FY 2015 Summary of

Wildlife and Plant Management Activities on

Travis County's Balcones Canyonlands Preserve and Select Parks



Large boar caught in trap on the Sam Hamilton tract

Travis County
Department of Transportation and Natural Resources
Natural Resources and Environmental Quality Division

1 October 2014 – 30 September 2015

TABLE OF CONTENTS

Introduction 3

Brown-headed cowbirds.....5

Feral hogs 8

White-tailed deer 10

Non-native plant management 15

Literature Cited.....18

List of Tables

Table 1. FY15 Cowbird trap locations, trapping period dates, and initial cowbird stocking numbers 6

Table 2. Non-target species found in Travis County operated traps in FY15 6

Table 3. Results of the FY15 Travis County cowbird trapping season 7

Table 4. White-tailed deer population trends at Pace Bend Park FY97 through FY15 13

Table 5. White-tailed deer population trends on the BCP Jollyville Unit FY03 through FY15.....14

Table 6. Deer Harvested on Travis County Properties by Orion Research and Management Services, Inc. during FY15……..……..……..…14

Table 7. Non-native plant species targeted for removal on Travis County Balcones Canyonlands Preserve……17

Table 8. Summary of invasive plant control efforts by Travis County Natural Resources from FY09 to FY15……...18

INTRODUCTION

On May 2, 1996, the City of Austin and Travis County were jointly issued a U.S. Fish and Wildlife Service (USFWS) regional permit (the Permit) referred to as the Balcones Canyonlands Conservation Plan (BCCP) that allows incidental "take" of eight locally occurring endangered species under Section 10(a)1(b) of the Endangered Species Act (U. S. Fish and Wildlife Service 1996a). The thirty-year permit covers Travis County outside of proposed Preserve boundaries identified in the Habitat Conservation Plan and Final Environmental Impact Statement (HCP/FEIS) (U. S. Fish and Wildlife Service, 1996b). The permit also covers incidental take of 27 species of concern should any become listed as threatened or endangered during the life of the Permit. The City of Austin and Travis County (the Permit Holders) are required by the terms of the Permit to assemble and manage a minimum of 30,428 acres of suitable habitat for the benefit of these species. This series of protected lands is known as the Balcones Canyonlands Preserve (BCP).

The City of Austin and Travis County also agreed to protect and manage populations of unique or endemic plant species of concern found within preserve boundaries, as well as on other city- and county-managed properties. Plant species of concern listed in the permit include canyon mock-orange *(Philadelphus ernestii)* and Texabama croton (*Croton alabamensis var. texensis*). Bracted twistflower (*Streptanthus bracteatus*) and Texas amorpha *(Amorpha roemerana)* were discussed in the HCP/FEIS, but were not listed in the BCCP Permit (U. S. Department of the Interior, Fish and Wildlife Service 1996b). However, because these two species are rare, they are afforded the same protection as plants listed under the permit.

The negative impacts of non-native, nuisance and invasive species have been well documented throughout Texas and around the world. The 2007 BCP Land Management Plan, approved by the USFWS, directs management of the BCP, including control of non-native, nuisance and invasive species.

Beginning in 2002 and updated annually, a *Travis County Parks and Preserves Wildlife Management Permit* is drafted which serves as a general guideline for Travis County staff to direct management of these species in response to the potential human health and safety, economic, and environmental impacts. The purpose of this permit is to recognize that threats may be posed by these species, outline appropriate management strategies, and provide management authority to implement measures to minimize these threats. The guidelines in this permit are intended to provide direction to managers for lands throughout the County system and are anticipated to represent a continually updated and flexible set of directives that are able to meet the needs of a changing environment. As new species or conditions are discovered, this information will be incorporated to provide current status of the conditions and challenges faced by County Park and Preserve land managers.

The Texas Parks and Wildlife Department (TPWD) define exotic animals as herbivorous single-hoofed or cloven-hoofed mammals (ungulates) that are not indigenous or native to Texas, including animals from the deer and antelope families. Ranch and game managers throughout Texas have introduced such animals for various reasons. Animals found on Travis County-managed portions of the BCP meeting the definition of exotic include Russian boars, which freely interbreed with feral hogs.

Non-native animals are species not indigenous to Texas, but which fall outside of the TPWD definition of "exotic". Examples of non-native animal species in Travis County include house sparrows, European starlings, red-imported fire ants, tawny crazy ants, and rock doves.

Feral animals are wild populations of otherwise domesticated species that have through release or escape reverted to a wild condition. Feral species found in Travis County include house cats, dogs, goats, and hogs.

Nuisance animals are native species that present threats to human health and safety, County property, or other natural resources due to population densities, by providing a disease reservoir or other threat. Nuisance animals may include species such as brown-headed cowbirds, coyotes, opossum, and white-tailed deer.

The BCP Land Management Plan (2007) defines non-native plants as species that were introduced where they did not evolve and do not naturally occur. These introduced species often thrive in the absence of their natural predators, diseases, competitors, and parasites. Non-native plant species can be detrimental to BCP properties by overcrowding and outcompeting native species that are important components to endangered species habitat, as well as reducing overall plant diversity in infested areas.

