

HERPTILE RESPONSE TO A CONTROLLED BURN AT RABBIT MOUNTAIN OPEN SPACE



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Prepared for:

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EXECUTIVE SUMMARY

During the survey time frame, we located 33 individuals and eight species.

- Burned area - six species with 13 individuals
- Control area - seven species with 20 individuals

The most common species in the burned areas was Prairie Lizards, and during summer only.

The most common species in the control areas was Prairie Rattlesnakes, during spring, summer and fall.

Central Plains Milksnakes were not observed during our surveys.

Racers were observed or detected in both the control and burn sites.

Accomplishments and Recommendations:

- This project contributes to extremely information about fire effects on amphibians and reptiles.
- Baseline data allows managers to follow-up with additional surveys measuring impacts on species through habitat changes, such as vegetation re-growth.
- Continue monitoring amphibians and reptiles for 2-4 years following similar methods to be comparable to our baseline data.
- Reference this data, 2015 survey data, and other recorded observations (e.g. iNaturalist, volunteer/ staff notes), for post-fire monitoring of future burns. Establish routine post-fire (or other disturbance) monitoring plans.
- The survey comprised 86.5 hours, where BCPOS staff contributed 11.5 hours and volunteers contributed 25 hours.

Staff sponsor: Susan Spaulding, Senior Wildlife Biologist - BCPOS

ABSTRACT

Very little is known about effects of fire on native reptiles and amphibians. We aimed to evaluate the effects of a controlled burn that occurred in 2017, on herptiles at Rabbit Mountain Open Space. The survey focused around searching for reptiles and amphibians during their primary activity season of April to October in 2018. Our 2015 survey data of this property gave us a baseline from which to evaluate new observations. Using recommended and non-invasive techniques, we recorded all reptile and amphibian species in the burned areas and adjacent unburned areas that were determined at the beginning of the study. Our data, report, and recommendations are intended to inform and guide land management decisions as to the effects of controlled burns on the presence of reptile and amphibian species not only in Boulder County, but in western U.S. grassland habitats. We located 33 individuals and eight species over the course of the survey. Six species making up 13 of the 33 individuals were found in the area of burned areas, with the remainder (seven species, 20 individuals) in unburned adjacent areas.

KEY WORDS: amphibians, reptiles, controlled burn, shortgrass prairie, Rabbit Mountain Open Space

INTRODUCTION

Very few studies have measured the effects of fire on herpetofauna in grassland habitats, and none in Colorado's shortgrass prairie. In 2015, we inventoried reptiles and amphibians (hereafter "herptiles") native to Rabbit Mountain Open Space (RMOS), an area designated by the County as Critical Wildlife Habitat, and documented important species at the property. In 2017, a controlled burn was conducted at RMOS. This project has been a follow-up to our 2015 work by evaluating herptile responses at this site to prescribed burns. This study provides insight into fire management practices and research with wildlife not just locally, but also globally in grassland ecosystems around the world.

Fire impacts ecosystems and wildlife positively and negatively (Russell et al 1999). Reptiles and amphibians are indicator species that tell a larger story about the health of an ecosystem. Fire regimes are generally considered beneficial to many herpetofauna species and are recommended for grasslands by the Partners in Amphibian and Reptile Conservation (PARC) in their Habitat Management Guidelines for the Southwest. In a Kansas study, Racers (*Coluber constrictor*) were encountered less frequently in burned versus unburned areas over several years demonstrating a negative relationship. In 2015, we found Racers to be abundant throughout the property, second only to Prairie Rattlesnakes (*Crotalus viridis*) which are prey to Racers. Other important species found in 2015 within or very near the 2017 burned area include Lined Snakes (*Tropidoclonion lineatum*) and Plains Black-headed Snakes (*Tantilla nigriceps*) both of which are very infrequently encountered in this area of Boulder County and their responses to fire are largely unknown.

Using our 2015 study to inform this project, we conducted monitoring techniques (e.g. anuran call monitoring surveys, area- and time-constrained searches, visual encounter and cover

surveys) to carefully evaluate effects of the controlled burn on herptiles. We assessed species found in burned and unburned (hereafter *control*) areas. These techniques allow us to contribute to the extremely limited research of fire on herptiles, as well as inform BCPOS more of this management practice.



