ABSTRACT

A WILDLIFE MANAGEMENT INTERNSHIP AT BALCONES CANYONLANDS NATIONAL WILDLIFE REFUGE (BCNWR)

by Megan Fay Wolf

The following pages are a summary of, and reflection on, my internship with the Student Conservation Association. Spanning one year (September, 2008 – September, 2009), the location of the internship was Balcones Canyonlands National Wildlife Refuge (US Fish and Wildlife Service) in central Texas.

Established in 1992, Balcones Canyonlands National Wildlife Refuge covers approximately 25,000 acres in the scenic Texas Hill Country. It was established in order to attain 3 conservation goals: 1) preservation and restoration of habitat for two endangered songbirds, the Golden-cheeked Warbler (GCWA; Dendroica chrysoparia) and the Black-capped Vireo (BCVI; Vireo atricapillus), and 2) preservation karst habitat for rare and endangered cave invertebrates.

As a wildlife management intern, my responsibilities at the refuge included: territory mapping for the GCWA, gathering presence/absence data for the BCVI and GCWA, banding of the BCVI, vegetation transect work for the BCVI, and assisting the fire crew as a Type 2 wild-land firefighter.
A WILDLIFE MANAGEMENT INTERNSHIP AT BALCONES CANYONLANDS NATIONAL WILDLIFE REFUGE (BCNWR)

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INTRODUCTION

For one year, from September 2008 to September 2009, I served as a wildlife management intern with the Student Conservation Association (SCA) at Balcones Canyonlands National Wildlife Refuge. This internship was completed in partial fulfillment of my Master’s Degree from Miami University’s Institute of Environmental Sciences. Although 4 career opportunities presented themselves to me in the summer of 2008, I chose this US Fish and Wildlife internship because its duties ran along the same line as my ultimate career goals.

I accepted this opportunity because I wanted the conservation and wildlife management training/experience that the position offered. My personal interests, as well as my career interests, have always been in the field, getting my hands dirty, while making a difference. This position not only offered me the opportunity to gain valuable field experience, but it was also a chance to work in Texas, a state that has always intrigued me due to its rugged grandeur.

In a world of growing environmental degradation, there has never been a more urgent need for conservation and the environmentally minded individuals that make a real difference in the conservation arena. By choosing to work with the US Fish and Wildlife Service, I indeed gained valuable experience and a more indispensable skill set. But, what became, in my opinion, the most important aspect extracted from this past year, is a unique perspective about working with a government agency. I also learned the importance of resilience, and keeping true to yourself and those feelings that started you on your present career path.

BALCONES CANYONLANDS NATIONAL WILDLIFE REFUGE

REASON FOR ESTABLISHMENT

“Balcones”, as everyone who works there calls it, was established in 1992 under the Endangered Species Act (ESA) of 1973. While the refuge was primarily constructed in order to preserve and enhance habitat for the GCWA and BCVI in the Texas Hill Country, it also served as an addition to a larger conservation effort/strategy of the city of Austin. As discussed in the 2007 environmental impact assessment concerning big game hunt alternatives, Austin’s conservation strategy since the early 1990’s has focused on preserving and restoring habitat for many species of concern along the eastern edge of the Edwards Plateau Ecosystem – the location of the city itself (BCNWR (USFWS), 2007). The city of
Austin joined forces with Balcones Canyonalands National Wildlife Refuge staff in order to extend habitat conservation for listed species.

**LOCATION**

Refuge tract boundaries along with future acquisition acreage goals are all contained within the beautiful Texas Hill Country. This area of central Texas stands out among other ecosystems around the U.S. for its unique assemblage of extreme relief, with rugged hills and valleys, and a faunal mixture from intersecting ecoregions. Because of these outstanding qualities, the Edwards Plateau Region (the hill country flanks the eastern and southern edges of the plateau region) was included as one of the “Global 200” or, “Last Great Places” worldwide, by The World Wildlife Fund (an international conservation organization) (USFWS, 2007).

![Figure 1. Balcones Escarpment area, Central Texas. Only major streams and those mentioned in text are named. Relief across the Balcones Escarpment varies from 800 to 5000 ft.](http://lib.utexas.edu/geo/balcones_escarpment/images/p2fig1.gif)

**Figure 1.** Balcones escarpment and Edwards Plateau regions of central Texas- BCNWR is situated within the blue circle. (courtesy of: http://lib.utexas.edu/geo/balcones_escarpment/images/p2fig1.gif)
**PHYSIOGRAPHY**

Because of the refuge’s location along the southeastern edge of the Edwards Plateau (Figure 1), the terrain varies widely from northern tracts to southern tracts. In the very northernmost portion of the refuge, on the Edwards Plateau, the landscape is flat (Figure 2) and most tracts are dominated by prairie and oak savannah vegetation configurations. In the central portion of the refuge, the terrain shifts markedly to that of stark hills and low-lying valleys due to its location on the Balcones Escarpment (Figure 3). Vegetation in the central tracts is a mixture of mature Ashe juniper (*Juniperus ashei*) forests on hillsides and oak savannas in the flat valley bottoms. At the very southern edge of the refuge lies a more gently rolling landscape (Figure 4) dominated by juniper and mixed hardwood forests.

![Figure 2. Landscape of Simmons tract- northern portion of refuge; notice the generally flat topography – (personal photo, Spring, 2009.](image)
Figure 3. Grand hills and valleys of Doeskin Ranch tract – central portion of BCNWR, 2008 (Jason Merlo – www.pbase.com)

Figure 4. Gently rolling landscape of southern portion of BCNWR along FM 1431 – near refuge headquarters (personal photo, Fall, 2008).
It is important to note that, along with such parameters as geology and climate, the varied physiography displayed in the landscape of the refuge significantly contributes to the comparably large amount of biodiversity observed because organisms inhabit all physiographic features. For example, the endangered GCWA prefers to nest on steep slopes, where mature Ashe juniper stands are found. On the other hand, many ground dwelling animals prefer the protection of shin oak thickets on generally flat stretches of land.

**VEGETATION**

As stated by the USFWS in their 2007 environmental assessment of the refuge yearly general hunt program, BCNWR is situated within a very important ecotone of the world (ecotone = mixed community of flora and fauna) (USFWS, 2007). This central Texas ecotone was created by the overlap of adjacent ecoregions (eastern deciduous forest, southwestern desert, Texas coastal plains and interior Great Plains), which are all represented in the Refuge landscape (USFWS, 2007).

![Figure 5](image.png)

*Figure 5.* Typical mixed landscape of vegetation types (juniper forests on the hillsides and grasslands/ranchlands/hardwood savannas on the flatter areas and valleys (personal photo, Spring, 2009).
In general, vegetation on the refuge falls into 3 major zones: 1) mixed juniper/hardwood forests of the hillsides and valleys 2) oak savannas/hardwood scrublands on plateau tops and areas with flat terrain 3) grasslands on the plateau tops and flat lowlands (Figures 5&6). Contributing greatly to the diversity of animal life, these three vegetation assemblages are all home to varying arrays of species.

DISTURBANCE FACTORS

Discussed below are two critical disturbance factors in central Texas, in terms of their effect on wildlife; specifically in regards to the Golden-cheeked Warbler and Black-capped Vireo.
Drought

If you ask any Central Texas resident about the weather, the first thing they will mention is the current drought. The second thing they will say is that they cannot remember a time that there were not drought conditions. Although this is an exaggeration, the current drought in central Texas has lasted for more than two years (U.S. Drought Monitor, 2009). It has decimated crops, range lands and livestock, has destroyed native vegetation, claimed the lives of many wild animals and greatly hampered water recreation (Figure 9). The last month that did not show drought conditions is October of 2007!

Throughout my entire year of service with the Student Conservation Association, central Texas was in an extreme drought (Figures 7&8). For most of that year, there was a burn ban in all 3 counties in which the refuge resides. The drought of the last two years is literally one of the worst in recorded history.

