

Travis Audubon's Baker Sanctuary

2019 - 2020 Annual Report (October 1, 2019 - September 30, 2020)

prepared for the

Travis County Transportation and Natural Resources Department Natural Resources Program

by

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Baker Cabin (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 permits 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 2020, the 130-acre Northwest plot was surveyed for golden-cheeked warblers (*Setophaga chrysoparia*) for the third, and final, consecutive season. The Northwest plot is located north of Lime Creek Road and to the west of the formerly surveyed Northeast 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 both surveys. In short, GCWA were color-banded if

possible, territories mapped, and an attempt made to quantify productivity. It is anticipated, beginning in 2021, a survey effort will begin on the North Valley plot to conclude in 2023, completing the survey effort of the Sanctuary north of Lime Creek Road. By continuing to rotate survey efforts the entire Sanctuary will be covered by approximately 2029, providing 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 effort will largely cease and future monitoring will be accomplished through a less intrusive and time intensive method such as variable circular plot point counts.

Northwest Plot Synopsis:

Based on the compilation and analysis of 520 GCWA observations including movement patterns, re-sighting of color banded males, counter-singing, and the presence of females and fledglings, it is estimated 11 full territories and three edge territories were established in the Northwest plot for an adjusted total of 12.5 territories. With the exception of two edge territories, females were observed in all the territories in addition to a total of 28 fledglings. Approximately two territories were established directly adjacent to the Northwest plot and were not included in the analysis.

Territory density was calculated at 0.10 territories per acre. This calculation was based on the adjusted total of 12.5 territories in the 130 acres surveyed. The pairing success rate in the Northwest plot was 100% (females were observed in all of the full territories). The breeding success was estimated at 91%, based on the observation that 10 of the 11 full territories produced fledglings. The estimated brood size was 2.4 fledglings based on the aforementioned criteria. Productivity was estimated at 2.2 based on the total of 24 fledglings observed in 10 of the 11 full territories (**Appendix C**).

With the completion of the three-year Northwest plot survey effort, it is possible to make some tentative territory density and fecundity comparisons between the Northwest plot (surveyed 2017–2020) and the other two surveyed areas, the Northeast plot (surveyed 2017-2019) and the 100-acre plot (surveyed 2014-2016). 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, if possible, in areas where it is comparatively lower.

No significant differences were detected between the three plots with regard to territory density and fecundity metrics (**Appendix C**). These data suggest management of the surveyed areas does not warrant targeted intervention and should continue to be managed as outlined in the BCCP Tier II (2007) and Tier III (2014) Land Management Plans. While no statistical significant differences were determined for the measured metrics of the various plots, it has to be acknowledged that, for the most part, the surveys did not occur concurrently, with the only seasonal overlap being 2018 and 2019 when the Northeast and Northwest plots were both surveyed. However, in the time span the surveys were undertaken, 2014 – 2020, no unusual drought or precipitation events were recorded so it is unlikely weather played a significant role with regard to prey availability or nesting success, although it is possible the timing and amount of precipitation may have been a factor.

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 38 GCWA males, 30 ASY and eight 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 2021 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. 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 2020 effort which produced 61 GCWA male detections, 47 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 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, 2019 – January 19, 2020 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 three bucks during 325 hours of hunt effort, a decrease in take from the average harvest of 10 deer per season over the prior 18 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 fall 2016. The survey was again conducted from mid-September 2019 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 9.8 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 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 is 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 294 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 spp.*) were trimmed, precautionary techniques such as disinfecting saws and painting wounds were utilized to prevent the spread of oak wilt fungus (*Ceratocystis fagacearum*).

Slash from cut vegetation was chipped prior to the onset of the GCWA breeding season yielding an estimated 40 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, and at the Kutac memorial garden.

During the fall and winter of 2019 - 2020 a total of 65 woody and herbaceous plants were put in the ground at the Sanctuary, all donated by Paul and Georgean Kyle, Julia Marsden, 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*) traps from March 20 through May 22 of the 2020 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 five individuals (four males and one female) while TAS2 recorded no captures for a total of five individuals captured, results significantly lower than the average of 21 per season captured over the prior 18 recorded seasons (**Figure 5**). Two non-targets, both male northern cardinals (*Cardinalis cardinalis*), were captured and released unharmed.

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 10 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, 96 tree-of-heaven seedlings were discovered and hand pulled, a surprising increase over the 12 discovered the year prior. After an extensive search of the area, a single, formerly overlooked fruiting individual was discovered in the middle of a slash pile, most likely the source of most of the seedlings. Since the grove was discovered in 2010, a total of 5,044 tree-of-heaven (**Figure 6**) and 50 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 30% imazapyr solution when encountered throughout the Sanctuary. Species treated or removed included 81 chinaberry, 99 Chinese pistache (*Pistacia chinensis*), one common fig (*Ficus carica*), one crepe myrtle (*Lagerstroemia* species), 276 heavenly bamboo (*Nandina domestica*), 18 medium-sized patches of Japanese honeysuckle (*Lonicera japonica*), five medium-sized patches of Johnsongrass (*Sorghum halepense*), 178 jujube (*Ziziphus zizyphus*), 247 large-leaf privet (*Ligustrum japonicum*), 336 small-leaf privet (*Ligustrum sinense*), and 103 tree-of-heaven.

The 18 common figs initially treated on July 2013 near Walnut Spring were monitored over the course of the year and re-sprouts were removed when encountered. Approximately 7% of the figs continue to re-sprout requiring continued monitoring and treatment of the site.

Over the past fiscal year, nine 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 19 through June 28, the tenth 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 97% of the stations, black-crested titmouse (*Baeolophus bicolor*) at 87% of the stations, and painted bunting (*Passerina ciris*) at 84% of the stations. Golden-cheeked warblers were detected at 58% of the stations (**Table 5**) compared to 26% for the previous year. Point count data were analyzed with a linear regression test (log-transformed, 2-tail, 95% confidence level) for the 10 years' worth of data. All populations appear stable with no statistically significant trends with the exception of Hutton's vireo (*Vireo huttoni*), Inca dove (*Columbina inca*), 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 and American crow (*Corvus brachyrhynchos*), greater roadrunner (*Geococcyx californianus*), great-tailed grackle (*Quiscalus mexicanus*), and northern bobwhite (*Colinus virginianus*) which 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 eight nest boxes, two were occupied by either Carolina (*Thryothorus ludovicianus*) or Bewick's wrens (*Thryomanes bewickii*), as determined by nest composition and egg shell fragments, and one an eastern screech owl (*Megascops asio*). In addition to the nest boxes, the six chimney swift (*Chaetura pelagica*) towers on the Sanctuary were estimated to have successfully fledged a total of 11 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 2019 - 2020 and was expanded to include other hardwood species of concern in the 2016 – 2017 season. During the 2019 - 2020 season an additional two plateau live oak, four shin oak, eight Spanish oak, one Texas ash, and six escarpment black cherry were caged throughout the Sanctuary. To date a total of 54 plateau live oak, 61 shin oak, 143 Spanish oak, 20 Texas ash, 29 escarpment black cherry, and one coma (*Bumelia lanuginosa*) have been caged, a total of 307 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 12.1 cm/season, plateau live oak 9.5 cm/season, shin oak 3.8 cm/season, escarpment black cherry 23.3 cm/season, Texas ash 10.9 cm/season, and coma 6.1 cm/season. With regard to basal diameter, caged Spanish oak have exhibited an annual average increase of 0.176 cm/season, plateau live oak 0.259 cm/season, shin oak 0.174 cm/season, escarpment black

