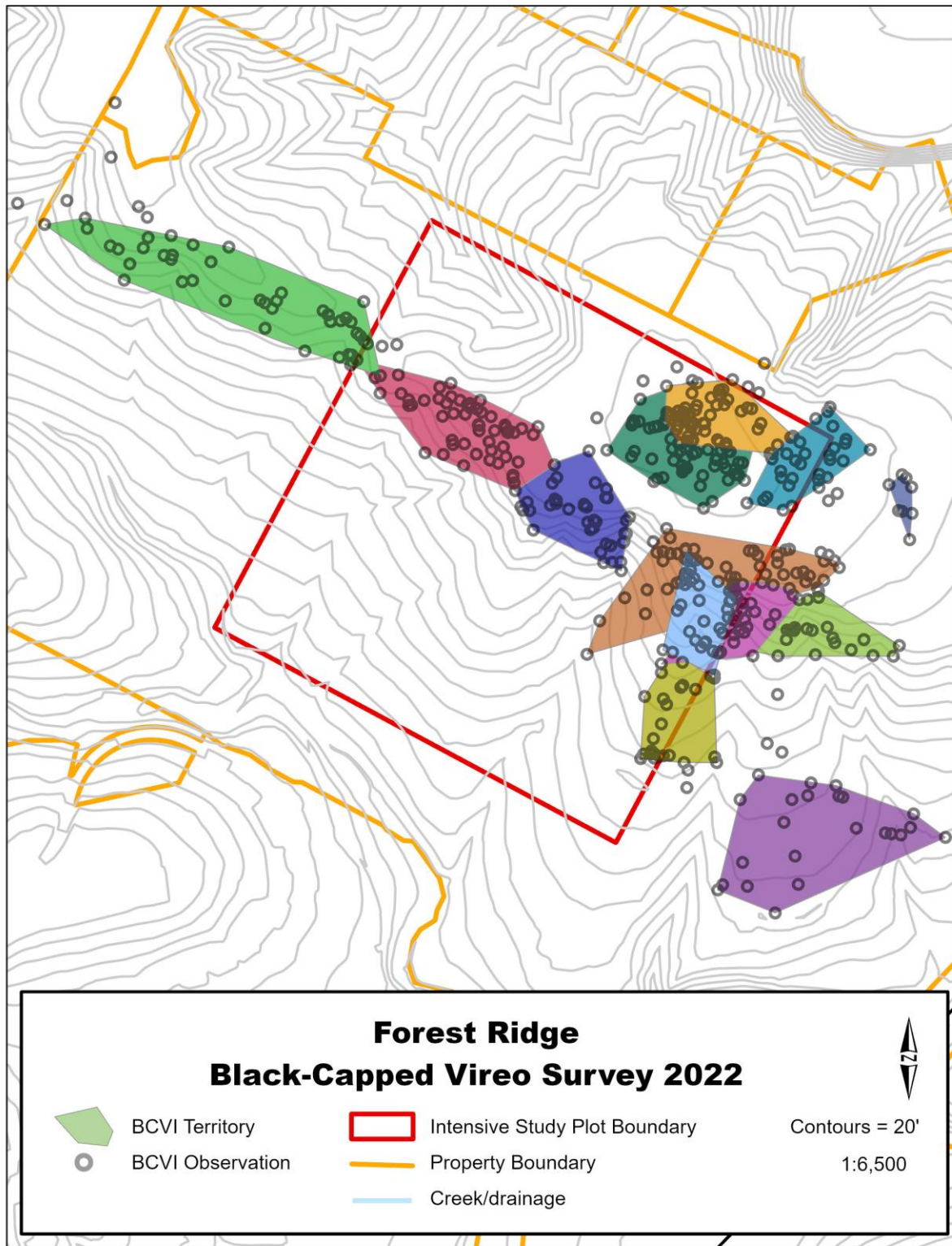


Figure B. Locations of Black-capped Vireos on Forest Ridge, 2022.

