Travis Audubon
Baker Sanctuary

2020 - 2021 Annual Report

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Travis County Transportation and Natural Resources Department Natural Resources Program

by

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Baker gate (photo by Christopher Murray)

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Introduction

Baker Sanctuary (Sanctuary) is owned and operated by Travis Audubon Society (TAS) with approximately 715 acres managed as part of the Balcones Canyonlands Preserve (BCP). As of March 2015, Travis County purchased a conservation easement on approximately 675 acres of the Sanctuary. Forty acres, the 'Headquarters Tract;' are excluded from the easement (**Appendix A**). The management agreement for the easement allows TAS to continue to manage the Sanctuary with oversight from Travis County for as long as TAS retains ownership of the Sanctuary and adheres to the conditions of the management agreement.

Bisected by Lime Creek Road, the Sanctuary is within the Cypress Creek Macrosite and adjacent to several additional BCP tracts including the City of Austin's Lime Creek and Austin Simon tracts to the northeast, a small tract belonging to the City of Cedar Park to the south, and several tracts belonging to Travis County along the southwestern boundary, including the approximately 2300-acre Wheless tract formerly owned by the Lower Colorado River Authority (**Appendix B**). The Sanctuary is composed of densely wooded uplands, slopes, and canyons dominated by mature oak-juniper woodlands with occasional pockets of open and semi-open savannah which are slowly being encroached by Ashe juniper (*Juniperus ashei*).

Golden-cheeked Warbler Surveys

During the spring of 2021, golden-cheeked warbler (*Setophaga chrysoparia*, GCWA) surveys were initiated for the approximately 104-acre North Valley plot. The North Valley plot is located north of Lime Creek Road and to the north of the formerly surveyed Northwest plot (**Appendix C**). Spot-mapping techniques as outlined in the USFWS protocol for GCWA presence/absence surveys (USFWS 2010) as well as Bibby *et al.* (2003) and the Tier II Land Management Plan (2007a) were utilized for the survey. In short, GCWA were color-banded if

possible, territories mapped, and an attempt made to quantify productivity. The North Valley survey is on schedule to conclude in 2023, completing the survey effort for the Sanctuary north of Lime Creek Road. By continuing to rotate survey plots, the entire Sanctuary will be covered by approximately 2029, providing GCWA distribution and productivity data which will more effectively inform future land management plans and decisions. Upon completion of the Sanctuary-wide survey effort it is expected the color-banding and territory mapping efforts will largely cease and future monitoring will be accomplished through a less intrusive and time intensive method such as variable circular plot point counts.

North Valley Plot Synopsis:

Based on the compilation and analysis of 316 GCWA observations including movement patterns, re-sighting of color banded males, counter-singing, and the presence of females and fledglings, it is conservatively estimated that 10 full territories and four edge territories were established in the North Valley plot for an adjusted total of 12 territories. Females were observed in nine of the 10 full territories in addition to a total of 24 fledglings for all territories surveyed. Approximately two territories were established directly adjacent to the North Valley plot and were not included in the analysis.

Territory density was calculated at 0.12 territories per acre. This calculation was based on the adjusted total of 12 territories in the 104 acres surveyed. The pairing success rate in the North Valley plot was 90% (females were observed in all but one of the full territories). The breeding success was estimated at 60%, based on the observation that six of the 10 full territories produced fledglings. The estimated brood size was 3.3 fledglings based on the aforementioned criteria. Productivity was estimated at 2.0 based on the total of 20 fledglings observed in six of the 10 full territories, which includes a second brood by one female (**Appendix C**).

Thus far, results from the North Valley survey appear to be fairly similar to prior areas surveyed from 2014 - 2020 in all measured parameters (**Appendix C**). Territory density in formerly surveyed plots has ranged from 0.09 – 0.12 (North Valley = 0.12), % pairing success 67% - 100% (North Valley = 90%), % breeding success 57% - 100% (North Valley = 60%), estimated brood size 1.50 – 3.70 (North Valley = 3.30), and productivity 1.00 – 2.30 (North Valley = 2.00). As additional data are collected over the next two breeding seasons, the picture should come a bit more into focus.

One observation of note for the 2021 season was that it seemed GCWA activity and density was not as randomly distributed across the North Valley plot as had been observed during surveys on prior plots. Anecdotally, density seemed to be concentrated in the valley bottom, especially on the southern end of the plot. Few observations of GCWA were made on the western or eastern edges of the plot, perhaps for a variety of reasons. GCWA were also not observed in the Ruth Fredericksen Tract to the north but due to its vegetation composition discussed in **Appendix C,** that did not come as a surprise.

On the western edge of the plot, the vegetation is markedly stunted and disperse compared to the valley bottom. Due to its aspect and aridity, the western edge is predictably growth challenged however, to exacerbate the situation, in 2009 an alleged dry lightning strike ignited a grass fire which swept through the area and caused the mortality of many Ashe juniper trees. While the western edge will never be as lush as the valley bottom, it is still an area under recovery from the 2009 fire and less than ideal GCWA habitat.

The eastern slope, on the other hand, is the polar opposite of the western slope. Overall, the vegetation is nearly as lush and thick as that found in the valley bottom and should be ideal GCWA habitat. However, it is bisected by multiple steep drainages which makes it extremely hazardous to traverse, especially after the severe February ice storm which caused a significant number of dead falls.

As a result, it is quite possible that the lack of GCWA observations in this area may be due to the difficulty of the terrain.

In 2014 TAS initially obtained state and federal permits to band (plastic color-bands and USFWS aluminum bands) GCWA throughout the Sanctuary. Since then, a total of 49 GCWA males, 37 ASY and 12 SY, have been captured and banded under TAS and Travis County permits during various survey efforts (**Table 1**). It is anticipated banding will continue during the 2022 survey effort.

In an effort to explore alternatives in assessing the GCWA population density and distribution at Baker, a pilot variable circular plot (VCP) point count study was initiated in the spring of 2016. Point count stations were established 250 meters apart in a grid pattern for a total of 50 stations at the Sanctuary (**Figure 1**). Counts began 10 minutes after sunrise and concluded by 11 AM. Originally, GCWA were counted for five minutes at each station and their locations, activity, and movements recorded per minute at each station where they occurred. To reduce observer bias, the Sanctuary steward conducted all surveys. The point counts were performed again for the 2017 breeding season utilizing the 2016 protocol (**Appendix D)** but the counts were doubled from five minutes to 10 in an effort to ascertain the most accurate survey interval for GCWA on the Sanctuary. The 10 minute count was utilized again for the 2021 effort which produced 52 GCWA male detections, 42 if truncated to five minute counts, with the majority of the initial detections occurring during the first minute of observation (**Table 2**). Due to the ease of truncating the point count data if needed, the 10 minute count will be employed in future efforts until the entire Sanctuary has been methodically surveyed and the accuracy of the count interval tested over multiple seasons.

Whitetail Deer Management

Baker Sanctuary was closed from November 1, 2020 – January 17, 2021 for the annual whitetail deer (*Odocoileus virginianus*) management hunt (rifle hunting

only). Seven primary hunters hunted at sites 3, 5, 10, 11, 12, 13, and 14 (**Figure 2**) and harvested a total of eight deer (three does and five bucks) during 306.5 hours of hunt effort, a decrease in take from the average harvest of 9.7 deer per season over the prior 19 recorded seasons (**Figure 3**).

To gain a better understanding of the size and composition of the whitetail deer (WTD) population on the Sanctuary, a camera trap survey was initiated in the fall of 2016. The survey was again conducted from mid-September 2020 through the first week of October utilizing protocol outlined by Texas Parks and Wildlife (Oetgen et al, 2008). Six camera trap sites **(Figure 2)** were pre-baited with feed corn for five days prior to deploying the camera traps which were then left active for 10 consecutive days. Results from the survey (**Table 3**) suggest the Sanctuary has a WTD density of approximately 5.2 deer/km2. It is difficult to put the results in context because little to no regional deer density data are available prior to the institutionalization of a regulated deer hunting season in Texas and prior to eradication of the screwworm (*Cochliomyia hominivorax*) parasite. According to the most recent version of the BCP Tier II LMP (2007b), TPWD recommends a density of approximately 13 deer/km2 but it is later acknowledged in the document that a density of approximately seven deer/km2 may be necessary for hardwood recruitment. References are not provided for either assertion so it so not clear how the recommendations were determined. Dey (2014) proposes a density of three deer/km2 as a reasonable estimate of historical deer densities for the area but, once again, at best it is an educated guess. However, hardwood recruitment at the Sanctuary does not appear to be very robust with few preferred hardwood species such as Spanish oak (*Quercus buckleyi*), shin oak (*Quercus sinuata*), escarpment black cherry (*Prunus serotina*), and Texas ash (*Fraxinus texensis*) significantly regenerating, a pattern which may be occurring throughout the BCP (Russell and Fowler 1999, 2002, 2004).

The Hatfield Tract is a 50-acre parcel deeded to TAS in 1986 with the following stipulation: “it will never lease any portion of the property for hunting or trapping

purposes"; as a result, no hunting took place on this tract during the 2019 – 2020 whitetail deer season.

Vegetation Management

Approximately 457 cubic yards of vegetation were trimmed from trails, maintenance roads, shooting lanes, and structures when it either encroached upon hiking trails or roads, posed a safety or structural hazard, or impeded hunting efforts. Unless it posed an immediate safety or structural concern, trimming was restricted to the GCWA non-breeding season (September 1 – February 28) and was performed so that canopy fragmentation, if it occurred, was kept to a minimum. When oaks (*Quercus* sp.) were trimmed, precautionary techniques such as disinfecting saws and painting wounds were utilized to prevent the spread of oak wilt fungus (*Ceratocystis fagacearum*). Due to the severe February ice storm, many Ashe juniper and plateau live oak required trimming or removal from trails and public spaces.

Slash from cut vegetation was chipped prior to the onset of the GCWA breeding season yielding an estimated 80 cubic yards of material. The mulch was spread on the Sanctuary's trail system as well as utilized to mulch individual seedlings which were planted near Baker Cabin, the Steward's residence, gate 12219 area, and in Hunt Site #11.

During the fall and winter of 2020 - 2021 a total of 28 woody and herbaceous plants were put in the ground at the Sanctuary, all donated by Paul and Georgean Kyle, Carol Ray, and the City of Austin BCP (**Table 4**).

In 2015, TAS applied for a Federal Emergency Management Agency grant to install a shaded fuel break in the Wildland Urban Interface Baker Sanctuary shares with approximately 85 homes of the Cypress Canyon subdivision. In total, it was estimated the fuel break would span 6,666 linear feet and treat an area of

approximately 15.4 acres (**Figure 4**). The application was approved and in the fall of 2018, TAS contracted Lake Travis Fire & Rescue (LTFR) to implement the grant and install the fuel break in accordance with the best management practices developed by USFWS and Travis County BCP. LTFR began work mid-January 2019 and completed approximately 98% of the northern section before work was halted for the GCWA breeding season. Work resumed on the shaded fuel break in October 2019 and wrapped up in November 2019 with the treatment of the remainder of the northern section and the three-acre southern section.

