FY 2019 Report on Monitoring and Management of the Black-capped Vireo (*Vireo atricapilla)* on Travis County-managed Balcones Canyonlands Preserve Tracts



Photo: Tom Hausler. Male black-capped vireo at nest, Kotrla Unit, 2019.

Travis County

Department of Transportation and Natural Resources

Natural Resources & Environmental Quality Division

October 1, 2018 – September 30, 2019

TABLE OF CONTENTS

INTRODUCTION.....1

STUDY SITES.....2

HABITAT RESTORATION.....4

METHODS.....6

Data Collection.....6

Banding.....7

Data Analysis.....7

RESULTS.....8

DISCUSSION.....15

LITERATURE CITED.....19

LIST OF FIGURES

Figure 1. Balcones Canyonlands Preserve Location Map, Travis County, TX.....23

Figure 2. BCVI Survey Locations and Observations on the BCP 2019, Travis County, Texas.....24

Figure 3. Manipulated BCVI Habitat and Habitat Management Areas (HMA) Travis, County, Texas (2019).....25

Figure 4. BCVI Observations and Territories on the Jollyville Unit, Travis County, Texas (2019).....26

Figure 5. BCVI Observations and Territories on the Ribelin & Concordia tracts, Travis County, Texas (2019).....27

Figure 6. BCVI Observations and Territories on the Kotrla Unit, Travis County, Texas (2019).....28

Figure 7. BCVI Observations and Territory on Milton Reimers Ranch Park, Travis County, Texas (2019).....29

LIST OF TABLES

Table 1. Summary of Jollyville Unit and Travis County BCVI survey data collected by various agencies, Travis County, Texas. 1989-2019…….. 9

Table 2. Abundance, territory number, and pairing success rate for BCVIs (*Vireo atricapilla*) on Jollyville Unit, Travis County, Texas, March-September 2001-2019 10

Table 3. Breeding success and productivity for BCVI (*Vireo atricapilla*) territories on Jollyville Unit, Travis County, Texas, March-September 2001-2019..... 11

Table 4. Features of BCVI nests located on Travis County BCP lands in 2019…… 12

Table 5. BCVI (*Vireo atricapilla*) nest locations on Travis County BCP, Travis County, Texas, in 2019……..……..…… 14

Table 6. Proportion of second-year males (pSY) and site fidelity on Travis County BCP, Travis County, Texas. 2010-2019…….....15

INTRODUCTION

In the United States and Canada, nearly 450 native bird species breed in terrestrial habitats (Rosenberg *et al.* 2016). Approximately 200 of those terrestrial species, commonly known as neotropical migrants, breed in North America, and then migrate south to winter in Mexico, Central America, South America, and the Caribbean (Sibley 2001). A majority of neotropical migratory bird species face population declines from widespread diminishing habitat quantity and quality due to urban growth, unsustainable agriculture and forestry, climate change and from direct mortality from anthropogenic sources (Rosenberg *et al.* 2016). Partners in Flight, the U.S. Fish and Wildlife Service (USFWS), and many other cooperating agencies are actively developing recovery and conservation plans, acquiring and protecting critical habitat, and educating the general public about bird conservation issues in order to slow or prevent further population declines.

The black-capped vireo (*Vireo atricapilla*; hereafter BCVI or vireo) was listed as a federally endangered species in 1987. Habitat loss and nest parasitism by brown-headed cowbirds (*Molothrus ater*) are among the greatest threats to BCVI populations. Historically, BCVIs in the United States were found in Kansas, Oklahoma, and Texas during the breeding season (Grzybowski 1995). Presently, the BCVI breeding range includes five counties in Oklahoma, 40 counties in central and south-central Texas, and south into central Coahuila, through Nuevo Leon and into southwestern Tamaulipas, Mexico (USFWS 2016). In 2018, the black-capped vireo was delisted and removed from the endangered species list (USFWS 2018). Regardless of the delisting, Balcones Canyonlands Preserve (BCP) partners are committed to providing continued management and protection to BCVI occurring on the BCP, as outlined in the Balcones Canyonlands Conservation Plan (USFWS 1996; hereafter BCCP). Management activities include acquiring and actively managing a minimum of 2,000 acres of vireo habitat on the BCP, monitoring the BCVI population, and controlling cowbirds, if deemed necessary.

BCVI habitat has been described as:

> "low scrubby growth, mostly deciduous and of irregular height and distribution, with small spaces between the thickets and clumps, with vegetation cover to ground level. This is an early to mid-successional progression, or one maintained in edaphic (due to soil or topography) settings such as occurs in

rocky gullies, edges of ravines, and on eroded slopes; thus often quite localized (Grzybowski 1995)."

Additionally BCVI habitat has been characterized as including the following:

- greater density of deciduous vegetation in height zones from 0 - 2 meters.
- average amounts of deciduous cover ranging from 30-45%, with total woody cover including Ashe juniper (*Juniperus Ashei*) ranging from 36-55%.
- greater within-territory heterogeneity of vegetation structure (with shrubs closely spaced but still separated, and allowing light to penetrate to ground levels).
- openness not exceeding about 65% in older adult vireo territories (i.e. at least 35% woody cover) (Grzybowski 1995, Bailey and Thompson 2007).

Available BCVI habitat, and subsequently BCVI populations, in Travis County have been significantly reduced as natural disturbances, such as fire, are suppressed and suburban development continues to expand. Additionally, browse pressure from White-tailed deer (*Odocoileus virginianus*) overpopulation can negatively affect BCVI habitat structure (Grzybowski 1995). In 1996, less than 100 individual BCVIs were estimated to occur in Travis County (USFWS 1996). More recent analyses of survey data indicate that since 2000, the BCVI population estimate in Travis County is fewer than 50 individuals (Wilkins et. al 2006).

This report summarizes BCVI monitoring and habitat management efforts conducted by Travis County Natural Resources staff in FY19. Annual BCVI population data collected on Travis County-managed lands is analyzed in order to monitor changes in distribution, abundance, and productivity. Monitoring the population will help gauge the effectiveness of habitat restoration projects and prioritize sites for future restoration activities.

STUDY SITES

During the 2019 breeding season, BCVI territory surveys were primarily conducted on portions of the Jollyville Unit, the Ribelin tract, the Kotrla Unit and the Concordia tract (Figure 2). Both golden-cheeked warbler (*Setophaga chrysoparia*) and BCVI inhabit these properties. Additionally, surveys to support Travis County Park staff were made at Milton Reimers Ranch Park. Secondary locations where BCVIs historically were present, or contain suitable habitat, were checked periodically for presence/absence of BCVIs on other areas of the Jollyville Unit, Sam Hamilton East, Lucas and Wheless

tracts, and parts of Steiner Ranch Preserve. The following site descriptions are included for any Travis County BCP properties where BCVIs established territories.

Historically, the Jollyville Unit contains the core BCVI colony on the BCP. The Jollyville Unit is comprised of 2122 acres (859 ha) and includes the following tracts: Blackmore, Bunten, Collins, Cuevas, Cuevas East, Grandview Hills, Nootsie, Snowden, Vireo Ridge, and Vista Point (Figure 2). Topography includes upland plateaus that give way to irregular, steep slopes and ravines. Ravines drain into an unnamed tributary of Lake Travis (Colorado River) or into Cypress Creek. Drainages tend to flow from the east to west. The Travis County soil survey shows that riparian soils in these drainages are composed primarily of soils of the Volente complex; Brackett and Tarrant soils are found on steep slopes (USDA 1974). Tarrant soils also occur in level upland areas.

The Jollyville Unit contains closed canopy, oak-juniper woodlands, which cover the majority of the canyons and slopes. Historic harvest of mature Ashe juniper has allowed shrubby, secondary-growth junipers to dominate much the uplands and slopes. Open grasslands are found in some valleys and ridge tops, and riparian vegetation, which contains black walnut (*Juglans nigra*), sycamore (*Platanus occidentalis*), cedar elm (*Ulmus crassifolia*), and oaks in areas along creeks and drainages. Portions of the ridge tops are often dominated with shin oak (*Quercus sinuata*), the signature species dominating most occupied BCVI habitat in Central Texas. Other common woody species include Texas redbuds (*Cercis Canadensis* var*. texensis*), grape (*Vitus* sp.), Texas ash (*Fraxinus texensis*), Texas oak (*Quercus Buckleyi*) agarita (*Mahonia trifoliolata*), twist leaf yucca (*Yucca rupicola*), wafer ash (*Ptelia trifoliata*), Carolina buckthorn (*Frangula caroliniana*), *Ilex* sp. and sumacs.

The 319 acres (129.1 ha) Ribelin tract and the 252 acre (102 ha) Concordia tract are located within the Bull Creek macrosite (Figure 2). These tracts contain tributaries into Bull Creek, and the topography includes upland plateaus that give way to irregular, steep slopes and ravines. Primary soils on this tract are found in the Tarrant series (USDA 1974). Closed canopy oak-juniper woodlands cover the majority of the canyons and slopes. Vegetation composition is similar to that of the Jollyville Unit, described above. Humans have heavily impacted these properties. There are several ranch roads, a substantial power line corridor (Ribelin tract), man-made clearings, old dumps, and livestock fences found throughout. Areas on Ribelin, generally along a power line easement, were restored for BCVIs in 2009 and 2010. No BCVI habitat management has occurred on Concordia.

The Kotrla Unit totals 954 acres (384 ha) and is comprised of the 500-acre Kotrla tract, the 450-acre Scott & White tract, and the 4-acre Enders tract (Figure 2). These tracts are located in the Big Sandy Creek macrosite in far northwest Travis County. This unit contains habitat for both protected songbirds and likely provides substantial connectivity between the core BCP area and the Balcones Canyonlands National Wildlife Refuge. The upland areas are relatively flat and are underlain by the hard gray limestone of the Edwards formation. These areas are classified as Karst Zone 2, and several known caves and sinks are scattered throughout the upland area.

