

**BALCONES CANYONLANDS PRESERVE
LAND MANAGEMENT PLAN**

TIER II A

**CHAPTER VIII
BLACK-CAPPED VIREO MANAGEMENT**



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APPENDIX A

COMPREHENSIVE BCVI BIBLIOGRAPHY

1.0 BACKGROUND INFORMATION

1.1 Regional permit

Of the 632,960 acres in Travis County, approximately 2,000 acres were known to be occupied by the black-capped vireo (*Vireo atricapilla*, hereafter BCVI) when the Balcones Canyonlands Conservation Plan (BCCP, or “the permit”) section 10(a)(1)(B) permit was issued by the U.S. Fish and Wildlife Service (USFWS) on May 2, 1996 (Figure 1). Under the BCCP, land development during the 30-year term of the permit was anticipated to “take” or irrevocably convert up to 55% of the area’s known BCVI habitat to other uses. The permit sought to protect and conserve the remaining 45% of the known occupied vireo habitat within the proposed preserve area. The permit, jointly issued to the City of Austin (COA) and Travis County (TC), requires the permit holders to manage and maintain a minimum of 2,000 acres of occupied and potential BCVI habitat within the Balcones Canyonlands Preserve (BCP).

1.2 BCVI Management in the Balcones Canyonlands Preserve

One of the primary goals of the BCP is to protect and enhance populations of this species by providing, in conjunction with the Balcones Canyonlands National Wildlife Refuge (BCNWR), a viable BCVI breeding population as prescribed by the USFWS BCVI Recovery Plan (USFWS 1991, 1996). To achieve this goal, BCP land managers seek to stabilize and increase local populations and promote opportunities for genetic mixing among the area’s breeding colonies. Habitat managed for the BCVI should help maintain source-sink population dynamics between colonies found on the BCP and those on the Refuge. The BCNWR supports vireo populations in Burnet, Travis and Williamson Counties, and currently comprises approximately 20,000 of an anticipated 46,000-acre goal (D. Holle pers com 2004).

“Potential vireo management areas” are referred to throughout the HCP, and should not be confused with occupied vireo habitat. Though these areas share a suite of characteristics (geologic substrate, slope, and vegetation composition or structure) with occupied habitat, they are not currently used by BCVI. These areas are identified for planning purposes and represent acreage that may be successfully managed for BCVI habitat.

Occupied or potential BCVI habitat may progress to golden-cheeked warbler (*Dendroica chrysoparia*, hereafter GCWA) habitat through natural succession in the absence of natural or anthropogenic disturbance patterns. As early successional growth matures, vegetation may progress beyond the structure preferred by BCVI for nesting and rearing habitat (Grzybowski 1995). Though the BCVI is the more locally rare of the two species, the blocks of GCWA

habitat within the permit area are acknowledged to be among the most important in the remaining breeding range (BAT 1990; Sexton 1993). When habitat management conflicts occur between the two species, GCWA habitat will be managed as the primary permit obligation.

The 1996 Habitat Conservation Plan (HCP) required management of approximately 933 acres of “currently occupied vireo habitat” within the “proposed preserve acquisition area”. The permit further required that an additional 1,067 acres of BCVI habitat be created and maintained within the BCP. Some habitat areas categorized as “currently occupied” in 1996 have progressed through natural successional processes and are no longer suitable nesting habitat for the BCVI. Efforts to acquire remaining critical habitat areas within the “proposed preserve acquisition area” continue, focusing on the currently or recently occupied BCVI habitat primarily within the Cypress Creek macrosite.

BCVI in the BCP likely constitute a “sink population” within the species range. When fully occupied “source populations” reach carrying capacity due to successful breeding, expanding populations seek additional breeding habitat. Habitat areas within the BCP should be managed to provide this available nesting and rearing habitat. Further range contraction and loss of genetic variation within BCVI populations are matters of concern to ongoing recovery efforts. Additional information on source-sink population dynamics is available in the 1990 Comprehensive Report of the Biological Advisory Team, the 1991 Black-capped Vireo Recovery Plan, and the 1995 Black-capped Vireo Population and Habitat Viability Assessment Report.