Baker Sanctuary is composed primarily of dense mature oak-juniper woodlands interspersed with pockets of open and semi-open savannah; there are nine Fire Behavior Prediction System fuel models that correspond with the habitats within the BCP. A fire management plan based upon these prediction systems is located in the Sanctuary headquarters and is available to assist the Steward in monitoring for fire safety and response readiness. The Sanctuary is also equipped with a wildfire call-down list and basic wildfire response tools to expedite early response to wildfires.

Brown-headed Cowbird Trapping

TAS operated two brown-headed cowbird (*Molothrus ater*, BHCO) traps from March 12 through May 22 of the 2021 season. Trap TAS1 was located on the south side of Lime Creek Road adjacent to the public parking lot and trap TAS2 in the semi-open savannah near hunt site 11. Traps were checked daily and non-target species were released when discovered. This season, trap TAS1 captured seven males while TAS2 recorded no captures for a total of seven BHCO captured, results significantly lower than the average of 18 per season captured over the prior 18 recorded seasons (**Figure 5**). No non-target species were captured during the trapping effort.

Exotics Control

Two distinct populations of Malta star-thistle (*Centaurea melitensis*) were known to occur at the Sanctuary, one centered near Baker Cabin to the north of Lime Creek Road (LCR) and another centered at the Steward's old residence to the south of LCR. While both populations occurred in heavily disturbed, semi-open savannah habitat, the northern population was more established and extensive, typically forming a dense monoculture where it occurred. With a regime of consistent hand-pulling and limited use of glyphosate over the past 11 years, both populations have been greatly reduced in density and distribution to the point where only occasional hand removal of scattered individuals is now required.

The extensive tree-of-heaven (*Ailanthus altissima*) grove discovered in December 2010 (Grove 1) in a northern drainage of the Sanctuary is still being actively monitored and treated. Over the last year, 85 tree-of-heaven seedlings were discovered and hand pulled, most of which seemed to have derived from several overlooked mature trees on the fringe of the treatment area. Since the grove was discovered in 2010, a total of 5,129 tree-of-heaven (**Figure 6**) and 53 chinaberry (*Melia azedarach*) seedlings have been removed from the area. This area will continue to be monitored until three consecutive years have passed without detection of any emergent seedlings.

Various non-native, invasive plants were either manually removed or stump-cut and treated with a 40% imazapyr solution when encountered throughout the Sanctuary. Species treated or removed included 65 chinaberry, 89 Chinese pistache (*Pistacia chinensis*), one crepe myrtle (*Lagerstroemia* species), 214 heavenly bamboo (*Nandina domestica*), nine patches of Japanese honeysuckle (*Lonicera japonica*), 11 patches of Johnsongrass (*Sorghum halepense*), 11 jujube (*Ziziphus zizyphus*), 97 large-leaf privet (*Ligustrum japonicum*), 288 small-leaf privet (*Ligustrum sinense*), and 116 tree-of-heaven.

The 18 common figs initially treated on July 2013 near Walnut Spring were monitored over the course of the year and no new re-sprouts were observed. The site will continue to be monitored until no new growth has been recorded in three successive years.

Over the past fiscal year, 10 boiling water treatments were applied to visible red imported fire ant (*Solenopsis invicta)* mounds which occurred in high traffic, disturbed areas such as the Jackie Arnold Education Center, the Steward's residence, and the public parking lot.

Research

In an effort to achieve a more complete understanding of the composition, distribution, and density of avian species which inhabit the Sanctuary, the fixed-radius point count methodology proposed by Hutto *et al.* (1986) has been employed in an annual breeding bird survey since 2011. From June 7 through June 13, the eleventh annual count was performed at a total of 38 point count stations (**Figure 7**). While in the past the survey had been conducted over the course of one morning with the help of volunteer surveyors, beginning in 2016 one observer, Christopher Murray, conducted all the surveys over the course of several weeks. Of the 40 species recorded, the most abundant were northern cardinal detected at 100% of the stations, painted bunting (*Passerina ciris*) at 79% of the stations, and black-crested titmouse (*Baeolophus atricristatus*) and lesser goldfinch (*Carduelis psaltria*) both at 71% of the stations. Golden-cheeked warblers were detected at 29% of the stations (**Table 5**) compared to 58% for the previous year. Point count data were analyzed with a linear regression test (log-transformed, 2-tail, 95% confidence level) for the 11 years' worth of data. All populations appear stable with no statistically significant trends with the exception of Inca dove (*Columbina inca*), lesser goldfinch (*Spinus psaltria*), painted bunting (*Passerina ciris*), red-eyed vireo (*Vireo olivaceus*), and white-

eyed vireo (*Vireo griseus*) who demonstrated significant positive population trends. American crow (*Corvus brachyrhynchos*), great-tailed grackle (*Quiscalus mexicanus*), northern bobwhite (*Colinus virginianus*), and turkey vulture (*Cathartes aura*) demonstrated significant negative population trends.

From 2011 – 2014, 15 nest boxes were installed throughout the Sanctuary as a community outreach activity and to provide additional nesting opportunities for cavity nesting birds. Of the remaining six nest boxes, two were occupied by Carolina chickadees (*Poecile carolinensis*), as determined by nest composition and egg shell fragments. In addition to the nest boxes, the seven chimney swift (*Chaetura pelagica*) towers on the Sanctuary were estimated to have successfully fledged a total of 12 young, determined by analysis of nesting detritus accumulated on the bottom plates of the towers.

To enhance survivorship and to investigate factors which may contribute to hardwood seedling growth rates and mortality, an oak caging project was initiated in December 2013. The oak caging effort has continued through 2020 - 2021 and was expanded to include other hardwood species of concern in the 2016 – 2017 season. During the 2020 - 2021 season an additional one plateau live oak, one shin oak, three Spanish oak, and three escarpment black cherry were caged throughout the Sanctuary. To date a total of 55 plateau live oak, 62 shin oak, 146 Spanish oak, 20 Texas ash, 32 escarpment black cherry, and one coma (*Bumelia lanuginosa*) have been caged, a total of 315 hardwood individuals of concern. In conjunction with the caging effort, data such as habitat type, basal stem diameter, seedling height, percent cover, and distance to nearest mature individual were collected to potentially better understand factors which may affect seedling growth and survival. Currently, analysis of the data set has only focused on growth rates per species and has not yet explored possible effects related to habitat type or density of canopy cover. To date, caged Spanish oak have exhibited an annual average increase in height of 12.4 cm/season, plateau live oak 9.8 cm/season, shin oak 3.3 cm/season, escarpment black

cherry 17.8 cm/season, Texas ash 10.0 cm/season, and coma 5.1 cm/season. With regard to basal diameter, caged Spanish oak have exhibited an annual average increase of 0.192 cm/season, plateau live oak 0.345 cm/season, shin oak 0.177 cm/season, escarpment black cherry 0.200 cm/season, Texas ash 0.371 cm/season, and coma 0.015 cm/season. To date, plateau live oak have demonstrated a 26% mortality rate for caged individuals, shin oak 30%, Spanish oak 13%, Texas ash 5% and no mortality has yet been recorded for the caged escarpment black cherry or coma.

Following the extreme drought of 2011, Baker Sanctuary experienced significant, localized Ashe juniper mortality centered primarily on the east portion of the preserve near Lime Creek Road. In September 2014, 10 juniper seedlings were flagged and given a unique tag but they were not caged. Ten additional juniper were flagged and tagged in February 2016. With the goal to obtain growth rates (height and mid-stem diameter) to compare with those of hardwoods, trees were selected with the criteria that they were seedlings and growing in full sun. To date seedling juniper height has increased at an average of 33.3 cm/season and mid-stem diameter at a rate of 0.360 cm/season. Mortality has been low with only one individual (5%) expiring to date.

Water quality tests were continued for Baker Spring on a monthly basis, flow and time permitting, and intermittently for Audubon Spring. Both sites have been documented to support populations of the threatened Jollyville plateau salamander (*Eurycea tonkawae*). As a participating member of the Colorado River Watch Network (CRWN), water quality data collection followed CRWN protocols. During the 2020 - 2021 season, no water quality tests were performed, due to a lack of flow at the spring during the end of the month data collection window (**Table 6**).

Education and Outreach

From October 2020 through September 2021 Baker Sanctuary experienced a total of 445 visitations from day hikers. Due to a new sign-in procedure initiated in March 2020 on the outset of the COVID-19 pandemic, it is not known what percentage TAS members represented of the day hikers. An additional 113 visitations occurred during organized activities such as educational programs, TAS events, and guided hikes. A total of 855 volunteer hours were logged at the Sanctuary on a variety of activities (see below).

October: Grounds & facilities maintenance.
November: Facilities maintenance.
December: No volunteer activity.
January: Grounds & facilities maintenance.
February: Habitat restoration & grounds maintenance.
March: Grounds & trails maintenance, habitat restoration, biological monitoring.
April: Grounds maintenance & biological monitoring.
May: Facilities maintenance, habitat restoration, biological monitoring.
June: Biological monitoring.
July: Grounds & facilities maintenance.
August: Facilities, grounds, and trail maintenance.
September: Grounds & facilities maintenance.

Other activities to enhance community involvement and increase awareness of Baker Sanctuary and the BCP mission included seven guided hikes for various community groups and the facilitation and supervision of eight Eagle Scout projects (Troops 70, 202, and 271). Presentations on natural history topics were given to a total of 470 LISD fourth grade students, 135 LISD fifth grade students, 15 high school students at St. Michael's Catholic Academy, 15 AISD high school

students, 16 undergraduate students at St. Edward's University, and 15 participants of TAS programming.

Literature Cited

BCP. 2007a. Balcones Canyonlands Preserve land management plan, Tier IIA, chapter VII: golden-cheeked warbler management. 35 pp.

BCP. 2007b. Balcones Canyonlands Preserve land management plan, Tier IIA, chapter X: animal management. 46 pp.

Bibby, C. J., N. D. Burgess, D. A. Hill, and S. Mustoe. 2003. Bird census techniques; chapter 3: territory mapping methods. Academic Press, London.

Dey, Daniel. 2014. Sustaining oak forests is eastern North America: Regeneration and recruitment, the pillars of sustainability. Forest Science 60(5).

Hutto, R.L., Pletschet, S.M., and Hendricks, P. 1986. A fixed-radius point count for nonbreeding and breeding season use. Auk 103: 593-602.

Oetgen, J.G., Lambert, Jr, B.C., Whiteside, J.D. 2008. Surveying white-tailed deer populations using infrared-triggered cameras. Texas Parks and Wildlife.

Russell, F. Leland and Norma L. Fowler. 1999. Rarity of oak saplings in savannas and woodlands of the eastern Edward's Plateau, Texas. The Southwestern Naturalist, 44(1).