Eastern Yellow-belly Racer at RMOS

METHODS

All methods used were recommended techniques by PARC (Graeter et al 2013). A scientific collection permit (no. 18HP2337) was acquired for this research from Colorado Parks and Wildlife to legally handle herptiles for voucher and identification purposes only, and activities reported according to its issuance. Appropriate documentation was always carried on our person and all protocols for Rabbit Mountain Open Space (RMOS) property access during and after hours were followed. Snake-gaiters were always worn by all researchers and volunteers

whenever on the property and during this research. A mobile phone was carried in the field by either one or both co-investigators during all site visits for safety (e.g. in case of rattlesnake bite). Disinfection protocol took place by removing all obvious mud, debris, and vegetation, followed by being sprayed with 10% bleach to water solution prior to all surveys.

The surveys conducted during this study used similar methodology to our 2015 General Survey at RMOS in that we target species known and expected from the area. Our 2015 survey evaluated habitats across the entire property while this study evaluates a smaller, more-focused area on the western and northwestern portions of the property. Sites were selected with BCPOS staff and included areas from the burn location and areas adjacent to the burn location of approximate similar size. The study used visual encounter, natural cover, and frog/toad call surveys in the burned area as well as similar control areas. Visual encounter surveys were timed, with a total of 24 hours targeted per season. Each timed survey resulted in equal efforts between burned and control sites. The survey was broken down into three seasons: spring (April 1st - June 15th), summer (June 16th - August 30th), and fall (September 1st - October 31st).



Volunteer with a Lined Snake

RESULTS and DISCUSSION

During the survey time frame, we located 33 individuals and eight species (Table 1; Figure 1).

- Burned area - six species with 13 individuals
- Control area - seven species with 20 individuals

The most common species in the burned areas was Prairie Lizards, and during summer only. The most common species in the control areas was Prairie Rattlesnakes, during spring, summer and fall. Central Plains Milksnakes were not observed during our surveys. Racers were observed or detected in both the control and burn sites.

The survey comprised 86.5 hours, where BCPOS staff contributed 11.5 hours and volunteers contributed 25 hours.

Burn versus Control Sites

We observed 13 herptiles in prescribed burn sites compared to 20 in control sites (Figure 2.). Boreal Chorus Frogs were only observed in burn sites. Lined Snakes and Bull Snakes were only observed in control sites. (Please see below for further explanation regarding species.) The species differences observed between burned and control sites is likely less noteworthy than the numbers between areas. More herptile observations were detected in control sites during spring ($n = +2$), summer ($n = +1$), and fall ($n = +4$; no herptiles were detected in burn areas) seasons (Figure 2). Due to the limited scope of this project, we were unable to assess longer-term effects and comparisons of burned and control sites. We recommend follow-up with staff and/ or trained volunteers to evaluate if any effects are noted for three-five years.

Species Evaluations

This survey yielded results consistent with our 2015 survey at RMOS. Similar species, and/ or their evidence (e.g. shed skin), were observed in both control and burned areas: Eastern Yellowbelly Racer, Prairie Rattlesnake, Plains Black-headed Snake, and Prairie Lizard.



