Travis Audubon
Baker Sanctuary

2022 - 2023 Annual Report

(October 1, 2022 - September 30, 2023)

prepared for the

Travis County Transportation and Natural Resources Department Natural Resources Program

by

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Yet another ice storm (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 a component 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 minimal 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,* juniper).

Golden-cheeked Warbler Surveys

Formal golden-cheeked warbler (*Setophaga chrysoparia*, GCWA) surveys at Baker Sanctuary began in 1986 and ran for five years, terminating in 1991. The only area surveyed was the Baker Springs trail and the study birds were not banded. As a result, the estimated population size of the surveyed GCWA varied widely between various observers and breeding seasons.

In 2011, the 100-acre plot was established, once again in the Baker Springs area (**Appendix C**). Male GCWA were mist-netted, color-banded, and surveyed to determine territory distribution, territory size, and fecundity. With the benefit of color-banded individuals, a more precise and accurate population estimate was derived for the study population. After the 2016 breeding season, the 100-acre survey effort was discontinued in favor of the rotating full Sanctuary survey initiated in the spring of 2017.

The goal of the rotating full Sanctuary survey is to determine territory distribution, territory density, fecundity, and a baseline Sanctuary population estimate for GCWA. To accomplish this goal, delineated study plots are surveyed for three consecutive years. When a plot is surveyed, an effort is made to mist net and color-band all male GCWA in the study area. To date, the Northeast plot (65-acres) was surveyed from 2017-2019, the Northwest plot (130-acres) from 2018-2020, and the North Valley plot (104-acres) from 2021- 2023, completing the survey of the northern section of the preserve (**Appendix C**). With the completion of the North Valley survey effort, it is expected the southern Sanctuary survey effort will begin in the Spring of 2024 and finish by 2032. When the rotating survey is complete, it is anticipated that the color-banding and territory mapping effort will cease, and variable circular plot point counts will be the preferred GCWA survey instrument going forward.

North Valley Plot Synopsis:

During the spring of 2023, the third year of golden-cheeked warbler surveys were undertaken 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 BCP 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.

Based on the compilation and analysis of 265 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 two edge territories were observed in the study plot for an adjusted total of 11 territories. Females were recorded in all the full territories as well as a total of 25 fledglings. One territory was established directly adjacent to the 104-acre plot and was not included in the analysis nor indicated on the territory map (**Appendix C**).

Territory density was calculated at 0.11 territories per acre. This calculation was based on the adjusted total of 11 territories in the 104 acres surveyed.

The pairing success rate in the North Valley plot was 100% (females were observed in all the full territories). The breeding success was estimated at 80%, since eight of the 10 full territories produced fledglings. The estimated brood size was 3.1 fledglings. Overall productivity was estimated at 2.5 fledglings per territory based on the total of 25 fledglings observed in eight of the 10 full territories (**Appendix C**).

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 the subsequent 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.

Results from the 2023 North Valley survey appear to be consistent with results from surveys spanning 2014 - 2022 in all measured parameters (**Table 3**). Territory density in prior surveys has ranged from 0.09 – 0.12 (North Valley = 0.11), pairing success 67% - 100% (North Valley = 100%), breeding success 44% - 100% (North Valley = 80%), estimated brood size 1.50 – 3.70 (North Valley = 3.10), and productivity 1.00 – 2.80 (North Valley = 2.50) (Murray 2014 - 2023).

When considering only the north survey plots, excluding the 100-acre plot located on the southern Sanctuary, on average the north plots exhibited a territory density of 0.10, pairing success of 92%, breeding success of 74%, estimated brood size of 2.4, and productivity of 1.7. To put the data into perspective and with the assumption historical patterns will be followed in the future, an average territory density of 0.10 translates into 30 GCWA territories for the entire northern Sanctuary, 28 of which would be expected to successfully attract a female. Of those 28 territories, an average of 21 will be productive with the average being 2.4 fledglings per successful territory. When all territories for the northern Sanctuary are considered, successful and not, an average of 1.7 fledglings will be produced per territory. Therefore, on average, the northern Sanctuary could be expected to produce approximately 51 GCWA fledglings annually.

In 2014 TAS obtained state and federal permits to band (plastic color-bands and USFWS aluminum bands) GCWA throughout the Sanctuary. Since then, a total of 65 GCWA males, 45 ASY and 20 SY, have been captured and banded under TAS and Travis County permits during various survey efforts (**Table 1**). It is anticipated banding will continue through the sanctuary-wide 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 2023 effort which produced 46 GCWA male detections, 34 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 to visitors from November 1, 2022 – January 15, 2023 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 two deer (one buck and one doe) during 208.75 hours of hunt effort, a decrease in take from the average harvest of 9.7 deer per season over the prior 21 recorded seasons (**Figure 3**).

To gain a better understanding of the size and composition of the whitetail deer (WTD) population on the Sanctuary, an annual camera trap survey was initiated in the fall of 2016. The survey was again conducted from September 2022 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 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 4.9 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. Despite having deer density below the TPWD recommended level, hardwood recruitment at the Sanctuary does not appear to be very robust, particularly in the uplands, 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 2022 – 2023 whitetail deer season.

Vegetation Management

Approximately 632 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 2021 and 2023 February ice storms, many trees still require trimming or removal from trails, public spaces, shaded fuel break, and maintenance roads.

Slash from cut vegetation was chipped prior to the onset of the GCWA breeding season yielding an estimated 96 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 12221 and 12219 areas, and select senderos.

During the fall and winter of 2022 - 2023 a total of 26 woody and herbaceous plants were put in the ground at the Sanctuary, all donated by Carol Ray (**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 completed 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 24 through May 24 of the 2023 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 six males and TAS2 captured one male and one female for a total of 8 BHCO captured, results significantly lower than the average of 17.6 per season captured over the prior 20 recorded seasons (**Figure 5**). No non-target species were captured during the trapping effort.

Exotics Control

Two distinct and robust 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 13 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, only 13 tree-of-heaven seedlings were discovered and hand pulled, most of which were located on the fringe of the treatment area. Since the grove was discovered in 2010, a total of 5,151 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 42 chinaberry, 102 Chinese pistache (*Pistacia chinensis*), six common fig (*Ficus carica*), one common horehound (*Marrubium* vulgare), 29 common mullein (*Verbascum thapsus*), 217 heavenly bamboo (*Nandina domestica*), four patches of Japanese honeysuckle (*Lonicera japonica*), nine patches of Johnsongrass (*Sorghum halepense*), 12 large-leaf privet (*Ligustrum japonicum*), 101 small-leaf privet (*Ligustrum sinense*), and 39 tree-of-heaven.

