HERPTILE ABUNDANCE AND DIVERSITY IN RESPONSE TO SEASONAL BURNING ON A CENTRAL TEXAS ASHE JUNIPER-LIVE OAK SAVANNA

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ABSTRACT

HERPTILE ABUNDANCE AND DIVERSITY IN RESPONSE TO SEASONAL BURNING ON A CENTRAL TEXAS ASHE JUNIPER-LIVE OAK SAVANNA

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Current research on the effects of fire on herpetofauna generally has ignored the timing of a burn. I investigated the seasonal effects (summer versus winter) of prescribed burning on the herpetofaunal community of a central Texas Ashe juniper-live oak savanna. One trapping line, consisting of 1 drift fence, 2 pitfall traps and 2 funnel traps, was established on 12 treatment (6 on each burn treatment) and 6 control plots (unburned), for a total of 18 trap lines. Eighty-two individual herptiles, representing 8 snake, 3 lizard and 2 toad species were captured between April 2002 to June 2003. Herptile diversity on summer burn, winter burn and unburned plots was calculated using 4 diversity indices. Species diversity values were slightly higher on summer burn plots, while control and winter burn plots had comparable diversity values. Kruskal-Wallis Chi-Square analysis of variance did not detect a significant difference in herptile diversity among treatments and control plots ($X^2 = 0.66$, $p > 0.10$). However, Texas spiny lizard (*Sceloporus olivaceus*) was one species that did seem to respond negatively to prescribed burning. Seventy-one percent of *Sceloporus* captures ($n = 21$) occurred on control plots. This research may serve as baseline information on herptile trends in response to seasonal burning in the Ashe juniper- live oak savanna community.

INTRODUCTION

Wildfire has played an integral role in the evolutionary history of North American grasslands and their associated communities (Cooper 1961, Daubenmire 1968, Mutch 1970, Wright and Bailey 1980, Hover and Bragg 1981, Madany and West 1983, Hulbert 1988, Hobbs et al. 1991). Historically, periodic lightning-induced wildfires were instrumental in prairie stability by stimulating the growth and vigor of grasses and forbs and through the suppression of invasive, woody species (Kline 1997). Additionally, natural fires served a major role in the preservation of peripheral prairie communities, such as the oak savanna and oak woodlands characteristically found on the eastern edge of the Great Plains (Wright and Bailey 1980). This mosaic of fire-adapted communities favored greater floral species richness and diversity as a result of periodic disturbances (Collins and Gibson 1990, Kline 1997). With the advent of European colonization came fire suppression and conversion of land for agricultural use. Tillage of the land and livestock grazing changed the landscape dramatically. In order to protect their economic investment and agricultural practices, colonists suppressed both natural and anthropogenic fires. Fire suppression lead to the establishment of invasive trees and shrubs, while increased ground disturbance greatly reduced native seed sources. Consequently, seral communities of the prairie were altered as opportunistic weeds and, ultimately, trees and shrubs moved into these areas (Kline 1997).

It now is known that prescribed burning may be used to achieve a variety of ecological objectives, including (1) enhancement of vegetative biomass, (2) control of undesirable shrubs and/or tress, (3) wildlife habitat management, and (4) reduction of potential fuel loads (Higgins et al. 1989). It should be noted however that several factors, including seasonality and frequency of a burn, climate, topography, edaphic factors and precipitation, synergistically contribute to differential vegetational responses within grassland communities (Wright and Bailey 1980, Tester 1989, Anderson 1990).

Fire-induced changes in vegetational communities may have profound effects on animals living there and on their abilities to adapt to these changes. This, in turn, will influence foraging, movement, reproduction, and selection of shelter by animals (Mushinsky 1986, Henke and Fair 1997, Smith 2000). Consequently, focus has turned to the examination of prescribed burning as a management tool, not only for different plant communities, but also for associated wildlife (Rice 1932, Lawrence 1966, Vogl 1973, Bock and Bock 1978, Breininger and Smith 1992, Kirkland et. al 1996, Smith 2000, Beckman 2002).

Research on herpetofaunal responses to prescribed burning in North America has covered many historically fire-prone plant communities including those of the eastern pine forests (McLeod and Gates 1995, Ford et al. 1999), chaparral (Kahn 1960, Lillywhite and North 1974), and prairie grasslands (Erwin and Stasiak 1979, Cavitt 2000). Nevertheless, information concerning herpetofaunal response to fire, particularly within the Ashe juniper- live oak savanna community, still is lacking.