cherry 0.209 cm/season, Texas ash 0.404 cm/season, and coma 0.108 cm/season. To date, plateau live oak have demonstrated a 16% mortality rate for caged individuals, shin oak 19%, Spanish oak 6%, Texas Ash 6% 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 34.7 cm/season and mid-stem diameter at a rate of 0.438 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 2019 - 2020 season, seven water quality tests were performed, all at Baker Spring. Data were collected for water depth, water temperature, dissolved oxygen, specific conductance, pH, and nitrate nitrogen. All results fell within expected values (**Table 6**).

Education and Outreach

From October 2019 through September 2020 Baker Sanctuary experienced a total of 962 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 168 visitations occurred during organized activities such as educational programs, TAS events, and guided hikes. A total of 609.25 volunteer hours were logged at the Sanctuary on a variety of activities (see below) with most volunteer activity ceasing on the outset of the COVID-19 pandemic.

October: Grounds & facilities maintenance, habitat restoration.

November: Grounds & facilities maintenance.

December: Grounds, trails, & facilities maintenance.

January: Grounds, trails, & facilities maintenance, habitat restoration.

February: Trails maintenance, habitat restoration, education, biological monitoring.

March: Grounds, trails, & facilities maintenance, habitat restoration, biological monitoring.

April: Grounds, trails, & facilities maintenance, habitat restoration, biological monitoring.

May: Grounds maintenance, biological monitoring.

June: Grounds maintenance, biological monitoring.

July: Grounds maintenance.

August: No volunteer activity.

September: Grounds & facilities maintenance.

Other activities to enhance community involvement and increase awareness of Baker Sanctuary and the BCP mission included the Great Backyard Bird Count, seven guided hikes for various community groups, one Ecology presentation to 51 members of the Texas State Wildlife Society, four central Texas centered ecology presentations to a total of 405 LISD fourth grade students and 19 high students at St. Michael's Catholic Academy, and facilitation and supervision of five Eagle Scout projects (Troops 202 and 271).

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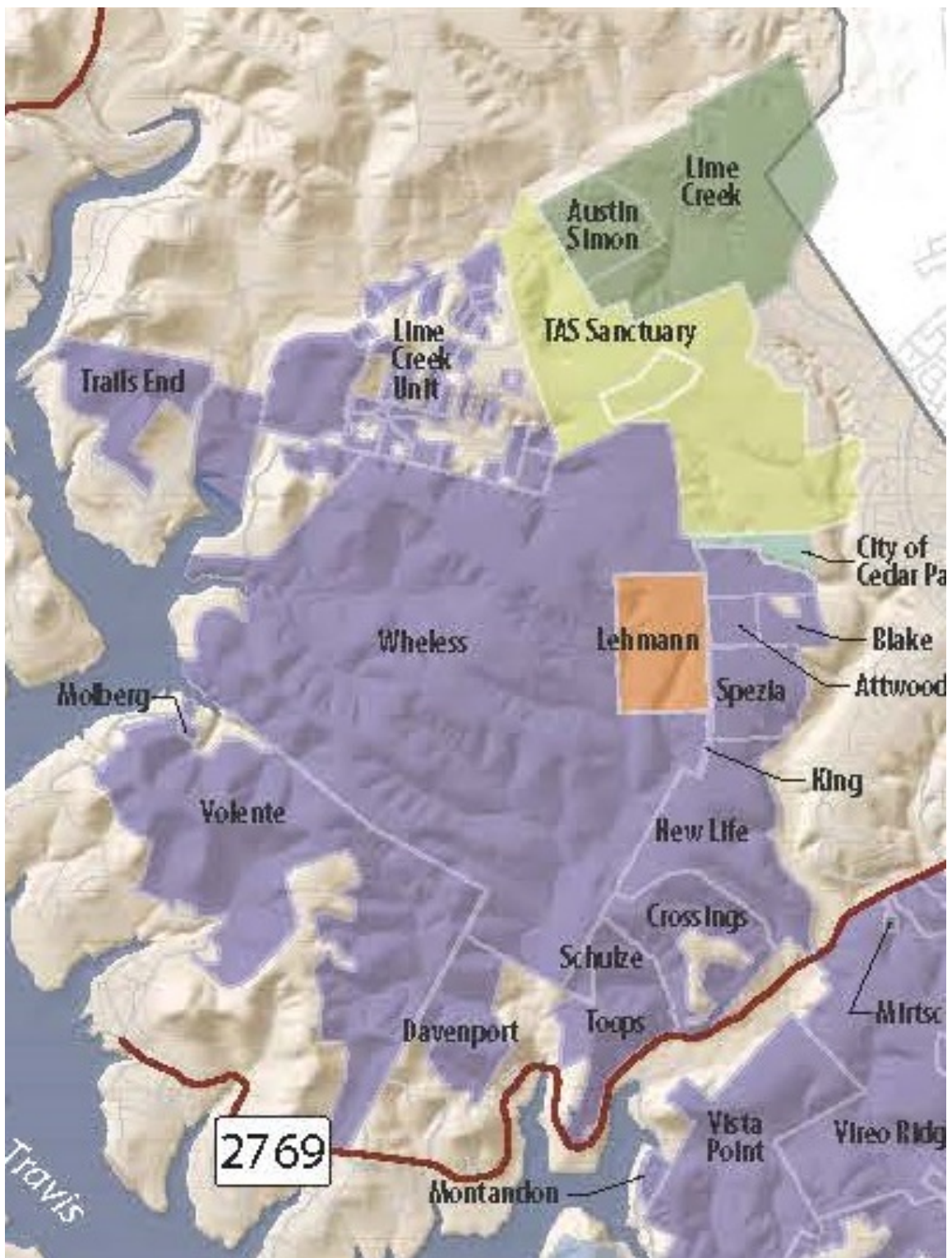
Appendix A

Baker Sanctuary 40-acre headquarters tract



Appendix B

Baker Sanctuary and adjacent BCP partner properties



Appendix C

**RESULTS OF THE GOLDEN-CHEEKED WARBLER SURVEY
FOR THE NORTHWEST BAKER SANCTUARY PLOT
SPRING 2020
TRAVIS COUNTY, TEXAS**



TRAVIS
A U D U B O N
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.

