Section 6 (Texas Traditional) Report Review

Form emailed to FWS S6 coordinator (mm/dd/yyyy): 3/5/2014

TPWD signature date on report: 2/20/2014

Project Title:
Breeding Ecology and Population Status of the Black-capped Vireo in Mexico: filling critical information gaps.

Final or Interim Report? Final

Grant #: TX E-128-R

Reviewer Station: Arlington ESFO

Lead station concurs with the following comments: NA (reviewer from lead station)

Interim Report (check one):

- ☐ Acceptable (no comments)
- ☐ Needs revision prior to final report (see comments below)
- ☐ Incomplete (see comments below)

Final Report (check one):

- ☒ Acceptable (no comments)
- ☐ Needs revision (see comments below)
- ☐ Incomplete (see comments below)

Comments:

FINAL PERFORMANCE REPORT

As Required by

THE ENDANGERED SPECIES PROGRAM

TEXAS

Grant No. TX E-128-R
F10AP00542

Endangered and Threatened Species Conservation

Breeding Ecology and Population Status of the Black-capped Vireo in México: filling critical information gaps.

Prepared by:

Dr. Irene Revulcaba, Melanie Colon, Dr. Jose I. Gonzalez, Dr. Michael Morrison

TEXAS PARKS & WILDLIFE

Carter Smith
Executive Director

Clayton Wolf
Division Director, Wildlife

19 February 2014

FINAL PERFORMANCE REPORT

STATE: ____Texas_______________ **GRANT NUMBER:** ___E – 128-R___

GRANT TITLE: Breeding Ecology and Population Status of the Black-capped Vireo in México: filling critical information gaps.

REPORTING PERIOD: ____1 Sep 2010 to 31 Dec 2013

OBJECTIVE(S):

To quantify the breeding ecology, population status, habitat conditions, and threats for the black-capped vireo in Mexico over 3 years.

Segment Objectives:

Task 1. Date of approval of funding to March 2011. Develop list of initial land areas to include in sampling.
Task 2. Annually Mar-Aug. Initiate field sampling of locations identified in Task 1.

> **Task 2.1.** At each location (habitat patch) identified in Task 1 we will conduct an initial assessment of the presence or absence of vireos using visual and auditory cues, as well as through the use of song playback as necessary.
>
> **Task 2.2.** At a subset of locations where birds were found to be present (Task 2.1) we will quantify bird abundance.
>
> **Task 2.3.** At a subset of locations used for density estimation (Task 2.2) we will locate nests and monitor nesting behavior and success.
>
> **Task 2.4.** Conduct habitat assessment of all locations surveyed at the patch, territory, and nest scale; locations where no birds were detected will be included.

Task 3. Sep-Dec 2011. Data will be entered into databases and analyzed. Analyses will include a listing of sampling locations, size, habitat conditions (overall, territory, nest site), results of breeding attempts (e.g., successful-unsuccessful, cause of failure), and other observations recorded (e.g., cowbird activity, status of other threats).
Task 4. Jan-Mar 2012. Based on analyses of 2011 data, we will re-evaluate and improve the criteria we used for identifying potential vireo habitat; based on 2011 sampling we will be able to analyze data at the patch, territory, and nest scales. We will then use the same sampling procedure (Task 1) to identify a new set of locations to visit in 2012 field season.
Task 5. Mar-Aug 2012. Conduct the same field sampling procedures listed above for Task 2 (including 2.1 to 2.4).
Task 6. Sep-Dec 2012. Conduct the same summaries and analyses as listed for Task 3, above.
Tasks 7 and 8: Repeat Tasks 4 and 5, respectively, for 2013.
Task 9. Sep-Dec 2013. All study results will be summarized, the appropriate statistical, genetic, and isotope analyses applied, and a final report produced.

Significant Deviation: Unforeseen problems in establishing the contract between grant PI (Texas A&M University) and their Mexican contractor (Universidad Autónoma de

Nuevo Leon; UANL) significantly delayed the start of the grant, anticipated for Spring 2011. Therefore, field work could not begin until Spring 2012.

Summary of Progress: Please see Attachment A. Electronic data (GIS and shapefiles) to be delivered to TPWD under separate cover, then forwarded to USFWS.

Location: States of Coahuila, Nuevo Leon, Tamaulipas, Mexico

Cost: ___Costs were not available at time of this report.__

Prepared by: _Craig Farquhar_____________ **Date:** _20 February 2013

Approved by: ______________________________ **Date:**___ 20 February 2013 ___
C. Craig Farquhar

ATTACHMENT A

REPORT of TAMU and UANL SECTION 6 ACTIVITIES, 2012-2013.

Project Title: Breeding Ecology and Population Status of the Black-capped Vireo in Mexico: *Filling Critical Information Gaps*

Principal Investigators: Dr. Michael L. Morrison [1], Dr. José González-Rojas [2]

Additional Researchers: Dr. Irene Ruvalcaba-Orega [2], Mario Guerrero-Madriles [2], Melanie Colón [1], Tiffany McFarland [4]

TABLE OF CONTENTS

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[4] Report prepared by Irene Ruvalcaba-Ortega (i.ruvalcaba.o@gmail.com) and Melanie Colón (melaniec@neo.tamu.edu).

INTRODUCTION

The black-capped vireo *(Vireo atricapilla;* hereafter vireo) was listed as endangered by the USFWS in 1987 and SEMARNAT in 2010. Major threats to the species include habitat loss from development and grazing and lowered productivity resulting from cowbird (*Molothrus* spp.) parasitism and nest predation (Ratzlaff 1987, Grzybowski 1986, Tazik 1988, Cimprich 2004). A recent survey of literature and unpublished data indicated that fewer than 7,000 breeding males likely exist across the current range in Texas, Oklahoma, and Mexico (Wilkins et al. 2006). Although the numbers of birds may have increased in several core breeding locations in the U.S., the overall population remains critically low and is concentrated in these few locations. Focused research has been ongoing in Texas and Oklahoma at a few locations, and management (primarily cowbird trapping and some habitat manipulation) is underway at several locations. However, a gap in knowledge exists concerning the vireo population across the border in Mexico (Ratzlaff 1987, Farquhar and Gonzalez 2005, Wilkins *et al*. 2006).

The project discussed herein is aimed at quantifying the breeding ecology, population status, habitat conditions, and threats for vireos in northern Mexico. This research will enable us to provide quantitative assessments of the numbers of birds present, their breeding status, primary threats, and rigorous descriptions of habitat conditions. The overall goal of this study is to substantially expand our knowledge of the vireo in Mexico by filling critical gaps in our knowledge, which will provide a more thorough understanding of the condition of the species overall and provide guidance for recovery in the U.S. and Mexico.

Breeding Habitat

The breeding range of this species once extended from Kansas to northwestern Mexico (Coahuila , Nuevo León and Tamaulipas; USDI 1991, Howell and Webb 1995). Until 2003, the known breeding area included parts of southwestern Oklahoma, central Texas and northern Coahuila (Grzybowski 1995). Subsequently, breeding populations were identified in Nuevo León and Tamaulipas (Farquhar and Gonzalez 2005). In Texas, vireo habitat is characterized by a patchy mosaic of scrub shrubs and open areas (Cimprich and Kostecke 2006). Vegetation tends to be short, less than 3 m high, with trees and sparse shrubs (Noa et al. 2007). However, habitat varies across the state (Gryzbowki et al. 1994), and some individuals may use alternatives to the norm (Cimprich and Kostecke 2006, Pope et al. 2013b).

Though plant species may vary by location, vegetation across the range in Texas typically includes oaks (i.e., *Quercus sinuata, Q. fusiformis,* and *Q. buckleyi*), Ashe juniper (*Juniperus ashei*), deciduous trees (e.g., *Ulmus crassifolia, Diospyros texana, Sophora secundiflora*), prickly pear (*Opuntia spp.*), and greenbrier (*Smilax spp.*; Pope et al. 2013). The plant communities found in the western portion of the vireo's range in Texas (e.g., Devil 's

River State Natural Area and Dolan Falls Preserve) are characterized by mesquite (*Prosopis spp*.), chaparral, juniper-oak woodlands (*Juniperus - Quercus*) and sotol-lechuguilla (*Dasylirion leiophyllum-Agave lechuguilla*; Hedges and Poole 1999, Smith et al 2012a), and in southwest Texas vegetation is similar in many respects to that found in parts of its range in Mexico (Farquhar and Gonzalez 2005, Smith et al. 2012a).

Authors such as Graber (1961), Marshall et al., (1985) and Benson and Benson (1990) mentioned potential reproductive habitat in Mexico for black-capped vireos, but only a few nests have been described formerly for Coahuila in Sierra Padilla and Sierra Masera (*n*=5; Graber 1961), and in Rancho La Escondida (*n*=4; Farquhar et al. 2003); and recently for Nuevo León and Tamaulipas (n=5; González-Rojas et al. *in press*).

Potential habitat, described mainly for northern Coahuila, is characterized as lowland shrub habitat found among several mountain ranges (Marshall et al. 1985, Grzybowski 1995, Farquhar and Gonzalez 2005). Benson and Benson (1990), described it as pine and oak forest with dense foliage. Later, Farquhar and González (2005) described new localities as dense, low stature (< 3 m) thornshrub in hilly regions of NE Nuevo León to the west of the Sierra Madre Oriental, and scrub oak woodlands and thornshrub along the bases of the slopes and along drainages in canyons in Coahuila.

Survival and Mortality

Different authors have evaluated survival and mortality in vireos with annual survival values for adult males ranging from 0.40 to 0.75 (Grzybowski 1991, Alldredge et al. 2003). Population viability analyses consider typical adult male survival approximately equal to 0.57 (USFWS 1996, Parysow and Tazik 2002). The survival of adult females is not well known, but is likely to be lower than that of males because the proportion of males is higher in the areas of distribution (Grzybowski 1995).

Reproductive Success

In the United Stats, reproductive success in the vireo is threatened most notably by habitat loss and brood parasitism by the Brown-headed Cowbird (*Molothrus ater;* Graber 1961,Robinson et al. 1995). Though predation by snakes, fire ants (*Solensopsis spp*.), birds, mammals, and katydids have also been noted during the breeding season (Stake and Cimprich 2003, Conkling et al. 2012, Smith et al. 2012b).

METHODS

This project was carried out during two breeding seasons (2012 and 2013) in four northeastern states of Mexico: Coahuila, Nuevo León, Tamaulipas, and San Luis Potosí. In 2011, we created a nine block survey area across these states to determine presence and to better understand density and reproductive ecology (Figure 1). During the course of the research, we added two additional survey blocks. We performed density estimates, measures of reproductive success, and breeding habitat characterization in three blocks that we categorized as intensive (block 7 and the two new blocks).

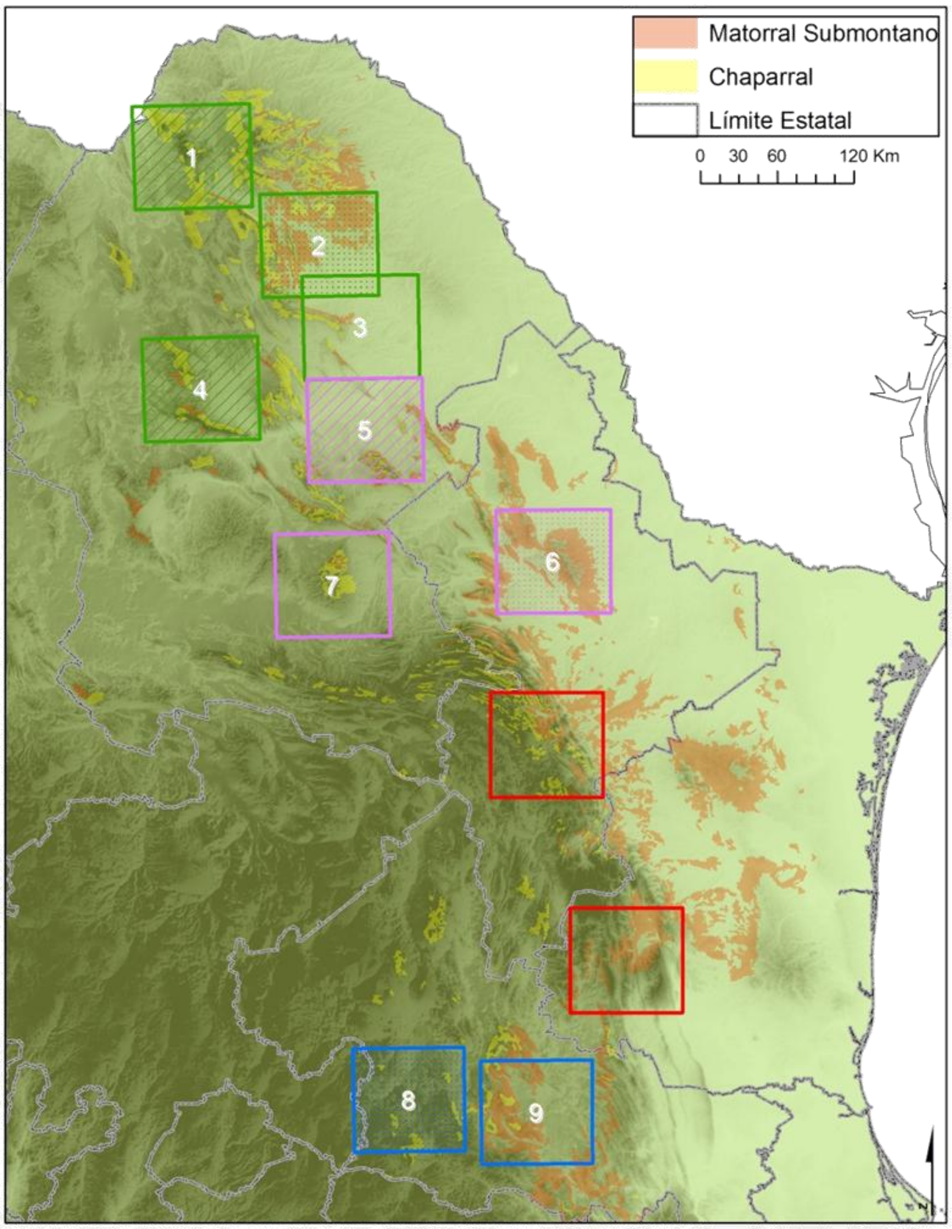

Figure 1. Survey Blocks. In red the two additional areas included during project implementation**.**

Presence Surveys

During the 2012 season, we performed presence surveys in six blocks (i.e., blocks 5-9 and a new block in Tamaulipas). In 2013, we conducted surveys in only three blocks (i.e., block 7 and two new blocks in Nuevo León and Tamaulipas). Blocks 1-4 were not surveyed due to security concerns. We performed point counts every 500 meters along roads or trails if the habitat seemed suitable for vireos. We conducted additional counts every 250 m along transects originating from roads and trails. We conducted all point counts between dawn and 12:00 pm. All counts lasted five minutes during which we recorded the distance and direction to all vireos or cowbirds seen or heard. If no vireos were detected after five minutes, we briefly played recorded vireo songs and waited for a response.

At each point, we also characterized vegetation using the point-quadrant method in which distances to the four nearest trees or shrubs in each quadrant were recorded. We then used the average distance at all points to calculate the mean area ($\bar{A} = d^2$) in square meters (Cottam and Curtis 1956, Morisita 1954). We used an area unit (*U)* of 100 m^2 to determine the density of plants according to the following formula TD (Total Density) = $U/\bar{A}$. To reduce overestimation, we applied the Pollard (1971) correction formula ($TD = 4U (\Sigma n - 1) / \pi \Sigma d_i^2$). To determine relative density (RD_i), we counted all individuals of each species by the total individuals of all species (Σn_i) according to $RD_i = n_i / \Sigma n_i$. We calculated frequency as the incidence of each species per sampling point (j_i) by the total points recorded in the area (k_i) according to $f_i = j_i / k_i$. We also calculated the relative frequency (RF_i) as the frequency one species divided by the total frequency of all species according to $RF_i = f_i / \Sigma f_i$. We calculated height as $H_i = (a_i D_i)/n_i$, where a_i is the sum of all heights recorded for a species, D_i is the density of the species, and n_i is the total number of individuals sampled for that species; and relative height (RH_i) as $RH_i = H_i / \Sigma H$ (ΣH is the total height recorded for all species). Finally, we calculated the importance value index (IV) of species based on the sum of the values of relative density plus the value of relative frequency divided by three ($IV_i = RD_i + RF + RH_i/3$).

