

## Status Report

### *Cirsium grahamii*

(Graham's Thistle)



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### **Introduction**

In 2021 while conducting invasive plant surveys in the Gila Wilderness I came across a stand of unusually dark purple thistles on Iron Creek Mesa. I was unfamiliar with the species but keyed out and read in the description of the NPSNM Thistle Guide that the species was rare, only collected three times, and was known from the area I was hiking. I counted the flowering plants and continued my trip. Two days later I came across another stand of *Cirsium grahamii* in Turkeyfeather Creek. At this point I vowed to try and find some money to fund a survey effort for *C. grahamii*. In January I received funding from NPSNM for this project.

The primary focus of this study was to locate populations of *C. grahamii*. *Cirsium grahamii*s dependent on wet soils. In 2021 I noticed both populations persisted in large numbers in damp low slope drainages around 8000ft of elevation. There were a couple of exceptions where I found a few individuals as low as 7000ft. Survey efforts were focused on habitats that aligned with these sets of characteristics.

After some research on the Sacramento Mountain Thistle (*Cirsium vinaceum*), I read about the threat of thistle population failure due to weevil infestation. *Lixus pervestitus*, a native stem boring weevil, and *Rhinocyllus conicus* an introduced flower head boring weevil. Determining the threat of failure due to weevil infestation in *C. grahamii* became the secondary objective of this project.

Thistles are known as important pollinator plants and for that reason people have been tracking which species of insects use thistles for some time. *C. grahamii*s spotty in distribution throughout its range from NM and AZ down to the state of Durango in Mexico. Because of this scarcity documentation of wildlife use is lacking in *C. grahamii*. In 2021 I noticed a high level of insect biodiversity on the thistle. Noting wildlife utilization of the thistle became the third objective of the project.

## Methods

Survey periods were planned for three visits in the summer of 2022. The months of July, August, and September were chosen for survey efforts because of the plant's flowering window. Due to extreme rain events and health problems, I was unable to get into the wilderness in August. This lowered the projected 11-12 days of field work to 8 days. Surveys were conducted in mid-July and mid-September via backpacking and remote camping. A total of 94 miles were surveyed over these 8 days. This included areas on and off trails. As a note to area surveyed, I was aware of *C. grahamii* starting in 2021 and while I was conducting invasive plant surveys for a different project across the Gila Wilderness I was looking for the thistle as I worked. This constituted over 300 additional miles of trails across the forest.

As noted earlier, the populations found in 2021 were in low slope wet soils around 8000ft in elevation. Using satellite imagery in Google Earth I scanned for meadows and low slope drainages in the Iron Creek Mesa area. Survey efforts were directed to these areas. When *C. grahamii* was found in an area counting was done in a systematic way.

1. Counting took place in 10 meter circles
2. Flowering plants and rosettes were counted
3. Individuals in-between circles were carefully monitored to avoid double counting
4. GPS points were made for each 10m circle

These density surveys occurred in mid-July just before flower heads opened.

Weevil surveys occurred in September when the plants had matured more. A total of 699 or about 43% of flowering plants were surveyed for stem lesions and egg scars. These surveys occurred randomly with about 3-5 plants being scanned every 10m circle.

To survey wildlife use of *C. grahamii* all insects and other wildlife using the thistle was recorded whenever the surveyor was in proximity to the thistle. This took place across all 8 days of surveying with the highest diversity occurring in September. It is likely that if a survey was conducted in August this would have represented the highest diversity due to temperature and moisture.

## Results

*Cirsium grahamii* was found in three populations. Iron Creek and Turkeyfeather Creek were known from 2021 but a new population called Iron Creek East was found East of the Iron Creek Populations.

