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**Black-capped Vireo Survey
Big Bend National Park, Texas
2009**

Lars Y. Pomara
Department of Geography and the Environment
University of Texas at Austin

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Science and Resources Management
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Introduction and summary

This document reports the 2009 survey of the Black-capped Vireo (*Vireo atricapillus*, hereafter, bcvi) population inhabiting the Chisos Mountains in Big Bend National Park, Texas (hereafter, the Chisos). The goal of the survey was to evaluate habitat occupancy by bcvi in areas traditionally searched during previous annual surveys, and some new areas that appeared to provide adequate habitat, using methods and a search intensity similar to those used in previous surveys. I had the additional goal of recording the vocalizations of as many bcvi as possible. Barlow and Griffin (1988) provided a brief but informative history of bcvi observations in the Chisos, as well as an outline of objectives that has generally remained consistent for the annual bcvi survey to date.

At the time of the 2009 survey, researchers at Texas A&M University were involved with a state-wide bcvi survey, including the Chisos population. The efforts of the A&M crew in Big Bend were coordinated with mine, so that much more area was searched than would otherwise have been possible. The locations of all bcvi detected by the A&M crew were generously contributed to this report.

The A&M crew and I searched nine major areas between 21 and 29 May, 2009 (the A&M crew worked between 25 and 28 May), locating 36 male and 5 female bcvi, and observing nestling or fledgling food provisioning by adult pairs at two locations. In addition to confirming occupancy of all general areas that are usually included in the annual bcvi survey, a substantial number of birds were observed in additional areas, some of which have not been included in past surveys. The unusually large number of birds observed, relative to past years, can partly be attributed to greater search effort, but it also indicates a continuation of the relatively high levels of occupancy seen in recent years.

The areas searched and the locations of bcvi detections are shown on Map 1, and more detailed locations are shown on additional maps. The spatial files displayed on the maps, including all geographic coordinates, constitute part of this report and have been deposited at the Science and Resource Management Division of Big Bend National Park. Most of the singing males observed by LYP were sound-recorded, and all audio files are available to the Park Service upon request.

Acknowledgements

As, I presume, in most years, this survey would hardly have been possible without the guidance and assistance of park Wildlife Biologist Raymond Skiles. The Texas A&M bcvi survey crew provided crucial data, and crew leader Ardath Lawson was particularly helpful in coordinating survey efforts. Thanks also to Betty Alex for assistance with GIS data. This survey was carried out under US National Park Service Scientific Research and Collecting Permit #BIBE-2009-SCI-0033.

Survey Methods

Site selection

Two principal criteria were used to prioritize areas in the Park for searches, which addressed the dual objective of monitoring historically occupied areas and documenting new areas (Barlow and Griffin 1988, Griffin and Barlow 1989). Reports from previous years were used to compile a list of areas where bcvi have been observed in the past. Consistently occupied areas such as Juniper Canyon, Blue Creek Canyon, and the Basin were given highest priority, mainly because they have also been the most consistently visited across all survey years and therefore probably provide the best indication of inter-annual changes in the total Chisos population (although surveys have never been standardized, and assumptions about the relationship between survey results and true population changes are risky at best). I was also interested in a few areas that have been visited only once or a few times but that have not been consistently monitored or have not been visited in recent years. In particular, the north slope of Pulliam Ridge has not been a survey priority since birds were not found there during either the 1996 or 1997 surveys (Peck and Barlow 1997), but it has historically been occupied (Griffin and Barlow 1989). Historical observations and early survey results also suggested that Oak Spring, Cattail Spring, and Panther Canyon would be of interest (Barlow and Griffin 1988).

The second approach was based on assumptions about bcvi habitat associations and the appearance of habitat in digital aerial photos (USGS digital orthophoto quadrangles or DOQs). There are a number of general locations in the Chisos that have apparently not been included in past surveys due to time restrictions and difficulty of access, but that appear in aerial photos (and, at coarser spatial resolutions, in satellite imagery) quite similar in vegetation structure to areas that are known to be occupied. There are, in fact, more such areas than could be searched, given time and budget restrictions. Priority was given to a few promising areas that were near other occupied sites, on the basis of the assumption that groups of territorial individuals are clustered due to social facilitation or pseudo-colonial behavior, as has elsewhere been postulated for the species (Graber 1961, Ward and Schlossberg 2004). In particular, I made an effort to significantly increase the search areas in and around Pine and Juniper Canyons. Searches have traditionally included only the areas along the trails that follow the primary washes of these two canyons, whereas aerial photos suggested that the majority of potentially suitable habitat is located off-trail in the upper reaches of the northern forks of both canyons. It should also be noted that Raymond Skiles' intimate knowledge of the Chisos landscape was helpful in identifying promising, but non-obvious, search areas.

Field Methods

I visited search areas only once, with few exceptions. However, the A&M team searched several areas that I also searched (areas of overlap are shown on Map 1), and some portions of the Basin and Green Gulch were covered on two mornings by the A&M crew. Observers visited places that appeared to offer appropriate habitat within the general search areas, detecting birds by sight and sound (initial detections were almost exclusively by sound). Special attention was paid to specific locations that were indicated as occupied in previous years, using maps and/or geographic coordinates from previous reports to find the locations with a GPS in the field. No particular protocol was followed with regard to search method or observation times; rather, I attempted to balance the need to visit as much apparently suitable habitat as possible with the need to spend sufficient time in each location, moving slowly and as quietly as possible.

Song playback was used extremely conservatively, and in several of the general search areas it was not used at all. However, I made an effort to record all singing male bcvi that I encountered, as well as any vocalizing females. Recordings were made with a Sennheiser shotgun microphone and a Marantz digital recorder.

The locations of observed birds were recorded with a Garmin GPS. Usually, a single point was recorded, and additional movements of the individual were recorded as meters and azimuth degrees from the original location, using a compass and visually estimating distance. Upon locating a male, extra time was spent in the area to search for a female, fledglings, or a nest. Emphasis, however, was placed on finding occupied territories rather than on finding females and nests. Whenever practical, attempts were made to see singing birds; in a few cases this was highly impractical and birds were not seen.

Methods used by myself and by the A&M crew were similar, although A&M crew members did not make sound recordings or utilize playback, and generally did not record more than a single location for an individual bird. The A&M crew collected additional vegetation data that I did not collect, and that is not reported here.

Estimation of numbers

It is assumed that there are, in any year, more bcvi in the Chisos than can be located during a survey of this brevity. Indeed, it is likely that individuals are overlooked even within the areas searched, given the fact that most sites are visited only once. Thus, my goal was only to estimate a conservative minimum of individuals detected.

When two observations were within 200 meters of one another, and could not be safely assumed to be distinct individuals due to counter-singing or other simultaneous observations, they were assumed to be the same individual. Distances were estimated both in the field with a GPS, and later in a GIS. The 200 meter limit is arbitrary, but loosely based on assumptions about typical territory sizes for the species (e.g., Cimprich 2009). Additional information based on the movements of individual birds occasionally helped suggest territorial boundaries. In nearly all cases, observations that were determined to be of distinct individuals were either significantly further apart than 200 meters, or were confirmed by simultaneous observation.

Maps were made in ArcMap 9.3, using a Digital Elevation Model provided by the US Park Service and DOQs downloaded free of charge from USGS. Areas that I searched were visually estimated from the aerial photos and digitized in ArcMap, usually the afternoon after having visited the site. I also digitized the areas searched by the A&M crew, on the basis of verbal and written descriptions from Ardath Lawson. Because I had more specific knowledge of the areas that I searched, those areas are more precisely represented on Map1 than are the areas searched by the A&M crew. There is undoubtedly some error involved in both cases.

Survey Results

About 170 person-hours were spent searching for bcvi between 21 and 29 May, 2009, resulting in the location of 36 male and five female individuals. Four of the females were observed with males as apparently mated pairs, and of those four pairs, two were observed making food provisioning trips to nestlings or fledglings. The juvenile birds were not observed, and no nests were located. The locations of all detections, and the extent of the areas searched, are shown in Map 1. No banded individuals were observed, despite efforts to determine the banding status of all birds that could be seen.

The following area accounts include detailed information only for the areas searched by LYP, although detailed information was provided by the A&M crew for Pine Canyon. Survey times for the A&M crew are approximate. When more than one A&M crew member was deployed in an area on the same day, the number of surveyors is indicated. When multiple surveyors searched an area, single surveyors searched separate parts of the area; thus, the total search time is based on individual person-hours.

Green Gulch—Three male bcvi. Map 2.