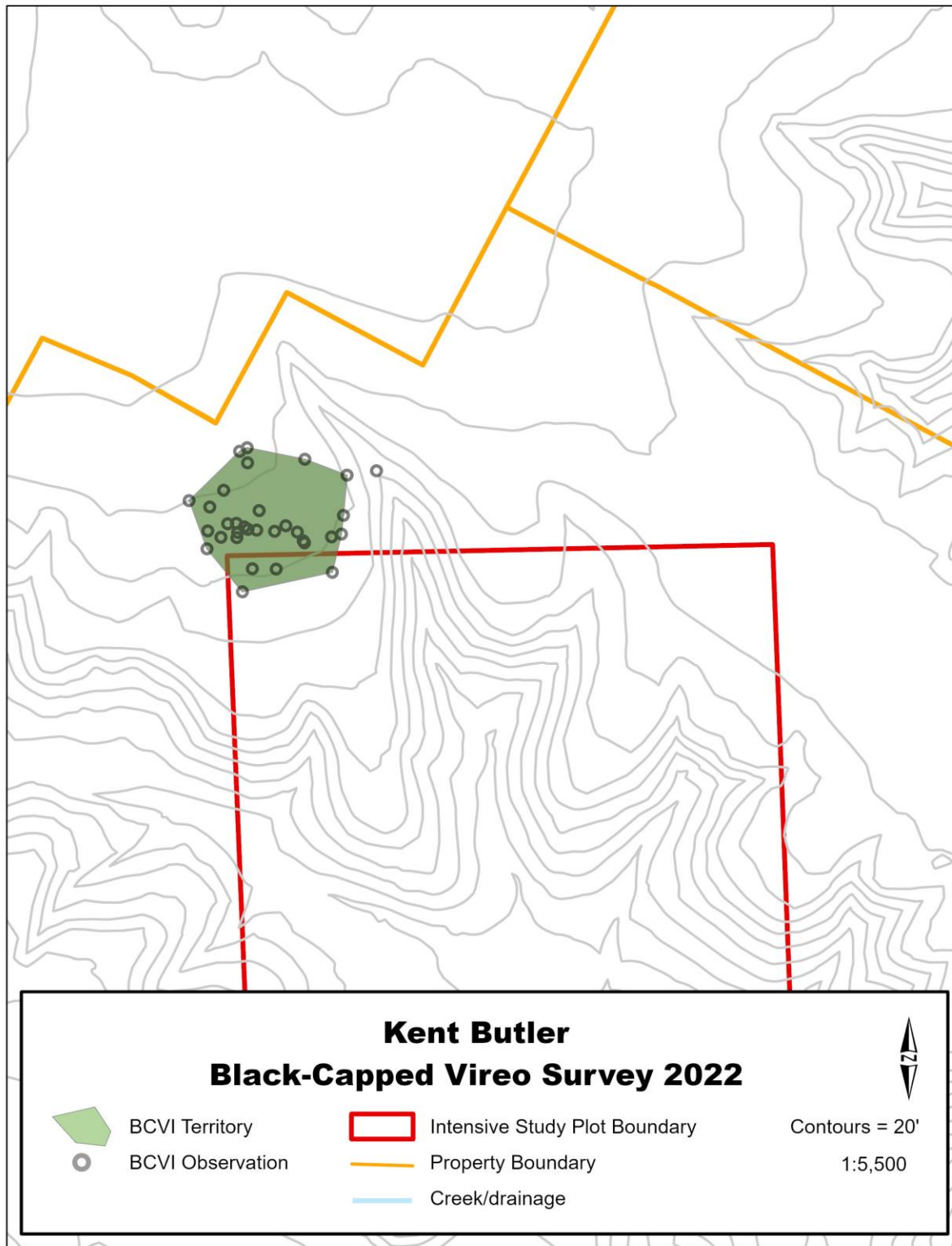


Figure C. Locations of Black-capped Vireos on Kent Butler Ecological Reserve, 2022.