Table 1. Summary of *Cirsium grahamii* individuals counted during 2022 surveys

Population Name	Flowering	Rosettes	Total Individuals
Iron Creek	887	1742	2629
Iron Creek East	260	367	627
Turkeyfeather Creek	482	285	767
Totals	1629	2394	4023

To calculate density, the area of the populations was calculated. First the area was calculated in ArcMap based on drawn shape files that followed the contour of waypoints collected during surveys. Second an additional estimated size based on the number of 10m plots surveyed was calculated. These numbers were quite different then the projected size because of the geography of the areas surveyed. Iron Creek was open with relatively flat and well-defined habitat boundaries. Iron Creek East and especially Turkeyfeather Creek had narrow bands of habitat in deeper drainages where the 10m circles were often largely unsuitable habitat. Neither of these area measurements are perfect and they both have advantages and disadvantages. For this reason, both are combined into an average that more closely represents the available germination area. All density measurements were based on this averaged area.

Table 2. Average plot size of *Cirsium grahamii*

Population Name	Projected Size calculated by ArcMap	Estimated Size based on 10m plots	Average of Both
Iron Creek	41391.89 m <sup>2</sup>	41469.02 m <sup>2</sup>	41430.46 m <sup>2</sup>
Iron Creek East	7369.01m <sup>2</sup>	10995.57 m <sup>2</sup>	9162.29 m <sup>2</sup>
Turkeyfeather Creek	3647.02m <sup>2</sup>	7225.66 m <sup>2</sup>	5436.34 m <sup>2</sup>

Thistle density was the greatest in the Turkeyfeather Creek area where it was also the least evenly distributed. Iron Creek was the largest population in terms of individuals and area, and the number of individuals was the most consistently distributed. The percent density is the percentage of the area occupied by the thistle. The percent ground cover is an estimate of the ground cover occupied by the thistle with a presumed footprint of .3 meters per individual.

Table 3. Density of *Cirsium grahamii*

Population Name	% density of total area	% ground cover	Average # of individuals Per 10m plot	Standard Deviation of individuals per 10m plot	High Count of Individuals	Low Count of Individuals
Iron Creek	6.35%	1.93%	19.91	22.11	120	1
Iron Creek East	6.84%	2.09%	17.91	12.72	48	1
Turkeyfeather Creek	14.11%	4.30%	33.34	58.50	261	1

After inspecting 699 plants across all three populations no weevils were detected and no egg scars or stem lesions were found.

Table 4. Weevil damage inspections in 2022

Population Name	Plants Inspected	% infected
<b>Iron Creek</b>	400	0
<b>Iron Creek East</b>	107	0
<b>Turkeyfeather Creek</b>	192	0

*Cirsium grahamii* like all thistles is a valuable food, nectar, and pollen source for wildlife. Below is a summary of the fauna I observed while conducting surveys with an emphasis on pollinators. A detailed list of species identified is found in Appendix A.



Picture 1. *Tapinoma sessile* tending aphids on *Cirsium grahamii*



Picture 2. Painted lady and Nokomis Fritillary feeding on *Cirsium grahamii*



Picture 3. *Hylawrightorum*(Arizona Tree Frog) hiding in the leaves of *C. grahamii*

Table 5. Summary of faunal use on *Cirsium grahamii*

<b>Faunal Group</b>	
<b>Anthophila (bees)</b>	<b>8 species including 5 species of Bumblebee</b>
<b>Lepidoptera (butterflies and moths)</b>	<b>28 species of butterfly and 3 species of moths</b>
<b>Numerous families (beetles, true bugs, etc.)</b>	<b>7</b>
<b>Formicidae (ants)</b>	<b>1</b>
<b>Vertebrates</b>	<b>3</b>

## Conclusions

After finding *Cirsium grahamii* in two locations in 2021 I thought that with more searching it would come to light that the plant was more common than realized. However, after searching in 2022 it appears to be quite rare. There are likely small populations elsewhere in the Gila Region that I was not able to get to this year. The thistle seems to be highly dependent on small scale disturbances. In areas where there are many pocket gophers it appears to be thriving in a density not seen elsewhere. Without some disturbance habitat can become overgrown with grasses and sedges. I came across many meadows and drainages with the same structure and soil moisture as Iron Creek and they had thick tufted grasses and sedges but no *C. grahamii* even though they were geographically close to thriving populations.

There is a notable difference in the physical characteristics between the Turkeyfeather Creek population and the Iron Creek Mesa populations. It would be interesting to compare the two genetically to see if there is some element of hybridization occurring.

