HORNED LIZARD CONSERVATION SOCIETY
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Phrynosomatics

The Newsletter of the Horned Lizard Conservation Society

Our purpose is to document and publicize the values and conservation needs of horned lizards, to promote horned lizard conservation projects, and to assist with horned lizard management initiatives throughout their ranges.

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Population survey of and habitat use by the Greater Short-Horned Lizard (*Phrynosoma hernandesi*) in Butte-Silver Bow County, Montana

2019 Grant recipient summary

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Figure 2: Picture of Greater Short-horned Horned Lizard (*Phyrnosoma hernandesi*)

ABSTRACT

Greater short-horned lizards (*Phrynosoma hernandesi*) are endemic to western North America. They are listed as a species of concern in Montana due to a lack of sightings and limited data regarding many aspects of their biology. In 2009, a small population of greater short-horned lizards was discovered west of the Continental Divide close to the Montana Tech campus. This was unusual as all previous populations have been located on the east side of the Divide. My study focused on surveying the area for lizards and quantifying the existing habitat of the area. The study area was divided into 14 quadrats which were surveyed for lizards using walking surveys. Public outreach requesting any sightings of lizards to be reported was also used. The study area habitat was characterized by measuring the amount of bare ground and vegetation in 10 randomly placed 1x1 m plots within each of the 14 quadrats. The study revealed that lizards in the area are rare or have gone locally extinct. The wet and cool conditions during the summer may have also limited our ability to locate them. Vegetation in the area has increased since 2009 and recent human disturbances in their area may be creating unsuitable habitat for the greater short-horned lizard.

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Figure 1. Distribution of Greater Short-horned Lizards in North America. (Source: Environment Canada, 2014)

INTRODUCTION

The greater short-horned lizard (*Phrynosoma hernandesi*) ranges from southern Mexico to the southern Canadian border (Environment Canada, 2014) (Fig. 1). It is one of four North American lizard species that can endure extreme winter conditions by hibernating using a compound that prevents freezing (Mathies & Martin, 2008). P. hernandesi can grow up to 15 cm in length from snout to tail (total length (TL) (MNHHP, 2018). The species can be identified by the unique number, length, arrangement, and shape of the horns on the back of its head and side of torso (Fig. 2) (Sherbrooke, 2003).

The greater short-horned lizard (*P. hernandesi*) is most commonly found in areas with rocks, loose soil, and plant communities with open spaces and canopies that allows direct sunlight to penetrate (Sherbrooke, 2003).The species of plants within the communities consist of pinyon-juniper, aspen, pine, fir, sagebrush, and grasses (Sherbrooke, 2003).

The diet of horned lizards consists mostly of small arthropods, such as ants and beetles (Lahti & Beck, 2008). The diet may vary depending on the current environmental and habitat variables depending on present arthropods and water availability (Lahti & Beck, 2008). The lizards get water from their diet and by "rain harvesting" (Sherbrooke, 2013). Rain harvesting is a behavior where they use their broad backs to collect rainwater (Sherbrooke, 2003). They then pull the water into their mouth by opening and closing it causing capillary action (Sherbrooke, 2003). They camouflage into their surrounding environment using cryptic coloration and object mimicry (Sherbrooke, 2013). They also use immobility as a defense mechanism against predation (Sherbrooke, 2013). The lizards also use a chemical defense system called ocular-sinus blood-squirting which allows them to shoot blood from the eye socket creating a foul taste in the predator's mouth (Sherbrooke, 2013). This chemical defense behavior is typical with mammalian predators such as dogs, coyotes, and foxes (Sherbrooke, 2013).

In Montana, greater short-horned lizards (*P. hernandesi*) are classified as distributed throughout the state on the east side of the Continental Divide (Werner et al., 2004) (Fig. 3). In the 19th century the greater short-horned lizard (*P. hernandesi*) was one of the most abundant reptiles along the Missouri River in Montana (MNHHP, 2018). In 2009, Dr. William Good, a now retired Montana Tech professor, discovered a small population of P. hernandesi, both adults and neonates, on the west side of the Divide in Butte-Silver Bow County close to the Montana Tech campus in Butte, Montana. The lizards found were genetically confirmed to be the species P. hernandesi because it looks similar to the Pygmy Horned Lizard (*Phrynosoma douglasii)*. Greater short-horned lizards (*P. hernandesi*) are listed as a species of concern by the state of Montana due to a lack of sightings, as well as a lack of knowledge regarding many aspects of their biology (Werner et al., 2004). Thus, basic studies on this species are needed to aid in their conservation.

The objective of this study was to survey for greater short-horned lizards (*P. hernandesi)* in the area near Montana Tech's campus where they had previously been found and gather baseline data on pop-