The current drought is important in conservation terms because it has destroyed many stands of native hardwoods, due to heat stress and has dried up many perennial water resources throughout central Texas. To date, the total acreage destroyed or damaged at BCNWR is a little over 500 acres. Because of these climatic hardships brought on by the extreme heat and dryness, GCWA and BCVI populations have seen exaggerated declines over the past two years.
LAND AQUISITION

The proposed 80,000 acre refuge boundary is situated throughout the Hill Country in Burnet, Travis and Williamson counties. To date, however, roughly 25,000 acres have been bought or acquired through conservation easement negotiations due in part to the reluctance of landowners to sell.

STAFF AND VOLUNTEERS

Currently, there are 15 full-time staffers at refuge headquarters. Eight of these are fire crew and the remaining seven are management (refuge manager and assistant manager), biological, administrative, realty, GIS specialist, and recreation. Most of the projects, fund-raising events (chiefly, the Texas Songbird Festival), and environmental education programs (“Bridges to Birding” and “Going Buggy”) are staffed by the Friends of Balcones, or other volunteers.

The BCNWR fire crew (Figure 10) is well-known throughout the US Fish and Wildlife Service not only for the number of refuge acres they burn annually and their expertise at completing those burns, but also
for their efforts in assisting other refuges and landowners across the country with their controlled burns and wildfire responses.

![BCNWR fire crew during pre-burn briefing on site of Eckhardt South. (Fall, 2008 – personal photo).](image)

**Figure 10.** BCNWR fire crew during pre-burn briefing on site of Eckhardt South. (Fall, 2008 – personal photo).

**CONSERVATION SETTING**

Although it is easy to imagine BCNWR as a ‘stand alone’ refuge acting as an advocate for the vitality and longevity of scores of endangered fauna, the reality is much different. Central Texas stretches over millions of rugged acres. Because of this, there are MANY conservation-minded groups (master naturalists, Texas Amphibian Watch, etc.) organizations (eg. the Nature Conservancy), agencies (eg. Texas Parks and Wildlife Department, Texas Forest Service, etc.), preserves (eg. Balcones Preserve), and landowners that are battling to do the same. As stated in the introduction to this report, even the city of Austin, itself, has developed its own broad-scoped conservation strategy.

The climate for conservation/preservation in central Texas is unlike that of the rest of the state. There is real desire and motivation, as well as great communication that is happening throughout the region, all in the name of conservation and preservation.
SCOPE OF INTERNSHIP

My SCA title was ‘Wildlife Management Intern’ and my duties at the refuge fell in line with those of a US Fish and Wildlife Service biological technician. The opening months of my internship consisted of me orienting myself with the rules of the refuge, the duties I would be required to carry out, and the wildlife I would be asked to monitor and assist. I poured over refuge species lists and BCVI and GCWA information, roamed as much of the 25,000 refuge acres as I could, started training for the fire fighting work capacity test, and attended the Texas Interagency Wildland Fire Academy.

As the months progressed, my duties evolved into such things as: monitoring GCWA and BCVI populations, performing habitat management and vegetation transect work for the BCVI, bird banding, being a Type 2 wildland firefighter, revising environmental education programs, and being an environmental educator. It will be made clear that my responsibilities did not just support the staff of the refuge, but I also assisted visiting researchers, volunteers and a neighboring nature preserve, as well.

Through this internship, I was able to become more familiar with and experience:

1) the workings of a national wildlife refuge,

2) the general responsibilities of a biological technician,

3) the knowledge one must attain to benefit wildlife the best way possible,

4) the communication and cooperation necessary to provide a better service to wildlife, and

5) the willpower, tenacity and self-reflection it takes to remain true to the passion of one’s life.

The pages that follow are an attempt to paint the rewarding picture of my experience at BCNWR over the past year. This report will describe the many duties I had, along with the knowledge I gained while I was there. Though I came into brief contact with a wide variety of fauna (especially, birds), a smaller list of the most pertinent is listed below.
Table 1. Species I worked closely with during my internship.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Dendroica chrysoparia</em></td>
<td>Golden-cheeked Warbler</td>
</tr>
<tr>
<td><em>Vireo atricapillus</em></td>
<td>Black-capped Vireo</td>
</tr>
<tr>
<td><em>Geococcyx californianus</em></td>
<td>Greater Roadrunner</td>
</tr>
</tbody>
</table>

BLACK- CAPPED VIREO MANAGEMENT

![Image](image.jpg)

Figure 11. First BCVI sighting for author taken on Russell tract. (March, 2009 – personal photo)

THE BLACK-CAPPED VIREO

Black-capped Vireos are small songbirds (the smallest vireos in North America; Figure 11) whose range extends from Oklahoma through central Texas, all the way to the mountains of northern Mexico. They are categorized as neotropical migrants because they spend the fall and winter months in Central America. They return to North America in the spring (usually at the end of March) to breed.

Habitat for the BCVI is generally described as shrub land/open woodlands with a patchy structure (Klym, 2008) and canopy averaging 2-5 meters tall. Black-capped Vireo habitat must have a mix of
woody and non woody vegetation/grasses. Shrubby vegetation (eg. shin oak (Quercus sinuata) and persimmon (Diospyros texana) thickets) is important because BCVI’s build their nests 75 centimeters – 1.75 meters above the ground in the crooks of the vegetation’s branches that provides great cover from predators. Black-capped Vireo males use emergent hardwood trees in their territory as perching trees from which they sing. Grasslands are essential to good BCVI habitat because they contain the insects, which are the vireo’s primary food. In ‘outstanding’ BCVI breeding habitat, plant composition appears less important than the presence of broad-leaved shrubs, foliage to ground level, and the mixture of open grassland and woody cover (Klym, 2008).

Arrival on the North American continent is accomplished by males first. Upon arrival, males stake out breeding territories of two or more hectares and set up a “bachelor nest” (nest frame used to attract possible mates; Figure 14) which hangs from the fork of a woody branch two to four feet from the

Figure 12. Author monitoring BCVI numbers (BCVI song is being played from recorder) at a grassland/shrub-land interface (personal photo, Spring, 2009).
ground. Black-capped Vireos nest in shin oak – dominated woodlands, where total canopy cover of hardwoods is typically between 30-80 percent. Black-capped Vireo males sing all day long (uncommon for most songbirds who are quiet during the hottest part of the day), in order to defend their breeding territory and attract a female. Pairs mate only one season. The typical mating season spans from the beginning of April to very August. After the breeding season has ended, BCVI’s start migrating back to the Pacific slopes of Western Mexico (Figure 13), throughout August and September.

**Figure 13.** Breeding and wintering range of the BCVI (adapted from Grzybowski (1995) and the National Geographic Society (1999)).

**Figure 14.** Typical hanging BCVI nest built in the fork of a shin oak tree (personal photograph- 2008).
THE NEED FOR POPULATION MONITORING AND HABITAT MANAGEMENT

This species of songbird has seen a dramatic decline in abundance since its discovery in the 1800’s. The major factors that have lead to the BCVI’s endangered species listing are: habitat loss (reduction of their breeding range through residential and commercial development), habitat fragmentation, nest parasitism by Brown-headed Cowbirds (*Molothrus ater*), predation by Texas rat snakes (*Elaphe obsoleta lindheimeri*), fire ants (*Solenopsis invicta*) and other fauna (fox, etc.).

In central Texas, more acreage is comprised of hills and valleys (great GCWA habitat) than scrubby flatlands (great BCVI habitat). The major reason for this is due to the disturbance of humans on flat lands. Ranching, cedar chopping, and residential/commercial development has taken away much land for the BCVI. Even after ranchers have sold their land to the refuge, or put it in easement, the land remains damaged (eg. heaving grazing causes overgrowth of prickly pear cactus and desert-like conditions) for many years.

There is one key factor of BCVI habitat loss that is subtle, but ‘all important’ at the same time. That factor is natural plant succession. Black-capped Vireos prefer a mid-succession stage of scrub habitat. Although plant succession is of less concern in the southern and western regions of the BCVI range, in Texas, it is a constant battle of habitat manipulation at BCNWR to return overgrown vegetation back to good vireo habitat.