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

Over the past fiscal year, four 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 May 22 through May 28, the thirteenth 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 a week. Of the 40 species recorded, the most abundant were northern cardinal detected at 100% of the stations, black-crested titmouse (*Baeolophus atricristatus*) at 89%, and painted bunting (*Passerina ciris*) at 74% of the stations. Golden-cheeked warblers were detected at 55% of the stations (**Table 5**) compared to 68% for the previous year. Point count data were analyzed with a linear regression test (log-transformed, 2-tail, 95% confidence level) for the 13 years of data. All populations appear stable with no statistically significant trends with the exception of ash-throated flycatcher (*Myiarchus cinerascens*), broad-winged hawk (*Buteo platypterus*), chimney swift (*Chaetura pelagica*), lesser goldfinch (*Spinus psaltria*), painted bunting (*Passerina ciris*), red-eyed vireo (*Vireo olivaceus*), red-shouldered hawk (*Buteo lineatus*), and white-eyed vireo (*Vireo griseus*) who demonstrated significant positive population trends. Black-and-white warbler (*Mniotilta varia*), great-tailed grackle (*Quiscalus mexicanus*), northern bobwhite (*Colinus virginianus),* turkey vulture (*Cathartes aura*), and Woodhouses's Scrub-jay (*Aphelocoma woodhouseii*) 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 four nest boxes, one was occupied by Carolina chickadee (*Poecile carolinensis*) and another by a wren species, as determined by nest composition and egg shell fragments. In addition to the nest boxes, the 11 chimney swift towers on the Sanctuary were estimated to have successfully fledged a total of 22 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. Beginning in 2016, the caging effort was expanded to include other hardwood species of concern. During the 2022-2023 season four Spanish oak, two Texas ash, four escarpment black cherry, and two Western soapberry (*Sapindus saponaria) were* caged throughout the Sanctuary. To date a total of 58 plateau live oak, 63 shin oak, 157 Spanish oak, 24 Texas ash, 41 escarpment black cherry, two Western soapberry, and one coma (*Bumelia lanuginosa*) have been caged, a total of 346 hardwood individuals of concern. In conjunction with the caging effort, data such as habitat type, basal stem diameter, seedling height, percent canopy 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 11.4 cm/season, plateau live oak 8.3 cm/season, shin oak 3.4 cm/season, escarpment black cherry 10.8 cm/season, Texas ash 9.3 cm/season, and coma 4.0 cm/season. With regard to basal diameter, caged Spanish oak have exhibited an annual average increase of 0.136 cm/season, plateau live oak 0.303 cm/season, shin oak 0.138 cm/season, escarpment black cherry 0.153 cm/season, Texas ash 0.299 cm/season, and coma -0.030 cm/season. To date, plateau live oak have

demonstrated a 39% mortality rate for caged individuals, shin oak 24%, Spanish oak 16%, Texas ash 16%, escarpment black cherry 4%, and no mortality has yet been recorded for 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 Ashe 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 27.2 cm/season and mid-stem diameter at a rate of 0.333 cm/season. To date, a mortality rate of 20% has been observed for the monitored Ashe juniper individuals.

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 2022-2023 season, no water quality tests were performed, due to a lack of flow at the spring during the monthly data collection window (**Table 6**).

Education and Outreach

From October 2022 through September 2023 Baker Sanctuary experienced a total of 826 visitations from day hikers, 792 of which were by TAS members. An additional 549 visitations occurred during organized activities such as educational programs, TAS events, Baker Nature Day, and guided hikes. A total of 680 volunteer hours were recorded for the Sanctuary on a variety of activities (see below).

October: Trails, facilities, and grounds maintenance, non-native, invasive plant removal, wildfire fuels reduction.

November: Trails maintenance.

December: Grounds and trails maintenance, habitat restoration, non-native, invasive plant removal.

January: Trails, facilities, and grounds maintenance.

February: Trails and grounds maintenance.

March: Trails, facilities, and grounds maintenance, small engine repair, biological monitoring.

April: Trails maintenance, biological monitoring.

May: Trails & facilities maintenance, biological monitoring, non-native, invasive plant removal, community outreach.

June: Trails and grounds maintenance, biological monitoring, community outreach.

July: Trails and facilities maintenance.

August: Trails and facilities maintenance.

September: Trails maintenance.

Other activities to enhance community involvement and increase awareness of Baker Sanctuary and the BCP mission included 17 guided hikes for various community groups and the facilitation and supervision of four Eagle Scout projects (Troops 70, 410, 234, and 271). Presentations on natural history topics were given to a total of 90 LISD fourth grade students. The annual Baker Nature Day (formerly Baker Open House) was attended by an estimated 325 community members.

