Travis Audubon's

Baker Sanctuary

2016 - 2017 Annual Report

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prepared for the

Travis County Transportation and Natural Resources Department Natural Resources Program

by

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Photo: Shelf fungus (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;' is 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 other 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 recent additions to Travis County's Lime Creek Unit 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 2017 a 65-acre survey plot located in the northeast portion of the Sanctuary (Northeast Plot) was surveyed for golden-cheeked warblers (*Setophaga chrysoparia*). 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 surveyor. In short, male golden-cheeked warblers (GCWA) were color-banded if

possible, territories mapped, and an attempt was made to quantify productivity. The Northeast Plot GCWA survey will be repeated in the spring of 2018 and 2019 before rotating to an adjacent area for another three year effort. In time the entire Sanctuary will be surveyed 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.

Based on the compilation and analysis of 209 golden-cheeked warbler observations including movement patterns, re-sighting of color banded individuals, counter-singing, and the presence of females and fledglings, it is estimated seven full territories and no edge territories were delineated in the Northeast Plot for an adjusted total of seven territories. Females were observed in six territories and a total of seven fledglings were observed in four territories. Two territories, UB3 and UB4, were established directly adjacent to the Northeast Plot and were not included in the analysis (**Appendix C**).

Results from the Northeast Plot were fairly similar to the average of the six seasons of 100-acre survey data (2011-2016). Territory density was the same (0.11 territories/acre) and pairing success was negligibly lower in the Northeast Plot at 86% compared to 93% for the 100-acre plot. However, all three calculations for fecundity (breeding success, average brood size, productivity) were slightly lower in the Northeast Plot compared to the 100-acre plot. It remains to be seen if the fecundity measurements are due to a real difference or are instead a product of other variables such as survey time (the 100-acre plot averaged 52.1 hours/25 acres and the Northeast Plot 20.4 hours/25 acres) or, in the case of the Northeast Plot, lack of data spanning more than one season. If a comparison is made between the Northeast Plot and the 2016 100-acre survey,

where survey efforts were similar, the differences in fecundity measurements are still present but not as pronounced (**Appendix C**).

An interesting observation from the Northeast Plot was that two males, PI/SI:WH/RD and UB2, were detected across Lime Creek Road on the southern section of the preserve on several occasions. The Lime Creek Road corridor is approximately 50 feet in width and it had been assumed in the past that such a wide canopy gap would be a natural barrier to GCWA, however that is apparently not the case for all individuals.

In 2014 TAS obtained state and federal permits to band (plastic color-bands and USFWS aluminum bands) golden-cheeked warblers throughout the Sanctuary. Five golden-cheeked warbler males (all after-second year (ASY) were captured and banded under TAS permits during the 2017 Northeast Plot survey (**Table 1**). It is anticipated banding will continue during the 2018 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 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 ten in an effort to eventually ascertain the most accurate survey interval for GCWA on the Sanctuary. Under the 10 minute count, 56 GCWA male detections were recorded, 46 if truncated to five minute counts, with the majority of the initial detections occurring in the first minute of observation (**Table 2**). Compared to the Northeast Plot results, the five minute count was more accurate recording eight singing males compared to the

seven known to be on the plot from the color-banding and territory mapping effort while the 10 minute count recorded a total of nine individuals. 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 various seasons and habitat conditions.

Whitetail Deer Management

Baker Sanctuary was closed from November 5, 2016 – January 15, 2017 for the annual whitetail deer (*Odocoileus virginianus*) management hunt (rifle hunting only). Seven primary hunters hunting at sites 3, 5, 10, 11, 12, 13, and 14 (**Figure 2**) harvested a total of three bucks during 337 hours of hunt effort, a decrease from the average harvest of eleven deer per season over the prior 15 recorded seasons (**Figure 3**). The Sanctuary will be closed for the 2017 - 2018 season from November 4, 2017 – January 21, 2018 for rifle hunting.

To gain a better understanding of the size and composition of the whitetail deer population on the Sanctuary, a camera trap survey was initiated in fall 2016. The survey was conducted from mid-September through the first week of October utilizing protocol outlined by Texas Parks and Wildlife (Oetgen et al, 2008). Six camera trap sites **(Figure 4)** were pre-baited with feed corn for five days prior to opening the camera traps which were then left active for 10 consecutive days. Results from the survey (**Table 3**) suggest the Sanctuary has a deer density of 35.3 acres/deer, which falls within the range of 30-40 acres/deer needed for successful hardwood recruitment according to the 2007 Tier II Land Management Plan. However, hardwood recruitment at the Sanctuary does not seem 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.

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 2016 – 2017 whitetail deer season.

Vegetation Management

Approximately 235 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*). Due to tree mortality caused by the drought of 2011, especially with regard to Ashe juniper, more time was invested in slash removal than in previous years to keep trails, shooting lanes, and roads open and to ensure the safety of visitors.

Slash from cut vegetation was chipped prior to the onset of the GCWA breeding season yielding an estimated 15 cubic yards of material. Approximately 40% of the mulch was donated to Chaetura Canyon for its trail system with the remainder utilized on the Sanctuary’s trail system as well as to mulch individual tree seedlings which were planted near Baker Cabin and the Steward’s residence.

During the fall and winter of 2016 a variety of woody and herbaceous plants were put in the ground at the Sanctuary (all donated by Paul and Georgean Kyle unless stated otherwise). Baker Cabin area: (6) Spanish oak, (1) escarpment black cherry, (2) elbow bush (*Forestiera pubescens*), (3) hog plum (*Colubrina*

texensis), (1) Texas persimmon (*Diospyros texana*), (8) chile pequin (*Capsicum annum*), (5) pigeon-berry (*Rivina humilis*), (1) Texas kidneywood (*Eysenhardtia texana*), (1) Texas nightshade (*Solanum triquetrum*), (6) Turk's cap (*Malvaviscuc drummondii*), (3) Virginia creeper (*Parthenocissus quinquefolia*), (34) common wild petunia (*Ruellia nudiflora*), and Travis County donated (6) Texabama croton (*Croton alabamensis*). Residence area: (37) Texas mountain laurel (*Sophora secundiflora*), (1) wafer ash (*Ptelea trifoliata*, (1) pigeon-berry, (2) Turk's cap, (1) tropical sage (*Salvia coccinea*), and (2) giant spiderwort (*Tradescantia gigantea*). Dead zone south of Lime Creek Road: (14) Spanish oak, (3) giant spiderwort, (2) agarita (*Berberis trifoliata*), (1) hog plum, (2) Texas persimmon, (7) Texas mountain laurel, (25) common wild petunia, (2) southwestern bristlegrass (*Setaria scheelei*), and (1) broadleaf woodoats (*Chasmanthium latifolium*). Baker Spring: (10) common wild petunia and Travis County donated (2) bodark (*Maclura pomifera*).

In October 2015, fifty-four little bluestem (*Schizochyrium scoparium*) were planted near the Baker Spring trailhead in an area dominated by the invasive grass King Ranch bluestem (*Bothriochloa ischaemum*). A combination of mulching and manual removal was employed to remove existing King Ranch bluestem in the treatment area. As of October 2017 overall survivorship for the little bluestem was 65% with lower survivorship in the non-mulched portion (50%) compared to the mulched portion (72%).

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 calldown 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 21 through May 31 of the 2017 season. Trap TAS1 was located on the south side of Lime Creek Road in the side yard of the Steward's residence 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 individuals (3 males and 3 females) while TAS2 captured one female for a total of seven individuals captured, results significantly lower than the average of 24 per season captured over the prior 14 recorded seasons (**Figure 5**). No non-target species were captured during the 2017 trapping effort.

Exotics Control

Two extensive, distinct populations of Malta star-thistle (*Centaurea melitensis*) are 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 residence to the south of LCR. While both populations occur in heavily disturbed, semi-open savannah habitat, the northern population is more established and extensive, typically forming a dense monoculture where it occurs. Due to vigorous growth triggered by the wet, mild fall, Malta star-thistle management began on October 2016 and continued through April 2017.

For the second year both populations (north and south of LCR) were effectively managed solely with the utilization of hand-removal techniques. In the past, the north population was selectively treated with glyphosate due to the extensive nature of the invasion. While plants continued to germinate in 2016-2017, they did so in a more 'patchy' fashion, which allowed effective control via hand-removal only. All removed plants were disposed off-site.