In Fiscal Year 2015 (FY15, Oct. 1-Sept. 30), wildlife management activities on Travis County-managed portions of the BCP focused on five species: brown-headed cowbirds (*Molothrus ater*), feral hogs (*Sus scrofa*), white-tailed deer (*Odocoileus virginianus*), tawny crazy ant (*Nylanderia fulva),* and red imported fire ants (*Solenopsis invicta*). Monitoring and control of cowbirds, hogs, and deer are described in their respective sections in this report. Fire ant control and Tawny crazy ant monitoring efforts are described in *Appendix H: Balcones Canyonlands Preserve Karst Monitoring and Management FY2015 Annual Report*.

In FY15, plant management activities focused on survey and control of eight species of non-native plants, which are described in the *Non-Native Plant Management* sections of this report.

BROWN-HEADED COWBIRDS

Introduction

In addition to many other avian hosts, brown-headed cowbirds (cowbird) parasitize the nests of two Central Texas endangered avian species; the black-capped vireo (*Vireo atricapilla*) and golden-cheeked warbler (*Setophaga chrysoparia*). Cowbird trapping has been the subject of considerable research and management effort and is believed to be an important technique for the conservation of both species. At Fort Hood, cowbird trapping has been credited for drastically reducing parasitism rates of black-capped vireos from 91% before cowbird management to below 20% after a cowbird management program was implemented. Fort Hood currently meets local and regional recovery goals for the black-capped vireo and attributes this success to cowbird management (Kostecke et al. 2005).

This report summarizes the results of the FY15 Travis County cowbird trapping program. Five traps were operated within, or near, Travis County's BCP properties: the Hamilton Pool Preserve (HP), the Nootsie tract, and on private land adjacent to the Toops and Vireo Ridge tracts. A fifth trap was operated at Travis County's Milton Reimers Ranch County Park.

Background

Cowbird trapping was previously conducted in western Travis County by Espey Huston and Associates and DLS Associates in 1989 and Texas Animal and Damage Control from 1990-1996. In 1997, Travis County Natural Resources Department initiated its own cowbird trapping program. This program was co-managed with the City of Austin until 2001, at which time the City of Austin began operating a program independently. Since 1997, trap locations have been added or removed according to trap success or failure and access availability. Trapping did not occur in 1998 due to staff shortage.

Methods

Cowbird trapping in FY15 was conducted exclusively in the western half of the county. Travis County operated two mega traps (16'x16') and three metal hybrid traps (6'x 8'), two of which were on loan from TPWD. The mega traps are located at HP and on private property adjacent to the Vireo Ridge tract on FM 2769 (hereafter, FM 2769 trap). The three hybrid traps were operated at Milton Reimers Ranch County Park (hereafter,

Reimers trap), within the Nootsie tract (hereafter, Nootsie trap), and on private property adjacent to the Toops tract (hereafter, Toops trap).

A group of decoy birds (13 males, 11 females) were acquired from a private landowner at the beginning of March which allowed the Nootsie trap to open on March 2, 2015. The remaining traps were opened on March 25th (Toops), March 26th (HP), April 1st (2769), and April 4th (Reimers) once additional bait birds were captured. Table 1 summarizes the FY 15 cowbird trapping schedule and initial stocking numbers of decoy birds.

Table 1. FY15 Cowbird trap locations, trapping period dates, and initial cowbird stocking numbers.

Trap	Date Opened	Date Closed	Initial Stocking Numbers
Nootsie	March 3	June 3	13 Males, 11 Females
Toops	March 25	June 3	5 Males, 2 Females
FM 2769	April 1	June 3	6 Males, 3 Females
Reimers	April 4	May 22	2 Males, 2 Females
HP	March 26	June 3	7 Males, 2 Females

Traps were inspected and maintained every day of the week throughout the season. If no one was available to check for non-target species on the weekend, the trap was shut down by placing a board over the opening. Water and feed (whole milo mixed with wild bird seed) were refreshed three times a week. To offset the impact of rising air temperatures on bird health and survivability, plastic water baths and shade cloth were added to the traps. Some traps were reinforced with poultry fencing along the outer base edges to prevent digging by predators attempting to gain access. Non-target species found in traps were removed unharmed unless otherwise noted (Table 2). Cowbirds were euthanized by placing them in a container with carbon dioxide gas following TPWD protocol (TPWD No Date). This was the first season where compressed CO_2 gas was used in lieu of dry ice. This proved to be a more effective and efficient method of cowbird euthanization.

Table 2. FY15 Non-target species found in Travis County operated traps.