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 third and final GCWA survey conducted on the Northwest 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. In the future it is expected two plots will be surveyed, when possible, per breeding season until the entire Sanctuary has been covered. 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 2020 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 130-acre Northwest 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 throughout the majority of the 130-acre plot is fairly uniform and ranges between 1080 feet above mean sea level (msl) to 1040 feet above msl.

Approximately six acres of the plot intersects the southern drainage for Harris Creek where topographical relief is considerable, ranging from 1040 feet above msl to 940 feet above msl. In the southeastern portion of the plot there is a 12-acre savannah (**Figure 1**) which is dominated by the non-native, invasive grass King Ranch bluestem (*Bothriochloa ischaemum*) and interspersed with Ashe juniper, plateau live oak, and native grasses such as little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), red grama (*Bouteloua trifida*), fall witchgrass (*Digitaria cognate*), and Halls panicum (*Panicum hallii*).

3.0 METHODS

Surveys began on March 13 and concluded on June 14. 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. Four surveyors, Christopher Murray, Beth Samuelson, Toni Taylor, and Celeste Treadway surveyed the Northwest study plot on a weekly basis and invested a total of 191.5 hours, or 36.8 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. If a GCWA was detected, 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 33 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, 520 GCWA observations were recorded over the course of the survey effort. Eleven full territories and three edge territories were delineated in the study plot for an adjusted total of 12.5 territories (**Figure 2**). With the exception of edge territories WH/SI:DG/PI and UB4, females were observed in all the territories as well as a total of 28 fledglings (**Table 2**). Approximately two territories were established directly adjacent to the 130-acre plot and were not included in the analysis nor indicated on the territory map.

Territory density was calculated at 0.10 territories per acre. This calculation was based on the adjusted total of 12.5 territories in the 130 acres surveyed.

The pairing success rate in the Northwest plot was 100% (females were observed in all of the full territories). The breeding success was estimated at 91%, based on the fact that 10 of the 11 full territories produced fledglings. The estimated brood size was 2.4 fledglings based on the aforementioned criteria. Productivity was estimated at 2.2 based on the total of 24 fledglings observed in 10 of the 11 full territories.

5.0 DISCUSSION

The 2020 season marked the third and final survey of the Northwest plot. Throughout the three years, territory density, pairing success, and breeding success remained relatively consistent with some minor variation in average brood size and productivity (**Table 3**). With the completion of the Northwest plot survey effort, it is possible to make some tentative comparisons between the Northwest plot (surveyed 2017–2020) and the other two surveyed areas, the Northeast plot (surveyed 2017-2019) and the 100-acre survey plot (surveyed 2014-2016). 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, if possible, in areas where it is comparatively lower.

With regard to the territory density, there were no statistically significant differences between group means as determined by one-way ANOVA ($F(2,6) = 0.1, p = .19$). Territory density is defined as the number of territories per acreage surveyed. With the majority of the study population color-banded, this metric is arguably the most objective although some subjectivity does creep into the equation with the unbanded individuals and the assignment of ‘edge’ versus ‘full’ territory designation. With edge territories counting as half a territory and also not included in fecundity calculations, an edge designation does have the ability to potentially skew the data, a variable that can be controlled but not eliminated, and results should be interpreted with that firmly in mind. While the three plots are similar with regard to vegetation, the Northeast plot is the only one of the three that did not have any significant topographical relief with elevation ranging between 1020 to 1060 feet above mean sea level.

With regard to pairing success, there were no statistically significant differences between group means as determined by one-way ANOVA ($F(2,6) = 0.77, p = .66$).

Pairing success is defined by a territorial male observed with a female and/or a male tending at least one fledgling. The pairing success rate equals the number of territories determined to have pairing success divided by the total number of full territories. Once again, this metric is fairly objective with color-banded individuals but some uncertainty does creep into the equation with unbanded individuals.

With regard to breeding success, there were no statistically significant differences between group means as determined by one-way ANOVA ($F(2,6) = 0.25$, $p = .79$). The breeding success rate is determined by the number of territories that successfully fledged at least one young divided by the total number of full territories. This may be the most precise measurement of fecundity currently available since it requires the detection of only one fledgling per territory, minimizing some of the variables present when attempting a direct count of all fledglings, which is necessary to calculate the average brood size and productivity. While it may be more precise, the accuracy is not ideal but when making management decisions it may be better to err on the conservative side rather than interpreting measurements of average brood size and productivity as accurate and precise indicators of fecundity.

With regard to estimated brood size, there were no statistically significant differences between group means as determined by one-way ANOVA ($F(2,6) = 2.47$, $p = .16$). Estimated brood size is calculated as the average brood size per successful pair for the full territories, this calculation does not include territories where fledglings were not detected. This metric is potentially the most variable and may be influenced by the amount of time surveyors spend in the field and their ability to locate nesting females. If the nest is located, the surveyor is typically more successful documenting the true extent of the fledged brood the closer the survey effort aligns with the fledging event. In many instances once the nestlings fledge, the brood is split between the parents, with the female tending half the brood and the male the other half (Ladd and Gass, 1999). Fledglings can

be quite cryptic and difficult to detect (City of Austin, 2017) especially those tended by the female who does not sing or offer many clues to her location, unlike the male who actively defends his territory through song and intraspecific chases. As a result, it is not uncommon to discover fledglings 20 days or more fledged in a territory where no fledglings had previously been detected. It is also not uncommon that the only indication of breeding status may consist of a female sighted in a territory or a parent carrying prey items to a nestling or fledgling, however, if fledglings are not documented, it is assumed the nest was unsuccessful. As fledglings mature they become more mobile and do not necessarily stay within established territories (City of Austin, 2017), adding another layer of complexity to interpreting fecundity data. Since the fledglings and, typically, the females are unbanded, determining which fledglings belong to which territory can be difficult unless the color-banded male is observed feeding the fledglings (Reidy *et al*, 2015) or they are observed substantially within the interior of an established territory. Finally, the more time it takes to make the initial fledgling detection, the more likely it is that one or more of the fledglings may have fallen prey to a predator or disease (Cox *et al*, 2014). This could bias the data to have a higher fledgling count for instances where the nest was found and the surveyor was present near the time of fledging. When all factors are considered it may be difficult to make meaningful brood size or productivity comparisons between seasons or plots.

With regard to productivity, there were no statistically significant differences between group means as determined by one-way ANOVA ($F(2,6) = 2.17, p = .20$). Productivity is calculated as the sum of the highest number of fledglings recorded at any one time for each full territory divided by the total number of full territories, including the territories where fledglings were not detected. Like estimated brood size, this metric is dependent on the surveyor's ability to find fledglings, which can be influenced by a variety of factors discussed previously.