2.0 BIOLOGICAL OVERVIEW

2.1 Ecology of the Black-capped Vireo

The black-capped vireo is a small, neotropical migratory passerine bird (9-10 grams in weight and 11-12 cm in length) that nests in mixed deciduous or evergreen shrubland. The breeding range for the BCVI currently includes portions of Oklahoma, Texas, and Mexico. BCVI return to Texas from the wintering grounds along the Pacific coast of Mexico from late-March to mid-April and leave the breeding grounds by mid-September.

Breeding vireos select nesting substrates consisting of shrubby woody vegetation of irregular height and distribution with spaces between small thickets and clumps. Vegetative cover in nesting areas typically extends to ground level. The most common vegetation types chosen for nesting in the permit area are sumacs (*Rhus* spp.), shin oaks (*Quercus sinuata* var. *breviloba*), Ashe juniper (*Juniperus ashei*), Texas persimmon (*Diospyros texana*), Texas oak

(*Q. buckleyi*), and plateau live oak (*Q. fusiformis*). Appropriate nesting structure in these woody species typically occurs in a sub-climax vegetation state within that portion of the BCVI range that is covered by the regional permit. Habitat manipulation and maintenance to sustain seral stages preferred for nesting will be required to achieve the population management goals established by the permit.

According to the USFWS, viable BCVI colonies consist of 500 to 1,000 breeding pairs. One of the primary goals of the BCP is to protect and enhance populations of this species by providing, in conjunction with the BCNWR, a viable BCVI breeding population as prescribed by the USFWS BCVI Recovery Plan (USFWS, 1991).

The BCVI has suffered significant reductions in nesting range. This species was recorded nesting in Kansas in 1885 (Goss 1885), and has not been sighted in the state since 1952 (Tordoff 1956). BCVI are known from three locales in Oklahoma, and are likely extirpated from much of their former north central Texas ranges. Little information is available about the status of the Big Bend and Concho Valley populations that occur primarily on private land. Significant breeding colonies in Texas remain at Fort Hood Military Reservation in Bell and Coryell counties, in western Kerr and Bandera counties, and in the canyons of the Devil's River in Val Verde County (Maresh 2005). Researchers have confirmed breeding populations of BCVI in portions of northern Mexico, but population estimates vary significantly (Benson and Benson 1990, Scott and Garton 1991). Recent reports of BCVI nesting attempts in Coahuila, Nuevo Leon and Tamaulipas have been confirmed, though no systematic and thorough surveys have yet determined the total distribution and abundance of the species throughout the Mexico range. BHCO are known from these regions, and have been documented to parasitize BCVI nests in Mexico. While research is currently underway, no measure of BCVI productivity or the extent of BHCO parasitism in Mexico is currently available (C. Farquhar pers com 2005).

2.2 BCVI Habitat Description

Habitat descriptions provided here relate to BCVI in the Travis County area, and are not necessarily characteristic of the species throughout its entire range.

Grzybowski (1995) describes BCVI habitat as:

“low scrubby growth, mostly deciduous and of irregular height and distribution, with small spaces between the thickets and clumps, with vegetation cover to ground level.

This is an early successional progression, or one maintained in edaphic (due to soil or

topography) settings such as occurs in rocky gullies, edges of ravines, and on eroded slopes; thus often quite localized.”

BCVI habitat has been characterized as including:

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

Plant species most frequently encountered in occupied habitat in Travis County include shin oak, Texas oak, plateau live oak, and Ashe juniper. Other species providing a significant portion of deciduous cover in territories include sumac species, Texas persimmon and Texas redbud (*Cercis canadensis*) (USFWS 1991).