Common Name	Species Name	Trap(s)	Comments
Bronzed Cowbird	*Moluthrus aeneus*	NT, 2769	3 released (2 males and 1 female)
Northern Cardinal	*Cardinalis cardinalis*	NT, HP	3 released (female and 2 male)
Northern Mockingbird	*Mimus polyglottos*	NT, 2769	1 deceased and 1 released
Mourning Dove	*Zenaida macroura*	NT	1 juvenile released

RR= Reimers HP= Hamilton Pool Preserve NT= Nootsie TP= Toops 2769 = FM 2769

Results and Discussion

In FY15, a total of 94 male and 64 female cowbirds were captured. The total of 158 cowbirds captured this year was slightly higher than the previous year when 148 cowbirds were trapped. Table 3 summarizes cowbird captures at each trap by class (male, female, and juvenile), month, and trap efficiency (or capture rate) during the 2015 trapping season. Trap efficiency is calculated by dividing the number of females captured by the number of days in operation (x 100). Five of the six traps were operated in the same location as they were since the 2007 trapping season. A new trap was added on the Vireo Ridge tract in FY12 but was not opened in FY15.

Table 3. Results of the FY15 Travis County cowbird trapping season.

Trap	Month	Days in Operation	Males captured	Females captured	Juveniles Captured	Total Captured	Trap Efficiency %
FM 2769	April	30	0	0	0	0	0.00
	May	31	3	7	0	10	22.58
	June	3	1	0	0	1	0.00
	Total	**64**	**4**	**7**	**0**	**11**	**10.93**
Hamilton Pool	March	6	3	0	0	3	0.00
	April	30	17	23	0	40	76.67
	May	31	2	1	0	3	3.22
	June	3	0	0	0	0	0.00
	Total	**70**	**22**	**24**	**0**	**46**	**34.29**
Nootsie	March	30	17	3	0	20	10.00
	April	30	9	5	0	14	16.67
	May	31	5	0	0	5	0.00
	June	2	0	0	0	0	0.00
	Total	**93**	**31**	**8**	**0**	**39**	**8.60**
Reimers*	April	27	18	17	0	35	62.96
	May	21	4	1	0	5	4.76
	Total	**48**	**22**	**18**	**0**	**40**	**37.5**
Toops	March	7	0	2	0	2	28.57
	April	30	8	3	0	11	10.00
	May	31	7	2	0	9	6.45
	June	3	0	0	0	0	0.00

	Total	71	15	7	0	22	**9.86**
	Grand Totals	**346**	**94**	**64**	**0**	**158**	**18.50**

**Reimers trap was operated from April 4th to May 22nd. The trap was closed due to vandalism and any remaining birds were dispatched.*

Travis County Natural Resources maintains a minimum goal of 20% trap efficiency for the program. Trapping efforts have met this standard from 2001-2011, but has fallen short every year since then. In FY15 overall trapping efficiency was at 18.50%, which is the third lowest success rate since the inception of this program. The average efficiency rate from 2001-2014 was 34.26%. All traps performed better this year compared to FY14 except Nootsie, which had its lowest trapping efficiency since 2007. The total amount of cowbirds removed (n=158) was far below the average over the last eight years (n=307). In fact, this was the lowest amount of cowbirds removed from the preserve since 2001. The Hamilton Pool (efficiency of 34.29%) and Reimers (efficiency of 37.50%) traps were the only ones that exceeded the standard of a 20% efficiency rate.

In general, Travis County-managed preserve lands have few optimal trapping locations, particularly those adjacent to livestock or agricultural areas that serve as feeding and congregation sites for cowbirds. As the conversion of farms and ranches into subdivisions and other suburban development continues in much of western Travis County, easily accessible off-preserve areas that may concentrate cowbird numbers are becoming uncommon. With this change in land use, cowbird numbers have generally diminished on parts of the BCP over the last five years. It is worth noting that no instances of parasitism were noted on any avian species during the 2014 or 2015 field seasons.

Trap sites in and around the other County-managed BCP properties are limited, but as new tracts are acquired, additional, more suitable trap sites may be made available. This is the case with two tracts that were acquired during FY15, Scott & White and Kotrla. Before acquisition, site assessments were conducted and a large population of cowbirds was noted. This area will likely be a location for intensive trapping efforts in FY16. Further monitoring for the presence of cowbirds in endangered avian species habitat will continue each season and trap placements will be adjusted as necessary.

FERAL HOGS

Introduction

The BCP Land Management Plan (2007) directs land managers to control populations of feral hogs in order to minimize negative impacts to the native wildlife protected within

the preserve system. Feral hogs degrade wildlife habitat and compete directly with native wildlife for food. Hogs are omnivorous, primarily consuming vegetation, mast, roots and tubers, and to a lesser degree a wide range of animal species including invertebrates, reptiles, amphibians, small mammals and birds (Davis 1994, Hellgren 1997). Their rooting habits create severely disturbed areas, which may lead to a localized shift in plant succession and increase the potential for soil erosion (Davis 1994). Feral hogs also destabilize wetland areas, springs, creeks and other riparian areas through excessive rooting and wallowing. Their threat to humans and livestock through the spread of disease has also been documented (Miller 1997, U.S. Department of Agriculture 1992). Producing two litters a year, with an average litter size of four to eight piglets, hog numbers can expand rapidly if left unmanaged (Texas Wildlife Damage Management Service 1998).