No significant differences were detected between the three plots with regard to territory density and fecundity. These data suggest management of the surveyed areas does not warrant targeted intervention and should continue to be managed as outlined in the BCCP Tier II (2007) and Tier III (2014) Land Management Plans. While no statistical significant differences were determined for the measured metrics of the various plots, it has to be acknowledged that, for the most part, the surveys did not occur concurrently, with the only seasonal overlap being 2018 and 2019 when the Northeast and Northwest plots were both surveyed (**Table 3**). However, in the time span the surveys were undertaken, 2014 – 2020, no unusual drought or precipitation events were recorded so it is unlikely weather played a significant role with regard to prey availability or nesting success, although it is possible the timing and amount of precipitation may have been a factor.

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7.0 ACKNOWLEDGEMENTS

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Table 1. Golden-cheeked warblers banded on the Northeast and Northwest Baker Sanctuary plots, 2017 - 2020.

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

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 Northwest Baker Sanctuary plot, 2020.

Territory Designation	Full/Edge Territory	Number of Confirmed Detections	Female Detected	# Fledglings Detected
DG/SI:PI/PI	Full	30	Yes	3
YE/SI:WH/RD	Full	43	Yes	1
DB/GR:GR/SI	Full	44	Yes	3
BK/PI:OR/SI	Full	44	Yes	3
BK/SI:WH/BL	Full	43	Yes	3
DB/YE:YE/SI	Full	45	Yes	2
GR/BL/RD/SI	Full	16	Yes	2
BK/MV:BK/SI	Full	47	Yes	3
MV/SI:DB/RD	Full	37	Yes	2
UB1	Full	51	Yes	2
UB3	Full	12	Yes	0
WH/SI:DG/PI	Edge	18	No	0
UB2	Edge	14	Yes	4
UB4	Edge	8	No	0

Table 3. Summary of golden-cheeked warbler reproductive success on the Northeast, Northwest, and 100-acre Baker Sanctuary plots, 2014-2020.

Survey	Territory Density	% Pairing Success	% Breeding Success	Estimated Brood Size	Productivity	Survey Time/25 Acres (Hours)
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
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	2.4	1.30	25.8
*Northeast Average	0.10	84	75	1.83	1.30	32.3
**Northwest Average	0.09	98	85	2.36	2.03	24.3
***100-acre Average	0.11	92	77	2.83	2.17	52.1

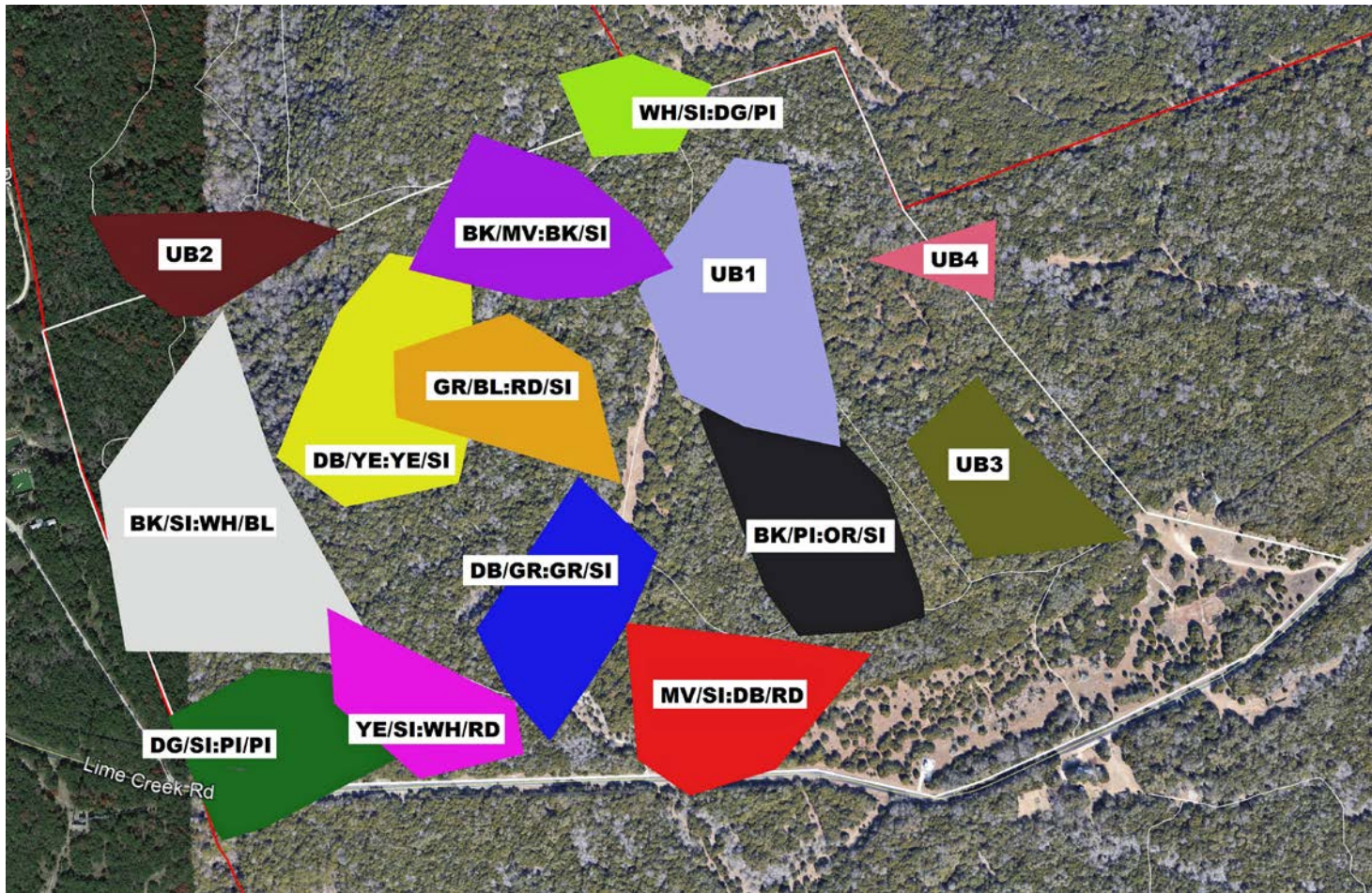
*Average for three seasons, 2017-2019

**Average for three seasons, 2018-2020

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



Figure 2. Golden-cheeked warbler territory distribution on the Northwest Baker Sanctuary plot, 2020.





MV/MV:MV/SI, aka Rico Mauve, failed to return to Baker Sanctuary for the 2020 season. Whether departed or merely dispersed, his *joi de vivre* will be remembered fondly and celebrated through art and poetry for all the ages. Artwork compliments of Toni Taylor.