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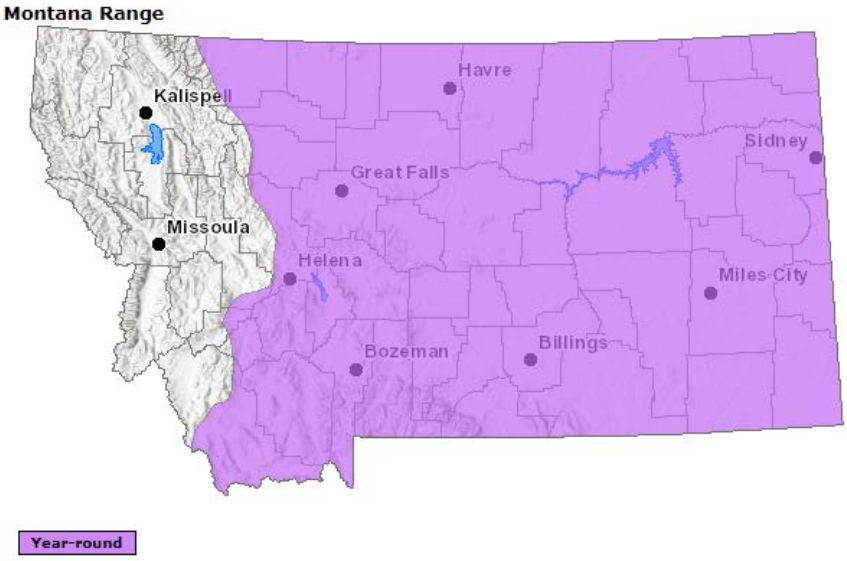

Figure 3. Distribution of Greater short-horned lizard in Montana. (Source: MNHHP, 2018)

ulation size and demographics (age, sex). While there have been multiple documented and anecdotal sightings of the lizards in the area up to 2016, the area had never been intensively surveyed. The population in the area is important because it is the only recorded population of P. hernandesi west of the Continental Divide. Another objective was to set up protocols for long-term monitoring and standards for collecting data so surveys could potentially be repeated and compared between years. Third, a plant survey of the study area was done to understand the habitat and determine if the lizards displayed any specific habitat preferences.

MATERIALS AND METHODS

This study was conducted in and around the Big Butte (location: 46° 01' 09" N, 112° 33' 33" W) overlooking the city of Butte, MT. Vegetation in the study area consists of trees, such as quaking aspens (*Populus tremuloides*) and Douglas fir (*Pseudotsuga menziesii*), but is comprised mostly of shrubs, such as rubber rabbitbrush (*Ericameria nauseosa*), and grasses, such as Canada (*Poa compressa*) and Kentucky (*Poa pratensis*) bluegrass. This study area contains many non-vegetated patches for several reasons, including natural rock outcrops, historic mine waste, and recreation disturbances.

Lizard Surveys

Prior to the initiation of lizard surveys, a trip was taken on June 3, 2019, to Billings, MT to get training on how to survey and PIT (Passive Integrated Transponder) tag this species of lizard. I met with Dr. James Barron, a professor at MSU Billings, who has been working with these lizards for 10 years. We went out to his field site and searched for lizards for about 4 hours. We only caught one lizard during this time. Dr. Barron suggested that the increased vegetation at the site that resulted from landscape changes over the past few years created unsuitable habitat for the lizards.

Figure 4. Quadrat map used in the survey. (Kayla Lappin, 2019)

For this current study, the study area was divided into two large survey quadrats, designated Q1 and Q2, measuring around 4,268 m2. Q1 and Q2 were each subdivided for a total of 14 sub-quadrats; #1 to #6 for Q1, and #1 to #8 for Q2 (Fig. 4). We used historical data of previous sightings of lizards to aid in determining quadrat placement.

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Specifically, the survey quadrats were centered on the bulk of previous sightings, so these areas and surrounding areas would be surveyed. Lizard surveys were conducted from June 2019, through the first part of September, 2019. The surveys were conducted at different times of the day and during different weather conditions to determine any patterns. All quadrats were surveyed for lizards at least three times each during the course of study. In the beginning of August, 2019, the survey method was modified to concentrate specifically on quadrats with preferred lizard habitat and areas of previous sightings. Lizards were surveyed by slowly walking through a sub-quadrat and observing the ground for presence of lizards. A walking stick was used while walking to disrupt the vegetation to force movement of the lizard.

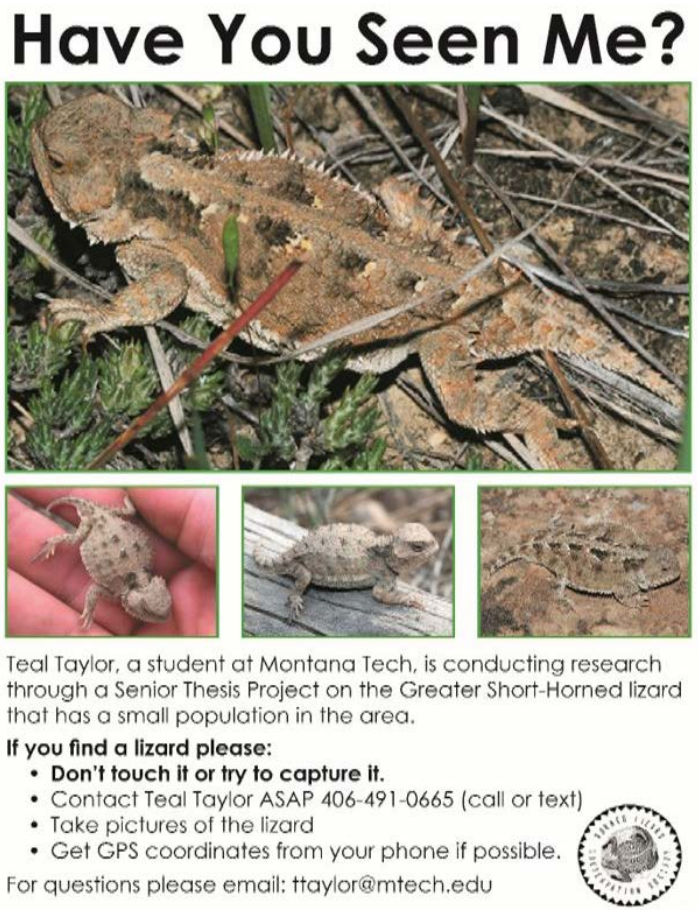

Figure 5. Copy of poster used to obtain information from the general public on lizard sightings in the Big Butte area.