The extensive tree-of-heaven (*Ailanthus altissima*) grove discovered in December 2010 in a northern drainage of the Sanctuary is still being actively monitored and treated. Over the last year, only five tree-of-heaven seedlings were discovered and hand pulled, a significant decrease since management efforts were initiated. Since the grove was discovered in 2010, a total of 4930 tree-of-heaven and 45 chinaberry (*Melia azedarach*) seedlings have been removed from the area.

The less extensive population of tree-of-heaven discovered in May 2012 approximately 1000 feet downstream from the original tree-of-heaven site is also being actively monitored and treated. Over the last year no seedlings were observed at the site. Since the grove was discovered in 2012, a total of 3228 seedlings have been removed from the area. It is anticipated both groves will be completely eradicated over the next several growing seasons
(**Figure 6**).

Various invasive plants were either manually removed or treated with a 30% imazapyr solution when encountered throughout the Sanctuary. Species treated included 175 chinaberry, 570 heavenly bamboo (*Nandina domestica*), four medium-sized patches of Johnsongrass (*Sorghum halepense*), 648 jujube (*Ziziphus zizyphus*), 12 privet (*Ligustrum* species), and 27 tree-of-heaven. In the Baker Cabin/JAEC area 233 common mullein (*Verbascum thapsus*) and 24 common horehound (*Marrubium vulgare*) were also manually removed.

To analyze the efficacy of the herbicide imazapyr (Arsenal formulation) in non-native plant control, individuals were treated with a 30% Arsenal solution and re-visited the following year to document mortality. Treatments consisted of either stump-cutting the individual and applying several milliliters to the wound or girdling the individual and applying the solution to the cut. In both cases a small dropper-style container was used to carefully apply the Arsenal solution directly to the wounds to negate the possibility of herbicide drift. Overall, non-native

plants treated with the 30% Arsenal solution experienced a mortality rate of 82.4% with some species possibly exhibiting more resistance to the herbicide than others (**Table 4**).

The 18 common figs (*Ficus carica*) initially treated on July 2013 near Walnut Spring were monitored over the course of the year and re-sprouts were removed when encountered. Approximately 30% of the figs continue to re-sprout requiring continued monitoring and treatment of the site.

Over the past fiscal year, 59 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, 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 inhabiting 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 15 through May 26, the seventh 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 42 species recorded, the top three detected were northern cardinal (*Cardinalis cardinalis*) at 95% of the stations, black-crested titmouse (*Baeolophus bicolor*) at 92% of the stations, and lesser goldfinch (*Spinus psaltria*) at 79% of the stations. Golden-cheeked warblers were detected at 32% of the stations (**Table 5**) compared to 24% for the previous year. Point count data were analyzed with a linear regression test (log-transformed, 2-tail, 95% confidence level) for the seven years' worth of data. All populations appear stable

with no statistically significant trends with the exception of lesser goldfinch, painted bunting (*Passerina ciris*), and blue-gray gnatcatcher (*Polioptila caerulea*) who demonstrated weakly positive population trends and American crow (*Corvus brachyrhynchos*) which demonstrated a weakly negative population trend.

From 2011 – 2014, 15 nest boxes were installed throughout the Sanctuary to provide additional nesting opportunities for cavity nesting birds. Of the remaining 12 nest boxes, two were occupied during the 2017 breeding season by Carolina chickadees and three by either Carolina (*Thryothorus ludovicianus*) or Bewick's wrens (*Thryomanes bewickii*), judging by nest composition and egg shell fragments. In addition to the nest boxes, the chimney swift (*Chaetura pelagica*) tower adjacent to the Steward's residence is estimated to have successfully fledged one young, judging by analysis of nesting detritus accumulated on the bottom plate of the tower.

To enhance survivorship and to investigate factors which may contribute to seedling growth rates and mortality, an oak caging project was initiated in December 2013. The oak caging effort continued during 2016-2017 and was expanded to include other hardwood species of concern. During the 2016-2017 season an additional two shin oak, 20 Spanish oak, 13 plateau live oak (*Quercus fusiformis*), seven Texas ash, six escarpment black cherry, and one coma (*Sideroxylon lanuginosum*) were caged in throughout the Sanctuary. To date a total of 45 plateau live oak, 47 shin oak, 107 Spanish oak, seven Texas ash, six escarpment black cherry, and one coma have been caged, a total of 213 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 affecting seedling growth and survival. Currently, analysis of the data set has only focused on growth rates (height) per species and has not yet explored possible effects related to habitat type or density of canopy cover. Caged Spanish oak have exhibited an annual average increase in height of 13.0

cm/season, plateau live oak 11.5 cm/season, and shin oak 5.3 cm/season. To date, plateau live oak have demonstrated at 24% mortality rate for caged individuals, shin oak 19%, and Spanish oak 10%.

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 ten juniper seedlings were flagged and given a unique tag but they were not caged. Ten additional juniper were flagged and tagged in February 2016. Trees were selected with the criteria that they were seedlings and growing in full sun with the goal of obtaining growth rates (height and mid-stem diameter) to compare with those of hardwoods. To date seedling juniper height has increased at an average of 43.1 cm/season and mid-stem diameter at a rate of 0.4 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 2016-2017 season, 10 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 well within expected values (**Table 6**).

Education and Outreach

From October 2016 through September 2017 Baker Sanctuary experienced a total of 528 visitations from day hikers. Of those visitations, 517 were by TAS members and 11 were by non-members. An additional 607 visitations occurred during organized activities such as educational programs, TAS events, and

guided hikes. A total of 651 volunteer hours were logged at the Sanctuary on a variety of activities (see below).

October: Education, grounds & facilities maintenance, Eagle Scout project.
November: Grounds & facilities maintenance.
December: Grounds & facilities maintenance, administration.
January: Grounds maintenance, vegetation management.
February: Grounds & facilities maintenance, vegetation management, community outreach.
March: Facilities maintenance.
April: Education, Grounds & facilities maintenance.
May: Open House, education, trails maintenance, grant procurement.
June: Grant procurement, trail patrol.
July: Grant procurement, trail patrol.
August: Trail maintenance & patrol.
September: Eagle Scout project, trails & grounds maintenance, grant procurement, trail patrol.

The Hiking Club with Whitestone Elementary of the Leander Intermediate School District (LISD) convened for sessions in the fall. For six consecutive weeks per session, approximately 20 fifth grade English Language Learner students spent two hours per session hiking the Sanctuary, learning about central Texas flora, fauna, and habitats. The program was developed with support from Linda Lippe, the former LISD elementary science curriculum coordinator, and Charlie Ciernia, a teacher leader at Deer Creek Elementary. The program was designed to augment grade-appropriate science concepts as outlined in the Texas Essentials Skills and Knowledge.

Other activities to enhance community involvement and increase awareness of Baker Sanctuary and the BCP mission included the Baker Nature Day (formerly Open House), Great Backyard Bird Count, 18 guided hikes for various

community groups, two field trips for a total of 172 LISD fourth grade students, three GCWA presentations to a total of 303 LISD fifth grade students, one GCWA themed Youth Nature Camp for elementary students, two ecology presentations to a total of 279 LISD fourth grade students, installation of a Nature Path on the Deer Creek Elementary campus, and GCWA presentations at the UT Forum series, Yarborough public library, and the Anderson Mill Garden Club.