Background

Travis County Natural Resources is responsible for the management of non-native wildlife on County-owned and managed portions of the BCP. Staff uses the discovery of wallows, rooted areas, rubs, well-worn trails, tracks, and first-hand encounters in the field to identify where hog populations occur within the BCP. Travis County BCP tracts that often show signs of significant feral hog populations include Canyon Vista, Ribelin, Concordia, the Kotrla Unit, and several tracts within the Jollyville Unit. In 2008, feral hogs were also documented within Hamilton Pool Preserve for the first time since the property has been owned and managed by Travis County (since 1985), and have since caused considerable damage to habitat. Most tracts within the Bull Creek Macrosite still see a significant amount of hog traffic and damage.

In FY15, Travis County coordinated efforts with surrounding landowners and the City of Austin to implement management actions on and adjacent to Travis County BCP tracts. In 2008, an Interlocal Cooperation Agreement was entered into between Travis County and Texas AgriLife Extension Service (AgriLife) to conduct an operational wildlife damage management program for the protection of property from damage caused by wildlife and for the protection of human health and safety from wildlife-related diseases in Travis County. Covering all the unincorporated areas of Travis County, this agreement provides a way of addressing the occasional nuisance wildlife complaints (most commonly feral hogs and coyotes) from preserve neighbors. In FY15, AgriLife continued to address nuisance wildlife complaints but was not actively managing hogs on Travis County properties.

A hog trapping protocol was developed in December 2008 to guide the activities of both County staff and contracted hog trappers in Travis County operated feral hog trapping efforts. The protocol is updated regularly and addresses trapping guidelines as well as trapped animal management. The only contracted entity that performed management

activities on the preserve in FY15 was Orion Research and Wildlife Management Services (Orion).

Methods

Travis County Natural Resources staff baited areas of high hog activity on the Ribelin, Concordia, Sam Hamilton, and Woody Hollow tracts. Stock panel traps were operated intermittently on Ribelin from June-September 2015, Sam Hamilton from October 2014-January 2015 and May-October 2015, Woody Hollow from October 2014-January 2015, and Concordia from September-October 2015. Travis County Parks staff operated one stock panel trap at Milton Reimers Ranch County Park (Reimers) from October 2014-May 2015.

Standard operation for Travis County staff included setting and baiting stock panel traps with dry or soured corn and occasionally rotten fruit and vegetables. Traps were routinely baited and monitored with the aid of motion-sensing cameras. Utilizing cameras enabled managers to set the trap at the most beneficial time to maximize success. Trapped hogs were humanely dispatched and carcasses were taken to be composted. The traps were operated until signs of hog activity in the area subsided.

Results and Discussion

During FY15, Travis County staff and contractors successfully dispatched 43 total hogs. Forty-one of these were trapped and two were shot opportunistically by Orion. Hogs removed included four adults (two males and two females), 14 sub-adults (nine males and five females), and 25 juveniles (13 males and 12 females). An overall increase in trapping effort led to a slight increase in success from FY14 (39 hogs) to FY15. The Reimers trap was monitored and moved to various locations but was never successful in capturing any individuals. Plans are underway to add wireless cameras and remote door triggers to some County-operated traps in FY16. This technology is more advanced and should further increase efficiency and success.

WHITE-TAILED DEER

Introduction

The BCP Land Management Plan (2007) directs that white-tailed deer populations be monitored and maintained at a level that allows for successful recruitment of plant species which make up habitat supporting the species listed in the permit (e.g. the golden-cheeked warbler and the black-capped vireo). Central Texas currently has the highest population density of white-tailed deer in the United States (Richards 2000). Recent research indicating that little or no regeneration of vital habitat components is

occurring on some preserve tracts (Russell and Fowler, 1999; Russell and Fowler 2002; Russell et. al. 2001) has generated an effort to design and implement a white-tailed deer population monitoring and control program for Travis County BCP properties.

Travis County staff operated a deer management program utilizing lethal harvest from the FY03 through the FY08 hunting seasons on the Jollyville Unit of the BCP. Beginning in FY09 and continuing through FY15, Travis County contracted the services of Orion to manage the population by lethal harvest on the Jollyville Unit and several other BCP tracts.

Under the terms and condition of the BCCP, Travis County is also charged with managing populations of golden-cheeked warblers and Texabama croton (*Croton alabamensis var. texensis*) that occur at Pace Bend Park. Texabama croton is a rare plant that is usually not over-browsed, but is commonly subject to physical damage from rubbing by deer. In 2002, and continuing through the present, Travis County has utilized lethal harvest to manage deer at Pace Bend Park.

Methods

Travis County staff and volunteers conducted nighttime spot-light deer surveys during the fall of FY15 on the Jollyville Unit of the BCP, Hamilton Pool Preserve/Reimers Park/ Pogue Springs Preserve, and Pace Bend Park. Due to limitations in conducting reliable censuses on other less accessible BCP tracts, Travis County biologists also utilized data collected by neighboring partner agencies on their properties (City of Austin and LCRA) for other County tracts (Volente, Lucas, Ribelin) that were targeted for harvests. Travis County staff analyzed the survey data to determine deer population estimates and make harvest recommendations.