Public outreach was also used to try to find lizards in the area. A poster with pictures of the lizard and contact information were posted at entrances of trailheads in the area (Fig. 5). An email questionnaire was sent out to the respondents of the poster, and to people that had previously reported sighting lizards.

The questionnaire asked about the weather, surface (substrate) they were seen on, surrounding vegetation, number of lizards seen, when the last time they saw the lizards, and any other observations or comments. The air temperature (oC) was also recorded at the time of each survey.

Vegetation Surveys

Vegetation was surveyed within each sub-quadrat in order to evaluate the habitat conditions of the study area. There were 10 vegetation sampling plots in each of the 14 sub-quadrats, totaling 140 plots (Fig. 6). The ten vegetation sampling plots were randomly placed throughout each sub-quadrat to obtain an unbiased sample. One sampling plot consisted of 1x1 m frame that was used to collect vegetation and substrate features within the given area.

Figure 6. Quadrat map with locations of plant plots.

The features that were collected were bare mineral soil (BMS), pebble, cobble, rock, litter, cryptogrammic crust (crypto), and vegetative ground cover (VGC). Plants observed in the sub-quadrats were identified to species level (Daubenmire, 1959). If a plant could not be keyed out in the field, a specimen was collected and "Manual of Montana Vascular Plants" (Lesica, 2012) was used to identify it in the lab. While conducting vegetation surveys, any incidental lizard observations were recorded.

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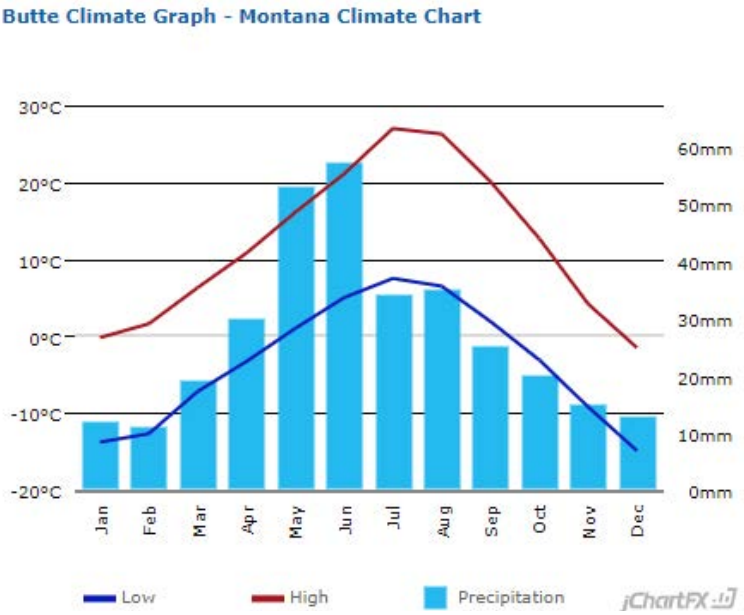

Figure 7. Precipitation data for Butte, Montana, for 2019
Source: https://www.usclimatedata.com/climate/butte/montana/united-states/usmt0052/2019/1.

RESULTS

Lizard Surveys

From June through September 2019, a total of 43 surveys were conducted in the study area. A total amount of 188 survey hours were spent in the area. During the time of dedicated lizards searches and during the plant survey times when lizard presence was also monitored, not one greater short-horned lizard was sighted in the area. The average temperature was 17.0° C (SD 4.4) during the survey period. The lowest temperature was 6.6° C on June 21, and the highest temperature was 26.3° C on July 2. Fifty-seven millimeters of precipitation (rain) was recorded in June, while 34 mm of precipitation (rain) was recorded in July (Fig. 7).

Two responses resulted from the poster requests, and four responses resulted from the questionnaire on information regarding the sightings of the greater short-horned lizard. Most of the responders sighted the lizards during a hot and sunny day but one sighted the lizard one a cold snowy day (Table 1). For all three spotters, lizards were seen on rocky soil with no to low vegetative cover (Table 1). The last time that the responders spotted a lizard at the site was in 2016, before the installation of the biking skills park (Table 1).

Contact	Weather	Surface	Vegetation	Number of lizards	Last seen	Other Notes
BG	80+ degrees	Rocky with sand	Spotted knapweed with no vegeation	Several with different color variations	Ever since they put the bike trail and did some large amount of dirt work where I used to see them, I have not seen them since. I believe it was a unique micro-site where the lizards had a place to winter and the site was destroyed by the dirt work. I have looked for them all over Big Butte, but only saw them in that very small area.	
BF	Overcast, 36 degrees, and snowed briefly	Dirt, rock, and a little mud	Away from grass and brush	1	04/28/16	
KW	65 - 75 degrees, mostly sunny	Decomposed granite, not too sandy, slightly rocky, near a path, lots of bare spots	Not very grassy; grasses short to medium, mostly big sagebrush and rabbitbrush, mostly wildflowers and weeds	1	Have not seen one since, I saw it in 2010, 2011, or 2012 (it was the first one recorded)	Found midmorning; it seemed like the individual was warming up and used the sagebrush as cover when we disturbed it.
TM	Hot and sunny with calm winds	Wide-open ridge top, mostly rocky, covered with loose dirt and sands. Dry environment near the ridge top	Mostly bare ground with sparse vegetation, comprised mostly of short grasses, native forbs, sagebrush, rubber rabbitbrush, other native plants.	1	09/27/12	I discovered one single short-horned lizard on at approximately mid-afternoon, about 3 pm. Discovery location is approximately 46° 00' 47.6" N at 112° 33' 55.6" (Google Earth coordinates), approximately ¼ mile west of the Montana Tech Campus in Butte, MT. The site is not currently developed, but has seen extensive disturbance over the past 100 years. Topographically, the lizard was near the top of a wide open ridge.