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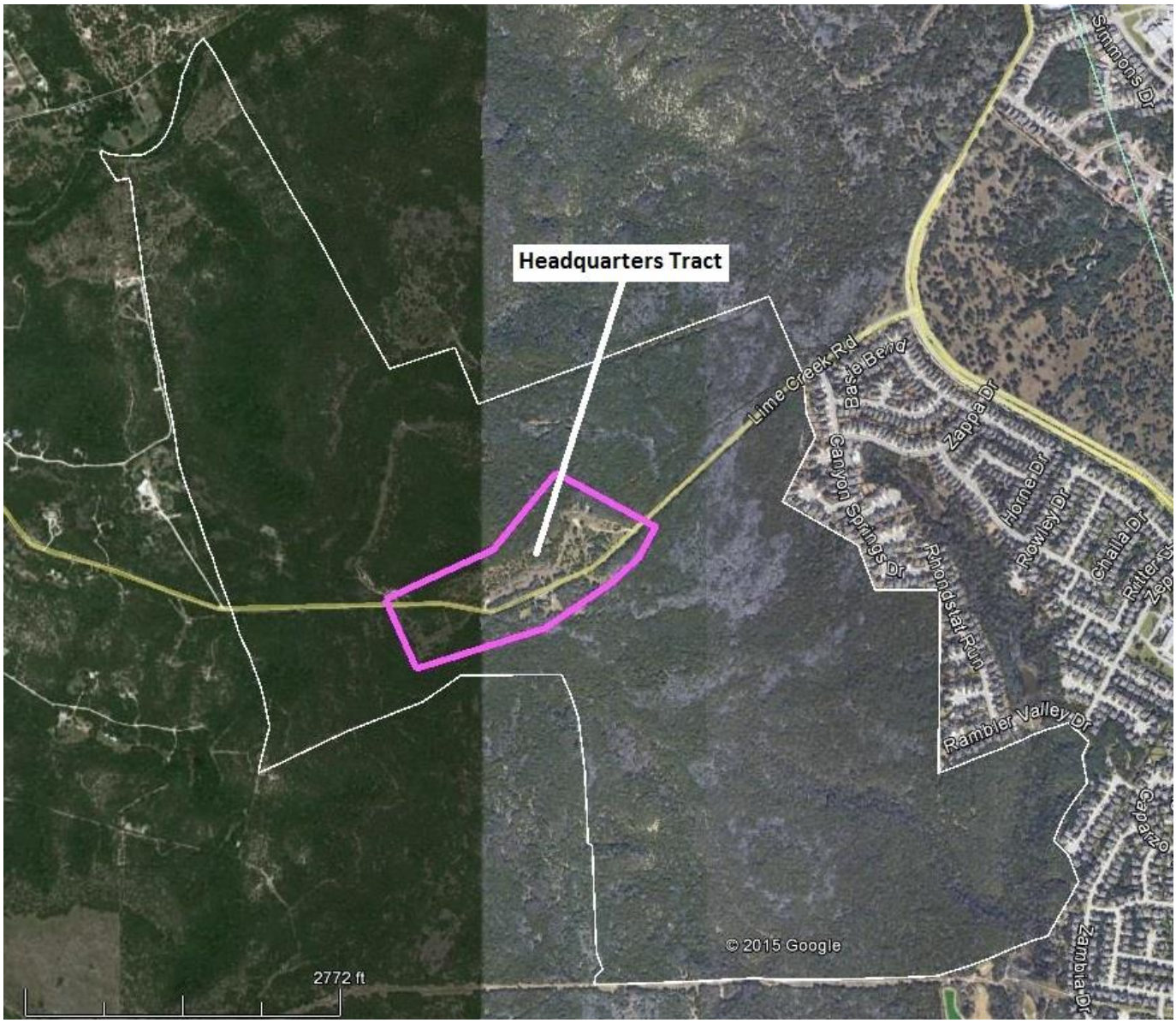
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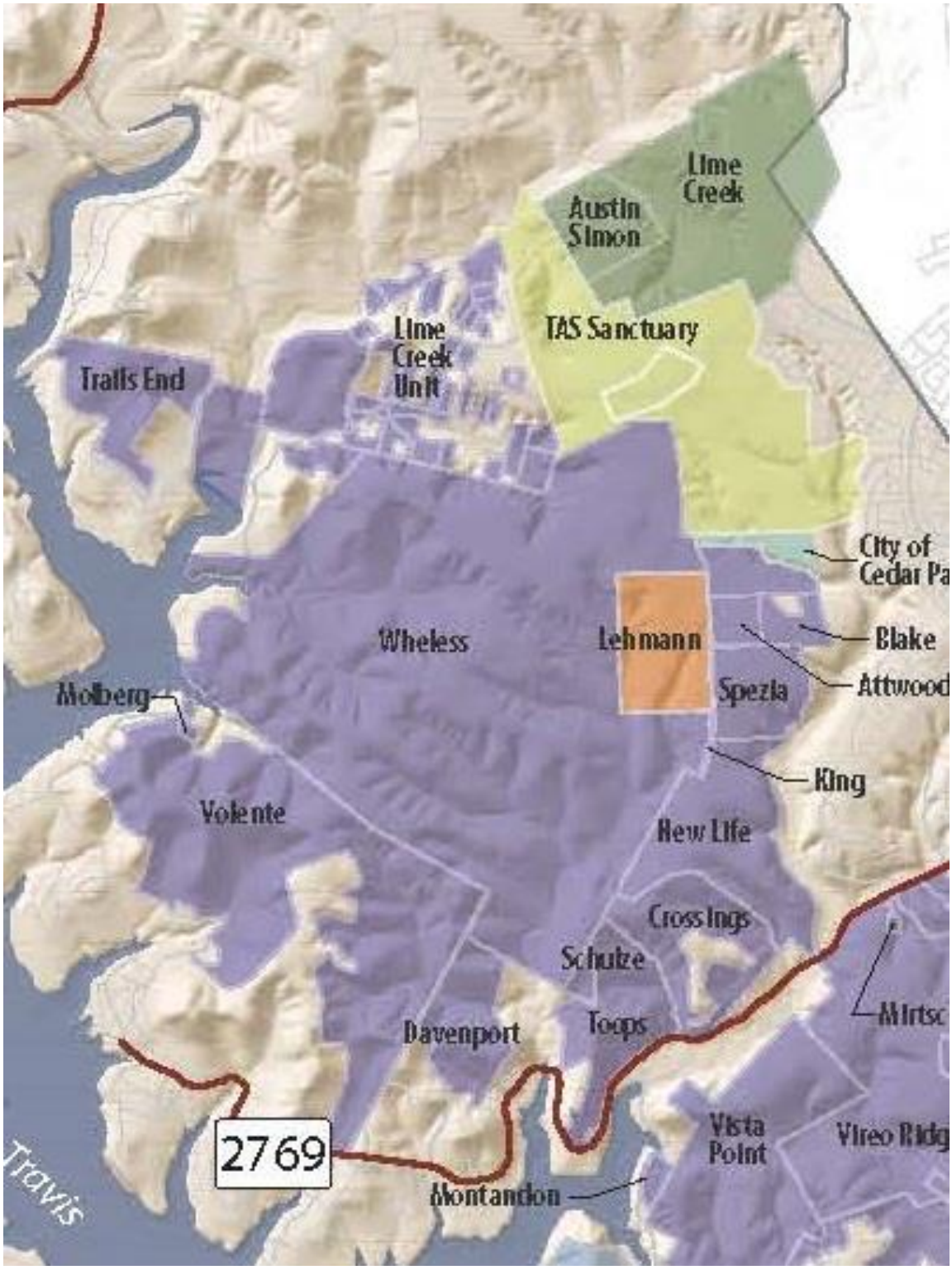
Appendix A

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 2023 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 Neotropical passerine species, the federally endangered 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 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 third and final year of the GCWA survey conducted on the North Valley plot. A Sanctuary-wide survey effort was initiated in 2017 to gain a more complete understanding of the density, distribution, and fecundity of GCWA throughout the Sanctuary. The northern portion of the Sanctuary was divided into survey plots for territory mapping to be carried out for three successive seasons. The Northeast plot was surveyed in 2017, 2018, and 2019 and the Northwest plot was surveyed in 2018, 2019, and 2020. The 2023 North Valley survey marks the third and final year of surveys for that plot, the results of which are presented in this report. For comparison

purposes, results of the Baker Sanctuary 100-acre survey conducted 2014-2016 are also included in this report.

The methodology for the 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. ES94739A), issued May 10, 2013. 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 (BCCP 2007) were utilized for the surveys. GCWA were color-banded if possible, territories mapped, and an attempt made to quantify productivity.

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.

The 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. Like other canyons found at Baker Sanctuary, the understory vegetation density and average tree height increase as the habitat grades from the dry 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 18 and concluded on June 4. 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. Six surveyors, Christopher Murray, Julie 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 102.75 hours, or 24.7 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 (BCCP 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 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 capture unbanded breeding males on the survey plot. Males were captured by deploying 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 plastic color bands. All color combinations were coordinated with researchers throughout the state so that each banded individual possessed a unique color band combination. Since 2017 a total of 60 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 a 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, 265 GCWA observations were recorded over the course of the survey effort. Ten full territories and two edge territories were delineated in the study plot for an adjusted total of 11 territories (**Figure 2**). Females were observed in all the full territories as well as a total of 25 fledglings (**Table 2**). One territory was established directly adjacent to the 104-acre plot and was not included in the analysis nor indicated on the territory map.

Territory density was calculated at 0.11 territories per acre. This calculation was based on the adjusted total of 11 territories in the 104 acres surveyed.

The pairing success rate in the North Valley plot was 100% (females were observed in all of the full territories). The breeding success was estimated at 80%, since eight of the 10 full territories produced fledglings. The estimated brood size was 3.1 fledglings. Overall productivity was estimated at 2.5 fledglings per territory based on the total of 25 fledglings observed in eight of the 10 full territories (**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 the subsequent 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.

Results from the 2023 North Valley survey appear to be consistent with results from surveys spanning 2014 - 2022 in all measured parameters (**Table 3**). Territory density in prior surveys has ranged from 0.09 – 0.12 (North Valley = 0.11), pairing success 67% - 100% (North Valley = 100%), breeding success 44% - 100% (North Valley = 80%), estimated brood size 1.50 – 3.70 (North Valley = 3.10), and productivity 1.00 – 2.80 (North Valley = 2.5) (Murray 2014 - 2022).

When considering only the north survey plots, excluding the 100-acre plot located on the southern Sanctuary, on average the north plots exhibited a territory density of 0.10, pairing success of 92%, breeding success of 74%, estimated brood size of 2.4, and productivity of 1.7. To put the data into perspective and with the assumption historical patterns will be followed in the

future, an average territory density of 0.10 translates into 30 GCWA territories for the entire northern Sanctuary, 28 of which would be expected to successfully attract a female. Of those 28 territories, an average of 21 will be productive with the average being 2.4 fledglings per successful territory. When all territories for the northern Sanctuary are considered, successful and not, an average of 1.7 fledglings will be produced per territory. Therefore, on average, the northern Sanctuary could be expected to produce 51 GCWA fledglings annually.