In the Travis County portion of their range, BCVI typically select nesting substrates located in early successional stages of woody shrub species. This preferred dense structure is often caused by some disturbance, such as vegetation clearing or fire. Some evidence seems to provide a correlation between BCVI concentrations and areas recovering from relatively hot fires. Fire can retard or kill young junipers and enhances regrowth of fire-tolerant oak and sumac species. BCVI nesting habitat may also occur in vegetative communities found in eroded gullies, areas with poorer soils, steep slopes, or more rocky substrates that maintain vegetation at an early successional stage (Grzybowski 1995).

Areas with early successional vegetation caused by fire, eroded gullies, poor soils, steep slopes, or rocky substrates are not rare but are also not predictive for vireo habitat. Other factors may be important to the development of suitable habitat, such as the apparent relationship between certain geologic layers and BCVI habitat. Sexton notes that the distribution of breeding populations of BCVI in Texas seems to be highly correlated with only a few distinctive strata of sedimentary rocks, foremost among them the Fredericksburg group of the lower Cretaceous age (Sexton 1993). The cause and effect relationship between BCVI and these formations are not understood, but this correlation may help to explain the extreme patchiness of distribution observed throughout the species range. This apparent relationship between BCVI nesting habitat and edaphic factors was used in conjunction with

historic BCVI nesting records to quantify “potential BCVI habitat” in the HCP (Sexton 1994 COA unpublished BCVI map information).

2.3 Threats

The USFWS BCVI Recovery Plan identifies low reproductive success, nest parasitism by the brown-headed cowbird (*Molothrus ater* hereafter BHCO), direct impacts to habitat areas, overbrowsing, suppression or alteration of natural disturbance regimes, and indirect effects of land uses as the primary threats to the continued survival of this species (USFWS 1991).

2.3.1 Low Reproductive Success

Low measures of reproductive success and recruitment of young into the breeding population led in part to the listing of the BCVI as endangered in 1987. Estimates of survivorship based on observed field data fall short of the calculated minimums required to maintain stable populations (Grzybowski 1990a, b, c, USFWS 1991). Estimated recruitment based on field observations from the Austin area also indicates levels inadequate to achieve population stability (Grzybowski 1988a, USFWS 1991).

2.3.2 Nest Parasitism by the Brown-headed Cowbird

A significant cause for declining BCVI populations cited by the USFWS is BHCO nest parasitism (USFWS 1991). BHCO incubation intervals are four to five days shorter than the BCVI, lending a significant competitive advantage to the larger BHCO chicks. Researchers have documented clutch failure due to BHCO females damaging or removing BCVI eggs, parasitized nests in which BCVI eggs never hatch, and complete nest abandonment (USFWS 1991). USFWS estimates of adult and juvenile survival rates yield very high probabilities of BCVI extinction in parasitized areas. USFWS concluded that without effective brood parasitism control, habitat management efforts to support the BCVI would be futile (USFWS 1996a) (See Tier II-A Chapter X).

2.3.3 Direct Impacts to Habitat Areas

Habitat loss has also been identified as a major threat to BCVI. Conversion of BCVI habitat into urban and suburban landscapes through road and subdivision construction has been documented in western Travis County (Espey, Huston and Associates 1988, DLS Associates 1989). Range management practices that remove or reduce low brushy vegetation are common throughout the Edwards Plateau, and may destroy and impair recovery of suitable habitat areas. Rangelands that have been cleared are often exposed to grazing patterns utilizing cattle, goats and sheep that may further inhibit development or recovery of impacted BCVI nesting and rearing habitat (Marshall et al 1985, USFWS 1991).

Oak wilt is a disease of the family Fagaceae (*Quercus spp.*) caused by the fungus *Ceratocystis fagacearum* (Bretz) Hunt. In 1972, oak wilt in Texas was known to occur only in one county (Jones and Phelps 1972). By 1995 oak wilt had been confirmed in 55 counties with 2,000 oak wilt centers. In Travis County 258 centers were confirmed from June 1988 to December 1994 (Texas Forest Service, 1995). Oak wilt represents a significant threat to the BCVI due to the potential to significantly impact key components of nesting and rearing habitat. There is currently no cure for oak wilt, though several measures to manage the disease are available. See the Tier II-A Chapter 3 for a more thorough discussion of this disease and recommended management actions.