Due to the limited population size in New Mexico, I believe that *C. grahamii* should be relisted as a state rare plant. It is in a precarious situation and could easily be wiped out by hybridization, disease, wildfire, or livestock. It is a major pollinator food source in a rare and fragile habitat. My hope is that by shining light on the species it will get the protection it needs.

I would like to thank the Native Plant Society of New Mexico for funding this project. Without the Jack and Martha Carter Conservation Fund this project would have never happened.

## Sources

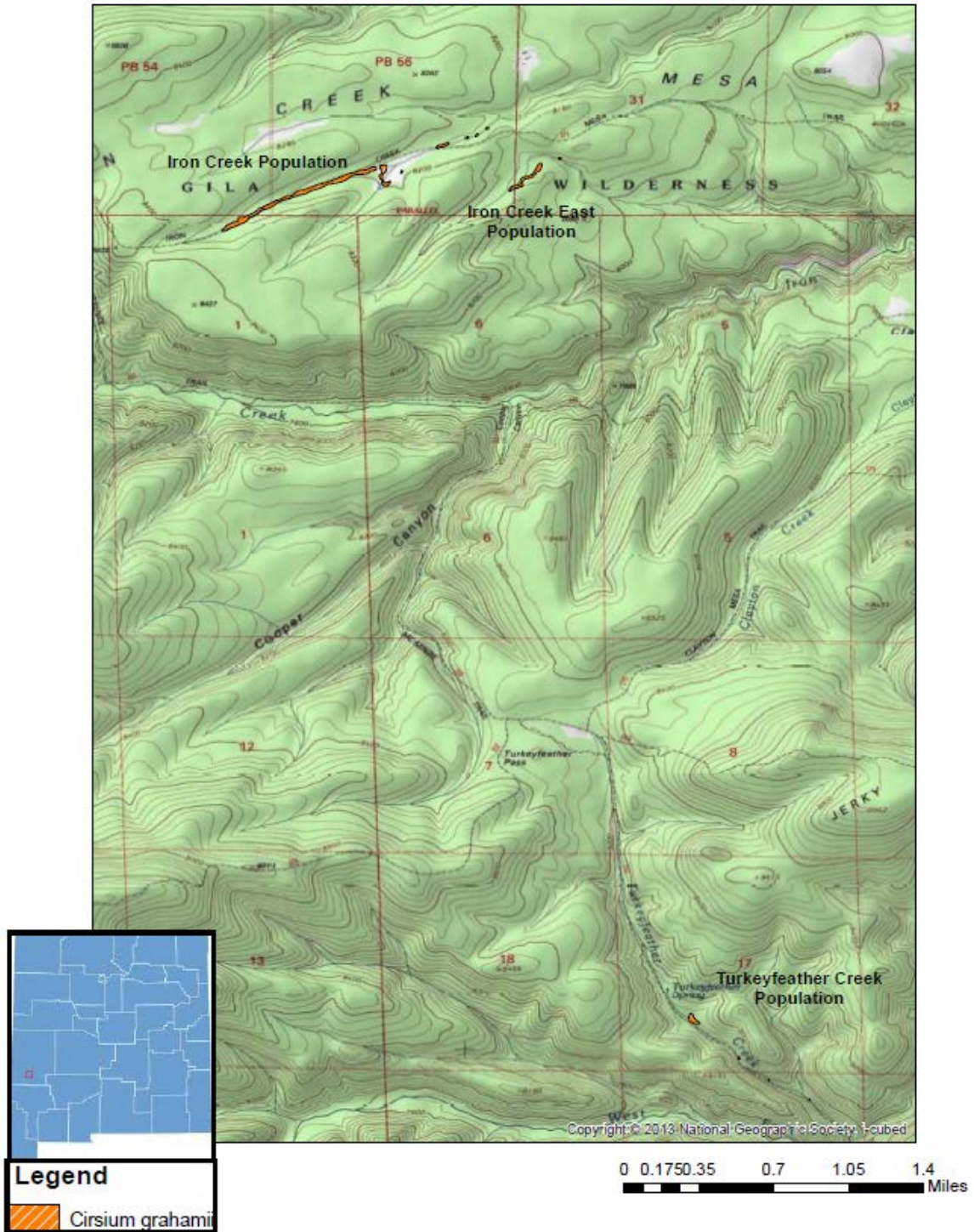
Ackerfield, Jennifer R. et al. "Thistle be a mess: Untangling the taxonomy of *Cirsium* (Cardueae: Compositae) in North America." *Journal of Systematics and Evolution*, Nov 2020.