Humans affect Black-capped Vireo numbers by vegetation manipulation (e.g. range management, urbanization), fire suppression and by maintaining an excess of grazing animals (cows and goats)(Klym, 2008). One bright spot in the population viability saga of the BCVI is that, within the last year, new breeding habitat has been found in Mexico. As this report was being written, there were meetings occurring and discussions undertaken in order to decide whether or not delisting the BCVI from the Endangered Species List is warranted due to the discovery of this new breeding habitat.

HABITAT MANAGEMENT

On refuge lands alone, roughly 1,500 acres are being, or will be managed for the Black-capped Vireo (Figure 15). BCNWR staff believe that the best way to manage the landscape for BCVI’s is to bulldoze (“smash”) or cut (“slash”) vegetation that has grown “too tall” (over 10 ft. average), and “too dense” (very little prairie/grassland) to be considered suitable BCVI habitat (Figure 18). The next step that the
refuge staff employs, in order to return overgrown vegetation back to high quality BCVI habitat, is to set prescribed burns on newly smashed and slashed tracts.

Figure 15. BCVI populated acreage (and therefore, refuge management acreage for BCVI habitat) – note the location of author’s vegetation transects as depicted by the colored circles (Rodger’s and Eckhardt Northwest tracts)(map created by author, Spring, 2009).
Figure 16. Map of Eckhardt Northwest transect locations (map made by author – ArcMap). Transect locations are depicted by the colored circles.
Figure 17. Map of Rodger’s tract transects (map made by author on ArcMap). Transect locations are depicted by the colored circles.
The goal of each prescribed burn for Black-capped Vireo habitat management is to attain a “compete” burn (a burn that consumes all vegetation; Figure 19). Such a burn, it is believed, will allow hardwood trees and shrubbery the chance to outcompete Ashe juniper trees for space. As good BCVI habitat ages, it becomes less dominated by low-growing hardwood trees (eg. shin oak), and more dominated by evergreen trees (eg. Ashe juniper). In about five years from the time of a complete prescribed burn, BCNWR staff believes the vegetation is “too high and too dense” to be considered great BCVI habitat. Because of this, BCVI habitat at BCNWR is set on a five-year prescribed burn cycle.
VEGETATION TRANSECT WORK

From September 2008, to August 2009, a large part of my time was taken up by locating and constructing vegetation transects on two tracts of land: the Rodger’s (24 transects- 8 control, 16 treatment) and Eckhardt (8 transects- 4 control (the eastern portion of the Eckhardt northwest tract is abbreviated “EckNW_E”), 4 treatment (the western portion of the Eckhardt northwest tract is abbreviated “EckNW_W”)) tracts (Figures 17 &16, respectively). Our purpose was to gather data on vegetation physiognomy, composition, and density within areas of these two tracts that would be managed (smash/slash and burn) for BCVI habitat within six months of transect construction.

In September, 2008, I helped the refuge biologist, Chuck Sexton, pick random coordinates for the starting points of 24, 30-meter transects on one 36-hectare area of the Roger’s tract that was slated for

Figure 19. Author observes the results of Eckhardt NW_W ‘complete’ prescribed burn of August, 2009. (personal photo)
manipulation in order to promote habitat for the black capped vireo (Wolf (mo. report 1), 2008). In January, 2009, I selected random coordinates for the 8 EckNW transects.

Manipulation of the 36 hectare study area on the Roger’s tract included: 1) cutting Ashe juniper in one section (75% of 36 hectares) 2) ‘smashing’ Ashe’s Juniper with a bulldozer in another section (25% of 36 hectares), -and then doing a complete prescribed burn for the total 90 acres in spring 2009. The goal of manipulation on both the Rodger’s and the EckNW_W tract was to attain a complete burn after smashing/slashing the units.

The hope was that, after getting rid of all of the juniper trees (either by smashing or cutting) and then burning, shin oak trees (the prime habitat for vireo nesting, which are shaded out by taller juniper) would be able to flourish once again (Wolf (mo. report 1), 2008). At the end of my internship (September, 2009), the Rodger’s BCVI manipulation unit had not yet been burned, while the EckNW_W unit had.

Measurements along both the Eckhardt NW_W and Rodger’s tract transects included: 1) species composition every 1 meter and 2) maximum height by species every 1 meter. The point in measuring only these two characteristics was to get the clearest and most simple picture of habitat composition (percent cover, height, etc.) pre and post- burn. Basically, the first 4-5 months of my internship were devoted to designing a habitat management program for the black capped vireo.

As with the 24 transects in the Rodger’s manipulation unit, the eight EckhardtNW transects will be monitored/measured and photographed at least every year, post- manipulation, in order to better understand regrowth patterns (eg. rate of growth, spacing of trees, compositon, etc.). The control transects of the EckhardtNW tract will be smashed in 2 years. Until that time, it will serve as a good reference for the western/smash portion of the tract. The control units of the Rodger’s tract are not going to be manipulated, at all, because they are classified as good GCWA habitat. The data I collected from the control units will give future researchers and refuge staff a good sense of: habitat composition, density/ percent canopy cover, canopy height and percent open ground, prior to manipulation (Wolf (mo. report #4), 2009).

In December, 2009 after finishing the in-field measurements, I began working on, and completed the calculation of, multiple parameters for all transects included in the two manipulation units. I used Microsoft Excel to enter all data and determine statistics such as: average height, maximum height,
standard deviation of height and variance of height for oak and juniper species; mean and variance of canopy cover, percent canopy cover, and percent bare ground. Directions for the completion of vegetation transects is included in Appendix A.

RESULTS FROM VEGETATION TRANSECTS

It is important to note that, due to time constraints, I was not able to complete an analysis and interpretation of the data I collected from the Eckhardt Northwest tract. Information presented in this section is from the Rodger’s tract, alone. It can be hypothesized that the key findings presented below can be used as an estimate/approximation, of the results of a similar analysis using the data from the Eckhardt Northwest tract. The most striking results from my transect data analysis of Rodger’s tract is as follows:

1) The average canopy height for all vegetation in the landscape, is taller in ‘deeper’ soil (top soil that is at least 5 inches in depth) than in ‘more shallow’ soil. This depth classification scheme is basically subjective and based largely on the wildlife biologist’s opinion. I followed his rule that anything over about 1-2 inches was ‘deep’ soil and under this, ‘shallow’. This classification scheme is basically, subjective.

   a. 2.3 ±.47m. (avg. ± var.) – ‘shallow’ soil, 2.9 ±.59m. (avg. ± var.) – ‘deep’ soil

This fact is quite obvious when briefly considered. Shallow soil holds less nutrients and water reserves. Thus, vegetation that germinates/sprouts from shallow soils tends to spend more energy to grow and survive in order to spread adventitious and tap roots and conserve water. This fact leads to a slight stunting of individuals, decreasing average canopy height.

Interestingly, prime BCVI habitat exists on relatively flat terrain (in lowland or plateau top scrublands) with shallow soil. Prime GCWA habitat is primarily in old-growth, mixed (juniper/hardwood) forests on hillsides or in valley bottoms, where the soil generally ‘deep.’

2) Average canopy height is tallest for the “cut” unit transects and shortest for the “smash” unit transects.
Before any manipulation was completed on both the Rodger’s and Eckhardt Northwest BCVI habitat manipulation units, the fire management officer (FMO) for BCNWR consulted with the wildlife biologist concerning exactly what manipulation tactic would be used. It was agreed upon that the most heavily wooded/oldest forests would be ‘slashed’ (cut by hand crews), while the less densely wooded acres would be ‘smashed’ by the use of a bulldozer.

All of Eckhardt Northwest’s Western manipulation unit was bulldozed. Of the total Rodger’s BCVI habitat manipulation unit (36 hectares), roughly 24 hectares was ‘slashed’, while 12 hectares was ‘smashed’ prior to burning (Figure 18).