Historically, reptiles and amphibians have been given less attention compared to birds and mammals. This attitude has begun to change in Texas, as demonstrated by greater public awareness and participation in conservation efforts for threatened herptiles, such as the Texas horned lizard (*Phrynosoma cornutum*), Houston toad (*Bufo Houstonensis*) and Texas tortoise (*Gopherus berlandieri*). Amphibians as indicators of environmental well being also have become a much-discussed topic in conservation (Landres et al. 1988, Wyman 1990 and Pechmann et al. 1991). Amphibians and reptiles are important components in many biotic communities and population monitoring should, therefore, be an integral part of management practices. The decline or even absence of a species from their appropriate habitat may be indicative of erroneous species management and may need to be addressed through life history research in addition to population monitoring (Dodd and Franz 1993).

Fire may affect herptiles both directly and indirectly. Immediate responses of individuals may vary, depending on the timing and season of the burn. For example, snakes undergoing ecdysis may be more vulnerable to mortality during a fire (Smith 2000). Those species dependent on leaf litter for cover and protection also may be more vulnerable (McLeod and Gates 1998), particularly during a dry season burn. Reptiles, such as those of North American tallgrass prairie, may suffer some mortality from spring fires that occur at the peak of their activity levels (Erwin and Stasiak 1979). Winter fires, however, may have minimal effect on herptile mortality because most species are in hibernacula during this time (Cavitt 2000). However, Henke and Fair (1997) found that horned lizards (*Phrynosoma cornutum*) in south Texas might be more vulnerable to mortality from late fall and winter burns because of shallow burrowing during hibernation. Western fence lizards (*Sceloporus occidentalis*) in southern California survived the direct effects of a chaparral fall fire by seeking cover in their burrows or under rocks (Kahn 1960). Florida box turtles (*Terrapene carolina bauri*) also were found to seek shelter in underground burrows during fire occurrences, thereby avoiding mortality (Ernst et al. 1995). Fire, both seasonality and frequency, may indirectly affect herpetofaunal communities through changes in floristic species composition and alterations in the vertical and horizontal structure of the community (Simovich 1979, Russell et al. 1999, Smith 2000). These changes in landscape structure may, in turn, influence habitat utilization by a species. Mushinsky (1986) reported that different frequencies of fire cycles result in variable responses from herpetofauna on the southern Florida sandhills ecoregion. He reported that frequent burning (one-year cycles) minimized herbaceous/grass biomass, resulting in an increased density of predatory herptiles, such as the six-lined racerunner (*Cnemidophorus sexlineatus*). Unburned areas (fire suppressed for 20 years) consistently showed lower herptile diversity. The two-year burn cycle produced the lowest herptile diversity after the control. Two-year cycles also produced greater vegetative cover, which ultimately served to minimize herpetofaunal diversity within this community. The seven-year burn cycle produced highest herptile diversity. The vegetational heterogeneity and the mosaic effect created by the seven-year fire cycles may have been more conducive to herptile residency (Mushinsky 1986).

Reptiles and amphibians may respond differently to burned areas. Texas horned lizards (*Phrynosoma cornutum*) in south Texas responded positively to recently burned plots and actively selected for them (Henke and Fair 1997). However, Cavitt (2000) reported that eastern yellowbelly racers (*Coluber constrictor*) and slender glass lizards (*Ophisaurus attenuatus*) of the North American tallgrass prairies responded negatively to a winter burn. Both species declined in abundance on winter burn plots when compared to their abundance the year prior to the burn. The winter fire, however, did not affect common garter snake (*Thamnophis sirtalis*) abundance. In contrast, abundance of *Thamnophis sirtalis* in the Atlantic coastal plains of Maryland decreased on hardwood-pine burn plots compared to unburned plots, and *Coluber constrictor* abundance increased on burn plots compared to unburned (McLeod and Gates 1998).

The Lady Bird Johnson Wildflower Center is located on an Ashe juniper-live oak savanna on the eastern edge of the Edwards Plateau in central Texas. The Center was founded in 1982 by Lady Bird Johnson and Helen Hayes to educate people about the environmental necessity, economic value, and natural beauty of native plants. In 1999, a landscape restoration research program was initiated on the center's property. Beginning in 2001, research on seasonal controlled burning and mowing began with the objective of studying the long-term effects of these disturbances on vegetational composition and productivity. In spring 2002, research was expanded to include faunal responses to prescribed burning.

The objectives of my study were: (1) to establish baseline data on herptile populations on a Ashe juniper-live oak savanna, (2) to collect and compare abundance data on herptile populations with two treatments and control (summer burn, winter burn, unburned plots), and (3) to assess and compare species richness and diversity among the treatments and control plots.