Density and Territory Mapping

At a subset of locations, we mapped territories and estimated densities. We used two different methods for estimating densities depending on the severity of the slopes encountered. In 2012, we mapped territories in Sierra La Paila (block 7). In 2013, we continued mapping in Sierra La Paila, but also mapped territories in the newly added blocks in Nuevo León and Tamaulipas (Figure 1).

Territory Mapping

To map territories, we traveled on foot throughout large portions of potential breeding habitat. When a vireo was detected, we located the individual and followed it for up to an hour, maintaining a safe distance to minimize the influence of the observer on the bird's movements. Using a handheld GPS, we recorded the initial location as well as 3-5 additional points. We repeated this procedure on subsequent visits allowing us to accumulate at least 15 locations per male, which we later used to define the boundaries of each territory. Using Hawth's Tools, we created minimum convex polygons with territory points to get estimates of territory size.

Distance Point Counts

To estimate density, we established a 250 m grid at each of the survey locations in Nuevo León and Tamaulipas. At each point, we conducted five minute counts along the grid during which we recorded distance and direction to all vireos and cowbirds seen or heard. Using these data, we performed density analyses using the program Distance 6.0 v.2 (Thomas et al. 2009). We tested uniform detection models, hazard -rate and half-normal with cosine expansions and simple and Hermite polynomials, then selected the best model based on the lowest value of the Akaike Information Criterion (AIC; Akaike 1973 and 1985, Buckland et al., 2001). When we obtained models with ΔAIC less than 2 units, we used χ^2 test to choose the model with the best goodness of fit (Burnham and Anderson 1998). Given the model selected, we estimated density (individuals/ha), confidence intervals (95%), and the coefficient of variation for vireos and cowbirds.

Reproductive Ecology

We observed nesting behavior during the 2012 season, and we provide information on productivity, the probability of reproductive success, and nesting microhabitat (as described below) observed during the 2013 season.

Nesting behavior

In 2012, we monitored three active nests in Sierra La Paila that were found during the construction phase. We placed programmable cameras near nests that allowed for the observation of behavior during the incubation and nestling stages. We watched video recordings, noting the frequencies and average visit times of parents during 30 minute intervals (pulse observation). We later divided results based on sex and behaviors (e.g., incubation, nestling care, etc.).

Productivity and probability of breeding success

In 2013, we defined territories as described earlier in this report and searched for nests systematically and by using behavioral cues (e.g., material or food carries; Martin and Geupel 1993). We recorded nest locations using a handheld GPS unit, and monitored contents every 3-5 days until nests fledged or failed. During each visit, we noted nest contents (e.g., number of eggs, chicks) and noted any indication of predation or parasitism (e.g., cowbird eggs/nestlings).

We evaluated apparent reproductive success and productivity using the following formulas: hatching success = (number of eggs hatched)/(number of total eggs) and fledging success = (number of fledglings)/(number of eggs hatched). We calculated the probability of daily survival (psd) with 95% confidence intervals using the program MAYFIELD, based on Mayfield (1961, 1965) and amended by Bart and Robson (1982). We also calculated the probability of reproductive success based on the number of nesting days by stage (i.e., total 28 days; 17 incubation days, Gryzbowski 1995; 11 nestling days, Cambell 1995). This method reduces the overestimation of reproductive success, because it takes into account the days of exposure (of eggs or chicks), allowing nests at any stage of development to be included in analyses.

Reproductive Habitat

We sampled vegetation in breeding areas at the nest (microhabitat), territory, and landscape scales. At the nest level, we recorded the substrate species, stand height, nest height, nest concealment (index), and distance to the edges of the nest patch. We estimated 95% confidence intervals for each variable recorded. We also recorded the same information for a sample of potential nest locations within 25-50 m in each territory to better assess nesting microhabitat selection. Within territories, we also recorded vegetation across at points on a 20 m grid. At each point, we recorded the dominant woody species and its height. We recorded the same measurements at the landscape scale across an 80 m grid.

RESULTS

Presence Surveys

2012 Season:

We detected a total of 25 vireos in 3 of the 6 blocks surveyed (Figure 2).

The Monclova block (block 5) includes the mountains of La Gloria, El Mercado, La Purisima, Obayos, and La Rata. We explored this area from 27 to 30 March and from 14 to 15 April. In the Sierra de La Gloria, we accessed Chilpitin Canyon, where the slopes were dominated by barreta (*Helietta parvifolia*), and the vegetation appears favorable for vireo reproduction. However, we could not confirm the presence of vireos at this site, perhaps because drought conditions in the area limited habitat factors including vegetative cover or the availability of food and water.

Cerro El Mercado was characterized by scrub elements inlcuding mesquite, chaparro prieto, and chapote and was considered an unfavorable habitat marked by dry conditions. Vireos were not detected at this location.

In the Sierra La Purisima, we surveyed a location known as the Lantriscal Ranch, located between the Bocatoche Canyon in the north and the east-central section of the mountain. At this location, habitat was affected by a heavy fire that occurred in 2011. In unburned portions of the ranch, the landscape was dominated by sweet acacia (*Acacia farnesiana*).

Another visit was made to Zacatita in the northwestern end of the sierra, 7 km south of Sacramento, Coahuila. In this area, the lower and middle parts of the mountains have a desert scrub vegetation, and their summits have forest fragments surrounded by chaparral oak. The latter offer potential for the presence of vireos, but we did not visit the peaks. We also did not visit the Obayos Mountains and La Rata.

We visited the Sierra Picachos block (block 6) on May 11 and 12, searching areas northeast of the mountains in the south-western canyons. These canyons were dominated by baretta (*Helietta parvifolia*) and Gregg ash (*Fraxinus greggii*). The area was defined by drought conditions, with no flowering or fruiting plants and few insects. These conditions do not favor the presence of breeding birds, and no vireos were detected. The mountain areas of Sierra Picachos have conditions that might accommodate breeding populations, however, local security concerns in the region prevented exploration.

We visited the Sierra La Paila block (block 7) on April 12. Traveling the road to Ejido Cedral Palomas, where we detected a total of 6 individuals along a 5 km stretch. The vegetation was adequate with scrub dominated by *Gochnatia hypoleuca*, *A. farnesiana*, *Rhus virens,* and *Quercus* spp. The area was very dry, and the *G. hypoleuca* that dominates the landscape had no foliage. The remaining plants had no flowers.

On April 15, we visited a new block in Sierra San Marcos y Pinos just south of the Monclova block and north of the La Paila block. We detected a single male singing and engaging in territorial behavior. Seven kilometers southeast of this detection point, Dirk Lanning noted a vireo on May 20, 1983 (referred to in Marshall et al. 1987). The site features mentioned by Lanning remain after 29 years, including: scrub oak in the middle of the slope, fragments of oak-pine on the top of the mountain, and overgrazed scrub at the bottom. The vegetation in general had little foliage and flowering plants were not observed. As in Sierra La Gloria, the lack of rain in the area was the cause of the dry landscape.

The Jaumave block belongs to the continuous mountain range of the Sierra Madre Oriental, whose boundaries are complex but we use local names for reference (e.g., Sierra El Filo, Sierra Nogales, Sierra Los Treinta, Sierra Magueyeros, Sierra Mocha). We visited this block from May 5 to 7 and documented four singing males on the way to Miquihuana-Palmillas. The birds were observed in a thicket dominated by *H. parvifolia*, with good moisture conditions, plants in bloom, and insects, which all provide favorable breeding conditions for vireos. We also detected 12 singing males north of Sierra Mocha, on the stretch from Capulin to Bustamante. This area had a more diverse herbaceous community with *Juniperus spp*., *Quercus spp*., *Acacia spp*., *Dasylirion spp.,* and *Rhus spp.* These sites were previously reported by Farquhar and Gonzalez (2005). We observed another male singing in a dry creek with abundant vegetation in Capulin, at the intersection of the roads to Tula, Bustamante, and Jaumave. We did not observe vireos in the Sierra El Filo. We did not conduct presence surveys along roads in the Nogales and Sierra Magueyeros, because potential breeding locations were not observed.

We visited the San Luis Potosí block (block 8) on June 6. This block includes the Sierra San Miguelito and Cerro Potosí. Oaks (*Quercus spp.*) dominate this area, which does not have viable vehicle access for extensive surveys, and we did not observe vireos in this block.

We visited the Rio Verde (block 9) on June 5. This block includes Sierra El Tablón, Sierra La Noria, Sierra las Paradas, Sierra Palomas, and Sierra San Antonio. Overall, habitat conditions in the area were not particularly favorable, and drought conditions (as in the Coahuila blocks) were observed. We conducted surveys in the north of this block, where potential habitat was dominated by *Juniperus* spp. and *H. parvifolia*. We did not detect vireos, though the northern area contains potential habitat for this species.

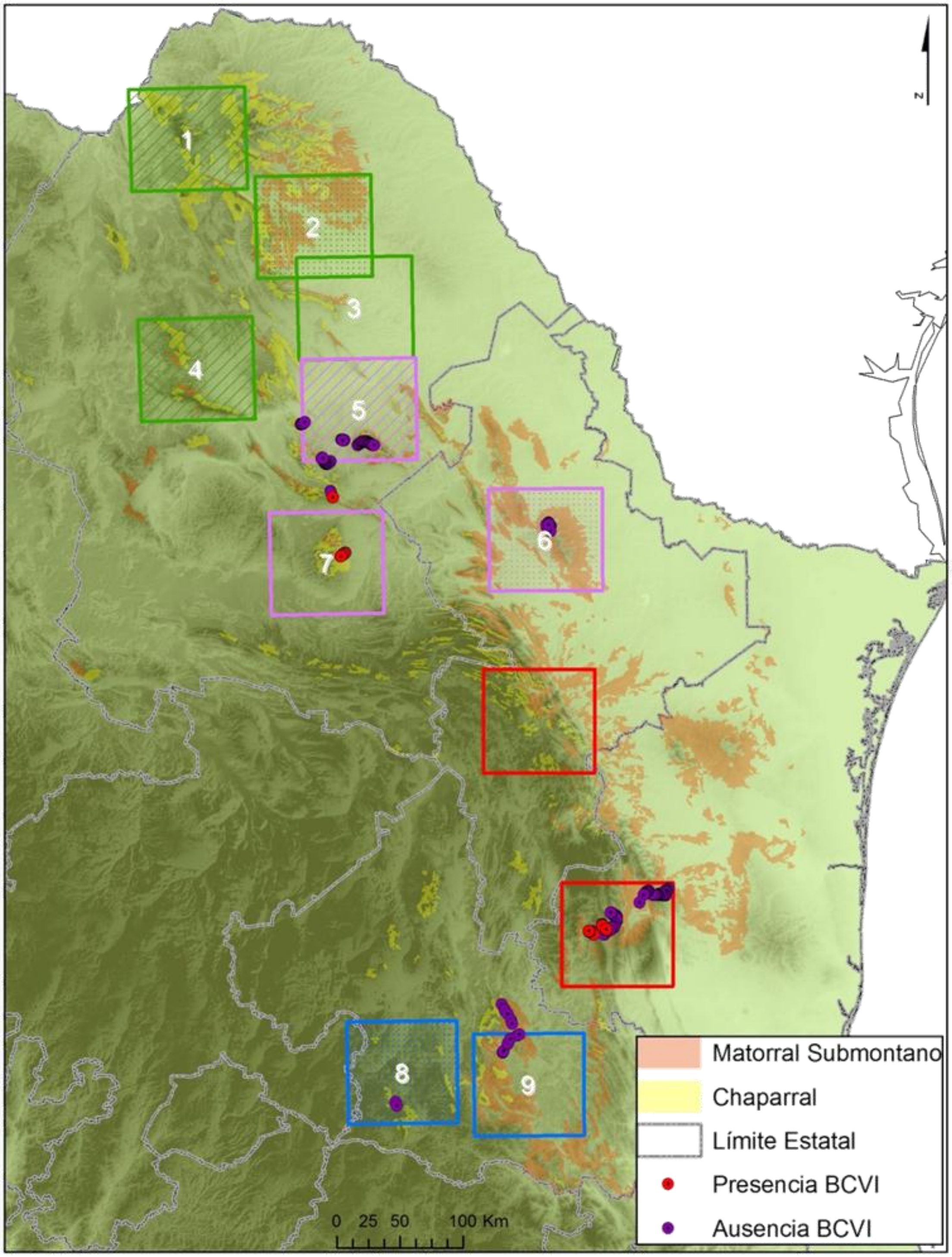

Figure 2. Sites visited during the 2012 season, with vireo presence (red) and absence (purple).

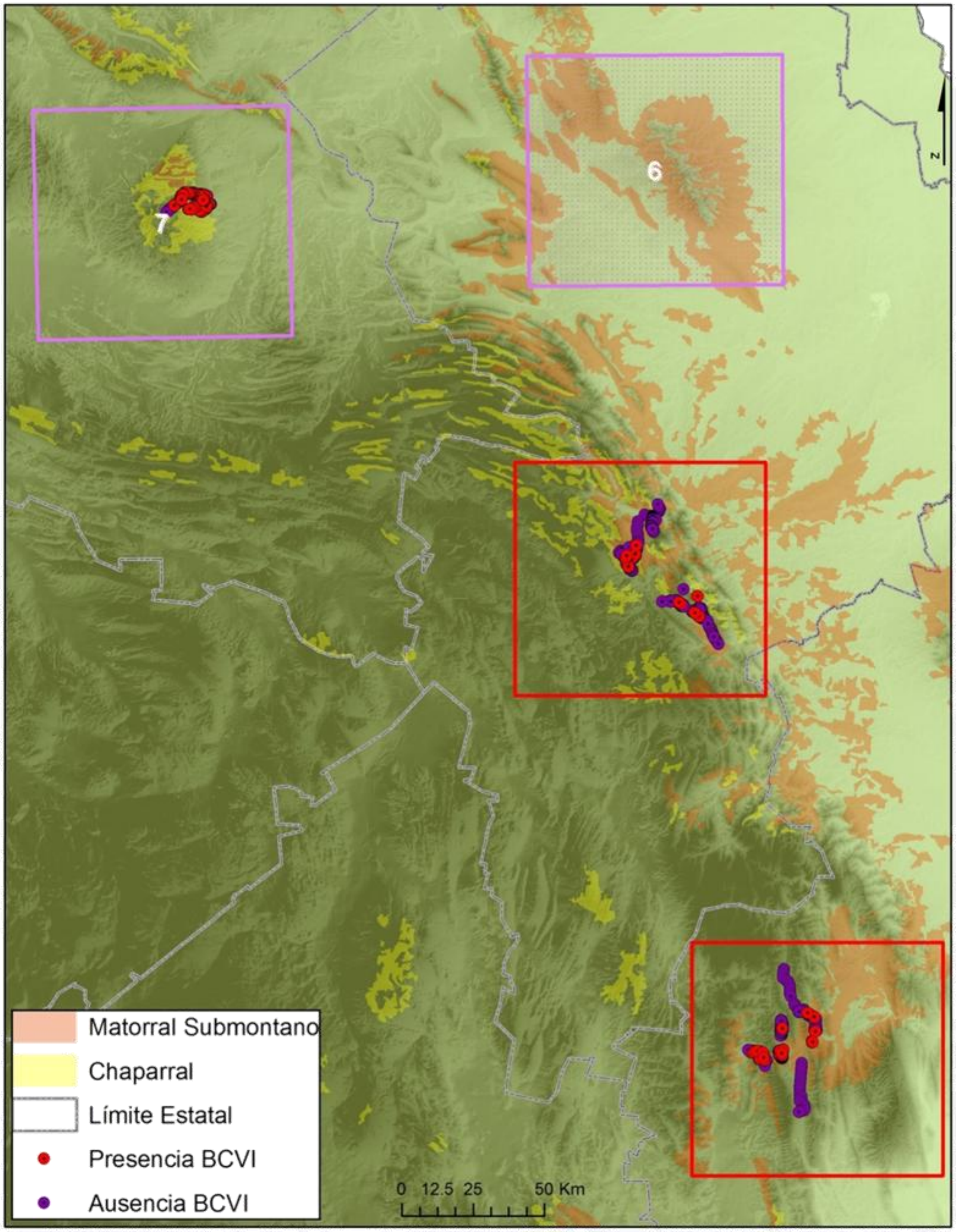

Figure 3. Sites visited during the 2013 season, with vireo presence (red) and absence (purple).