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7.0 ACKNOWLDGEMENTS

Many thanks go out to Julie Murray, Alexis Puchek, Elizabeth Samuelson, Toni Taylor, and Celeste Treadway who, once again, volunteered many, many early morning hours in search of the elusive, typically uncooperative GCWA. This project would not have been possible without their dedication, perseverance, outstanding ornithological prowess, and generally stoic manner in the face of unpleasant weather and rampant wendigos.

Table 1. Golden-cheeked warblers banded on the Northeast, Northwest, and North Valley Baker Sanctuary plots, 2017 - 2023.

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

Year Banded	Color Combination	Plot	USFWS Band #	Gender	Age
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
2022	OR/OR:RD/SI	North Valley	2770-41251	Male	ASY
2022	YE/SI:DB/BK	North Valley	2770-41252	Male	SY
2022	PI/SI:RD/RD	North Valley	2770-41253	Male	SY
2022	DB/SI:OR/DG	North Valley	2770-41254	Male	SY
2022	DG/SI:YE/BK	North Valley	2790-44736	Male	SY
2022	PI/MV:MV/SI	North Valley	2770-41255	Male	SY
2022	BK/MV:OR/SI	North Valley	2770-41256	Male	ASY
2023	PI/PI:BL/SI	North Valley	2770-41257	Male	ASY
2023	YE/PI:YE/SI	North Valley	2770-41258	Male	ASY
2023	OR/SI:WH/MV	North Valley	2770-41259	Male	ASY
2023	BL/SI:RD/BK	North Valley	2770-41261*	Male	ASY
2023	BK/SI:RD/MV	North Valley	2770-41262	Male	ASY
2023	DG/BK:DB/SI	North Valley	2770-41263	Male	SY
2023	RD/DB:DB/SI	North Valley	2770-41264	Male	SY
2023	WH/SI:PI/DG	North Valley	2770-41265	Male	SY
2023	RD/SI:WH/WH	North Valley	2770-41266	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 2770-41260 was lost to the wilds of the North Valley, never to be seen again.

Table 2. Golden-cheeked warbler territory status and enumeration of females and fledglings detected on the North Valley Baker Sanctuary plot, 2023.

Territory Designation	Full/Edge Territory	Number of Confirmed Detections	Female Detected	# Fledglings Detected
YE/PI:YE/SI	Full	20	Yes	2
OR/SI:WH/MV	Full	27	Yes	3
RD/DB:DB/SI	Full	9	Yes	3
DG/BK:DB/SI	Full	20	Yes	0
PI/PI:BL/SI	Full	29	Yes	0
WH/SI:PI/DG	Full	17	Yes	3
DB/YE:YE/SI	Full	27	Yes	4
BK/SI:RD/MV	Full	11	Yes	4
UB1	Full	21	Yes	3
UB3	Full	23	Yes	3
RD/SI:WH/WH	Edge	6	No	0
UB2	Edge	19	No	0

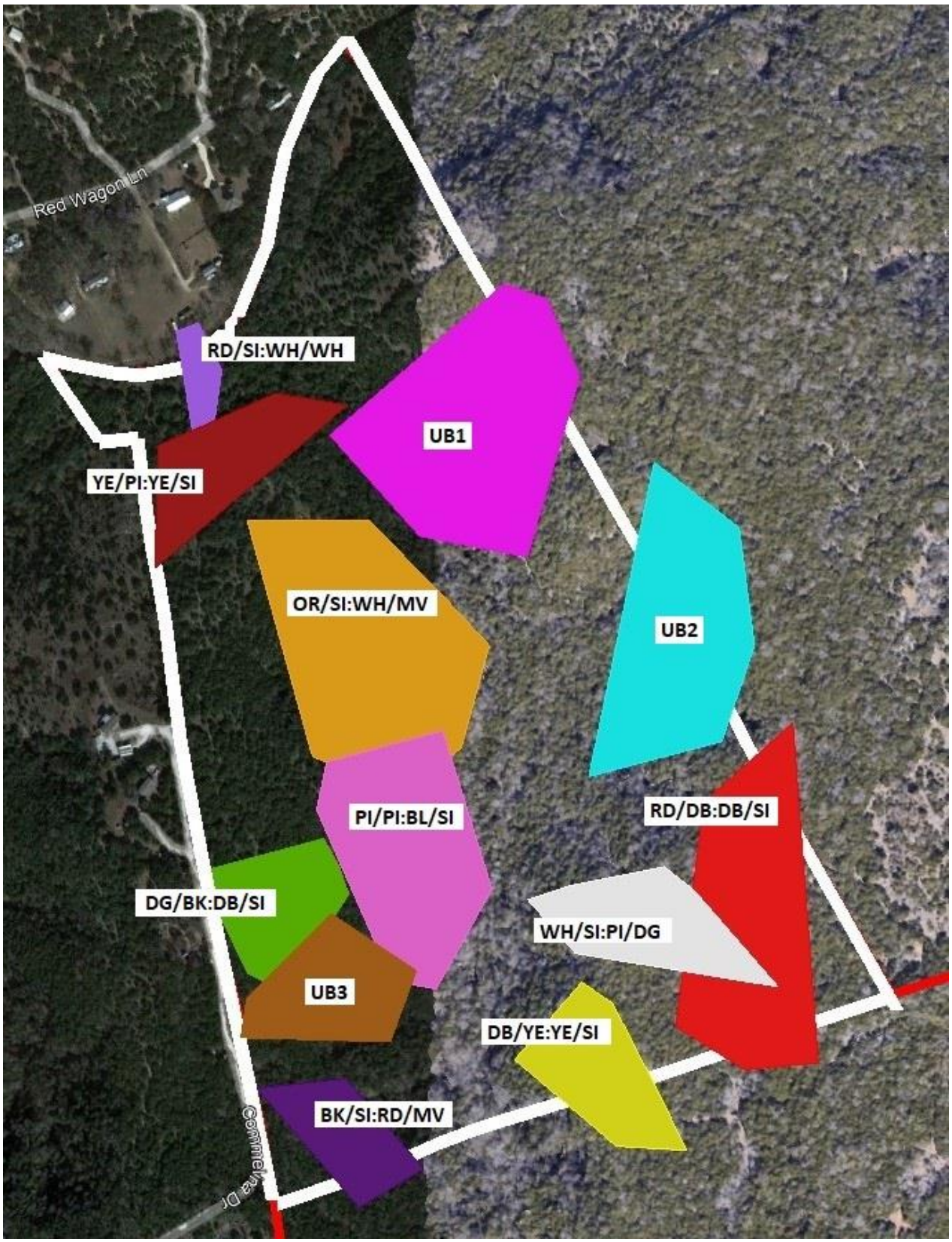
Table 3. Summary of golden-cheeked warbler reproductive success on the Northeast, Northwest, North Valley, and 100-acre plots, 2014-2023.

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
North Valley 2022	0.09	89	44	2.30	1.00	30.1
North Valley 2023	0.11	100	80	3.10	2.50	24.7
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**
North Valley Average	**0.11**	**93**	**61**	**2.90**	**1.83**	**31.2**

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



Figure 2. Golden-cheeked warbler territory distribution on the North Valley Baker Sanctuary plot, 2023.