LYP: 21 May, 07:45-08:20 and 12:30-16:45; 23 May, 07:10 to 13:00.

A&M: 25 and 27 May, approximately 07:00 to 13:00.

The lower portion of Green Gulch was surveyed by LYP, focusing on locations that were occupied in 2008 (Troy 2008). Two of the males I observed were located fairly near 2008 locations, while bcvi 2 (Map 2) was distant from any 2008 location. The upper portion of Green Gulch and the lower portion of Maple Canyon were searched by members of the A&M crew, but no additional bcvi were detected. In particular, it was surprising that no bcvi were detected in the low wash between lower Maple Canyon, the south margin of Pulliam Ridge, and the Basin Road, given that it has been fairly consistently occupied in past years (including 2008) and was probably the most intensively searched area in 2009.

Pulliam Ridge—four male bcvi. Map 3.

LYP: 21 May, 08:20-12:30; 24 May, 06:45-14:30.

The earliest Black-cap surveys indicate occupancy of washes along the north margin of the ridge, but the area has apparently not been searched in since 1997 (I did not systematically review all reports to find the date of the last visit, but none of the reports I reviewed gave any indication that the area had been considered after no birds were detected in '96 or '97). A singing male was located in each of the two washes that were occupied in 1988 and '89 (Photo 4), and two additional males were located in new areas. I did not reach the westernmost wash that was occupied in 1989, and there appeared to be additional sites with appropriate habitat further west and south along the ridge that should be searched in the future. The entire area should be considered important for future survey efforts.

Panther Canyon—Two male and one female bcvi. Map 4.

LYP: 22 May, 07:00-12:45.

One singing male was located at the confluence of the north and main forks of the canyon (Photos 1 and 2), and another was located near the furthest extent of appropriate habitat up the north fork. A female was also observed at the second location, but no nest-related behavior was observed during approximately 10 min of observation of the female and 30 min of observation of the male. The earliest bcvi surveys indicate occupancy of the same general area, but Panther Canyon was not searched in most subsequent years. Maresh (2004) indicates that Black-cap occupancy of the canyon had not been recorded before 2004, and that the canyon had not been surveyed. In fact, there were individuals reported in 1980 and 1986 (Barlow and Griffin 1988, Griffin and Barlow 1989), and the first two annual surveys included the canyon but did not produce bcvi observations. Birds were detected in 2006 and '07 but not in '08 (Troy 2008).

Juniper Canyon—Seven male and one female bcvi; pair provisioning nest or fledglings. Map 5.

LYP: 25 May, 06:45-14:00

A&M: 25 May, 06:45-14:00; three surveyors.

The primary wash in middle Juniper Canyon has been described as the most consistently occupied bcvi habitat in Big Bend, and four singing males were heard and seen in the same general reach of the wash where they are typically found. Two smaller secondary washes were also searched, one on either side of the primary wash and near the lower margin of apparently suitable habitat. The northern of those two washes was occupied in 2008 (Troy 2008), but no bcvi were detected in either wash in 2009. Four singing males were encountered in the primary wash where bcvi have typically been found, including two counter-singing individuals (bcvi 11 and 12).

Few, if any, annual surveys have included upper Juniper Canyon beyond the confluence of the Juniper and Boot Canyon washes. This area lies to the north of the trail, as the trail veers west into the increasingly forested lower portion of Boot Canyon (Maps 1 and 5). Whereas the habitat along the trail becomes increasingly unsuitable for bcvi, there is a very large area of apparently suitable habitat in the upper canyon to the north, which is very difficult to reach due to the lack of trails and the thick, chaparral-like vegetation (Photo 5). Four bcvi, comprising three singing males and one adult female, were observed within a small portion of this large area. The female was paired with one of the males, and the pair were observed carrying food items to concealed nestlings or fledglings. I could not locate the young birds, but the provisioning adults returned to the same place several times, probably indicating either nestlings or fledglings only a few days out of the nest. This male also actively counter-sang with the neighboring male immediately to the northwest. This portion of Juniper Canyon, which may actually represent a larger expanse of suitable habitat than the primary wash along the trail, should be considered a priority for future surveys, despite difficulty of access.

Oak Spring and Cattail Spring—three male bcvi. Map 6.

LYP: 26 May, 18:30-20:30.

A&M: 26 May, approximately 07:00-12:00.

There has been at least one historical record of a bcvi in the wash vegetation below Cattail Spring, but annual surveys have included the easily accessed area only intermittently. Two singing males were detected in the relatively tall vegetation (very similar to that found in Panther Canyon; see Photo 1) along the middle reach of the Cattail Spring wash, and one singing male was detected in similar habitat in the Oak Spring wash. The Oak Spring male was found quite near the Window pour-off; an additional, later observation of a male bcvi from the switchbacks area of the lower Window trail was extremely near the Oak Spring observation, and was assumed to be the same male.

Blue Creek Canyon—four male bcvi. Map 7.

LYP: 27 May, 06:45-15:30.

Only the main stem of Blue Creek, along the trail, was surveyed due to time limitation. Three males were detected and recorded as they sang. An additional male (bcvi 20) was detected by response to playback at a location that was occupied in 2008 (Troy 2008). All birds were also seen. No females were detected. Territories were located along the same general portion of the canyon where bcvi have typically been observed in previous years. However, the lowest-elevation observation was significantly lower than the lowest of 2008, and the highest observation was significantly higher than the highest of 2008, despite the same number of observations in both years. It is possible that some territorial males were not detected in one or both years, or that the distribution of territories along the creek wash was more dispersed in 2009 than in 2008.

Pine Canyon—Seven male and two female bcvi; one apparently mated pair. Map 8.

A&M: 27 May, approximately 07:00-13:00; four surveyors.

The area in Pine Canyon that has usually been searched in previous surveys, consisting of the main wash along the trail, the secondary wash paralleling it to the north, and surrounding slopes, was searched in 2009, with no bcvi detected. Some apparently appropriate wash vegetation along the southern margin of the Pummel Peak ridge, just northeast of the trailhead parking lot, was also searched with the same results.

All nine bcvi detected, comprising two females and seven singing males, were widely scattered within the valley to the north of the main canyon, roughly between the trailhead and Smuggler's Gap (Map 1). This is an area that has apparently not been included in previous surveys, despite relative ease of access and a large expanse of apparently suitable habitat. In past years, one or two territories have occasionally been observed near the Pine Canyon trailhead, but not further up-canyon along the trail, and even those few occupied territories have not been confirmed consistently across years. It may very well be that the northern canyon has been consistently occupied for a number of years, and the few territories occasionally found near the trailhead represent the southern edge of the primary occupied area. This represents the largest group of bcvi found in the Chisos in 2009; contrary to previous consideration of Pine Canyon as a marginal area for bcvi, the northern fork should be a priority for future surveys.

The Basin/Window/Lost Mines—Six male and one female bcvi; pair provisioning nest or fledglings. Map 9.

LYP: 28 May, 08:00-13:45.

A&M: 25 May, approximately 07:00-13:00; 28 May, 07:00-13:00; four surveyors.

As in most years, multiple bcvi territories were located in the general basin area. It should be noted that two separate males were located near the settling ponds below the Basin campground (Map 9), an area where bcvi have not consistently been observed. Plans for the improvement of the facilities in that specific area should take into consideration the potential influence of development activities on bcvi habitat and habitat occupancy, particularly as regards wash vegetation. Those two males were observed less than 200 meters apart, counter-singing.

A singing male was observed near the road switchbacks below the Lost Mines trailhead, and four additional males were observed in the general area of the upper portion of the Window trail, including those near the settling ponds. One male was observed very near the Window pour-off (bcvi 35), and indeed was nearer to the male observed below the pour-off at Oak Spring (bcvi 24) than to the other Basin territories.

The male observed singing near the Window trail just below the trailhead at the Basin Loop (bcvi 22) was paired with a female that was observed making several food provisioning trips to either nestlings or fledglings, while the male actively sang nearby. As was the case for the food provisioning trips observed in Juniper Canyon, the location of food delivery did not change during the observation period, suggesting either a nest or very young fledglings.

Laguna Meadows—no bcvi detected.

LYP: 29 May, 08:45-12:30.

A&M: 26 May, approximately 08:00-13:00.

Two bcvi records exist near Laguna Meadows, in 1974 and 1987 (Barlow and Griffin 1988), before and after the 1980 Laguna Meadow fire, and both before the 1989 Blue Creek fire. The area has intermittently been included in annual surveys. Despite habitat in several locations that seemed at least structurally appropriate, and despite two visits to the area, no bcvi were detected in 2009.