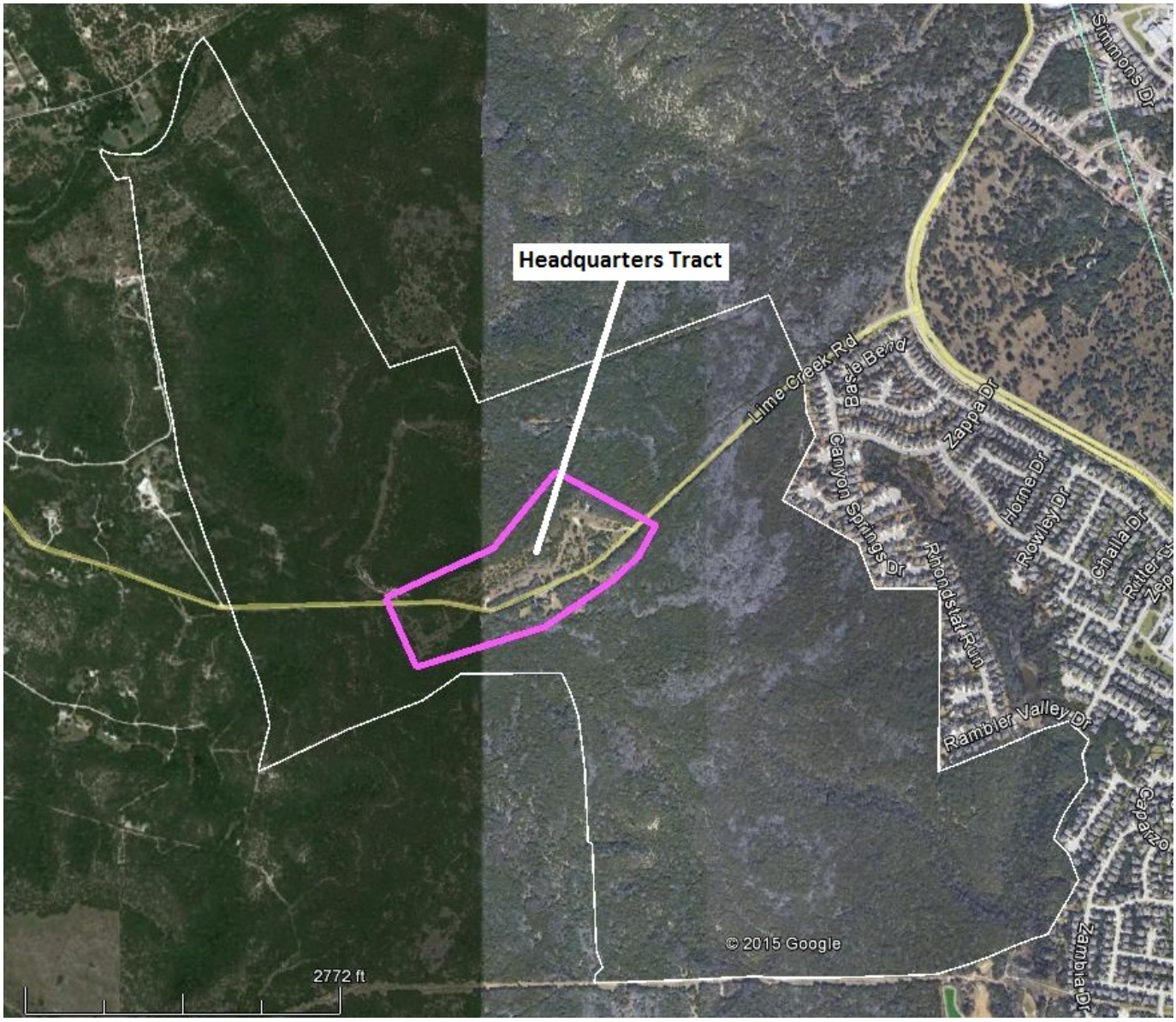
Russell, F. Leland and Norma L. Fowler. 2002. Failure of adult recruitment in *Quercus buckleyi* populations on the eastern Edward's Plateau, Texas. The American Midland Naturalist, 148(2).

Russell, F. Leland and Normal L. Fowler. 2004. Effects of white-tailed deer on the population dynamics of acorns, seedlings, and small saplings. Plant Ecology, 173:59-72.

U.S. Fish and Wildlife Service (USFWS). 2010. USFWS Section 10(a)(1)(A) scientific permit requirements for conducting presence/absence surveys and habitat assessments for endangered golden-cheeked warblers. USFWS Ecological Services Field Office, Austin, Texas. 10 pp.

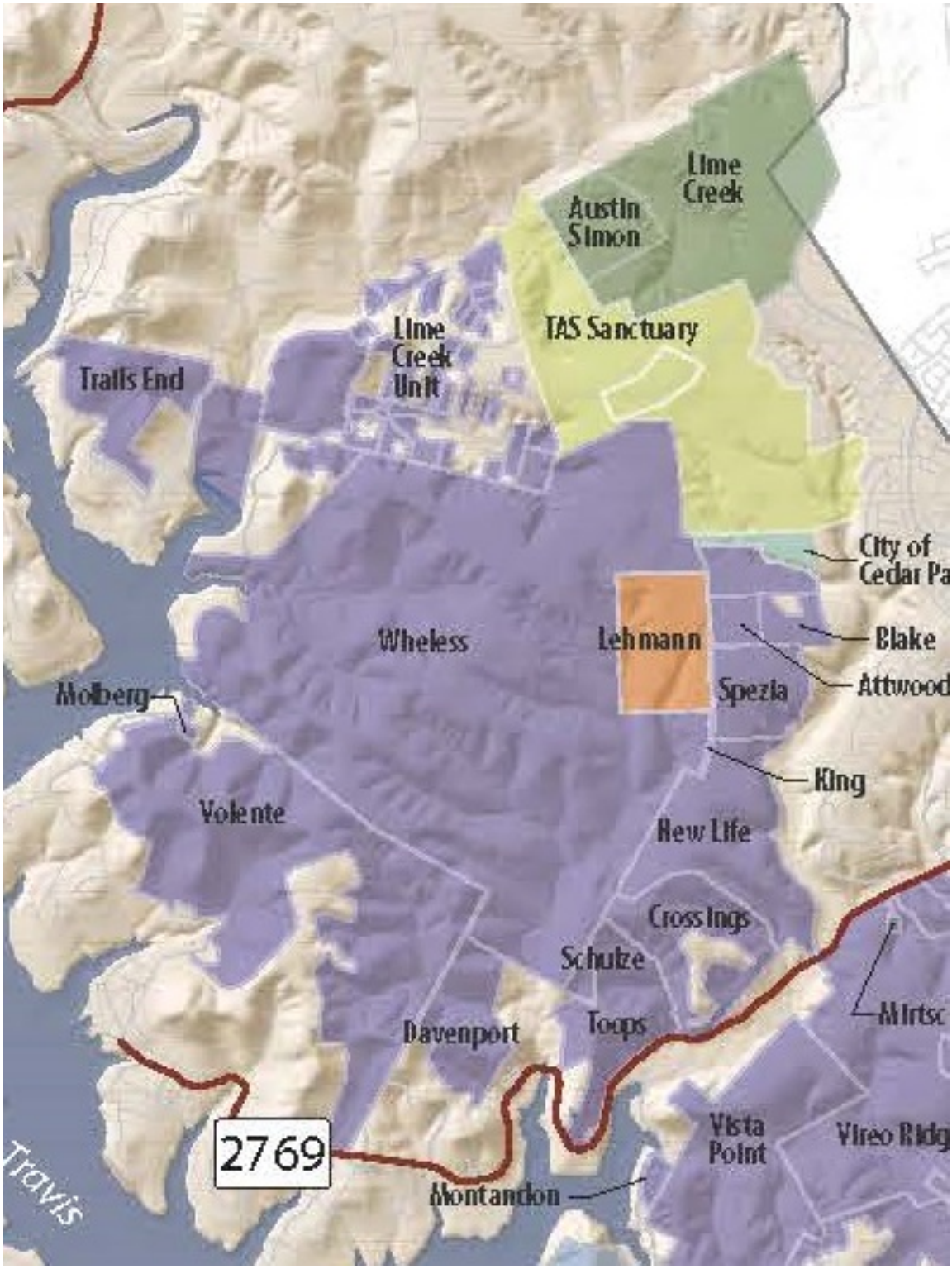
Appendix A

Baker Sanctuary 40-acre headquarters tract



Appendix B

Baker Sanctuary and adjacent BCP partner properties



Appendix C

RESULTS OF THE GOLDEN-CHEEKED WARBLER SURVEY
NORTH VALLEY BAKER SANCTUARY PLOT
SPRING 2021
TRAVIS COUNTY, TEXAS



TRAVIS
AUDUBON
Listen. Look. And Learn.

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1.0 INTRODUCTION

Travis Audubon Society (TAS) owns and operates the 715-acre Baker Sanctuary and is a Managing Partner in the Balcones Canyonlands Preserve (BCP) system. The BCP was formed in 1996 with the adoption of the Balcones Canyonlands Conservation Plan (BCCP), a 30-year regional permit issued by the US Fish and Wildlife Service (USFWS) of which the City of Austin and Travis County are the joint Permit Holders. The BCCP set aside a minimum of 30,428-acres throughout Travis County for the protection of two federally endangered Neotropical passerine species, the golden-cheeked warbler (*Setophaga chrysoparia*) and the black-capped vireo (*Vireo atricapilla*). The Permit Holders are also required to protect six federally endangered karst invertebrate species as well as twenty-seven other species of concern. In 2018, the black-capped vireo was down-listed to 'vulnerable' status by the USFWS.

Baker Sanctuary is bordered primarily by properties owned and managed by various BCP partners, including the City of Austin, Travis County, and the City of Cedar Park. In addition to preserve lands, Baker is bordered by several small rural lots to the west and north comprised of Fisher Hollow and Red Wagon Estates, and a large suburban development to the southeast, Cypress Canyon. Lime Creek Road, which runs from east to west, effectively divides the Sanctuary into two roughly equal parcels. It is estimated Baker Sanctuary contains 690 acres of high-quality golden-cheeked warbler (GCWA) habitat.

The purpose of this report is to present the results of the first year of the GCWA survey conducted on the North Valley plot. The full Sanctuary survey effort was initiated in 2017 as part of an effort to gain a more complete understanding of the density, distribution, and fecundity of GCWA throughout the entire Sanctuary, data which had not been collected in the past. The survey effort began with the Northeast plot in 2017 with the intent of surveying for three successive years before rotating to an adjacent plot (Murray 2017). However, due to an influx of

qualified survey volunteers, the Northwest plot was added in 2018 and was surveyed in addition to the Northeast plot. To date, both the Northeast and Northwest plots have been surveyed for three consecutive seasons and the 2021 North Valley survey marks the beginning of the final three year survey effort for the northern half of the Sanctuary. Ideally the Sanctuary should be surveyed in its entirety over the course of one breeding season for successive seasons but, due to financial constraints, the rotating survey method is the best option currently available.