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	9:54.03	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	26
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	A	46
3	3-1	10:00	B	21
3	3-1	10:01	B	26
1	1-2	10:01	A	36
2	2-2	10:01	A	58
1	1-2	10:02	A	36
1	1-3	10:03	A	39

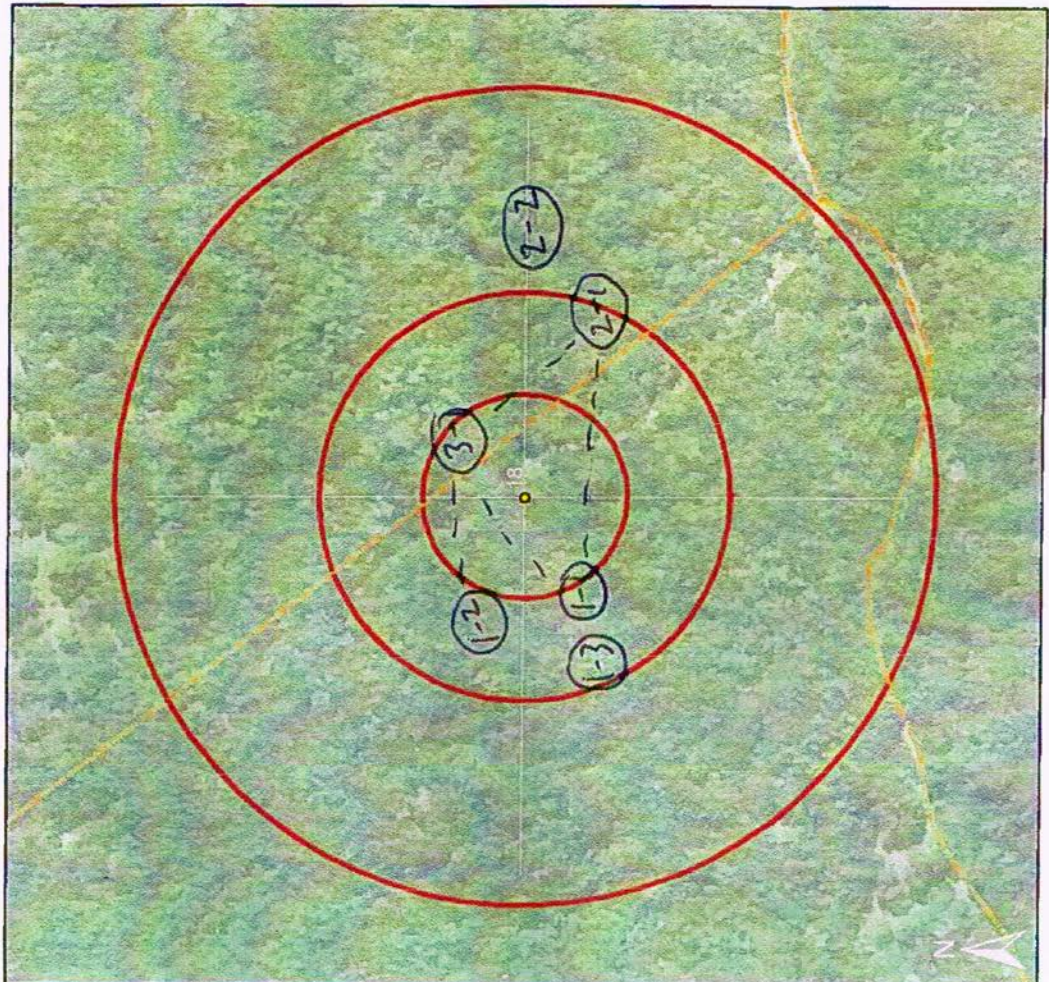


Figure 1. Baker Sanctuary VCP point counts stations, 2020.



Figure 2. Baker Sanctuary whitetail deer hunt and camera sites, 2019 - 2020.