Additional notes

Both male and female Brown-headed Cowbirds (*Molothrus ater*) were generally present in all surveyed areas, excepting Pine Canyon, for which I did not receive information on the species from the A&M crew, but where it is also very likely to occur. At least a few singing male Grey Vireos (*Vireo vicinior*) were present in all the survey areas, generally at slightly higher, but overlapping, elevations than bcvi, as reported in past years. Several pairs were also observed, and a nest was found under construction in a small upper canyon along the north margin of Pulliam Ridge, in a Grave's Oak (*Quercus gravesii*). Bell's Vireo (*Vireo bellii*) were also present in significant numbers at all locations other than the Basin and Laguna Meadows, generally in wash vegetation at slightly lower elevations than bcvi, but again overlapping and sometimes occupying the same vegetation patches. At one location in Panther Canyon (bcvi 3), all three species were observed using the same general area; no agonistic behavior was observed among vireo species at any location. As has been reported in some past surveys, bcvi were observed

strongly mobbing Mexican Jays (*Aphelocoma ultramarina*), a probable nest predator, in the Basin and in Blue Creek Canyon.

Discussion

The 2009 breeding season appears to be at least as good as any on record for bcvi in the Chisos Mountains, continuing a series of recent years in which larger than average numbers have been detected. Only two instances of nesting activity were observed, primarily because the focus of the survey was on determining occupancy rather than breeding activity. In those two cases, however, adults brought relatively large food items to nestlings or fledglings (it was not determined which in either case), indicating that by 25 May (Juniper Canyon) and 28 May (the Basin), those pairs had either fairly well-developed nestlings or recently fledged young.

The annual bcvi survey at Big Bend has never been methodologically standardized across years, and comparisons among years can only be made very cautiously, with the recognition that varying survey effort can partly account for varying results. The 2009 survey represents the highest count of bcvi individuals, and of singing males, on record. This can partly be accounted for by the increased search effort afforded by the contribution of the A&M team, but it also falls in line with above-average numbers observed during the past several years. The unusually large number of birds detected also accords with the favorable weather conditions seen in the first half of 2009, which themselves represent a continuation of generally favorable conditions over the past several years. At a minimum, it can be said that the Chisos bcvi population has not been in decline over the short term.

Recommendations for optimizing occupancy surveys

I consider it unlikely that the recent trend in survey results can be accounted for by the high degree of variability in search effort alone. The influence of search effort should not, however, be discounted. The 2009 survey represents a more intensive and extensive effort than has been deployed in recent years, and this has almost certainly contributed to the correspondingly higher bcvi count. Importantly, this implies that there are multiple bcvi individuals that typically go undetected due to low search effort, a further implication being that little is known of the true size of the Chisos bcvi population. Gaining a better understanding of the Chisos population size, and variations in size and habitat occupancy across years, would not necessarily require dramatically increased search effort (although that would certainly help). Another approach would be to vary the search area across future years to include a few new areas each year, eventually accumulating information about most areas that harbor apparently suitable habitat. This would require sacrificing information about a few of the traditionally surveyed areas each year, but such sacrifices could be rotated so that no primary area goes unsurveyed for two consecutive years. The benefit of learning the full spatial extent of the habitat that is at least occasionally used by bcvi in the Chisos Mountains may outweigh this loss.

An additional way to mitigate the loss of information about those areas not surveyed in a given year would be to establish a standard search area and search effort that is employed consistently every year, but which is considerably smaller in area and less time-consuming than the typical survey efforts of past years. Thus, a standard search of a 'core' area would occur each year, alongside the wider exploration of new areas. The benefit of the standard search would be

an increased ability to discern inter-annual trends for at least a representative portion of the Chisos population. Recommended sites for inclusion in a standard search would be those that have been most consistently included in past surveys: the Juniper Canyon trail, the Basin from the road switchbacks below Lost Mines trailhead to the Window, the Blue Creek Canyon trail, and possibly a portion of Green Gulch along the Basin Road. Because these areas have easy road and trail access, they can be searched relatively rapidly, leaving time to explore new sites. Trails would also be useful in a standard search because they can define a non-variable search area, serving essentially as transects.

The list of areas that could eventually be included in exploratory searches is fairly long, and includes some places that have never been searched for bcvi as well as some that have only been searched once or a few times, more than a decade ago. The success in 2009 of limited efforts in the off-trail portion of upper Juniper Canyon, and the northern fork of Pine Canyon, strongly recommends more extensive searches in those large areas. The valley that faces from Smuggler's Gap north to lower Green Gulch appears to offer superficially appropriate habitat and is spatially between known bcvi groups in Green Gulch and the northern fork of Pine Canyon. Likewise, the area between the Window pour-off and those canyons along the northwest slope of Pulliam Ridge that are known to be sometimes occupied, includes several small canyons with superficially appropriate habitat. Another series of relatively isolated, small canyons begins at Panther Canyon and proceeds southward along the eastern margins of Wright Mountain and Pummel Peak to lower Pine Canyon. At the western edge of the Chisos, a similar situation exists between Cattail Spring and Blue Creek Canyon, around the western base of the Ward Mountain complex. In other words, the entire ring of small, isolated canyons encircling the Chisos remains mostly un-surveyed. Cattail Canyon, between Laguna Meadow and the top of the Cattail Spring pour-off, would be much more difficult to access than the sites listed above, but aerial photos suggest habitat similar to that found in occupied areas such as the Window Trail and upper Blue Creek Canyon.

The majority of potentially suitable bcvi habitat in the Chisos is not located near trails. However, trails provide easy access to several areas with suitable habitat, and these are the areas upon which the vast majority of search effort has been focused in most survey years. As suggested above, those areas could be very useful as a core survey area where a standard effort is employed each year. Those areas should not be focused on, however, at the cost of ignoring the larger off-trail areas referred to above. The largest group of bcvi found during this year's survey was located in the north fork of Pine Canyon, a previously unsearched area. Future surveyors should continue to search promising new areas as suggested above, making full use of the documentation of habitat conditions at known occupied sites, the local knowledge of park biologists, and remotely sensed data such as aerial photos to identify potentially suitable habitat and to access it. Thus, I recommend a survey approach that pairs a standardized, rapid annual survey of historically surveyed trails with a systematic inventory of new areas over the coming years.

It has been noted by past surveyors that territory occupancy appears to be highly variable from one year to the next in the Chisos, in contrast to more stable multi-year occupancy by individual males in more mesic portions of the species' range (Barlow and Griffin 1988, Peck and Barlow 1997). Comparison of the 2009 results with those from the previous year (Troy 2008) also suggest that males were not necessarily located in the same specific territories in the two years, despite unusually favorable conditions and high occupancy in both years.

Examination of past survey results also suggests that not only are different locations within particular canyons occupied in different years, but that canyons may be occupied in some years but not in others. Even the largest consistently surveyed populations in Juniper Canyon and the Basin can be virtually absent in some years. Because surveys typically consist of only one visit, these apparent dynamics are probably exaggerated by survey error (birds that are present are not detected); nonetheless, observations across two decades of surveys almost certainly reflect an underlying reality—occupancy is quite dynamic at small and large spatial scales, and across short time scales. Rather than speculate on reasons for this fascinating possibility, I would stress that it provides an additional reason to implement a standardized survey of a core area, which could produce data that are more comparable across years. Local measurements of environmental variables along survey trails—particularly annually variable factors such as temperature, precipitation, and plant phenologies—would also be a useful addition to the surveys.

Occupancy vs. reproductive success: distinctive goals

Only five females were observed in 2009, and only two of those were associated with clear evidence (food provisioning) of either nestlings or fledglings. An effort was made to locate females in areas that were occupied by males, but I placed a higher priority on covering a wide area with relatively low search intensity, as I also recommend for future surveys. Thus, information about female occupancy and reproductive activity was sacrificed in favor of information about male occupancy and population size. Barlow and Griffin (1988) correctly pointed out that, contrary to McKinney (1987), male occupancy is not necessarily indicative of female occupancy, and neither indicates reproductive success. This suggests that a status report aimed at providing information about the bcvi population's 'status', which presumably includes some measure of reproductive success, should focus more heavily on locating females, nests, and nestlings. In particular, some measure of Cowbird (*Molothrus spp.*) nest parasitism would be helpful.