METHODS AND MATERIALS

Study area. —My study was conducted on a 66 ha site at the Lady Bird Johnson Wildflower Center, Austin, Texas, (30° 19'N, 97° 52'W, elevation 247 m, mean annual rainfall 810mm). Situated on the eastern edge of the Edwards Plateau, this area historically was an Ashe juniper- live oak savanna. However, shifts in fire and grazing regimes following European settlement have reduced the grassland element and increased the density of Ashe juniper (*Juniperus ashei*). The site formerly was a cattle, sheep and goat ranch until 1985. In the early 1950s, extensive manual clearing removed most juniper trees. This species subsequently recolonized the area (40–100 ha^{-1}) and is co-dominant with *Quercus fusiformis* (45 ha^{-1}). Other woody species include *Celtis laevigata, Ulmus crassifolia, Diospyros texana, Opuntia* spp. and *Berberis trifoliata.* The understory is dominated by warm-season (*Bothriochloa laguroides subsp. torreyana, Hilaria belangeri, Bothriochloa ischaemum*) and cool-season (*Nasella leucotricha, Bromus japonicus, Limnodea arkansana*) grasses with over 200 annual and perennial forbs (e.g., *Gaillardia pulchella, Ambrosia psilostachya, Galium* spp., and *Rudbeckia hirta*). Soils are clayey, mixed thermic, lithic argiustolls of the Speck series, tending toward fine montmorillonitic, thermic, udic chromusterts of the Crawford series on deeper sites. Both soil types are limestone derived on less than 3% slopes and chemically similar, but with soil depths of 10-50 cm and 30-100 cm deep on Speck stony clay and Crawford clay, respectively (U.S.D.A 1974).

In 2000, the research area was divided into 54 (about 0.6-0.8 ha each) experimental plots for investigations on the response of vegetation to both seasonal burning and grazing (Fig. 1). My study focused only on treatment plots burned in summer and winter and unburned (control) plots. Prescribed burning began in winter 2001 and continued through summer 2002. A burn history of the research plots is presented in Table 1.

Table 1. Burn history of research plots at the Lady Bird Johnson Wildflower Center, Travis Co., Austin, Texas, 2001-2002. Temperature (°C), relative humidity (%) and wind speed (km/hr) are reported as averages.

Date	**Treatment**	**Temp. (°C)**	**Relative Humidity (%)**	**Wind Speed (km/hr)**
Feb-01	Winter burn	18	63	10
Jun-01	Summer burn	29	64	6
Feb-02	Winter burn	13	38	6
Jun-02	Summer burn	35	40	6

Field procedures. — Trap lines, consisting of 1 aluminum flashing drift fence (45 cm high, 15 m long) with 2 pitfall and funnel traps (80 x 23 cm), were placed on 18 plots in late March 2002. One funnel trap from each line was placed under adjacent live oak (*Quercus fusiformis*) mottes during the fifth month of the study. Pitfall traps composed of

19-L buckets were buried at ground level at either end of each drift fence. Soil and a damp cloth were placed in each bucket to prevent desiccation of captive herptiles. Additionally, we fashioned bucket covers from aluminum flashing and used rocks within buckets to protect captured animals from direct sunlight. Trap lines were built on 6 randomly chosen plots for each of the 2 treatment (burn summer, burn winter) and control plots for a total of 18 trap lines. Control plots were representative of the natural vegetative community of the research area. Traps were opened simultaneously once each month for six days, giving a total of 1512 trapping days over a 14-month period. A trap day is defined as one 24-h period. Traps were opened for an average of 3024 hours per month. Individuals captured were identified to species and sex when possible, weighed, measured (snout-vent and total length) and marked by toe or scale clipping, depending on the species. All individuals were released at the site of capture after marking. Individuals encountered while checking trap lines were captured when possible and recorded. Temperature, percent humidity, cloud cover, and precipitation data were collected with all captures. In months with a scheduled burn, I conducted sampling prior to the prescribed burn. Thus, newly burned plots always had a minimum of 1 month of vegetative regrowth before herptile sampling occurred again. Trapping began in April 2002, during the second year of the prescribed burn program and was completed in early June 2003.

Data analysis. — Relative abundance (% of total) for each species captured and as a reflection of trapping effort (# of individuals/100 trap days) was calculated. Species richness and diversity, using four diversity indices (Table 2), were calculated on pooled data from all treatment and control plots, as well as the total research area (Krebs 1999). A non-parametric Kruskal-Wallis Chi-Square (x^2) analysis of variance was used to test for abundance differences among summer, winter burn and controls among the 4 most prevalent species, *Sceloporus olivaceus, Gastrophryne olivacea, Bufo valliceps,* and *Masticophis flagellum.* Brillouin diversity values from each of the 18 plots were tested using Kruskal-Wallis Chi-Square analysis (S-Plus 1997). The null hypothesis was stated that herptile diversity was the same among control and treatments. All analysis of variance tests were performed using S-Plus statistical software (1997). The alpha level was set at 0.05, a priori, for all statistical analyses.