2.3.4 Overbrowsing

Populations of native and introduced ungulates have the capacity to significantly impact vegetation composition and structure. White-tailed deer (*Odocoileus virginianus*) for example, require approximately one-half ton of browse and forage per individual per year. Browse pressure can suppress natural regeneration of native plants, resulting in changes in species abundance and distribution throughout the habitat. As some plant species are preferentially selected as food sources, these species may be reduced throughout the landscape. In the mixed juniper and deciduous woodlands of the BCP hardwood seedling establishment is especially vulnerable to selective foraging pressures. Both mast (seeds and fruit) and vegetation of young seedlings are high quality foods available to and preferentially selected by white-tailed deer (Cook 1984).

Long-term plant community changes resulting from browse pressure may reduce the quality and quantity of nesting and rearing habitat for breeding songbirds, including the BCVI and GCWA (Russell et al 1996). Populations of browsing ungulates including white-tailed deer must be managed to protect habitat areas within the BCP (Campbell 1995a, Campbell 1995b). For management guidelines addressing control of native and introduced ungulates, see Tier II-A Chapter X.

2.3.5 Suppression or Alteration of Natural Disturbance Regimes

Suppression or alteration of natural disturbance regimes may prevent the creation and maintenance of suitable BCVI habitat in Travis County. Under natural conditions, a mosaic of suitable vegetation types co-occurring at different seral stages due to varying disturbance patterns would be expected across the landscape. Anthropogenic control of disturbance events tends to reduce the heterogeneity of habitat structure and allow areas to proceed through natural successional processes beyond habitat suitability for BCVI.

2.3.6 Indirect Effects of Land Uses

Predation by elevated populations of raccoons, squirrels, skunks, domesticated and feral house cats, and other species associated with an increasingly urbanized setting represent an additional threat to BCVI survival (USFWS 1991). Documented impacts upon native wildlife by these predators in urban environments (Wilcove 1985) may require action to successfully manage preserves located in a rapidly developing western Travis County. Red imported fire ants (*Solenopsis invicta*) are generally associated with disturbed habitats and often accompany new suburban development. Red imported fire ants and snakes have been found to be the two most dominant predators of BCVI at Fort Hood (Stake 2000) and may represent a previously underappreciated threat to this species (See Tier II-A Chapter X).

3.0 MANAGEMENT PROGRAM

BCVI management within the BCP focuses on creating and maintaining suitable nesting and rearing habitat through vegetation manipulation, reducing habitat fragmentation, reducing pressure by nest parasites and browsers, and minimizing secondary impacts of increasing urbanization. BCP Land Managers are encouraged to coordinate management actions throughout the preserve.

3.1 Management Goals

This document provides a general framework for BCVI habitat management throughout the BCP. Specific population and habitat goals, objectives, and priorities are to be defined on a tract-by-tract basis by agency Land Managers based on the USFWS BCVI Recovery Plan and with review and guidance from the BCP Scientific Advisory Committee. See Tier III Land Management Plans for tract specific goals and strategies.

Primary goals of the BCP include protection and maintenance of a minimum of 2,000 acres of BCVI habitat within defined preserve areas and a net increase of the size of local BCVI populations in accordance with the USFWS Recovery Plan (USFWS 1991, USFWS and RECON 1996).

Meeting these goals requires vegetation management to maintain seral stages preferred for BCVI nesting, revegetation efforts to improve habitat, promoting contiguous blocks of BCVI habitat, reducing fragmentation between suitable habitat areas, reducing cowbird nest parasitism, reducing over-browsing by white-tailed deer and non-native browsers, reducing predation by red imported fire ants, controlling oak wilt, minimizing secondary impacts due to increasing urbanization and educating the public.