Upland areas contain substantial Ashe juniper and areas of concentrated shin oak growing in shrub form. In particular, the dominant savannah (old pasture land) on the southern ridge contains suitable BCVI habitat. Other areas, particularly on the north side, might be made suitable by on-going restoration efforts. Dominant vegetation throughout this unit is similar to that of the Jollyville Unit.

A substantial canyon runs generally northwest to southeast through the property. The sloped areas are steep and heavily wooded. The tree canopy is generally taller than that on the upland areas, although the species composition is similar. There is a substantial deciduous component to the tree composition on these slopes, particularly Texas oak. A substantial colony of rare Texabama croton (*Croton alabamensis* var*. texensis*) occurs in this canyon.

HABITAT RESTORATION

Beginning in FY2001, and continuing every winter thereafter, Travis County has conducted BCVI habitat restoration within BCVI Habitat Management Areas (HMAs). These HMAs are located within Travis County BCP lands and they have been designated as having the potential to be restored to BCVI habitat. HMA locations are targeted based on known historic vireo occupancy and the presence of soil and vegetative components necessary for vireo habitat. More HMAs will be developed as additional land with restoration potential is acquired.

Poor quality BCVI habitat has been altered through a variety of techniques to create the patchy, early to mid-successional physiognomy associated with BCVI breeding habitat. By selectively removing undesirable monoculture woody species such as Ashe juniper, the growth and shrubby structure of other woody species can be improved. The following woody species benefit from Ashe juniper removal: shin oaks, possomhaw (*Ilex decidua*), yaupon (*Ilex vomitoria*), Texas redbud, wafer-ash,

Carolina buckthorn and sumacs. Several areas that have been restored have become good to excellent quality habitat. It has been observed on the Jollyville HMA that BCVIs begin occupying restored areas three to five years following initial habitat manipulation.

During the winter of 2018-19, 12.5 acres on the Kotrla Unit were restored using chain saws, pruning loppers and a forestry mower (Figure 3). These actions increased the cumulative total of restored habitat on Travis County managed lands to approximately 207.4 acres (83.9 ha). Also, a prescribed burn was conducted on 13 acres of open savanna on the Kotrla Unit, in and adjacent to previously occupied BCVI habitat to maintain existing shrub-lands and to stimulate preferred woody vegetation to grow (Figure 3).

Follow up clearing is required to maintain BCVI habitat at an early to mid-successional stage. In most previously manipulated areas, much of the refined hand clearing is completed in subsequent years rather than at the onset of the initial larger scale brush removal, which is typically completed mechanically. Portions of areas cleared in 2001-2003 are beginning to grow out of ideal BCVI habitat and will require maintenance in the near future. Other locations being considered for targeted habitat restoration in the future include areas on the Vireo Ridge, Lucas, Ribelin, New Life and Cuevas East tracts as well as the Kotrla Unit due to their history of occupancy and proximity to currently occupied habitat. The Kotrla Unit has a particularly high value for restoration due to its large swaths of shin oaks and recent occupation by BCVIs.

Restoration activities will continue where habitat potential has been identified on the HMAs. Target areas for restoration vary from year to year based primarily on the following: habitat utilized by BCVI during the preceding breeding season, presence of occupied GCWA habitat, diversity of desired woody species, and available budget. Efforts are made to document any co-occurrences of GCWA and BCVI during the breeding season in order to investigate and evaluate the possibility of creating areas of mixed or composite habitat. Travis County staff utilizes a flexible multi-year BCVI habitat restoration plan which defines areas targeted for restoration and allows for additional areas to be added or removed based on new land acquisitions, changes in land use and updated management techniques and recommendations. A second phase of prescribed fire is planned for the Kotrla HMA in winter 2020.

METHODS

Data Collection

Detailed protocol for BCVI territory mapping, nest monitoring, and presence/absence surveys are described in an unpublished report by Travis County (2009). In FY 2018, territory mapping was used to estimate BCVI abundance and number of individual territories present. All observations (both visual and auditory) of male, female and juvenile BCVIs were plotted on hard-copy, digital ortho-photo maps with a scale of 1:3,000 or less. The following data were recorded in the field for each observation: location, date, behavior, sex, age, presence of a mate, number of fledglings and color band combination, if banded. BCVI locations and corresponding data were later recorded into an ArcGIS 10.7 (ESRI, Inc., Redlands, CA) geodatabase with the Texas State Plane (with NAD 1983 projection) coordinate system. All males encountered were assigned a unique territory ID ("territory number") to signify them as individuals. Female locations were either recorded as independent locations or with the corresponding territory number of a territorial male where applicable. If color-banded, the band combination was used as the territory number.

Territory mapping methods generally followed International Bird Census Committee (IBCC) guidelines (1970). Bibby's (2000) "consecutive flush" method was employed to increase accuracy in assigning observations of BCVIs to specific territories ("clusters"). However, Bibby's method was modified to be less intrusive in order to avoid harassment and/or human induced behaviors (Holiman and Craft 2000). No more than 10 locations for an individual bird were mapped at one time. The presence of returning color-banded BCVI allowed identification of particular individuals in many cases. When band status was unknown or when dealing with unmarked BCVI, conspecific singing or counter-singing was used to differentiate between males. BCVIs that could not be positively identified were designated as "unknown."

Nests were located opportunistically during normal territory mapping surveys. Disturbance was minimized by refraining from intensive nest searches. When found, nests were checked every five to seven days from the date of discovery until an outcome could be determined. Nest stage, contents, location and behavior of the attending adult were recorded during each nest check. In territories where no nest was found, but fledglings were present, staff recorded the maximum number of fledglings observed being attended. Fledglings observed being tended by a male or

female confirmed breeding success within a territory; the total number of fledglings observed at any one time was used as a conservative measure of productivity.

In addition to territory mapping and select presence/absence surveys for BCVIs on the Jollyville Unit, the Ribelin tract and the Kotrla Unit, additional presence/absence surveys were conducted at the following additional sites (Figure 2): 1) two ridgetops of the Vireo Ridge tract, referred to as “35-acres” and “Denali”; 2) the power line easement on the Sam Hamilton East tract; 3) the Lake Travis Bluffs section of the Lucas; 4) a previously cleared upland on the Wheless tract; and 5) northern sections of the Steiner Ranch Preserve. Two areas of Milton Reimers Ranch Park were surveyed, primarily by Park staff (Figure 8).

BCVIs were surveyed for a total of 466 hours from March 28 (first detection) to August 23, 2019 (last detection). Data can be interpreted as a comprehensive census due to the relatively large amount of time spent monitoring these birds.

Banding

In an effort to build a long term demographic data set, the banding program initiated in 2008 as part of a graduate study of avian dispersal, has continued. The original project investigated interpatch dispersal patterns within a fragmented preserve network (Simper 2009). Throughout the survey season, Travis County staff updates and shares data, including banded bird resightings and nest locations in an effort to coordinate banding attempts. In 2019, four adult males were banded. Since 2008, 60 adult BCVIs have been banded on Travis County-managed BCP properties. Travis County intends to continue the BCVI banding program alongside the City of Austin’s banding program to better understand the Travis County-area population.

Data Analysis

BCVI abundance is defined as the sum of all individual male BCVIs detected at a given study site, regardless of territory status. Overall species distribution is comprised of all locations where BCVIs were detected (i.e. registrations) and includes males, females, fledglings, and multiple sightings of the same individual. An individual male was considered to have established a breeding territory if the following behaviors were observed: 1) accompanying a female, 2) tending a nest or fledglings, or 3) singing in the same locality on three separate occasions each separated by one week (i.e. six days between observations). In calculating territory numbers, all BCVI territories, whether they were observed entirely or partially on Travis County property, were considered ‘full’ territories (as opposed to ‘edge’ or partial territories). Due to

limitations of time and survey effort, the set of registrations shown on attached maps do not represent a definitive description of territory boundaries.

Pairing success rate was calculated as the proportion of territories within which a female was observed or a nest was located (Anders 2000). Productivity data is represented in the following two ways: 1) the total number of fledglings divided by the total number of territories and 2) the total number of fledglings divided by the number of successful territories. A territory was considered successful if at least one fledgling was observed with a territorial male or female. The breeding success rate is the proportion of full territories that successfully fledged young (Koloszar and Becker 2000).

RESULTS

In 2019, BCVIs, regardless of territory establishment, were located on the Jollyville Unit (Figure 4), the Ribelin and the Concordia tracts (Figure 5), the Kotrla Unit (Figure 6) and Milton Reimers Ranch Park (Figure 7). Additionally, there were unique, non-territorial, males detected at Hamilton Pool Preserve, the Ribelin, Kotrla and Vireo Ridge tracts and adjacent to the Toops tract. Some of these detections were “one-day” occurrences. The Toops tract male is not represented in detail on a map in this report. Abundance totaled 22 males throughout Travis County’s managed properties.

On Travis County managed properties, 11 of 13 males established territories in areas where habitat manipulation had previously occurred. Seven additional males were transient or migrating individuals, and were only accounted for in abundance. Eight males, six of which established territories, were detected in areas slotted for presence/absence surveys. Once detected, territory surveys were conducted for the remainder of the field season. One male established a territory in an area not slotted for any BCVI survey effort (Concordia tract) but first detected while GCWA surveys were being performed.

Table 1 presents a summary of BCVI data collected during the 2019 breeding season in addition to data collected by various agencies exclusively on the Jollyville Unit since 1989. Since the primary BCVI colony exists on the Jollyville Unit (Jollyville), these data are reflected for historic context. This table also indicates total abundance and territories on all Travis County properties (including BCVI detected from Travis County properties on adjacent properties).

Table 1. Summary of Jollyville Unit and Travis County BCVI survey data collected by various agencies, Travis County, Texas. 1989-2019.