Table 1. Report of lizard sightings from public outreach.

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Description of Habitat Study				
Number of plots		140		
Variable	**Average**	**SD**	**Median**	**Range**
Number of Species	4.6	1.1	5	2 - 8
Vegetation Cover	25.5%	12.0	23.5%	5 - 60%
Composition of Substrate	**Average (%)**	**SD**	**Median (%)**	**Range (%)**
Bare Ground	41.3	15.4	42.5	4 - 77
Litter	20.1	13.2	15	0 - 60
Pebble	6.7	7.1	4	0 - 35
Crypto	6.0	4.3	5	0 - 30
Rock	3.6	5.2	0	0 - 25
Cobble	3.5	3.1	0	0 - 20

Table 2. Summary of habitat study, including number of species of plants, percent vegetation cover, and percent compostition of ground substrates.

Vegetation Surveys

The percent composition from each plot was calculated for vegetation cover, number of species, bare ground, litter, pebble, cryptogrammic crust (crypto), rock, and cobble (Table 2). The average, standard deviation (SD), median, and range was determined for the 140 plots (Table 2). The plots were mostly composed of bare ground averaging at 41.3% of plots and ranging from 4 – 77%; the second highest feature was litter at 20.1%, ranging from 0 – 60% (Table 2). The least occurring feature in the plots was cobble with an average of 3.5%.

Frequency of Values for Composition of Substrate						
Frequency of %	**Bare ground**	**Litter**	**Pebble**	**Crypto**	**Rock**	**Cobble**
0 - 10%	5%	34%	85%	94%	96%	99%
11 - 20%	4%	36%	11%	5%	3%	1%
21 - 30%	16%	11%	4%	1%	1%	
31 - 40%	22%	14%	1%			
41 - 50%	26%	3%				
51 - 60%	18%	2%				
61 - 70%	6%					
71 - 80%	2%					

Considering the range for some features was so large, the frequency of composition values was calculated. As shown in Table 3, 99% of plots had 0-10% of cobble. Similar frequencies were found for pebble, crypto and rock. There was more variation of frequencies of bare ground and litter (Table 3). Most of the sites (82%) had between 21 – 60% bare ground (Table 3).

Table 3. Frequency of values for percent composition of ground substrates.

Throughout the study area 33 different plant species were identified (Fig. 8). The number of species that were in each individual plot ranged from two to eight species with a median of five species (Table 2). The top ten dominant plant species in the area were: Canada bluegrass (9.2%), Kentucky bluegrass (8.2%), smooth brom (8.0%), slender wheatgrass (7.0%), sheep fescue (6.6%), crested wheatgrass and spotted knapweed (6.0%), common comandra (5.8%), prairie lupine (5.1%), and yellow tuft (4.8%) (Fig. 8).

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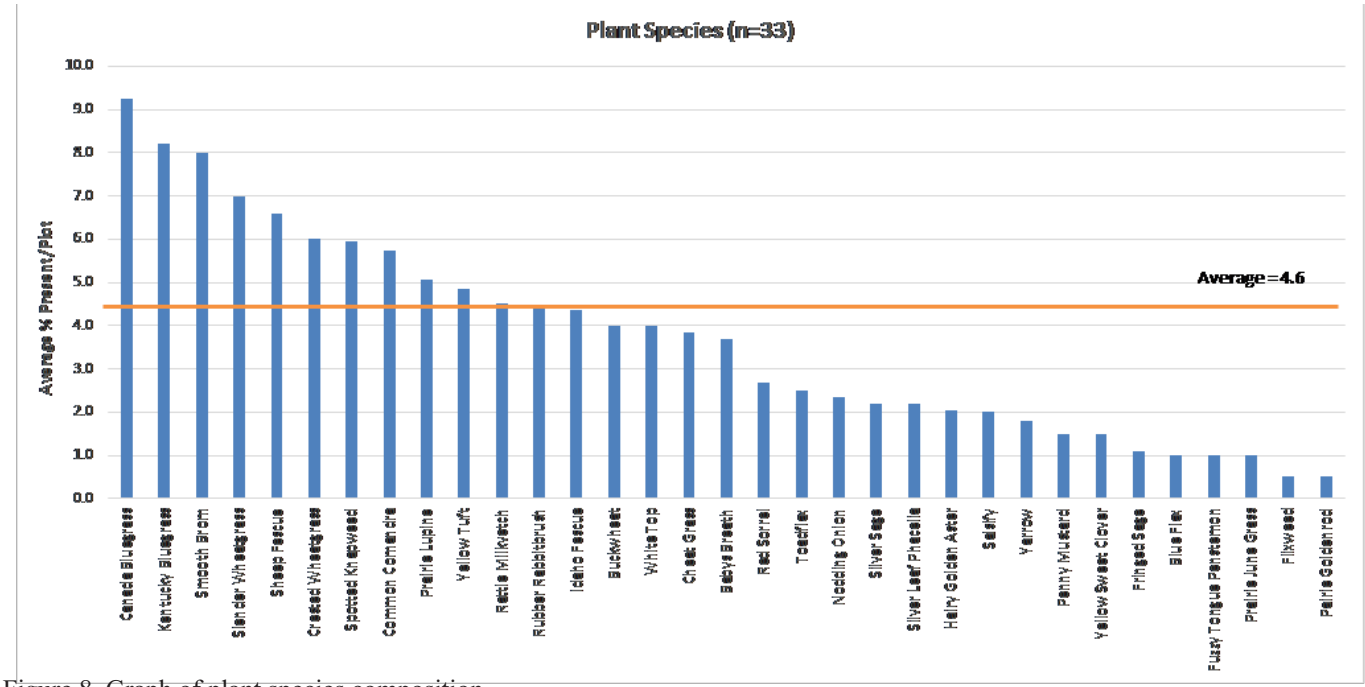