2013 Season

We used the southern block (in Tamaulipas) as an indicator of the beginning of the breeding season. We monitored this area from the first week of March and every week following. We recorded the first vireo observations on April 27 and 29 in Tamaulipas and the Sierra La Paila of Coahuila, respectively. Over the season, we detected a total of 297 individuals in 3 survey blocks located in Coahuila, Nuevo León, and Tamaulipas (Figure 3). We performed 1,239 point counts: 372 in Coahuila, 419 in Nuevo León, and 448 in Tamaulipas. We recorded 316 vireo detections: 152 detections at 126 points in Coahuila, 61 detections at 44 points in Nuevo León, and 103 detections at 90 points in Tamaulipas. The proportion of points with vireos present by state is as follows 33.87% in Coahuila, 10.50% in Nuevo León, and 20.09% in Tamaulipas.

Density

Territories

During the 2012 season, we mapped 14 territories ranging in size from 1 to 3.6 hectares in three canyons of the Sierra de la Paila, with a slightly larger average size than that observed the in the same location in 2013. The territories sizes in Coahuila in both seasons were significantly larger than those observed in Nuevo León, while in sizes were more variable in Tamaulipas. Territory size in Coahuila and Tamaulipas matched the average given by Graber (1961), while the upper confidence limit of Coahuila matches the average noted by Tazik (1961) for birds breeding in Texas (Table 1).

Table 1. Average territory size and density (95% CI) of territories by location and year.

State	**Coahuila**		**Nuevo León**	**Tamaulipas**	**Texas**	
Year	***2012 (n=14)***	***2013 (n=63)***	***2013 (n=27)***	***2013 (n=13)***	***Graber 1961***	***Tazik 1991***
Territory size (ha)	1.79 (1.36-3.15)	1.53 (1.24-1.65)	0.66 (0.48-0.84)	0.96 (0.27-1.65)	1.5	3.6
Density (machos/ha)	0.56 (0.32-0.74)	0.65 (0.61-0.81)	1.51 (1.19-2.08)	1.04 (0.62-3.70)		

Point Counts

During the 2013 season, we established 81 point count stations in Nuevo León, but we were only able to sample 68 of these as result of the slope in the field. We detected vireos at 28 of these points (41.17%). We also sampled 89 points in Tamaulipas and detected vireos at 20 (22.47%) of them. The result of density estimations are shown in Table 2 and are compared to those obtained using point count surveys. Cowbird density was only estimated for Coahuila (0.105) due to the number of detections, and was found to be a third of the vireo density (0.396). In Nuevo León, densities from both sampling efforts are very similar (0.16 vs. 0.18). For Tamaulipas, we have a more confident estimation from the survey effort because of a higher number of detections (n=101).