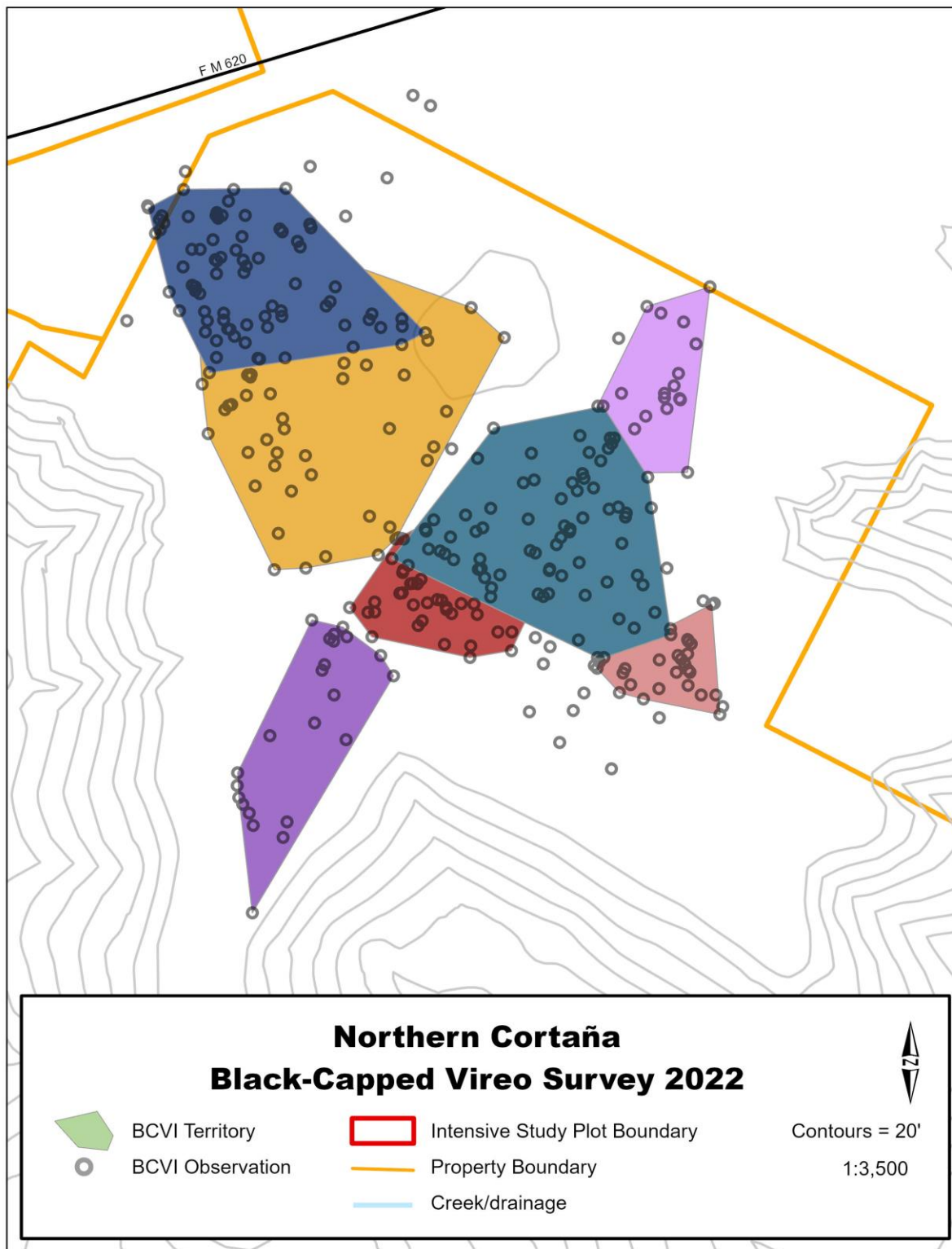


Figure D. Locations of Black-capped Vireos on Northern Cortaño, 2022.