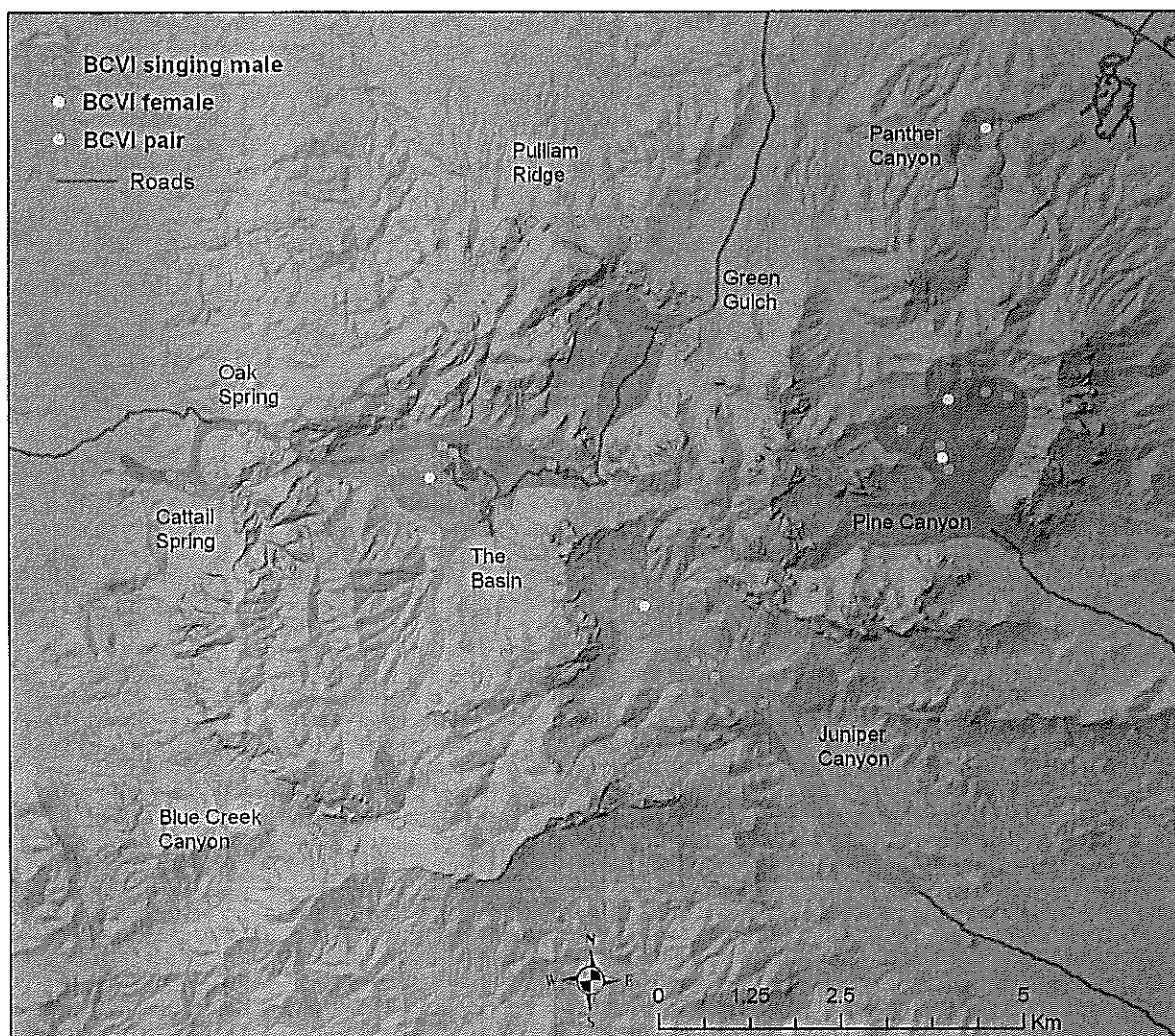
While I agree with this line of reasoning, the degree of effort applied to locating females and nests over the past two decades of annual surveys has arguably not significantly contributed to an understanding of bcvi population dynamics in the Chisos. The summary of nest data provided by Peck and Barlow (1997) and Maresh (2004) demonstrates this fact. During the limited survey period for which funding has been provided each year, a reasonable number of nests to document any kind of productivity estimate simply have not been found, and even more importantly, the outcome of those nests that have been found has seldom been known. Locating females, nests, and fledglings, and, critically, determining nest outcomes, in large enough numbers to provide a reasonable indication of population-level reproductive success would require quite significant increases in effort, and therefore in funding. Furthermore, understanding population dynamics requires estimates of adult survivorship, which requires additional effort.

In the absence of such funding and effort increases, more can be learned about the Chisos bcvi population during the brief annual survey by using the available time for less intensive, more extensive, searches for singing males. While male occupancy is not an optimal, or even good, indicator of population dynamics, it is the best surrogate that can be accounted for given very limited field effort. Females, nests, and nestlings should be documented as opportunities arise, and special care should always be taken to find nests and nestlings when adult behavior suggests that they are present. A separate, concerted effort to measure reproductive success and

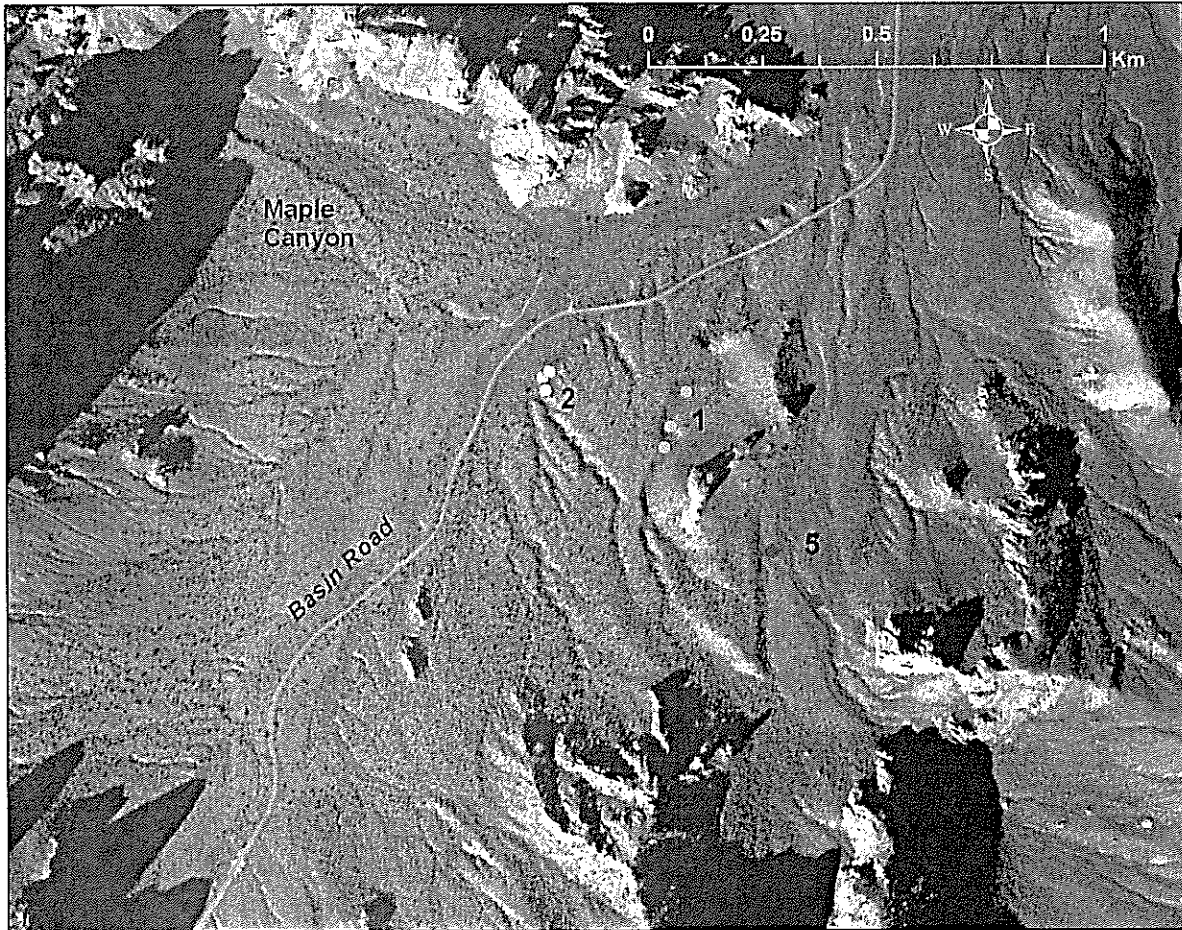
survivorship, involving field seasons of sufficient length to follow nest fates, would be a critically important compliment to the existing annual survey.