Year Surveyed	Agency**	Jollyville Unit Abundance	Jollyville Unit No. Territories	Abundance/ No. Territories (all Travis County lands)
1989	DLS	11	5	n/a
1990	DLS	11	5	n/a
1991	DLS	14	9	n/a
1992	TXDOT	Unknown[1]	Unknown	n/a
1993	TXDOT	25	20	n/a
1994	TXDOT	27	27	n/a
1995	TXDOT	23	23	n/a
1996	SWCA	19-22	15	n/a
1997	No Data	Unknown[1]	Unknown	n/a
1998	No Data	Unknown	Unknown	n/a
1999	No Data	Unknown	Unknown	n/a
2000	SWCA	3[2]	Unknown	n/a
2001	Travis County TNR	19	13	19/13
2002	Travis County TNR	21	19	21/19
2003	Travis County TNR	21	20	22/20
2004	Travis County TNR	13	12	13/12
2005	Travis County TNR	12	11	12/11
2006	Travis County TNR	12	9	13/9
2007	Travis County TNR	14	13	18/15
2008	Travis County TNR	15	15	15/15
2009	Travis County TNR	13[3]	11	15/11
2010	Travis County TNR	13	11	13/11
2011	Travis County TNR	9	8	10/9
2012	Travis County TNR	9	8[4]	9/8
2013	Travis County TNR	13	9	15/11
2014	Travis County TNR	14	12	14/12
2015	Travis County TNR	15	13	21/16
2016	Travis County TNR	14	12[4]	19/14
2017	Travis County TNR	6	6	12/9
2018	Travis County TNR	9	9[4]	17/12
2019	Travis County TNR	7	5	22/13

*Study area is only referred to as "Jollyville Unit" since 2001. ** See Literature Cited for appropriate report citation.
[1] Restricted access on the tract. [2] Detected while on brief site visit.
[3] Does not include individual detected on Lake Perspectives tract (now part of the Lake Travis Unit).
[4] One banded male established two separate, isolated territories.

In 2019 on all Travis County managed lands, nine territories were considered successfully paired. Seven territories fledged offspring, yielding at least 29 "hatch year" (HY) individuals. On Jollyville alone, four of five territories were considered successfully paired (Table 2). Of these, four territories fledged offspring, yielding at

least 15 'hatch year' (HY) individuals observed in the field (Table 3). For the fifth time (every year since 2015), at least one territory (n=1) definitively had more than one successful nest (on the Ribelin tract).

Table 2. Abundance, territory number, and pairing success for BCVIs (*Vireo atricapilla*) on Jollyville Unit, Travis County, Texas, March-September 2001-2019.

Year	Total Hours Surveyed•	Abundance	No. Territories	Successfully Paired	Pair Success Rate (%)
2001	100	18[a]	15 [a]	13 [a]	86.7 [a]
2002	179	21	19	18	94.7
2003	290 [b]	21	19 [a]	14	73.7 [a]
2004	127.5	13	12	9	75
2005	140	12	11	8	72.7
2006	146	11 [a]	9	8	88. 9
2007	178	14	13	12	92.3
2008	199	15	15	14	93.3
2009	204	13[c]	11	11	100
2010	181	13	11	11	100
2011[d]	131	9	8	8	100
2012	141	9	8	8	100
2013	154	13	9	9	100
2014	190	14	12	11	91.7
2015	179	15	13	11	84.6
2016	142	14	12	11	91.7
2017	146	6	6	6	100
2018	194	11	9	9	100
2019	466	7	5	4	80.0

[a] Adjusted values to reflect BCVI found only on the JV Unit. • Total hours for entire season on all properties, not only JV Unit
[b] Total hours surveyed for 2003 could not be verified and likely overestimated.
[c] The male located at Lake Perspectives (Lake Travis Unit) was not included in this dataset.
[d] The territory located at Lucas-Lake Travis Bluffs (Lake Travis Unit) was not included in this dataset.

Current protocol counts either the number of fledglings directly observed in the field or the number of nestlings discovered in a nest that is later demonstrated to be successful. Because of their dull-colored plumage, cryptic behavior, and unpredictable flights, we expect observer counts of fledglings to be biased low. On Jollyville, productivity in 2019 (Table 3), whether measured relative to successful territories (3.8 HY/ territory) or all territories (2.8 HY/ territory), is likely accurate due to intensive survey effort.

Table 3. Breeding success and productivity for BCVI (*Vireo atricapilla*) territories on Jollyville Unit, Travis County, Texas, March-September 2001-2019.

Year	No. of territories with breeding success[1]	Breeding success rate (%)	No. Fledglings	No. fledglings/ successful territory[2]	No. fledglings/ total no. territories[3]
2001	4	26.7*	12	3.0*	0.8*
2002	13*	68.4*	25*	1.4*	1.3*
2003	9	47.4*	16	1.8	0.8
2004	6	50.0	13	2.2	1.1
2005	1	9.1	1	1.0	0.1
2006	8	88.9	15	1.9	1.7
2007	8	61.5	24	3.0	1.8
2008	10	66.7	29	2.9	1.9
2009	7	63.6	12	1.7	1.1
2010	8	72.7	10	1.3	0.9
2011	4	50.0	11	2.8	1.4
2012	7	87.5	21	3.0	2.6
2013	6	66.7	19	3.2	2.1
2014	8	66.7	23	2.9	2.1
2015	7	53.8	30	2.7	2.3
2016	8	66.7	29	2.6	2.4
2017	4	66.7	15	3.8	2.5
2018	4	44.4	15	3.8	1.7
2019	4	80.0	15	3.8	3.0

[1] Represents the number of all territories that fledged at least one young.
[2] Represents the average no. of fledgling from territories with breeding success.
[3] Represents the average no. of fledgling from all successfully paired territories.
* Adjusted values to reflect BCVI found only on the JV Unit.

A total of 17 BCVI nests were located in 2019 (Table 4). Two of these were found depredated and one was found abandoned with dead nestlings. Of the remaining 14 nests monitored, nine (64.3%) successfully fledged at least one young. Five nests were depredated (35.7%) by unknown predators. Two territories had at least three nest attempts. A third territory likely did as well, however one nest was never located. Of these “three-nesters”, all three had one successful nest. Of note amongst the other territories, one territory had two successful nests and two others were successful once out of two attempts. Timing and behavior indicated that several territories likely had failed early- and late-season nests that were never located. Detailed data regarding nest substrate, height, and orientation were collected post breeding season for each nest found (Table 4).

Table 4. Features of BCVI (*Vireo atricapilla*) nests located on Travis County BCP in 2019.

Substrate	Primary substrate height (m)	Additional Concealment	Nest height (cm)	Distance from stem (cm)	Distance from foliar edge (cm)	Orientation	Comments
Shin oak (*Quercus havardii*)	2.5	Texas mulberry (*Morus microphylla*)	72	75	22	SE 130°	Successful; first attempt (3 HY, 1 unfertilized egg)
Flameleaf sumac (*Rhus copallina*)	2.25	n/a	101	13	13	S 169°	Depredated; second attempt (2 eggs)
Shin oak	4	Flameleaf sumac Texas ash (*Fraxinus texensis*)	84	28	13	N 8°	Successful; first attempt; (2 HY)
Shin oak	3.5	Flameleaf sumac	95	38	16	SSW 200°	Successful; second attempt (2 HY, 2 eggs)
Evergreen sumac (*Rhus virens*)	2.0	Kidneywood (*Eyesenhaedtia texana*)	87	19	15	E 90°	Successful; first attempt (4 HY)
Shin oak	2.5	n/a	125	61	14	SE 130°	Failed; second attempt likely depredated
Evergreen sumac	4.0	Ashe juniper (*Juniperus ashei*)	149	42	26	E 90°	Failed; third attempt; (abandoned, 2 dead nestlings)
Shin oak	3.5	Ashe juniper Texas persimmon (Diosporos texana)	90	54	21	SW 240°	Successful; first attempt (4 HY)
Yaupon (*Ilex vomitoria*)	5.0	Hackberry (*Celtis laevigata*)	70	140	32	SW 100°	Successful; first attempt (4 HY)
Carolina buckthorn (*Frangula caroliniana*)	8.0	Ashe juniper	114	88	27	NW 300°	Depredated; second attempt (2 eggs)
Cedar elm (Ulmus crassifolia)	4.0	Greenbriar (Smilax bona-nox)	75	5	20	SE 124°	Failed; first attempt likely depredated

Substrate	Primary substrate height (m)	Additional Concealment	Nest height (cm)	Distance from stem (cm)	Distance from foliar edge (cm)	Orientation	Comments
Ashe juniper	3.0	Texas persimmon	69	27	27	N 0°	Depredated; first attempt (4 eggs)
Shin oak	3.5	Wafer ash (*Ptelea trifoliate*)	103	75	25	NW 294°	Failed/damaged second attempt; (4 eggs knocked out of nest)
Shin oak	7.0	Ashe juniper	191	80	32	NE 61°	Successful; third attempt; (3 HY)
Shin oak	4.5	Ashe juniper	200	40	21	N 21°	Depredated; first attempt (4 eggs)
Live oak	5.0	Ashe juniper	233	38	11	NW 54°	Successful; second attempt (4 HY)

Definitions: Substrate: plant species in which the nest is located. Concealment: plant species or other substrates that is primarily responsible for concealing the nest. Orientation: compass direction of nest relative to its substrate.

A total of nine individual adult BCVIs (all males) wearing color bands were observed on Travis County properties in 2019. Of these, four adult males were banded during the 2019 field season. The five additional male BCVIs were banded in previous years (one in 2016 [now a 5Y]; four in 2018 [all now A3Y]).

Adult males showed a 55.6% return rate (five of nine banded males observed in 2018). All returning males returned generally to their same 2018 territorial areas. One male, referred to as Robin Hood, continued to be an adventurous individual. He originally was banded in 2018 on City of Austin property quite far from his active territory on the County's Ribelin tract. In 2019 he returned to the same general area, established a territory and had a nest depredated. Soon after, he was observed on a completely new City property approximately two miles away. No females were banded in 2019 and no banded females from previous years were observed.