The BCP Partners continue to develop relationships with individual USFWS permit holders to offer technical and management guidance to landowners with occupied or potential BCVI habitat. The permit holders will continue to seek cooperative efforts that offer new opportunities to protect, maintain or enhance BCVI populations through innovative approaches such as conservation easements, management agreements, and land-in-lieu of fees agreements.

Locations of black-capped vireo territories occupied between 1991 and 1996 are depicted on the BCCP Permit Area map (Travis County 1996). Areas identified for BCVI habitat management within the BCP include portions of the Cypress Creek, North Lake Austin, South Lake Austin, West Austin, and Barton Creek macrosites (USFWS and RECON 1996).

Though the Bull Creek macrosite was at one time considered a priority for BCVI habitat acquisition and management, extensive surveys within the BCP units of the area have located few BCVI since permit issuance in 1996. In accordance with the HCP, little active BCVI habitat management has been undertaken in this macrosite due to the extensive GCWA habitat now found throughout the area and the resulting management priority afforded this species.

Preserve areas proposed for BCVI management were selected based on one or more of the following criteria:

1. currently occupied BCVI habitat;
2. historic BCVI habitat;
3. evaluation of BCP tracts by Dr. Chuck Sexton for potential BCVI habitat (Sexton 1994);
4. the largest areas of BCVI habitat possible with minimum edges;
5. ownership of land by BCP Partners; and
6. areas currently or potentially suitable for BCVI without destruction of GCWA habitat.

3.2 Management Objectives

Primary BCP management objectives include:

- Protection and maintenance of current BCVI populations and acquisition of a total of at least 2000 acres of BCVI habitat within the proposed preserve boundaries;
- Maintenance and enhancement of occupied habitat areas, creation of additional nesting and rearing habitat through vegetation management, reduction of browse pressure in

habitat areas, nest parasitism control, management of red imported fire ants, and minimization of secondary impacts such as increased predation due to increasing urbanization; and

- Monitoring and reporting to determine BCVI locations, population size and reproductive success thorough territory mapping and vegetation survey and characterization in existing habitat, potential habitat, and newly created habitat areas in accordance with federally accepted standards.

Minimum protective measures outlined in the HCP (USFWS 1996) include:

- Fencing and signage for all preserve tracts;
- Intensive public education and outreach initiatives specifically addressing threats to the protected species;
- Minimization of habitat fragmentation through closure of trails that cross through habitat and active habitat restoration sites;
- Routine surveillance to stop unauthorized public access to habitat areas of the preserve;
- Elimination of recreational access to BCVI habitat areas during the breeding season (defined by the USFWS as March 15 through August 31);
- Restrict access to habitat areas during the breeding season to supervised guided tours with defined restrictions concerning number of permitted tours per season and number of attendees per tour (See Tier IIA Chapters XII and XIII for recommended public access and education policies and procedures);
- Prohibition of unauthorized recreational activities (mountain biking, horseback riding, all-terrain vehicles, etc.) unless clearly demonstrated through scientific research (in areas outside the preserve) that they are not a threat, and they are introduced slowly with monitoring and oversight to ensure no negative impact;
- Exclusion of activities that may promote degradation or destruction (through erosion, habitat fragmentation, introduction of exotic species, noise impacts, etc.) of BCVI habitat.

3.3 Specific Implementation Strategies

Strategies to address habitat and visitor management as well as coordination of management activities among BCP Partners are presented below.

3.3.1 Habitat Management

Habitat management to achieve the goals of the BCVI recovery plan (USFWS 1991) and the terms and conditions of the HCP (USFWS 1996) include creation of suitable new nesting and rearing habitat as well as maintenance of existing habitat areas.