RESULTS

A total of 82 individuals, representing 8 snake, 3 lizard and 2 toad species were captured from April 2002 to June 2003 (Table 2). Five individuals (3 *Scincella lateralis,* 1 *Thamnophis cyrtopsis ocellatus* and 1 *Sceloporus olivaceus*) were captured on adjacent experimental plots. These individuals were included only in the total research area analysis. Four of 13 species represented 76 % of all captures while the remaining species were represented by ≤ 5 individuals (Fig. 2). Abundance values, as a reflection of trapping effort, were calculated for each treatment and control (Table 4). *Sceloporus olivaceus* was the most common species encountered (Table 4) with 22 individuals captured.

Control plots yielded the greatest number of captures with 34 individuals, representing 11 species. Twenty-three individuals representing 9 species were captured on summer burn plots (Table 2). The lowest capture rate (n=19) occurred on winter burn plots. Diversity and species richness also were lowest on winter burn plots, with 7 species represented (Table 3). Diversity measurements were consistently higher on summer burn plots despite their intermediate species richness value (Table 3). Four snake species and 1 lizard species were represented by only one captured individual on summer burn plots (Table 2). Brillouin and Shannon-Weiner indices suggest that control plots rank second in diversity, while Simpson and Berger-Parker suggest that control plots rank third after winter burn plots (Table 3). Kruskal-Wallis Chi-Square analysis showed no significant