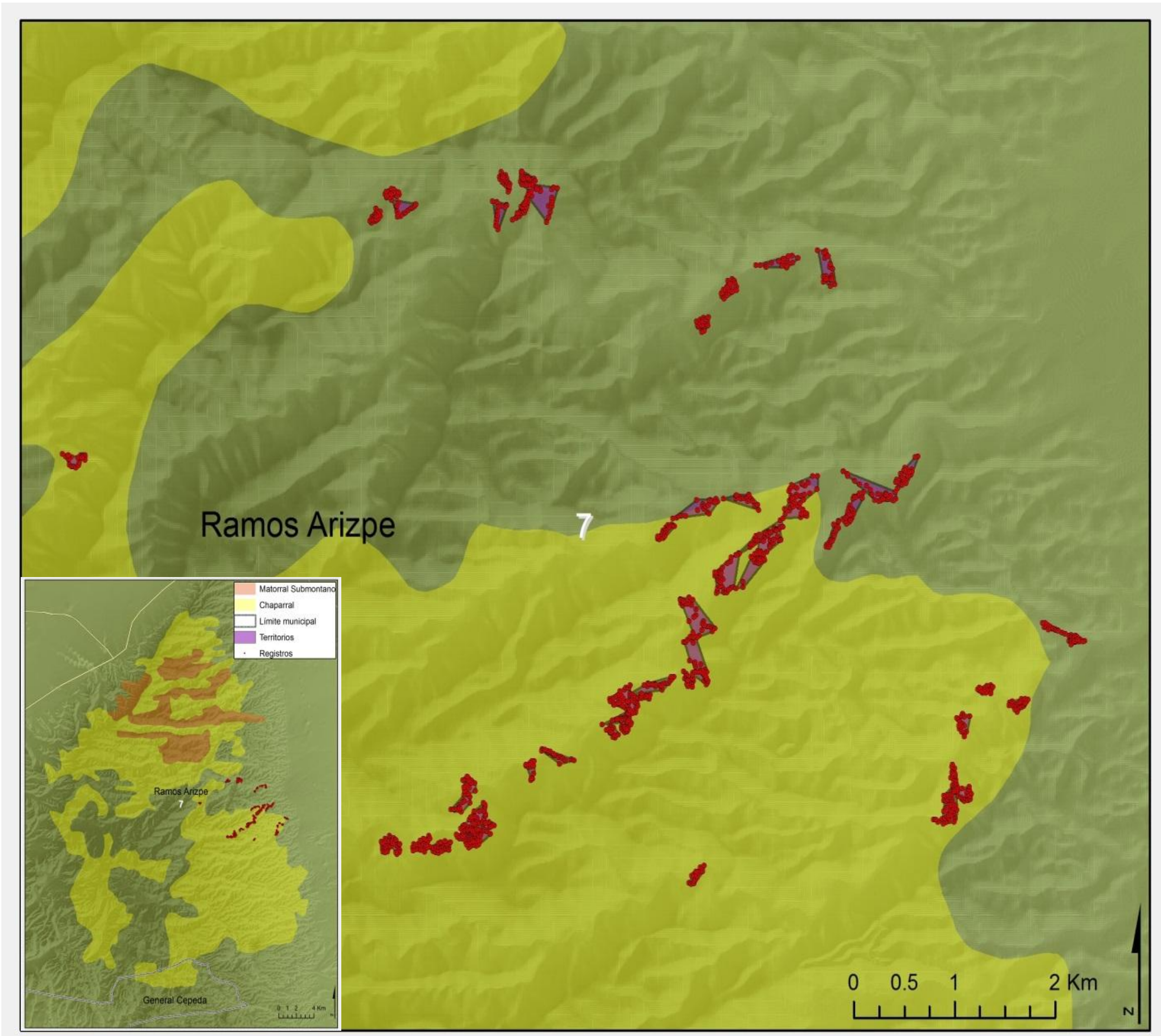

Figure 4. Defined territories in La Sierra La Paila, Coahuila

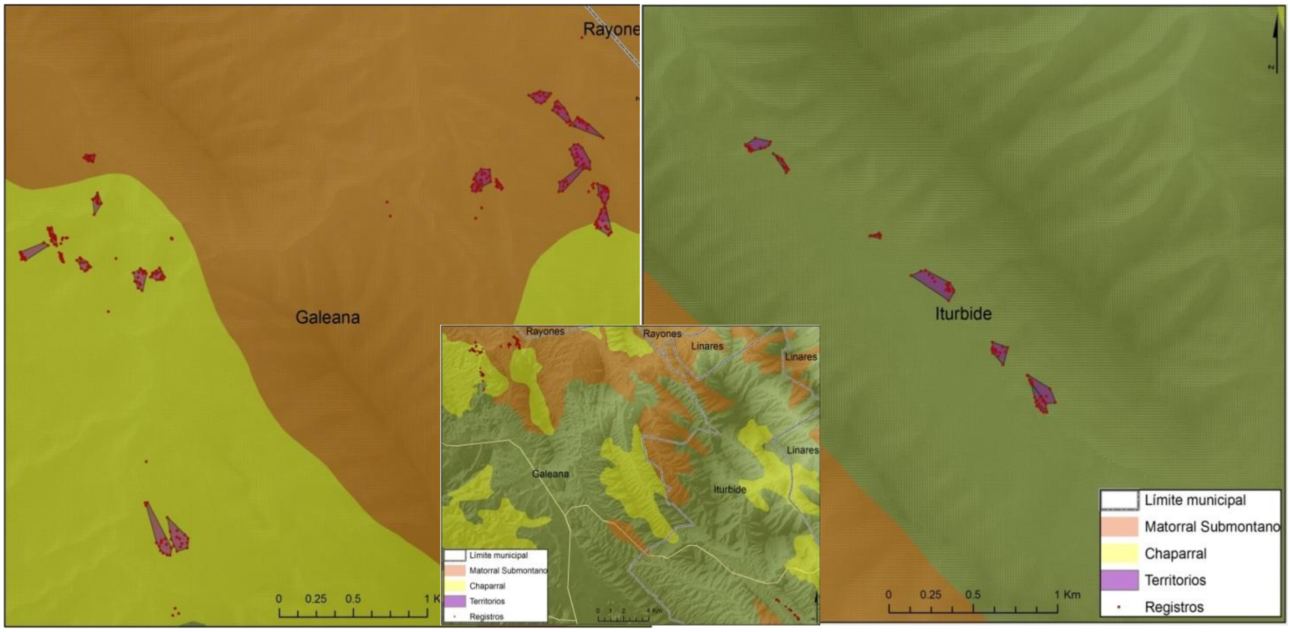

Figure 5. Delimited territories in Iturbide and Galeana, Nuevo León

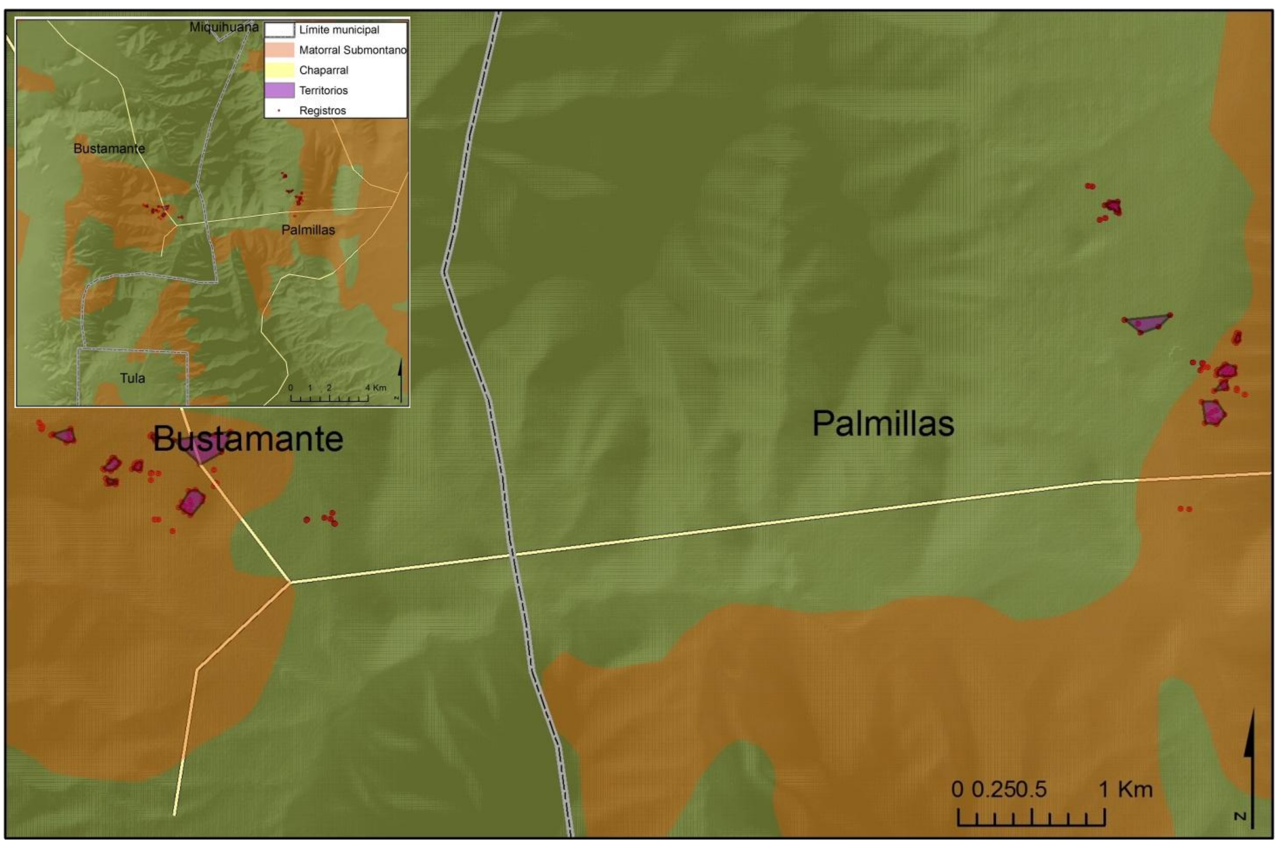

Figure6. Delimited territories in Bustamante and Palmillas, Tamaulipas

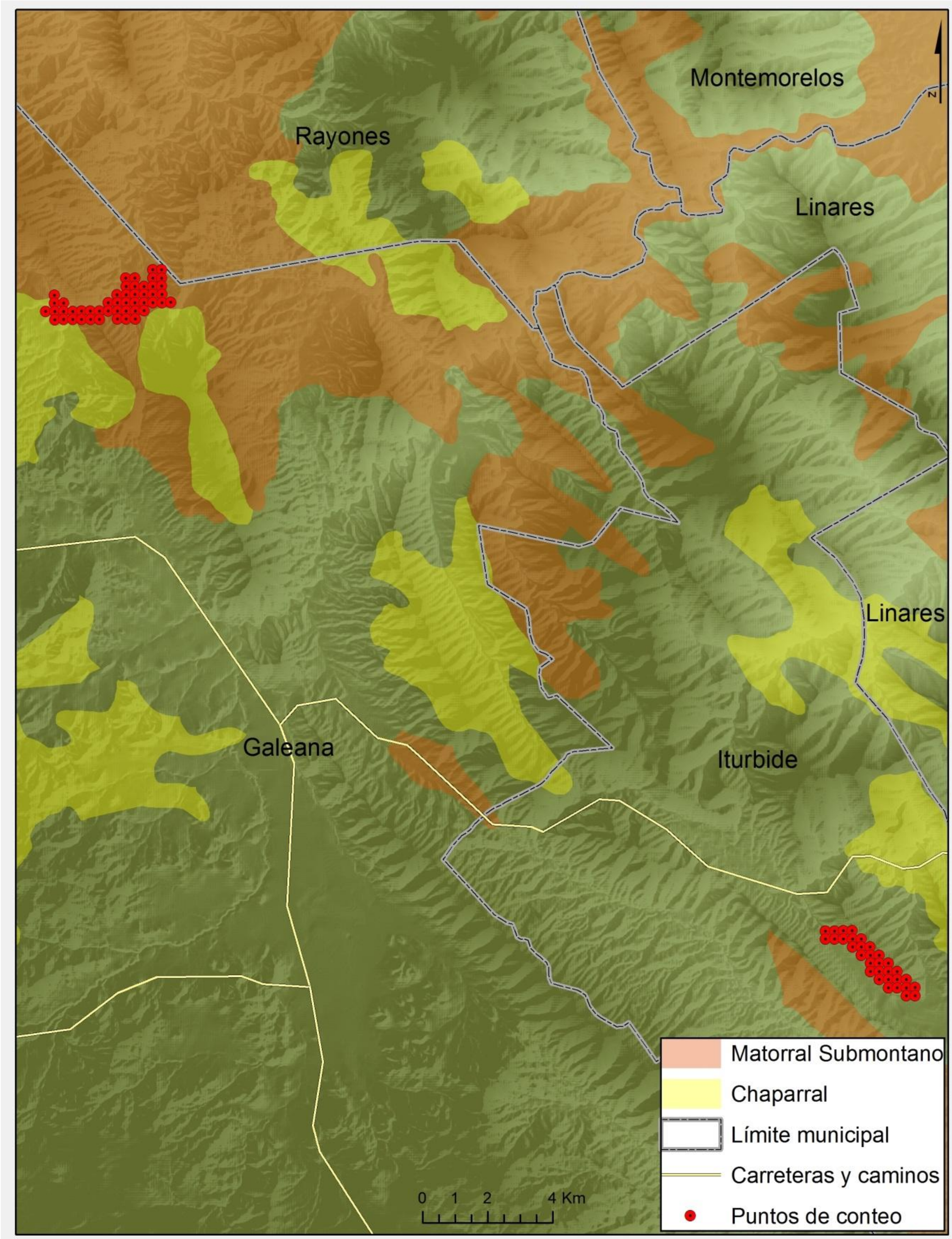

Figure 7. Systematic sampling of distance point counts in Nuevo León

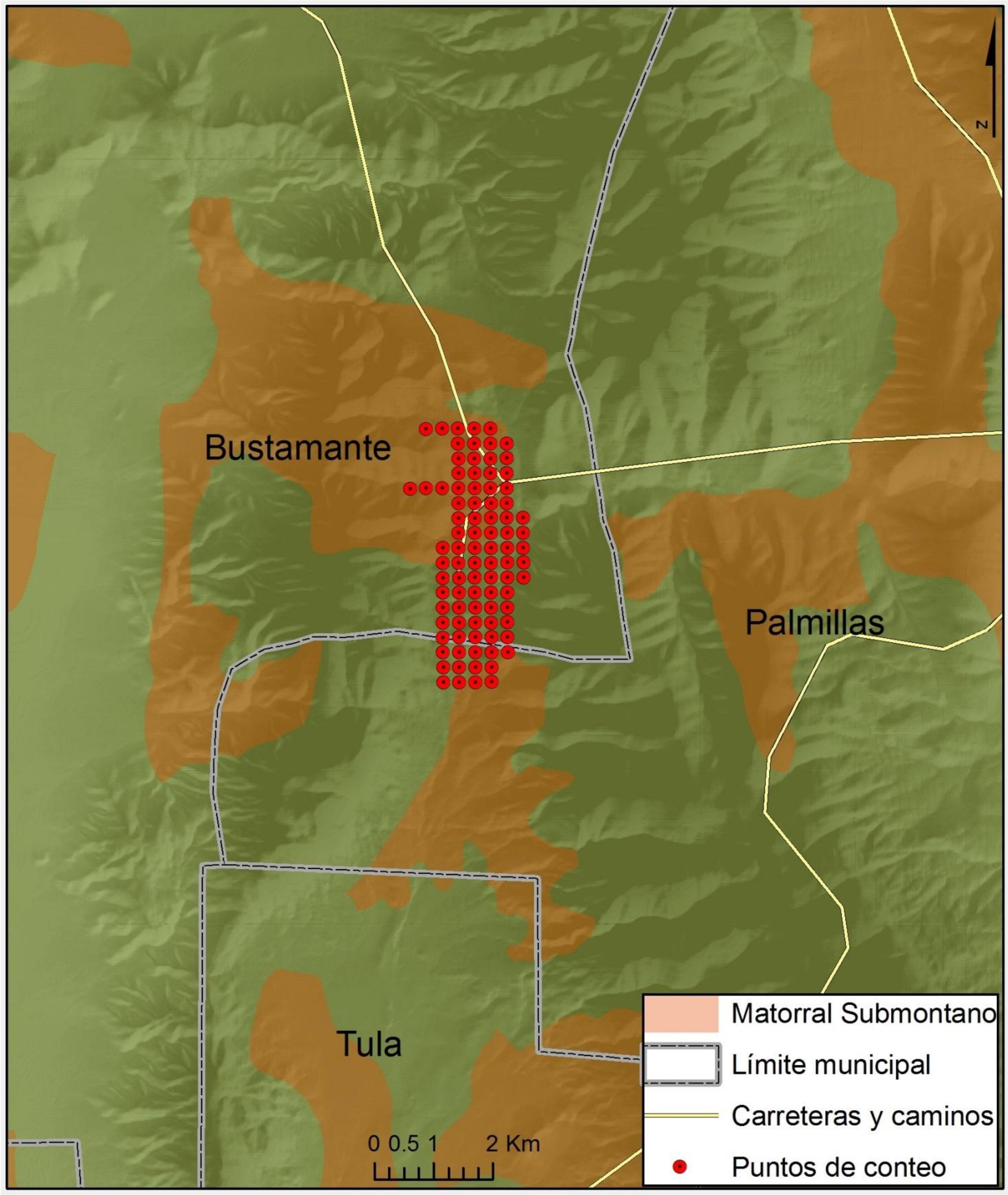

Figure 8. Systematic sampling of distance point counts in Tamaulipas.

Table 2. Mean densities (95% CI) of black-capped vireo (*Vireo atricapilla*) and cowbird (*Molothrus* spp.) individuals for Coahuila, Nuevo León and Tamaulipas from surveys (S) and point counts (PC).

State	Species	n	ΔAIC	D (95%CI)	CV (%)	Effective Detection Radius	Goodness of fit χ^2 (p)
Coahuila	*Vireo atricapilla* (S)	126	0	0.396 (0.327-0.48)	9.8	55.28	0.8221
	Molothrus spp. (S)	51	0	0.105 (0.076-0.145)	16.1	65.59	0.4731
Nuevo León	*V. atricapilla* (S)	58	9.09	0.161 (0.124-0.210)	13.3	52.33	0.1059
	Molothrus spp. (S)	10	-	-	-	-	-
	V. atricapilla (PC)	39	0.07	0.182 (0.110-0.301)	25.2	100.16	0.7117
Tamaulipas	*V. atricapilla* (S)	101	0.84	1.109 (0.848-1.449)	13.6	26.3	0.0023
	Molothrus spp. (S)	5	-	-	-	-	-
	V. atricapilla (PC)	24	0.75	2.803 (1.68-4.67)	25	17.50	0.3897

Reproductive Ecology

Nesting behavior

2012 Season

From our video data, we observed a total of 46 pulses (at 30 minutes each) covering a duration of 25:01 hours. We divided these data into 3 different periods corresponding the nest stage: construction (2:38 hr), incubation (19:19 hr), and chick development (3:04 hr). From these recordings, we determined that the male only participates in construction of the base of the nest, which is then reinforced by the female, showing a frequency of 4 visits every 35 min and an average duration 1:12 min at the nest per visit. During incubation work is shared between the male and female with similar percentages of time spent on the nest (40.08% and 54.94%, respectively) and a period of shared absence of 4.98%. These values are similar to those reported by Graber in 1961 (42.49% for males and 51.75 for females, with an absence of 5.76 %); though Pope et al. (2013a) observed females at the nest 80% more often than males during incubation. Finally, we observed that females spend more time at the nest (80.83%) than males (3.37%) during the nestling stage. During this period, females tended to maintain proper sanitation and temperature regulation. Males did not spend much time at nests, but the frequency of their visits was almost double that of females (2.43/30 min vs. 1.62/30 min). Eighty-eight percent of the food provided to the chicks was Lepidopteran larvae.

Table 3.Percentage of length of stay (95% CI) and absence, and frequency of hauling material during the construction phase of BCVI nests in Sierra La Paila, Coahuila.

	Male	Female	Graber 1961(30 min)
Stay at nest	-	38.35%	-
	-	01:12 min (00:00-2:25)	-
Absence from nest	-	51.40%	-
Frequency of construction(35 min)	-	4	7

Table 4.Percentage and average length of stay (95% CI) and absence, and frequency of visits to the nest during the stage of vireo incubation in Sierra La Paila, Coahuila.

	Male	Female	Graber 1961 Male	Graber 1961 Female
Stay at nest	40.08%	54.94%	42.49%	51.75%
	15:56 min (11:25-20:27)	20:44 min (16:47-24:42)	-	-
Absence from nest	4.98%		5.76%	
Frequency (30 min)	0.90	0.81	-	-

Table5. Percentage and average length of stay (95% CI) and absence, and frequency of visits to the nest during the nestling stage in Sierra La Paila, Coahuila.

	Male	Female	Graber 1961 Male	Graber 1961 Female
Stay at nest	3.37%	80.83%		
	00:20 min (00:08-00:32)	14:56 min (04:34-25:19)		
Absence from nest	15.8%			
Frequency (30 min)	2.43 (60%)	1.622 (40%)	68.9%	31.2%

Productivity and probability of reproductive success.

2012 Season

We observed territorial, singing males in early April and May, but did not observe females or young at the start of the season. We believe the drought and lack of rain in the area was responsible for limited breeding activity early on. Rains started the last week of May, and the first indications of breeding were observed June 23, when we noted females carrying food in their beaks and detected the presence of fledglings. We only located four active nests in 2012.

Potential nest predators were recorded at camera-bait stations located throughout the three canyons. We baited traps with peanut butter and sausage for two months. Potential nest predators in the area included snakes, such as the Schott's whipsnake (*Coluber schotti*), which we observed 6 m away from an abandoned nest and approximately 1.5 m high in the branches of a bush. We also observed a skunk (*Mephitis mephitis*) at one bait station. Several predatory birds species were identified at the study locations as well, including common ravens, Mexican jays, roadrunners, screech-owls, great-horned owls, and several hawk species.

We also recorded the presence of brown-headed and bronzed cowbirds in the area though they were infrequently detected, only 2 brown-headed and 4 bronzed cowbirds were detected during the four months of work in the area. Their locations were restricted to canyons mouths and open desert scrub areas. None of the four active vireo nests located in 2012 experienced nest parasitism.

2013 Season

In 2013, we searched for nests from May to August. We located 49 active nests in Coahuila, 15 in Nuevo León, and 1 in Tamaulipas. We calculated an average 3.33 eggs per nest in Coahuila and 3.64 eggs per nest in Nuevo León. These values are similar to those reported by Campbell (1995) for vireos nesting in other parts of their range. The number of chicks and fledglings was 2.94 and 2.34, respectively, in Coahuila and 2.57 and 2.14 in Nuevo León. We noted 44% of nests in Coahuila were abandoned during construction or laying.

We also noted that 60% of active nests in Coahuila and 50% of active nests in Nuevo León were successful. Predation affected 23.33% and 30% of nests in Coahuila and Nuevo León, while cowbird parasitism in these states was 6.66% and 20%, respectively. The single nest found in Tamaulipas was also parasitized. The success of broods was higher than that found by Barber in 1996, who reported lower values of predation and parasitism than those found in Texas and Oklahoma. Apparently these lower values of predation and parasitism are due to the limited anthropogenic or natural disturbances found in the nesting areas, which are defined by primary vegetation in good condition .

We also calculated the likelihood of success in three periods (i.e., overall, incubation, and nestling). We determined that the probability of overall success of was 56% in Coahuila and 46% Nuevo León, these values are both higher than those obtained by Campomizzi et al. (8%; 2009), who observed vireos with nests that were exposed to red imported fire ants. Our observed values of nest success are likely related to the lowered rates of predation and parasitism at our study sites.

However, several potential predators were observed at survey locations in 2013. One snake (*Masticophis taeniatus*) was observed in a bush (*Rhus virens*) near a vireo nest. We observed the snake from a distance to reduce the likelihood that our presence would influence vireo or snake behaviors. We also observed a Pacific gopher snake (*Pituophis catenifer*) approximately 20 mm from a nest in a *G. hypoleuca* and a Texas alligator lizard (*Gerrhonotus infernalis)* approximately 15 m from a nest in *R. virens*. We repeatedly observed Mexican jays (*Aphelocoma wollweberi)* following adult vireos. Often we noted the vireos would make alarm calls at a safe distance from the nest when pursued by jays. We also observed northern mockingbirds (*Mimus polyglottos*) following vireos on occasion, though these tended to maintain distances greater than those maintained by jays. A few times we noted that screech-owls (*Megascops asio*) would discreetly follow adult vireos and elf owls (*Micrathene whitneyi*) repeatedly harassing adult vireos very close to their nests (within 5 m). Often elf owls stealthily followed adult vireos, which likely allowed them to get so close to the nests without being detected earlier. Finally, two mammals were observed, which may be potential nest predators in our study locations. A coyote (*Canis latrans)* was likely depredated at least one nest, and bobcat (*Lynx rufus*) traces and footprints were observed near vireo nests. Both have been reported as vireo nest predators in Texas (Conkling et al. 2012, Smith et al. 2012a).

Table 6. Average eggs, nestlings, and fledglings per nest in Sierra La Paila, Coahuila, and Iturbide and Galeana, Nuevo León

	Coahuila n=49	**Nuevo León n=15**
Eggs	3.33	3.63
Nestlings	2.94	2.57
Fledglings	2.38	2.14
Aandoned nests	44.89%	33.33%
Abandoned during construction	38.77%	26.66%
Abandoned after construction	6.12%	6.66%

Table7. Apparent reproductive success in Sierra La Paila, Coahuila, and Sierra Madre Oriental in Nuevo León.

	Coahuila n=30	Nuevo León n=10	Barber 1996 n=77	Noa2005 n=163	Noa2005 n=177
Reproductive success	60.0%	50%			
Hatching success	40.81%	50%			
Fledging success	46.15%	50%			
Nest failure	40.0%	53.3%			
Depredated	23.33%	30%		54%	38%
Parasitized	6.66%	20%	29.9%	12%	2%
Abandoned	10.0%				

Table8. Probability of reproductive success (95% CI) in Sierra La Paila, Coahuila, and Sierra Madre Oriental in Nuevo León,

Period (P)	Coahuila	Nuevo León	Total n=54	Campomizzi (n=27)
Total (28 d)	56% (42-77%)	46% (24-88%)	53% (33-82%)	8% (10-24%)
Incubation (17 d)	69% (54-87%)	51% (23-100%)	60% (39-98%)	
Nestling stage (11d)	90% (77-100%)	82% (56-100%)	86% (66-100%)	

Banding

We banded 57 individuals with USGS bands and unique color combinations. We banded 38 chicks in Coahuila; seven chicks, one juvenile, and an adult in Nuevo León; and 4 juveniles and 6 adults in Tamaulipas (Table 9).

Table9. Vireos banded in Sierra La Paila, Coahuila, Sierra Madre Oriental in Nuevo León, and Tamulipas in 2013. Birds with no color combination listed were banded with a red annodized USGS band only.