3) Average percent canopy cover of hardwood species decreases as age of forest, increases.
**Mean Canopy Cover (by species) – “Cut”, “Smash”, control**

Rodger's Plateau BCVI habitat manipulation (2008-2009)

![Mean Canopy Cover](chart)

**Figure 21.** Mean canopy cover (by species) for all transect manipulation categories of the Rodger’s BCVI habitat manipulation unit.

A major issue that must be dealt with on a continual basis at BCNWR is the natural process of vegetation succession. As the mixed hardwood/evergreen forests of central Texas age, the Ashe juniper begins to out-compete the hardwoods such as oaks, persimmon, hackberry, and mesquite. This occurs for two major reasons. First, hardwoods require more water to grow and flourish. Secondly, juniper trees grow much faster than hardwood trees, crowding them out and blocking all-important sunlight from penetrating the canopy.
At the time of my exit from BCNWR in September of 2009, the refuge staff considering the least labor intensive manipulation options that would rid juniper-dominated old growth forests of their juniper understory without harming the massive old juniper trees. Once these old forests are thinned of their juniper saplings, young hardwoods are able to pop up and have a chance to thrive.

4) Average percent open ground is greatest in the “cut” unit (40%) and least in the control unit (24%)—data collected prior to treatment.

![% open ground (mean)](image)

**Figure 22.** Mean percent open ground of all Rodger’s BCVI manipulation unit transects.

5) Average percent open ground is greatest (59%) in ‘shallow’ soil transects and least (41 %) in ‘deep’ soil transects.

As was stated above, at the time of my exit from the refuge, Eckhardt Northwest (west manipulation unit) had been burned (Figure 19). This burn ‘successful’ in that it met the objectives of the fire management officer, which were complete consummation and burning of all smashed vegetation. The Rodger’s tract BCVI management unit will be burned in the winter of 2009-2010.
**BCVI MONITORING**

During the last week in March 2009, I censused BCVI populations on three tracts of land at the refuge. These tracts were the Simmons, Webster and Russell tracts. The Simmons and Russell tracts are located in the northwestern portion of the refuge, while the Webster tract is located in the southeastern extent of refuge lands. These tracts of land were selected for monitoring because they contain much more suitable and un-burned BCVI habitat than any others.

Monitoring the BCVI populations consists of gathering topographic maps, and cassette player (specifically designed to broadcast playback of bird songs), and heading out to each tract of land. I would mark my start point and trace my monitoring path on the map as I went. Every 20 yards, or so, I would pause and play a BCVI male’s call. I would listen for any response, mark it if there was any, try to locate the source individual, and move on throughout the habitat.

Data recorded in the field included: sex of bird found, approximate age, overall condition, whether the call was solicited or not, any territory battles/defense that I witnessed, and the approximate area in which
I observed each individual. The goal was to return to each tract of land in 7-10 day intervals in order to track changes in population and to construct estimated territories.

RESULTS FROM BCVI MONITORING

Unfortunately, my GCWA census would prove much more fruitful than my BCVI monitoring efforts. A week into monitoring for the BCVI, a visiting researcher (Juan Pablo Assmuss from Texas A&M University) came to the refuge and took over the Russell tract for banding BCVI’s. Although I was later able to assist him, this tract was closed to my monitoring. However, he was able to attain a good estimate of BCVI numbers through banding.

The vegetation of the Simmons tract turned out to be too early in succession and comprised predominantly of “poverty/Roosevelt weed” or Baccharis sp. Because of this, no BCVI’s were detected within the first month and a half of my monitoring (end March- beginning of May). In about three years, because of natural vegetation growth and succession, the Simmons tract will no doubt be home to several pairs of BCVI’s.

The portions of the Webster tract that I was assigned to monitor were burned two weeks after I began monitoring there. Because of this, I was not able to hear or see any BCVI’s on this tract, either. It will take almost five additional years for the charred habitat on the Webster tract to re-grow into suitable BCVI habitat.
Most of my BCVI monitoring effort and success was manifested as I assisted with banding (Figures 25& 26). From April until July, 2009, a large portion of my time at the refuge consisted of waking up before sunrise, setting up mist nets, and monitoring them—until dark.

The bird banding process for the BCVI is no different from banding procedures for other small birds. 1) A good ‘net lane’ (area clear of brush, at least 3 meters long) must be found; 2) the mist net is set up across the net lane 3) speakers are affixed on each side of the net, hidden from view in shin oak shrubbery; 4) one person is seated on one end of the net with binoculars, following the movement of incoming BCVI’s. This person tells the other person which speaker to play the BCVI call from. 5) once the vireo is caught in the net, the banding equipment is unpacked and the bird taken out of the net; 6)
banding is ended with the bands being placed on the tarsi of the BCVI (4 bands, in total) (Figure 26) and release of the bird (Wolf (mo. report #7), 2009).

As we compared our data with the past three years of bird banding efforts on BCNWR, Juan Pablo and I were able to band the most BCVI individuals. We netted vireos on four separate tracts of land (Russell, Rodger’s Northeast, Eckhardt, and Gaynor). By the end of the banding season, we had banded about 40 BCVI’s (10 females, 10 fledglings, and 20 males). On a side note, I had the chance to hear and observe 5 BCVI individuals (4 males and 1 female) as they sang from emergent live oak trees at Peaceful Springs Nature Preserve as I completed a transect on September 12th, 2009! Peaceful Springs Nature Preserve is located adjacent to the Refuge’s Flying X tract in the central portion of Refuge property.

**GOLDEN-CHEEKED WARBLER MANAGEMENT**

![Golden-cheeked Warbler male](image)

*Figure 27. Golden-cheeked Warbler male sits on a dead tree branch in the early morning (Flying X tract – personal photograph, Spring, 2009)*
THE GOLDEN CHEEKED WARBLER

As with the Black-capped Vireo, the Golden-cheeked Warbler is a tiny colorful endangered songbird (Figure 27). The GCWA parallels the BCVI in size and in its diet. Both are insectivorous neotropical migrants that forage for insects either on hardwood trees or in prairies/grasslands. The similarities between the two really stop there.

Golden-cheeked Warblers generally occupy mixed old growth forests on the sides of hills and in valley bottoms. They use the peeling bark from Ashe juniper trees to build their nests. Juniper trees do not have peeling bark until they are close to 15-20 years old. Unlike the BCVI, only central Texas can be called ‘home’ to the breeding habitat of the GCWA. This is the major reason why the GCWA is listed as ‘more threatened’ than the BCVI on the endangered species list.

Males usually arrive in North America before females. Unlike BCVI’s, however, nests are not constructed until a mate has been secured and a breeding territory set up and defended. Breeding territories are usually larger than 2 hectares. As with the BCVI, the most broods recorded for GCWA pairs in a single breeding season is two.

Compared to the BCVI, GCWA fledglings mature quickly and become independent of their parents rapidly. Within 1 month of hatching, GCWA fledglings are completely independent and join ‘rogue’ bands of other warbler fledglings, Black-crested Titmouse, Carolina Chickadees, wrens, Hermit Thrushes, and robins. Hatching-year Black-capped Vireo’s migrate back to Mexico in the fall with their parents, while GCWA fledglings migrate south, unaccompanied.

Golden-cheeked Warblers start heading for Mexico earlier in the season than BCVI’s. Most golden cheeks are gone from central Texas by mid July-early August. BCVI’s can remain until early-mid September. Golden-cheeked Warbler males sing in the early morning and in the late afternoon, before sundown. During the hottest part of the day, they are mostly silent.
THE NEED FOR GCWA POPULATION MONITORING AND HABITAT MANAGEMENT

Currently, there are only an estimated 20,000 breeding pairs of GCWA’s. This number sounds like a decent amount. However, one must look beyond this population count and consider the underlying threats to the species, in order to really understand just how endangered these tiny songbirds are. For example, unlike the BCVI which, on top of breeding throughout 2 North American states (Texas and Oklahoma) also breeds in Mexico, the GCWA’s total breeding range consists ONLY of the Texas Hill Country (Figure 28).