Prior to 2008 there was no banding program in place, precluding staff from determining return rates, recruitment and associated data. From 2003 to 2009 BCVI territory and abundance numbers slowly declined despite a period of growth in 2007 and 2008. In 2018, seven males were banded and of these, three were 'second year'

males, i.e. males in their first reproductive season. All banded males established territories. Table 6 summarizes relevant demographic information since 2010.

- Proportion of SY males (pSY): The proportion of second year males has been used as an indicator of recruitment. A minimum pSY value (29%) has been suggested as a measure of a stable population (USFWS 1996). In 2019, the overall pSY, based on marked birds, was 33.3% (three of nine).
- Site fidelity: In 2019, five of nine banded males observed in 2018 returned indicating a 55.6% return rate on Travis County properties.

Table 5. BCVI (*Vireo atricapilla*) nest locations, Travis County, Texas, 2019.

Object-ID	Color Band Combination	Nesting attempt	UTM E	UTM N	LAT	LONG
Prince1	NB/MV:MV/SI	1	609740	3368121	30.440216	-97.857140
Prince2	NB/MV:MV/SI	2	609671	3368061	30.439688	-97.857864
CVE1	BL/SI:GR/WH	1	609589	3368098	30.440030	-97.858711
CVE2	BL/SI:GR/WH	2	609596	3368153	30.440518	-97.858629
CVE3	BL/SI:GR/WH	3	609589	3367990	30.439052	-97.858717
Sherbert1	PI/WH:OR/SI	1	609746	3368238	30.441274	-97.857064
Sherbert2	PI/WH:OR/SI	2	609808	3368326	30.442062	-97.856407
Sherbert3	PI/WH:OR/SI	3	609747	3368295	30.441785	-97.857039
RGP1	RD/SI:GR/PI	1	609680	3368364	30.442422	-97.857730
Pikachu1	YE/YE:RD/SI	1	602167	3381028	30.557343	-97.934718
Pikachu2	YE/YE:RD/SI	2	602102	3381116	30.558142	-97.935392
Seahawk1	DG/BL:WH/SI	1	602260	3381040	30.557440	-97.933747
Seahawk2	DG/BL:WH/SI	2	602251	3380967	30.556784	-97.933853
Beta1	MV/SI:BL/RD	1	613000	3363827	30.401182	-97.823660
Rib01-1	UB	1	613232	3363843	30.401304	-97.821234
Rib01-2	UB	2	613357	3363806	30.400959	-97.819947
RobinHood1	DG/SI:DG/BK	1	612692	3363760	30.400599	-97.826868

Table 6. Proportion of second-year males (pSY) and site fidelity on Travis County BCP, Travis County, Texas. 2010-2016.

Year	pSY	Site Fidelity (males)	Site Fidelity (females)
2010	27.3	70.0	n/a
2011	20.0*	25.0	n/a
2012	28.6*	66.7	50.0
2013	57.1	16.7	100.0
2014	62.5*	42.9	50.0
2015	43.8**	71.4	50.0
2016	71.4	16.7	66.7
2017	20.0*	42.9	n/a
2018	33.3	40.0	n/a
2019	33.3	55.6	n/a

* conservative number, at least three (2011), one (2012), two (2014) and one (2017) males were unsuccessfully aged.
** unofficial number based primarily on observations of territorial (n=7 of 16) males and not solely marked BCVIs.

DISCUSSION

Overall BCVI numbers (abundance) rose for the second year throughout County-managed lands however, the Jollyville Unit population fell to its lowest numbers on record. On the Jollyville Unit, there had been a leveling out of numbers from 2013-2016 after a decline in 2011-2012. The numbers of territories dropped by over half in 2017 (from 2016) then rebounded slightly in 2018. There was a hope that the numbers on Jollyville would continue to rise, but this was not the case in 2019.

Despite the drop in territories on the Jollyville Unit, four of five territories successfully paired. Fortunately, the four successfully-paired territories produced young marking one of the highest breeding success rates on Jollyville. 15 HYs were produced matching the previous two seasons.

The Ribelin tract area continues to steadily establish territories on both Travis County and City of Austin lands indicating the continued utilization of power line corridors by BCVIs. For the third season since Travis County has managed the Kotrla Unit, a successful BCVI territory was established and produced young. Here, two territories were established with two other unknown non-territorial males arriving later in the season. This unit offers a significant amount of possible BCVI habitat, both existing

and potential. Outside of the once-populous Jollyville Unit, eight territories were monitored: two on the Kotrla Unit, four on the Ribelin tract, one on the Concordia tract and one on Milton Reimers Ranch Park. These territories produced a minimum of an additional 14 HYs.

What drives changes in BCVI numbers is unclear, but normal population fluctuations, climate, changes in migration patterns through the area, and changes in quality of habitat are likely factors. A variety of active measures should benefit this species on Travis County-managed properties. The potential of increasing suitable habitat on the Kotrla Unit through both mechanical methods and prescribed fire will likely increase BCVI numbers on this unit. The proximity of this unit to the BCVI populations on the USFWS Balcones Canyonlands National Wildlife Refuge is an added benefit, if recruitment from dispersal occurs. 2019 marks the fifth subsequent year that BCVIs have been detected on this unit. Additionally, the continued prescribed burn program in Travis County Parks may also create additional pockets of suitable habitat in the future and will need to be monitored. Milton Reimers Ranch Park is a good example where burns have occurred and habitat has been created. Pace Bend Park is another property that has the potential of habitat creation through prescribed burning.

Several factors may influence territory distribution, including the intrinsic habitat characteristics of the site, the age structure of the population, overall population density, and habitat restoration activities in protected areas (Grzybowski et al. 1994; Anderson and Gutzwiller 1996). Territory establishment in 2019 occurred in the same general core areas on the Jollyville Unit as in previous years (Travis County 2001-2018). Although the same areas are being utilized, often by returning males, the distribution of BCVI territories on the Jollyville Unit has changed each year. Similarly, habitat utilization has become constant on Kotrla and Ribelin.

Habitat loss and degradation is a primary concern for BCVI recruitment onto Travis County BCP properties. Typical BCVI nesting habitat was uncommon on the Jollyville Unit when first acquired by Travis County in 2000 and 2001. Habitat change through vegetational succession, dominated primarily by encroaching Ashe juniper, reduced canopy openings. Additionally, the successional change in vegetation structure tends towards closed canopy woodlands, rather than the low, shrubby, mid-successional stage preferred by BCVIs. Through mechanical efforts of BCVI habitat restoration, significant portions of the Jollyville Unit HMA still show characteristics of prime BCVI habitat. However, portions are beginning to grow out of optimal habitat and may have

contributed to the decline in BCVI numbers. Several areas that were common to have BCVI territories have become less utilized and likely will need increased habitat manipulation.

All of the 2019 BCVI territories both on the Jollyville Unit, as well as those on the Ribelin tract and Kotrla Unit, were established primarily in previously manipulated areas which may be considered “restored”. This has been the observed trend since 2006. In the case of the Kotrla Unit, previous owners manipulated the uplands to improve grazing, which eventually modified the habitat into the shrub land that the County now manages for BCVI. These observations indicate that BCVIs continue to respond positively to habitat restoration efforts undertaken in the past. It should be noted, however, that not all areas of apparently restored habitat have been reoccupied. Still other areas that have been occupied appear to have enough suitable habitat for additional territories. Numerous factors influence territory establishment, but regional natural population fluctuations, declining connectivity, as well as the location of the Preserve on the far eastern edge of BCVI range are all likely to contribute to overall population trends.

In general, BCVIs tend to be “semi-colonial” and establish territories near other BCVIs (Ward and Schlossberg 2001). However, isolated territories composed of either individual pairs or small-clusters have occasionally been located (Grzybowski 1990). These territories are often difficult to detect as noted by Ward and Schlossberg (2001). They found that in low-density populations of BCVIs, song rates and duration of song bouts were much lower than in high-density populations. Thus, low detection rates of these isolated territories may affect estimates of abundance.

Travis County is committed to continued research and monitoring of BCVI, particularly on the Jollyville Unit, to determine whether this, or any other colony, is a source population or a population sink. Source populations contribute to the general overall population and help to maintain satellite colonies. Population sinks are maintained solely through immigration and contribute nothing to species-wide abundance (Pulliam 1988). Data obtained from continued banding efforts would improve estimates of inter-population connectivity as well as age-specific survival and reproduction. If adequate connectivity with neighboring sub-populations is not maintained, then BCVI numbers on isolated preserve tracts may decline precipitously, leading to local extinctions and deficient levels of colonization. Information regarding productivity and dispersal is limited because it is difficult and slow to obtain. Additional

survey seasons and continued research will help gauge the effectiveness of habitat restoration projects and prioritize sites for future restoration. Without comprehensive productivity, survivorship, and dispersal information, as well as complimentary data from surrounding properties, we cannot make a definitive statement regarding the role of the Jollyville Unit within the central Texas portion of the BCVI's range.

Travis County will continue to conduct intensive BCVI monitoring, including annual color-banding. Such research could help address many questions concerning the long-term viability of the Jollyville Unit colony and its relationship to other sub-populations in the region. The long-term data sets generated from such studies would facilitate yearly comparisons and improve the accuracy of model-generated population forecasts. Data collected will continue to include the following: abundance, age structure, dispersal patterns, distribution of subpopulations, habitat associations throughout the breeding season, nest success, recruitment, return rates and age-specific measures of productivity and survivorship. Future research should be focused upon answering questions of immediate relevance to management and recovery priorities.

Notes concerning the presence of non-native ant species:

- Although it did not appear that any BCVI nest attempts failed due to red imported fire ant (*Solenopsis invicta*, RIFA) predation in 2019, control of this nuisance species should continue within restored BCVI habitat areas when warranted. RIFA have been documented as a common cause of nest failure in BCVI (Smith, et al. 2002). There were no instances of RIFA mounds within 25 meters of nests in 2019, thus no treatments occurred. Twenty-five meters is based on the foraging distance of RIFA (USFWS 2014).
- The discovery of a new, imported ant species, the Tawny Crazy Ant (*Nylandaria fulva*) in the far northern region of the Jollyville Unit is a great concern. This species is known to displace other vertebrate and invertebrate species and is particularly detrimental to nesting avian species. As this is an entirely new threat to the Preserve, any and all information gathered through study will assist in its management.