Date	Locality	State	USGS Band	Color Combo	Age	Fat	Wing Chord	Culmen	Tarsus	Tail	Weight
13/06/2013	La Luz	Coahuila	2660-27701	GR/RR:NB/PI	L	3	22	6.02	19.2	3	7.42
13/06/2013	La Luz	Coahuila	2660-27702	NB/BK:DB/RR	L	3	23	6.38	16.62	4	6.88
20/07/2013	La Luz	Coahuila	2660-27703	NB/YE:GR/RR	L	2	17	5.38	15.66	2	4.77
20/07/2013	La Luz	Coahuila	2660-27704	OR/RR:OR/DG	L	2	19	6.27	17.41	3	5.65
20/07/2013	La Luz	Coahuila	2660-27705	PI/RD:WH/RR	L	2	23	6.07	15.9	3	6.67
21/07/2013	La Luz	Coahuila	2660-27706	PI/RR:PI/BK	L	2	29	5.79	16.58	3	7.41
21/07/2013	La Luz	Coahuila	2660-27707	WH/RR:DB/MV	L	2	22.5	5.6	17.18	2	6.64
21/07/2013	La Luz	Coahuila	2660-27708	WH/RR:DG/BK	L	2	27	7.4	19.2	3	8.76
22/07/2013	La Luz	Coahuila	2660-27709	DB/RR:RD/MV	L	2	29	7.41	17.68	3.5	7.4
22/07/2013	La Luz	Coahuila	2660-27710	DG/WH:GR/RR	L	3	24	6.94	16.8	2	6.74
22/07/2013	La Luz	Coahuila	2660-27711	GR/RR:NB/MV	L	2	27	6.44	16.95	3	7.62
22/07/2013	La Luz	Coahuila	2660-27712	MV/MV:MV/RR	L	3	24	6.13	17.44	2	7.15
22/07/2013	La Luz	Coahuila	2660-27713	NB/RR:YE/RD	L	2	23	6.3	16.49	2	6.4
22/07/2013	La Luz	Coahuila	2660-27714	OR/GR:OR/RR	L	2	20	6.2	16.56	2	5.5
22/07/2013	La Luz	Coahuila	2660-27715	OR/RR:DB/RD	L	2	28	6.65	18.51	5	7.69
28/07/2013	La Luz	Coahuila	2660-27748	RD/PI:YE/RR	L	2	24	7.32	16.49	3	5.96
28/07/2013	La Luz	Coahuila	2660-27749	RD/RR:WH/MV	L	2	22	6.35	15.71	2	5.28
28/07/2013	La Luz	Coahuila	2660-27750	BK/PI:GR/RR	L	2	21	6.72	15.79	2	4.68
30/07/2013	Los Fresnos	Coahuila	2660-27751	DB/RR:DG/DB	L	3	32	8.7	21.12	12	7.43
30/07/2013	Los Fresnos	Coahuila	2660-27752	DG/GR:RD/RR	L	3	31	8.53	21.32	12	7.72
30/07/2013	Los Fresnos	Coahuila	2660-27754	PI/RR:MV/MV	L	3	36	8.34	22.23	10	7.74
30/08/2013	Los Fresnos	Coahuila	2660-27755	PI/RR:RD/DB	L	3	30	6.49	48.38	6	7.2
05/07/2013	El Sotolar	Coahuila	2660-27756	WH/RR:PI/YE	L	3	30	6.7	18.4	8	8.99
05/07/2013	El Sotolar	Coahuila	2660-27757	YE/OR:WH/RR	L	3	29	5.78	15.56	7	7.79
05/07/2013	El Sotolar	Coahuila	2660-27758	BK/RR:BK/MV	L	3	31	7.45	18.88	7	7.56
05/07/2013	El Sotolar	Coahuila	2660-27759	DB/MV:RD/RR	L	4	30	6.91	18.66	7	7.33
06/07/2013	La Luz	Coahuila	2660-27760	DB/MV:WH/RR	L	2	27	6.6	18.1	6	7.41
06/07/2013	La Luz	Coahuila	2660-27761	DG/RR:RD/DG	L	3	28	5.92	19.86	5	7.4
06/07/2013	La Luz	Coahuila	2660-27763	MV/RR:MV/RD	L	2	26	5.82	14.75	5	6.32
06/07/2013	La Luz	Coahuila	2660-27764	NB/RR:DB/DG	L	2	21	6.53	14.39	4	6.27
06/07/2013	La Luz	Coahuila	2660-27765	OR/MV:MV/RR	L	3	25	6.12	16	4	6.33
06/07/2013	La Luz	Coahuila	2660-27766	RD/OR:MV/RR	L	2	19	6.63	13.74	2	5.09
07/07/2013	La Luz	Coahuila	2660-27767	RD/RR:MV/RD	L	3	31	6.95	17.84	8	7.72

Table 9. continued

Date	Locality	State	USGS Band	Color Combo	Age	Fat	Wing Chord	Culmen	Tarsus	Tail	Weight
07/07/2013	La Luz	Coahuila	2660-27768	BK/RR:WH/DG	L	3	27	5.85	18.36	6	7.63
07/07/2013	La Luz	Coahuila	2660-27769	DB/OR:WH/RR	L	3	30	6.88	19.01	6	6.87
07/07/2013	La Luz	Coahuila	2660-27770	DB/RR:OR/DB	L	2	25	6.87	18.4	5	6.38
16/08/2013	Los Fresnos	Coahuila	2660-27781	MV/YE:MV/RR	L	1	25	9.4	20.8	11	8.3
16/08/2013	Los Fresnos	Coahuila	2660-27782	NB/RR:DG/YE	L	1	21	7.2	18.12	10	7.7
02/07/2013	Galeana	Nuevo León	2660-27716	BL/GR:YE/RR	L	3	38	3.45:4.48	17.84	10	8.31
02/07/2013	Galeana	Nuevo León	2660-27717	BL/RR:BD/BL	L	3	37	2.78:4.46	14.78	8	7.58
04/07/2013	Santa Rosa	Nuevo León	2660-27718	BD/MV:GR/RR	L	4	27	2.29:3.59	10.86	2	7.76
04/07/2013	Santa Rosa	Nuevo León	2660-27719	DG/DB:OR/RR	L	3	22	3.22:2.55	9.97	1	6.14
05/07/2013	Santa Rosa	Nuevo León	2660-27720	DG/RR:DB/OR	L	1	27	3.66:4.09	11.47	4	7.5
05/07/2013	Santa Rosa	Nuevo León	2660-27721	NB/RR:OR/BK	L	1	29	3.92:4.20	13.87	4	7.26
10/08/2013	Galeana	Nuevo León	2660-27722	NB/YE:WH/RR	L	1	23	3.66:2.95	9.99	1	4.96
15/08/2013	Santa Rosa	Nuevo León	2660-27723	PI/DB:DB/RR	HY	1	67	3.81:7.02	15.19	19	12.786
16/08/2013	Santa Rosa	Nuevo León	266027724	WH/RR:BK/GR	SY	2	55	3.66:7.18	13.71	42	10.206
10/07/2013	Capulin	Tamaulipas	2660-27736	-	AHY	1	57	8.93		44	9.39
12/07/2013	Capulin	Tamaulipas	2660-27737	-	HY	0	52	8.73		43	9.41
12/07/2013	Capulin	Tamaulipas	2660-27738	-	AHY	1	54	8.43		40	8.48
13/07/2013	Capulin	Tamaulipas	2660-27739	-	HY	0	53	9.43		39	9.10
13/07/2013	Capulin	Tamaulipas	2660-27740	-	AHY	0	56	10.13		40	9.08
14/07/2013	Capulin	Tamaulipas	2660-27741	-	AHY	1	55	9.23		44	8.70
15/07/2013	Arrieros	Tamaulipas	2660-27742	-	HY	1	55			42	9.53
15/07/2013	Arrieros	Tamaulipas	2660-27743	-	HY	1	51	9.93		43	9.13
16/07/2013	Capulin	Tamaulipas	2660-27744	-	AHY	3	56	10.6		45	10.11
17/07/2013	Capulin	Tamaulipas	2660-27745	-	AHY	0	56	8.6		43	9.07

Breeding Habitat

Nest Microhabitat

We located 65 active nests during 2013 in three states (n = 49 in Coahuila, 15 in Nuevo León, and 1 in Tamaulipas); plus 18 inactive nests among sites. Sixteen woody plant species were used as the supporting tree for nesting. Including both seasons and active and inactive nests in Coahuila (n=75), vireos demonstrated a preference for nesting in *Q. grisea* (34.7%), followed by *R. virens* (21.33%) and *Pistacia mexicana* (16%). In Nuevo León, *R. virens* was strongly used (88.2% of nests; Table 10). Average nest height was between 0.82 – 1.18 m, coinciding with heights reported by Graber (1961) in Texas (i.e., 1.12 m) and Oklahoma (0.88 m). The height of tree stands was higher than expected, reaching 3.84 m in Coahuila and a maximum height of 2.12 m in Nuevo León. The index of nest concealment averaged 46.97% in Coahuila and 44.75% in Nuevo León (Table 11). These values suggest that the vireos are highly selective, choosing nest heights within narrow ranges and a high degree of foliage cover at the nest.

Table 10. Main trees/shrubs used as nesting substrates in Sierra La Paila, Coahuila and Sierra Madre Oriental in Nuevo León

2012		2013					
Coahuila (n=11)*		**Coahuila (n=64)***		**Nuevo León (n=17)***		**Tamaulipas (n=2)***	
Quercus grisea	54.5%	*Quercus grisea*	31.3%	*R.virens*	81.25%	*S. secundiflora*	
Rhus virens	9.1%	*R. virens*	23.4%	*Quercus* sp.	6.25%	Unidentified shrub	
Pistacia mexicana	9.1%	*P. mexicana*	17.2%	*Vauquelinia corymbosa*	6.25%		
Bernardia myricaefolia	9.1%	*B.myricaefolia*	6.3%	*D. texana*	6.25%		
Acacia berlandieri	9.1%	*Amyris marshii*	6.3%				
Ugnadia speciosa	9.1%	*A. berlandieri*	3.1%				
		Fraxinus greggii	3.1%				
		Gochnatia hypoleuca	3.1%				
		Berberis trifoliolata	1.6%				
		Colubrina greggii	1.6%				
		Diospyros texana	1.6%				
		Sophora secundiflora	1.6%				

*Inactive nests were included

Tabla 11. Mean values of nest height, tree height, and tree concealment indices (95% CI) in Sierra La Paila, Coahuila and Sierra Madre Oriental in Nuevo León

	2012	2013	
	Coahuila (n=11)	**Coahuila (n=49)**	**Nuevo León (n=15)**
Nest height	1.32 m (1.05-1.58)	0.94 m (0.83-1.05)	1.00 m (0.82-1.18)
Tree height	3.84 m (3.15-4.52)	3.27m (2.79-3.75)	2.12 m (1.73-2.50)
Index of nest concealment	80.28% (62.05-98.51)	44.75% (41.11-48.38)	46.97% (39.92-54.01)

Territory and Patch Vegetation

We sampled a total of 1771 points in Coahuila, 669 in Nuevo León, and 425 in Tamaulipas (Figures 9-11). Data is being analyzed.

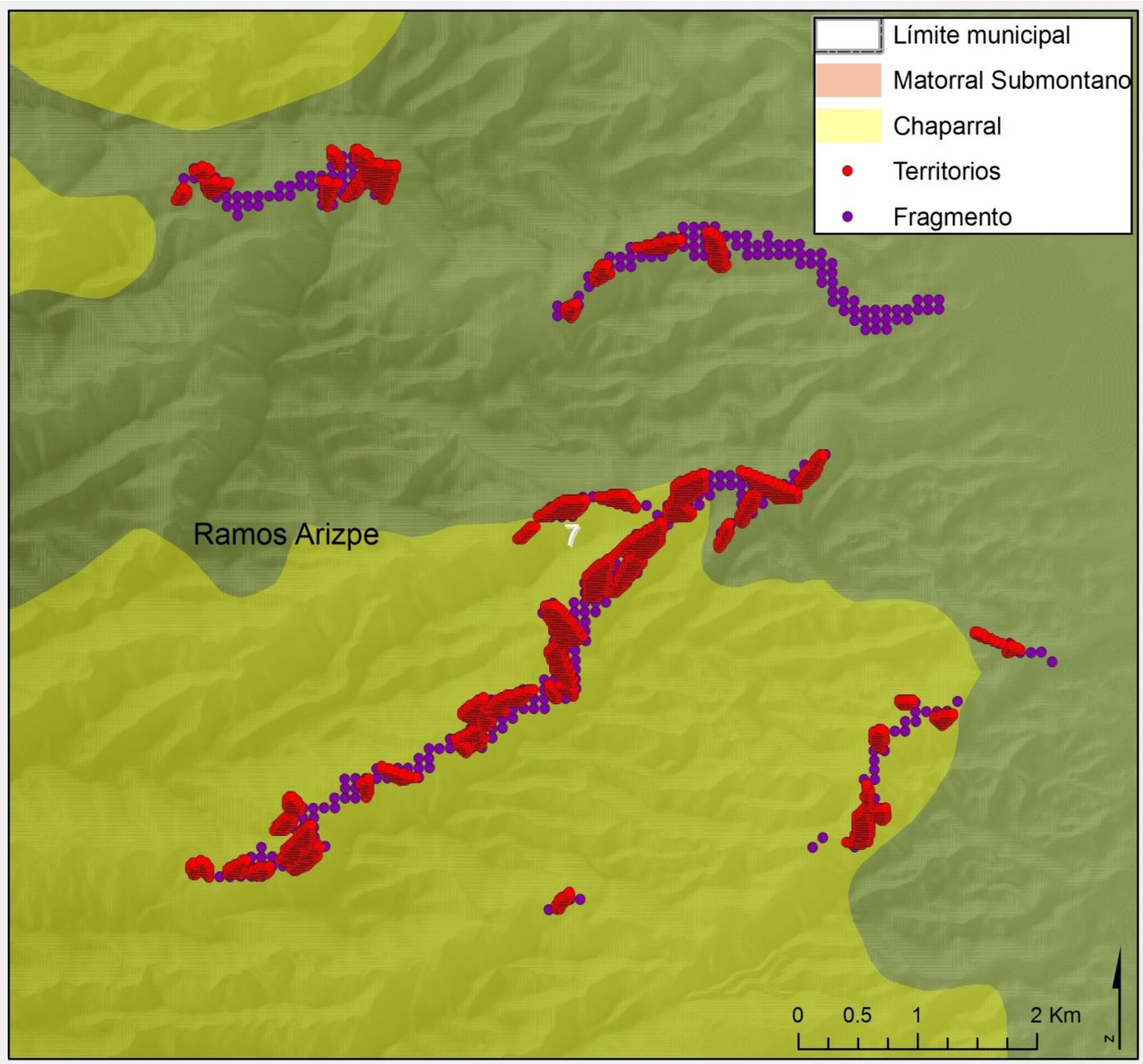

Figure 9. Vegetation sampling points within territories (red) and fragment vegetation (purple) in the Sierra La Paila, Coahuila.

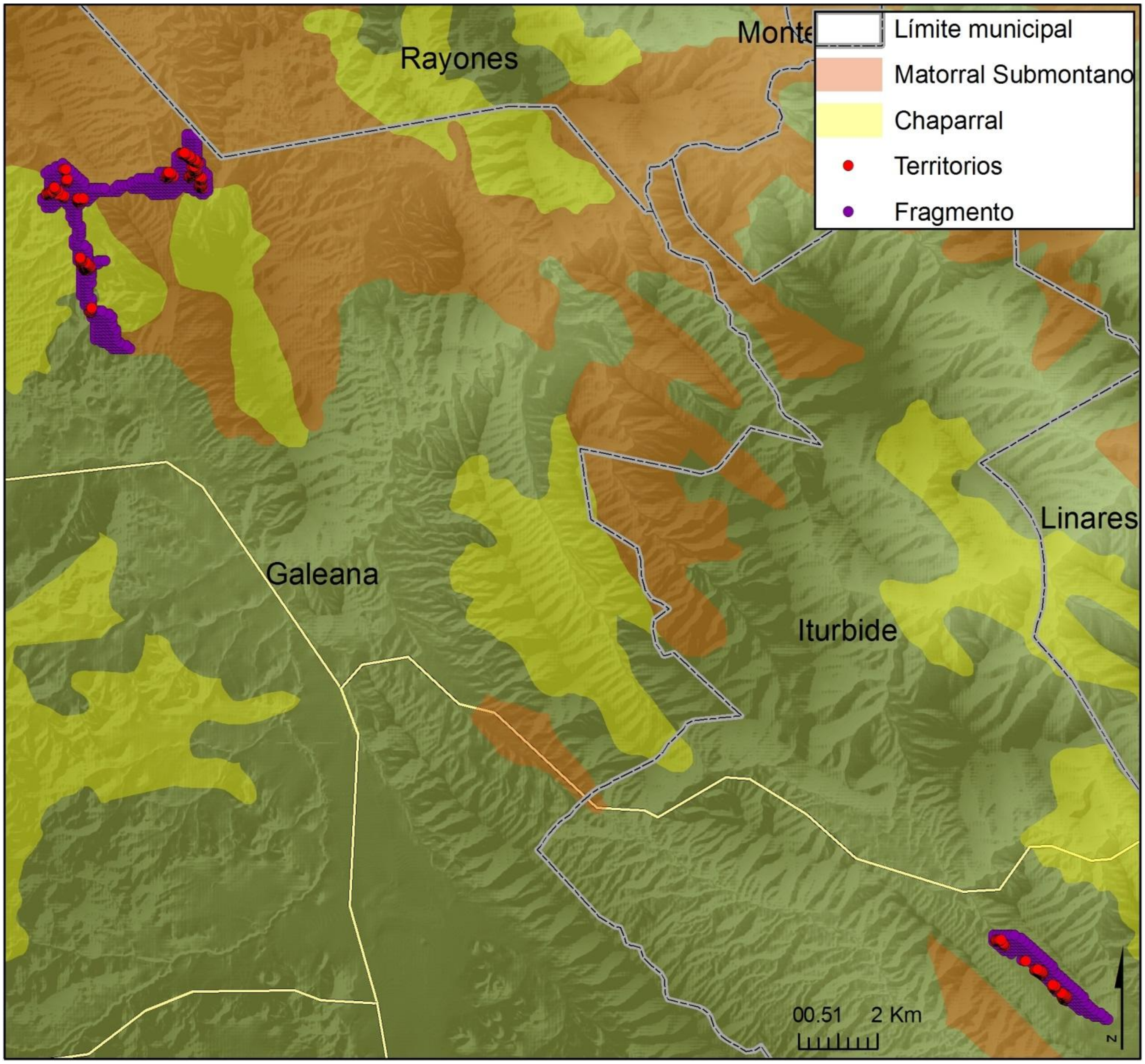

Figure 10.Vegetation sampling points within territories (red) and across landscape (purple) in Galeana, Nuevo León.