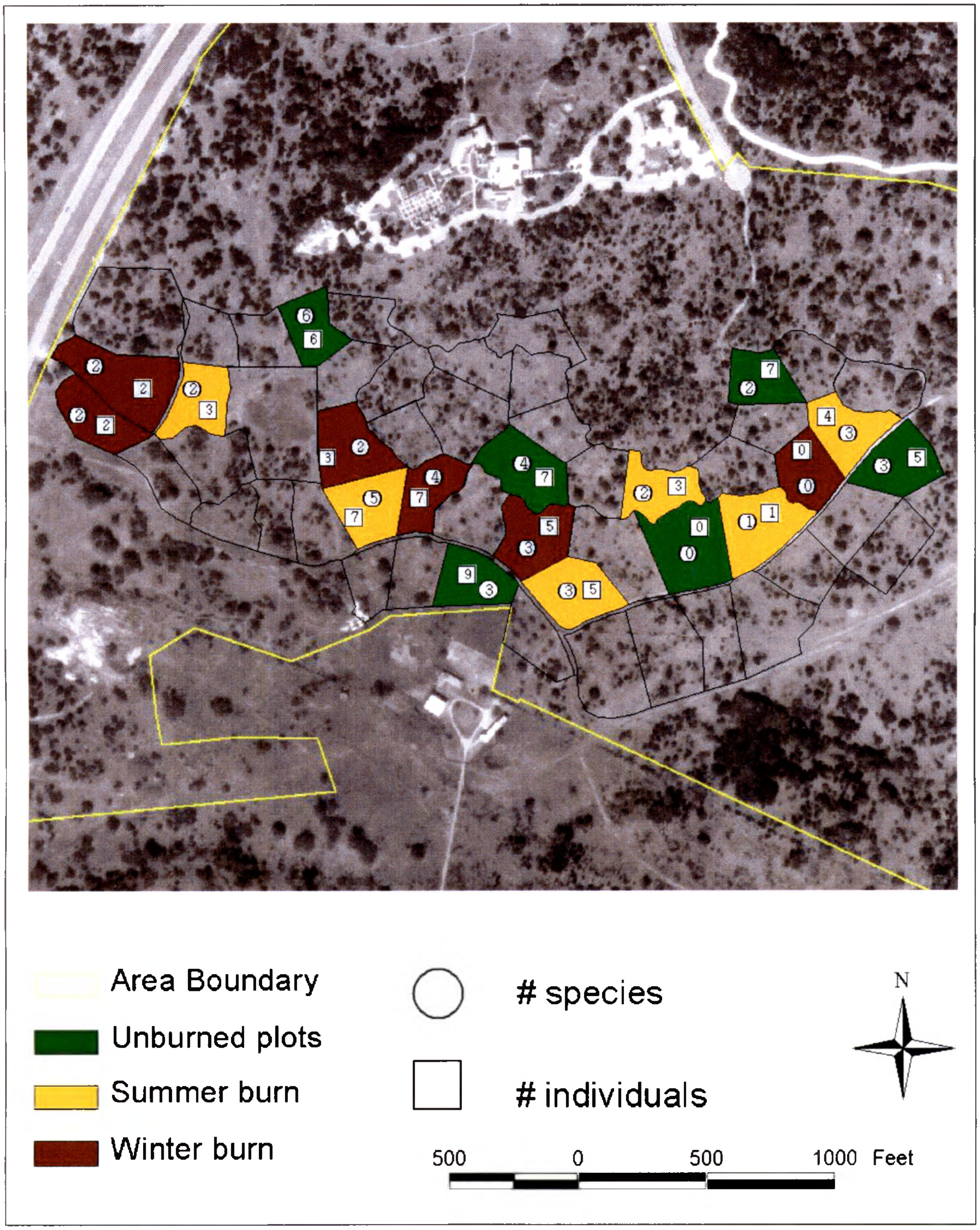

Figure 1. Map showing study plots within the Lady Bird Johnson Wildflower Center research area, Travis Co., Austin, Texas. Number of species and individuals captured from each plot from 2002-2003 are also shown.

difference in species diversity among winter, summer burn and control plots (X^2= 0.67, p > 0.10).

There was no statistical difference in number of individuals, of the 4 focal species, found on winter, summer burn and control plots (*Sceloporus*-X^2 = 4.22, p = 0.12, *Gastrophryne*-X^2 = 0.80, p > 0.2, *Bufo*- X^2 = 2.13, p > 0.2, *Masticophis*- X^2 = 1.60, p > 0.20) (Table 5).

Table 2. Herptile species and number of individuals captured on treatment and control plots at the Lady Bird Johnson Wildflower Center, Travis Co., Austin, Texas from 2002–2003.

Species	**Summer burn**	**Winter burn**	**Control**	**Other**	**Total Facility**
Lizards:					
Sceloporus olivaceus *	5	1	15	1	22
Hemidactylus turcicus	1	0	1	—	2
Scincella lateralis	0	2	1	2	5
Toads:					
Bufo valliceps *	5	2	4	—	11
Gastrophryne olivacea *	5	8	6	—	19
Snakes:					
Elaphe guttata emoryi	1	0	0	—	1
Elaphe obsoleta lindheimeri	1	0	1	—	2
Opheodrys aestivus	1	0	1	—	2
Crotalus atrox	0	1	1	—	2
Salvadora grahamiae lineata	0	0	2	1	3
Masticophis flagellum testaceus *	3	5	1	—	9
Thamnophis cyrtopsis ocellatus	0	1	1	1	3
Pituophis catenifer sayi	1	0	0		1

* focal species

Abundance values for *Sceloporus* were greater on unburned plots (Table 4), with 71% of captures occurring there. Only 1 *Sceloporus* individual was captured on a winter burn plot (Table 2). Eleven of the 22 *Sceloporus* individuals captured, including the 1 captured on the winter burn plot, were observed on or near trees or were caught in a funnel trap placed under trees. Three of these funnel trap captures were juveniles.

Eighty nine percent of *Masticophis flagellum testaceus* individuals were captured on burned plots (winter and summer combined) with the majority of captures occurring in the second year of the study. Three of the 9 *Masticophis* individuals were caught in 2002. All of these early captures occurred in summer on winter burn plots, about 6 months after the winter burn. Abundance values for *Masticophis* were greatest on winter burn plots (Table 4). Throughout the study, only 1 of the 9 *Masticophis* was captured on a control plot. No individuals were captured on summer burn plots until April of 2003, about 10 months after the 2002 summer burn.

Most toads were captured on burn plots (Fig. 3). *Bufo* abundance was slightly greater on summer burn plots, while *Gastrophryne* abundance was greater on winter burn plots (Table 4). Seventy- three percent of all *Bufo* captures occurred in late September 2002 after several days of rainfall.

Some mortality did occur during trapping, mainly because of fire ants. Two snakes (*Opheodrys aestivus* and a juvenile *Crotalus atrox*), 2 *Gastrophryne olivacea*, and 1 *Hemidactylus turcicus* were killed in pitfall buckets by fire ants. The *Opheodrys aestivus* and *Hemidactylus turcicus* mortalities occurred on summer burn plots about 2 months after the June summer burn. Two other snakes (*Salvadora grahamiae lineata* and *Elaphe obsoleta*) were found dead in funnel traps.

Table 3. Species richness and diversity values among captured herptiles at the Lady Bird Johnson Wildflower Center, Travis Co., Texas from 2002-2003. Calculated values are based on pooled data from each of the treatments and control plots and are categorized under winter burn, summer burn, control and total research area.