These observations and recommendations are largely reiterations of the recommendations given by Barlow and Griffin when the annual bcvi surveys were initiated. They recognized then that while a brief survey to determine occupancy was useful, a more intensive effort to measure reproductive success would be critical for understanding Chisos bcvi population dynamics and habitat quality. This remains true today. However, efforts to collect reproductive data during the brief annual survey have not produced significant information, whereas the time devoted to that effort could have produced new occupancy information in unexplored canyons of the Chisos. Keeping these two different goals distinct will probably result in better use of field efforts in the future, assuming that the Park Service and other researchers take seriously the need to one day undertake more intensive study of this important population's ecology and conservation.

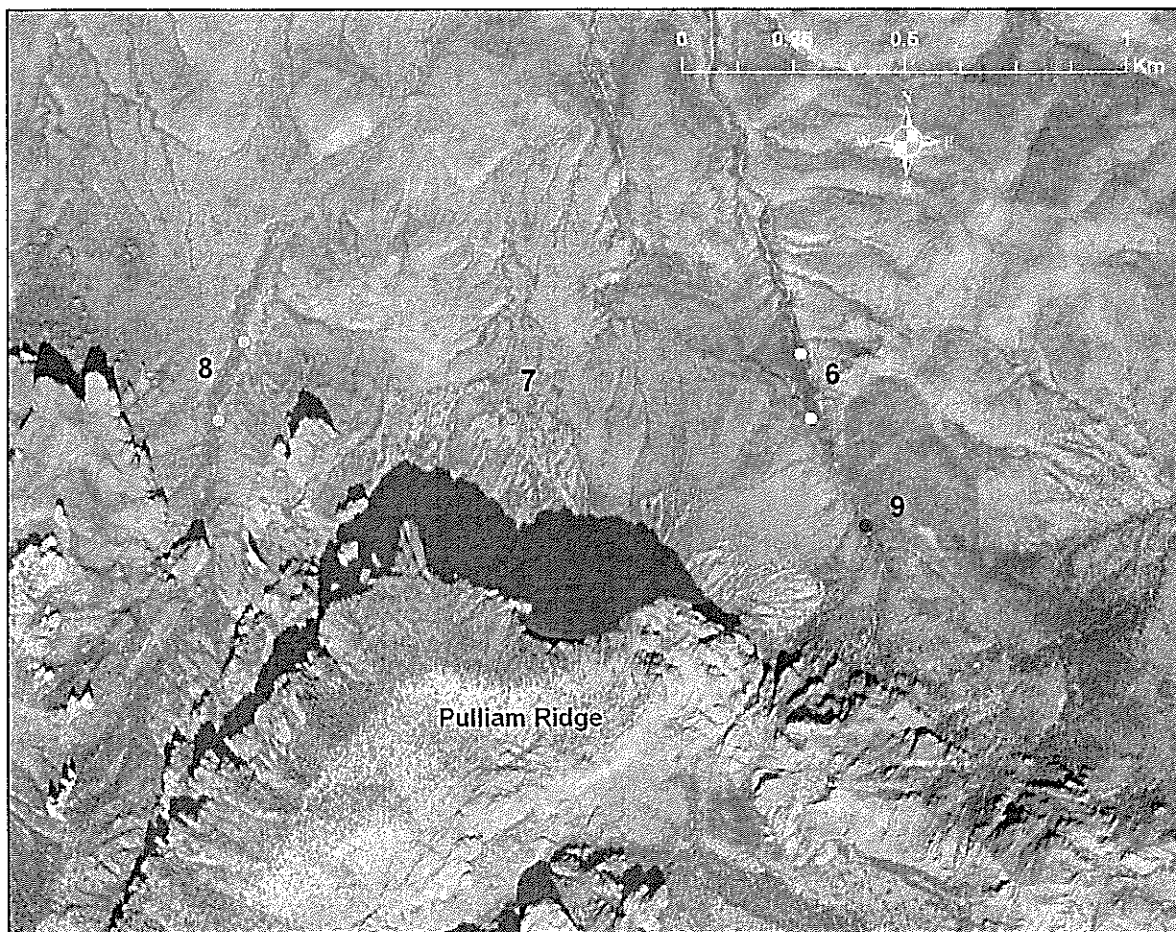
Maps



Map 1. Chisos Mountains, showing the locations of all Black-capped Vireos observed during the 2009 annual survey, and the areas visited at least once during the survey. Areas searched by LYP are shown in orange, and areas covered by the A&M team are shown in purple. Only one location is shown for each individual bcvi; multiple locations for individual birds are shown on maps 2-9. The yellow dot indicates an observation of only a female; it was not known if the female was paired with either of the neighboring males. The light blue dots indicate a male and female bcvi observed together, displaying behavior that indicated a pair bond. Food provisioning trips to either a nest or nestlings were observed at the pair locations in upper Juniper Canyon and the Basin. Note that an additional male was observed very near the pair in upper Juniper Canyon; two singing adult males and the female were observed simultaneously at that location.



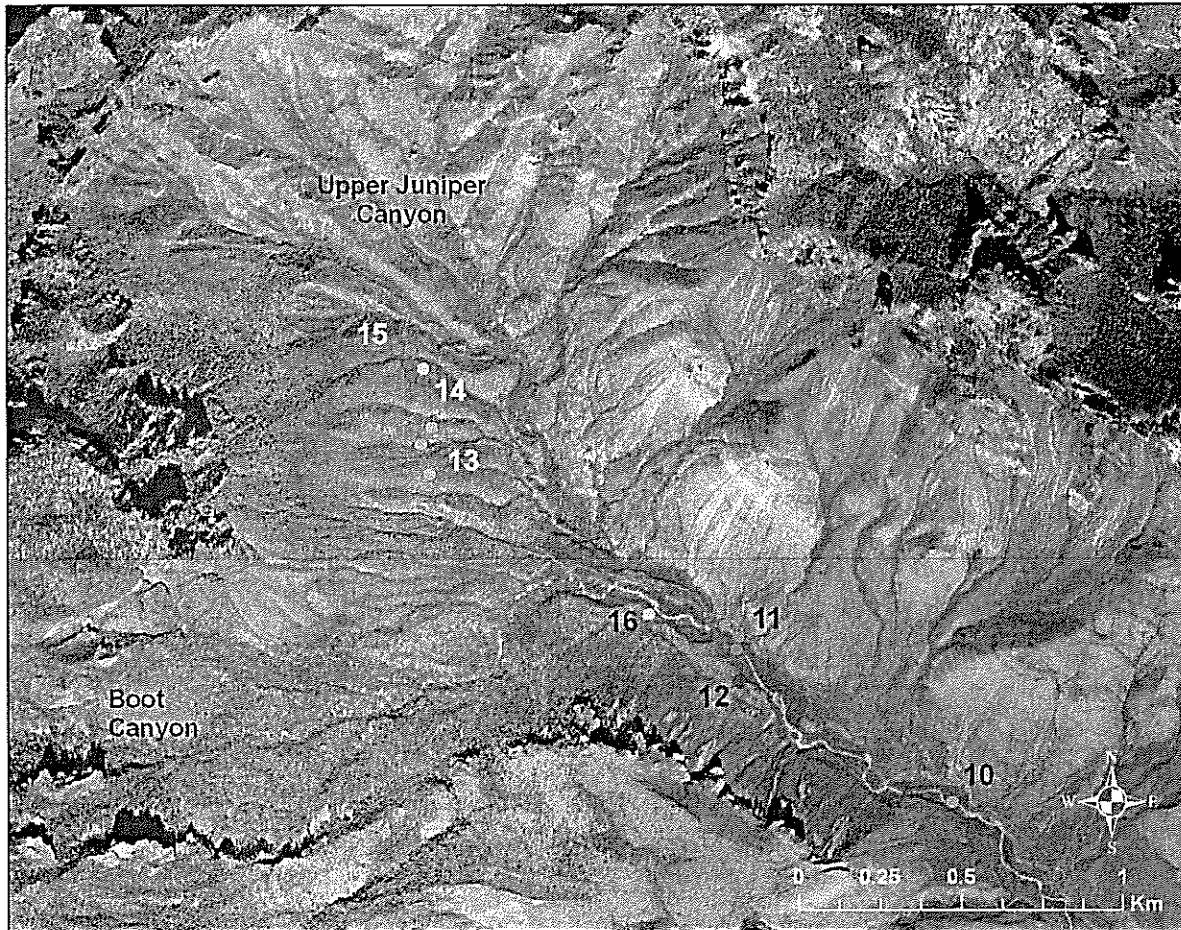
Map 2. Air photo view of the middle reach of Green Gulch, showing the locations of three male Black-capped Vireos. Circles with similar colors are observations of the same individual.