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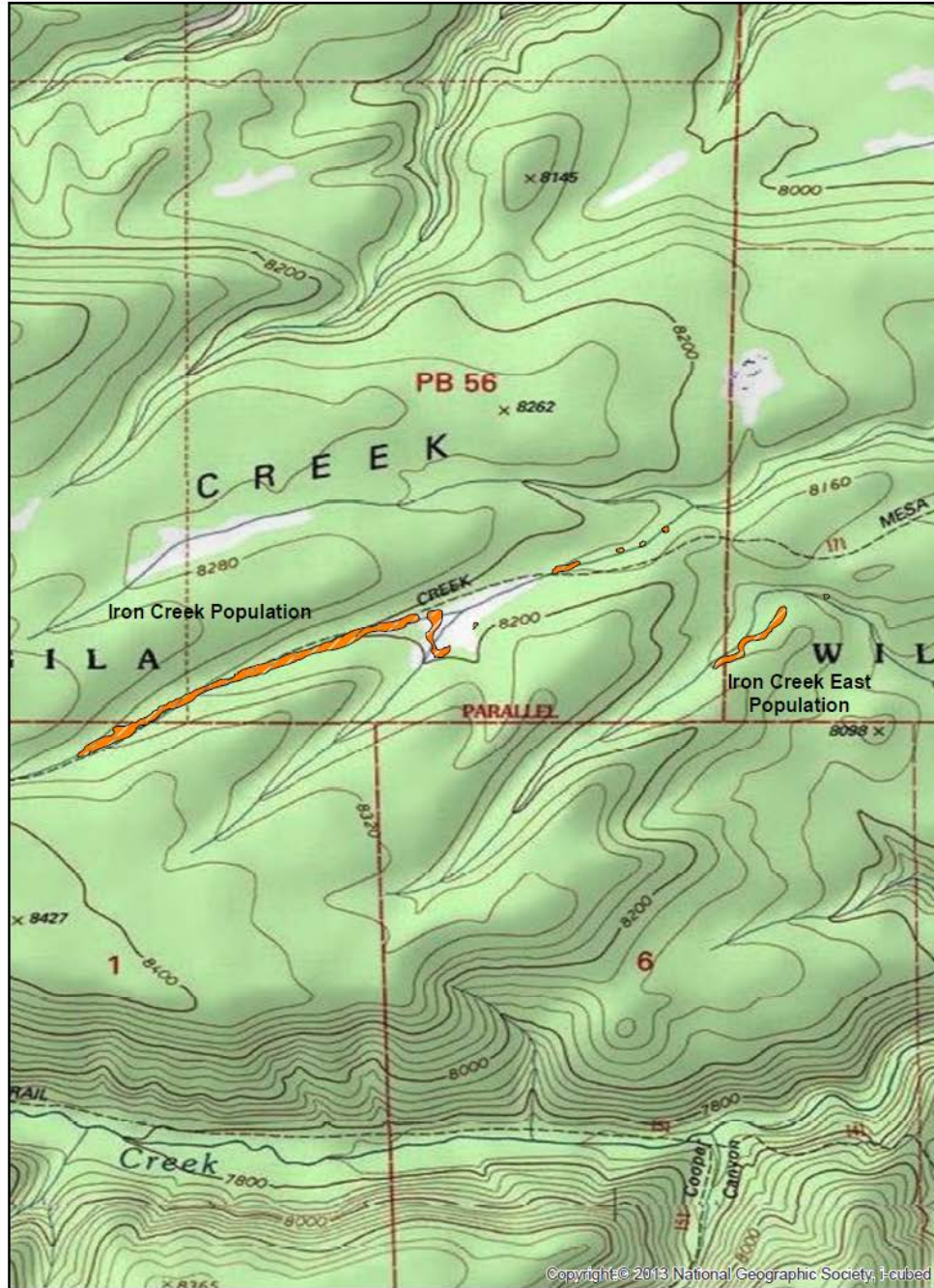
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Sivinski, Robert. "New Mexico Thistle Identification Guide." Native Plant Society of New Mexico, 2016, <http://www.npsnm.org/education/thistle-identification-booklet/>.