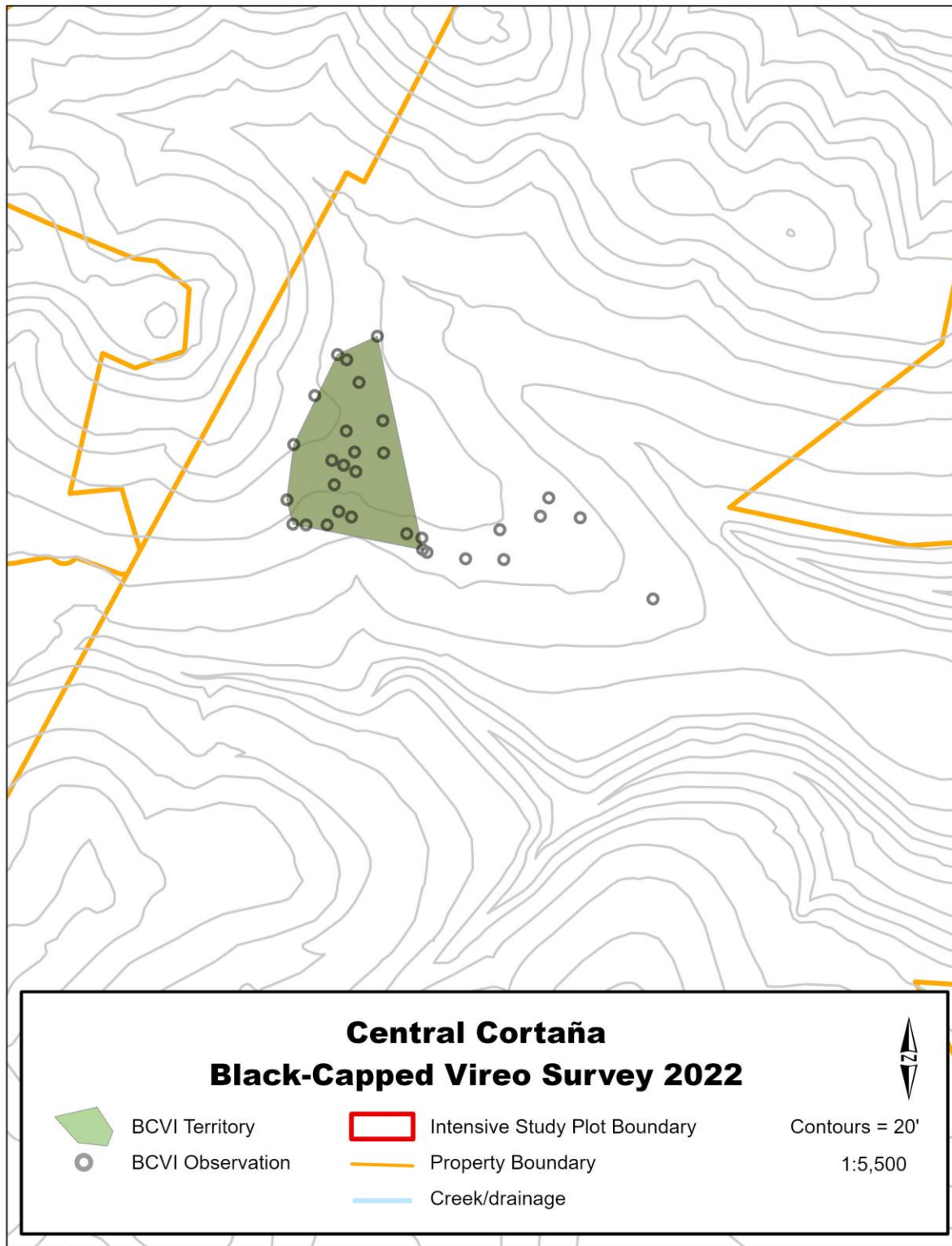


Figure E. Locations of Black-capped Vireos on Central Cortaño, 2022.