LITERATURE CITED

Anders, A. D. 2000. Demography of golden-cheeked warblers on Fort Hood, Texas in 2000: productivity, age structure, territory density, and adult return rates. In Endangered species monitoring and management at Fort Hood, Texas: 2000 annual report. Fort Hood Project, The Nature Conservancy of Texas, Fort Hood, Texas, USA.

Anderson, S. H., and K. J. Gutzwiller. 1996. Habitat evaluation methods. Pages 592-606 *in* T. A. Bookhaut, ed. Research and management techniques for wildlife and habitats. Fifth ed., rev. The Wildlife Society, Bethesda, Maryland, USA.

Balcones Canyonlands Preserve Land Management Plan 2007. BCVI management. Chapter 8 *in* Tier II A, Balcones Canyonlands Management Handbook. Unpublished document. Travis County, Texas, USA.

Bailey, W. J., and F. R. Thompson. 2007. Multiscale Nest-Site Selection by BCVIs. Journal of Wildlife Management 71:828-836.

Bibby, C. J., N. D. Burges, D. A. Hill and S. H. Mustoe. 2000. Bird census techniques. Second edition. Academic Press.

DLS Associates. 1989b. BCVI monitoring program, Travis County, Texas and vicinity, 1989. Submitted to: The Nature Conservancy of Texas, Inc. and Executive Committee of the Austin Regional Habitat Conservation Plan.

_____. 1990a. BCVI monitoring program, Travis County, Texas and vicinity, 1990. Submitted to: The Nature Conservancy of Texas, Inc. and Executive Committee of the Balcones Canyonlands Habitat Conservation Plan.

_____. 1992. BCVI monitoring program, Travis County, Texas and vicinity, 1991. Submitted to: The Nature Conservancy of Texas, Inc. and Executive Committee of the Balcones Canyonlands Habitat Conservation Plan.

Grzybowski, J.A. 1990. Population and nesting ecology of the Black-capped vireo--1990. Austin (TX): Texas Parks and Wildlife Department. Report nr E-1-3. Job 29. 39 p.

_____ . 1995. BCVI (*Vireo atricapillus*). In The Birds of North America, No. 181 (A. Poole and F. Gill, editors). The Academy of Natural Sciences, Philadelphia, Pennsylvania, USA and The American Ornithologists' Union, Washington, D.C., USA.

_____, D. J. Tazik, and G. D. Schnell. 1994. Regional analysis of BCVI breeding habitats. Condor 96: 512-544.

Holiman, W. C., and R. A. Craft. 2000. Breeding density and productivity of the golden-cheeked warbler on Fort Hood, Texas in 1999. Pages 79-103 *in* Endangered Species monitoring and management at Fort Hood, Texas: 1999 annual report. Fort Hood Project, The Nature Conservancy of Texas, Fort Hood, Texas.

International Bird Census Committee. 1970. An international standard for a mapping method in bird census work, recommended by the International Bird Census Committee. Audubon Field Notes 24 (6):722-726.

Koloszar, J. A. and H. M. Becker. 2000. Monitoring of the BCVI during 2000 on Fort Hood, Texas. Endangered species monitoring and management at Fort Hood, Texas: 2000 annual report. Fort Hood Project, The Nature Conservancy of Texas, Fort Hood, Texas, USA.

Pulliam, H.R. 1988. Sources, sinks, and population regulation. American Naturalist 132: 652-661.

K. V. Rosenberg, J. A. Kennedy, R. Dettmers, R. P. Ford, D. Reynolds, J.D. Alexander, C. J. Beardmore, P. J. Blancher, R. E. Bogart, G. S. Butcher, A. F. Camfield, A. Couturier, D. W. Demarest, W. E. Easton, J.J. Giocomo, R.H. Keller, A. E. Mini, A. O. Panjabi, D. N. Pashley, T. D. Rich, J. M. Ruth, H. Stabins, J. Stanton, T. Will. 2016. Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. Partners in Flight Science Committee. 119 pp.

Sibley, D. A. 2001. The Sibley Guide to Bird Life and Behavior. Alfred A. Knopf, Inc.New York. 587 p.

Simper, W.S. 2009. Black-capped vireo (*Vireo atricapilla*) color banding and surveying on the Balcones Canyonlands Preserve and the Balcones Canyonlands National Wildlife Refuge: Project Year 2. Austin (TX): USFWS. Report nr TE168189-0-2009. 32 p.

Smith, J.E., S.J. Taylor and C.J. Whelan. 2002. Red Imported Fire Ant (*Solenopsis invicta*) depredation of Black-capped Vireo (*Vireo atricapillus*) nests at Ft. Hood, Texas. Illinois Natural History Survey Technical Report 2002(24).

SWCA 1996. Master BCVI survey map, Grandview Hills Parcel 13. Unpublished document. Travis County, Texas, USA.

Texas Department of Transportation. 1992. BCVI monitoring program, northwest Travis County, Texas. Unpublished report.

_____. 1993. BCVI monitoring program, northwest Travis County, Texas. Unpublished report.

_____. 1994. BCVI monitoring program, northwest Travis County, Texas. Unpublished report.

_____. 1995. BCVI monitoring program, northwest Travis County, Texas. Unpublished report.

_____. 2001. Monitoring of the Golden-cheeked warbler 2001 field season. Unpublished report.

_____. 2001. Status of the BCVI on the Vireo Ridge Tract, Travis County, Texas, 2001 field season. Unpublished report.

_____. 2002. Monitoring of the BCVI, 2002 field season, Travis County, Texas. Unpublished report.

_____. 2003. Monitoring of the BCVI, 2003 field season, Travis County, Texas. Unpublished report.

_____. 2004. Monitoring of the BCVI, 2004 field season, Travis County, Texas. Unpublished report.

_____. 2005. Monitoring of the BCVI, 2005 field season, Travis County, Texas. Unpublished report.

Travis County Natural Resources and Environmental Quality Division. 2006. Monitoring of the BCVI, 2006 field season, Travis County, Texas. Unpublished report.

_____. 2007. Monitoring of the BCVI, 2007 field season, Travis County, Texas. Unpublished report.

Travis County Natural Resources and Environmental Quality Division. 2008. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2008 field season, Travis County, Texas. Unpublished report.

_____. 2009. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2009 field season, Travis County, Texas. Unpublished report.

_____. 2010. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2010 field season, Travis County, Texas. Unpublished report.

_____. 2011. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2011 field season, Travis County, Texas. Unpublished report.

_____. 2012. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2012 field season, Travis County, Texas. Unpublished report.

_____. 2013. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2013 field season, Travis County, Texas. Unpublished report.

_____. 2014. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2014 field season, Travis County, Texas. Unpublished report.

_____. 2015. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2015 field season, Travis County, Texas. Unpublished report.

_____. 2016. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2016 field season, Travis County, Texas. Unpublished report.

_____. 2017. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2016 field season, Travis County, Texas. Unpublished report.

_____. 2018. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2016 field season, Travis County, Texas. Unpublished report.

U.S. Department of Agriculture. 1974. Soil survey of Travis County, Texas. United States Department of Agriculture, Soil Conservation Service, Washington, D.C. 123pp.

U.S. Fish and Wildlife Service. 1991. Black-capped vireo recovery plan. U.S. Fish and Wildlife Service, Region 2, Albuquerque, NM.

_____. 1996. Habitat Conservation Plan and Final Environmental Impact Statement. U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA.

_____. 2014. Karst Preserve Managing and Monitoring Recommendations. Austin Ecological Services Field Office, Austin, TX. Pg. 14.

_____. 2016. Species status assessment report for the black-capped vireo (*Vireo atricapilla*),version 2.0, revised March 2018. Arlington, TX Ecological Field Office. 138 pp.

_____. 2018. Endangered and threatened wildlife and plants; removing the black-capped vireo from the Federal list of endangered and threatened wildlife. Federal Register Vol. 83, No. 73. April 16, 2018. 16228-16242 pp.

Ward, M. and S. Schlossberg. 2001. Conspecific attraction in BCVIs. 2001 Annual Report. Natural Resources Branch. Endangered Species Management Program, Ft. Hood, Texas

Wilkins, N., R. A. Powell, A. A. T. Conkey and A. G. Snelgrove. 2006. Population Status and Threat Analysis for the BCVI. Department of Wildlife and Fisheries Sciences, Texas A&M University.