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	9:54.00	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	21
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	21
2	2-1	9:58	B	46
3	3-1	9:58	B	21
1	1-2	9:58	A	36
1	1-2	9:59	A	X
2	2-1	9:59	B	46
3	3-1	9:59	B	21
1	1-2	10:00	A	36
2	2-1	10:00	B	46
3	3-1	10:00	B	21
3	3-1	10:01	B	X
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

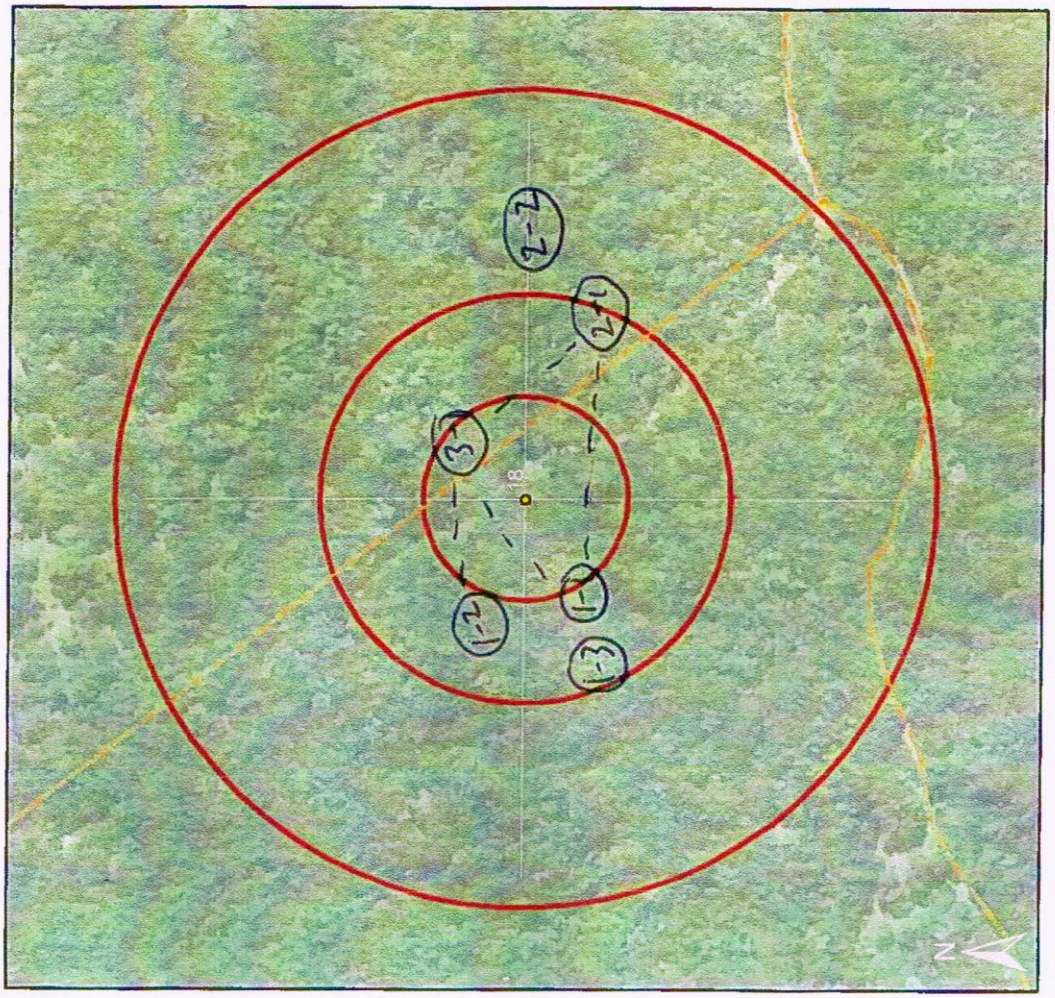


Figure 1. Baker Sanctuary VCP point counts stations, 2023.



Figure 2. Baker Sanctuary whitetail deer hunt and camera sites, 2022 - 2023.

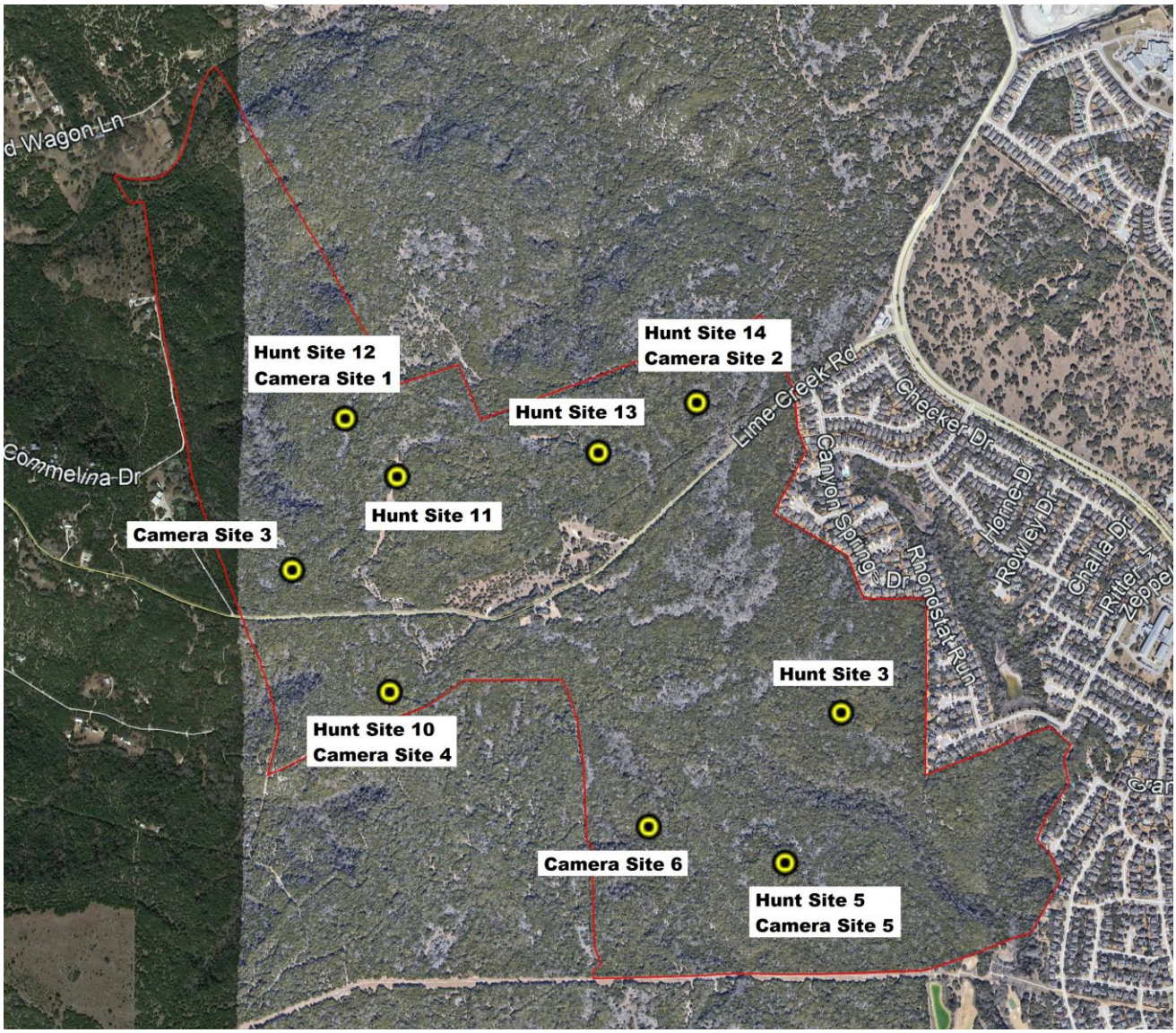


Figure 3. Summary of Baker Sanctuary whitetail deer harvest, 2000-2023. Juvenile deer are a year or less in age.