Additionally, hilly old-growth forest along the central flyway (migration route of the GCWA as well as the BCVI) between North and South America is rapidly disappearing due to timber harvesting and human development. Many GCWA’s die along the journey due simply to not being able to find suitable habitat in which to land and rest. When you add in the human population explosion element, and think about the fact there are 20,000 breeding pairs of Great-tailed Grackles within the city limits of Austin alone, the number of remaining GCWA’s does not seem as large as before.

Figure 28. Current habitat range of the GCWA (adapted from Ladd and Gass (1999) and the National Geographic Society (1999)).
Figure 29. Current GCWA management areas at BCNWR (map courtesy of BCNWR).
At BCNWR, almost 16,000 acres are, or will be managed for the GCWA. Golden-cheeked Warbler habitat (Figure 29) was spared more than BCVI habitat because of its inherently inaccessible nature (on the sides of steep slopes) to humans. Historically, fire has also impacted the hillsides in central Texas less than the flat and open ground.

The best way to manage for GCWA habitat is to simply let forests alone. At BCNWR, more land is dedicated to management for the GCWA than for the BCVI because: 1) the GCWA is considered 'more endangered' than the BCVI, and 2) it is much easier to manage for GCWA habitat. The landscape of the refuge is predominantly comprised of old growth – forested hills and valleys. Much of the available scrubland / open grassland has been converted to ranches, homesteads or commercial property.

The other major reason for this management discrepancy is the conservation status of the respective songbirds, on the Endangered Species List. Golden-cheeked Warblers are considered to be endangered

Figure 30. Breathtaking view of the fantastic GCWA habitat on the Webster tract. (personal photograph – spring, 2009)
because only an estimated 20,000 pairs are known to exist. In addition to this, their entire breeding range is limited to central Texas, while the BCVI breeding habitat extends north into Oklahoma. It is widely believed that the Black-capped Vireo will be downgraded from endangered to threatened status within the next year because of the discovery of the Mexican based breeding colony.

**GCWA MONITORING**

![Figure 31](image)

Figure 31. Author monitors for the GCWA on the Rodger’s Front Range tract in the spring of 2009 (personal photograph, Spring 2009).

**THE PROCESS/ GATHERING THE DATA**

My beginning days of Golden-cheeked Warbler monitoring consisted of numerous “practice trials”. In effect, I spent many days out in great warbler habitat practicing my listening, tracking and recording skills. Starting in April, I officially started recording GCWA sightings and songs heard for use in constructing a population estimate and in territory mapping. I was assigned one section of the refuge to survey throughout the breeding season (the Rodger’s Front Range (RFR)). Encompassing an estimated 500 acres, this tract of land is on the southeastern boundary of the refuge.

I heard my first Golden-cheeked Warbler male while driving to work on March 17th (Figure 32). This particular GCWA was a male that had set up a territory alongside the driveway of the Flying X ranch. Two days later, while surveying for GCWA males on a different tract of refuge land (the “Rodger’s
Front Range), I had the opportunity to snap my first pictures of a very territorial male (Figure 33). I had caught him in the middle of setting up his territory and he quickly came within camera range when he heard a GCWA cassette tape recording. Some have argued against the use of taped recordings during bird surveys. However, I had authorization under federally issued permits to use these tapes for GCWA and BCVI surveys/monitoring. Only staff and appointed volunteers fall under coverage of such permits.

Figure 32. Author hears first GCWA along the driveway to the Flying X tract (March 17th, 2009- personal photo).
The same methodology and equipment that I used during BCVI monitoring were employed for GCWA monitoring. The only difference between monitoring these two species is the habitat/landscape. Monitoring for BCVIs can be more difficult than monitoring for GCWAs because BCVIs are camouflaged very easily by the hardwood trees/scrubby vegetation of their habitat. Golden-cheeked Warbler’s do not ‘blend in’ as well because their beautiful yellow heads contrast so sharply with the dark green of ash juniper trees (and other vegetation/trees).

A couple of elements that tend to make monitoring for GCWAs difficult are: 1) the terrain 2) GCWA males are much quieter during midday and during nesting, incubation and raising young. Unlike BCVI males (who sing non-stop from sunup to sundown, throughout the entire breeding season), most mated GCWA males will become more silent as the nesting season wears on. The only GCWAs that can be heard mostly day- and season- long are unmated, young males.
RESULTS OF GOLDEN CHEEKED WARBLER MONITORING

During late March through early June, 2009 I made 10 territory monitoring hikes into different parts of the Rodger’s Front Range (RFR) and Penn-Post Oak (PPO) tracts (Figure 34). At the end of this time, I had tracked and recorded at least 50 GCWA males and observed 10-15 females in approximately 500 acres (250 hectares). An estimate for the number of GCWA territories observed is not as easy to come by as presence/absence figures. Even late into the breeding season (eg. mid-May through July), some males fail to find mates. Because of this, the total number of definite nesting territories will usually be a little lower than the total number of males observed. This being said, I can safely estimate the number of nesting territories to be close to 40. This number is slightly above the average for the RFR/PPO tract, when considering past monitoring periods.

In May, I was able to hear a variation of the ‘B song’ of male GCWAs that was rarely recorded by refuge staff in previous years of monitoring. The B song is one of 4 most- prominently used songs of the GCWA male (the others being labeled A, C and D). I was monitoring a particularly steep canyon on May 12th when a second year (1 year on the refuge as an ‘adult’ bird) male came flying toward me in response to the ‘B song’ I was playing from my cassette player. I actually chuckled to myself because he was so excited, he could barely get his call out.

It was only upon doing a little research on the different calls of male GCWA’s that I discovered that the song I had heard coming from the SY male was, in fact, a lesser known variation of the ‘B song’. Golden-cheeked Warbler’s have a wide range of songs/calls (known as Types A–D songs) with variations occurring within each song and between different birds. This being said, they only regularly use song Types A and B, however.

A slightly ominous tidbit was the fact that, as of June 10th, 2009 only 5 GCWA hatchlings or fledglings had been discovered, across all monitoring efforts. On numerous occasions, refuge trackers had witnessed males and females building nests, but we had seen very few youngsters being reared in these nests. Therefore, we could not determine if the lack of hatchlings and fledglings was due to our ill-timed observances (ie. in the amount of time that it took for us to check-back at various nest sites, very new hatchlings could possibly have fledged), or whether there really was a severe downturn in the number of successful clutches on the RFR. All indications (eg. the fact that I did not allow more than a week before revisiting a nest) point to the later situation being the case.
On another disappointing note, in no more than 6 months from now, development will begin for a new sub-division directly across the road from the RFR tract. Currently, that site contains wooded canyons, old growth juniper stands and many GCWA territories. A big purpose of conducting the 2009 GCWA survey was to obtain a baseline number of pre-development territories/birds on the RFR. There is no doubt that many warblers will seek out new territories on the RFR next year after they are displaced by the new subdivision. We expect inflated territory/individual numbers and decreased territory sizes on the RFR over the next few years, as a result of the influx of warblers.

I covered close to 1/2 of the RFR acreage (and ¼ of Penn-Post Oak acreage) (Figure 34). Until the first week in May, I was essentially ‘flying blind’ because I had not been equipped with a tape recorder. After I obtained one, it made tracking the warblers a much easier process.
Figure 34. Golden-cheeked Warbler monitoring areas (pink patches) covered by author from spring through summer, 2009 (map created by author, Spring, 2009).
FIRE CREW RESPONSIBILITIES

Figure 35. (Top) Texas Interagency Wildland Fire Fighter Academy - fall, 2008 (photo courtesy of Texas Interagency Wildland Fire and Incident Management Academy photographer.) Figure 36. (Bottom Left) Author after responding to a wild fire call (personal photo). Figure 37. (Bottom Right) Fire line set by author on Eckhardt tract – (personal photo - winter, 2008).
Week 4 of my position was devoted to the Interagency Fire Academy in Bastrop, Texas (Figure 35). Balcones paid me to attend this academy so that I could assist with some prescribed burning and
eventually become a Type 2 wildland firefighter (Figure 37). The academy ran from Tuesday, Oct. 21st – Saturday, Oct. 25th. At the academy, I learned the basics of wildland firefighting and safety (Figure 38). I was able to patrol an actual prescribed burn at Camp Swift (in Bastrop, where the Academy was held) (Figure 39). While patrolling, the duty of my class was to ‘hold’ the fireline, looking for spotting and observing the behavior of the fire. On the last day of the academy, my class had to construct a mile-long fire line by hand. The fire line was close to Bastrop State Park and would serve the purpose of holding a prescribed forest fire set for this coming spring/summer (Wolf (Monthly Report 1), 2008).