Literature Cited

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

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

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

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

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

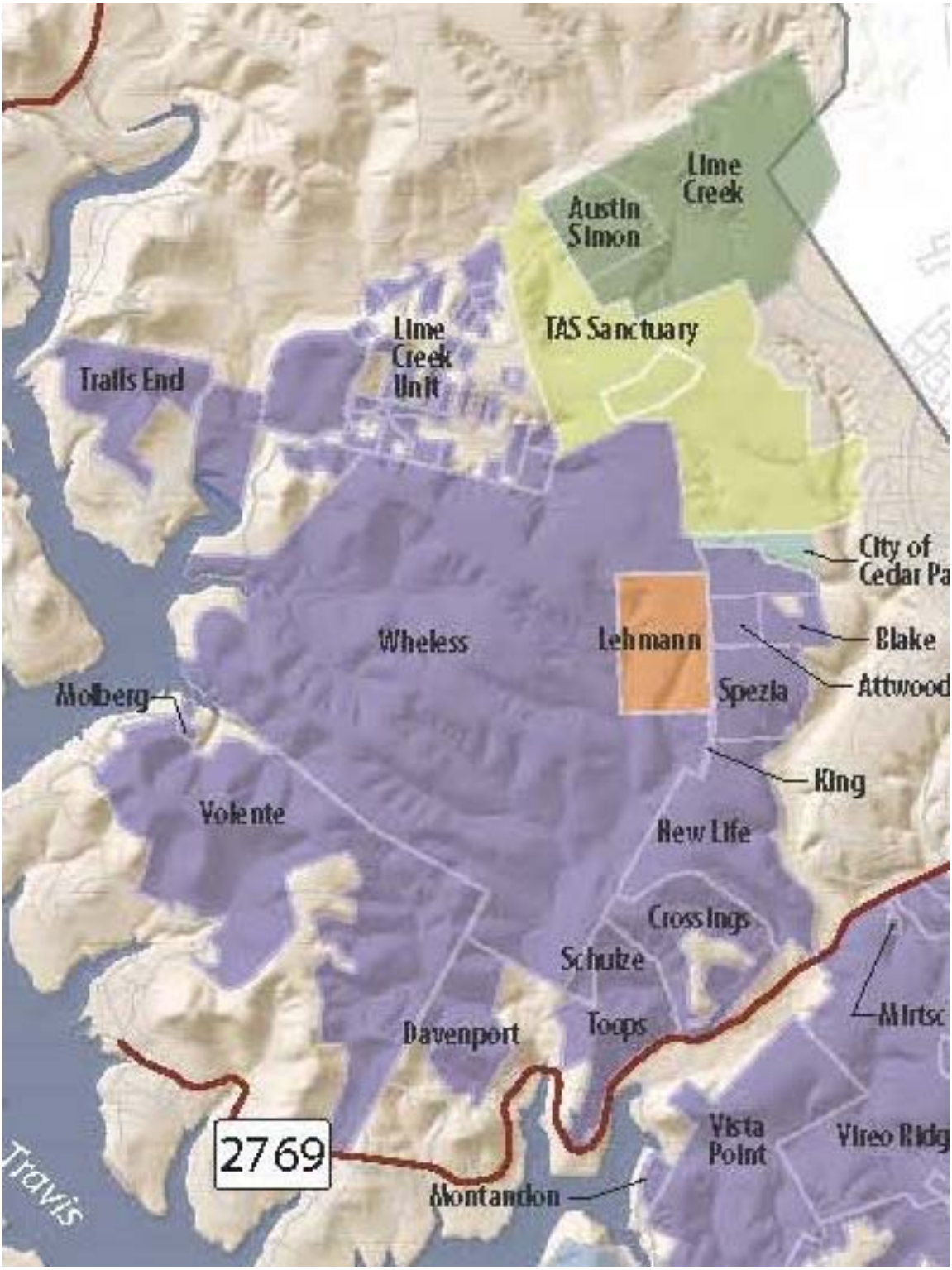
Appendix A

Baker Sanctuary 40-acre headquarters tract



Appendix B

Baker Sanctuary and adjacent BCP partner properties



Appendix C

RESULTS OF THE GOLDEN-CHEEKED WARBLER SURVEY FOR THE NORTHEAST BAKER SANCTUARY PLOT SPRING 2017 TRAVIS COUNTY, TEXAS



TRAVIS AUDUBON

Listen. Look. And Learn.

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1.0 INTRODUCTION

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

Baker Sanctuary is bordered primarily by BCP properties owned and managed by various partners, including the City of Austin, Travis County, City of Cedar Park, and conservation easements held by Travis County on privately owned land. In addition to preserve lands, Baker is bordered by several small rural lots to the west and north composed 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. Baker Sanctuary contains approximately 690 acres of high-quality golden-cheeked warbler (GCWA) habitat.

The purpose of this report is to present the results of the 2017 Northeast Baker Sanctuary survey. The 65-acre Northeast plot is located north of Lime Creek Road and roughly east of the Baker Cabin complex (**Figure 1**). The Northeast survey was initiated as part of an effort to gain a more complete understanding of the density and distribution of GCWA throughout the entire Sanctuary. The plot will be surveyed for a total of three years and then rotated to an adjacent section of the Sanctuary for another three year survey effort, etc. until the entire

Sanctuary is covered. Ideally the Sanctuary should be surveyed in its entirety over the course of one breeding season but, due to financial constraints, the rotating survey method is the second best option currently available.

The methods for the 2017 Northeast Baker Sanctuary survey 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 65-acre 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*), 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*), flameleaf sumac (*Rhus lanceolata*), agarita (*Berberis trifoliata*), 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 65-acre plot is fairly uniform and ranges between 1060 feet above mean sea level (msl) to 1020 feet above msl. Unlike the 100-acre plot in the southern section of Baker Sanctuary, there is no significant topographical relief nor canyons to be found anywhere in the study area. In the eastern portion of the plot there is a relatively contiguous, seven acre section of woodland which experienced high Ashe juniper mortality during the severe

drought of 2011 (**Figure 1**). This area is characterized primarily by standing or fallen Ashe juniper snags, poverty weed (*Baccharis neglecta*), and plateau live oak which successfully weathered the drought.

3.0 METHODS

Surveys began on March 29 and concluded on May 31. 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. One surveyor, Christopher Murray, surveyed the entire study plot on a weekly basis and invested a total of 53 hours, or 20.4 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 surveyor.

During each visit the surveyor hiked through the entire 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 time of day, song type (A or B), whether the GCWA was color banded, presence of a female or fledglings, territorial interactions such as counter-singing or chases between males, and whether the detected male was an After Second Year (ASY) or Second Year (SY) bird. 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 breeding males on the 65-acre plot. 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. To date five GCWA have been banded on the Northeast Baker Sanctuary study plot (**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, 209 GCWA observations were recorded over the course of the survey effort. Seven full territories and no edge territories were delineated in the study plot for an adjusted total of seven territories. Females were observed in six territories and a total of seven fledglings were observed in four territories (**Table 2**). Two territories, UB3 and UB4, were established directly adjacent to the 65-acre plot and were not included in the analysis.

Territory density was calculated at 0.11 territories per acre. This calculation was based on the adjusted total of seven territories in the 65 acres surveyed.

The pairing success rate in the Northeast plot was 86% (females were observed at six of the seven full territories). The breeding success was estimated at 57%, based on five of the seven full territories were observed to have fledglings. The average brood size was 1.75 fledglings based on the aforementioned criteria. Productivity was estimated at 1.0 based on the total of seven fledglings observed in the seven full territories.

5.0 DISCUSSION

While the 100-acre survey has been performed at Baker since 1999, intensity and methodology have varied significantly enough to make 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 six years of data collection on the 100-acre plot can cautiously be compared with

results of the Northeast Sanctuary survey. 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 Northeast survey are fairly similar to the average six seasons of 100-acre survey data (**Table 3**). Territory density is the same (0.11 territories/acre) and pairing success is negligibly lower in the Northeast plot at 86% compared to 93% for the 100-acre plot. However, all three calculations for fecundity measurements (breeding success, average brood size, productivity) were slightly lower in the Northeast plot compared to the 100-acre plot. It remains to be seen if the fecundity measurements are due to an actual difference or a product of other variables such as survey time (the 100-acre plot averaged 52.1 hours/25 acres and the Northeast plot 20.4 hours/25 acres) or, in the case of the Northeast plot, lack of data spanning more than one season. If a comparison is made between the Northeast survey and the 2016 100-acre survey, where survey effort was similar, the differences in fecundity measurements are still present but not as pronounced (**Table 3**).

An interesting observation from the survey was that two birds, PI/SI:WH/RD and UB2, were detected across Lime Creek Road on the southern section of the preserve on several occasions. The Lime Creek Road corridor is approximately 50 feet in width and it had been assumed in the past that such a wide canopy gap would be a natural barrier to GCWA, however that is apparently not the case for all birds.

6.0 REFERENCES

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

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

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

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

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

7.0 ACKNOWLDGEMENTS

Many thanks go out to Julie Murray who assisted with color-banding GCWA and provided GIS assistance.

Table 1. Golden-cheeked warblers banded on the Northeast Baker Sanctuary plot, 2017.

Date Banded	Color Combination	USFWS Band Number	Gender	Age
2017	RD/RD:DG/SI	2770-41206	Male	ASY
2017	DG/DB:OR/SI	2770-41207	Male	ASY
2017	BK/WH:BL/SI	2770-41208	Male	ASY
2017	PI/SI:WH/RD	2770-41209	Male	ASY
2017	WH/BL:MV/SI	2770-41210	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 Northeast Baker Sanctuary plot, 2017.