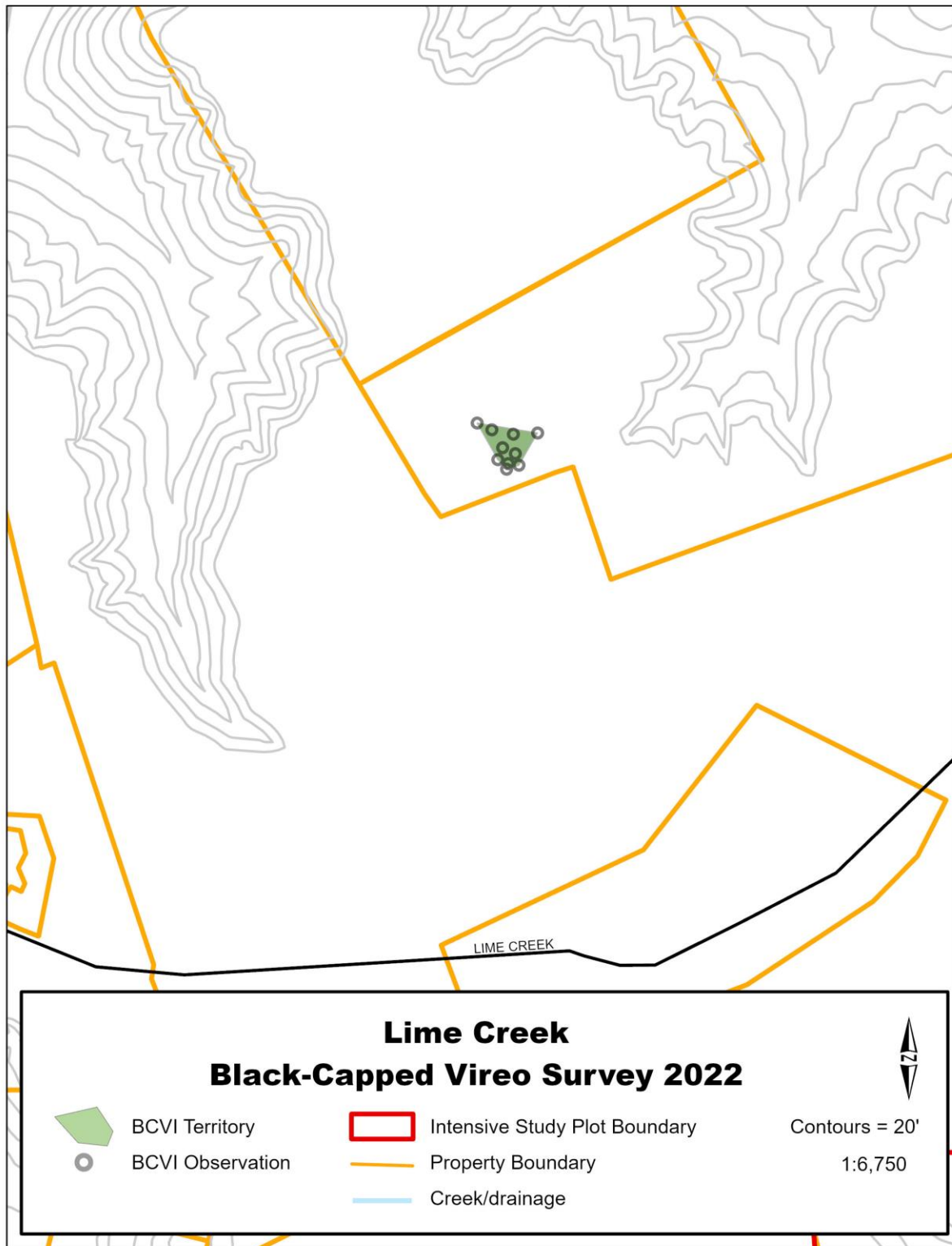


Figure F. Locations of Black-capped Vireos on Lime Creek, 2022.