TPWD currently recommends population levels in the Texas Hill Country of one deer to 15-20 acres for effective songbird habitat management, and some research indicates population targets of one deer per 30 to 40 acres for successful hardwood forest regeneration. The goal on the BCP is to have a deer density of about one deer to 15-30 acres. At Pace Bend Park, the deer population goal is set at one deer to 12-15 acres in order to balance the needs of protecting habitat with the desire of the public to observe white-tailed deer in a park setting.

During FY15, deer management was carried out through the contracted services of Orion. Orion operates under a TPWD Scientific Permit and harvested on the BCP, Pace Bend Park, and Reimers Ranch during FY15. This season marked the sixth year that Orion was contracted to harvest deer for Travis County.

Animals taken during deer harvests were dispatched in a swift, effective, and humane manner. The safety of the public and staff was Travis County's top priority as efforts focused on effective management of the deer population. Through the Hunters for the Hungry Program, all venison from Travis County's harvest program was donated to Caritas of Austin. This donation provided nutritious meals for needy citizens within the county.

Results and Discussion

Survey data gathered in September and October 2014 were used to estimate deer densities and determine harvest recommendations for the FY15 harvest season (October 2014 to February 2015). Census results for Pace Bend Park estimated a deer density of 19.4 acres per deer (Table 4). This density is lower than the average acres per deer (8.1) over the previous seven years (2008-2014) and represents a trend of declining density compared to the 4.1 average observed from 1997-2007. Census results for the Jollyville Unit, which estimated 71.3 acres per deer, indicate the lowest deer densities since the inception of the management program (Table 5). At Hamilton Pool Preserve/Reimers Ranch/Pogue Springs Preserve the deer density was 25 acres per deer.

Orion removed 18 deer from Pace Bend Park and 17 deer from Reimers Ranch Park (Table 4 and Table 6). Eleven deer were removed by Orion from the BCP Jollyville Unit and an additional 43 deer were removed from other preserve tracts, including Hamilton Pool (Table 5 and Table 6). Since implementing the lethal cull strategy on these tracts in FY03, the total population on the Jollyville Unit has been steadily declining and the number of acres per deer has increased dramatically (Table 5). Although the deer harvest has impacted the Jollyville Unit deer population, it should be noted that the current prolonged drought and increased habitat fragmentation are likely also playing a role in the population decline.

Overall population trends at Pace Bend Park and on the BCP have begun to reflect the harvest management strategies implemented by Travis County. The population trend data indicate that the lethal cull strategy has successfully increased the total acreage available per deer and is an effective management option to control deer populations.

In addition to successfully managing the overpopulation of deer, this program has also generated significant public support for County management efforts. This support is largely due to the donation of processed ground venison to Caritas of Austin. In FY15, approximately 3,560 pounds of venison was given to Caritas which provided meat for over 14,000 meals, bringing the total that Travis County has donated over the years to approximately 18.2 tons (36,480 lbs.) of meat. This meat provided high quality, low fat protein to needy local residents.

Travis County staff will continue to monitor deer populations on Travis County-managed land and work to implement TPWD recommendations concerning appropriate management strategies and harvest levels. Annual censuses allow managers to evaluate the effectiveness of management strategies, determine whether desired deer densities have been attained, and calculate future harvest recommendations. As long as census data indicate that deer herds exceed the carrying capacity of County preserve or parklands, deer management should continue on select Travis County Parks and the tracts of the BCP.

Table 4. White-tailed deer population trends at Pace Bend Park FY97 through FY15.

Year	Acres/Deer	Estimated Composition (Buck/Doe/Fawn)	Estimated Population	Total Removed
FY1997	4.9	70/117/57	244	85
FY1998	3.7	40/167/63	270	80
FY1999	3.8	53/156/55	264	111
FY2000	4.5	61/119/45	225	92
FY2001	5.7	29/97/28	326	19
FY2002	3.6	61/86/43	519	0
FY2003	2.7	29/139/30	464	18
FY2004	3.6	110/232/83	425	74
FY2005	2.5	154/329/133	616	91
FY2006	3.4	183/181/79	443	96
FY2007	6.2	86/134/25	245	59
FY2008	8.9	61/91/20	172	34
FY2009	6.1	48/135/67	250	41
FY2010	5.0	56/188/65	307	61
FY2011	6.9	56/108/55	219	89
FY2012	6.6	44/150/37	231	65
FY2013	9.6	N/A	N/A	43
FY2014	13.9	23/74/12	109	32
FY2015	19.4	13/53/12	78	18

Table 5. White-tailed deer population trends on the BCP Jollyville Unit FY03 through FY15.