Figure 8. Graph of plant species composition.

DISCUSSION

The fact that these lizards were spotted on the west side of the Continental Divide is significant, and worthy of systematic study. This study revealed that it is unclear if lizards are still present in the study area; if they are present, then they are in low numbers. The lizards were sighted by several people in the area up to 2016, but as far as is known they have not been seen since. The area's characteristics consisted of high percentages of bare soil with low percentages of vegetative ground cover. These characteristics make it a suitable habitat for the greater short-horned lizards to inhabit (Sherbrooke, 2003). Therefore, something must have occurred between 2016 and 2019 to influence the presence of the lizards.

There are a few possible reasons why the lizards were not found during these current surveys. First, it is possible they are locally extinct because of changes to their desired habitat within the last four or five years. The habitat has changed because of the installation of a bike skills park and golf course. These installations caused a lot of disturbance with large amounts of dirt being moved and trucks moving throughout the area compacting the soil. Second, the population may have declined to such low numbers this year that the lizards are very difficult to locate. This means they may come back up in numbers in the future. Third, there was increased moisture this year, thus the ground never quite dried out as evident by the long green summer grasses that were around (personal observation). The grasses appeared longer and denser. This type of vegetative cover is not suitable for the lizards. Finally, the population may have moved locations because of the disturbances, and so it is worth searching different areas surrounding the historic site.

Recommendations for future studies on this population is to keep searching but do surveys in surrounding areas where it is suitable for them to inhabit. When surveying one should use a large group of people so that there is a higher chance of sighting lizards. Consultation with a professional scientist that has a good background with these types of lizards is needed. The expert should come to the area to help establish a field site and search for lizards. Also the surveys should be done over multiple summers at several different suitable areas on the western part of the Divide to ensure that seasonal differences in years (such as rainy versus dry years) are not a source of population numbers.

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Member Highlight
Wilson Seay Stout

By Lynn Seman

Wilson Stout and dog, Kobi

Wison S. Stout, a Horned Lizard Conservation Society Lifetime member, has been supporting horned lizard conservation with generous donations to HLCS research grants. Mr. Stout has a beautiful ranch near Ozona, Texas that is rich with horny toads. He can enjoy the "horny toads" on his ranch today. When I recently contacted Mr. Stout about his connection with horned lizards he said, "I can observe these lizards almost anytime during the summer. I can see one or more every time I go exploring my ranch. I always wanted to help these horned lizards."

Several HLCS grants have been directly funded by Mr. Wilson Stout. Recently, I asked him why he chooses to continue to support HLCS grants. He replied, "I grew up in the outdoors. I fell in love with the horny toad or Texas horned lizard as I was a boy in the woods. I realized that the horned lizard was declining. Now, I believe that horned lizard habitat and conservation is very important."

Because others share the same sentiments when asked about these enchanting reptiles, HLCS is fortunate to have generous donors like Mr. Stout. With these donations, HLCS can provide the resources needed for conservation and research efforts so that "boys (and girls) in the woods" can enjoy horned lizards and fall in love with them as Wilson Stout did as a child. He continued, "You guys are making a difference with your grants conserving the horned lizard. I am grateful to help. With everyone's help, we can keep these beautiful lizards around for the next generation and generations to come."

Thank you, Wilson Stout, for your contributions. You ARE making a difference!

Help HLCS Save Money

As part of HLCS's strategy to save money to better focus what we have, we are asking our members who are receiving the newsletter by paper and post mail to move to having it delivered by email in-stead. This will save HLCS printing and mailing costs for sending the paper newsletter. Digital newsletters are sent by a link to all members who have given us an email address. The link will take you to a version that is in color and if you prefer paper, you can print it out and read it. The post mailed paper newsletter is black and white.