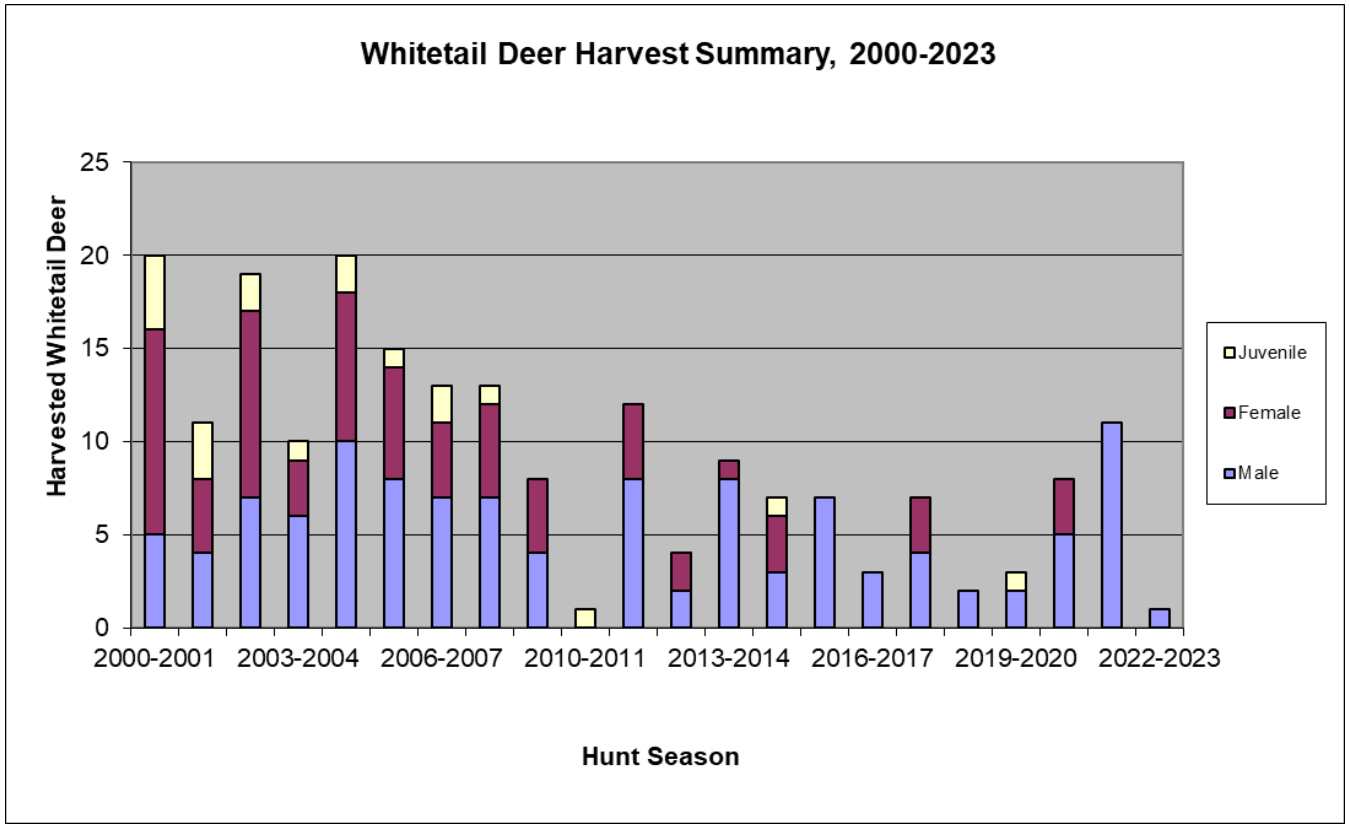


Figure 4. Baker Sanctuary shaded fuel break.

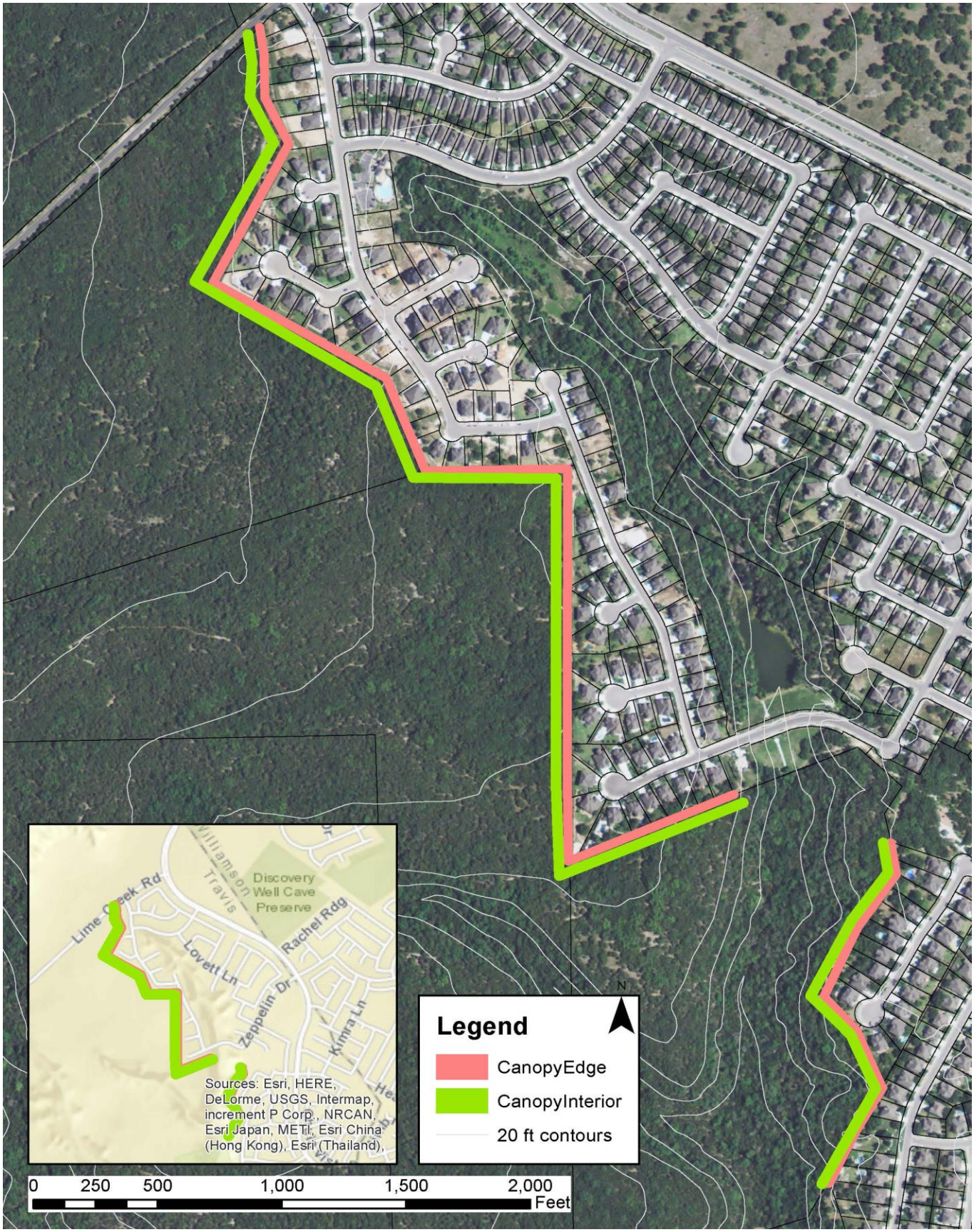


Figure 5. Summary of Baker Sanctuary brown-headed cowbird trapping effort, 2001-2023.