Year	Acres/Deer	Estimated Composition (Buck/Doe/Fawn)	Estimated Population	Total Removed
FY03	5.6	46/162/82	290	9
FY04	5.5	61/158/78	297	12
FY05	7.2	35/127/63	225	22
FY06	9.6	33/103/33	169	20
FY07	10.0	44/142/55	241	12
FY08	9.1	29/122/46	197	26
FY09	10.9	37/111/37	185	20
FY10	18.8	20/60/20	100	35
FY11	21.9	22/43/22	86	9[a]
FY12	27.3	31/36/33	90	22[b]
FY13	38.1	26/29/10	65	10[c]
FY14	36.4	27/30/10	67	12[d]
FY15	71.3	7/21/7	35	11[e]

[a] An additional 13 deer were removed from the Volente tract and one deer from the Lucas tract.
[b] An additional 13 deer were removed from the Cypress Creek Unit and four deer from the Lucas tract in the Lake Travis Unit.
[c] An additional 8 deer were removed from the Cypress Creek Unit and 21 from the North Lake Austin Unit (Webb Tract).
[d] An additional 10 deer were removed from the Cypress Creek Unit and 22 from the North Lake Austin Unit (Webb Tract)
[e] An additional deer was removed from the Lake Travis Unit (Lake Perspectives), 18 from the Cypress Creek Unit (Volente, New Life, and Spezia), and 5 from the Lake Austin Unit (Webb).

Table 6. Deer Harvested on Travis County Properties by Orion Research and Management Services, Inc. during FY15.

Location	Bucks	Does	Fawns	Total
BCP Jollyville Unit	8	2	1	**11**
BCP Volente Tract	11	5	1	**17**
BCP Lake Perspectives	1	0	0	**1**
BCP Webb Tract	7	4	2	**13**
BCP New Life/Spezia Tracts	7	2	1	**10**
Hamilton Pool Preserve	0	0	2	**2**
Reimers Park	7	7	3	**17**
Pace Bend Park	5	6	7	**18**
Total	**46**	**26**	**17**	**89**

NON-NATIVE PLANT MANAGEMENT

Introduction

In addition to managing for exotic, feral, and nuisance animal species, Travis County Natural Resources also manages non-native plant species in accordance with the BCP Land Management Plan (2007).

Non-native plants outside their home range can become invasive (Keane and Crawley 2002). This occurs for several reasons, including release from native competitors and predators (Mitchell 2003), higher productivity in a new location (Thébaud and Simberloff 2001), direct chemical (allelopathic) interference with native plant performance (Callaway and Ridenour 2004), and variability in the responses and resistance of native systems to invasion (Hobbs and Huenneke 1992, Levine and D'Antonio1999).

A key driver of change in ecosystems is invasion by an alien species. Invasive, non-native plants have bottom-up impacts on higher trophic levels and reduce local plant species diversity of the invaded community (Vilà 2011). Also, exotic plants can alter soil nutrient dynamics (Ehrenfeld 2003). Loss of native biodiversity decreases the quality of food, cover, and breeding sites for wildlife (Cheater 1992, MacDonald 1985, Simberloff 1996). For example, non-native trees can compete with native oaks, impacting a major component of both golden-cheeked warbler and black-capped vireo habitat.

Invasive species control is an increasingly important component of the conservation and management of natural ecosystems, especially on preserves such as the BCP, which is surrounded by urban areas. Successful control can be achieved with large short-term investments and routine monitoring (Zavaleta et al. 2001). Invasive species control combined with broader ecosystem restoration goals gives native biodiversity the best chance to recover (Hobbs 1999).

In order to maintain the integrity of natural ecosystems on the BCP and prevent a negative impact on endangered species habitats, non-native plants found on the BCP are targeted for removal.

Methods

In FY15, Travis County BCP properties were inventoried for the presence of non-native plant species by surveying tracts and documenting locations. When located, these species were assessed for potential impacts to native plant and wildlife populations. Non-native plant species constituting a threat were prioritized for management action based on invasiveness of species, amount of infestation, and threats to sensitive habitats.

Control methods employed to manage non-native species included manual removal (mechanical control) and application of site-appropriate herbicide by Texas Department of Agriculture-licensed staff (chemical control). Whenever possible, mechanical control of non-natives without the use of herbicides was selected, since this method has no risk of impact on surrounding vegetation. Hand-pulling was especially effective on young seedlings and saplings of many woody plants, such as Heavenly Bamboo (*Nandina domestica*), Chinaberry (*Melia azedarach*), Japanese Privet (*Ligustrum lucidum*), and Tree of Heaven (*Ailanthus altissima*), as well as ground-running plants such as Periwinkle (*Vinca sp*.). Larger woody plants were removed through use of Weedwrenchs™, which ensured the removal of the entire root and eliminated the potential for re-sprouting.

When necessary, two chemical control techniques were used in conjunction to remove non-native plants. The “cut-treat” method was used on woody plants that could not be completely removed using hand tools such as chainsaws, handsaws, or loppers. The cut stems were then treated with herbicide. The “hack-squirt” method was used on larger trees that could not be easily removed. These target plants were instead girdled around the circumference of the trunk at breast height using a hatchet or hand saw. The wounds were then sprayed with the appropriate herbicide. In FY15, 12% Arsenal AC/surfactant or 50% Garlon 3A/surfactant mixes were applied on all treated woody plants. All chemical applications were made when no rain was forecasted for ≥ 24 hours and winds were < 10 mph. Also, staff avoided using chemical control near aquatic resources.