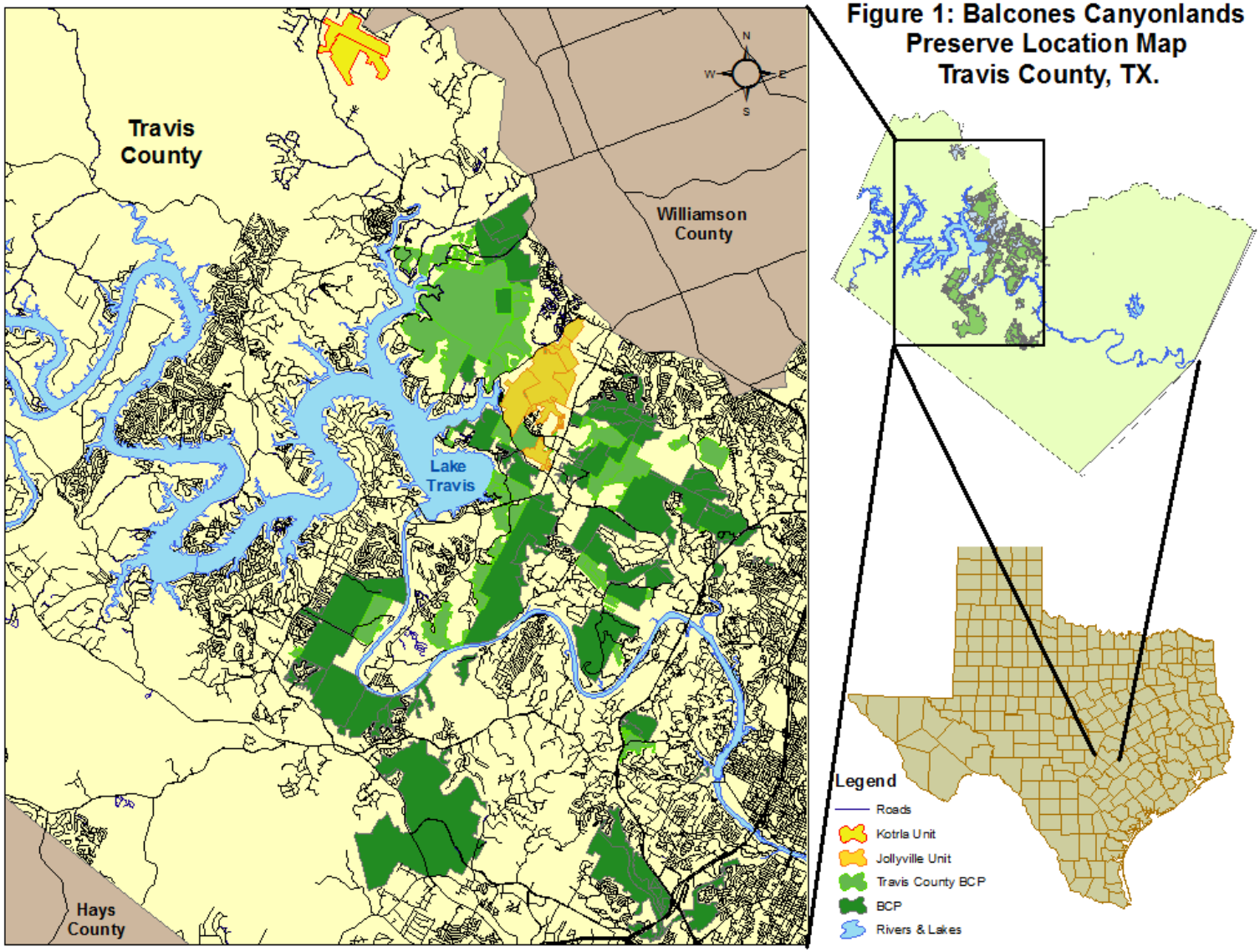


Figure 1: Balcones Canyonlands Preserve Location Map Travis County, TX.