The methods for the 2021 Sanctuary surveys followed the USFWS recommended minimum procedures for determining the presence/absence of GCWA (USFWS 2010), as outlined in TAS's Federal Fish and Wildlife Permit (Permit No. TE94739A-0), issued May 10, 2013. In addition, GCWA territory mapping followed procedures outlined in Bibby et al. (2003) and the BCCP Tier II Land Management Plan (BCCP 2007) unless otherwise stated.

2.0 DESCRIPTION OF SURVEY AREA

In general, the approximately 104-acre North Valley plot shares a vegetation community that is typical of GCWA habitat throughout the central Texas Hill Country where mixed woodlands are dominated primarily by Ashe juniper (*Juniperus* ashei) and plateau live oak (*Quercus fusiformis*) and lightly interspersed with Spanish oak (*Quercus buckleyi*), shin oak (*Quercus sinuata*), cedar elm (*Ulmus crassifolia*), post oak (*Quercus stellata*), escarpment black cherry (*Prunus* serotina), and Texas ash (*Fraxinus texensis*). A limited variety of deciduous and evergreen understory species such as Texas persimmon (*Diospyros texana*), possumhaw (*Ilex decidua*), yaupon (*Ilex vomitoria*), wafer ash (*Ptelea* trifoliata), flameleaf sumac (*Rhus lanceolata*), agarita (*Berberis trifoliata*), Lindheimer's silktassel (*Garrya* ovata), elbow bush (*Forestiera pubescens*), poison ivy (*Toxicodendron radicans*), prickly pear (*Opuntia* sp.*),* and twist leaf yucca (*Yucca rupicola*) can also be found throughout the survey area.

Topography of the North Valley plot may be the most robust of the plots surveyed to date. While the Northeast and Northwest plots had very little topographical relief, nearly the entire North Valley plot is dominated by an extensive, steep canyon which ranges from 1040 feet above mean sea level (msl) to 820 feet above msl. Stuart Harris Creek, which runs through the center of the canyon and is fed by multiple tributaries from the canyon slopes, drains to the north into Lime Creek which, in turn, flows into the Sandy Creek arm of Lake Travis. Similar to the other canyons found at Baker Sanctuary, the understory vegetation density and average tree height increase as the habitat grades from the uplands to a more riparian habitat near the canyon bottom.

The 9.7-acre parcel (the Ruth Fredericksen Tract or RFT) located at the northern end of the North Valley plot, was purchased by Travis Audubon to act as a buffer between Baker Sanctuary and the homes of the Red Wagon Estates, located to the north of Lime Creek. The habitat in the riparian portion of this tract is composed mostly of a canopy of cedar elm and a dense, mixed understory of small Ashe juniper, elbow bush, and wafer ash. To the south of the creek, a dry slope with scattered, stunted Ashe juniper rises steeply to the tree line. The RFT is not considered optimal GCWA habitat but since GCWA have been observed in this tract on occasion, it was included as part of the North Valley survey plot.

3.0 METHODS

Surveys began on March 17 and concluded on June 12. Surveys occurred in the morning hours and were not conducted if sustained wind speeds were greater than 15 mph or during precipitation other than a light drizzle. Five surveyors, Christopher Murray, Alexis Puchek, Beth Samuelson, Toni Taylor, and Celeste Treadway surveyed the North Valley study plot on a weekly basis and invested a total of 161.75 hours, or 38.9 hours per 25 acres. Spot-mapping techniques as outlined in the USFWS protocol for GCWA presence/absence surveys (USFWS

2010) as well as Bibby et al. (2003) and the Tier II Land Management Plan (2007) were utilized by the surveyors.

During each visit the surveyor hiked through the study area and searched for GCWA by sight and/or sound. Upon detection of a GCWA, the surveyor recorded the location of the bird on a field map and also with a Garmin eTrex GPS receiver. GPS locations were designated as precise or imprecise with precise locations indicating a visual and/or auditory observation within 30 feet of the observer. Imprecise locations were auditory detections only and were estimated locations extending 30 to 120 feet from the observer. At each location the surveyor also recorded the song type (A or B), whether the GCWA was color banded, presence of a female or fledglings, and territorial interactions such as counter-singing or conspecific chases. Auditory recordings were not utilized during any surveys to lure GCWA to the observer.

After the surveys were complete, data were compiled with GPS Trackmaker and uploaded into GoogleEarth for analysis. Territories were determined primarily by utilizing defensive cues, such as counter-singing and chases, exhibited by males at or near territory boundaries. In addition to territorial behavior, re-sighting of color bands, sequential movement patterns, presence of females and fledglings, and age of fledglings were used to conservatively estimate the amount and distribution of territories throughout the survey area.

To increase the accuracy and ease of delineating territories, an effort was made to mist net and capture all previously unbanded breeding males on both plots. Males were captured by setting up a mist net (2.6 x 6 meters, 30 mm mesh, 2 ply) in the target male's territory and using a play-back recording to draw the bird to the net. If captured, the male was outfitted with an aluminum USFWS band and two to three color bands. All color combinations were coordinated with researchers throughout the state so that all banded individuals had a unique

color-band/aluminum band combination. Since 2017 a total of 44 male GCWA have been banded on the study plots (**Table 1**).

Reproductive success was determined as follows:

1. Territory density: number of territories per acreage surveyed;
2. Calculation of edge territories: each territory that significantly straddled plot boundary counted as a half territory (i.e., 0.5 territory) (Verner 1985); and
3. Productivity measures (Anders 2000) - calculated for full territories ONLY, as follows:
    a. Pairing success: pairing success of male GCWA determined by observing one or more of the following conditions: a territorial male observed with a female and/or a male tending at least one fledgling. Pairing success rate = number of territories determined to have pairing success / total number of full territories;
    b. Breeding success: breeding success rate = number of territories that successfully fledged at least one young / total number of full territories;
    c. Estimated brood size: average brood size per successful pair (based on “breeding success”); and
    d. Productivity = sum of the highest number of fledglings recorded at any one time for each full territory / total number of full territories.

4.0 RESULTS

In total, 316 GCWA observations were recorded over the course of the survey effort. Ten full territories and four edge territories were delineated in the study plot for an adjusted total of 12 territories (**Figure 2**). With the exception of UB2 and MV/DG:BL/SI, females were observed in all the territories as well as a total of 24 fledglings (**Table 2**). Approximately two territories were established directly

adjacent to the 104-acre plot and were not included in the analysis nor indicated on the territory map.

Territory density was calculated at 0.12 territories per acre. This calculation was based on the adjusted total of 12 territories in the 104 acres surveyed.

The pairing success rate in the North Valley plot was 90% (females were observed in all but one of the full territories). The breeding success was estimated at 60%, based on the fact that six of the 10 full territories produced fledglings. The estimated brood size was 3.3 fledglings based on the aforementioned criteria. Productivity was estimated at 2.0 based on the total of 20 fledglings observed in six of the 10 full territories, which includes a second brood by PI/SI:DG/RD (**Table 2**).

5.0 DISCUSSION

While the 100-acre survey has been performed at Baker since 1999, intensity and methodology have varied enough to make significant comparisons between years problematic. With the onset of color-banding and adoption of a standardized survey protocol beginning in the 2011 season, the results of seasonal surveys can cautiously be compared. The comparison is worthwhile to begin to ascertain if certain areas of the Sanctuary are more productive than others and, if so, what the possible causes of such a difference could be. Ultimately, the goal is to elucidate management techniques which would increase productivity in areas where it is comparatively lower, if possible.

Thus far, results from the North Valley survey appear to be fairly similar to prior areas surveyed from 2014 - 2020 in all measured parameters (**Table 3**). Territory density in formerly surveyed plots has ranged from 0.09 – 0.12 (North Valley = 0.12), % pairing success 67% - 100% (North Valley = 90%), % breeding success 57% - 100% (North Valley = 60%), estimated brood size 1.50 – 3.70 (North

Valley = 3.30), and productivity 1.00 – 2.30 (North Valley = 2.00). As additional data are collected over the next two breeding seasons, the picture should come a bit more into focus.

One observation of note for the 2021 season was that it seemed GCWA activity and density was not as randomly distributed across the North Valley plot as had been observed during surveys on prior plots. Anecdotally, density seemed to be concentrated in the valley bottom, especially on the southern end of the plot. Few observations of GCWA were made on the western or eastern edges of the plot, perhaps for a variety of reasons. GCWA were also not observed in the RFT area to the north but due to its vegetation composition discussed earlier, that did not come as a surprise.

On the western edge of the plot, the vegetation is markedly stunted and disperse compared to the valley bottom. Due to its aspect and aridity, the western edge is predictably growth challenged however, to exacerbate the situation, in 2009 a hypothesized dry lightning strike ignited a grass fire which swept through the area and caused the mortality of many Ashe juniper trees. While the western edge will never be as lush as the valley bottom, it is still an area under recovery from the 2009 fire and less than ideal GCWA habitat.

The eastern slope, on the other hand, is the polar opposite of the western slope. Overall, the vegetation is nearly as lush and thick as that found in the valley bottom and should be ideal GCWA habitat. However, it is bisected by multiple steep drainages which makes it extremely hazardous to traverse, especially after the severe February ice storm which caused a significant number of dead falls. As a result, it is quite possible that the lack of GCWA observations in this area may be due to the difficulty of the terrain.

6.0 LITERATURE CITED

Anders, A. D, J. S. Horne, and L. L. Sanchez. 2000. Relationship between habitat characteristics and demography of golden-cheeked warblers on Ft. Hood, Texas. In Endangered species monitoring and management at Ft. Hood, Texas: 2000 annual report. Fort Hood Project, The Nature Conservancy of Texas, Ft. Hood, Texas, USA.

Balcones Canyonlands Conservation Plan (BCCP). 2007. Balcones Canyonlands Preserve land management plan, Tier II: golden-cheeked warbler.

Bibby, C. J., N. D. Burgess, D. A. Hill, and S. Mustoe. 2003. Bird census techniques; chapter 3: territory mapping methods. Academic Press, London.

Murray, C. 2017. Results of the golden-cheeked warbler survey for the Northeast Baker Sanctuary plot, spring 2017. Travis Audubon Society, Austin, Texas. 13 pp.

U.S. Fish and Wildlife Service (USFWS). 2010. USFWS Section 10(a)(1)(A) scientific permit requirements for conducting presence/absence surveys and habitat assessments for endangered golden-cheeked warblers. USFWS Ecological Services Field Office, Austin, Texas. 10 pp.

Verner, J. 1985. Assessment of counting techniques. Current Ornithology 2:247-302.

7.0 ACKNOWLDGEMENTS

Many thanks go out to Alexis Puchek, Elizabeth Samuelson, Toni Taylor, and Celeste Treadway who volunteered many, many hours in search of the elusive, typically uncooperative GCWA, an effort made even more difficult this season due to the amount of downed debris from the February ice storm. This project would not have been possible without their dedication, perseverance, and outstanding ornithological prowess.

Table 1. Golden-cheeked warblers banded on the Northeast, Northwest, and North Valley Baker Sanctuary plots, 2017 - 2021.