Prairie Lizard found at RMOS during survey

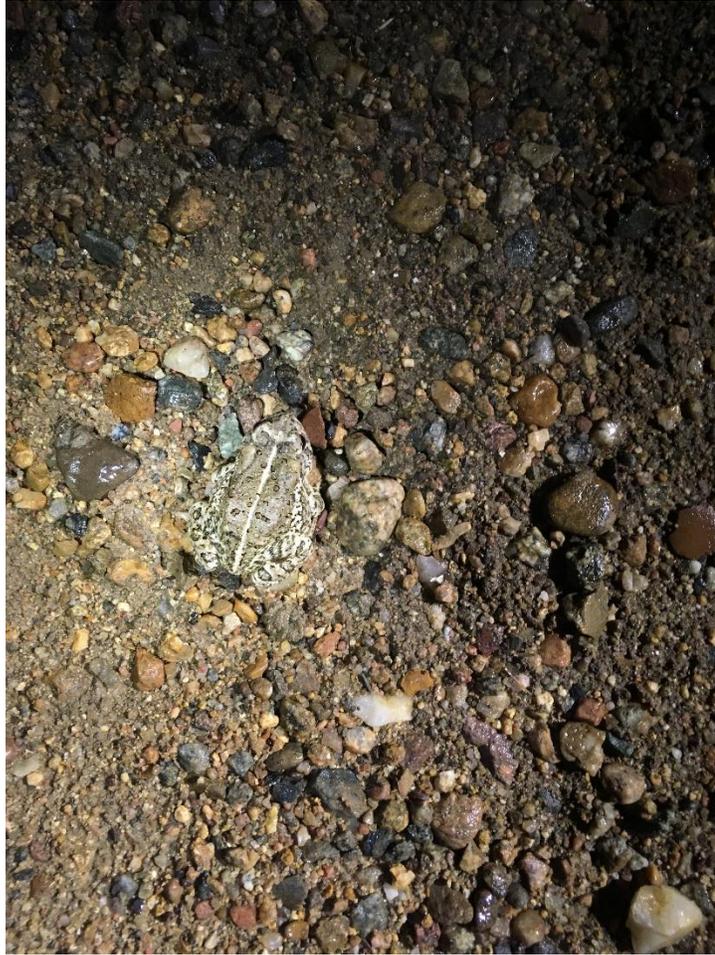
The most numerous species from burned areas that we observed was the Prairie Lizard (*Sceloporus consobrinus*), $n = 5$, and was only observed during our summer survey window, June 16 - August 30. This species was observed in 2015 at several different locations throughout RMOS and during similar times of year; the last 2015 observation was on September 2. We believe this species may respond positively to the controlled burn based on Templeton's research in Missouri Ozark glades (2011, 2001). In his research Templeton mimicked natural fires, which had been suppressed, and subsequently improved dispersal for lizard species (and pollinators) as a result of the controlled burns amongst and between rocky glades. The habitat matrix of rocky outcrops surrounded by vegetation in MO may be similar enough to RMOS that similar effects would be observed.

The Eastern Yellowbelly Racer (EYR; *Coluber constrictor flaviventris*) was a focal species of our survey due to a previous study indicating their decline in post-fire areas of

tallgrass prairie habitat (Cavitt 2000). Although this effort represents one year of post-fire monitoring, we recorded two observations from burn areas and four from control areas. This species was only detected during our spring and fall survey windows. Seeing EYR in both areas is positive in that it confirms the species' presence, but further monitoring would likely inform longer term post-fire effects on this species.

Detecting fossorial species was accomplished through natural cover surveys (i.e. flipping rocks). Although this technique relies on certain variables (e.g. time, effort, and weather conditions like temperature and rainfall) we did detect Plains Black-headed Snakes (*Tantilla nigriceps*) in both types of survey areas and in two survey windows: spring and fall. We also observed one Lined Snake (*Tropidoclonion lineatum*) in a control area during a spring survey. This species may occur in adjacent burn areas and further monitoring would help in detection. NOTE: No Central Plains Milksnakes (CPM; *Lampropeltis triangulum*) were observed in the survey area. This is not a surprise due to the secretive behavior of the species. In 2015, we observed three CPM and two were found close to the northern end of the survey area. We believe both burned and control areas provide suitable habitat for this species even though none were detected. The effects of fire on this species remain unclear.

We hypothesize that fossorial species may be less affected by a regular burn regime as their resources (e.g. prey) may be less impacted from such surface disturbances. However, fires with unusually high amounts of fuels may negatively impact fossorial species due to high temperatures and longer burn times potentially creating a lethal situation where an individual may not be able to escape the heat.



Woodhouse's Toad on road between control and burn sites

We detected two amphibian species during our survey: Boreal Chorus Frog (BCF; *Pseudacris maculata*) and Woodhouse's Toad (WT; *Anaxyrus woodhousii*). Observations of BCF were in similar areas as in 2015, which were burned in 2017, however these areas are reliably wet in spring likely influencing site-fidelity (i.e. wetland breeding sites) for the species. The observations for BCF were of the species calling (i.e. breeding behavior). Our observations of WT ($n = 5$) were only during summer surveys and occurred on trails dividing burn and control sites. In 2015, we observed heavy WT activity on trails too and their detection here may not favor burn or control sites, but rather be influenced by temperature and prey availability (i.e. WT and ectotherm prey may use the warmer trail after sundown for energy conservation purposes).