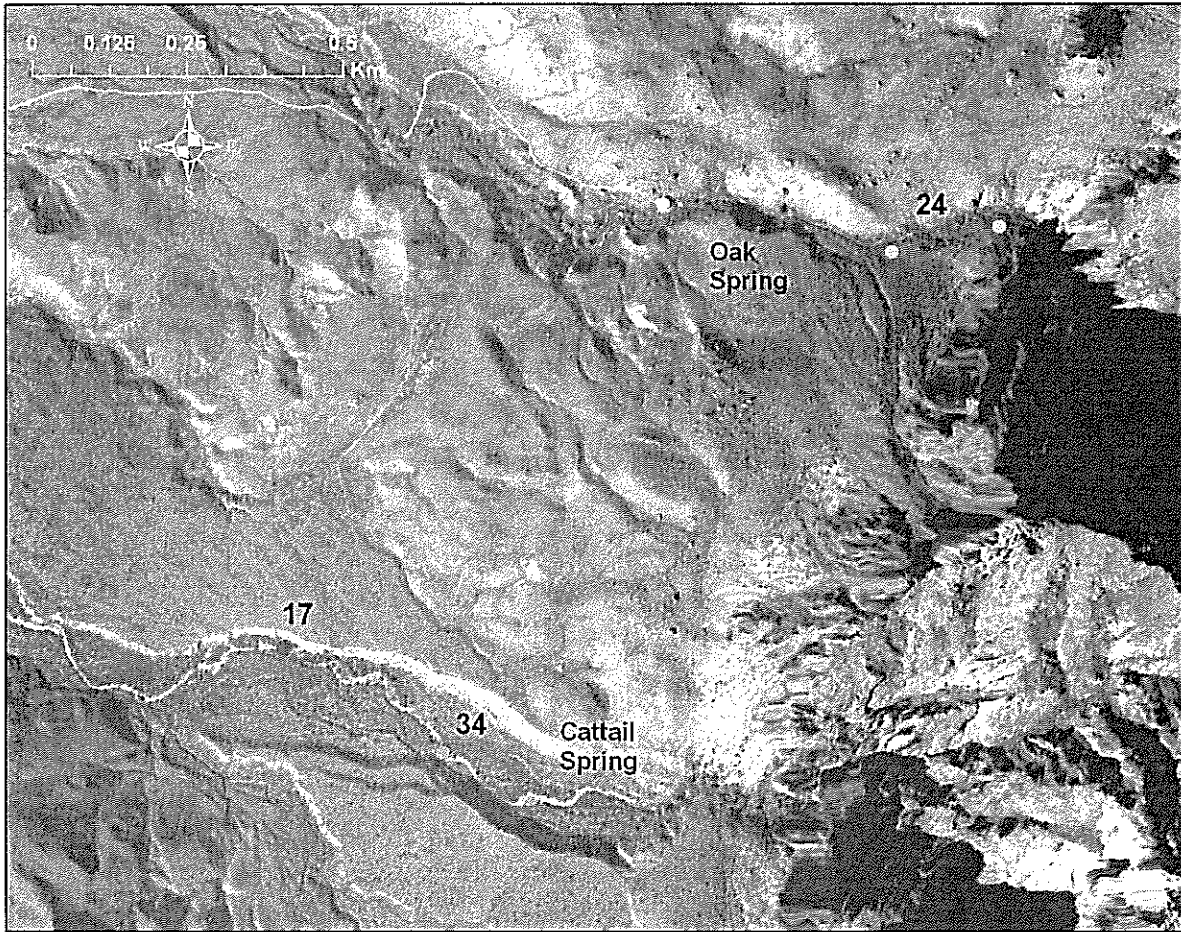
Map 3. Air photo view of the north slope of Pulliam Ridge, showing the locations of four male Black-capped Vireos. Circles with similar colors are observations of the same individual.



Map 4. Air photo view of Panther Canyon, showing the locations of two male and one female Black-capped Vireos. Circles with similar colors are observations of the same individual. The light blue circle indicates a female that was paired with the male whose locations are shown in yellow (bcvi 4).



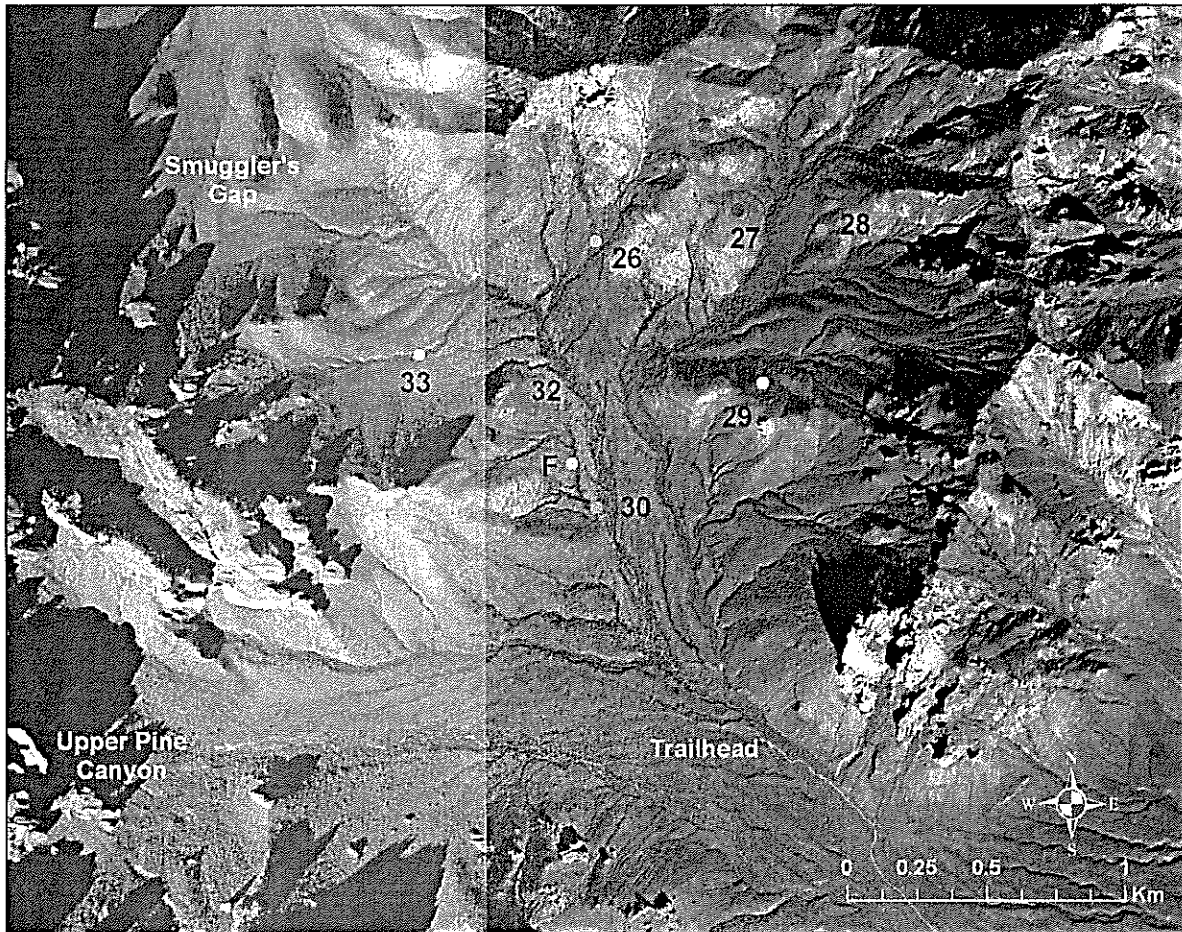
Map 5. Air photo view of Juniper Canyon, showing the locations of seven male and one female Black-capped Vireos. Circles with similar colors are observations of the same individual. The light blue circle indicates a female that was paired with the male whose locations are shown in darker blue (bcvi 14). Both were observed provisioning a nest or nestlings. Territorial interactions were observed between bcvi 14 and 15, and between bcvi 11 and 12. The upper portion, or north fork, of Juniper Canyon, where bcvi 13, 14, and 15 were found, contains a very large area of apparently suitable bcvi habitat and should be more extensively searched in future surveys.