Results and Discussion

Staff targeted eight species of non-native plants (seven woody and one herbaceous) for removal on BCP tracts during FY15 (Table 7, Figure1). Management activities occurred

at the following thirteen BCP tracts: Bunten, Canyon Vista, Chandler Ranch, Cuevas West, Grandview Hills North, Hamilton Pool, Lucas, Ribelin, Snowden, Stark's Mine, Steiner Ranch, Trails End, and Vireo Ridge.

In FY15, approximately 78 hours of staff time and 95 hours of volunteer time were devoted to non-native plant removal (Table 8). It is worth noting that 90 of the volunteer hours were spent removing non-natives that were planted as landscaping at the Snowden house. These plants include approximately 20 different species and are too numerous to include in the tables and graphs. This activity will continue during FY16 as the Snowden house makes its transformation to an outreach facility for the public.

Table 7. Non-native plant species targeted for removal on Travis County Balcones Canyonlands Preserve tracts in FY15.

Species	Common Name	Location[1]	Amount Removed	Removal[2] Methods
Ailanthus altissima	Tree of Heaven	CV, NO, RI, SN, VR	62 stems	CT, HP, HS
Centaurea melitensis	Malta Star-thistle	CU	150 stems	HP
Ligustrum sp.	Privets	CR, CV, SH, SR, ST, TE	299 stems	CT, HP, HS, WW
Melia azedarach	Chinaberry	BU, CR, CV, GS, GV, HP, LU, RI, SR, ST, TE, VR	1,476 stems	CT, HS, HP
Nandina domestica	Heavenly Bamboo	BU, CR, CV, GV, LP, RI, SH, SN, SR, ST, VR	1,075 stems	CT, HP, HS, WW
Photinia sp.	Photinia	CR, SH, SN, SR	274 stems	CT, HS, WW
Pyracantha koidzumi	Formosa Firethorn	CR, SH, SN, SR	22 stems	CT
Triadica sebifera	Chinese Tallow	LU	14 Stems	CT

[1] BCP tracts: BU=Bunten, CH=Chandler Ranch; CU=Cuevas; GV= Grandview Hills; HP=Hamilton Pool; LU= Lucas; RI=Ribelin; SH=Sam Hamilton; SN=Snowden; ST=Stark's Mine; SR=Steiner Ranch; TE=Trails End; VR= Vireo Ridge

[2] Removal Methods: HP=Hand Pull; CT=Cut and Treat; HS=Hack and Squirt; WW=Weed Wrench

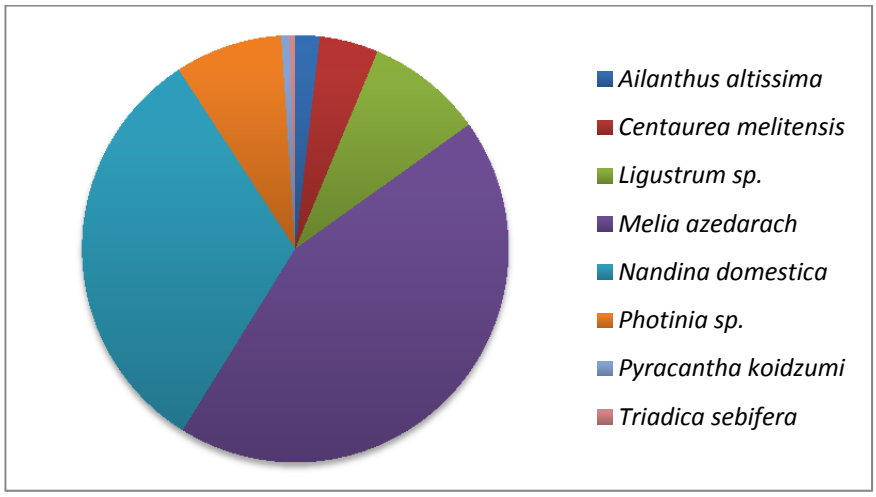


Figure 1. Percent of each non-native woody plant species targeted for removal on Travis County Balcones Canyonlands Preserve tracts in FY15.

Table 8. Summary of invasive plant control efforts by Travis County Natural Resources from FY09 to FY15.

FY	Staff Hours	Volunteer Hours	Number of Species	Locations	Woody Stems	Herbaceous Stems
2009	25	0	11	5	422	50
2010	158	3495	12	12	2862	0
2011	91	96	10	13	5883	300
2012	103	92	7	15	3510	0
2013	45	35	9	11	1954	0
2014	89	87	5	13	2491	4
2015	36	95	8	13	3217	150

Future plans for non-native plant management include continuing to collect baseline data of non-native plant species on all current and newly acquired Travis County BCP properties, and prioritizing areas of non-native plant encroachment for mechanical and/or chemical control. Control efforts for FY16 will include removal of the typical invasive plants (tree of heaven, chinaberry, Chinese tallow, heavenly bamboo, and Japanese privet) from areas that have been selected to receive fuel mitigation treatments, as well as other BCP tracts that have issues. Natural Resources staff will continue coordinating volunteer projects with Concordia University staff, students, and Master Naturalist's program to identify and control invasive plants within all BCP tracts.