**CONTROLLED BURNS**

![Author stands in front of the charred remains of the Eckhardt tract landscape after a controlled burn with which she has assisted (winter, 2008- personal photo).](image)

On January 8th, I took, and successfully completed my pack test in order to become certified (“red carded”) as a Type 2 wildland firefighter. That same day, I was asked to assist the fire crew with a controlled burn on the Eckhardt tract (not within the manipulation or control units) (Figure 40). I was excited when I was assigned the drip torch. I enjoyed lighting the fire along the fire line (about 1.5 miles) and watching it consume so much acreage. On that day, we burned a 100 hectare unit. The objective was to kill all shin oak less than 2 meters tall and all juniper to convert the burn unit back into an oak savanna.
A couple of tense moments occurred on this fire. First, the fire “slopped over” onto the wrong side of the fireline. It burned about an acre before we could get it put out. Another really tense moment occurred when we realized that there was a hiker right in the middle of two fire walls that we had created! He barely made it out of an opening. When asked what he was doing on private refuge property, he said that he saw smoke and decided to investigate.

On January 16th, I was able to run the drip torch on another 100 hectare controlled burn on the Johnson and Barhoe tracts. This burn included land from 2 separate units of the refuge and additional land from a private landowner. The objectives were to consume at least 80% of cedar slash (cut cedar trees that have died and are lying on the ground) and most juniper/oak trees less than 5 feet tall. The goal of completing this objective was to convert the land back into pastureland and grassland for the private landowner.

![Figure 41. A look at the Eckhardt tract controlled burn from author’s fireline. (winter, 2008- personal photo)](image)

The final controlled burn I assisted with was on the Gaynor tract in the very early spring of 2009. That burn encompassed about 100 hectares of scrubland and hardwood savanna.

**WILDFIRE RESPONSE/PATROL**

On Tuesday, April 7th, I was called out to my very first wild fire (Figure 42 & 43)! A local rancher had tried to burn some cedar slash piles, but the fire got away from him and started spreading rapidly. Balcones Canyonlands NWR fire crew and local volunteer fire departments responded to the fire. At
this fire, I had the opportunity to do a ‘direct attack’ (spraying the head of the fire with water to cut down the flames).

About an hour after the start of the fire, a tanker was called in to drop water on the flames. Water was retrieved from the pond of the rancher, who had started the wildfire in the first place.

Although exciting, I was a little apprehensive at times because I had no escape route to a safety zone. If the fire threatened, I would have had to run back to the engine and jump in (and hope that the flames wouldn’t engulf the vehicle)! All told, the fire burned about 20 hectares (15 private land, 5 refuge land).
Figure 42. (Top) A look at a central Texas wildfire from the author’s vantage point—author is holding camera (Spring, 2009—personal photo). Figure 43. (Bottom) A tanker takes water from a pond to drop on the wildfire (Spring, 2009—personal photo).
During the first week of November, I checked out a 45 pound pack from our fire crew in order to begin training for my pack test. The general layout of this wildland firefighter’s test is to walk 3 miles in 45 minutes with 45 pounds on your back. The test is labeled ‘arduous’ and is the highest ranked in a group of 3 similar physical endurance tests. I started training (jogging, running, etc.) at the end of October, and continued my training throughout November in preparation for the pack test. In December, 2008, I took and passed the pack test (Figure 44).

For me, the goal of training to become a wildland firefighter was two-fold: 1) I would be able to aide in setting/managing prescribed burns, in order to enhance habitat for local and endangered species. I could also be able to fight naturally occurring or human-made wild fires, in order to protect habitat and human structures. 2) I would also be able to add my experience and knowledge of wild fires and firefighting to my skill set in order to help obtain a great position in the future.
Wild land Firefighter Refresher Course

On April 2nd, 2009 I participated in the annual wild land firefighter refresher course. The Balcones Canyonlands NWR fire crew hosts this annual refresher. The theme for this all-day course was “If You See Something, Say Something!”. The reason behind this title was that, over the past 5 years, the number of wild land firefighter deaths have increased, due to negligence/recklessness on the scene of a fire or, not speaking up when dangerous “look out” situations are discovered (“look out” situations include, but are not limited to- the weather changing/becoming drier, increased wind speed, change in wind direction, erratic fire behavior, etc.).

The course for 2009 contained two parts: 1) inside/classroom discussion of fire communication/ fire shelter deployment, etc. and how to be more cautious (going to, at, and coming back from a fire). Most wild land firefighter deaths each year are attributed to reckless driving of heavy machinery and vehicles on the way to a wildfire (not while battling the blaze). 2) fire shelter deployment drills – there were 3 of these drills and each was used to simulate fire shelter deployment in different environmental/ terrain situations. Video was taken of us doing our drills and will be available on the Balcones Canyonlands NWR fire crew website page in the coming months.

‘BRIDGES TO BIRDING’ AND ‘GOING BUGGY’

The title of this section is the title of the two most popular environmental education programs put on by BCNWR recreation specialist Rob Iski. Over the past 5 years, these two programs have been developed and perfected to very efficiently teach grade and middle school – aged children about conservation, biology, anatomy and the environment. It was my responsibility to aid Rob in further perfecting these programs. I was given the task of simplifying and organizing all the information so that it could be presented in a better manner to prospective school district teachers and administrators.

I not only served as an on-site environmental educator during days the programs were being held, I also totally overhauled and reworked the information used to train program staff/volunteers. The refuge recreation specialist administers the program several times throughout each year. Each program consists of 3 days of environmental education stations/talks/demonstrations. Students from neighboring schools attend each program. For May’s programs (for example), we had an attendance of approximately 100 students /day.
My station for the ‘Bridges to Birding’ program was the ‘bird banding’ station. Students rotated between stations in groups of roughly 10-15. My station covered such topics as: netting, types of bird nets, banding, reasons for banding, species of birds banded, technique, etc. At the end of my talk, students were able to ‘band’ their own birds (stuffed animals, of course). I had set up a badminton net (as a ‘practice’ mist net) and the students practiced such things as: removing the bird from the net, banding the tarsus (pipe-cleaners), taking wing and tail measurements, and identifying the species of bird (using pocket field guides) (Wolf (mo. report 8), 2009).

Although arduous at times, my work on reorganizing and ‘beefing up’ the education material of these two programs gave me a huge sense of pride. Through my efforts as an educator and in the office, I really believe I made a difference in inspiring children, through being more knowledgeable, to care more about environmental/conservation issues.

“OTHER DUTIES AS ASSIGNED” (OR, THE SMALL PRINT)

**BIG GAME HUNTS**

Throughout the fall and winter of 2008-2009, I was able to assist the fire crew with managing the general hunts on BCNWR property. I was in charge of maintaining the hunter payment log and manning a couple of hunt stations. As hunters brought in kill, I had to age the deer and keep tally of numbers, sex, and all other game species.

The one issue I had against doing this is the fact that, for the past 3 years, the white-tailed deer population on refuge property has seen a huge decline. While some decline is beneficial to habitat and human safety, too steep a decline should be slowed by less hunting on refuge lands. At present, 13 tracts are included as general hunt units. It is my opinion that hunting should be minimized (as much as possible) for several years to allow the white-tailed deer a chance to rebound.