Habitat management actions may occur between October 1 and February 28 to achieve the following goals and objectives:

- Occupied BCVI habitat may be maintained through removal of no more than 10% of the total woody cover of the management area. This management shall maintain the character of the habitat as described in section 2.1.1, above.
- Occupied habitat areas growing beyond habitat suitability where total woody cover approaches or exceeds 55% may be restored through mechanical or hand removal of woody vegetation such that:
 1. This management shall maintain the character of the habitat as described in section 2.1.1, above;
 2. No more than 25% of the BCVI management area is manipulated per year;
 3. Management of maturing habitat must be documented with before-and-after aerial photographs, photo-point monitoring, or vegetation characterization per the USFWS protocols described in section 4.2.
- Cool prescription burns may be utilized to control immature junipers of no more than 3' in height.

BCVI habitat manipulation actions varying from the guidelines presented here require a USFWS approved written plan of action.

A number of tools are available to Land Managers seeking to create, maintain, or restore BCVI habitat within the preserve. These tools include prescribed fire, mechanical manipulation methods, the use of site-appropriate herbicides, and revegetation. These actions may require concurrent wildlife management actions to prevent subsequent impacts to managed habitats. Multiple management approaches may provide suitable disturbance regimes to maintain appropriate successional stages in habitat areas, but preferred options are those that minimize disturbance, removal or compaction of topsoil (BAT 1990).

Fire may have been one of the natural disturbances responsible for the creation of suitable habitat in the Travis County portion of the BCVI range. Prescribed fire has been demonstrated to be an effective tool for creation and maintenance of BCVI habitat. Correctly applied, prescribed fire can reduce densities of non-fire adapted species while stimulating growth of many plant species preferentially selected as nesting habitat (Rasmussen and Wright 1989). Prescribed fire may also be used to maintain the sub-climax seral stages utilized for nesting in the Travis County area. Fire can also threaten human health, safety, and property. Fire has the capacity to destroy as well as create and maintain habitat, and must

be used only by highly trained personnel in controlled conditions. For more information on the use and management of fire within the BCP see Tier II A Chapter VI.

Mechanical manipulation may include hand clearing as well as the use of heavy equipment (such as flail mowers, hydraulic tree shears, and hydro-axes). Brush cutting with hand tools is preferred but may be impractical for management of large habitat areas. Rubber tired tractors with shredders or “brush-hogs” are preferred to track-type vehicles which have a greater potential to disturb, remove or compact topsoil. Heavy equipment techniques such as chaining, grubbing, root plowing, blading, and hydro-axing have a greater potential for long-term soil erosion damage (USFWS and RECON 1996), and may be employed only after consultation and approval of the USFWS and the Scientific Advisory Committee. Felled woody debris may be removed, chipped or left intact to protect new growth from browse pressure.

Vegetation management including guidelines for appropriate use of approved herbicides to control exotic, invasive or nuisance plants is outlined in the Tier II-A Chapter IV. All applications of chemical herbicides must be performed by state licensed applicators and in accordance with label instructions. Herbicide use shall be closely monitored and documented by the managing BCP Partner.

Revegetation may be utilized to increase the abundance and distribution of preferred nesting species in potential habitat areas throughout the preserve. Section 2.1 Habitat Description above provides a list of plant species typically encountered in occupied BCVI habitat in Travis County. Planting efforts may require significant expenditures of time and energy to ensure successful establishment of new vegetation. Routine maintenance including suitable watering and protection from browsing animals may be necessary until new plants are established. Land Managers are encouraged to utilize seeds or plant materials from within the preserve to avoid the introduction of non-local genotypes into the plant community. Any nursery stock (i.e. any vegetation that is not planted from seed) should be thoroughly checked for disease or other potentially harmful materials (including red imported fire ants and their eggs) to minimize introductions to the preserve.

Management of native, non-native and nuisance wildlife may be necessary to control or prevent habitat impacts. This may include managing white-tailed deer populations to reduce browse pressure and controlling populations of feral hogs that cause damage through rooting and destruction of nesting habitat. Guidelines addressing the management of wildlife are addressed in Tier II-A Chapter X.