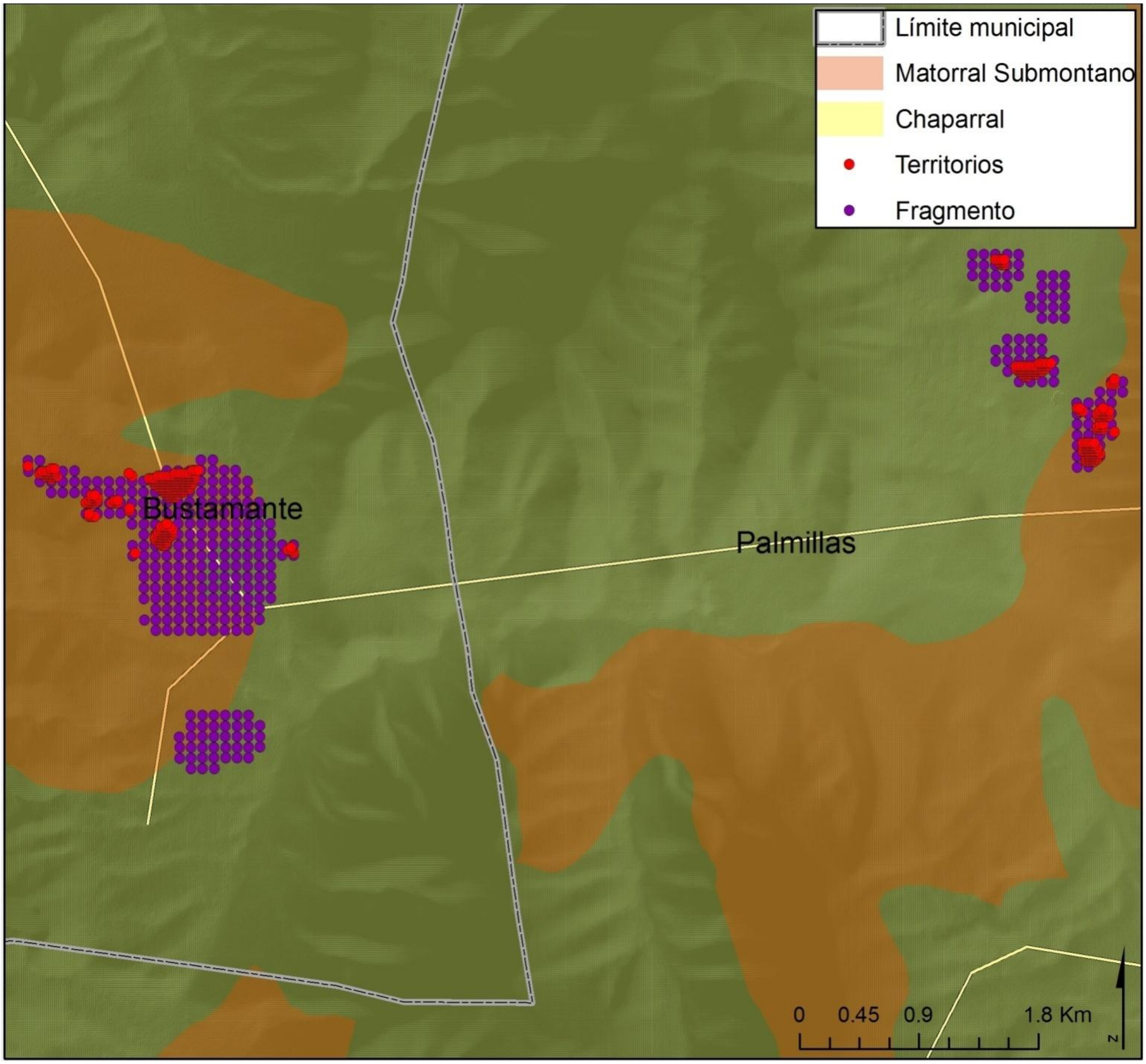

Figure 11.Vegetation sampling points within territories (red) and across landscape (purple) in Bustamante, Tamaulipas.

2012 Season

We sampled 126 points in three canyons in El Sotolar, 144 in La Luz, and 101 in El Fresno. We identified 56 plant species in the base of the Sotolar Canyon, the most important common being *Acacia berlandieri* (IV = 17.32%) and *Bernardia myricaefolia* (IV = 15.98%). Relative density, frequency, and height information are provided in Table 12. *Gochnatia hypoleuca*, *Fraxinus greggii, Dasylirion texanum, Agave lechuguilla,* were also important in this, the driest canyon. In the La Luz Canyon, we recorded 55 species, of which *A. berlandieri* (IV = 17.29%) and *B. myricaefolia* (IV = 17.05%) were again important and given by high frequencies and relative densities (Table 12). We identified 42 species in Fresno Canyon with *B. myricaefolia* (IV = 12.79 %) and *A. berlandieri* (VI = 8.33 %) again important, but taller species were also common (e.g., various species of oak, *Quercus* spp. especially *Q. gravesii* IV = 8%).

Table 12. Relative density (RD), relative frequency (RF), relative height (RH), and importance value (IV) of the flora of canyon El Sotolar, Sierra La Paila, Coahuila, 2012.

Species	RD	RF	RH	IV
Acacia berlandieri	16.47	14.84	20.66	17.32
Bernardia myricaefolia	16.47	15.63	15.85	15.98
Gochnatia hypoleuca	5.75	6.51	8.20	6.82
Fraxinus greggii	3.57	4.17	6.21	4.65
Dasylirion texanum	3.37	4.43	3.59	3.80
Lippia graveolens	3.77	3.65	1.99	3.13
Agave lechuguilla	4.76	2.86	1.66	3.10
Pistacia mexicana	2.18	1.82	4.19	2.73
Croton incanus	2.58	2.34	2.64	2.52
Rhus virens	1.98	1.82	3.08	2.29
Euphorbia antisyphilitica	2.78	3.13	0.96	2.29
Bahuinia uniflora	1.79	2.08	2.70	2.19
Croton dioicus	1.98	2.08	2.23	2.10
Hechtia glomerata	2.38	2.34	0.88	1.87
Calliandra eriophylla	1.98	2.08	1.00	1.69
Prosopis glandulosa	1.59	1.30	2.16	1.68
Vauquelinia corymbosa	1.19	1.30	2.53	1.67
Leucophyllum frutescens	1.79	1.82	1.23	1.61
Parthenium incanum	1.59	2.08	1.13	1.60
Salvia sp.	1.39	1.82	1.12	1.44
Guaiacum angustifolium	1.59	1.56	1.17	1.44
Mimosa texana	1.59	1.56	0.82	1.32
Larrea tridentata	1.59	0.78	1.32	1.23
Agave scabra	0.99	1.30	0.56	0.95
Berberis trifoliolata	0.79	1.04	0.87	0.90

Table 12. continued

Species	RD	RF	RH	IV
Celtis pallida	0.79	0.78	1.12	0.90
Quercus sp.	0.79	0.52	1.27	0.86
Zexmenia sp.	0.79	0.78	0.39	0.66
Opuntia engelmannii	0.79	0.78	0.37	0.65
Agave lophantha	0.79	0.78	0.30	0.62
Acacia rigidula	0.60	0.78	0.48	0.62
Citharexylum brachyanthum	0.60	0.52	0.67	0.60
Baccharis sp.	0.60	0.52	0.64	0.58
Agave striata	0.60	0.78	0.33	0.57
Ptelea trifoliata	0.40	0.52	0.64	0.52
Tecoma stans	0.40	0.52	0.49	0.47
Chamaecrista greggii	0.60	0.78	0.00	0.46
Forestiera reticulata	0.40	0.52	0.45	0.46
Viguiera stenoloba	0.60	0.26	0.45	0.43
Sophora secundiflora	0.40	0.52	0.37	0.43
Fouquieria splendens	0.40	0.52	0.34	0.42
Eysenhardtia polystachya	0.40	0.52	0.28	0.40
Acacia greggii	0.40	0.52	0.26	0.39
Karwinskia humboldtiana	0.40	0.52	0.26	0.39
Leucaena greggii	0.40	0.52	0.19	0.37
Yucca sp.	0.40	0.52	0.15	0.36
Dodonaea viscosa	0.40	0.26	0.34	0.33
Koeberlinia spinosa	0.40	0.52	0.00	0.31
Loganiaceae	0.40	0.52	0.00	0.31
Juglans microcarpa	0.20	0.26	0.40	0.29
Cercocarpus montanus	0.20	0.26	0.30	0.25
Diospyros texana	0.20	0.26	0.22	0.23
Condalia spathulata	0.20	0.26	0.22	0.23
Lycium berlandieri	0.20	0.26	0.11	0.19
Castela texana	0.20	0.26	0.10	0.19
Opuntia imbricata	0.20	0.26	0.07	0.18

At canyon La Luz, 55 species were recorded. Again, the most important elements were *Acacia berlandieri* (IV=18.07%) and *Bernardia myricaefolia* (IV=17.21%), given by high relative density, frequency and height values (Table 13).

Table 13. Relative density (RD), relative frequency (RF), relative height (RH), and importance value (IV) of the flora of canyon La Luz of the Sierra La Paila, 2012.

Species	RD	RF	RH	IV
Acacia berlandieri	17.36	17.21	19.63	18.07
Bernardia myricaefolia	19.44	14.65	17.53	17.21
Acacia greggii	6.08	6.28	6.03	6.13
Gochnatia hypoleuca	5.38	6.05	5.99	5.81
Fraxinus greggii	4.69	5.35	6.66	5.56
Lippia graveolens	3.82	3.95	1.91	3.23
Mimosa texana	3.65	3.26	2.67	3.19
Rhus virens	2.95	3.02	3.50	3.16
Pistacia mexicana	2.08	2.56	3.92	2.85
Leucophyllum frutescens	2.43	2.79	2.08	2.44
Karwinskia humboldtiana	2.26	2.56	1.56	2.12
Croton incanus	1.91	2.09	1.93	1.98
Forestiera reticulata	1.74	1.63	1.96	1.78
Parthenium incanum	2.08	1.86	1.34	1.76
Guaiacum angustifolium	1.74	1.63	1.46	1.61
Ptelea trifoliata	1.39	1.40	1.48	1.42
Castela texana	1.56	1.40	1.28	1.41
Cercocarpus montanus	0.87	1.16	1.86	1.30
Croton dioicus	1.22	0.93	1.50	1.22
Calliandra eriophylla	1.56	1.40	0.58	1.18
Condalia spathulata	1.04	1.40	0.97	1.13
Quercus grisea	0.69	0.93	1.49	1.04
Diospyros texana	0.87	1.16	0.84	0.96
Prosopis glandulosa	0.87	0.93	0.92	0.91
Rhus microphylla	0.69	0.93	1.07	0.90
Agave scabra	1.04	1.16	0.48	0.89
Chamaecrista greggii	1.04	0.70	0.76	0.83
Sophora secundiflora	0.69	0.93	0.64	0.76
Juglans microcarpa	0.52	0.70	0.97	0.73
Opuntia imbricata	0.69	0.70	0.59	0.66
Berberis trifoliolata	0.52	0.70	0.63	0.62
Dasylirion texanum	0.52	0.70	0.47	0.56
Anisacanthus linearis	0.52	0.70	0.44	0.55
Acacia rigidula	0.52	0.70	0.43	0.55
Euphorbia antisyphilitica	0.69	0.70	0.21	0.53
Bahuinia uniflora	0.52	0.47	0.61	0.53
Yucca sp.	0.35	0.47	0.38	0.40
Larrea tridentata	0.35	0.47	0.18	0.33
Citharexylum brachyanthum	0.35	0.47	0.17	0.33

Table 13. continued

Species	RD	RF	RH	IV
Gymnosperma glutinosum	0.52	0.23	0.21	0.32
Agave lechuguilla	0.35	0.47	0.10	0.30
Ungnadia speciosa	0.17	0.23	0.48	0.30
Leucaena greggii	0.17	0.23	0.45	0.28
Quercus sp.	0.17	0.23	0.31	0.24
Eysenhardtia polystachya	0.17	0.23	0.20	0.20
Vauquelinia corymbosa	0.17	0.23	0.18	0.20
Celtis pallida	0.17	0.23	0.18	0.19
Salvia sp.	0.17	0.23	0.18	0.19
Bumelia lanuginosa	0.17	0.23	0.13	0.18
Dodonaea viscosa	0.17	0.23	0.12	0.18
Garrya ovata	0.17	0.23	0.09	0.17
Ziziphus obtusifolia	0.17	0.23	0.09	0.17
Salvia ballotaeflora	0.17	0.23	0.07	0.16
Opuntia sp.	0.17	0.23	0.06	0.16
Hechtia glomerata	0.17	0.23	0.03	0.15

At canyon El Fresno, we identified 42 species. The most important trees were *Bernardia myricaefolia* (VI=11.39%), *Quercus gravesii* (IV=10.60%) and *Acacia berlandieri* (IV=7.99%; Table 14).

Table 14. Relative density (RD), relative frequency (RF), relative height (RH), and importance value (IV) of the flora of canyon El Fresno of the Sierra La Paila, 2012.

Species	RD	RF	RH	IV
Bernardia myricaefolia	14.36	11.22	8.59	11.39
Quercus gravesii	8.42	7.59	15.80	10.60
Acacia berlandieri	8.42	8.25	7.31	7.99
Fraxinus greggii	7.18	7.26	7.48	7.31
Quercus laceyi	4.70	3.96	7.36	5.34
Mimosa texana	5.69	5.61	4.61	5.30
Rhus virens	4.95	5.94	3.90	4.93
Eysenhardtia polystachya	4.70	5.28	4.02	4.67
Quercus grisea	4.95	4.62	4.38	4.65
Gochnatia hypoleuca	4.70	4.95	4.24	4.63
Garrya sp.	3.96	3.30	3.45	3.57
Dasylirion texanum	3.47	3.63	2.72	3.27
Cercocarpus montanus	2.97	2.97	3.78	3.24
Leucaena greggii	2.23	2.64	2.98	2.61
Croton incanus	2.23	2.64	1.55	2.14
Juniperus sp.	1.49	1.98	1.64	1.70

Table 14. continued

Species	RD	RF	RH	IV
Pinus sp.	1.49	1.65	1.87	1.67
Quercus sp.	1.49	0.99	2.47	1.65
Pistacia mexicana	1.24	1.65	1.25	1.38
Quercus invaginata	0.99	1.32	1.42	1.24
Dodonaea viscosa	1.24	1.32	0.91	1.15
Diospyros texana	0.99	0.99	0.98	0.99
Condalia spathulata	0.74	0.99	1.12	0.95
Rhus trilobata	0.74	0.99	0.62	0.79
Sophora secundiflora	0.74	0.99	0.43	0.72
Vauquelinia corymbosa	0.74	0.66	0.64	0.68
Berberis trifoliolata	0.50	0.66	0.44	0.53
Acacia greggii	0.50	0.66	0.41	0.52
Acacia rigidula	0.50	0.66	0.33	0.49
Chamaecrista greggii	0.50	0.66	0.24	0.47
Prunus serotina	0.25	0.33	0.65	0.41
Cupressus sp.	0.25	0.33	0.52	0.37
Lippia graveolens	0.50	0.33	0.18	0.33
Fouquieria splendens	0.25	0.33	0.39	0.32
Ptelea trifoliata	0.25	0.33	0.28	0.29
Bahuinia ramosissima	0.25	0.33	0.23	0.27
Juglans microcarpa	0.25	0.33	0.19	0.26
Koeberlinia spinosa	0.25	0.33	0.17	0.25
Bumelia lanuginosa	0.25	0.33	0.12	0.23
Mimosa sp.	0.25	0.33	0.12	0.23
Bahuinia uniflora	0.25	0.33	0.11	0.23
Quercus intricata	0.25	0.33	0.11	0.23

2013 Season

We characterized the plant community per state. For Sierra La Paila, Coahuila, mean woody plants height was 1.91 m, and the most dominant species were *Acacia berlandieri* (IV=19.15%), *Bernardia myricaefolia* (IV=10.07%), and *Gochnatia hypoleuca* (IV=10.07%; Table 15). However, overall search habitat for Nuevo León was taller (2.57 m) and dominated by *Rhus virens* (IV=14.79%), *Helietta parvifolia* (IV=14.79%), and *Fraxinus greggii* (IV=7.72%). It is worth mentioning that *H. parvifolia* was also the main species in an area were vireo were not detected. Finally, in Tamaulipas, mean shrub height was 2.02 m, and the woody plant community was dominetd by *Flourensia retinophylla* (IV=17.52%), an unidentified shrub (IV=9.08%), and *Leucophyllum revolutum* (IV=6.98%).