# Cirsium grahamii Population Overview 2022



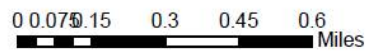
# Iron Creek Mesa Populations



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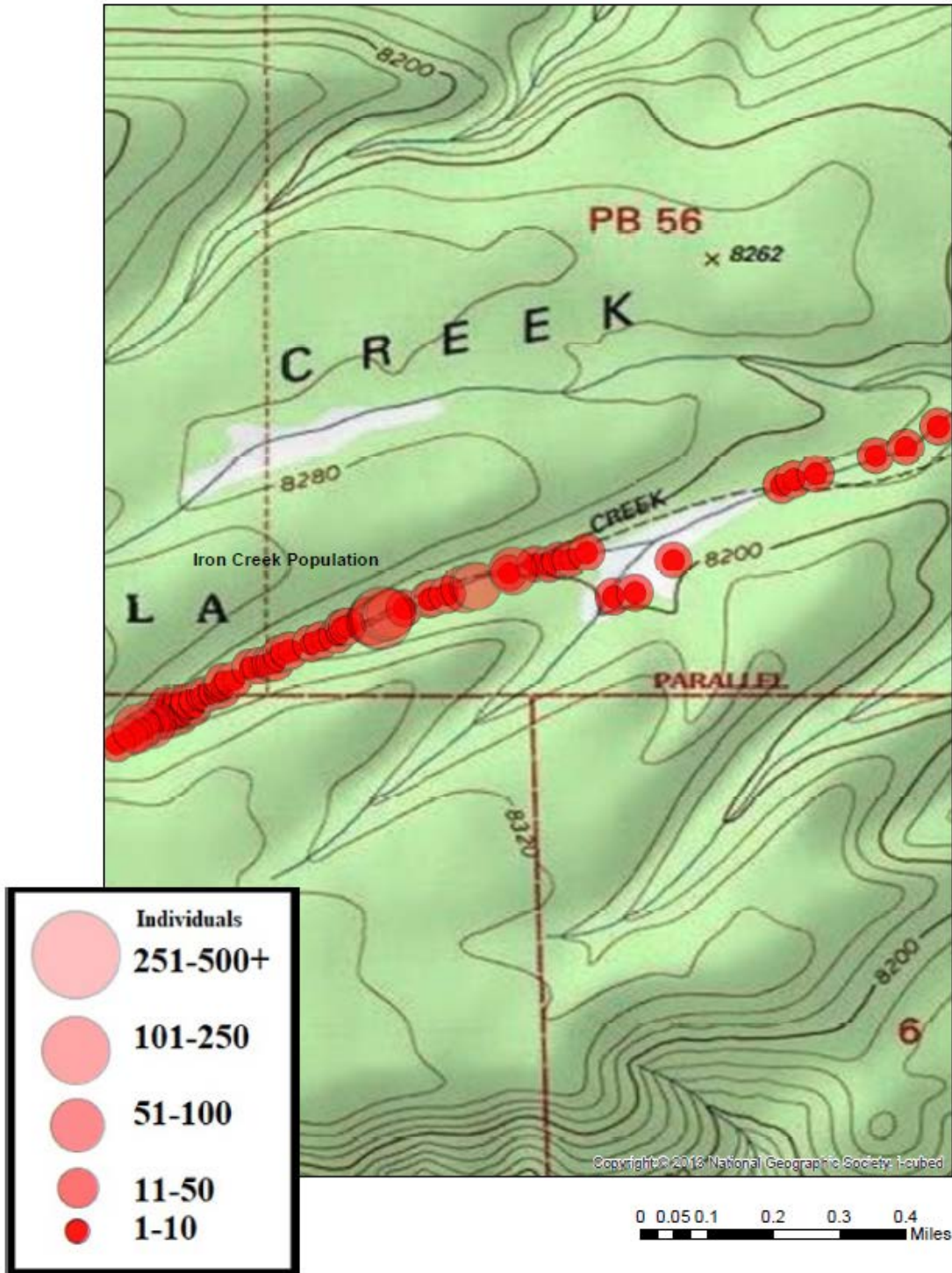
**Legend**