Territory Designation	Full/Edge Territory	Number of Detections	Female Detected	# Fledglings Detected
RD/RD:DG/SI	Full	24	Yes	*0
DG/DB:OR/SI	Full	20	Yes	1
BK/WH:BL/SI	Full	45	Yes	1
PI/SI:WH/RD	Full	24	Yes	2
WH/BL:MV/SI	Full	9	No	0
UB1	Full	28	Yes	0
UB2	Full	43	Yes	3

*Observed carrying food but fledglings were not detected.

Table 3. Summary of golden-cheeked warbler reproductive success on the Northeast Baker Sanctuary and 100-acre plots, 2011-2017.

Survey	Territory Density	% Pairing Success	% Breeding Success	Average Brood Size	Productivity	Survey Time/25 Acres (Hours)
Northeast 2017	**0.11**	**86**	**57**	**1.75**	**1.0**	**20.4**
***100-acre 2011-2016**	**0.11**	**93**	**68**	**2.8**	**1.85**	**52.1**
100-acre 2016	**0.11**	**100**	**56**	**2.4**	**1.3**	**25.8**

*Average for six seasons, 2011-2016.

Figure 1. Location of the Northeast Baker Sanctuary plot.



Figure 2. Golden-cheeked warbler territory distribution on the Northeast Baker Sanctuary plot, 2017.

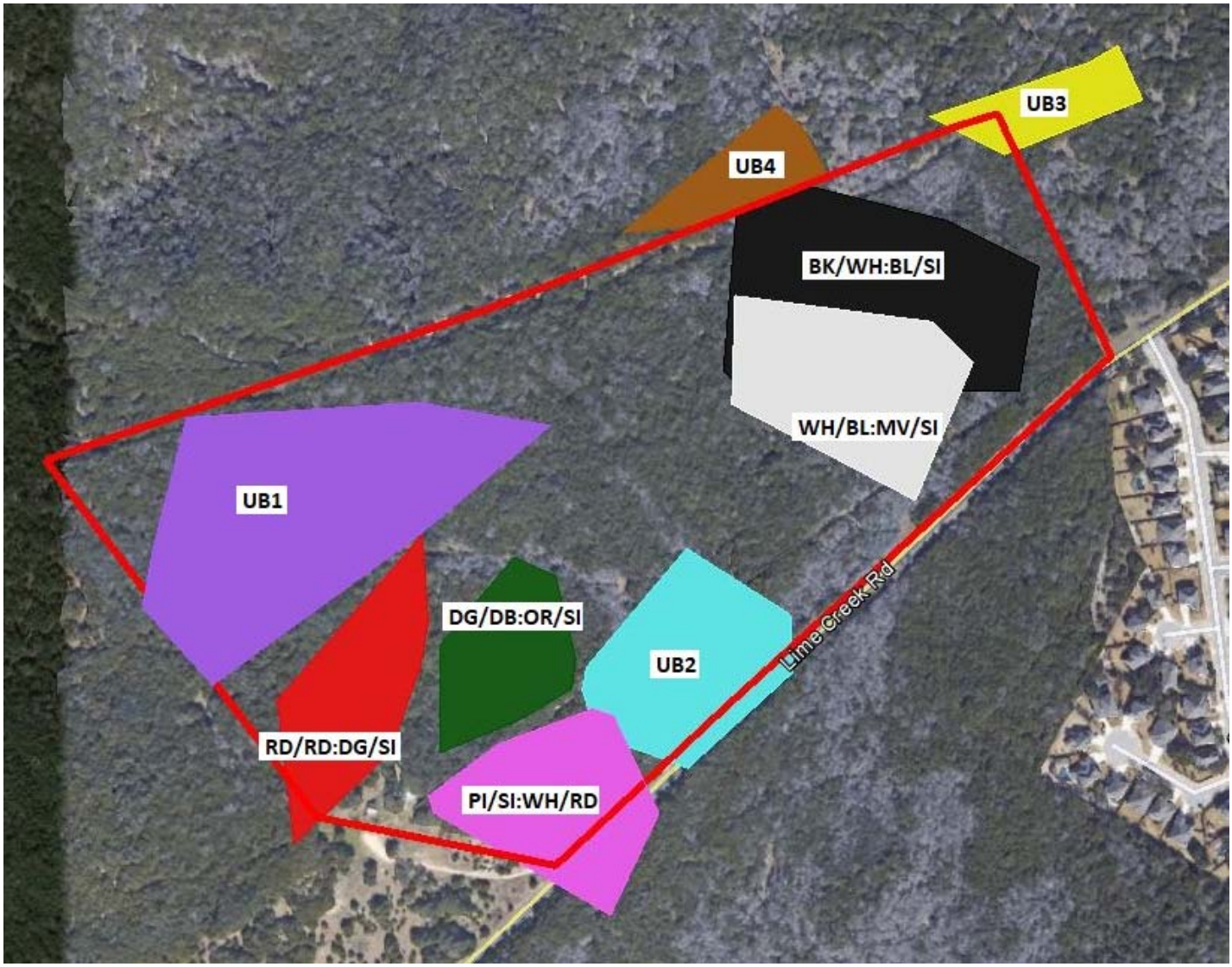


Table 1. Golden-cheeked warblers banded on Baker Sanctuary, 2011 – 2017.

Date Banded	Color Combination	USFWS Band Number	Gender	Age
2011	MV/SI:NB/YE	Unknown	Male	Unknown
2011	MV/BL:PI/SI	Unknown	Male	Unknown
2011	OR/OR:DG/SI	Unknown	Male	Unknown
2011	BK/YE:DG/SI	Unknown	Male	Unknown
2011	YE/DG:DB/SI	Unknown	Male	Unknown
2011	DB/BK:MV/SI	Unknown	Male	Unknown
2011	RD/SI:BK/DG	Unknown	Female	Unknown
2011	NB/SI:PI/MV	Unknown	Male	Unknown
2011	WH/SI:OR/BL	Unknown	Male	Unknown
2011	NB/MV:GR/SI	Unknown	Male	Unknown
2011	WH/BK:WH/SI	Unknown	Male	Unknown
2011	OR/SI:MV/DG	Unknown	Female	Unknown
2011	RD/SI:DB/YE	Unknown	Male	Unknown
2012	BL/DB:RD/SI	Unknown	Male	Unknown
2012	BL/WH:RD/SI	Unknown	Male	Unknown
2012	BK/DG:DB/SI	Unknown	Male	Unknown
2012	WH/SI:DG/YE	Unknown	Male	Unknown
2012	RD/SI:BL/PI	Unknown	Female	Unknown
2012	WH/DG:BK/SI	Unknown	Male	Unknown
2012	OR/SI:WH/RD	Unknown	Male	Unknown
2012	PI/SI:GR/YE	Unknown	Male	Unknown
2012	PI/SI:NB/DG	Unknown	Male	Unknown
2013	MV/SI:BL/MV	Unknown	Male	Unknown
2013	DB/SI:OR/YE	Unknown	Male	Unknown
2013	MV/SI:DG/DG	Unknown	Male	Unknown
2014	BK/SI:OR/BK	Unknown	Male	Unknown
2014	BL/SI:OR/RD	Unknown	Male	Unknown
2014	OR/SI:DG/DB	Unknown	Male	Unknown
2014	PI/DG:NB/SI	Unknown	Female	Unknown
9-Apr-15	RD/SI:RD/DB	2770-41201	Male	SY
2015	WH/OR:PI/SI	Unknown	Male	SY
2015	RD/WH:MV/SI	Unknown	Male	ASY
2015	YE/SI:PI/BL	Unknown	Female	SY
2-Apr-15	MV/MV:YE/SI	2770-41202	Male	ASY
2015	OR/SI:DB/YE	Unknown	Male	ASY
2015	NB/MV:MV/SI	Unknown	Male	SY
2015	DB/SI:RD/DB	Unknown	Unknown	HY

2015	**WH/SI:NB/YE**	**Unknown**	**Unknown**	**HY**
2015	**WH/YE:YE/SI**	**Unknown**	**Unknown**	**HY**
2015	**BL/SI:BL/MV**	**Unknown**	**Unknown**	**HY**
2015	**YE/DG:DG/SI**	**Unknown**	**Male**	**Unknown**
8-Apr-16	**BL/DG:BK/SI**	**2770-41205**	**Male**	**ASY**
8-Apr-16	**NB/SI:OR/DB**	**2770-41203**	**Male**	**ASY**
16-Apr-16	**WH/SI:BK/WH**	**2550-99699**	**Male**	**SY**
23-Mar-17	**RD/RD:DG/SI**	**2770-41206**	**Male**	**ASY**
23-Mar-17	**DG/DB:OR/SI**	**2770-41207**	**Male**	**ASY**
23-Mar-17	**BK/WH:BL/SI**	**2770-41208**	**Male**	**ASY**
30-Mar-17	**PI/SI:WH/RD**	**2770-41209**	**Male**	**ASY**
4-Apr-17	**WH/BL:MV/SI**	**2770-41210**	**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 Baker Sanctuary 100-acre plot, 2016.