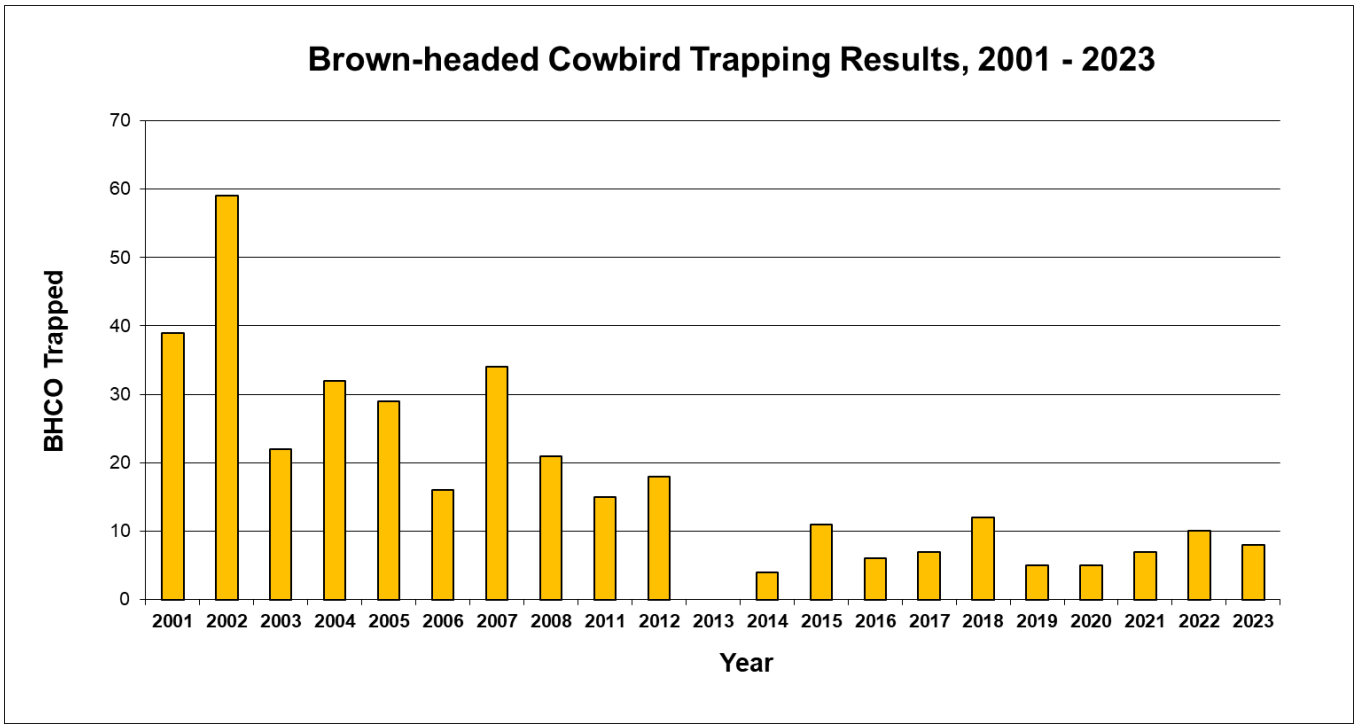


Figure 6. Summary of Baker Sanctuary tree-of-heaven eradication efforts, 2010-2023.

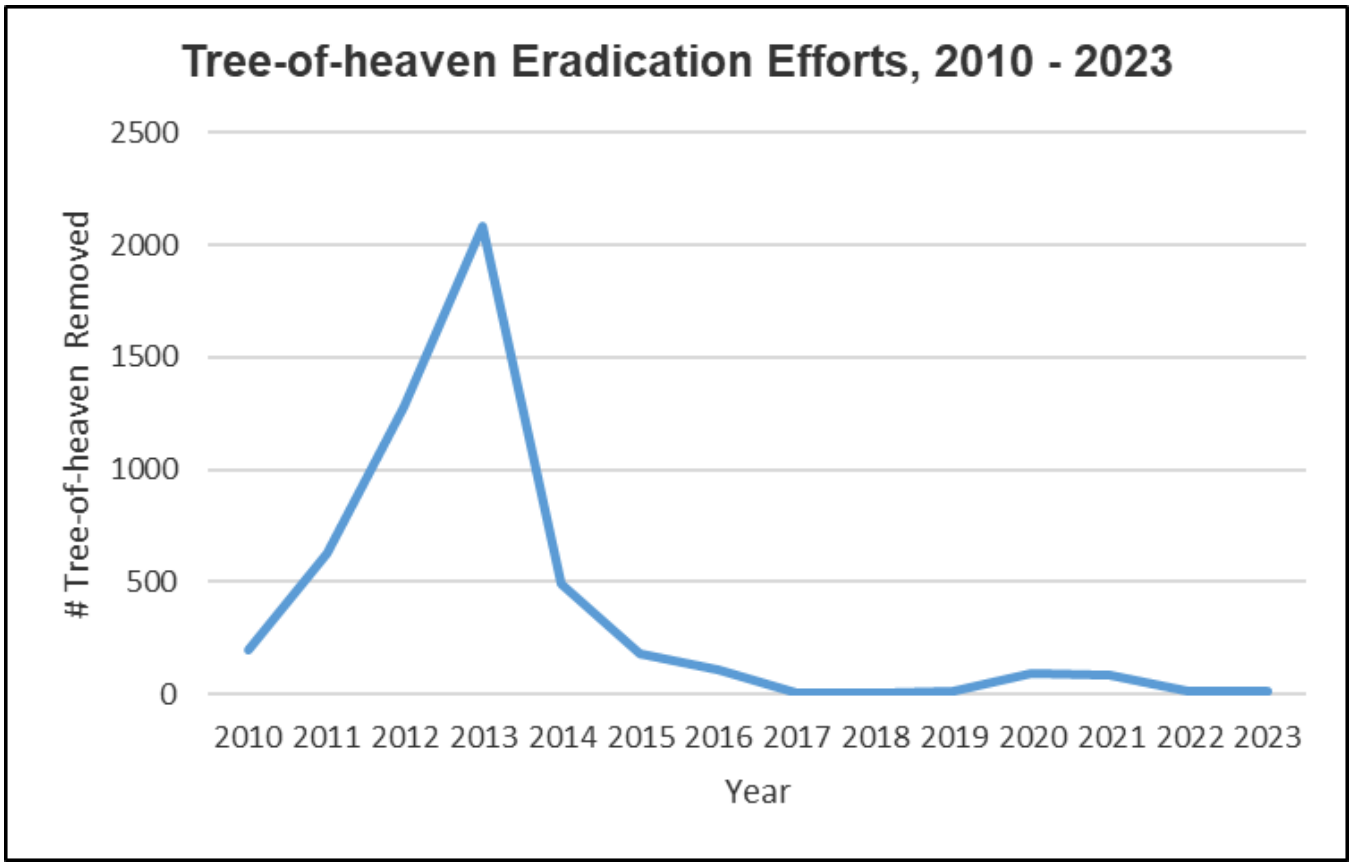


Figure 7. Baker Sanctuary BBS point count stations, 2023.