Figure 2: BCVI Survey Locations and Observations, 2019
Travis County, Texas

BCVI Observations

Presence/Absence survey location

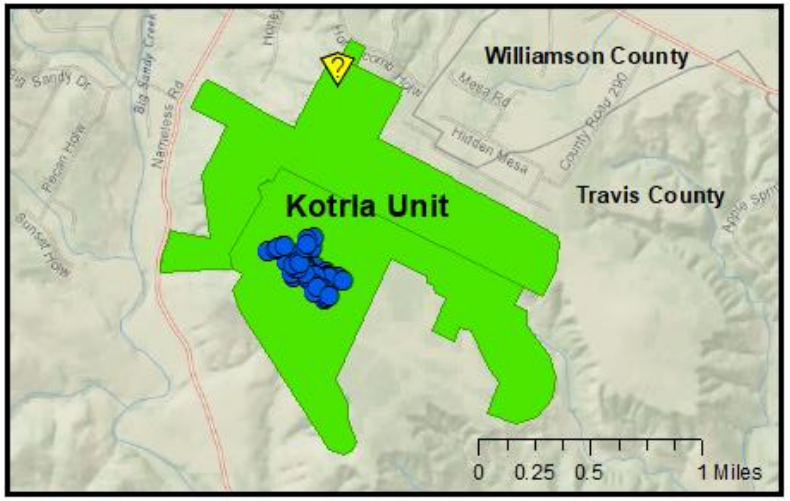
Travis County BCP, Kotrla Unit

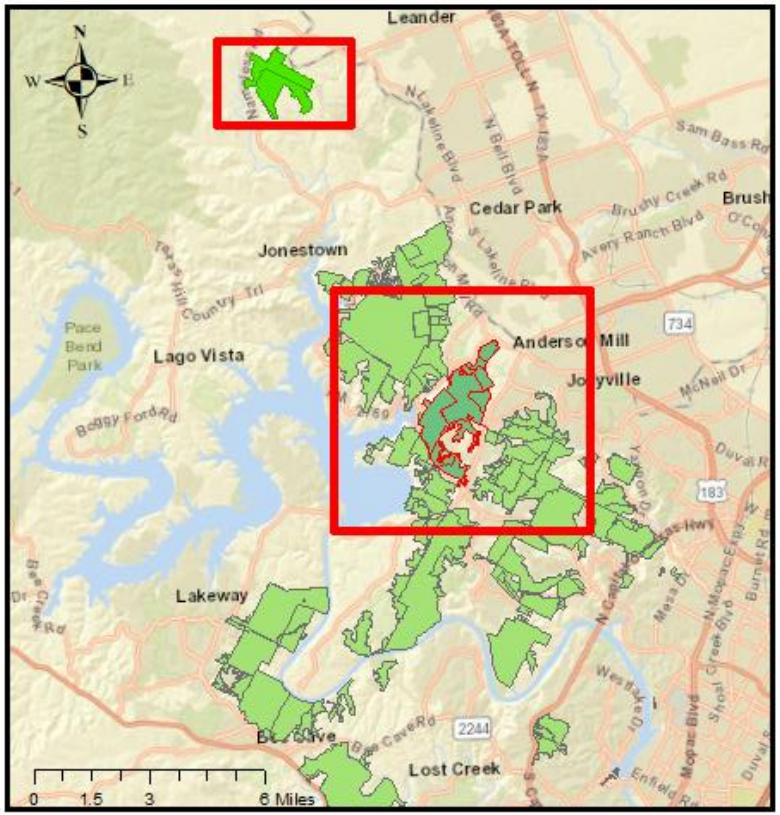
Travis County BCP, Jollyville Unit

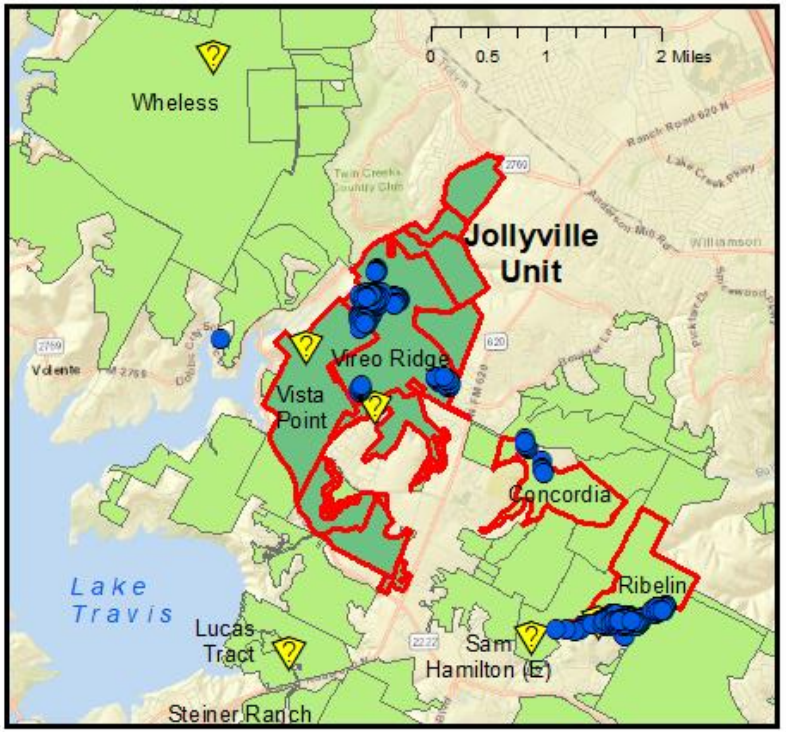
Balcones Canyonlands Preserve

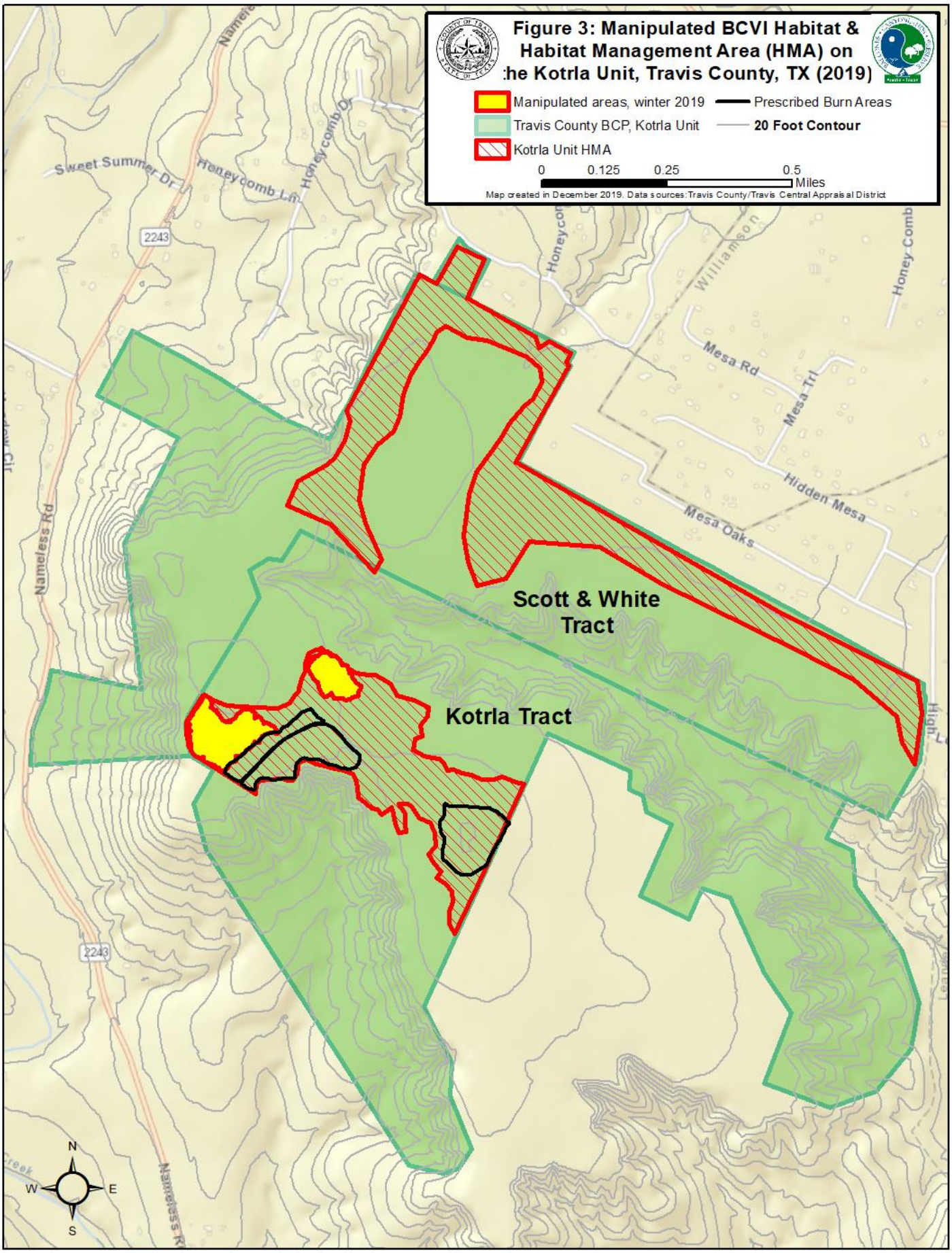
*Note - Presence/Absence surveys were also conducted at Milton Reimers Ranch Park in western Travis County and not shown on these maps.

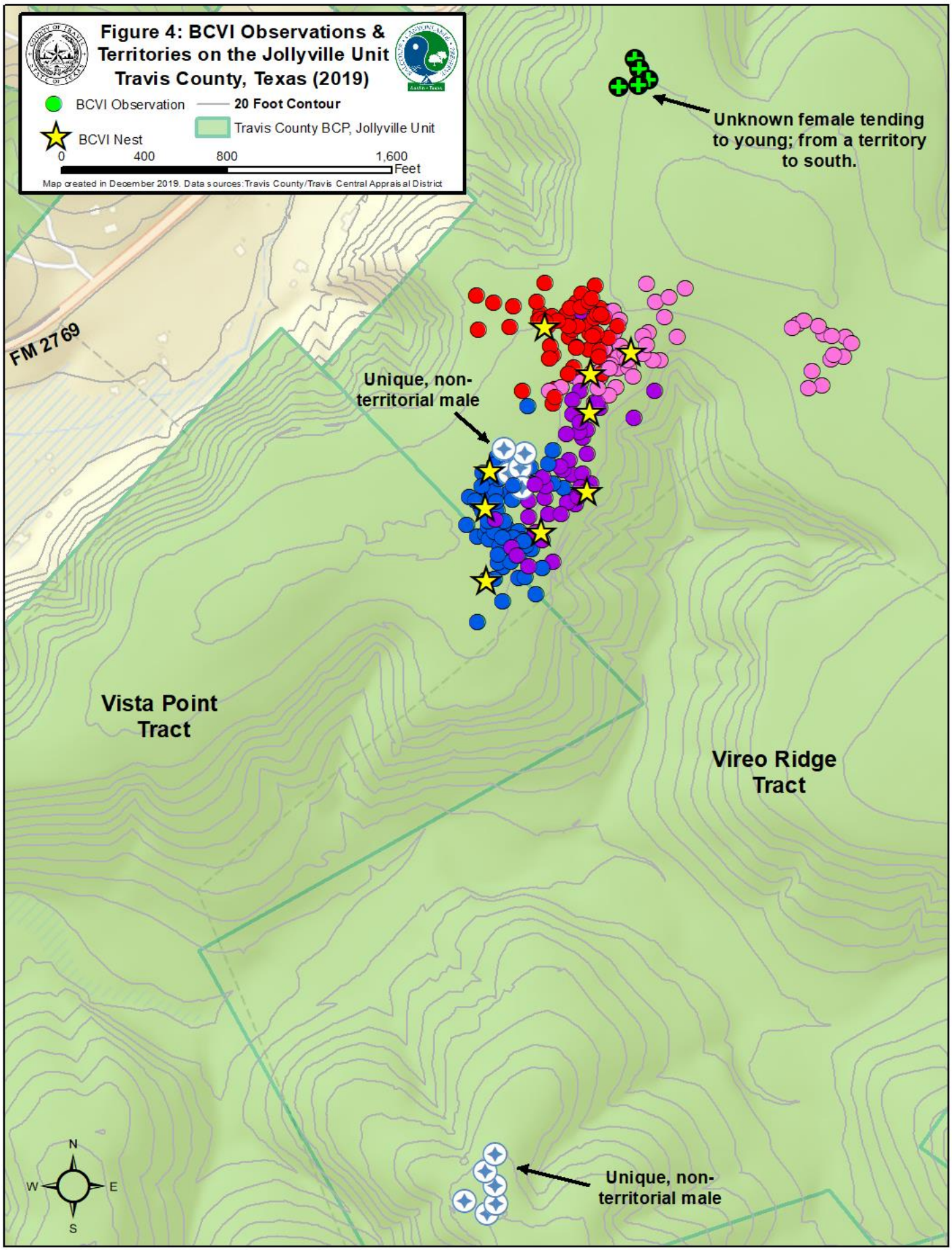
Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