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Introducing the First-Ever Commercially Available Native Plant Seed Mix for a Reptile (And NotJust Any Reptile…)

By Dusty Rhoades

It's a comfortably cool morning in October 2022. And here I am along with ecological restorationists Emily Neiman, Leslie Boorhem-Stephenson, and Orion Weldon planting 100 pounds of a brand-new native plant seed mix for Texas Horned Lizards at Willie Nelson's ranch in Spicewood, Texas. I could say this journey started early 2010 when I read a book by entomologist Douglas Tallamy about how you can invite and sustain native wildlife and their food webs in your yard with native plants, but in reality, this journey started long before that. At least as far back as my birth. I could even make the case, then again, that this story can trace its roots to the spring of 1837. Six months after Darwin completed his HMS Beagle expedition, John James Audubon started his own from New Orleans traveling aboard a US revenue schooner along the Gulf Coast. From at least late April thru mid-May, Audubon visited Galveston in the then-newly founded Republic of Texas to complete his legendary Birds of America illustrated work. Audubon encountered many birds in Galveston and among them was the species that became the symbol for the society that would later bear his name—the Great Egret. On plate 386 of his book is an ecological diorama that is vaguely (but not totally) familiar to my many wanderings around my youthful stomping grounds: an egret is there among crawdad chimneys—both familiar sights along the irrigation ditches around my neighborhood. Somewhat less familiar however is the tall bunchgrass—perhaps Eastern Gamagrass—in the background. But even less familiar is another animal that Audubon had instructed engraver Robert Havell Jr to etch onto the copper plate—a Horned Lizard.

Fast-forward to 1980. I was born in the place where Audubon stepped off the USCGC Campbell, was greeted by the secretary of the Texas Navy, Samuel Rhoads Fisher, and encountered the ecological setting in which he painted the Great Egret and saw other natural wonders like Ivory-billed Woodpeckers. But it was by this time a quite-changed, blue-collar Texas oil refinery town a few minutes' walk from Galveston Bay in a typical working-class neighborhood meticulously turfed and routinely manicured with a monoculture of exotic St. Augustine carpet grass lawns and lined with mature and equally exotic Chinese tallows. But only two-and-a-half decades before my birth, my childhood neighborhood was a nearly treeless coastal prairie filled with a diversity of native bunchgrasses like cordgrass, bluestems, paspalums, switchgrass, and gamagrass—species that had been there for tens of thousands of years up until only a quarter century before I graced the scene. This was the setting that welcomed Audubon to my place of birth but had ironically eluded me.

Audubon's "White Herring" (aka Great Egret) from Birds of America (1838). JJ Audubon painted the egret from scenes on location in Galveston and Charleston. Image in public domain, courtesy of the National Audubon Society.

By the time I was born, the rich historical community of Texas native wild grasses was replaced with a depauperate roster of foreign plants. The limited animal species that I could find in my yard as a child matched the limited parameters of such trimmed, controlled landscaping. But even though they were few in diversity (consisting of only three natives encountered with any consistency), herps were my window into the exquisite beauty of wildness because, for a toddler, they were the most accessible—I could touch them. We had lime-colored Green Anole lizards that could climb way up the trees, and down below the canopy shaded in the leaflitter, Gulf Coast Toads and Rough Earth Snakes kept their small bodies cool and damp, buffered from the Texas heat. These were the few reptile & amphibian species that could be found on a regular basis because they didn't need to cross busy roads as often to find mates, shelter, or food. They could also subsist because they were the few herp species that could live on the paltry few invertebrates that could eek a living in a conventional suburban yard landscaped with exotic plants and doused regularly with pesticides, her-

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bicides, and fertilizers. We also had one single non-native herp species—Mediterranean Geckos—which hunted moths on the outside walls at night. Encounters with these few taxa cemented my interest in nature and herpetology from a young age. I was grateful for their presence. But by the time I was four years old, I had become well-aware that this assemblage of reptiles and amphibians was not only different compared to what it was just a quarter century prior, it was also missing many key players.

The adults in my life—my parents, aunts, uncles, grandmothers, older neighbors, and friends' parents who grew up or lived in the same area and noticed my peculiar affinity for reptiles—told me of the animals they had encountered there in the 1950s and 1960s. Frequent visitors to their yards were such delightful guests as Box Turtles, Rough Green Snakes, Leopard Frogs, Garter Snakes, and the coveted Texas Horned Lizards. The ecstasy conjured up in my mind of what it could've been like finding such "exotic" fare in such a pedestrian place as my backyard induced in me such a pleasing reverie that I would nearly salivate at the thought of it and yet simultaneously seethe in envy at the squandered luck that my elders possessed but did not seem to appreciate as much as I did.

What was the cause of it? Where did these animals go? Could we ever get them back? Would Galveston County kids ever have them in their yards again? As I grew and eventually pursued degrees in ecology with a personal emphasis on studying Texas herps, these questions yet remained with me. It was shortly after my finishing my undergraduate studies when I came across the aforementioned book, Bringing Nature Home: How You Can Sustain Wildlife With Native Plants, by Douglas Tallamy that seemed to answer those questions. Tallamy's main argument was one of community: that in terrestrial environments all energy from the sun is converted to food energy by plants, that those plants don't want to get eaten and defend themselves with chemical and structural adaptive defenses, that the main reason that energy locked up in plants eventually travels throughout the food web anyway is via specially adapted insects that have evolved past the plants' defenses, that more than 90 percent of those herbivorous insects specialize on one or a few types of native plants that they have co-evolved with (and thus diversity of plants supports diversity of wildlife higher up the food chain), and that most wildlife species—including nearly all songbirds, practically all reptiles, absolutely all amphibians, and many fishes and mammals depend on eating those native insects that dined on those native plants. If you could trace any animal species' food web back to the native plants that sustain its food web, you could figure out which species of native plants to sow to create that animal's habitat. Simple.