 *Cirsium grahamii*

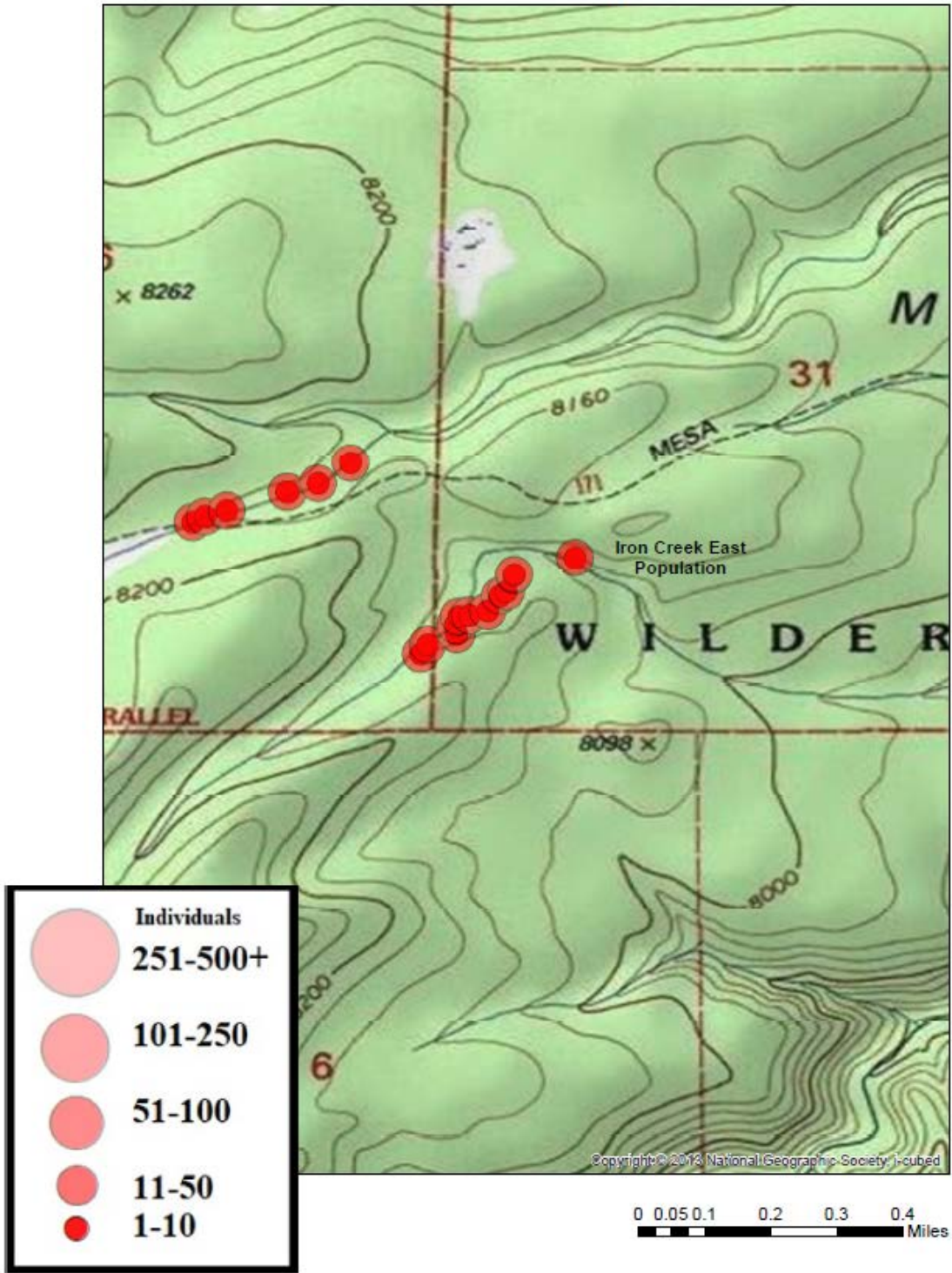