Indices	**Control**	**Summer burn**	**Winter burn**	**Total Research Area**
Species richness (S)	11.00	9.00	7.00	13.00
Shannon-Weiner (H′)	2.61	2.80	2.34	3.01
Simpson (1-D)	0.77	0.87	0.78	0.84
Berger-Parker (1-d)	0.56	0.78	0.58	0.74
Brillouin (HB)	2.13	2.22	1.84	2.70
# individuals captured	34	23	19	82

Table 4. Abundance values for all herptile species captured at the Lady Bird Johnson Wildflower Center, Travis Co., Austin, Texas from 2002-2003 as reflection of trapping effort (# of individuals caught/100 days).

Species	Summer burn	Winter burn	Control
Lizards			
Sceloporus olivaceus	1.0	0.2	3.0
Hemidactylus turcicus	0.2	0.0	0.2
Scincella lateralis	0.0	0.4	0.2
Toads			
Bufo valliceps	1.0	0.4	0.4
Gastrophryne olivacea	1.0	1.6	1.2
Snakes			
Elaphe guttata emoryi	0.2	0.0	0.0
Elaphe obsoleta lindheimeri	0.2	0.0	0.2
Opheodrys aestivus	0.2	0.0	0.2
Crotalus atrox	0.0	0.20	0.0
Salvadora grahamiae lineata	0.0	0.0	0.4
Masticophis flagellum testaceus	0.6	1.0	0.2
Thamnophis cyrtopsis ocellatus	0.0	0.2	0.2
Pituophis catenifer sayi	0.2	0.0	0.0

Table 5. Number of individuals captured among the four focal species at the Lady Bird Johnson Wildflower Center, Travis co., Austin, Texas in 2002-2003. Number captured in each treatment and control plots were tested for significance using Kruskal-Wallis Chi-Square (X^2) analysis of variance. Alpha level = 0.05

Species	**# captured on plots**	**X^2-value**	**p-value**
Sceloporus olivaceus	21	4.22	> 0.1
Gastrophryne olivacea	19	0.80	>0.1
Bufo valliceps	11	1.60	>0.1
Masticophis flagellum testaceus	9	2.10	>0.1

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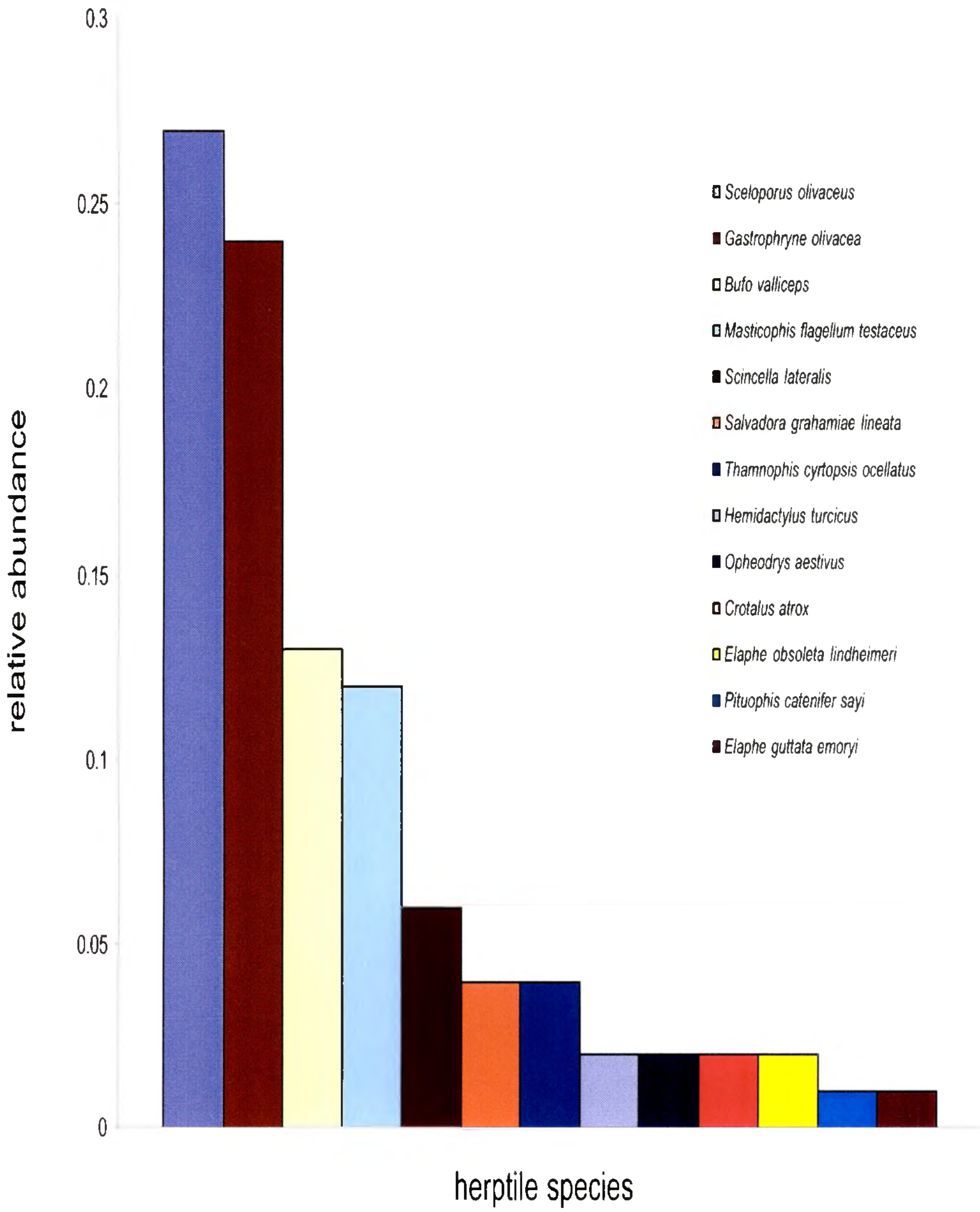