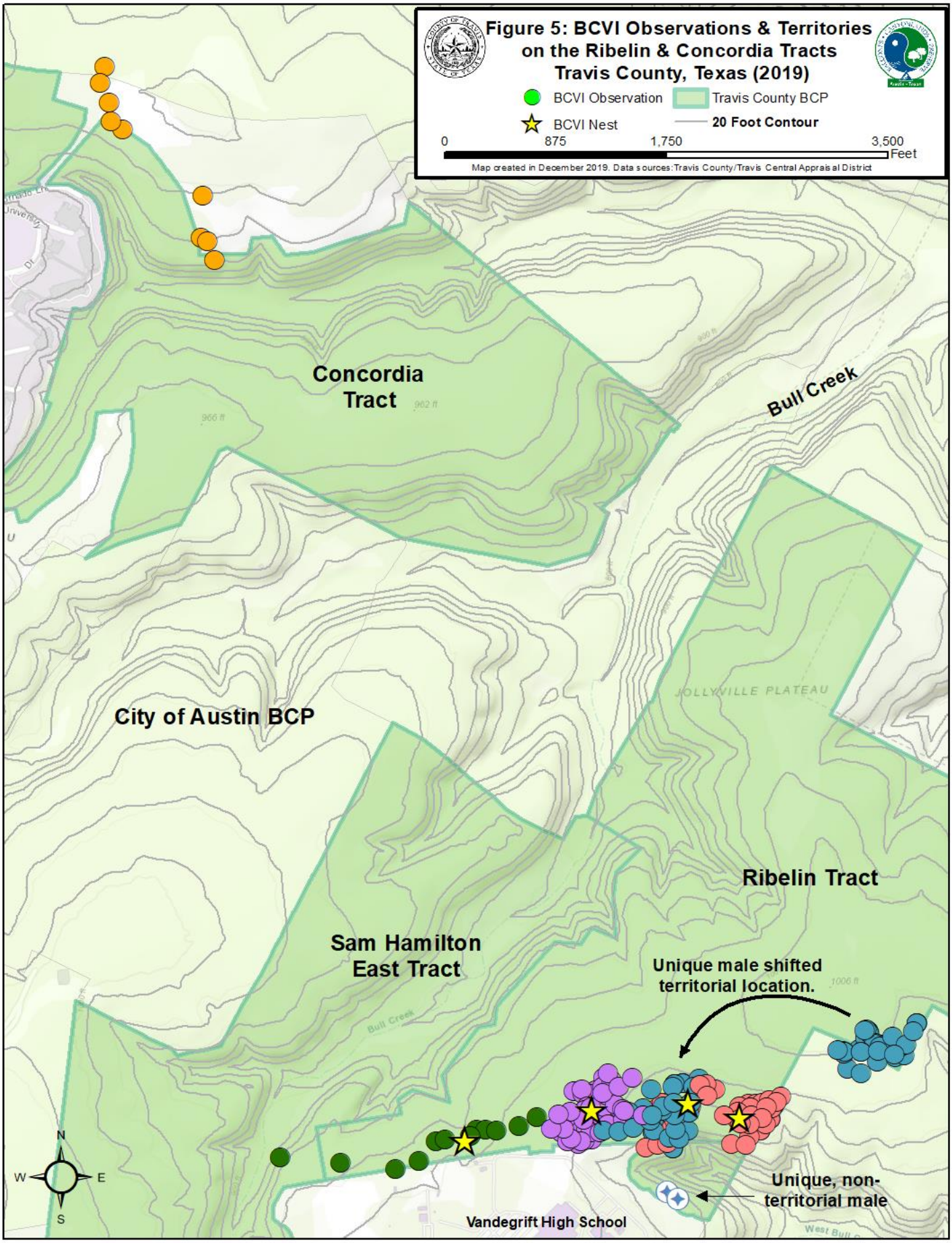


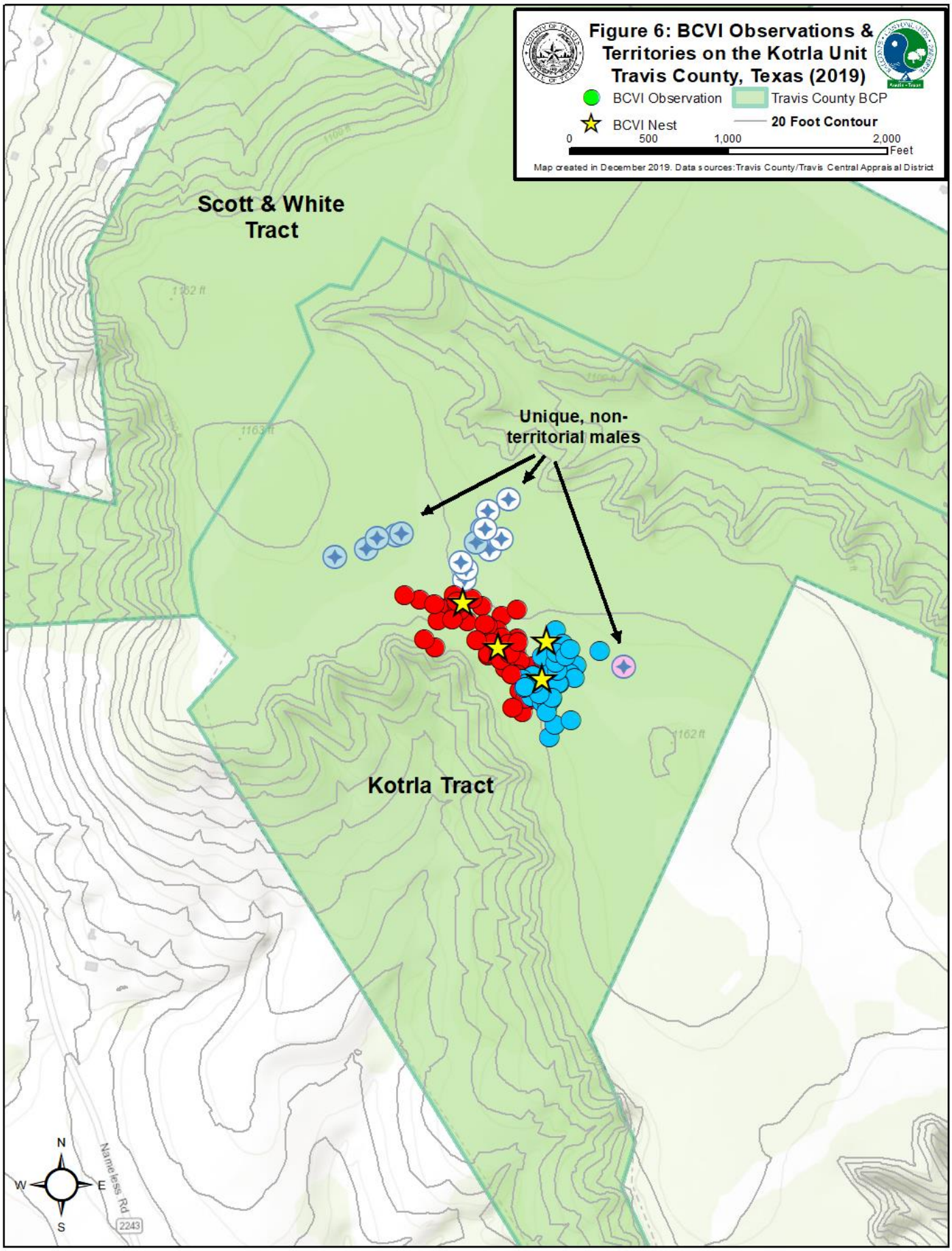


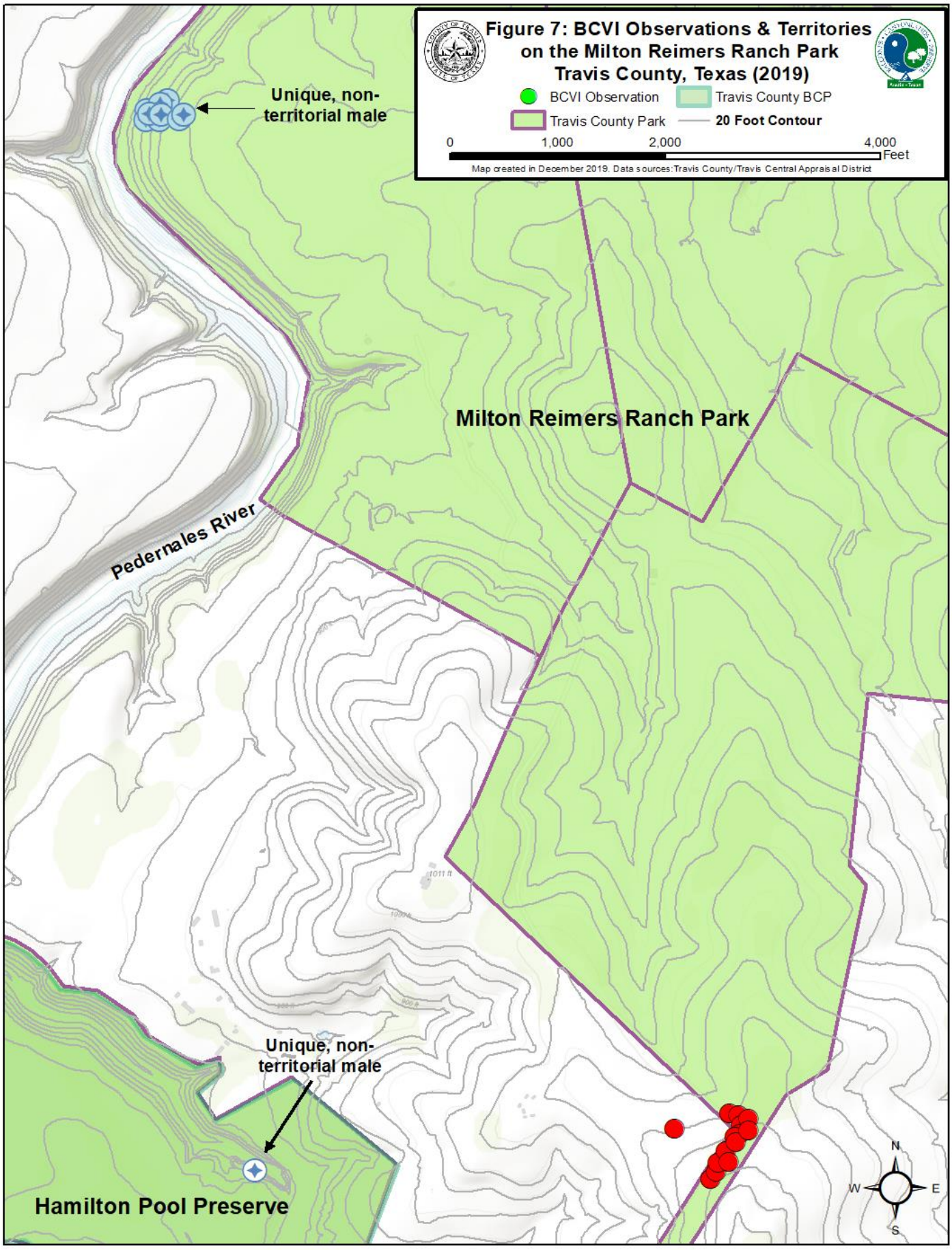



Figure 3: Manipulated BCVI Habitat & Habitat Management Area (HMA) on the Kotrla Unit, Travis County, TX (2019)
Manipulated areas, winter 2019
Travis County BCP, Kotrla Unit
Kotrla Unit HMA
Prescribed Burn Areas
20 Foot Contour
0 0.125 0.25 0.5
Miles
Map created in December 2019. Data sources: Travis County/Travis Central Appraisal District
Sweet Summer Dr
Honeycomb Ln
Honeycomb Dr
2243
Nameless Rd
Williamson
Mesa Rd
Mesa Trl
Hidden Mesa
Mesa Oaks
Scott & White Tract
Kotrla Tract
N
W
E
S


Figure 4: BCVI Observations & Territories on the Jollyville Unit Travis County, Texas (2019)
BCVI Observation
20 Foot Contour
BCVI Nest
Travis County BCP, Jollyville Unit
0
400
800
1,600
Feet
Map created in December 2019. Data sources:Travis County/Travis Central Appraisal District
Unknown female tending to young; from a territory to south.
FM 2769
Unique, non-territorial male
Vista Point Tract
Vireo Ridge Tract
Unique, non-territorial male
N
W
E
S


Figure 5: BCVI Observations & Territories on the Ribelin & Concordia Tracts Travis County, Texas (2019)
BCVI Observation
Travis County BCP
BCVI Nest
20 Foot Contour
0
875
1,750
3,500
Feet
Map created in December 2019. Data sources: Travis County/Travis Central Appraisal District
Concordia Tract
Bull Creek
City of Austin BCP
JOLLYVILLE PLATEAU
Ribelin Tract
Sam Hamilton East Tract
Unique male shifted territorial location.
Unique, non-territorial male
Vandegrift High School
N
W
E
S


Figure 6: BCVI Observations & Territories on the Kotrla Unit Travis County, Texas (2019)
BCVI Observation
Travis County BCP
BCVI Nest
20 Foot Contour
0
500
1,000
2,000
Feet
Map created in December 2019. Data sources:Travis County/Travis Central Appraisal District
Scott & White Tract
Unique, non-territorial males
Kotrla Tract
N
W
E
S
Nameless Rd
2243


Figure 7: BCVI Observations & Territories on the Milton Reimers Ranch Park Travis County, Texas (2019)
BCVI Observation
Travis County BCP
Travis County Park
20 Foot Contour
0
1,000
2,000
4,000
Feet
Map created in December 2019. Data sources: Travis County/Travis Central Appraisal District
Unique, non-territorial male
Milton Reimers Ranch Park
Pedernales River
Unique, non-territorial male
Hamilton Pool Preserve
N
W
E
S