Year Banded	Color Combination	Plot	USFWS Band #	Gender	Age
2017	RD/RD:DG/SI	Northeast	2770-41206	Male	ASY
2017	DG/DB:OR/SI	Northeast	2770-41207	Male	ASY
2017	BK/WH:BL/SI	Northeast	2770-41208	Male	ASY
2017	PI/SI:WH/RD	Northeast	2770-41209	Male	ASY
2017	WH/BL:MV/SI	Northeast	2770-41210	Male	ASY
2018	MV/MV:MV/SI	Northwest	2770-41211	Male	ASY
2018	PI/SI:YE/RD	Northwest	2770-41212	Male	ASY
2018	WH/BL:DB/SI	Northwest	2770-41213	Male	ASY
2018	BK/DB:MV/SI	Northwest	2770-41214	Male	ASY
2018	YE/SI:WH/RD	Northwest	2770-41215	Male	SY
2018	OR/SI:BK/MV	Northwest	2770-41216	Male	ASY
2018	DG/PI:WH/SI	Northwest	2770-41217	Male	ASY
2018	BK/SI:GR/WH	Northwest	2770-41218	Male	ASY
2018	MV/SI:BL/YE	Northwest	2790-44711	Male	ASY
2018	WH/WH:OR/SI	Northeast	2770-41219	Male	SY
2018	MV/OR:RD/SI	Northeast	2770-41220	Male	ASY
2018	BK/PI:OR/SI	Northwest	2770-41221	Male	ASY
2018	WH/SI:WH/YE	Northwest	2770-41222	Male	ASY
2019	YE/DG:RD/SI	Northeast	2770-41223	Male	ASY
2019	GR/SI:PI/PI	Northwest	2770-41224	Male	ASY
2019	WH/RD:BL/SI	Northwest	2770-41225	Male	SY
2019	BK/SI:DB/DB	Northeast	2770-41226	Male	ASY
2019	GR/PI:PI/SI	Northeast	2770-41228	Male	ASY
2019	WH/SI:YE/YE	Northeast	2770-41229	Male	SY
2020	DG/SI:PI/PI	Northwest	2770-41230	Male	ASY
2020	DB/YE:YE/SI	Northwest	2770-41231	Male	ASY
2020	BK/SI:WH/BL	Northwest	2770-41232	Male	SY
2020	BL/SI:MV/OR	Northwest	2770-41233	Male	ASY
2020	DB/GR:GR/SI	Northwest	2770-41234	Male	ASY
2020	MV/SI:DB/RD	Northwest	2770-41235	Male	ASY
2020	BK/MV:BK/SI	Northwest	2770-41236	Male	SY
2020	WH/SI:DG/PI	Northwest	2770-41237	Male	ASY
2020	GR/BL:RD/SI	Northwest	2770-41239	Male	ASY
2021	BL/OR:OR/SI	North Valley	2770-41240	Male	ASY
2021	MV/SI:BK/MV	North Valley	2770-41241	Male	SY
2021	RD/DG:WH/SI	North Valley	2770-41242	Male	SY

2021	WH/OR:DB/SI	North Valley	2770-41243	Male	ASY
2021	PI/SI:DG/RD	North Valley	2770-41244	Male	SY
2021	YE/SI:DG/DB	North Valley	2770-41245	Male	SY
2021	DG/BK:MV/SI	North Valley	2770-41246	Male	ASY
2021	OR/SI:WH/DG	North Valley	2770-41247	Male	ASY
2021	WH/RD:PI/SI	North Valley	2770-41248	Male	ASY
2021	PI/DG:WH/SI	North Valley	2770-41249	Male	ASY
2021	MV/DG:BL/SI	North Valley	2770-41250	Male	ASY

Red (RD), Orange (OR), Yellow (YE), Green (GR), Dark Green (DG), Blue (BL), Dark Blue (DB), Mauve (MV), Pink (PI), Black (BK), White (WH), USFWS band (SI), no band (NB)

Table 2. Golden-cheeked warbler territory status and enumeration of females and fledglings detected on the North Valley Baker Sanctuary plot, 2021.

Territory Designation	Full/Edge Territory	Number of Confirmed Detections	Female Detected	# Fledglings Detected
DG/BK/MV/SI	Full	18	Yes	2
MV/SI:BK/MV	Full	28	Yes	4
WH/OR:DB/SI	Full	40	Yes	0
WH/RD:PI/SI	Full	24	Yes	3
RD/DG:WH/SI	Full	27	Yes	0
PI/SI:DG/RD	Full	25	Yes	6*
OR/SI:WH/DG	Full	10	Yes	2
BL/OR:OR/SI	Full	22	Yes	3
UB1	Full	30	Yes	0
UB2	Full	14	No	0
PI/DG:WH/SI	Edge	5	Yes	2
MV/DG:BL/SI	Edge	13	No	0
DB/YE:YE/SI	Edge	15	Yes	2
UB3	Edge	10	Yes	0

*Produced two broods for a total of six fledglings.

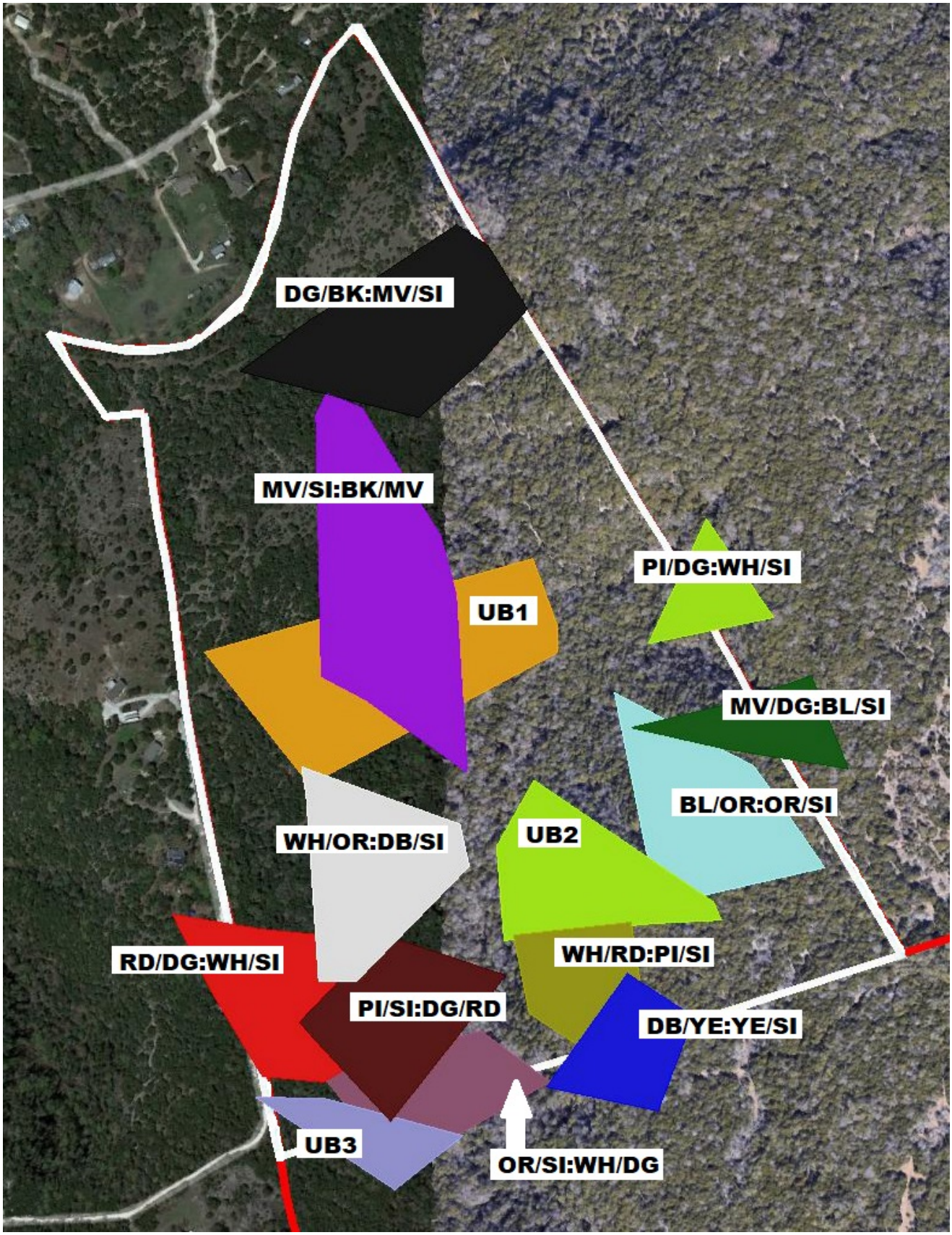
Table 3. Summary of golden-cheeked warbler reproductive success on the Northeast, Northwest, North Valley, and 100-acre plots, 2014-2021.

Survey	Territory Density	% Pairing Success	% Breeding Success	Estimated Brood Size	Productivity	Survey Time/25 Acres (Hours)
100-acre 2014	0.09	100	100	2.40	2.40	60.3
100-acre 2015	0.12	75	75	3.70	2.80	48.8
100-acre 2016	0.11	100	56	2.40	1.30	25.8
Northeast 2017	0.11	86	57	1.75	1.00	20.4
Northeast 2018	0.09	100	100	1.50	1.50	32.2
Northeast 2019	0.10	67	67	2.25	1.50	44.4
Northwest 2018	0.10	92	83	1.90	1.58	17.7
Northwest 2019	0.09	100	82	2.80	2.30	18.5
Northwest 2020	0.09	100	90	2.40	2.20	36.8
North Valley 2021	0.12	90	60	3.30	2.00	38.9
100-acre Average	0.11	92	77	2.83	2.17	52.1
Northeast Average	0.10	84	75	1.83	1.30	32.3
Northwest Average	0.09	98	85	2.36	2.03	24.3

Figure 1. Locations of the Northeast, Northwest, North Valley, and 100-acre Baker Sanctuary plots.