**ROADRUNNER RESEARCH ASSISTANT**

In the summer of 2009, I assisted a visiting researcher with trapping, banding, taking measurements and drawing blood samples from Greater Roadrunners (*Geococcyx californianus*) (Figure 45). His research focused on the genetic relatedness of the roadrunner gene pool. My initial help to him consisted simply of telling him (and setting down on a map) where I had seen roadrunners on refuge property. Luckily, I kept track of nearly all of my animal encounters/sightings, along with the locations of each. I really
enjoyed using my newly acquired knowledge of the Hill Country and its wildlife to aid his research. In our short time of working together, I also assisted the researcher in drawing blood samples and taking anatomical measurements of each roadrunner caught.

*Figure 45.* Author holds a roadrunner after taking its measurements and drawing blood (May, 2009- personal photo).

**TEXAS SONGBIRD FESTIVAL**

In the Spring of 2009, I acted as a tour guide for the Texas Songbird Festival. I was able to assist on a tour of part of the Cow Creek watershed on April 25th, 2009 (Figure 46). The tour was led by Joan Muckherjee, a Ph.D. in chemistry and master naturalist (self taught). This particular tour was a part of a series of expert – guided tours for the Texas Songbird Festival.
I also had the opportunity to answer questions posed by the members about the names of wildflowers, plants, grasses, birds, and other wildlife. Answering their questions allowed me to practice using the knowledge of native biota I had been accruing since my arrival to Central Texas in September, 2008 (Wolf (mo. report 8), 2009).

**OAK WILT**

Throughout the fall and spring of 2008-2009 I assisted a fellow biological technician with identifying and mapping oak wilt centers on refuge property. Essentially, we used old oak wilt maps with old centers as a reference to search for new centers.

**GIS/GPS**

It was through this task and through my mapping the BCVI habitat transects that I was able to become even more familiar with GIS/GPS technologies. I was also able to construct many of the maps included in this report. Since completing my master’s degree coursework, I have desperately wanted to learn more about GIS. This internship helped me to do just that.
REFLECTION

WHAT I HAVE LEARNED

What I have learned throughout my year at BCNWR is comprised mostly of two issues: 1) my viewpoint of the conservation approach at BCNWR (for the BCVI and GCWA) and an awareness of a different perspective I believe I could add if I had the chance/ power, and 2) my personal growth/strength/ambition.

*It is important to understand that what I offer in the following pages is simply ‘food for thought’. I do not intend to diminish the hard work and experience of scientists or bird enthusiasts who have spent many years studying these songbirds. My perspective on revisions to conservation strategies for the GCWA and BCVI is built upon my anecdotal evidence and observations, alone.*

WHAT I WOULD CHANGE

OPINION OF LIFE REQUIREMENTS/ CHARACTERISTICS FOR BCVI AND GCWA

After monitoring the habitat/territories of both the GCWA and BCVI (and spending many hours observing their behavior in the field), I have come to a surprising conclusion. The current and most popular conception, among avian biologists (and among BCNWR refuge staffers) concerning the habitat characteristics and basic behavior of these songbirds, may be in need of some revision.

HABITAT

In general, what is considered “suitable” habitat for both the GCWA and BCVI may need to be expanded in order to include many more vegetation associations, landscape reliefs and soil/bedrock geology. It is my opinion that, with the passage of time, what many biologists and other avian/songbird enthusiasts believe to be the best habitat for these two endangered songbirds, has shrunk (instead of expanding).

In 1955-56, Jean Graber described the habitat of the BCVI as one of hybridization and integration of vegetation associations (as east meets west and north meets south). In addition to this, she discussed the *transitional* nature of BCVI habitat (good BCVI habitat is neither very young, or old growth). So, although vireo habit is extremely localized in Texas, that does not necessarily mean that it must be comprised of only hardwood shinnery. In fact, I have heard BCVI songs calling from live oak motts, or
stand-alone juniper trees in wide open hardwood/juniper savannas (on the Webster tract) (Figure 47). Of course, I have no quantitative data, just scribbles in my refuge journal from the days I heard certain BCVI individuals.

Figure 47. A BCVI was heard in this live oak savannah by the author in April of 2009 (Webster lowlands- personal photo).

I believe that more consideration needs to be given to the possibility that the GCWA and BCVI are surviving and adapting in a rapidly changing/shrinking breeding range. It is my belief that these songbirds are expanding their list of what qualifies as ‘suitable’ habitat for their breeding purposes. In a sense, they are de-specializing in their habitat types. Shrinking habitat and human encroachment are forcing these birds to expand their range into suboptimal habitat.

The popular idea at BCNWR is that the BCVI’s and GCWA’s will only be found/will only venture into those habitat types that fall under “suitable” in the bird textbooks. In just my brief year of walking over thousands of acres of refuge land, I have witnessed many deviations in habitat use from the expected “norm”. One example of such a deviation is noted in a previous paragraph in this section.

For example, since my arrival in central Texas, I was told that GCWA’s will only be found in old-growth, mixed forests, usually on hillsides, canyon edges, or valley bottoms. While I found this fact to generally be the case, on a couple of occasions, I heard (or saw) GCWA individuals in either ‘unsuitable’ or even ‘BCVI habitat.’ I believe that further research could be utilized in order to discover
whether these movements of the songbirds are transient in nature, or whether they represent a more permanent response to human encroachment.

As I was assisting Juan Pablo Assmus with banding efforts in the spring of 2009, we were both shocked and ecstatic to hear and observe a young (second year) GCWA male singing away at the top of an emergent (5m) juniper tree in the middle of the Eckhardt Northwest tract (Figure 48)! This section of the Eckhardt tract has been historically managed for BCVI habitat ONLY because of the patchy/shrubby vegetation that grows there. There are absolutely no large hills and definitely no old-growth mixed forests to be found anywhere on this section of the tract!

While I understand that birds can move around and utilize different habitats as they pass from one patch of suitable habitat to another, it is still my belief that the number of times I witnessed the BCVIs and GCWAs ‘out of their preferred habitats’ was enough to warrant further research. In total, I witnessed (by either seeing or hearing) 3 BCVIs and 2 GCWAs that were far from their suitable habitat. These individuals remained in the suboptimal habitat throughout the monitoring season. One line of thought might me that these misplaced individuals were young males who were roaming rather far from good habitat in order to find a mate.

*Figure 48.* Author stands in front of Eckhardt Northwest after bulldozer manipulation (‘smashing’). Note the emergent juniper trees in the background. It was from these exact trees that the GCWA male was heard/seen singing in the spring of 2009 (personal photo).
LIFE CYCLE/MIGRATION

As I was doing some transect work at Peaceful Springs Nature Preserve (adjacent to the Flying X property) in mid September, both a fellow researcher and I heard, tracked down, and photographed a BCVI male. Upon listening further, we were able to hear 4 different males and a female, on only one plateau top! This information could add to the refuge thought on migration dates for the BCVI. Refuge staff believes all BCVI’s have left central Texas for Western Mexico by the end of August.

CONSERVATION STRATEGIES

I disagree with the conservation strategy of BCNWR staff in regard to their staunch belief in the power of controlled burning for habitat management. While I do understand and agree with the importance of periodic fire in the health of many habitats, I also think that too much fire can destroy potential nesting habitat.

Periodic fire thins out exceedingly dense habitat, returns nutrients back to the soil and helps put vegetation back into succession. When you burn too frequently, however, habitat never gets a fair chance of becoming really suitable for wildlife (and especially the BCVI). Years of a burning regime that is too intense and too frequent can, in my opinion, drive much wildlife away, especially sensitive species, such as songbirds.

I believe that the burning cycle of the BCNWR fire crew is too frequent, too widespread, includes too high a proportion of refuge BCVI habitat and, therefore, has caused a decline in the number of BCVI territories in the past 10 years. Refuge staffers are puzzled by this population decrease. But, where are the vireos to go when much of their refuge habitat is either ‘smashed’ or burned? In the fall of 2009, close to 1/3 of all BCVI habitat was being simultaneously manipulated. The average burn cycle has each burn unit of the refuge being burned every 3-5 years.