Table 1. Summary of GCWA banded at Baker Sanctuary, 2015 - 2023.

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
2022	2770-41251	OR/OR:RD/SI	North Valley	Male	ASY
2022	2770-41252	YE/SI:DB/BK	North Valley	Male	SY
2022	2770-41253	PI/SI:RD/RD	North Valley	Male	SY
2022	2770-41254	DB/SI:OR/DG	North Valley	Male	SY
2022	2790-44736	DG/SI:YE/BK	North Valley	Male	SY
2022	2770-41255	PI/MV:MV/SI	North Valley	Male	SY
2022	2770-41256	BK/MV:OR/SI	North Valley	Male	ASY
2023	2770-41257	PI/PI:BL/SI	North Valley	Male	ASY
2023	2770-41258	YE/PI:YE/SI	North Valley	Male	ASY
2023	2770-41259	OR/SI:WH/MV	North Valley	Male	ASY
2023	2770-41261***	BL/SI:RD/BK	North Valley	Male	ASY
2023	2770-41262	BK/SI:RD/MV	North Valley	Male	ASY
2023	2770-41263	DG/BK:DB/SI	North Valley	Male	SY
2023	2770-41264	RD/DB:DB/SI	North Valley	Male	SY
2023	2770-41265	WH/SI:PI/DG	North Valley	Male	SY
2023	2770-41266	RD/SI:WH/WH	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 mystical forest, never to be found again.
**Band 2770-41238 was damaged and left as an offering for the Wendigo.
***Band 2770-41260 was spirited away by a mischievous woodland sprite.

Table 2. GCWA detected per VCP point count time interval, 2017 - 2023.

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
2022	26	4	1	7	3	41	2	3	3	3	2	54
2023	16	7	3	2	6	34	4	3	2	1	2	46

Table 3. Baker Sanctuary whitetail deer population survey results, 2016 - 2022.

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
2021	0.03	12.00	8.78	2.86	23.65	8.10	0.73	32.6
2022	0.05	6.00	6.72	1.58	14.30	4.90	1.12	23.6

Table 4. Baker Sanctuary plantings, 2022 – 2023.

Common Name	Scientific Name	Class	# Planted
American Beautyberry	*Callicarpa americana*	Shrub/Tree	1
Coral Honeysuckle	*Lonicera sempervirens*	Shrub/tree	3
Firewheel	*Gaillardia pulchella*	Herbaceous/Grass	Sowed
Gay-feather	*Liatris* spp.	Herbaceous/Grass	2
Little Bluestem	*Schizachyrium scoparium*	Herbaceous/Grass	Sowed
Maximilian Sunflower	*Helianthus maximiliani*	Herbaceous/Grass	3
Narrow-leaf Cone-flower	*Echinacea angustifolia*	Herbaceous/Grass	9
Sideoats Grama	*Bouteloua curtipendula*	Herbaceous/Grass	Sowed
Silver Bluestem	*Bothriochloa laguroides*	Herbaceous/Grass	Sowed
Turk's Cap	*Malvaviscus arboreus*	Shrub/Tree	7
Zexmenia	*Wedelia acapulcensis*	Shrub/Tree	1

Table 5. Baker Sanctuary BBS point count survey, 2023.

Common Name	Scientific Name	Number Observed	Mean[1]	Frequency (%)[2] (25 yd radius)	Frequency (%)[3] (unlimited radius)
American Redstart	*Setophaga ruticilla*	0	0.00	0	3
Ash-throated Flycatcher	*Myiarchus cinerascens*	4	0.11	11	29
Barn Swallow	*Hirundo rustica*	0	0.00	0	3
Bewick's Wren	*Thryomanes bewickii*	10	0.26	0	37
Black-and-white Warbler	*Mniotilta varia*	1	0.03	1	3
Black-chinned Hummingbird	*Archilochus alexandri*	8	0.21	0	21
Black-crested Titmouse	*Baeolophus atricristatus*	8	0.21	0	89
Blue-gray Gnatcatcher	*Polioptila caerulea*	18	0.47	0	39
Broad-winged Hawk	*Buteo platypterus*	0	0.00	0	3
Carolina Chickadee	*Poecile carolinensis*	21	0.55	0	63
Carolina Wren	*Thryoothorus ludovicianus*	6	0.16	0	37
Chimney Swift	*Chaetura pelagica*	0	0.00	0	21
Common Grackle	*Quiscalus quiscula*	0	0.00	0	3
Common Nighthawk	*Chordeiles minor*	0	0.00	0	3
Common Raven	*Corvus corax*	0	0.00	0	5
Eastern Phoebe	*Sayornis phoebe*	0	0.00	0	3
Eastern Wood-pewee	*Contopus virens*	1	0.03	1	3
Field Sparrow	*Spizella pusilla*	1	0.03	3	13
Golden-cheeked Warbler	*Setophaga chrysoparia*	9	0.24	0	55
Greater Roadrunner	*Geococcyx californianus*	0	0.00	0	5
House Finch	*Haemorhous mexicanus*	1	0.03	0	5
Hutton's Vireo	*Vireo huttoni*	0	0.00	0	3
Ladder-backed Woodpecker	*Picoides scalaris*	1	0.03	0	3
Lark Sparrow	*Chondestes grammacus*	0	0.00	0	3
Lesser Goldfinch	*Carduelis psaltria*	8	0.21	0	66
Mourning Dove	*Zenaida macroura*	2	0.05	5	53
Northern Cardinal	*Cardinalis cardinalis*	25	0.66	0	100
Northern Mockingbird	*Mimus polyglottos*	0	0.00	0	13
Painted Bunting	*Passerina ciris*	18	0.47	0	74
Purple Martin	*Progne subis*	0	0.00	0	5
Red-eyed Vireo	*Vireo olivaceus*	2	0.05	0	8
Red-shouldered Hawk	*Buteo lineatus*	0	0.00	0	8

Common Name	Scientific Name	Number Observed	Mean[1]	Frequency (%)[2] (25 yd radius)	Frequency (%)[3] (unlimited radius)
Rufous-crowned Sparrow	*Aimophila ruficeps*	2	0.05	0	5
Summer Tanager	*Piranga rubra*	7	0.18	18	29
Woodhouse's Scrub-jay	*Aphelocoma californica*	0	0.00	0	3
White-eyed Vireo	*Vireo griseus*	15	0.39	0	53
White-winged Dove	*Zenaida asiatica*	0	0.00	0	13
Wild Turkey	*Meleagris gallopavo*	0	0.00	0	5
Yellow-billed Cuckoo	*Coccyzus americanus*	7	0.18	0	68

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 - 2023.

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	2021-2022	0	N/A	N/A	N/A	N/A	N/A	N/A
*Baker Spring	2022-2023	0	N/A	N/A	N/A	N/A	N/A	N/A

*Baker spring was dry the entire reporting period.