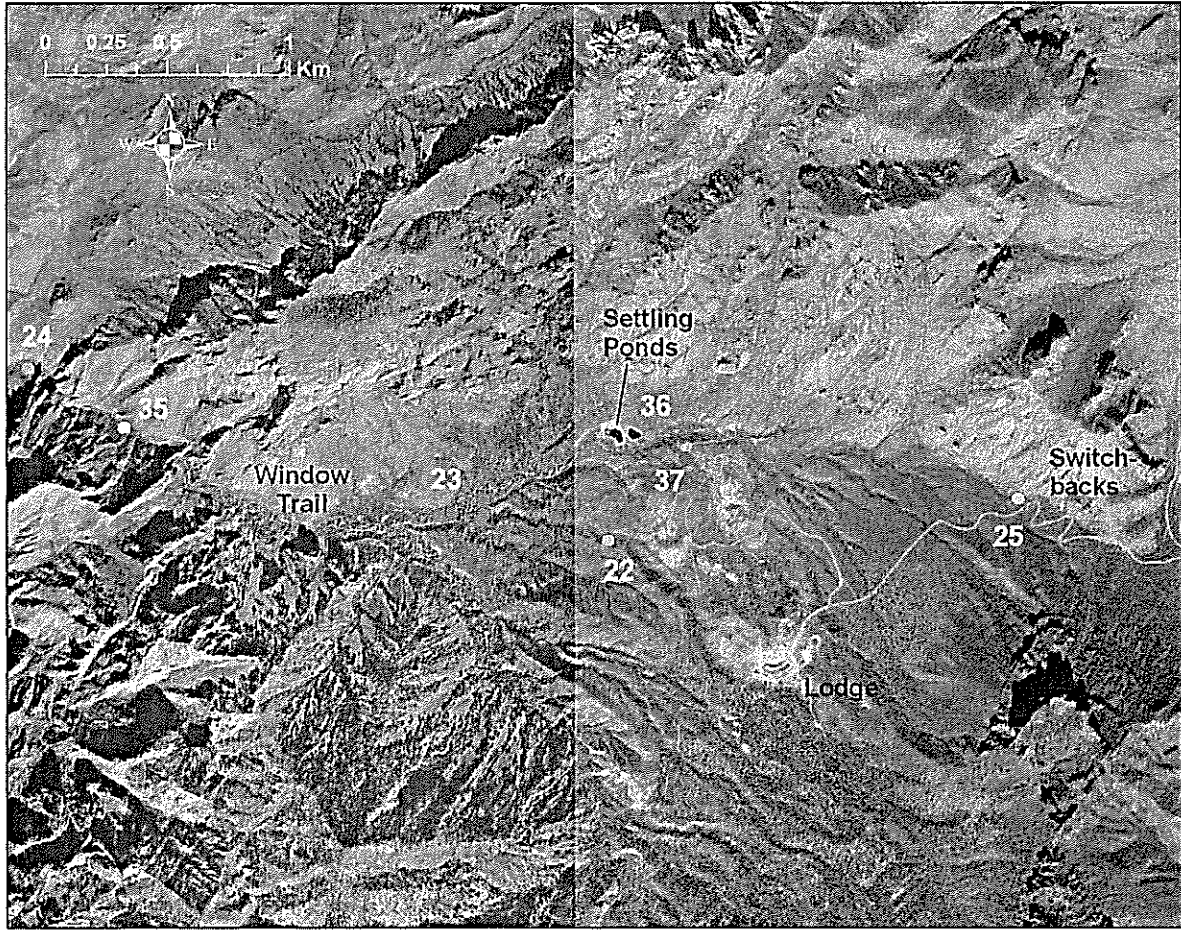
Map 6. Air photo view of Oak Spring and Cattail Spring, showing the locations of observations of three male Black-capped Vireos. Circles with similar colors are observations of the same individual.



Map 7. Air photo view of the middle and upper reaches of Blue Creek Canyon, showing the locations of four male Black-capped Vireos. Circles with similar colors are observations of the same individual.



Map 8. Air photo view of the north fork of Pine Canyon, showing the locations of seven male and two female Black-capped Vireos. Circles with similar colors are observations of the same individual. The light blue circle indicates a paired male and female (bcvi 26). The yellow circle marked with an F indicates an observation of a solitary female; it was not known whether the female was unpaired, or paired with bcvi 30 or 32. The north fork of Pine Canyon has apparently not been included in past annual surveys; it should be considered a priority for future surveys.



Map 9. Air photo view of the the Basin, the Window Trail, and the road switchbacks below the Lost Mines trailhead, showing the locations of six male and one female Black-capped Vireos. Circles with similar colors are observations of the same individual. The light blue circle indicates a paired male and female (bcvi 22). The individual (bcvi 24) shown at the western extent of the map was observed below the Window pour-off, and is shown in more detail on Map 6.

Photos

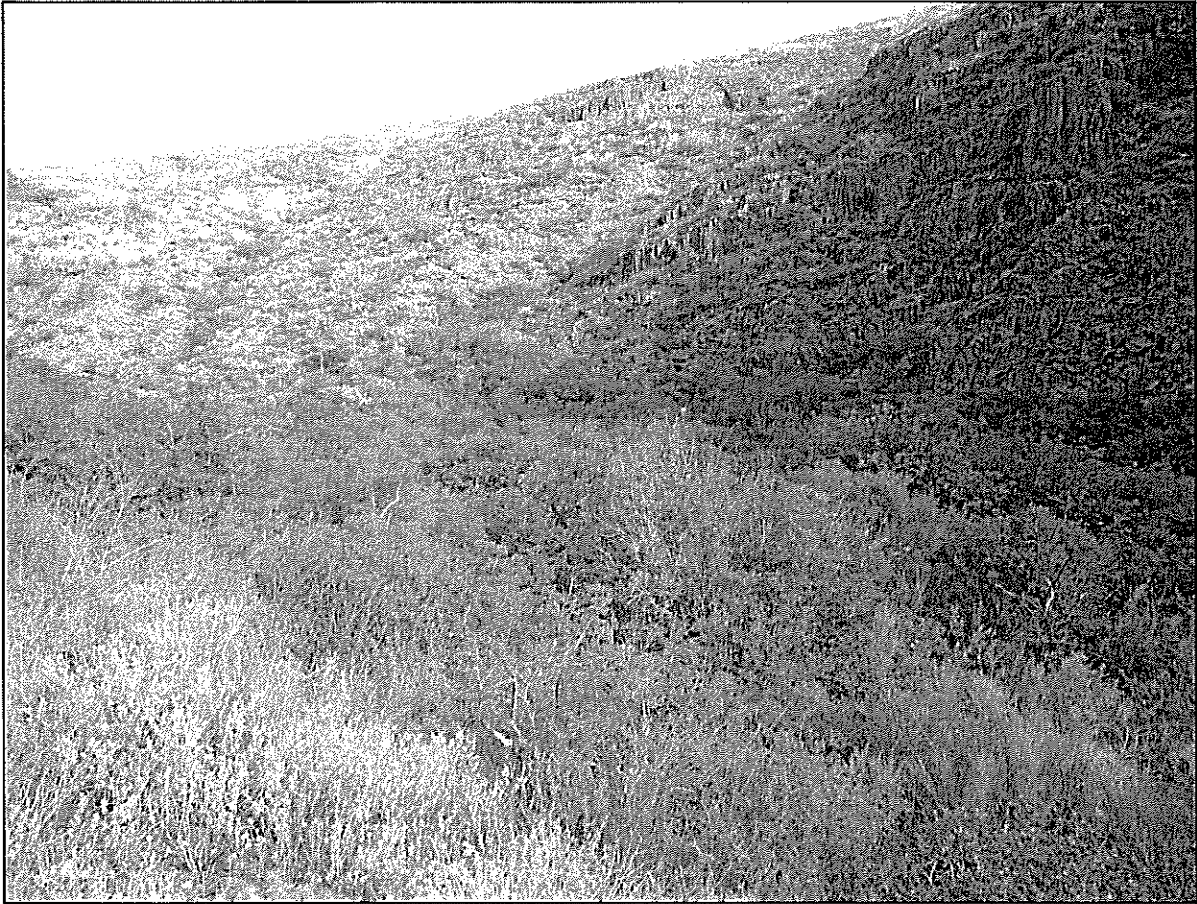


Photo 1. Occupied Black-capped Vireo habitat in Panther Canyon, May 2009. This tall riparian scrub vegetation was immediately adjacent to the more sparse desert wash vegetation shown in photo 2; a singing male (bcvi 3) was observed moving between both areas. In a second territory further up-canyon, a female was observed using the densest, tallest vegetation in the lowest part of the wash, similar to that shown here.