Figure 2. Relative abundance values for herptiles captured from 2002-2003 within the total research area of the Lady Bird Johnson Wildflower Center, Travis Co., Austin, Texas.

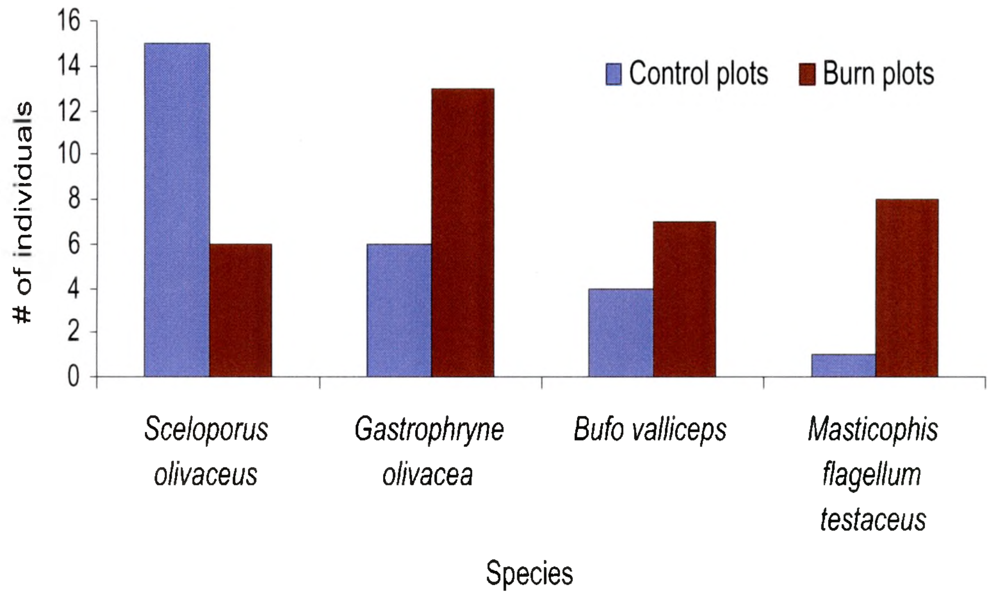

Figure 3. Comparison of number of individuals in burn plots vs. unburned plots of four focal herptile species captured from 2002-2003 at the Lady Bird Johnson Wildflower Center, Travis Co., Austin, Texas.

DISCUSSION

Results of this study suggest that seasonal prescribed burning may impact herpetofaunal communities of the Ashe juniper-live oak savanna of Central Texas. However, due to small sample size, statistical analysis failed to confirm this. Overall herptile abundance and capture rates were lower than expected but comparable to other herptile studies done in central Texas (Jeannie Munòz-personal communication). The Results of my study may have been confounded by the historical use of the site as a cattle, goat and sheep ranch until the mid-1980's. This, along with former management practices, including fire suppression, and the encroaching suburban development (Fig. 1) could have contributed to the paucity of herptiles at the site. Precipitation may have been another factor influencing numbers of herptiles captured, particularly for amphibians (Owen 1989). Despite the lack of statistical significance, the diversity indices and abundance data may be indicative of herptile trends.