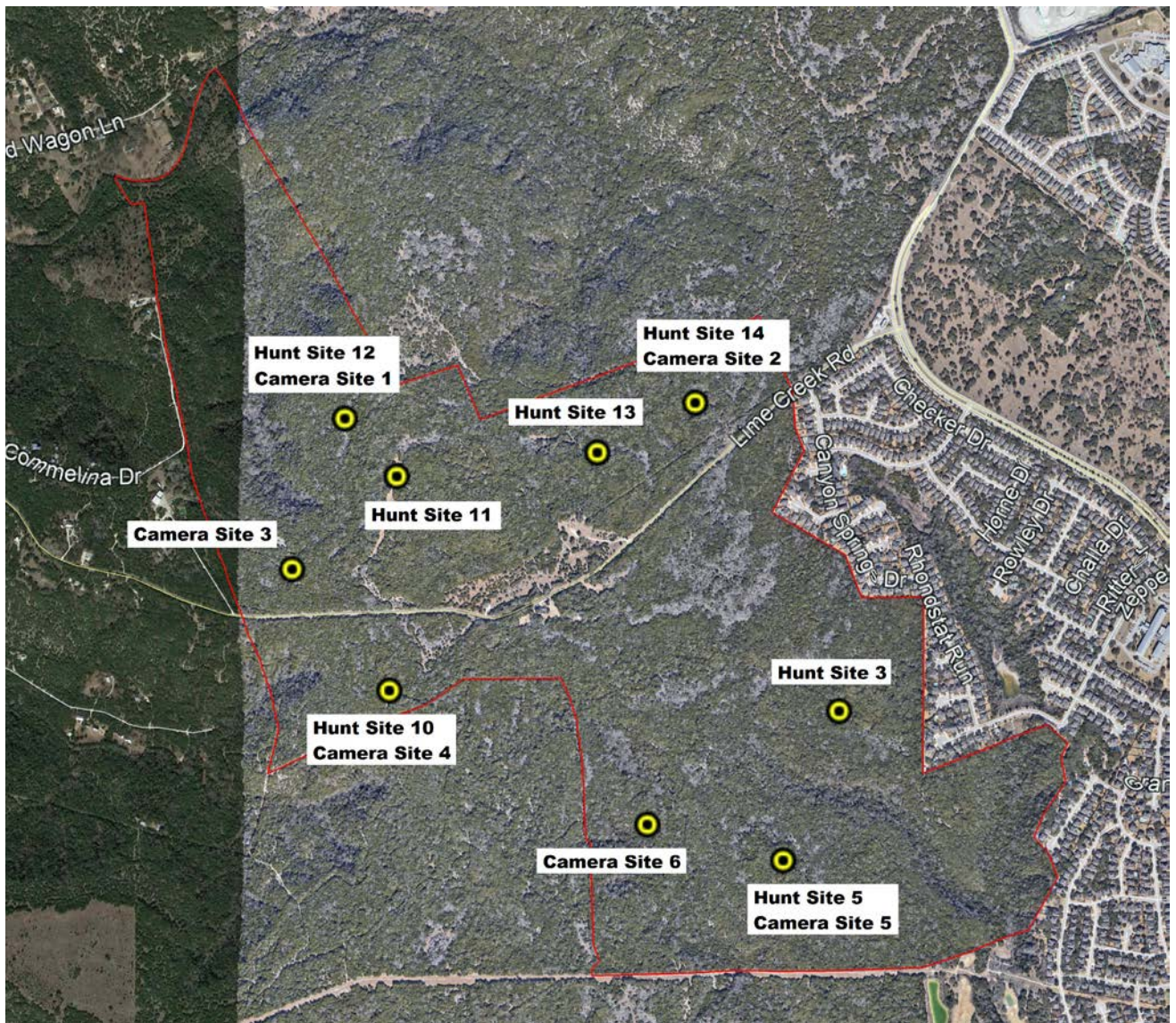


Figure 3. Summary of Baker Sanctuary whitetail deer harvest, 2000-2020. Juvenile deer are a year or less in age.

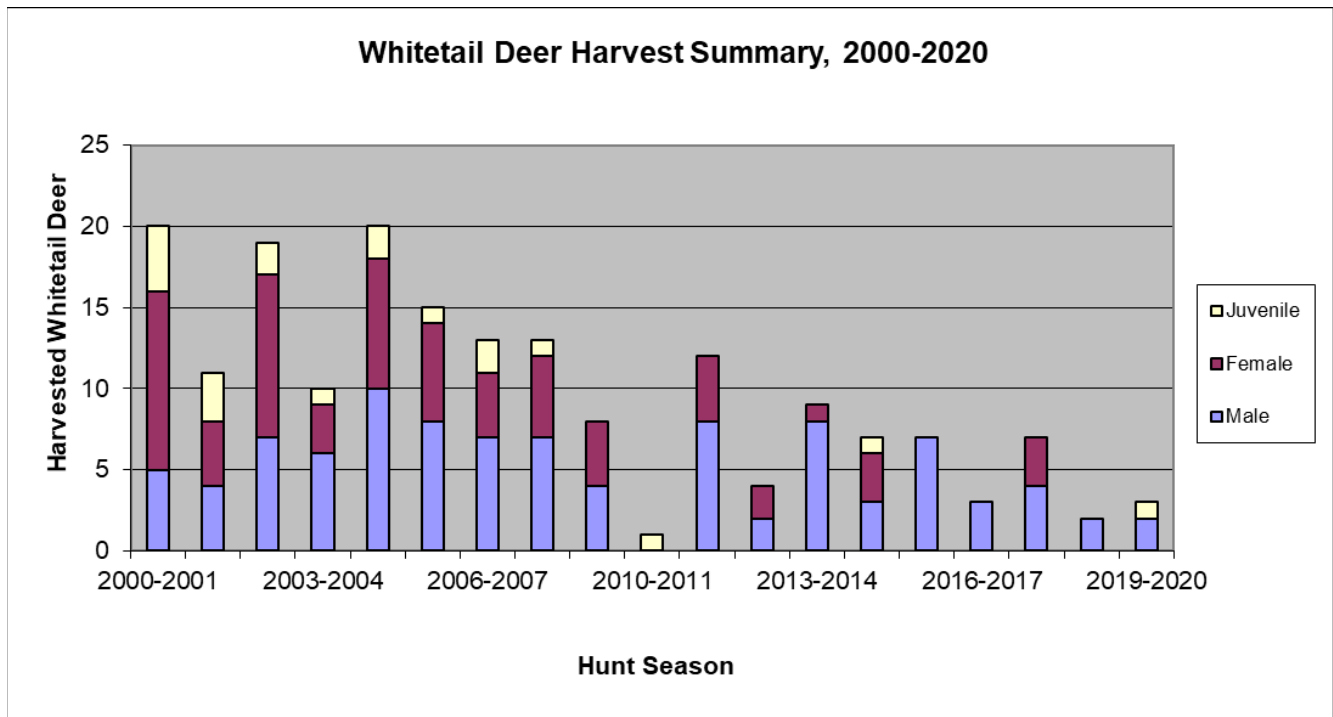


Figure 4. Baker Sanctuary shaded fuel break.