3.3.2 Visitor Management

The BCP Partners offer public access, education and recreation opportunities at selected sites. Public access may be permitted in habitat areas when and where such access does not threaten the welfare of protected species or cause the degradation of soil, vegetation, or water resources (USFWS 1996). Access may be permitted in areas with occupied or potential BCVI habitat during the non-nesting season, defined by the USFWS as September 1 through March 14. Public access to occupied or potential habitat areas during the course of the breeding season may be permitted through guided tours of small groups (e.g. less than 10 people). Such tours are limited to two per season at any given site to minimize impacts to habitat or the protected species. The use of audio players with recordings of bird vocalizations is prohibited on the preserve, as this use may constitute “harassment” and is prohibited unless specifically authorized for research purposes under a USFWS scientific section 10(a)(1)(A) permit. Public education and outreach efforts will be critical to the long-term success of the BCP system. See Tier IIA Chapters XII and XIII for additional information regarding Public Access and Education and Outreach guidelines.

3.3.3 Coordination of Management

The BCP Partners will continue to coordinate management of adjacent habitat areas to best achieve the goals of the permit and to attempt financial savings that may be achieved through expanded economies of scale. BCP Partners may also cooperatively seek alternative funding sources such as grants to support habitat creation, enhancement and management activities.

4.0 MONITORING

Monitoring is required under the terms and conditions of the regional permit and is a critical component of effective habitat management. Monitoring activities include surveys to determine distribution, abundance, productivity and recruitment of local BCVI populations. Vegetation and habitat monitoring to qualify and quantify suitable and potential habitat areas will continue throughout the preserve. Pre- and post-manipulation monitoring in newly created managed or restored areas using GIS, photo-point, aerial photography or other methods will be used to assess and compare the differing actions and direct future efforts.

4.1 Methods

State and federal scientific research permits are required to conduct surveys or perform research on species listed as threatened or endangered in the state of Texas. All monitoring and management activities shall comply with the terms and conditions associated with the appropriate TPWD and USFWS permits. Other research such as banding may require

additional permits. Each BCP Partner is responsible for obtaining and maintaining the appropriate permitting for activities performed by their staff.

Nest location and BHCO egg removal may be employed if authorized under the appropriate USFWS Scientific Permits. Extreme caution must be exercised to minimize stress to breeding birds. When checking nests, contents should be viewed with as little disturbance to the birds as possible, such as with the use of pole-mounted mirrors. Care should be taken to avoid creating dead end trails leading to nests or contacting surrounding vegetation to minimize attracting potential predators to human scent (BAT 1990).

Before instituting banding activities land managers must consider the inherent risks of such programs, including the potential injury and death of individual birds. Banding may only be conducted under supervision of qualified researchers possessing a Master Banding Permit from the Bird Banding Lab and the appropriate USFWS and TPWD scientific research permits. Only qualified trained personnel may conduct banding activities (MAPS-“Monitoring Avian Productivity and Survivorship” training or the equivalent is preferable). All banding activities shall follow recognized standards and be approved by the Bird Banding Lab and the USFWS.

Managers initiating habitat management activities including but not limited to the use of flail mowers, hydro-axe equipment, hydraulic tree shears or prescribed fire shall prepare a document detailing the project, receive input from the BCCP Scientific Advisory Committee and receive USFWS authorization prior to initiating work. The following project description outline is recommended:

- Scope of Work
- Limits of Work: Boundaries of all work areas within the site should be described, clearly marked in the field with signs or flagging, and delineated on project review maps. GCWA habitat, steep slopes, and areas adjacent to waterways should be avoided.
- Work Area Sequences: If work areas are to be designated in priority sequential order, managers should describe this procedure and attach a map indicating the sequence.
- GCWA and BCVI Sightings: All records within the last three years should be discussed and sighting or territory location maps attached.
- Excluded Habitat Areas: The document should describe protected GCWA or BCVI areas and include project review maps.