LITERATURE CITED

Balcones Canyonlands Preserve Land Management Plan. 2007. Unpublished document.
Travis County, Texas, USA.

Callaway R. M., W. M. Ridenour. 2004. Novel weapons: Invasive success and the evolution of increased competitive ability. Front Ecol Environ 2: 436–443.

Cheater, M. 1992. Alien Invasion. Nature Conservancy. September/October.

Davis, W. B., and D. B. Schmidley. 1994. The mammals of Texas. Texas Parks and Wildlife Press, Austin, Texas, USA.

Ehrenfeld, Joan G. 2003. Soil and nutrient processes. Ecosystems 6:503-523.

Hellgren, E. C., 1997. Biology of feral hogs (*Sus scofra*) in Texas. Proceedings of feral swine
symposium.

Hobbs, R. J. 1999. Restoration of disturbed ecosystems. In Restoration of Disturbed Ecosystems (Walker, L., ed), pp 673-687, Elsevier Science.

Hobbs R. J., L. F. Huenneke. 1992. Disturbance, diversity, and invasion: Implications for conservations. Conserv Biol 6: 324–337.

Keane R. M., M. J. Crawley. 2002. Exotic plant invasions and the enemy release hypothesis. Trends Ecol Evol 17: 164–170.

Kostecke, R. M, S. G. Summers, G.H. Eckrich and D.A. Cimprich. 2005. Effects of Brown-
Headed Cowbird (*Molothrus ater*) removal on Black-capped Vireo (*Vireo atricapilla*) nest success and population growth at Fort Hood, Texas. Ornithological Monographs 57:28-37.

Levine J. M., C. M. D'Antonio. 1999. Elton revisited: A review of evidence linking diversity and
invasibility. Oikos 87: 15–26.

MacDonald, C. 1985. Trouble in Paradise: Weeds in Nature Preserves. J. of Pesticide Reform, Fall 1985.

Miller, J. E., 1997. A national perspective on feral swine. Proceedings of feral swine symposium.

Mitchell C. E., A. G. Power. 2003. Release of invasive plants from viral and fungal pathogens. Nature 421: 625–627.

Richards, B. 2000. The deer dilemma: to fence or not to fence? Conference sponsored by Texas Parks and Wildlife Department. Reicher Ranch. June 15, 2001.

Russell, F. Leland and Norma L. Fowler, 1999. Rarity of Oak Saplings in Savannas and Woodlands of the Eastern Edwards Plateau, Texas. The Southwestern Naturalist. 44(1): 31-41.

Russell, F. Leland and Norma L. Fowler, 2002. Failure of Adult Recruitment in *Quercus buckleyi* Populations on the Eastern Edwards Plateau, Texas. American Midland Naturalist. 148: 201-217.

Russell, F. Leland, David B. Zippen and Norma L. Fowler, 2001. Effects of White-tailed Deer (*Odocoileus virginianus*) on Plants, Plant Populations and Communities: A Review. American Midland Naturalist. 146: 1-26.

Simberloff, D. 1996. Impacts of Introduced Species in the United States. Internet: http://cgrio.ciesin.org/CONSEQUENCES/vol2no2/article2.html

Texas Parks and Wildlife Department. No Date. Trapping brown-headed cowbirds to control songbird nest parasitism. www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_bk_w7000_1148.pdf

Texas Wildlife Damage Management Service. 1998. Controlling feral hog damage. Pamphlet No. L-1925. TX. Wildlife Damage Mgmt. Serv., San Antonio, TX.

Thébaud C, D. Simberloff. 2001. Are plants really larger in their introduced ranges? Am Nat 157: 231–236.

U.S. Department of Agriculture. 1992. Wild pigs, hidden dangers for farmers and hunters. Agriculture Information Bulletin No. 620. U.S. Dept. of Agriculture. Hyattsville, MD.

U. S. Fish and Wildlife Service. 1996a. Federal Fish and Wildlife Permit No. PRT-788841.

U. S. Fish and Wildlife Service. 1996b. Final Environmental Impact Statement/Habitat

Conservation Plan for Proposed Issuance of a Permit to Allow Incidental Take of the Golden-cheeked Warbler, Black-capped Vireo, and six karst invertebrates in Travis County, Texas.

Vilà, M., Espinar, J. L., Hejda, M., Hulme, P. E., Jarošík, V., Maron, J. L., Pergl, J., Schaffner, U., Sun, Y. and Pyšek, P. (2011), Ecological impacts of invasive alien plants: a meta-analysis of their effects on species, communities and ecosystems. Ecology Letters, 14: 702–708. doi: 10.1111/j.1461-0248.2011.01628.x

Zavaleta, E. S., R. J. Hobbs, H. A. Mooney. 2001. Viewing invasive species removal in a whole-ecosystem context. Trends in Ecology and Evolution. 16(8):454-459.