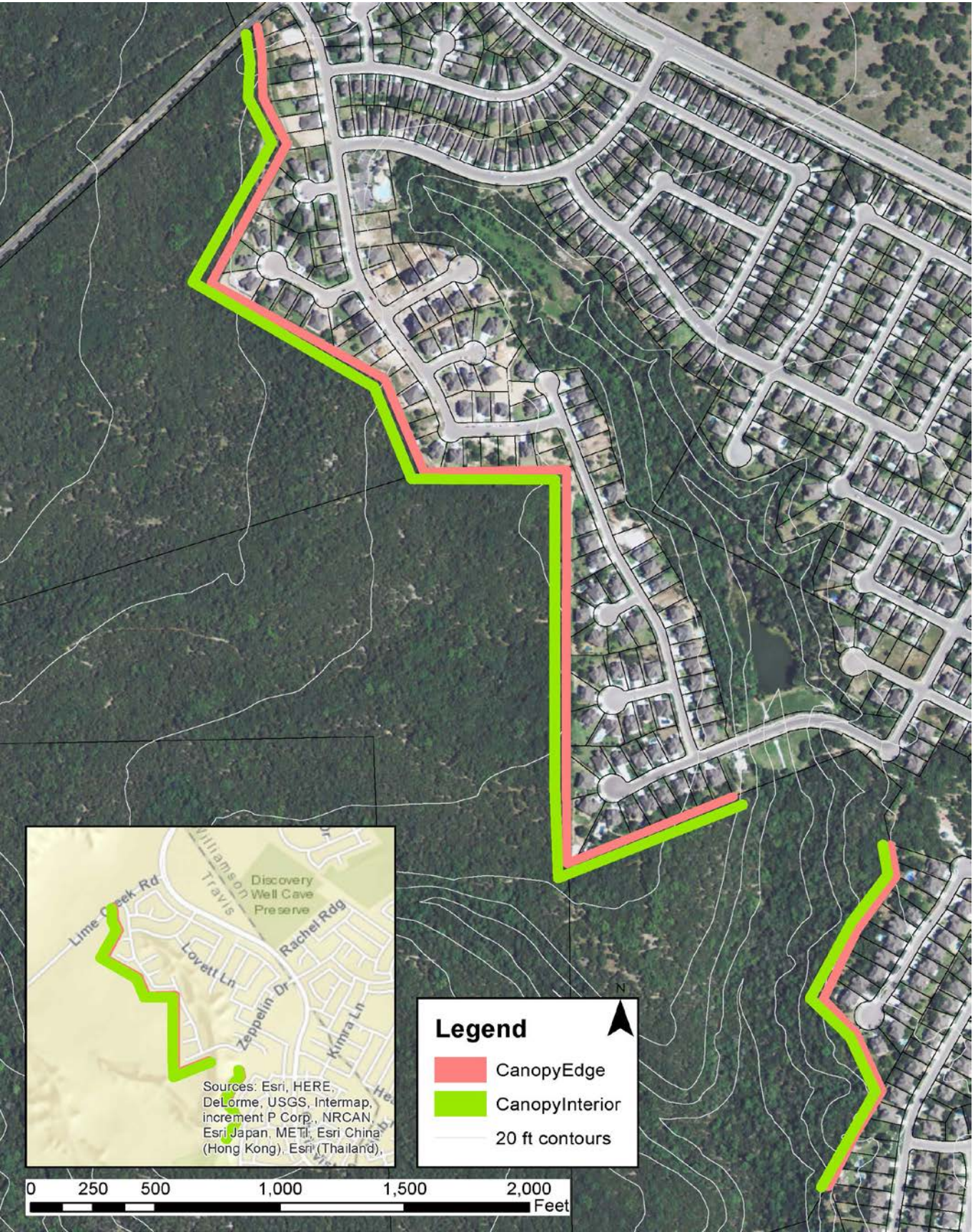


Figure 5. Summary of Baker Sanctuary brown-headed cowbird trapping effort, 2001-2020.

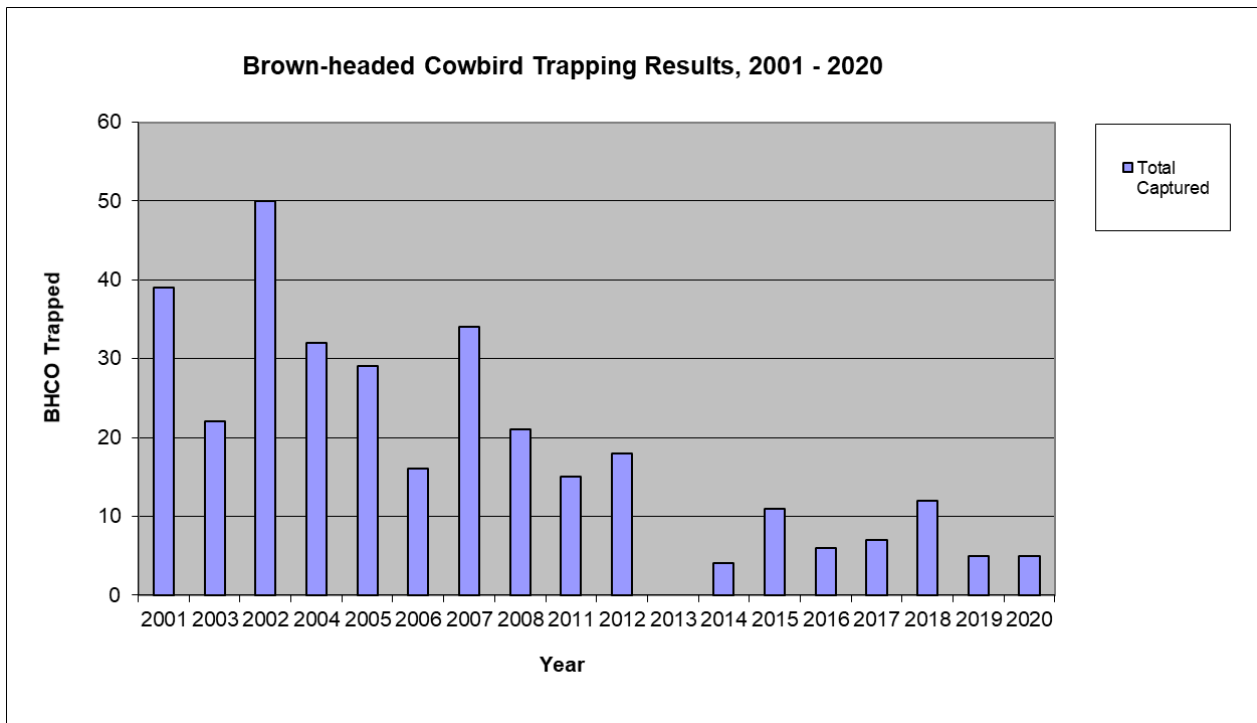


Figure 6. Summary of Baker Sanctuary tree-of-heaven eradication efforts, 2010-2020.

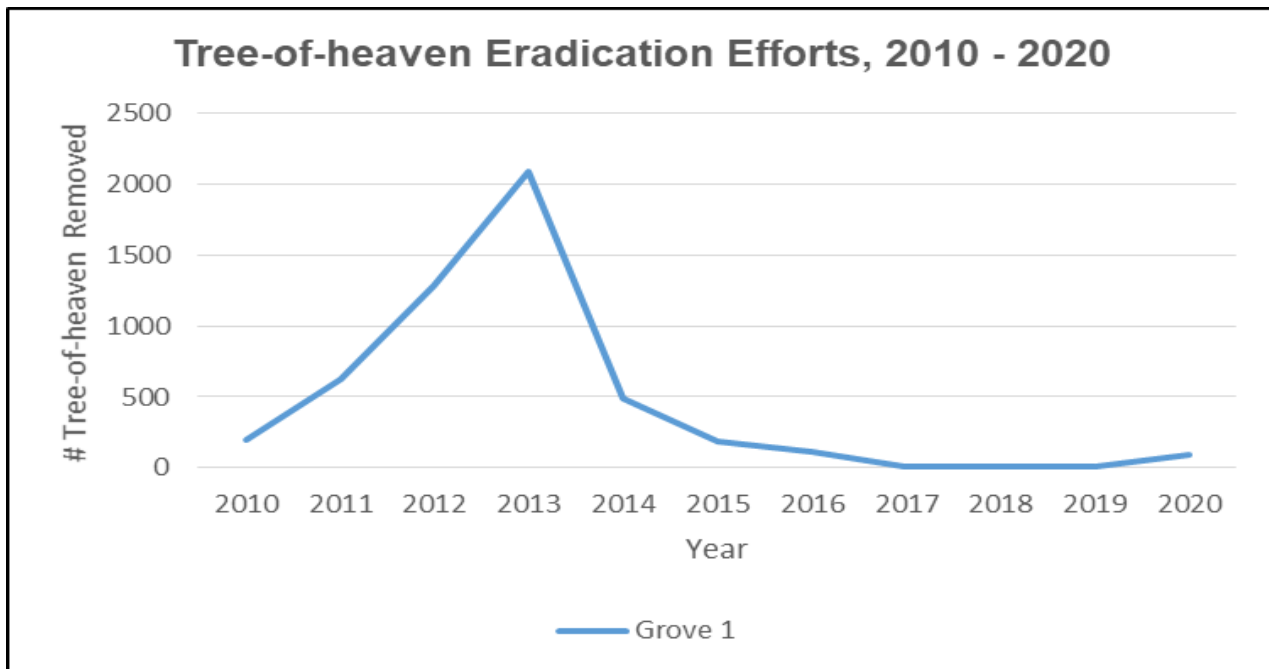


Table 1. Summary of GCWA banded at Baker Sanctuary, 2015 - 2020.