Figure 2. Golden-cheeked warbler territory distribution on the Nort



Appendix D

Baker Sanctuary GCWA VCP point count example, 2017

Date	Station	Time Begin	Time End	Wind Spd (mph)	Temp (F)	Precipitation	Female	BoC
4/6/17	18	09 54.00	10.04.00	0	56°	N/A	Y (N)	WESJ BLJA NOBO

Bird	Position	Time	Detect	Dist (m)
1	1-1	9:54.05	A	26
2	2-1	9:54.15	B	46
1	1-1	9:55	A	26
2	2-1	9:55	B	46
3	3-1	9:56.05	B	71
1	1-1	9:56	A	26
2	2-1	9:56	B	46
1	1-1	9:57	A	26
2	2-1	9:57	B	46
3	3-1	9:57	B	71
2	2-1	9:58	B	46
3	3-1	9:58	B	71
1	1-2	9:58	A	36
1	1-2	9:59	A	36
2	2-1	9:59	B	46
3	3-1	9:59	B	71
1	1-2	10:00	A	36
2	2-1	10:00	B	46
3	3-1	10:00	B	71
3	3-1	10:01	B	71
1	1-2	10:01	A	36
2	2-2	10:01	A	56
1	1-2	10:02	A	36
1	1-3	10:03	A	39

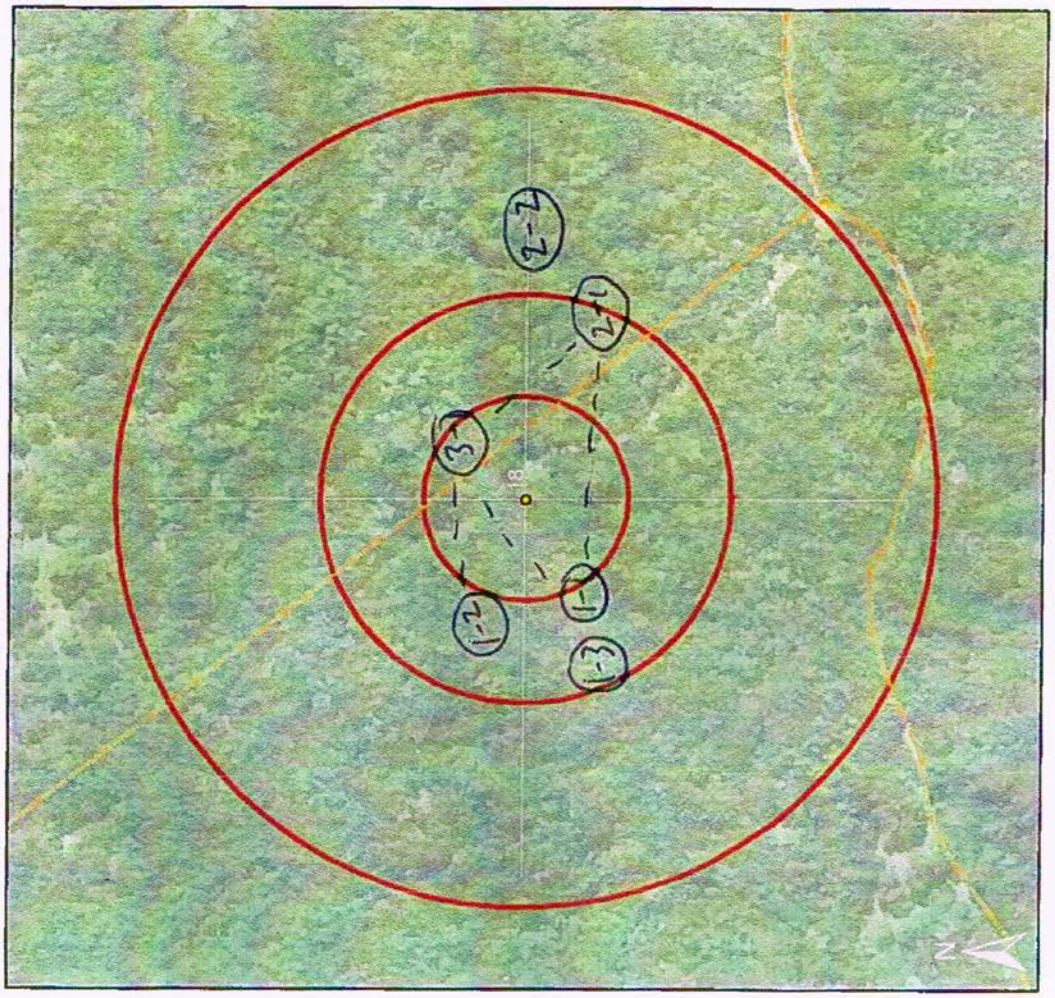


Figure 1. Baker Sanctuary VCP point counts stations, 2021.



Figure 2. Baker Sanctuary whitetail deer hunt and camera sites, 2020 - 2021.

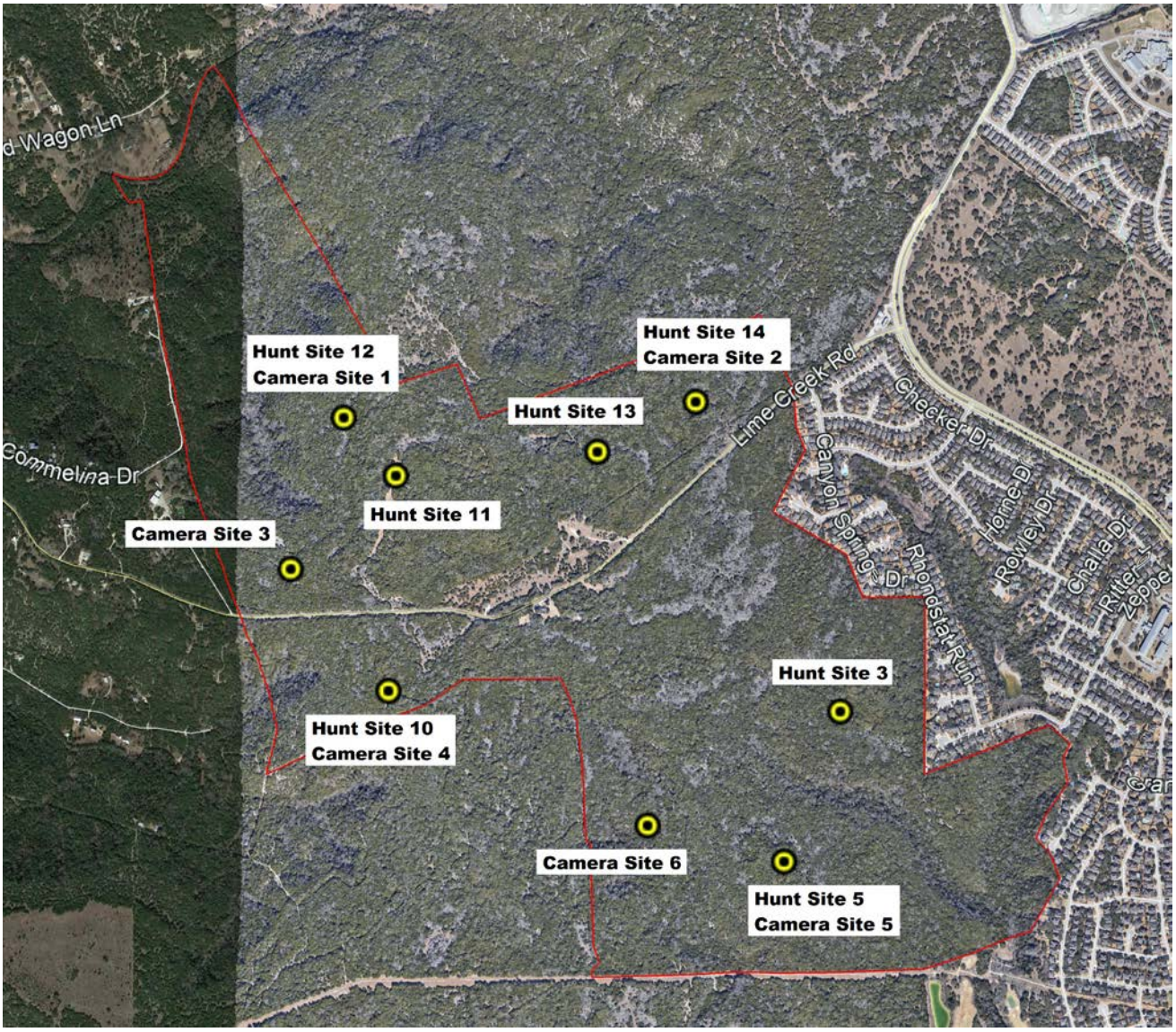


Figure 3. Summary of Baker Sanctuary whitetail deer harvest, 2000-2021. Juvenile deer are a year or less in age.

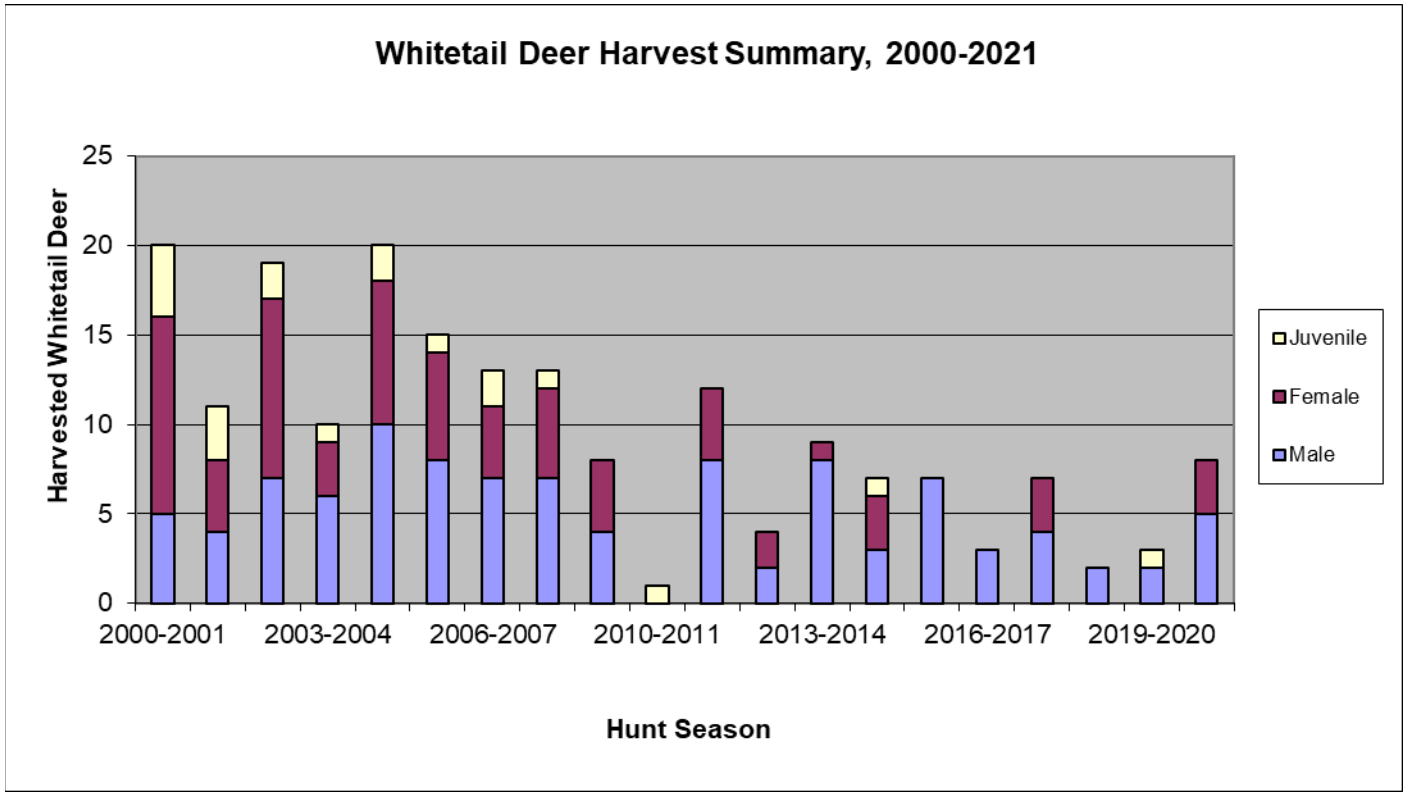


Figure 4. Baker Sanctuary shaded fuel break.