Territory Designation	Full/Edge Territory	Female Detected	# Fledglings Detected
OR/SI:DB/YE	**Full**	**Yes**	**2**
MV/MV:YE/SI	**Full**	**Yes**	**4**
RD/WH:MV/SI	**Full**	**Yes**	**2**
WH/SI:BK/WH	**Full**	**Yes**	**0**
YE/DG:DG/SI	**Full**	**Yes**	**0**
UB1	**Full**	**Yes**	**0**
UB2	**Full**	**Yes**	**2**
UB3	**Full**	**Yes**	**0**
UB4	**Full**	**Yes**	**2**
BL/DG:BK/SI	**Edge**	**Yes**	**1**
NB/SI:OR/DB	**Edge**	**Yes**	**1**
UB5	**Edge**	**Yes**	**3**
BK/SI:OR/DB	**Out**	**Yes**	**0**

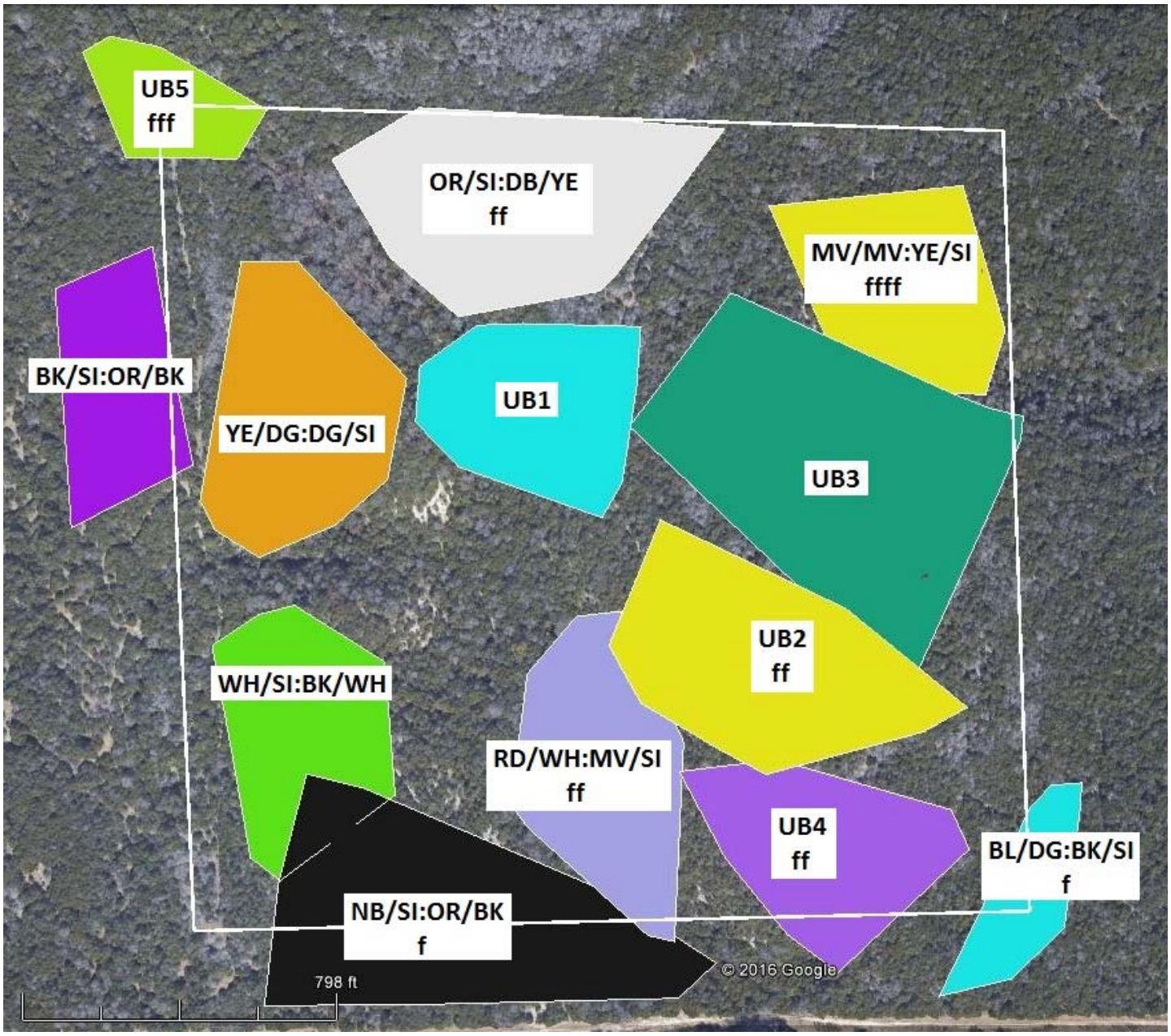
Table 3. Summary of golden-cheeked warbler reproductive success on the Baker Sanctuary 100-acre plot, 2011 – 2016.

Year	Territory Density	% Pairing Success	% Breeding Success	Estimated Brood Size	Productivity	Survey Time (Hours)
2011	10.5	83	50	2.3	1.2	150
2012	10	100	75	3.4	2.1	327
2013	10	100	50	2.7	1.3	234
2014	8.5	100	100	2.4	2.4	241
2015	11.5	75	75	3.7	2.8	195
2016	10.5	100	56	2.4	1.3	103
Avg.	10.2	93	67	2.8	1.9	208

Figure 1. Location of the Baker Sanctuary 100-acre plot.



Figure 2. Golden-cheeked warbler territory distribution on the Baker Sanctuary 100-acre plot, 2016.



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 BLIA NOBO

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

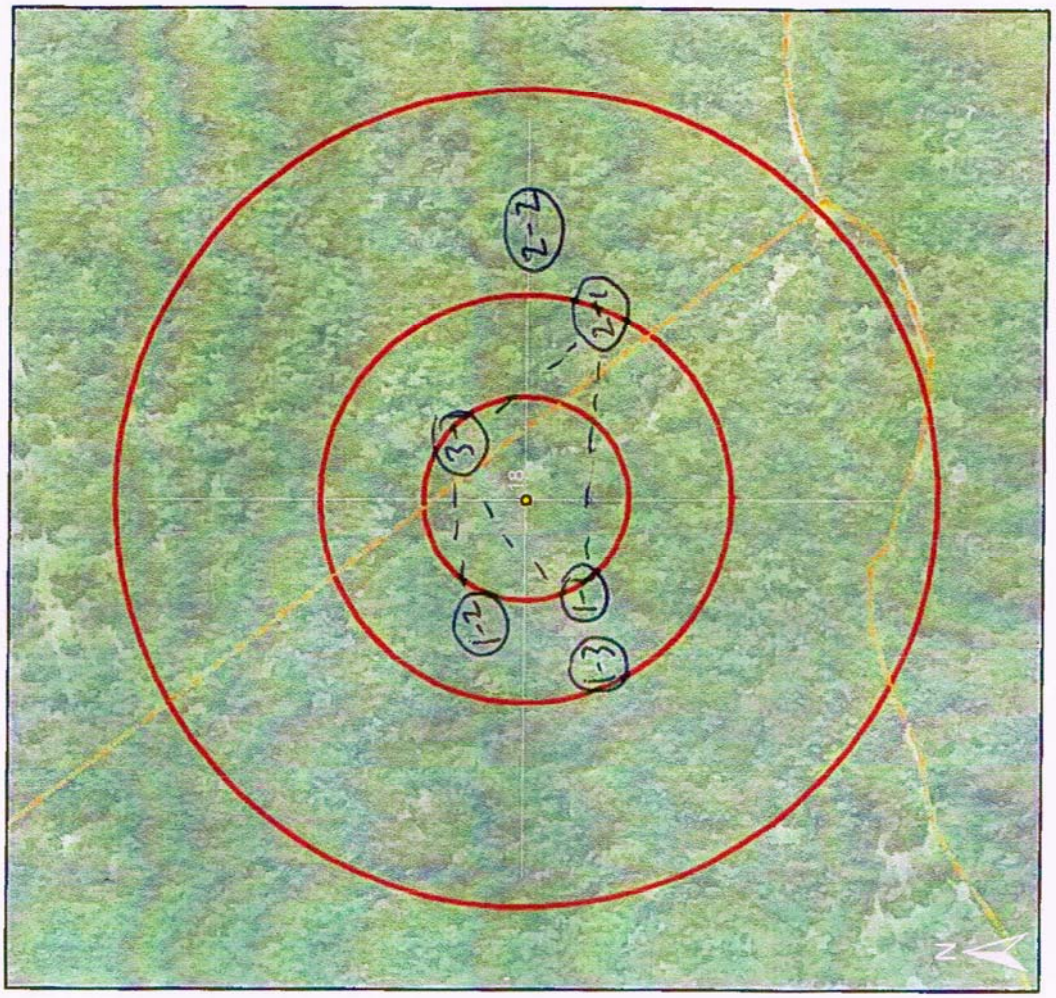


Figure 1. Baker Sanctuary VCP point counts stations, 2017.