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

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 - 2020.

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

Table 3. Baker Sanctuary whitetail deer population survey results, 2016 - 2019.

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

Table 4. Baker Sanctuary plantings, 2019 – 2020.

Common Name	Scientific Name	Class	# Planted
Agarita	<i>Berberis trifoliata</i>	Tree/shrub	2
Bodark	<i>Maclura pomifera</i>	Tree/shrub	1
Canyon Mock Orange	<i>Philadelphus ernestii</i>	Tree/shrub	3
Carolina buckthorn	<i>Frangula caroliniana</i>	Tree/shrub	2
Cedar sage	<i>Salvia roemeriana</i>	Herbaceous/grass	1
Desert Willow	<i>Chilopsis linearis</i>	Tree/shrub	1
Escarpment black cherry	<i>Prunus serotina</i>	Tree/shrub	1
Gayfeather	<i>Liatris mucronata</i>	Herbaceous/grass	2 & sowed
Goldenrod	<i>Solidago nemoralis</i>	Herbaceous/grass	sowed
Mexican Plum	<i>Prunus Mexicana</i>	Tree/shrub	4
Prairie verbena	<i>Glandularia bipinnatifida</i>	Herbaceous/grass	3
Shrubby boneset	<i>Eupatorium havanense</i>	Tree/shrub	15
Slender-lobe Passionflower	<i>Passiflora tenuiloba</i>	Herbaceous/grass	1
Southwestern bristlegrass	<i>Setaria scheelei</i>	Herbaceous/shrub	sowed
Spanish oak	<i>Quercus buckleyi</i>	Tree/shrub	5
Texas Madrone	<i>Arbutus xalapensis</i>	Tree/shrub	2
Twist-leaf yucca	<i>Yucca rupicola</i>	Herbaceous/grass	2
Wafer Ash	<i>Ptelea trifoliara</i>	Tree/shrub	2
Western Soapberry	<i>Sapindus saponaria</i>	Tree/shrub	1
White Honeysuckle	<i>Lonicera albiflora</i>	Herbaceous/grass	2
Wild Petunia	<i>Ruellia nudiflora</i>	Herbaceous/grass	2
Zexmenia	<i>Zexmenia hispida</i>	Herbaceous/grass	13

Table 5. Baker Sanctuary BBS point count survey, 2020.

Common Name	Scientific Name	Number Observed	Mean ¹	Frequency (%) ² (25 yd radius)	Frequency (%) ³ (unlimited radius)
American Robin	<i>Turdus migratorius</i>	0	0.00	0	3
Ash-throated Flycatcher	<i>Myiarchus cinerascens</i>	0	0.00	0	11
Barn Swallow	<i>Hirundo rustica</i>	1	0.03	3	11
Bewick's Wren	<i>Thryomanes bewickii</i>	2	0.05	5	47
Black-and-white Warbler	<i>Mniotilta varia</i>	2	0.05	5	5
Black-chinned Hummingbird	<i>Archilochus alexandri</i>	6	0.16	16	16
Black-crested Titmouse	<i>Baeolophus atricristatus</i>	11	0.29	21	87
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	20	0.53	45	55
Blue Grosbeak		0	0.00	0	3
Canyon Wren	<i>Catherpes mexicanus</i>	0	0.00	0	3
Carolina Chickadee	<i>Poecile carolinensis</i>	22	0.58	37	76
Carolina Wren	<i>Thryothorus ludovicianus</i>	5	0.13	11	24
Chimney Swift	<i>Chaetura pelagica</i>	0	0.00	0	13
Common Grackle	<i>Quiscalus quiscula</i>	0	0.00	0	8
Common Raven	<i>Corvus corax</i>	0	0.00	0	3
Eastern Phoebe	<i>Sayornis phoebe</i>	1	0.03	3	11
Field Sparrow	<i>Spizella pusilla</i>	0	0.00	0	3
Golden-cheeked Warbler	<i>Setophaga chrysoparia</i>	14	0.37	32	58
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	1	0.03	3	5
House Finch	<i>Haemorhous mexicanus</i>	1	0.03	3	5
Hutton's Vireo	<i>Vireo huttoni</i>	2	0.05	5	11
Inca Dove	<i>Columba inca</i>	0	0.00	0	8
Ladder-backed Woodpecker	<i>Picoides scalaris</i>	1	0.03	3	8
Lesser Goldfinch	<i>Carduelis psaltria</i>	5	0.13	8	66
Mourning Dove	<i>Zenaida macroura</i>	0	0.00	0	42
Nashville Warbler	<i>Oreothlypis ruficapilla</i>	2	0.05	5	5
Northern Cardinal	<i>Cardinalis cardinalis</i>	20	0.53	47	97
Northern Mockingbird	<i>Mimus polyglottos</i>	1	0.03	3	18
Painted Bunting	<i>Passerina ciris</i>	16	0.42	37	84
Purple Martin	<i>Progne subis</i>	0	0.00	0	24
Red-shouldered Hawk	<i>Buteo lineatus</i>	0	0.00	0	8
Red-eyed Vireo	<i>Vireo olivaceus</i>	4	0.11	11	34
Rufous-crowned Sparrow	<i>Aimophila ruficeps</i>	1	0.03	3	3
Summer Tanager	<i>Piranga rubra</i>	0	0.00	0	13
Turkey Vulture	<i>Cathartes aura</i>	0	0.00	0	3
Woodhouse's Scrub-jay	<i>Aphelocoma californica</i>	1	0.03	3	11
White-eyed Vireo	<i>Vireo griseus</i>	9	0.24	18	26
White-winged Dove	<i>Zenaida asiatica</i>	0	0.00	0	24
Wild Turkey	<i>Meleagris gallopavo</i>	0	0.00	0	11
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	8	0.21	18	58

Table 6. Baker Sanctuary water quality test results, 2015 - 2020.

Site	Year	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	43.7	18.1	64.9	628.7	7.0	0.47
Baker Spring	2016-2017	40.2	19.1	51.8	648.0	7.0	0.24
Baker Spring	2017-2018	33.1	12.3	47.2	628.0	7.0	0.03
Baker Spring	2018-2019	40.2	19.1	64.0	641.0	7.0	0.45
Baker Spring	2019-2020	34.8	12.7	53.8	656.0	7.0	0.06