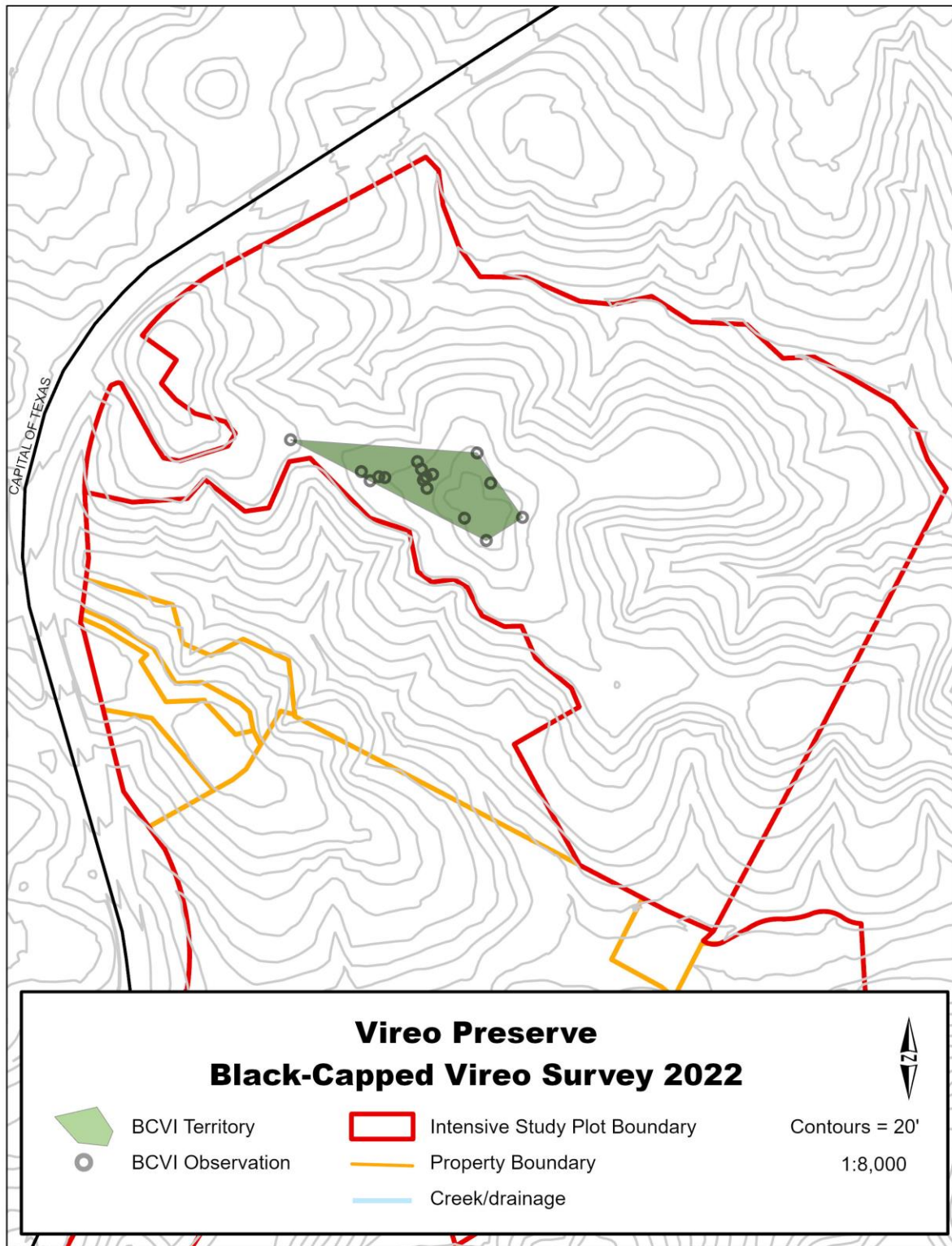


Figure G. Locations of Black-capped Vireos on Vireo Preserve, 2022.