As I followed this train of thought, I found other books, web sites, and even commercially available native plant seed mixes that were made to support birds, butterflies, and bees—in other words, species that could reasonably traverse a road or highway to get to the native plant in your yard. But there were none of these resources for reptiles, and it bothered me.

After graduating with a Masters of Science degree in Biology studying camouflage in Texas Horned Lizards from TCU in Fort Worth in December 2019, I wanted to work for a company or organization that would allow me to work on that problem. To learn my native plants, I volunteered at the Fort Worth Nature Center greenhouse and participated in Native Prairies Association of Texas workshops. Finally, in spring of 2022, I was hired as an ecological restoration sales associate for Native American Seed (NAS)—a company whose mission is "helping people restore the earth" via native Texas wildflowers and prairie grasses. Thanks to guidance and help from NAS veteran employees George Cates, Emily Neiman, Weston Neiman, Bill & Jan Neiman, others at NAS, input from Andy Gluesenkamp, Texas Parks and Wildlife botanists, and others, I was able start working on putting together a native plant seed mix for a reptile that all Texans love—the Texas Horned Lizard. It's fitting, isn't it? Few reptiles epitomize better the symbology of the American West.

When we are trying to restore Horned Lizards, what we are actually trying to restore is the community that supported them. Horned Lizards are part of a grassland community. And in some ways, they are latecomers to the grassland community and specialize in a filling a niche role. The wildlife communities that welcomed Texas Horned Lizards to the central grassland of North America are paradoxically analogous to the communities embodied by the Euroamerican settler land ethic regime that replaced them. As Ernest Callenbach said in his book Bring Back the Buffalo! A Sustainable Future for America's Great Plains:

"The first few trappers, explorers, and fur traders seemed to pose little threat. But after

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them came buffalo hunters, preying on the bison. Then came traders, making their living off the hunters and trappers and Indians. Then settlers took possession of the land to extract the accumulated richness of its soil, and gold miners invaded the Black Hills. Bandits, gunfighters, lawyers, and storekeepers arrived to live off the townsfolk and settlers. Finally, the military and its civilian helpers killed or rounded up the remaining Indians. …The water and land were first exploited by open-range cattle barons and their hired guns, but then came 'the plow that broke the Plains.' Wave after wave of farmers built sod houses, plowed, planted, watched their crops shrivel or blow away, and went bust. So in time a new variety of predator appeared on the Plains: not carnivore, not even human, but nonetheless voracious. Banks gobbled up the farms. Giant grain-trading corporations learned to manipulate commodity prices, producing waves of bankruptcies. Seed companies, fertilizer companies, and equipment companies racked up sales to failing farmers. These new predators were mostly legal fictions called corporations: self-replicating organisms driven by an ineluctable need to maximize profits, protected by law from personal liability claims. They steadily sucked money from the farmers, driving them to try ever harder to squeeze money from the land. For a time, the farmer fought back through populist political organizations. They even formed a new party and sent a few representatives to statehouses and to Washington, but their uprisings were soon beaten down."

Horned Lizards are, in a way, johnnies-come-lately to the prairie. About 57 million years ago, before the Great Plains was a grassland, it was a humid forest dominated by palm trees and soon inhabited by primitive horses, rhinos, and camels with puny teeth adequate for eating soft leaves. Then about 25 million years ago the tooth anatomy of their descendants changed—they all developed taller, higher-crowned teeth more suited for eating a tough, wiry newcomer called grass. A few more million years pass and social insects that specialize on grasses (like Harvester Ants and Harvester Termites) arrived on the scene, and a few million years after that, a toad-bodied lizard that specialized on eating these insects arrived too.
Horned Lizards are insectivores and there are, of course, other insects that "fill in the corners" of the Horned Lizard diet. In creating a native plant seed mix for Horned Lizards, it was priority to include as many native plant species as possible to attract and support as many insects as possible, not only staples of Horned Lizard diet like Harvester Ants/Harvester Termites but also insects that seem important outside the usual diet like other species of native ants and sweat bees, for instance.

We also included a wide variety of bunchgrasses (more than 30 species) of varying heights to dually provide not only food for Horned Lizard food but also to provide shade structures and cover under the grasses' skirts, while allowing bare ground micro-trails to exist between plants for Horned Lizards to bask, forage, and camouflage against the soil. When Audubon incorporated the Horned Lizard in his Great Heron watercolor painting, he borrowed a specimen from Richard Harlan (who had only a decade before described in a paper Texas Horned Lizards brought to Thomas Jefferson from the Lewis and Clark expedition). This was not a Texas Horned Lizard but a "*Phrynosoma orbiculare*" from the west coast of the continent. I have not come across any notes that explicitly stated Audubon saw Horned Lizards when he visited Galveston in the spring of 1837, but I like to think he did. They would've been common. As a teenager in the 1990s living where Audubon visited, I became aware of a couple tiny remnant populations of Texas Horned Lizards in Galveston County coastal prairie still hanging on—one in a field between my neighborhood and an adjacent neighborhood (and that field is now houses), and the other in a field in Dickinson, Texas. Those populations have likely winked out. As have most of them east of the I-35 corridor. What can we do to restore them?