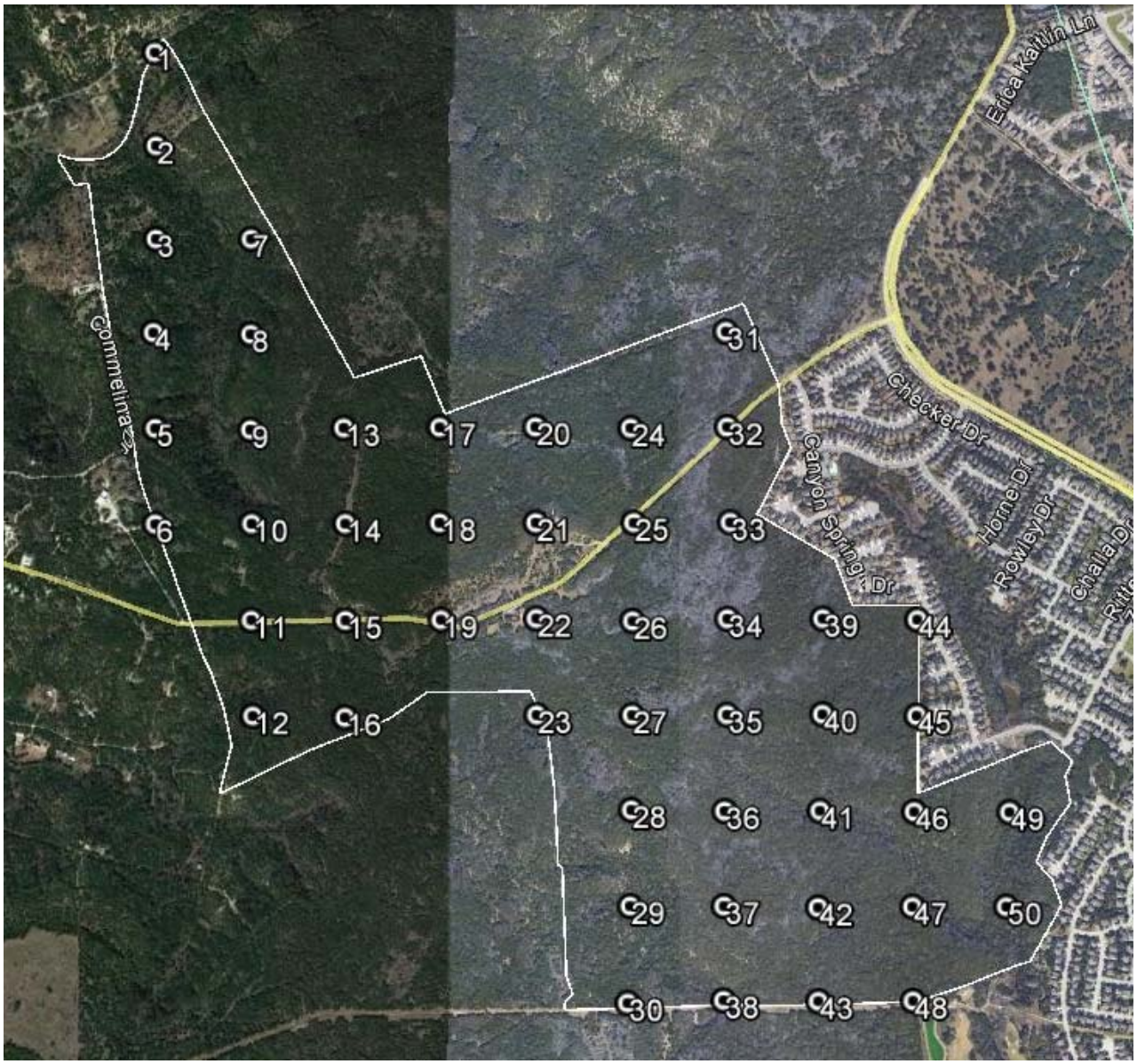


Figure 2. Baker Sanctuary whitetail deer hunt sites, 2017.

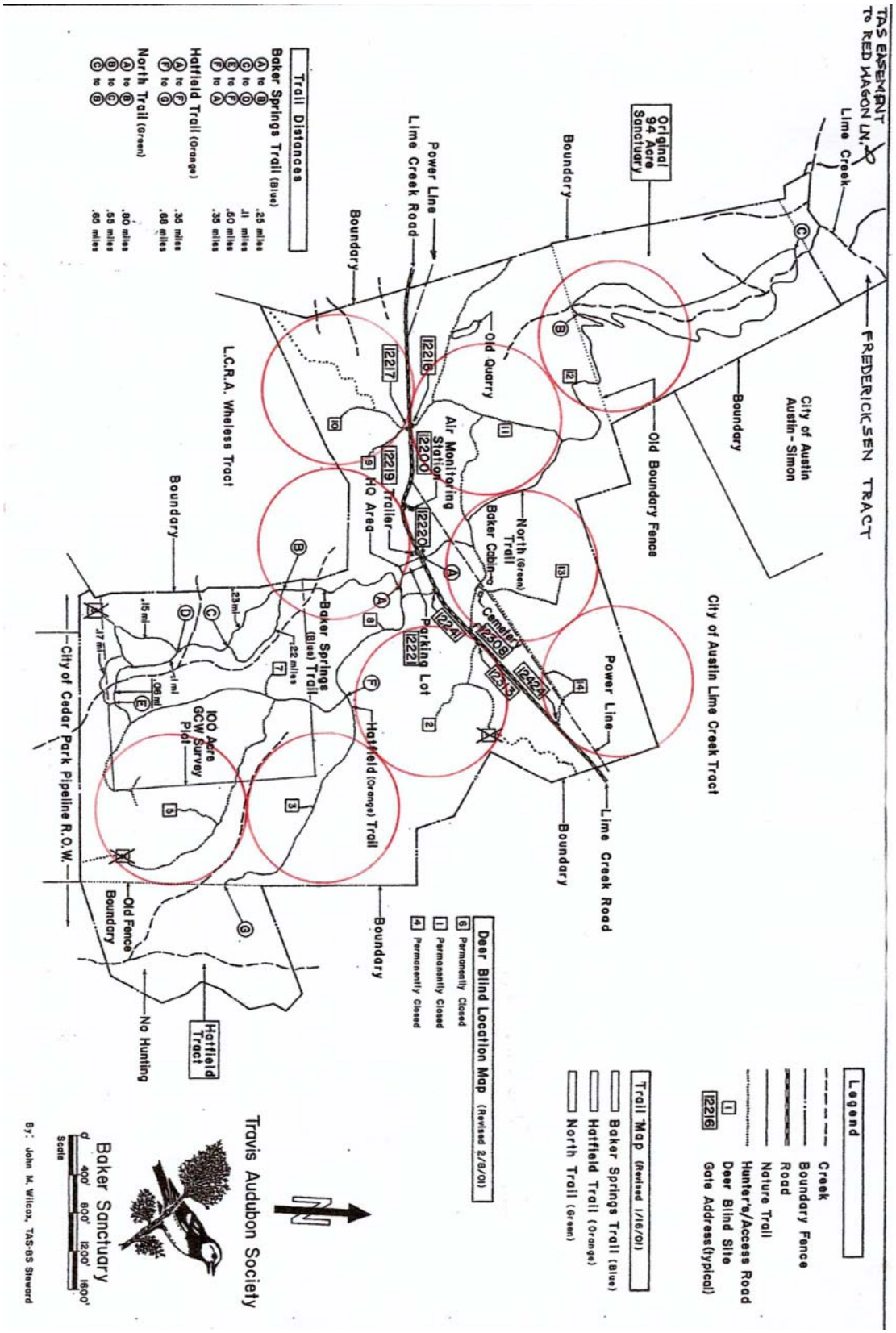


Figure 3. Summary of Baker Sanctuary whitetail deer harvest, 2000-2017. Juvenile deer are a year or less in age.