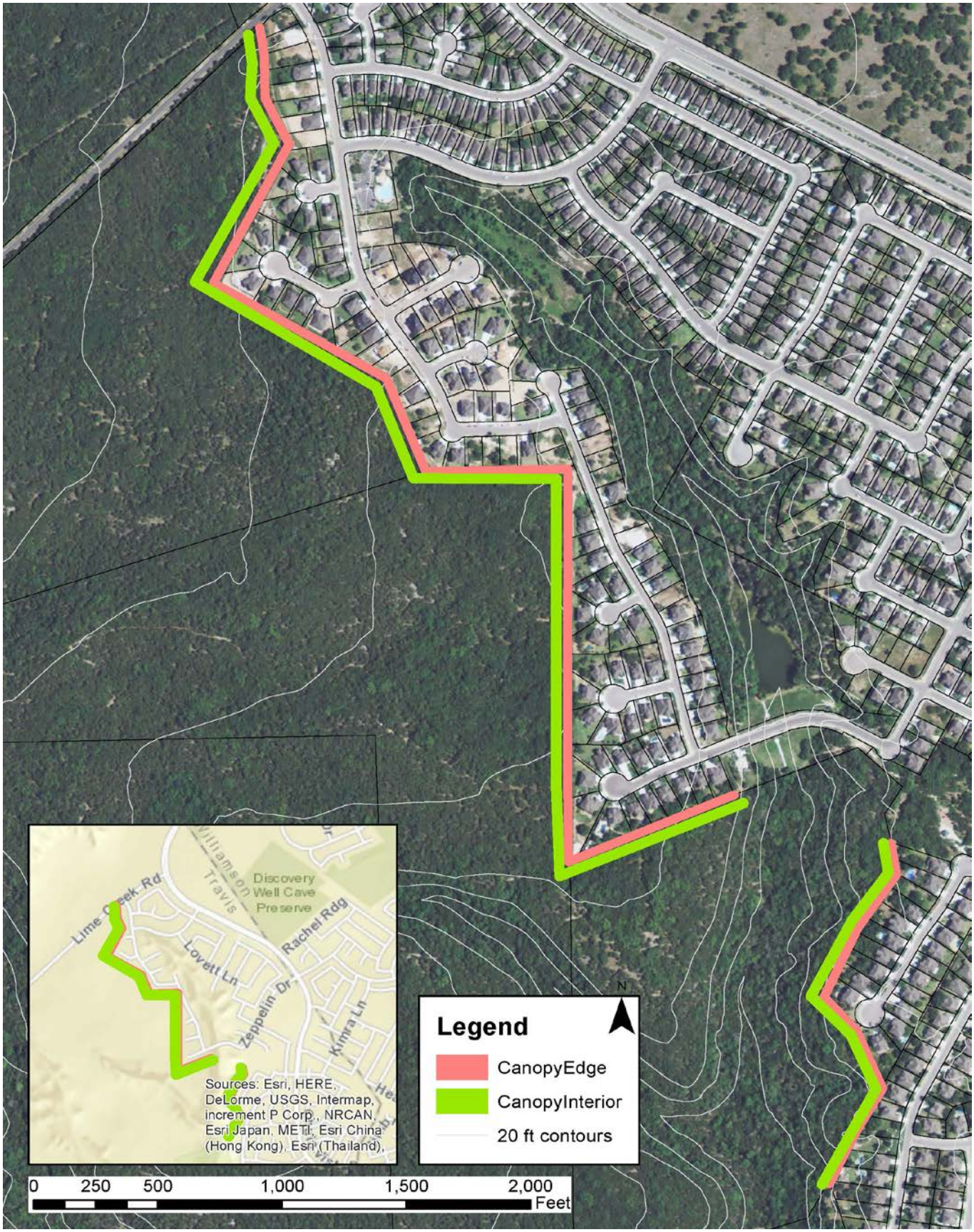


Figure 5. Summary of Baker Sanctuary brown-headed cowbird trapping effort, 2001-2021.

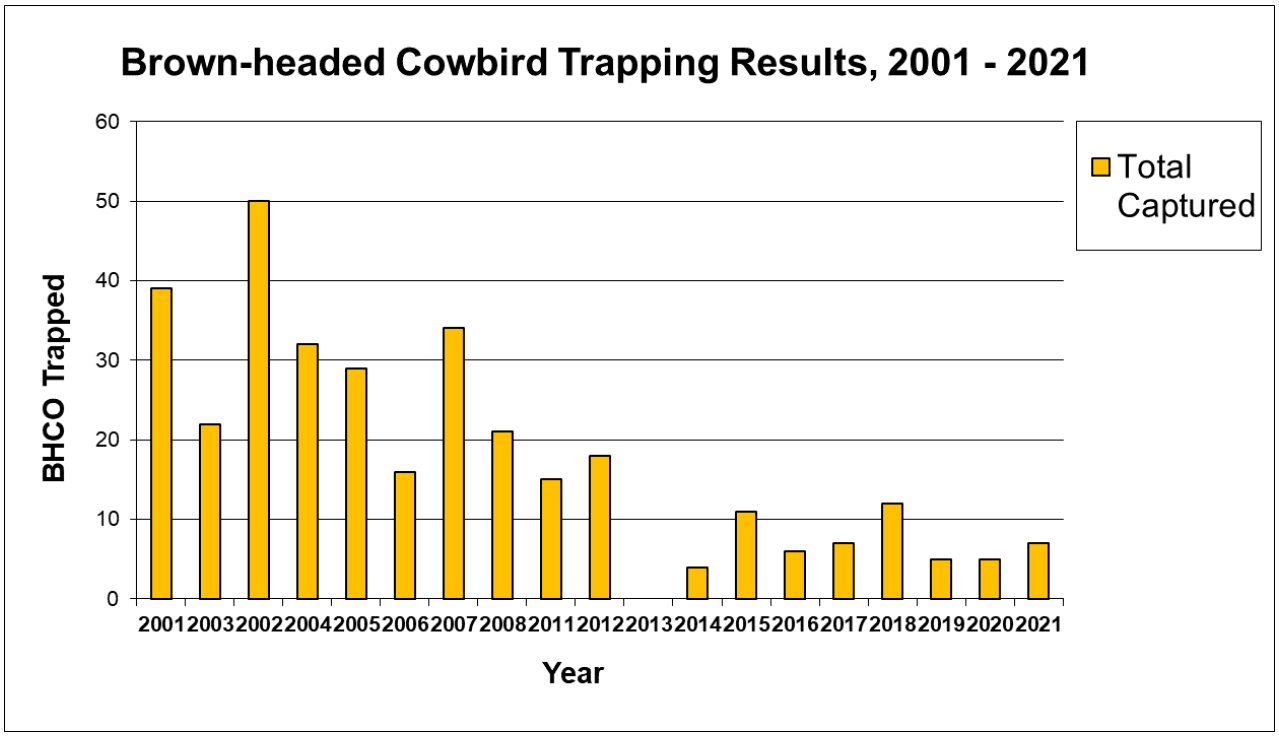


Figure 6. Summary of Baker Sanctuary tree-of-heaven eradication efforts, 2010-2021.

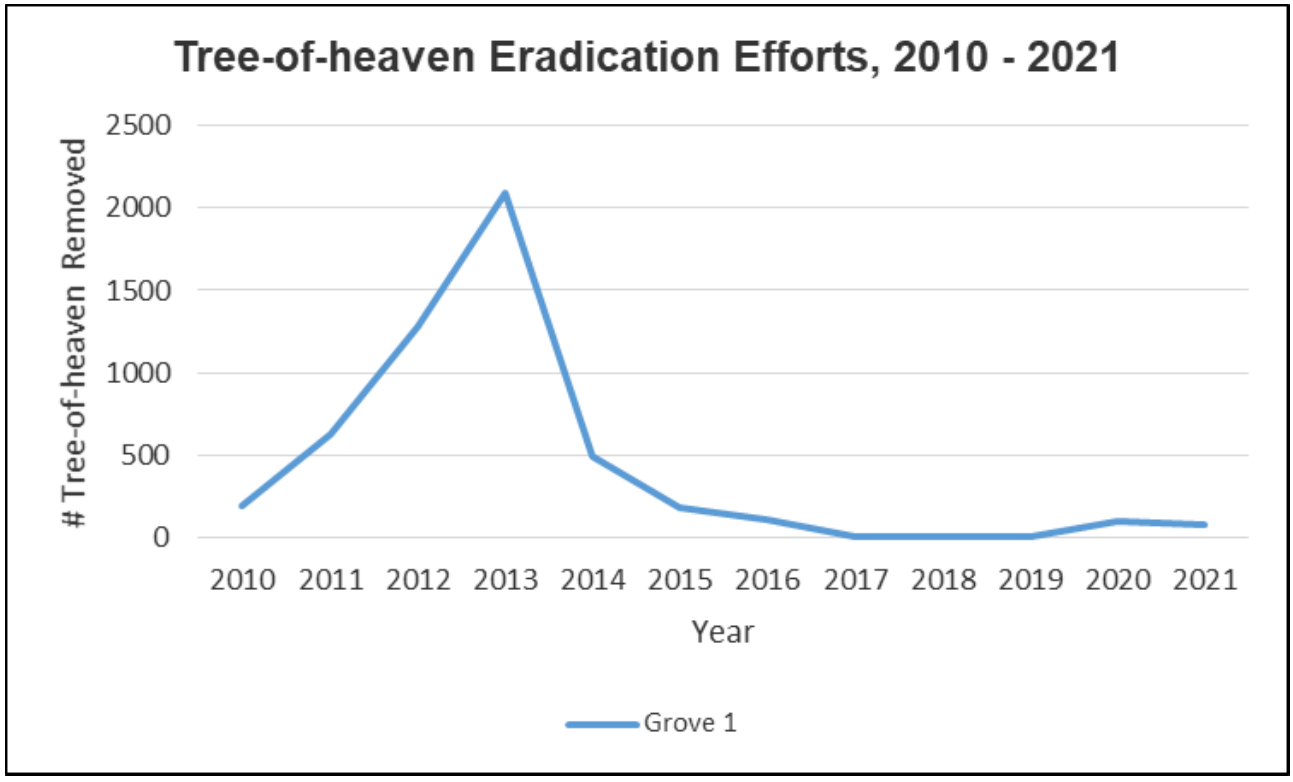


Figure 7. Baker Sanctuary BBS point count stations, 2021.