There are, of course, other inputs besides native plants that generate and maintain habitat suitable for Texas Horned Lizards. Keystone members of their community as well as natural wild processes build and maintain infrastructures so integral that if you remove them, it tripwires the entire community. History of the last 200 years in America has taught us that. Some of these members are species like Bison, Prairie Dogs, Pronghorn, Elk, Wolves, Dung Beetles, and all other native insects in general. Some of these natural wild processes are things like lightning-ignited prairie fires, drought, and wind, but also raw materials like deep perennial roots and fertile soil. But you need the native plants first if you hope to channel all of the sun's energy into that specific prairie community that supports Horned Lizards. Well, what we have created at NAS is a seed mix that will hopefully be a step in that direction of restoring this community, comprising more than 73 species and varieties of native bunchgrasses and wildflowers of the southern Great Plains. I couldn't be more pleased. It's not only the first commercially available native plant *continued on page 14*

"ecosystem in a bag" seed mix for Texas Horned Lizards, but also, to my knowledge, the first-ever commercially available native plant seed mix for a reptile. But I'd be happy to be wrong. And my hope is that this will trend so that we continue to learn the "native plant food web formula" for every species on earth. Onwards. (And who knows? Maybe Willie Nelson will pen a song for the Horny Toads to one day return to his ranch.)

2023 Grant Recipients

HLCS is proud to announce our 2023 grant award recipients.These projects represent valuable research and education opportunities to further horned lizard conservation and support the mission of the HLCS.

Kira Gangbin is a Ph.D. student researcher at Texas Christian University is the recipient of the 2023 HLCS grant in honor of Wilson Stout, a major grant donor. Her research involves evaluating the nest-sites of natural and reintroduced populations of Texas horned lizards (*Phrynosoma cornutum*) to assess a female's ability to select a nest site based on temperature, ant abundance, soil moisture, soil compaction, and vegetation structure.

Luciano Guerra is the Outreach Coordinator, Photographer, and Educator at the National Butterfly Center in Mission, TX is the recipient of the 2023 HLCS grant in honor of Wilson Stout, a major grant donor. His project involves a plan to clear trails in an overgrown, neglected wildlife area so that habitat for horned lizards can be assessed, surveyed, and documented. This work will also access educational opportunities for visiting school children and special programs on horned lizard conservation and outreach.

Dr. Rafael A. Lara Resendiz, from the Technological Institute of Sonora, Mexico, is the recipient of the 2023 HLCS grant in honor of Russell Posch, a major grant donor. This research will assess the vulnerability of *Phrynosoma mcallii* (Flat-tailed Horned Lizard) to climate warming throughout its distribution (Arizona, California, Baja California, and Sonora). The primary product will be a new climate change model that incorporates data related to the physiological tolerances, thermoregulatory behavior of *P. mcallii* and environmental thermal quality.

HLCS 2024 Grant Program

The Horned Lizard Conservation Society is dedicated to protecting horned lizards by documenting and publicizing the values and conservation needs of horned lizards, promoting horned lizard conservation projects, and assisting with horned lizard management initiatives. Towards those ends, the HLCS annually sponsors research that has direct conservation applications. To learn more about the society and past grants, go to http://www.hornedlizards.org/. HLCS will be offering grants again in 2024. In the past, priority has been given to projects that have direct conservation implications, including public education.

To apply, send a proposal detailing the goal of the study, the rationale for it including relevance to conservation of horned lizards, and how your work would benefit from this opportunity. The proposal may not exceed 1000 words. Also include a preliminary budget with as much detail as possible and with any other funding sources available, received for your project, and other grants you are applying for. Word format documents are preferred. In addition, send a short resume or CV (up to 3 pages) for the lead applicant and have a single letter of reference sent to Dalton Neuharth: dneuharth15@gmail.com. All three documents should be in separate digital files. Check the website for more information. The deadline is January 15, 2024. The decision will be announced by March 1, 2024.

President's Message

by Cheryl Jenkins

Spring has (finally) sprung where I am in southern California and with the record rains we have had this winter, the vegetation is green and abundant and the flowers are blooming! With blooming flowers comes food resources for our native harvester ants which in turn are food for the local horned lizards.

Warmer temperatures also mean that those horned lizards that were in brumation are starting to emerge. So keep an eye out for any horned lizards in your area and please send us any photos or sightings or post them on our Facebook or Instagram pages. Please follow safe and ethical practices
when taking photos and don't provide exact locations of your sightings, just a general vicinity. As always remember to tread lightly and keep in mind that most horned lizard species are protected and should not be handled or harassed unless it is to move them out of harm's way. You can also submit your sightings to our iNaturalist page here:
https://www.inaturalist.org/people/hornedlizardconservation

I just wanted to take a moment to recognize one of our wonderful volunteers. Amy Trost is indispensable to the HLCS and she recently manned a booth at the Elisabet Ney Museum's Nature Day in Austin, Texas. This was a great family event that allowed Amy to spread the word on the importance of horned lizard conservation to those in attendance. Thank you also to Lynn Seman and Leslie Nossaman for ensuring Amy had all the supplies needed for the booth, and to Lindsay Barras, Education Coordinator at the museum for inviting us to participate. We appreciate you all!

If you know of any events coming up in your area where HLCS might be able to set up an educational booth, please let us know. If you are willing to volunteer at an event in your area or would like to act as a HLCS representative for your state or region, please reach out to us.

HORNED LIZARD CONSERVATION SOCIETY
Post Office Box 122, Austin, Texas 78767

Return Service Requested

PLEASE JOIN US! Students/Seniors: $10; Regular: $25; Contributing: $50; Lifetime: $300
Families: $25 for the first person and $10 for each additional member
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