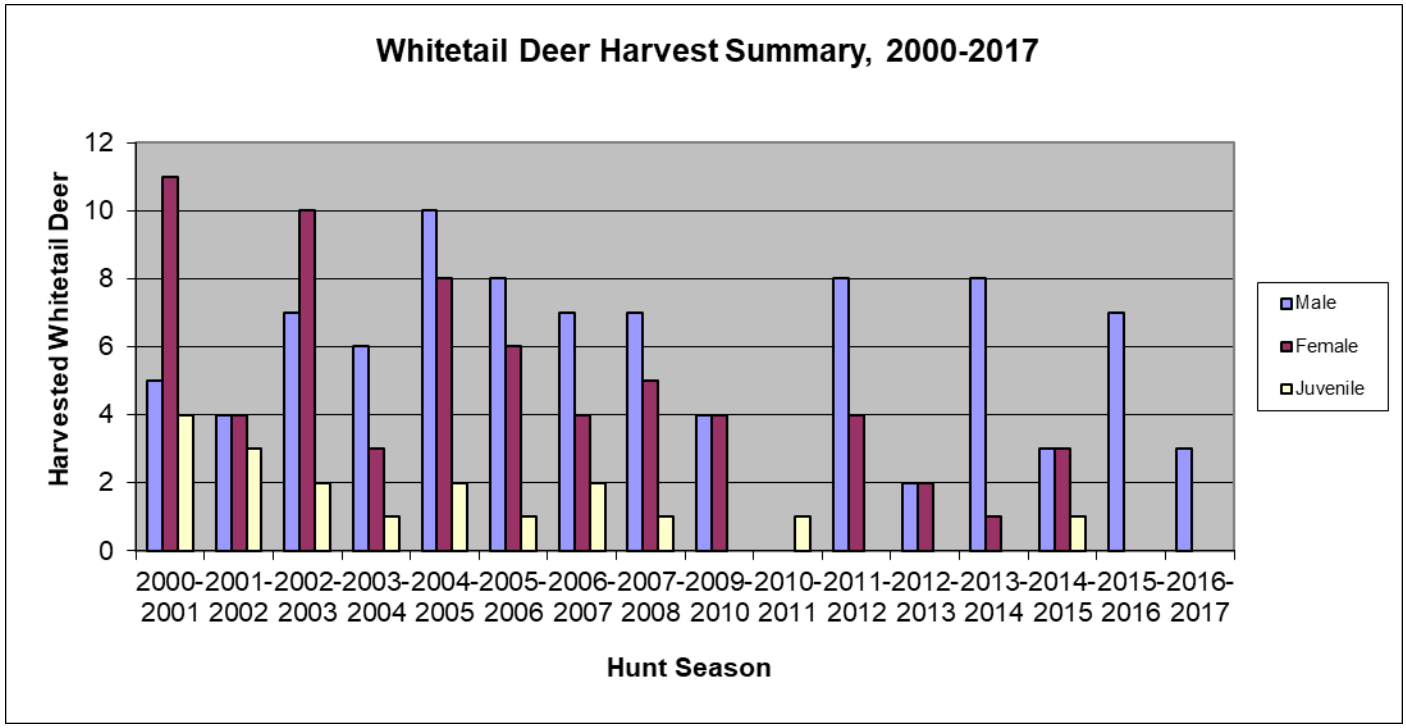


Figure 4. Baker Sanctuary whitetail deer camera trap sites, 2016.



Figure 5. Summary of Baker Sanctuary brown-headed cowbird trapping effort, 1986-2017.

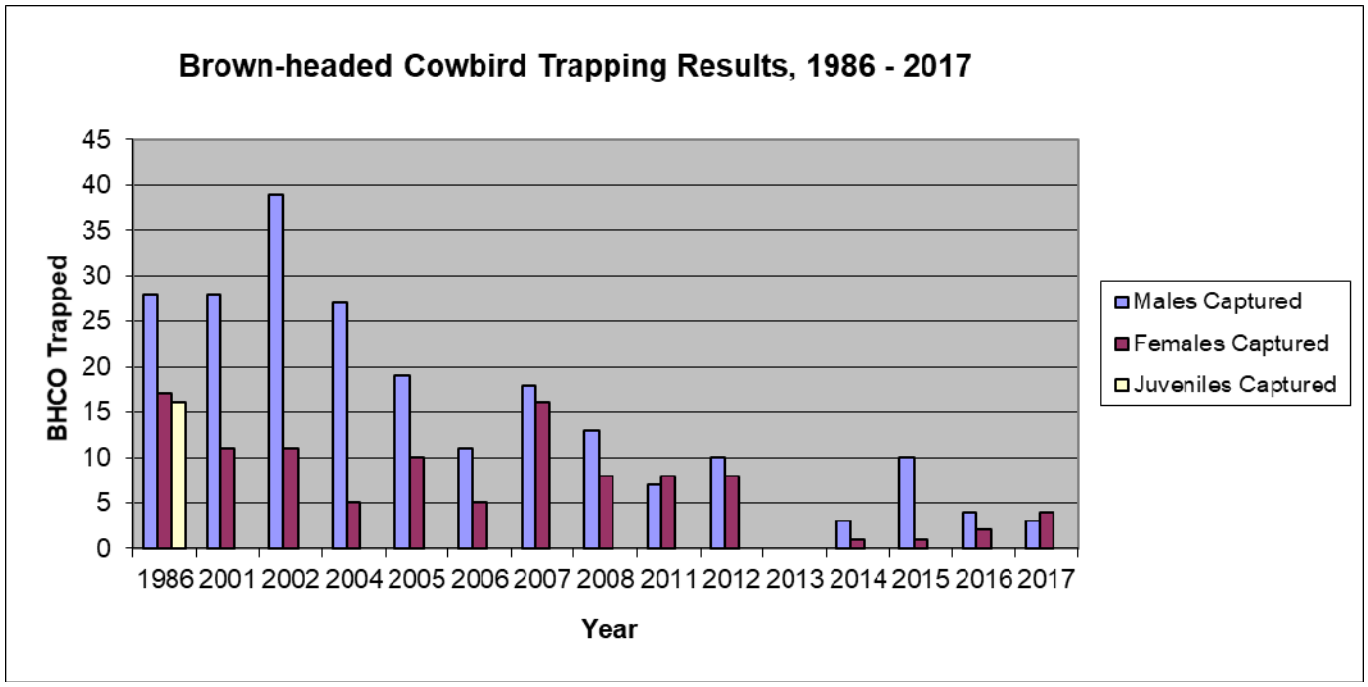


Figure 6. Summary of Baker Sanctuary tree-of-heaven eradication efforts, 2010-2017.