Historically, lightning-induced fire in North American grasslands likely occurred mainly during summer (Bragg 1982). Preliminary vegetational data for the study site suggests that plant diversity is highest on summer burn plots (Simmons- personal communication). This coincides with the higher herpetofaunal diversity also observed on summer burn plots and suggests that fire disturbances, although occurring during times of increased herptile activity, may not have long-term adverse effects on herptiles in these communities.

It is important to consider how seasonality and timing of a burn contributes to different vegetational responses (Wright and Bailey 1980, Bragg 1982). Vegetational differences have the capacity to affect habitat use by herptiles through changes in floristic structure (Pianka 1966, Simovich 1979). This may be especially important for the arboreal *Sceloporus olivaceus* (Blair 1960). This species may be vulnerable to high intensity summer burns that have the potential to top-kill many woody plants (Wright and Bailey 1980) that are used for shelter and cover. Winter burns in late February could coincide with emergence from hibernation (Blair 1960). Although burn intensity would be markedly lower during late winter burning, litter removal may be harmful because it is an important escape cover during early spring (Blair 1960). These factors may have contributed to the greater abundance of *Sceloporus* on unburned plots (Table 4).

The abundance and diversity of predatory herptiles on the study site may have been influenced by prey species abundance. For *Sceloporus*, *Gastrophryne*, and some snakes, such as *Opheodrys aestivus*, grasshoppers (order Orthoptera) and other insects are important components of their diet (Blair 1960,Werler and Dixon 2000, Stebbins 2003). Panzer (2002) found postfire responses of insect populations, representing 151 species and 7 orders, ranged from positive (26%) to negative (40%). Sixty-eight percent of insect populations responding negatively eventually recovered within 1 year. Koerth et al. (1986) studied arthropod responses to a winter fire in a Texas grassland community and found Orthoptera abundance increased during the second year after the burn. While insect populations, in general, may initially decrease following a burn, some orders of insects may increase. Eventually, the insect prey base will recover. Rodent populations, important prey species for *Masticophis flagellum testaceus* and *Elaphe obsoleta lindheimeri*, also have been examined. Although seasonal responses of species have been largely ignored, research shows that some species respond negatively or positively to seasonal burning (Kaufman et al. 1990). In the brush-prairie savanna community of Wisconsin, white-footed mice (*Peromyscus leucopus*) and deer mice (*Peromyscus maniculatus*) responded positively to a spring burn (Beck and Vogl 1972). Hispid cotton rats (*Sigmodon hispidus*) responded negatively to both summer and winter burns in Arizona sacaton grasslands (Bock and Bock 1978). During my study, 12 rodents were captured in funnel traps. The majority of these captures (75 %) occurred on winter burn plots, with *Sigmodon hispidus* being the most common species. Winter burn plots were slightly favored by *Masticophis flagellum testaceus* (Table 4), suggesting that any preference exhibited by this species may have been driven by food availability, as shown by other studies (Rogers 1976).

Results of my study may indicate that any fire disturbance, regardless of seasonality, affects *Gastrophryne olivacea* (Fig. 3). Of 19 individuals captured, 13 occurred on burn plots (Table 2). The structural heterogeneity created by fire may result in more suitable habitat and greater abundance of *Gastrophryne*, as in other herptile communities (Pianka 1966, Mushinsky 1986). Most *Gastrophryne* were captured on burn plots in late June 2002, when average rainfall exceeded 177 mm.

Results of my study must be interpreted with caution because of low capture rates. Additionally, when studying effects of fire on any vertebrate population, it is important to continue research for several years to discern any undetected patterns of community response. Therefore, it is my hope that this study will serve as a foundation for future research. Future studies should include analysis of changes in productivity and structure of the plant community, precipitation and its effect on herptile movement, abundance data on prey species, and temporal variations in species activity patterns. Trap lines also should remain open for longer periods of time in order to maximize captures and increase sample size.

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APPENDIX

Taxonomic species and common name of all herptile species captured at the Lady Bird Johnson Wildflower Center, Travis Co., Austin, Texas from 2002-2003.

Species	**Common Name**
Sceloporus olivaceus	Texas Spiny lizard
Hemidactylus turcicus	Mediterranean gecko
Scincella lateralis	Ground skink
Bufo valliceps	Gulf Coast toad
Gastrophryne olivacea	Plains Narrowmouth toad
Elaphe guttata emoryi	Plains ratsnake
Elaphe obsoleta lindheimeri	Texas ratsnake
Opheodrys aestivus	Rough Green snake
Crotalus atrox	Western Diamondback snake
Salvadora grahamiae lineata	Texas Patchnose snake
Masticophis flagellum testaceus	Western Coachwhip
Thamnophis cyrtopsis ocellatus	Black-necked Garter snake
Pituophis catenifer sayi	Bullsnake

VITA

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