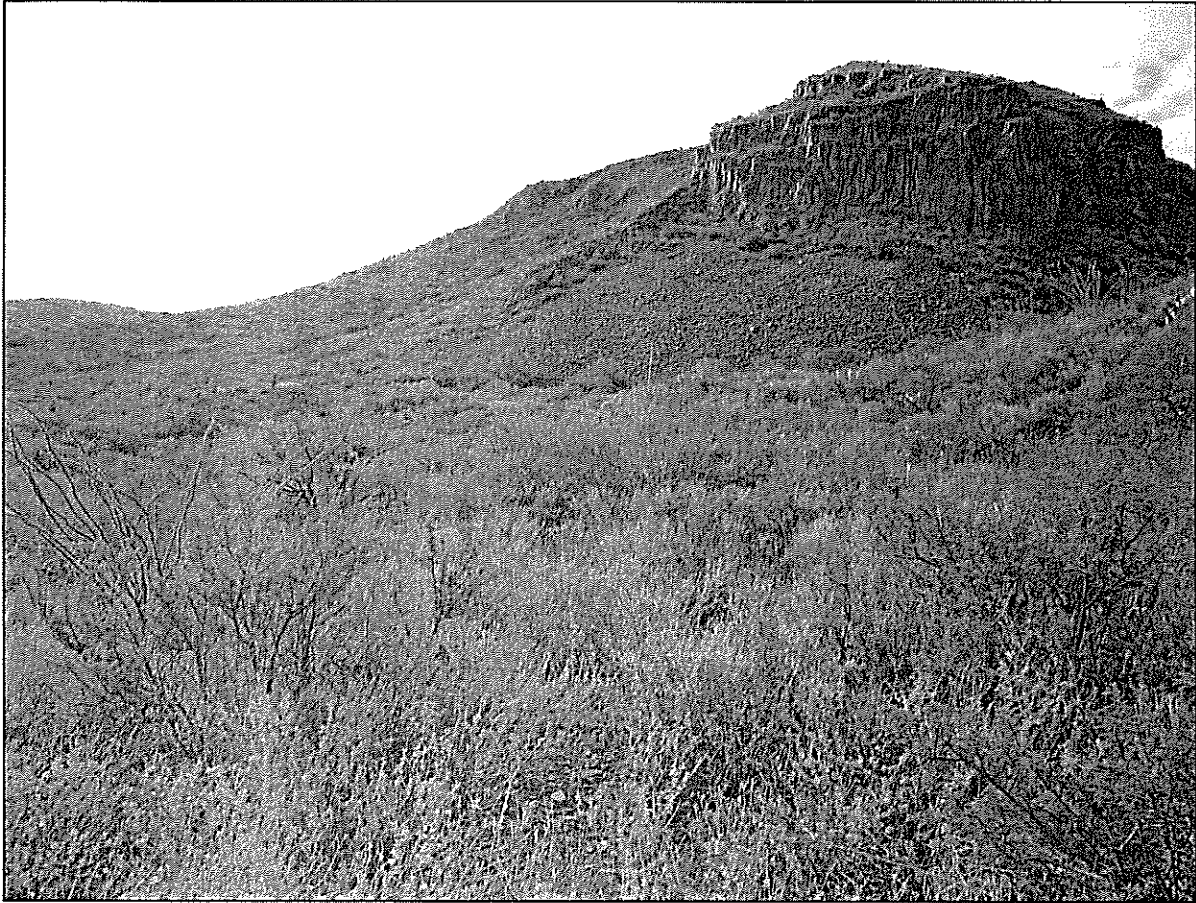


Photo 2. Occupied Black-capped Vireo habitat in Panther Canyon, May 2009. The vegetation shown in the foreground was immediately adjacent to that shown in photo 1, and both were used by the same male (bcvi 3), as well as by both a singing male Bells' Vireo and Gray Vireo.

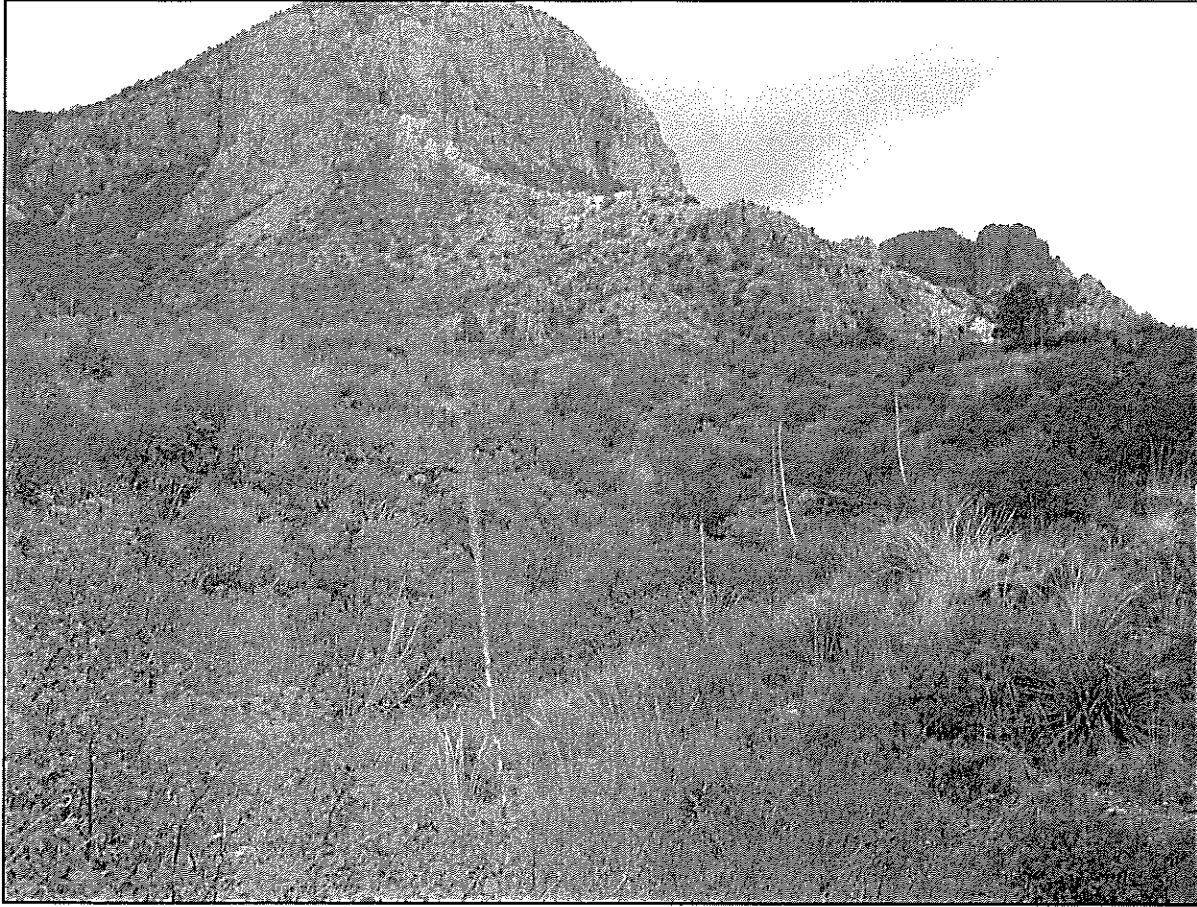


Photo 3. Occupied Black-capped Vireo habitat in Green Gulch, May 2009. This photo was taken at the southeastern point marked on Map 2 for bcvi 5.



Photo 4. Occupied Black-capped Vireo habitat on the north slope of Pulliam Ridge. A singing male (bcvi 8) foraged both in the canopy of the tall trees in the ravine, and in the immediately adjacent desert scrub.



Photo 5. Occupied Black-capped Vireo habitat in upper Juniper Canyon, several hundred meters northwest of the trail (bcvi 13). Vegetation in this area was somewhat different in structure and species composition from the areas typically searched during past surveys, although it was at the same time similar in that it consisted of dense patches of scrub with significant vertical structure. However, rather than being confined to washes or small canyons, it was fairly continuous across the rolling landscape, resembling chaparral vegetation, and potentially offering a very large area of suitable bcvi habitat.



Photo 6. Small ravine along the highest section of the Window Trail, in the Basin, May 2009. A female Black-capped Vireo (bcvi 22) made multiple food provisioning trips, presumably to a nest but possibly to very young fledglings, in a dense shrub cluster near the lowest part of the ravine, approximately in the center of the photo. A male Vireo actively sang at the same time and location.

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