Table 15. Mean height, relative density (RD), relative frequency (RF), relative height (RH), and importance value (IV) of the flora associated to vireo surveys in Sierra La Paila, Coahuila, 2013.

Species	n	Mean Height	RD	RF	RH	IV
Acacia berlandieri	246	1.72	20.23	18.54	18.67	19.15
Bernardia myricaefolia	132	1.46	10.86	10.81	8.55	10.07
Gochnatia hypoleuca	105	1.91	8.63	8.99	8.85	8.82
Bauhinia uniflora	125	2.04	10.28	4.21	11.30	8.60
Fraxinus greggii	71	2.24	5.84	6.60	7.04	6.49
Rhus virens	45	2.04	3.70	4.78	4.06	4.18
Leucophyllum frutescens	44	1.45	3.62	3.98	2.82	3.47
Quercus grisea	32	2.71	2.63	2.73	3.84	3.07
Berberis trifoliolata	37	1.94	3.04	2.16	3.18	2.79
Pistacia texana	26	2.77	2.14	2.50	3.18	2.61
Acacia greggii	28	1.85	2.30	3.19	2.30	2.59
Croton incanus	28	1.35	2.30	2.73	1.67	2.23
Mimosa texana	28	1.78	2.30	2.16	2.20	2.22
Dodonea viscosa	24	1.25	1.97	2.39	1.32	1.90
Diospyros texana	21	1.91	1.73	1.93	1.78	1.81
Dasylirion palmeri	19	1.47	1.56	1.93	1.24	1.58
Vauquelinia corymbosa	15	2.48	1.23	1.59	1.65	1.49
Cercocarpus montanus	18	1.99	1.48	1.37	1.59	1.48
Yucca filifera	13	2.91	1.07	1.48	1.67	1.41
Yucca carnerosana	11	3.33	0.90	1.14	1.62	1.22
Croton dioicus	13	1.30	1.07	1.37	0.75	1.06
Prosopis glandulosa	8	2.05	0.66	0.91	0.73	0.76
Leucaena greggii	8	1.95	0.66	0.68	0.69	0.68
Opuntia imbricata	8	1.63	0.66	0.80	0.57	0.68
Porlieria angustifolia	7	1.56	0.58	0.68	0.48	0.58
Bauhinia ramosissima	6	1.63	0.49	0.68	0.43	0.54
Sophora secundiflora	6	1.57	0.49	0.68	0.42	0.53
Buddleja marrubifolia	6	1.43	0.49	0.46	0.38	0.44
Chamaecrista greggii	6	1.25	0.49	0.46	0.33	0.43
Fouquiera spledens	5	1.31	0.41	0.57	0.29	0.42
Sin_Identificar	4	1.70	0.33	0.46	0.30	0.36
Juniperus flaccida	4	1.60	0.33	0.46	0.28	0.36
Chilopsis linearis	4	2.63	0.33	0.23	0.46	0.34
Ptelea trifoliata	3	3.22	0.25	0.34	0.43	0.34
Larrea tridentata	4	1.30	0.33	0.46	0.23	0.34
Yucca sp.	3	2.57	0.25	0.34	0.34	0.31
Colunbrina texensis	3	2.30	0.25	0.34	0.31	0.30
Croton sp.	3	1.52	0.25	0.34	0.20	0.26

Table 15. continued

Species	n	Mean Height	RD	RF	RH	IV
Croton pottsii	3	1.47	0.25	0.34	0.19	0.26
Quercus sp.	2	3.75	0.16	0.23	0.33	0.24
Quercus intricata	2	4.50	0.16	0.11	0.40	0.23
Dasylirion texanum	3	1.50	0.25	0.23	0.20	0.22
Krameria ramosissima	3	1.47	0.25	0.23	0.19	0.22
Juglans microcarpa	2	2.70	0.16	0.23	0.24	0.21
Quercus mohriana	2	2.35	0.16	0.23	0.21	0.20
Forestiera angustifolia	1	1.90	0.16	0.23	0.17	0.19
Koeberlinia spinosa	2	1.53	0.16	0.23	0.13	0.18
Parthenium incanum	2	1.28	0.16	0.23	0.11	0.17
Condalia spathulata	2	1.20	0.16	0.23	0.11	0.17
Lippia graveolens	2	1.15	0.16	0.23	0.10	0.16
Condalia sp.	2	1.05	0.16	0.23	0.09	0.16
Juniperus sp.	1	5.50	0.08	0.11	0.24	0.15
Dasylirion sp.	2	1.75	0.16	0.11	0.15	0.14
Eysenhardtia parvifolia	2	1.70	0.16	0.11	0.15	0.14
Ungnadia speciosa	2	1.60	0.16	0.11	0.14	0.14
Agave scabra	2	1.15	0.16	0.11	0.10	0.13
Mimosa sp.	1	2.00	0.08	0.11	0.09	0.09
Salvia ballotaeflora	1	1.80	0.08	0.11	0.08	0.09
Acacia rigidula	1	1.70	0.08	0.11	0.08	0.09
Castela texana	1	1.70	0.08	0.11	0.08	0.09
Emorya suaveolens	1	1.40	0.08	0.11	0.06	0.09
Opuntia sp.	1	1.30	0.08	0.11	0.06	0.08
Ipomopsis aggregata	1	1.20	0.08	0.11	0.05	0.08
Juglans rupestris	1	1.10	0.08	0.11	0.05	0.08
Opuntia rastrera	1	1.10	0.08	0.11	0.05	0.08

Table 16. Mean height, relative density (RD), relative frequency (RF), relative height (RH), and importance value (IV) of the flora associated to vireo surveys in Iturbide, Galeana, and Rayones, Nuevo León, 2013.

Species	n	Mean Height	RD	RF	RH	IV
Rhus virens	153	2.12	15.68	15.17	13.53	14.79
Helietta parvifolia	95	3.56	9.73	8.54	14.12	10.80
Fraxinus greggii	77	2.27	7.89	7.95	7.31	7.72
Acacia berlandieri	59	2.93	6.05	6.33	7.23	6.53
Juniperus flaccida	36	3.42	3.69	3.24	5.14	4.02
Mimosa texana	44	1.60	4.51	3.98	2.94	3.81

Table 16. continued

Species	n	Mean Height	RD	RF	RH	IV
Fraxinus sp.	30	3.40	3.07	3.39	4.26	3.57
Cordia boissieri	23	3.23	2.36	3.24	3.10	2.90
Acacia rigidula	28	2.63	2.87	2.65	3.08	2.87
Quercus galeanensis	29	1.65	2.97	2.50	2.00	2.49
Gochnatia hypoleuca	24	2.00	2.46	2.65	2.00	2.37
Acacia sp.	27	1.20	2.77	2.80	1.36	2.31
Lindleya mespiloides	22	2.22	2.25	2.21	2.04	2.17
Pistacia mexicana	19	2.22	1.95	2.36	1.76	2.02
Celtis pallida	17	3.02	1.74	1.91	2.15	1.93
Amelanchier denticulata	21	2.47	2.15	1.47	2.17	1.93
Bernardia myricaefolia	21	1.22	2.15	2.21	1.07	1.81
Dodonea viscosa	18	1.93	1.84	1.91	1.45	1.74
Chilopsis linearis	13	4.54	1.33	1.18	2.46	1.66
Unidentified shrub	17	1.41	1.74	1.47	1.00	1.41
Berberis trifoliolata	15	1.36	1.54	1.77	0.85	1.39
Pinus sp.	8	7.33	0.82	0.74	2.45	1.33
Acacia greggii	12	2.00	1.23	1.18	1.00	1.14
Agave scabra	11	1.22	1.13	1.47	0.56	1.05
Comarostaphylis polifolia	10	1.92	1.02	1.03	0.80	0.95
Karwinskia humboldtiana	10	1.12	1.02	1.33	0.47	0.94
Krameria ramosissima	10	1.40	1.02	1.18	0.58	0.93
Tecoma stans	10	1.35	1.02	1.18	0.56	0.92
Sophora secundiflora	9	2.24	0.92	0.88	0.84	0.88
Croton sp.	8	2.34	0.82	0.74	0.78	0.78
Brongniartia magnibracteata	8	1.23	0.82	1.03	0.41	0.75
Leucophyllum sp.	6	2.65	0.61	0.88	0.66	0.72
Mortonia greggii	8	1.74	0.82	0.74	0.58	0.71
Ulmus sp.	4	6.38	0.41	0.44	1.07	0.64
Mimosa biuncifera	5	1.46	0.51	0.74	0.30	0.52
Acacia farnesiana	6	2.30	0.61	0.29	0.58	0.50
Vauquelinia corymbosa	4	2.63	0.41	0.59	0.44	0.48
Unidentified shrub	6	1.22	0.61	0.44	0.30	0.45
Quercus sp.	3	4.67	0.31	0.44	0.58	0.44
Yucca sp.	3	4.37	0.31	0.44	0.55	0.43
Yucca filifera	2	7.75	0.20	0.29	0.65	0.38
Quercus canbyi	2	7.50	0.20	0.29	0.63	0.38
Quercus virginiana	2	5.50	0.20	0.29	0.46	0.32
Yucca carnerosana	2	5.00	0.20	0.29	0.42	0.31
Leucaena greggii	3	2.47	0.31	0.29	0.31	0.30
Celtis laevigata	2	4.75	0.20	0.29	0.40	0.30

Table 16. continued

Species	n	Mean Height	RD	RF	RH	IV
Quercus intricata	4	1.40	0.41	0.15	0.23	0.26
Fraxinus cuspidata	2	5.25	0.20	0.15	0.44	0.26
Mimosa sp.	4	1.38	0.41	0.15	0.23	0.26
Diospyros texana	2	3.00	0.20	0.29	0.25	0.25
Bauhinia ramosissima	2	2.05	0.20	0.29	0.17	0.22
Condalia viridis	3	1.30	0.31	0.15	0.16	0.21
Guaiacum angustifolium	2	1.25	0.20	0.29	0.10	0.20
Agave striata	2	1.00	0.20	0.29	0.08	0.19
Caesalpinia mexicana	2	2.00	0.20	0.15	0.17	0.17
Condalia sp.	1	3.50	0.10	0.15	0.15	0.13
Cercocarpus sp.	1	3.00	0.10	0.15	0.13	0.13
Leucophyllum frutescens	1	2.00	0.10	0.15	0.08	0.11
Juniperus sp.	1	1.70	0.10	0.15	0.07	0.11
Salvia ballotiflora	1	1.40	0.10	0.15	0.06	0.10
Mimosa sp.2	1	1.20	0.10	0.15	0.05	0.10
Quercus sp.2	1	1.10	0.10	0.15	0.05	0.10
Senna sp.	1	1.10	0.10	0.15	0.05	0.10
Dasylirion sp.	1	1.00	0.10	0.15	0.04	0.10
Opuntia sp.	1	1.00	0.10	0.15	0.04	0.10
Zanthoxylum fagara	1	1.00	0.10	0.15	0.04	0.10

Table 17. Mean height, relative density (RD), relative frequency (RF), relative height (RH), and importance value (IV) of the flora associated to vireo surveys in Palmillas, Bustamante, and Jaumave, Tamaulipas, 2013.

Species	n	Mean Height	R Di	R fi	R Ai	IVi / 3
Flourensia retinophylla	145	2.04	18.40	15.43	18.74	17.52
Unidentified shrub	80	1.64	10.15	8.76	8.32	9.08
Leucophyllum revolutum	54	2.39	6.85	5.90	8.17	6.98
Dodonea viscosa	52	2.36	6.60	4.57	7.75	6.31
Rhus pachyrrhachis	43	1.55	5.58	5.90	4.31	5.26
Gochnatia hypoleuca	33	2.38	4.19	4.38	4.97	4.51
Sophora secundiflora	26	2.12	3.30	3.43	3.48	3.40
Zanthoxylum sp.	25	0.44	3.17	2.86	3.62	3.22
Dasylirion quadrangulatum	22	1.97	2.79	3.62	2.75	3.05
Agave striata	19	1.47	2.41	3.24	1.76	2.47
Acacia farnesiana	19	1.70	2.41	2.67	2.04	2.37
Acacia greggii	17	1.78	2.16	2.67	1.92	2.25
Helietta parvifolia	14	2.96	1.78	2.10	2.63	2.17

Table 17. continued

Species	n	Mean Height	R Di	R fi	R Ai	IVi / 3
Rhus virens	15	1.67	1.90	2.29	1.58	1.92
Acacia sp.2	14	1.56	1.78	1.90	1.38	1.69
Bauhinia sp.	12	2.14	1.52	1.90	1.63	1.68
Pinus nelsonii	10	3.47	1.27	1.52	2.20	1.66
Nolina sp.	12	2.13	1.52	1.52	1.62	1.55
Mimosa texana	14	1.30	1.78	1.52	1.15	1.48
Acacia rigidula	11	2.35	1.40	1.33	1.63	1.45
Dasylirion palmeri	11	1.45	1.40	1.71	1.01	1.37
Juniperus sp.	9	2.13	1.14	1.71	1.21	1.36
Brahea sp.	10	1.61	1.27	1.71	1.02	1.33
Eysenhardtia polystachya	9	1.56	1.40	1.14	1.09	1.21
Acacia schaffneri	10	1.49	1.27	1.33	0.94	1.18
Euphorbiaceae	7	1.60	0.89	1.14	0.71	0.91
Acacia sp.3	8	1.74	1.02	0.76	0.88	0.89
Juniperus sabinoides	4	4.00	0.51	0.57	1.01	0.70
Pinus sp.	4	2.93	0.51	0.57	0.74	0.61
Croton punctatus	4	1.70	0.51	0.76	0.43	0.57
Forestiera sp.	4	2.45	0.51	0.57	0.62	0.57
Quercus sp.	4	1.84	0.51	0.57	0.47	0.51
Quercus intricata	4	1.28	0.51	0.57	0.32	0.47
Croton hypoleucus	4	2.43	0.51	0.19	0.61	0.44
Prosopis glandulosa	3	3.30	0.38	0.19	0.63	0.40
Salvia sp.	3	1.20	0.38	0.57	0.23	0.39
Opuntia engelmannii	2	4.00	0.25	0.38	0.51	0.38
Acacia sp.	3	1.67	0.38	0.38	0.32	0.36
Cordia boissieri	3	2.67	0.38	0.19	0.51	0.36
Quercus pringlei	2	3.00	0.25	0.38	0.38	0.34
Yucca carnerosana	1	9.00	0.25	0.38	0.38	0.34
Mimosa sp.	2	2.65	0.25	0.38	0.34	0.32
Yucca sp.	2	3.00	0.13	0.19	0.57	0.30
Leucophyllum frutescens	2	1.55	0.25	0.38	0.20	0.28
Gymnosperma glutinosum	2	2.90	0.25	0.19	0.37	0.27
Brongniartia intermedia	2	1.25	0.25	0.38	0.16	0.26
Forestiera angustifolia	2	1.20	0.25	0.38	0.15	0.26
Leucophyllum revolutum	2	1.20	0.25	0.38	0.15	0.26
Agave lophantha	2	1.10	0.25	0.38	0.14	0.26
Acacia berlandieri	2	1.00	0.25	0.38	0.13	0.25
Calliandra conferta	2	1.00	0.25	0.38	0.13	0.25
Fabaceae	2	2.50	0.25	0.19	0.32	0.25
Neopringlea integrifolia	2	1.75	0.25	0.19	0.22	0.22

Table 17. continued

Species	n	Mean Height	R Di	R fi	R Ai	IVi / 3
Neopringlea sp.	1	3.00	0.13	0.19	0.19	0.17
Celtis sp.	1	2.70	0.13	0.19	0.17	0.16
Unidentified shrub	1	2.00	0.13	0.19	0.13	0.15
Opuntia imbricata	1	1.90	0.13	0.19	0.12	0.15
Decatropis bicolor	2	1.85	0.13	0.19	0.12	0.14
Pithecellobium elastichophyllum	1	1.60	0.13	0.19	0.10	0.14
Opuntia sp.	1	1.60	0.13	0.19	0.10	0.14
Acacia couteri	1	1.40	0.13	0.19	0.09	0.14
Verbenaceae	1	1.30	0.13	0.19	0.08	0.13
Agave scabra	1	1.10	0.13	0.19	0.07	0.13
Euphorbiacea	1	1.10	0.13	0.19	0.07	0.13
Macrosiphonia sp.	1	1.10	0.13	0.19	0.07	0.13
Astrocasia populifolia	1	1.00	0.13	0.19	0.06	0.13
Asteraceae	1	1.00	0.13	0.19	0.06	0.13
Cercocarpus macrophyllus	1	1.00	0.13	0.19	0.06	0.13

Threats

Some vireo breeding areas are quite steep. As a result, they may be unattractive for large-scale economic activities with the potential to affect the life cycle of the species. A possible exception may be the quarrying of minerals that has so far been restricted by the federal environmental authorities. The Sierra La Paila does have a mining history, and prospectors have explored the canyons for minerals in recent decades. So far, however, no major mining operations have been established. North of the entrance of the Fresno Canyon there is an area where a mining company once extracted stone materials, but this operation is not currently active. In addition, a proposal was submitted, but not approved, to extract dolomite in the northern portion of the Sierra de la Paila (SEMARNAT 2010). This or similar programs could affect plant cover and reduce vireo reproductive success if approved in the future.