Neighbors of the refuge (who have their land in easement…and whose land is not burned) have reported an increase in the number of vireo territories on their property over the past 10 years. At Peaceful Springs Nature Preserve, the total number of territories increased from 3 in 2002, to 15 in 2009!
In general, I believe that my time at BCNWR became less of a chance at making a direct difference in the conservation of the GCWA and BCVI, and it became more about how I would make real change in the future (what I would do differently in order to assist the wildlife that I love above all else...except my family and close friends). During my year with the U.S. Fish and Wildlife Service, I learned much about my passion and my views on the conservation and management of wildlife.

**U.S.F.W.S MISSION AND MY ROLE IN IT**

The U.S. Fish and Wildlife Service mission statement is: **“The U.S. Fish and Wildlife Service’s mission is, working with others, to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.”** (U.S.F.W.S., 200

My role in working with the U.S. Fish and Wildlife Service was simple. Through my status as a wildlife management intern, I assisted in conserving and protecting the habitats of the Golden-cheeked Warbler and the Black-capped Vireo. I enjoyed working with a federal agency because it opened my
eyes to the power the federal government has to make change and get things accomplished in the realm of conservation.

**THE ROLE OF THE INSTITUTE OF ENVIRONMENTAL SCIENCES IN MY INTERNSHIP**

From beginning to end, the philosophy of the Institute of Environmental Sciences (IES) has permeated most decisions and actions I took with my internship. In general, the biggest reason I chose an internship with the U.S.F.W.S., as opposed to any other position, is because I came to better know and understand my ultimate career goals during my two years with the IES.

Prior to entering the Institute of Environmental Sciences, I had always thought I wanted to be a veterinarian. When it came time to pick a graduate school, I began to realize that I could make a much bigger difference in conservation and in environmental protection if I chose to continue my academic career as an environmental scientist. IES opened my eyes to the wide array of career opportunities available and gave me the skill-set and experience to make those opportunities a reality.

From the IES, I will take away a sense of freedom in choosing my career path. Having a degree in environmental science offers one a large pool of career opportunities. I admire the professors in the Institute because they believe whole-heartedly in what they do. It is my ultimate career goal to eventually become a professor in a biological field, after I have worn myself out from fieldwork.


APPENDIX A – supplemental transect completion information

Line Transects (Vegetation): Directions for Completion

**I completed the following vegetation transect directions in the spring of 2009 in order to pass on my specific office and field techniques to current BCNWR staffers, researchers, and all interested public. The refuge wildlife biologist gave me the basic steps and I tweaked them to be a little more applicable to the general public and master naturalists, as well.

**In the Office:**

1] Secure a good map (topographic) of your study area/habitat type.

2] Draw a grid over the top of the map (make certain you make copies of your map ahead of time, to ensure you don’t mark up the only map you have!). The grid should consist of vertical and parallel intersecting lines (each line should be about $\frac{1}{2} - 1$ inch apart from the next…this depends on the size of your map…but with most field maps, this spacing works well). Label the horizontal lines 0,1,2,… and the vertical in the same fashion. These numbers correspond to your (x,y) coordinates for the START points of your transects. Remember that the horizontal lines are the x-coordinates and the vertical are the y-coordinates.

3] Select random transect START points for transects by using a random number generator. Pick a random number in your head, like some one’s birthday… (for example, go across the top of the generator (columns) the number of days in the birthday and down the side of the generator (rows) the number of the month). You will need at LEAST 4 transects/habitat type for reliable data/results.

   * Start Points = random coordinates selected by use of a random number generator. Coordinates must fall within the pre-designated study site/habitat type. If they do not, throw them out, and keep looking for new random coordinates. Start points are simply the “start” of where you begin each transect (with a randomly pre-chosen azimuth), not the “origin” of each transect. The use of these points in the field will be described in more detail below.

4] Hand draw your START points on your grid map where the horizontal and vertical lines you picked meet up.

5] Now take those points, and use GIS technology to find real GPS coordinates that correspond.
6] Construct personalized transect data sheets for each habitat type. You will need one data sheet/transect. A copy of a transect data sheet is attached to these information pages for reference. (NOTE: you will also need to create 1 random azimuth and distance to the origin, for each transect in your study)

**7] Gather ALL materials needed for the completion of your transects. This seems like common sense, but it is severely frustrating to get all the way to the study site and discover that you have forgotten a key tool!

A list (not exhaustive) of common tools needed for vegetation transects:

A) **Stakes** (12 inch re-bar works nicely!) – 2/ transect (origin and end)
B) **Flagging** – to mark the vegetation above particularly well hidden transects
C) **Orange non-toxic spray paint** – to mark rock cairns at origin and end
D) **Compass** – for bearing from START points to “origins” (and “origins” to “ends”)
E) **Height estimation pole** – marked with meters and decimeters (at least 3 m.)
F) **Dry-erase board** – to label transect origins and ends for pictures
G) **Dry-erase board eraser and markers** (blue, green, and red are easily seen in photos).
H) **GPS unit** – for finding ‘waypoints’/ your randomly selected START points. Also log your official coordinates for your origins and endpoints. This will aid in re-locating the transects for re-photographing them, in the future.
I) **Hammer** – for driving stakes into the ground.
J) **Bookbag** – to carry everything securely and keep hands free
K) **Water bottle** – keep hydrated!
L) **Machete** – seriously useful depending upon the density of vegetation in which you are working.
M) **50 meter surveyor tape** – use to stretch the length of each transect (30 m.)
N) **Camera** – for taking pictures of transect origins and endpoints.
O) **Radio** – to stay in touch with office/other staff, co-workers.
P) **Data Sheets**- one/transect

**In the Field:**

1] Gather all tools together and set out to site. Make a checklist of materials and check off each item before you leave.

2] When you arrive at your study site, begin by dialing in the coordinates of your start points into the GPS unit. Do this by pushing the “Find” button on the unit and selecting “Way-Points”. Input ALL coordinates and then make a “trip” on the GPS unit. This will make for an easier travel path from start point to start point, in the field. Select the “Go To” button for your first start point. Press the “Page”
button until you see a screen that has a bearing arrow and a distance measurement to the start point. Follow the bearing arrow and pay close attention to the distance. When you have walked until the distance reaches 0-5 ft, stop and dial in the pre-selected azimuth for your first transect on the compass. Walk the randomly selected ‘distance’ to the origin, along the azimuth.

3] When you have reached your origin, hammer a stake into the ground and build a rock cairn in the shape of a circle around the stake (Figure 20). Spray paint the top of the stake and the rock cairn with the orange, non-toxic spray paint. Stretch the 50 m. surveyor tape along the azimuth from the origin to the endpoint (30 m. away). Be certain that the meter tape remains as close to ground level as possible. Stretch the tape straight along the bearing of the azimuth (any deviations from the azimuth…even one step to the left/right here and there can add up to a 5-10 degree mistake!

4] Hammer stake in at the endpoint and build a rock cairn in the shape of and “X”, with the stake in the center (Figure 50). Spray paint top of stake and cairn.

![Figure 50. Sketch of typical vegetation line transect.](image)

5] Fill out the dry-erase board with the following information for both the origin and end:
**Top Row:** Transect Code (eg. “EckNW_1”) – a transect code is simply the abbreviation of your study area (“Eck”), the location (eg. “NW”) of your transect on that area, and the number of your transect (“_1”).

**Second Row:** “Origin” or “End”

**Third Row:** Status of study area, or year (eg. “[pre-burn]”, or just: “2009”)

**Fourth Row:** Date of transect construction

6] Take a picture of the origin and endpoint of your transect (and all transects). Be certain to place the labeled dry-erase board unobtrusively in the frame of the picture, in order to label the transect origin and end.

7] Take (at least) 2 key measurements every meter along your 30 meter transect (including at the origin and end): species present (woody, herbaceous, and grasses), and maximum height of species present. Take height measurements using the rigid/marked pole. Any vegetation that directly touches, or comes within a 3 inch circle around the pole, should be recorded on your data sheet.

8] Time to move on to the next start point. Start the process all over again.