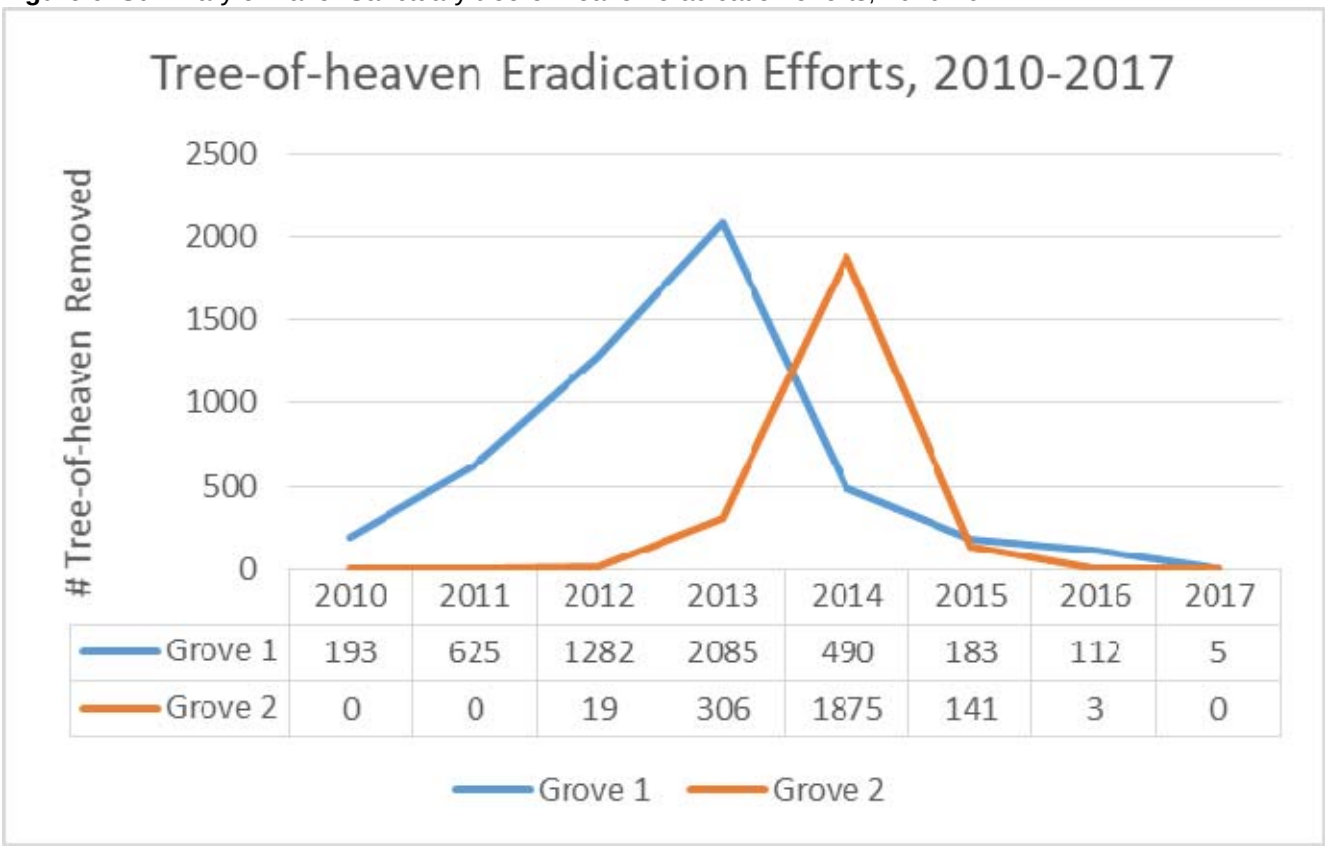


Figure 7. Baker Sanctuary BBS point count stations, 2017.



Table 1. Summary of GCWA banded at Baker Sanctuary, 2015-2017.

Year Banded	USFWS Serial Number	Color Band Combination	Sex	Age
2015	2770-41201	RD/SI:RD/DB	Male	SY
2015	2770-41202	MV/MV:YE/SI	Male	ASY
2016	2770-41203	NB/SI:OR/DB	Male	ASY
2016	2770-41205	BL/DG:BK/SI	Male	ASY
2016	2550-99699	WH/SI:BK/WH	Male	SY
2017	2770-41206	RD/RD:DG/SI	Male	ASY
2017	2770-41207	DG/DB:OR/SI	Male	ASY
2017	2770-41208	BK/WH:BL/SI	Male	ASY
2017	2770-41209	PI/SI:WH/RD	Male	ASY
2017	2770-41210	WH/BL:MV/SI	Male	ASY

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

Year	< 1 min.	1-2 min.	2-3 min.	3-4 min.	4-5 min.	5-6 min.	6-7 min.	7-8 min.	8-9 min.	9-10 min.	Total GCWA Detected
2017	27	5	4	3	6	2	2	0	3	4	57

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

Year	Buck Ratio	Buck Estimate	Doe Estimate	Fawn Estimate	Total Population Estimate	Acres/Deer	Doe:Buck Ratio	Fawn Production (%)
2016	0.05	10.00	8.41	1.85	20.26	35.3	0.84	22

Table 4. Efficacy of imazapyr treatments on non-native plant at Baker Sanctuary, 2017.

Species	Imazapyr Solution	# Treated	# Dead	% Mortality
Tree-of-heaven	30%	1	1	100.0
Chinaberry	30%	40	34	85.0
Chinese Tallow Tree (*Sapium sebiferum*)	30%	1	1	100.0
Ligustrum sp	30%	5	5	100.0
Heavenly Bamboo	30%	25	19	76.0
Paper Mulberry (*Broussonetia papyrifera*)	30%	2	1	50.0
Total		**74**	**61**	**82.4**

Table 5. Baker Sanctuary BBS point count survey, 2017.

Common Name	Scientific Name	Number Observed	Mean[1]	Frequency (%)[2] (25 yd radius)	Frequency (%)[3] (unlimited radius)
American Robin	*Turdus migratorius*	0	0.00	0	3
Ash-throated Flycatcher	*Myiarchus cinerascens*	0	0.00	0	3
Barn Swallow	*Hirundo rustica*	0	0.00	0	5
Bewick's Wren	*Thryomanes bewickii*	4	0.11	11	45
Black-and-white Warbler	*Mniotilta varia*	2	0.05	5	5
Black-chinned Hummingbird	*Archilochus alexandri*	7	0.18	18	18
Black-crested Titmouse	*Baeolophus atricristatus*	6	0.16	13	92
Blue-headed Vireo	*Vireo solitarius*	0	0.00	0	0
Blue Jay	*Cyanocitta cristata*	1	0.03	3	8
Blue-gray Gnatcatcher	*Polioptila caerulea*	29	0.76	61	71
Brown-headed Cowbird	*Molothrus ater*	0	0.00	0	0
Canyon Wren	*Catherpes mexicanus*	0	0.00	0	11
Carolina Chickadee	*Poecile carolinensis*	20	0.53	32	66
Carolina Wren	*Thryoothorus ludovicianus*	5	0.13	13	29
Chimney Swift	*Chaetura pelagica*	0	0.00	0	8
Common Grackle	*Quiscalus quiscula*	0	0.00	0	5
Common Raven	*Corvus corax*	0	0.00	0	5
Cooper's Hawk	*Accipiter cooperi*	0	0.00	0	3
Eastern Phoebe	*Sayornis phoebe*	0	0.00	0	3
Eastern Screech-owl	*Megascops asio*	0	0.00	0	0
Field Sparrow	*Spizella pusilla*	2	0.05	5	37
Golden-cheeked Warbler	*Setophaga chrysoparia*	8	0.21	18	32
Greater Roadrunner	*Geococcyx californianus*	0	0.00	0	5
House Finch	*Haemorhous mexicanus*	1	0.03	3	3
House Sparrow	*Passer domesticus*	0	0.00	0	0
Hutton's Vireo	*Vireo huttoni*	0	0.00	0	3
Ladder-backed Woodpecker	*Picoides scalaris*	0	0.00	0	3
Least Flycatcher	*Empidonax minimus*	1	0.03	3	3

Lesser Goldfinch	*Carduelis psaltria*	6	0.16	13	79
Mourning Dove	*Zenaida macroura*	0	0.00	0	24
Nashville Warbler	*Oreothlypis ruficapilla*	2	0.05	3	3
Northern Bobwhite	*Colinus virginianus*	1	0.03	3	3
Northern Cardinal	*Cardinalis cardinalis*	19	0.50	45	95
Northern Mockingbird	*Mimus polyglottos*	4	0.11	8	32
Painted Bunting	*Passerina ciris*	6	0.16	16	61
Purple Martin	*Progne subis*	0	0.00	0	37
Red-bellied Woodpecker	*Melanerpes carolinus*	0	0.00	0	5
Red-shouldered Hawk	*Buteo lineatus*	0	0.00	0	3
Red-eyed Vireo	*Vireo olivaceus*	2	0.05	5	13
Rufous-crowned Sparrow	*Aimophila ruficeps*	1	0.03	3	5
Summer Tanager	*Piranga rubra*	1	0.03	3	21
Turkey Vulture	*Cathartes aura*	0	0.00	0	3
Western Kingbird	*Tyrannus vociferans*	0	0.00	0	0
Woodhouse's Scrub-jay	*Aphelocoma californica*	6	0.16	11	21
White-eyed Vireo	*Vireo griseus*	3	0.08	8	29
White-winged Dove	*Zenaida asiatica*	0	0.00	0	11
Yellow-billed Cuckoo	*Coccyzus americanus*	3	0.08	8	32

Table 6. Baker Sanctuary water quality test results, 2015-2017.

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