Research has demonstrated that roadways and mowing create corridors of species richness for invertebrates (Forman and Alexander 1998), and we believe RMOS roads and trails may see similar effects if tested. (Roads also limit dispersal for some species, and so there are likely differing responses by species.) The species likely is more easily detected on trails too, creating a survey detection bias. We did not observe breeding behavior in this species, which is likely a result of our survey effort and associated constraints rather than indicating a lack of breeding effort.

Prairie Rattlesnakes (*Crotalus viridis*) were observed in all three survey windows. However, observations from summer and fall ($n = 5$) were only from control sites. Observations during the spring ($n = 4$) were split evenly, 2 - burned, 2 - control. Currently, it is difficult to draw conclusions from these observations and to infer effects from burning due to a limited sample size. However, if an effect is realized, perhaps a reduced seed bank may result in fewer prey limited hunting by the species in burned areas. Such speculation should be further evaluated from future opportunities.

One Bull Snake (*Pituophis catenifer sayi*) shed was observed during summer in a control site. Although a habitat generalist species for this area, we did not observe any Bull Snakes in the same areas of the burn and control sites during our 2015 survey ($n = 7$). With one observation, this species was expected, and we are not alarmed by our findings at this time.

Survey Windows

The most observations during any of our survey seasons were from the summer ($n = 17$; 8 - burn, 9 - control). During this window we recorded four species each from burn and control sites. Our

spring surveys yielded 12 observations of three species ($n = 5$) from burn sites and four species ($n = 7$) from control sites. We detected two species during fall surveys ($n = 4$): EYR and PR.

Conclusion

Additional efforts in post-fire monitoring by staff and volunteers would potentially provide a more accurate account of effects on amphibians and reptiles. Cavitt, in eastern Kansas, noted declines in subsequent years for racers, however it is unclear if we would see similar effects here in the shortgrass prairie as opposed to the tallgrass prairie where his research occurred (2000). We applaud efforts from BCPOS to consider this work, as there is substantial knowledge yet to be gained on this topic. This project was supported by BCPOS Small Grants program.



Volunteers safely observing a Prairie Rattlesnake basking on the road at RMOS

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Table 1. Species detected and ratios of findings

Species	Burn	Control
Boreal Chorus Frogs	2	0
Woodhouse's Toad	1	4
Prairie Lizard	5	1
Eastern Yellow-bellied Racer	2	4
Prairie Rattlesnakes	2	7
Bull Snake	0	1
Lined Snake	0	1
Plains Black-headed Snake	1	2

Figure 1: Count data of species found in both control and burned sites.