The main economic activity in the area is small-scale livestock. Less than 10 cows are kept in Sotolar Canyon during the months of June to September. There are fewer than 20 in La Luz Canyon and approximately 40 in El Fresno Canyon. During our surveys, we observed cows feeding on shrub species that support vireo nesting at a height range that could disturb or even destroy vireo nests.

Limitations of the project

Survey locations

Access to private lands for presence surveys in the different blocks was limited due to time and space, such that only few surveys provided information regarding the potential breeding distribution in certain regions in the mountains.

Security

A lack of security in the northern states of Mexico required the team to use greater precautions (including increased downtime, revised schedules, and a need to secure equipment) in survey sites recognized by local people as unsafe. Similarly, our choice of survey locations was limited by the process of acquiring permission to access ranches and areas along rural roads with unknown security risks. In addition, a security incident in Coahuila in 2013 temporarily threatened the safety of project participants. As a result, we consulted with local people and decided not to further explore the central and northern Coahuila region (blocks 1-4).

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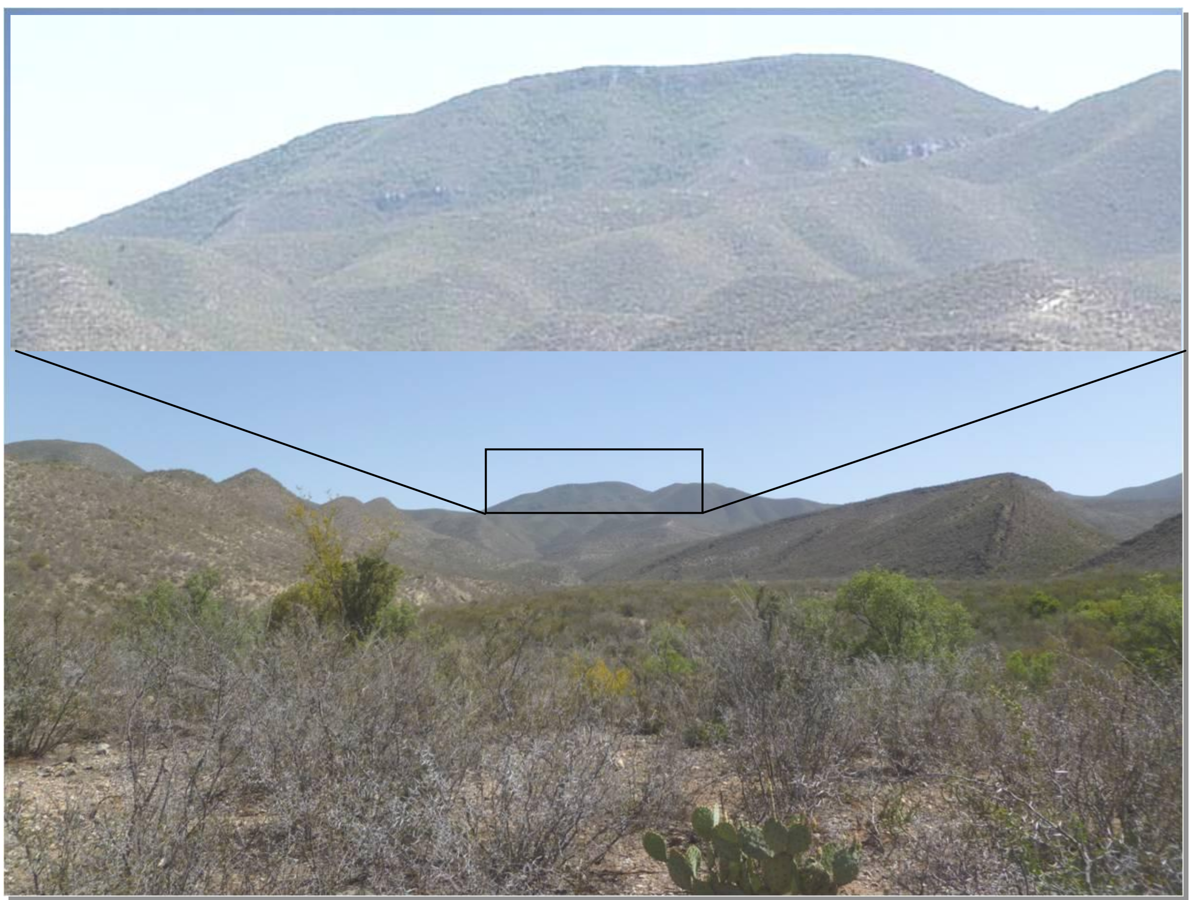
Photographic Gallery

Presence Surveys

Cerro el Mercado, Coahuila, 2012

Areas affected by fire in Rancho El Lantriscal, Coahuila, 2012

Mountains surrounding Zacatita Area, Coahuila, 2012



Potential breeding area in the mountains surrounding Zacatita, Caohuila, 2012

Localiy reported by Lanning in Marshall (1985), with vireo presence

Sierra de San Marcos y Pinos, Coahuila

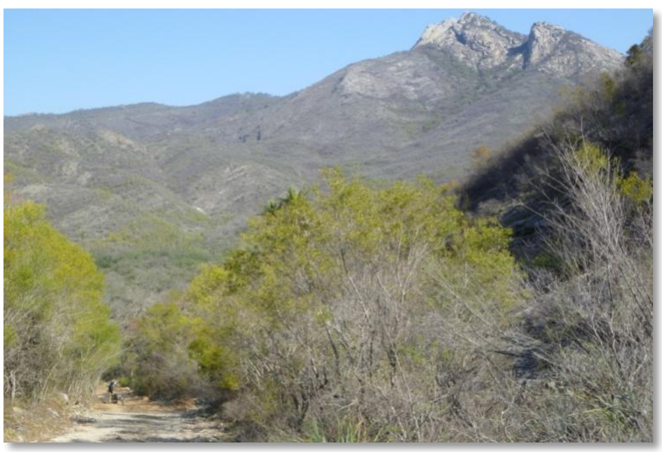
Sierra La Purisima, Coahuila, 2012

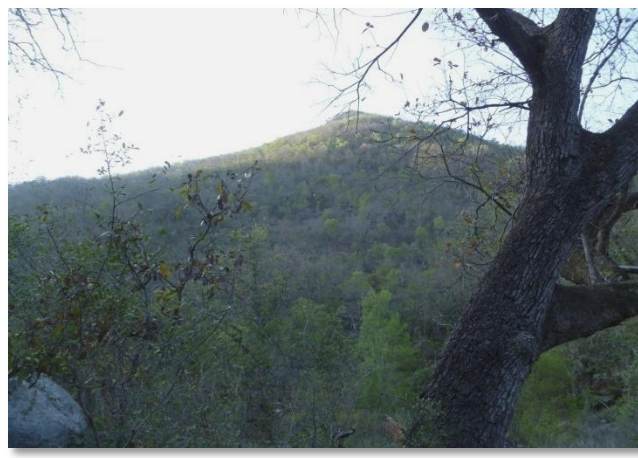
Vireo observed in Sierra San Marcos near Tanque de Noria, Coahuila

Vireo on *Quercus* branch.

Canyons at Sierra La Paila, Coahuila

Areas de *G. hypoleuca* without foliage



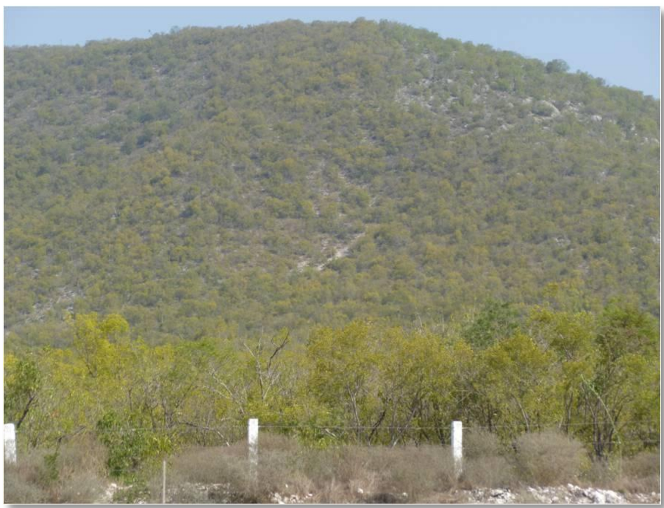


Sierra Picachos, Nuevo León

Canyon system located in the Sierra de Picachos, Nuevo León

Bustamante highway, Tamaulipas

Locality El Capulin with vireo detection



Shrubs on Rio Verde - B. Juarez highway, San Luis Potosí

Shrubs on Cerritos (S.L.P.) - Tula (Tamaulipas) highway

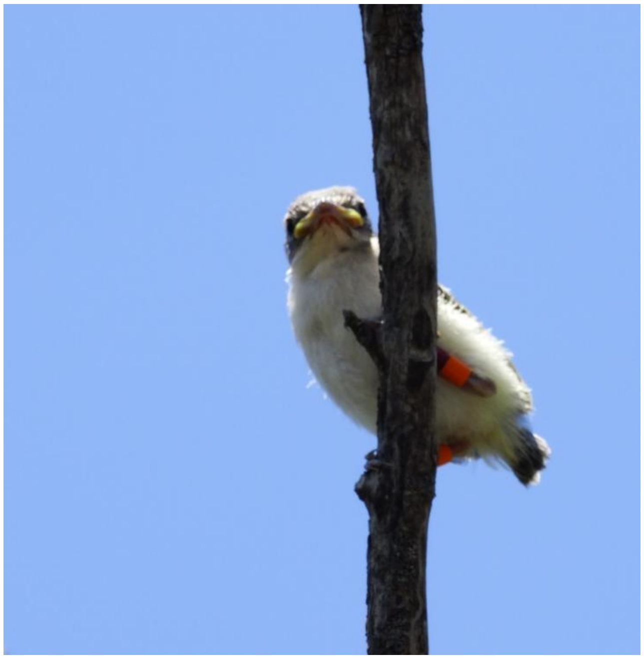
Canyon south of Amoles, San Luis Potosí

Potential habitat south of Amoles, San Luis Potosí

View of Cerro El Potosí and oak forests as the main vegetation

Nesting

Vireo nests during the construction, incubation and nestling stages



Banded fledgling in the Sierra La Paila, Coahuila (left). Fledgling in Sotolar canyon of the Sierra La Paila, Coahuila (right)

Vireo juvenile in the Sierra La Paila, Coahuila

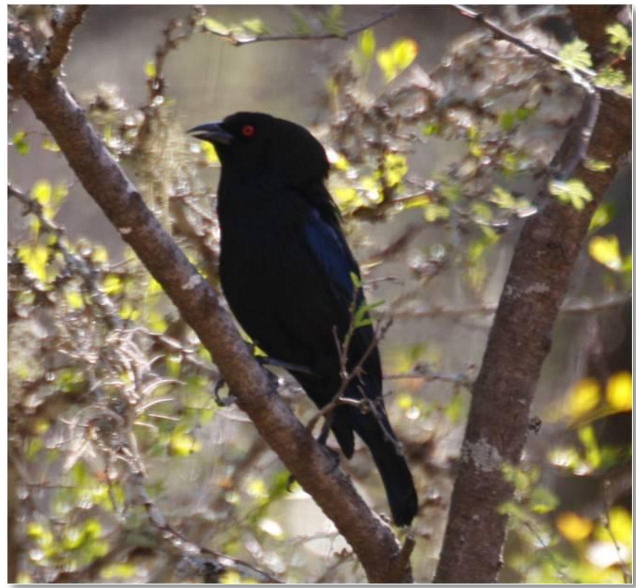
Potential predation /Parasitism

Coluber schottii at Cañon la Luz, Sierra La Paila, Coahuila, 2012

Masticophis taeniatus in Sierra La Paila, Coahuila, 2013

Micrathene whitneyi in Sierra La Paila, Coahuila, 2013

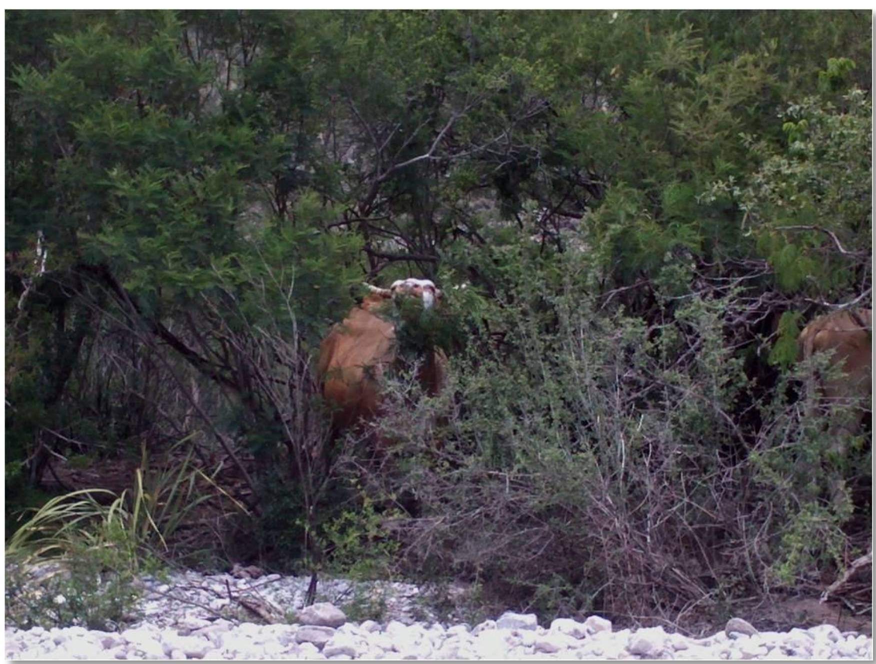
Birds of prey recorded in the three canyons on the Sierra La Paila, Coahuila, 2012

Molothrus ater and *M. aeneus*

Vireo nest parasitized with cowbird egg in the Sierra La Paila, Coahuila, 2013

Memphitis memphitis in Sierra La Paila, Coah.



Cattle feeding on of La Luz, Sierra La Paila, Coahuila