Table 1. Summary of GCWA banded at Baker Sanctuary, 2015 - 2021.

Year Banded	USFWS Serial Number	Color Band Combination	Survey Plot	Sex	Age
2015	2770-41201	RD/SI:RD/DB	100-acre	Male	SY
2015	2770-41202	MV/MV:YE/SI	100-acre	Male	ASY
2016	2770-41203	NB/SI:OR/DB	100-acre	Male	ASY
2016	2770-41205	BL/DG:BK/SI	100-acre	Male	ASY
2016	2550-99699	WH/SI:BK/WH	100-acre	Male	SY
2017	2770-41206	RD/RD:DG/SI	Northeast	Male	ASY
2017	2770-41207	DG/DB:OR/SI	Northeast	Male	ASY
2017	2770-41208	BK/WH:BL/SI	Northeast	Male	ASY
2017	2770-41209	PI/SI:WH/RD	Northeast	Male	ASY
2017	2770-41210	WH/BL:MV/SI	Northeast	Male	ASY
2018	2770-41211	MV/MV:MV/SI	Northwest	Male	ASY
2018	2770-41212	PI/SI:YE/RD	Northwest	Male	ASY
2018	2770-41213	WH/BL:DB/SI	Northwest	Male	ASY
2018	2770-41214	BK/DB:MV/SI	Northwest	Male	ASY
2018	2770-41215	YE/SI:WH/RD	Northwest	Male	SY
2018	2770-41216	OR/SI:BK/MV	Northwest	Male	ASY
2018	2770-41217	DG/PI:WH/SI	Northwest	Male	ASY
2018	2770-41218	BK/SI:GR/WH	Northwest	Male	ASY
2018	2790-44711	MV/SI:BL/YE	Northwest	Male	ASY
2018	2770-41219	WH/WH:OR/SI	Northeast	Male	SY
2018	2770-41220	MV/OR:RD/SI	Northeast	Male	ASY
2018	2770-41221	BK/PI:OR/SI	Northwest	Male	ASY
2018	2770-41222	WH/SI:WH/YE	Northwest	Male	ASY
2019	2770-41223	YE/DG:RD/SI	Northeast	Male	ASY
2019	2770-41224	GR/SI:PI/PI	Northwest	Male	ASY
2019	2770-41225	WH/RD:BL/SI	Northwest	Male	SY
2019	2770-41226	BK/SI:DB/DB	Northeast	Male	ASY
2019	*2770-41228	GR/PI:PI/SI	Northeast	Male	ASY
2019	2770-41229	WH/SI:YE/YE	Northeast	Male	SY
2020	2770-41230	DG/SI:PI/PI	Northwest	Male	ASY
2020	2770-41231	DB/YE:YE/SI	Northwest	Male	ASY
2020	2770-41232	BK/SI:WH/BL	Northwest	Male	SY
2020	2770-41233	BL/SI:MV/OR	Northwest	Male	ASY
2020	2770-41234	DB/GR:GR/SI	Northwest	Male	ASY
2020	2770-41235	MV/SI:DB/RD	Northwest	Male	ASY
2020	2770-41236	BK/MV:BK/SI	Northwest	Male	SY
2020	2770-41237	WH/SI:DG/PI	Northwest	Male	ASY
2020	**2770-41239	GR/BL:RD/SI	Northwest	Male	SY
2021	2770-41240	BL/OR:OR/SI	North Valley	Male	ASY
2021	2770-41241	MV/SI:BK/MV	North Valley	Male	SY

Year Banded	USFWS Serial Number	Color Band Combination	Survey Plot	Sex	Age
2021	2770-41242	RD/DG:WH/SI	North Valley	Male	SY
2021	2770-41243	WH/OR:DB/SI	North Valley	Male	ASY
2021	2770-41244	PI/SI:DG/RD	North Valley	Male	SY
2021	2770-41245	YE/SI:DG/DB	North Valley	Male	SY
2021	2770-41246	DG/BK:MV/SI	North Valley	Male	ASY
2021	2770-41247	OR/SI:WH/DG	North Valley	Male	ASY
2021	2770-41248	WH/RD:PI/SI	North Valley	Male	ASY
2021	2770-41249	PI/DG:WH/SI	North Valley	Male	ASY
2021	2770-41250	MV/DG:BL/SI	North Valley	Male	ASY

Red (RD), Orange (OR), Yellow (YE), Green (GR), Dark Green (DG), Blue (BL), Dark Blue (DB), Mauve (MV), Pink (PI), Black (BK), White (WH), USFWS band (SI), no band (NB)
*Band 2770-41227 was misplaced deep in the forest, never to be found again.
**Band 2770-41238 was damaged and discarded.

Table 2. GCWA detected per VCP point count time interval, 2017 - 2021.

Year	< 1 min.	1-2 min.	2-3 min.	3-4 min.	4-5 min.	GCWA Detected 5-min. Interval	5-6 min.	6-7 min.	7-8 min.	8-9 min.	9-10 min.	GCWA Detected 10-min. Interval
2017	27	5	4	3	6	45	2	2	0	3	4	57
2018	12	5	5	3	3	28	3	1	4	2	4	42
2019	24	8	7	2	2	43	2	2	4	2	1	54
2020	27	7	2	2	9	47	3	6	2	1	2	61
2021	28	5	3	3	3	42	3	2	3	1	1	52

Table 3. Baker Sanctuary whitetail deer population survey results, 2016 - 2020.

Year	Buck Ratio	Buck Estimate	Doe Estimate	Fawn Estimate	Total Population Estimate	Deer/km2	Doe:Buck Ratio	Fawn Production (%)
2016	0.05	10.00	8.41	1.85	20.26	7.00	0.84	22.0
2017	0.06	17.00	5.52	1.08	23.60	8.10	0.32	19.6
2018	0.12	9.00	3.24	1.68	13.92	4.80	0.36	51.9
2019	0.04	17.00	7.66	3.90	28.56	9.80	0.45	50.9
2020	0.04	9.00	4.90	1.37	15.26	5.20	0.54	27.9

Table 4. Baker Sanctuary plantings, 2020 – 2021.

Common Name	Scientific Name	Class	# Planted
Dwarf palmetto	*Sabal minor*	Tree/shrub	1
Huisache	*Acacia minuata*	Tree/shrub	3
Indian mallow	*Abutilon incanum*	Herbaceous/grass	sowed
Maximilian sunflower	*Helianthus maximiliani*	Herbaceous/grass	7
Mexican plum	*Prunus Mexicana*	Tree/shrub	5
Red Buckeye	*Aesculus pavia*	Tree/shrub	2
Rusty Blackhaw	*Viburnum rufidulum*	Tree/shrub	1
Shrubby boneset	*Eupatorium havanense*	Tree/shrub	5
Spanish oak	*Quercus buckleyi*	Tree/shrub	1
Zexmenia	*Zexmenia hispida*	Herbaceous/grass	3

Table 5. Baker Sanctuary BBS point count survey, 2021.

Common Name	Scientific Name	Number Observed	Mean[1]	Frequency (%) (25 yd radius)[2]	Frequency (%) (unlimited radius)[3]
Ash-throated Flycatcher	*Myiarchus cinerascens*	2	0.05	5	13
Barn Swallow	*Hirundo rustica*	0	0.00	0	5
Bewick's Wren	*Thryomanes bewickii*	7	0.18	0	66
Black-chinned Hummingbird	*Archilochus alexandri*	3	0.08	0	8
Black-crested Titmouse	*Baeolophus atricristatus*	7	0.18	0	71
Blue Jay	*Cyanocitta cristata*	0	0.00	0	3
Blue-gray Gnatcatcher	*Polioptila caerulea*	9	0.24	0	29
Broad-winged Hawk	*Buteo platypterus*	0	0.00	0	3
Canyon Wren	*Catherpes mexicanus*	0	0.00	0	3
Carolina Chickadee	*Poecile carolinensis*	15	0.39	0	58
Carolina Wren	*Thryoothorus ludovicianus*	4	0.11	0	21
Chimney Swift	*Chaetura pelagica*	0	0.00	0	11
Common Grackle	*Quiscalus quiscula*	0	0.00	0	11
Eastern Phoebe	*Sayornis phoebe*	0	0.00	0	5
Field Sparrow	*Spizella pusilla*	0	0.00	0	18
Golden-cheeked Warbler	*Setophaga chrysoparia*	9	0.24	0	29
Greater Roadrunner	*Geococcyx californianus*	0	0.00	0	8
Great Crested Flycatcher	*Myiarchus crinitus*	1	0.03	0	3
House Finch	*Haemorhous mexicanus*	2	0.05	0	5
Inca Dove	*Columbia inca*	0	0.00	0	3
Ladder-backed Woodpecker	*Picoides scalaris*	5	0.13	0	16
Lesser Goldfinch	*Carduelis psaltria*	5	0.13	0	71
Mourning Dove	*Zenaida macroura*	1	0.03	3	37
Northern Bobwhite	*Colinus virginianus*	0	0.00	0	3
Northern Cardinal	*Cardinalis cardinalis*	21	0.55	0	100

Common Name	Scientific Name	Number Observed	Mean[1]	Frequency (%) (25 yd radius)[2]	Frequency (%) (unlimited radius)[3]
Painted Bunting	*Passerina ciris*	14	0.37	0	79
Purple Martin	*Progne subis*	0	0.00	0	26
Red-eyed Vireo	*Vireo olivaceus*	1	0.03	0	21
Red-Shouldered Hawk	*Buteo lineatus*	0	0.00	0	5
Rufous-crowned Sparrow	*Aimophila ruficeps*	1	0.03	0	8
Summer Tanager	*Piranga rubra*	3	0.08	8	47
White-eyed Vireo	*Vireo griseus*	6	0.16	0	45
White-winged Dove	*Zenaida asiatica*	0	0.00	0	21
Yellow-billed Cuckoo	*Coccyzus americanus*	6	0.16	0	53

1 – Mean number of individuals observed within the survey radius of each point.
2 – Percentage of total points where species were observed within the survey radius.
3 – Percentage of total points where species were observed regardless of radius.

Table 6. Baker Sanctuary water quality test results, 2015 - 2021.

Site	Year	n	Average Water Depth (cm)	Average Water Temperature (°C)	Average Dissolved Oxygen (% Saturation)	Average Specific Conductance (µS/cm)	Average pH	Average Nitrate Nitrogen (mg/L)
Baker Spring	2015-2016	10	43.7	18.1	64.9	628.7	7.0	0.47
Baker Spring	2016-2017	10	40.2	19.1	51.8	648.0	7.0	0.24
Baker Spring	2017-2018	5	33.1	12.3	47.2	628.0	7.0	0.03
Baker Spring	2018-2019	10	40.2	19.1	64.0	641.0	7.0	0.45
Baker Spring	2019-2020	7	34.8	12.7	53.8	656.0	7.0	0.06
*Baker Spring	2020-2021	0	N/A	N/A	N/A	N/A	N/A	N/A

*Baker spring was dry the entire reporting period of 2020-2021.