4.2 Reporting

Summaries of all BCVI monitoring and management activities shall be incorporated into the BCCP annual report presented each January to the USFWS. The BCCP annual report is a public document provided to each BCP Partner as well as to the BCCP Scientific and Citizen's Advisory Committees.

5.0 GUIDELINES FOR BIOLOGICAL RESEARCH BY NON BALCONES CANYONLANDS PRESERVE STAFF

BCP land managers may receive requests from individuals, groups or organizations seeking permission to carry out research within the preserve. Such research must comply with the goals of management plans and guidelines as defined by the HCP and the USFWS permit (i.e. no research shall be permitted to "take" endangered species or in any way degrade protected habitat). Each BCP Partner is responsible for all research underway on tracts that they own or manage. Researchers must obtain approval from the land manager responsible for each tract within the research area. If proposed research may impact endangered species, the researcher shall be responsible for obtaining and providing current copies of the appropriate permits from USFWS and TPWD to the land manager before any research authorization may be provided. Researchers are required to abide by all BCP management plan guidelines and preserve rules. An annual report documenting all research occurring on the preserve must be submitted to the USFWS, and any publication resulting from such research must recognize the participation of the BCP partners. Individual BCP Partners may have additional requirements of researchers that are not listed here.

6.0 RESEARCH NEEDS

The following research topics related to black-capped vireos, their ecology and habitat were identified by BCP staff, other scientists, land managers, and regulators. This list is not meant to be exhaustive nor is it meant to identify these topics by priority.

- Analyze current Countywide BCVI data/information on: 1) average numbers of territories and territory sizes, 2) male-female ratios, 3) mated frequency, and 4) numbers of unmated males and females.
- Determine relationships among insect abundance, plant species composition, BCVI survival, reproduction and recruitment on the BCP.
- Refine local BCVI habitat characterizations and inventory remaining potential breeding and rearing habitat throughout Travis County to identify potential new population centers meriting protection under the BCCP.
- Evaluate the probabilities of extirpation of BCVI in Travis County due to projected local climactic changes in near, short and long-term scenarios.

- Evaluate minimum patch size in terms of BCVI extirpation probabilities on the BCP.
- Evaluate BCVI occupancy in relation to patch size on the BCP.
- Determine the relationship of limiting factors such as brood parasitism, predation, and fire ants to BCVI on the Preserve.
- Analyze the relative impacts of identified threats to BCVI since listing (habitat conversion and land use change, vegetation succession, grazing and browsing by domestic and wild herbivores, BHCO brood parasitism, etc.) and assess management strategies for addressing these impacts.
- Determine size of buffer zones needed to reduce impacts of urbanization on BCVI on the BCP.
- Study the dynamics of sub-climax seral regeneration in response to various habitat restoration techniques in Travis County.
- Study the effects of human activity (bird watching, running, biking, etc.) on BCVI during foraging, breeding and nesting activity.
- Study nesting success, recruitment and population trends through banding and blind cohort studies.
- Partner with other Agencies to monitor and assess BCVI habitat and populations in Oklahoma and Mexico as they relate to continued population viability in the BCP.
- Partner with other Agencies to determine the current distribution and availability of BCVI habitat in the winter range and migration corridor as they relate to continued population viability in the BCP.
- Compare diversity and abundance of other avian species associated with BCVI habitat and monitor ecosystem health metrics such as species richness and diversity as measures of overall BCP system viability.
- Assess livestock densities and BHCO populations over time relative to BCVI populations and observed brood parasitism rates, and project potential impacts of changing land use patterns in Travis County and various BHCO mitigation strategies.
- Determine impacts of the increasing Edwards Plateau white-tailed deer population on BCVI habitat and correlate with BCVI population trends to determine if there is a statistical significance to this relationship, and generate deer management recommendations targeted at habitat restoration and management goals.
- Determine impacts of exotic herbivores and feral hog populations in BCVI habitat and correlate with BCVI population trends to determine if there is a statistical significance to these relationships, and generate exotic mammal management recommendations targeted at habitat restoration and management goals.

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