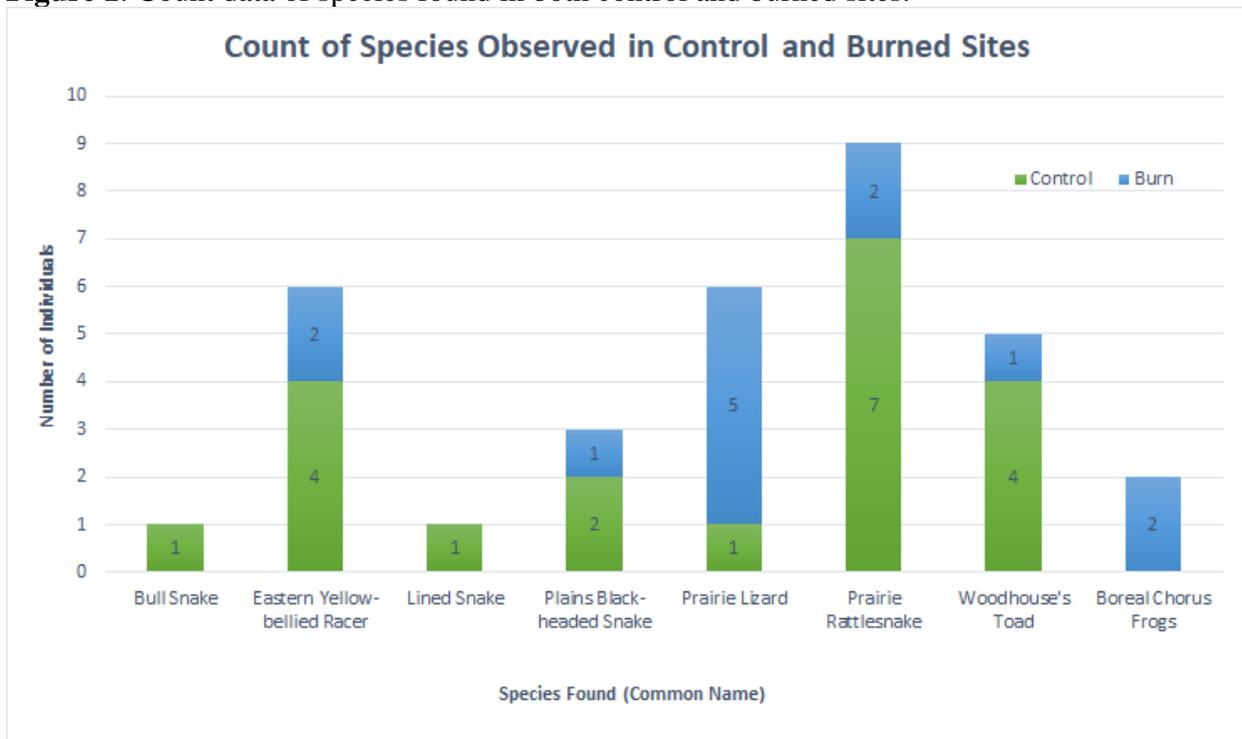
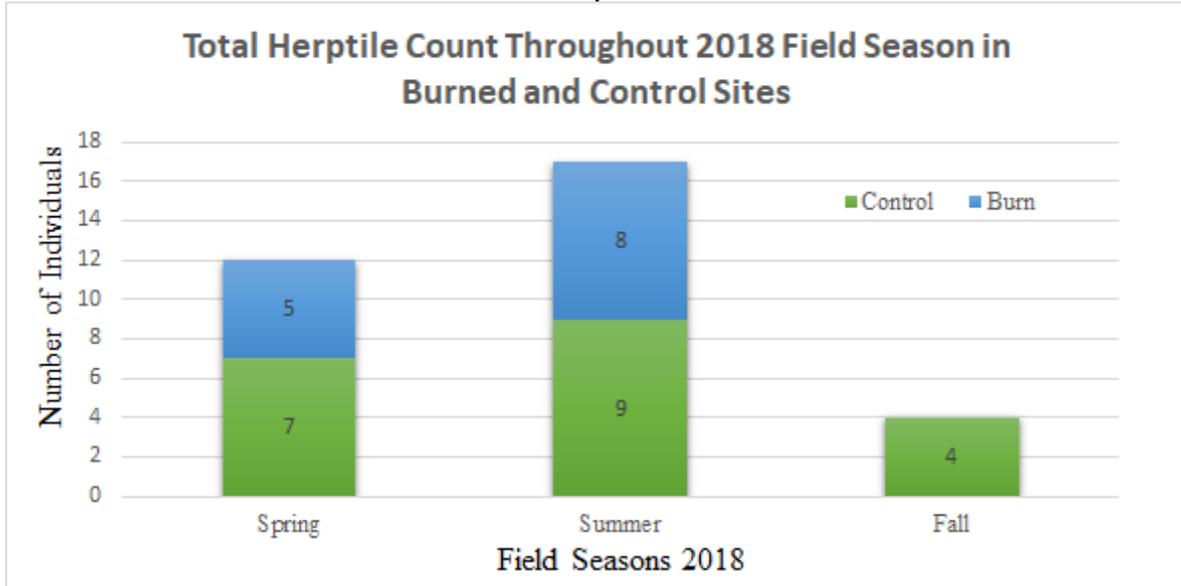
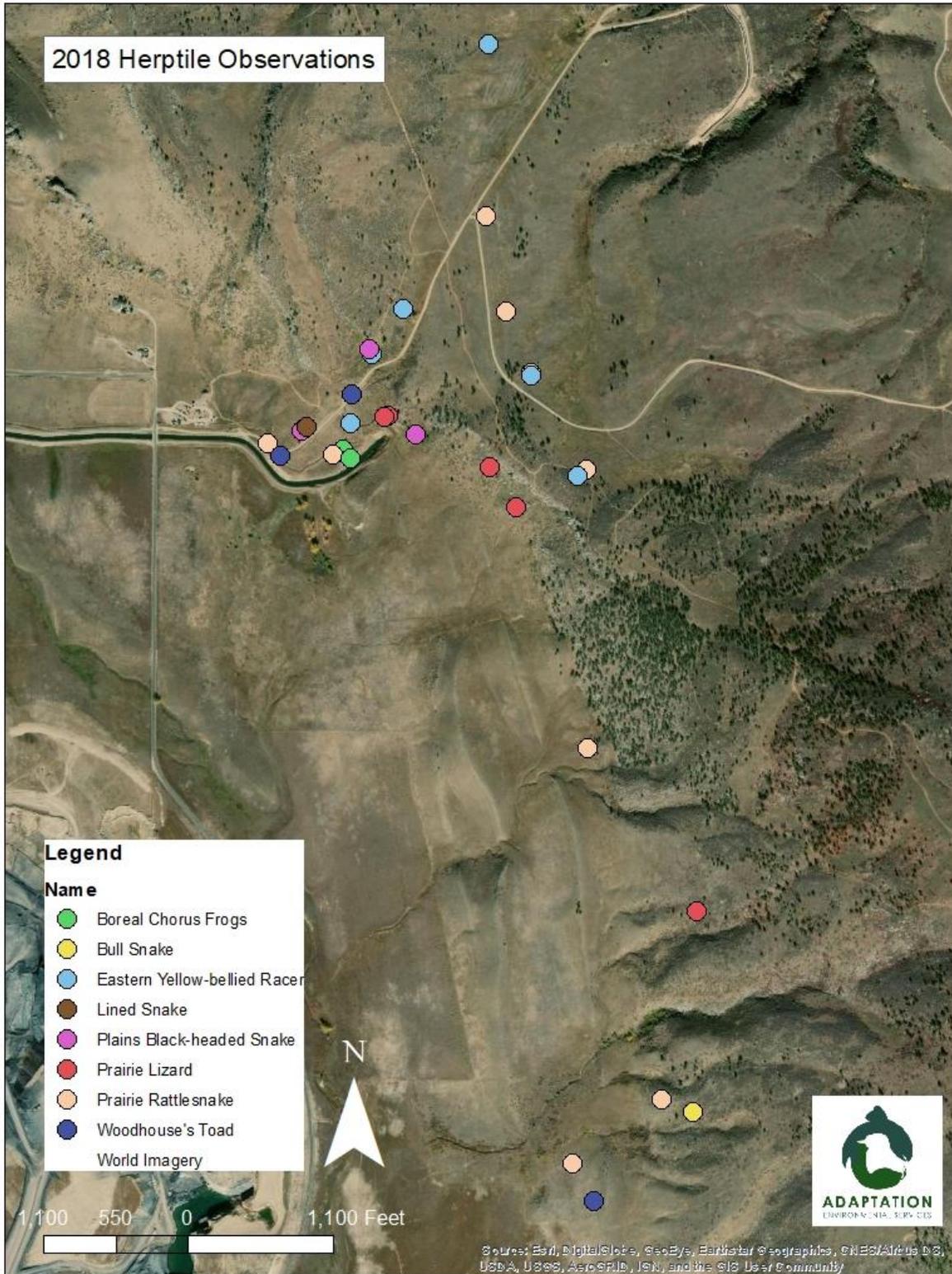


Figure 2: The number of herptile observations during Spring, Summer and Fall field seasons in both control and burn sites. Overall, more herptile observations occurred in control areas.



APPENDIX



Explanation of field effort. Units are in hours.

Date	Total Time	Burn Time	Control Time	BCPOS Staff Time	Volunteer Time
4/28	8	4	4		
5/11	18	6	12		10
6/14	4	2	2		
6/15	2	1	1		
6/17	2	1	1		1
6/27	12.5	6.25	6.25	7.5	
8/1	4	2	2		2
8/29	11	6	5	4	
9/21	3	2	1		
9/23	6	3	3		4
10/12	4	2	2		
10/25	7.5	3.75	3.75		5
10/27	4.5	2.25	2.25		3
TOTAL	86.5	41.25	45.25	11.5	25