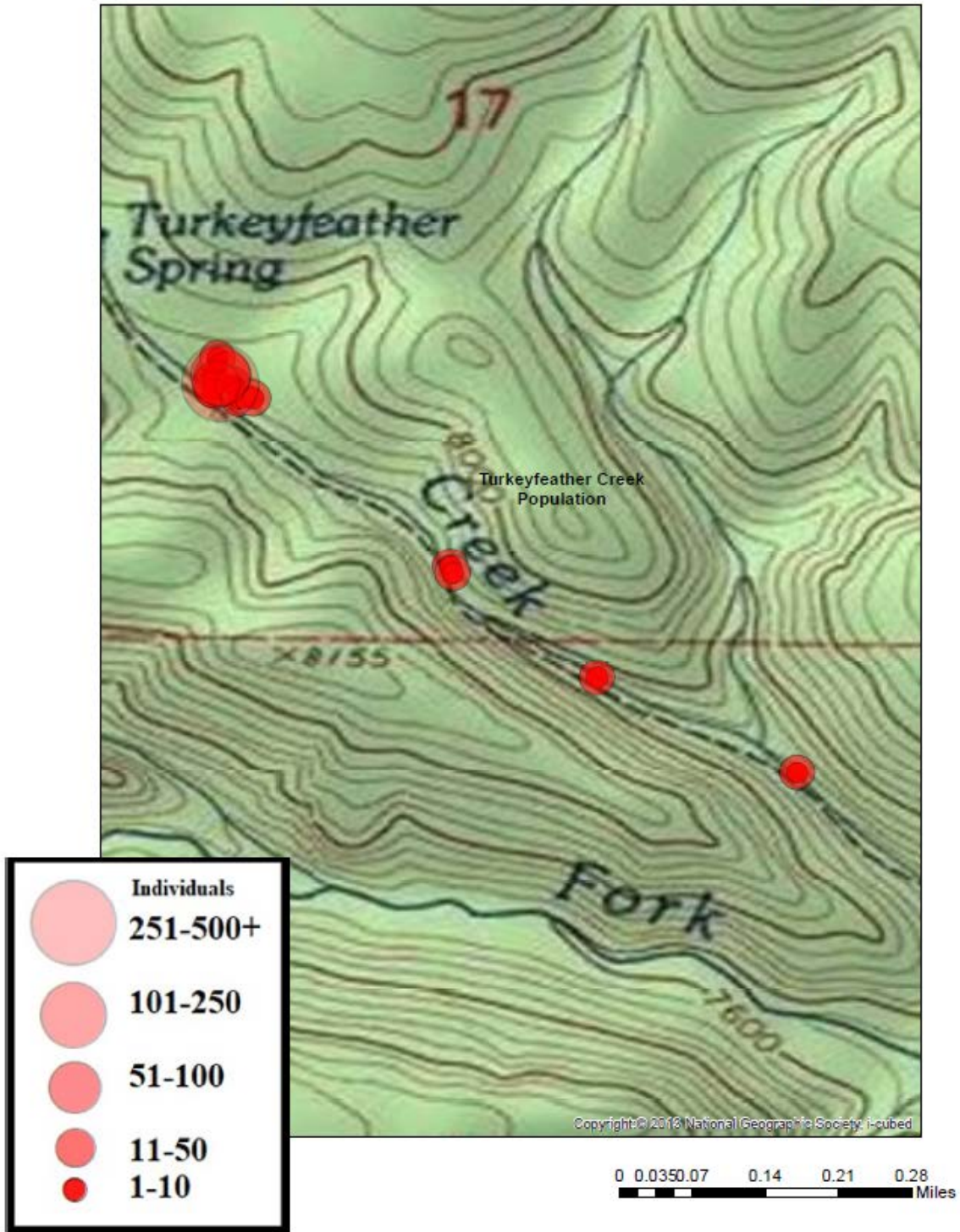
# Iron Creek Population



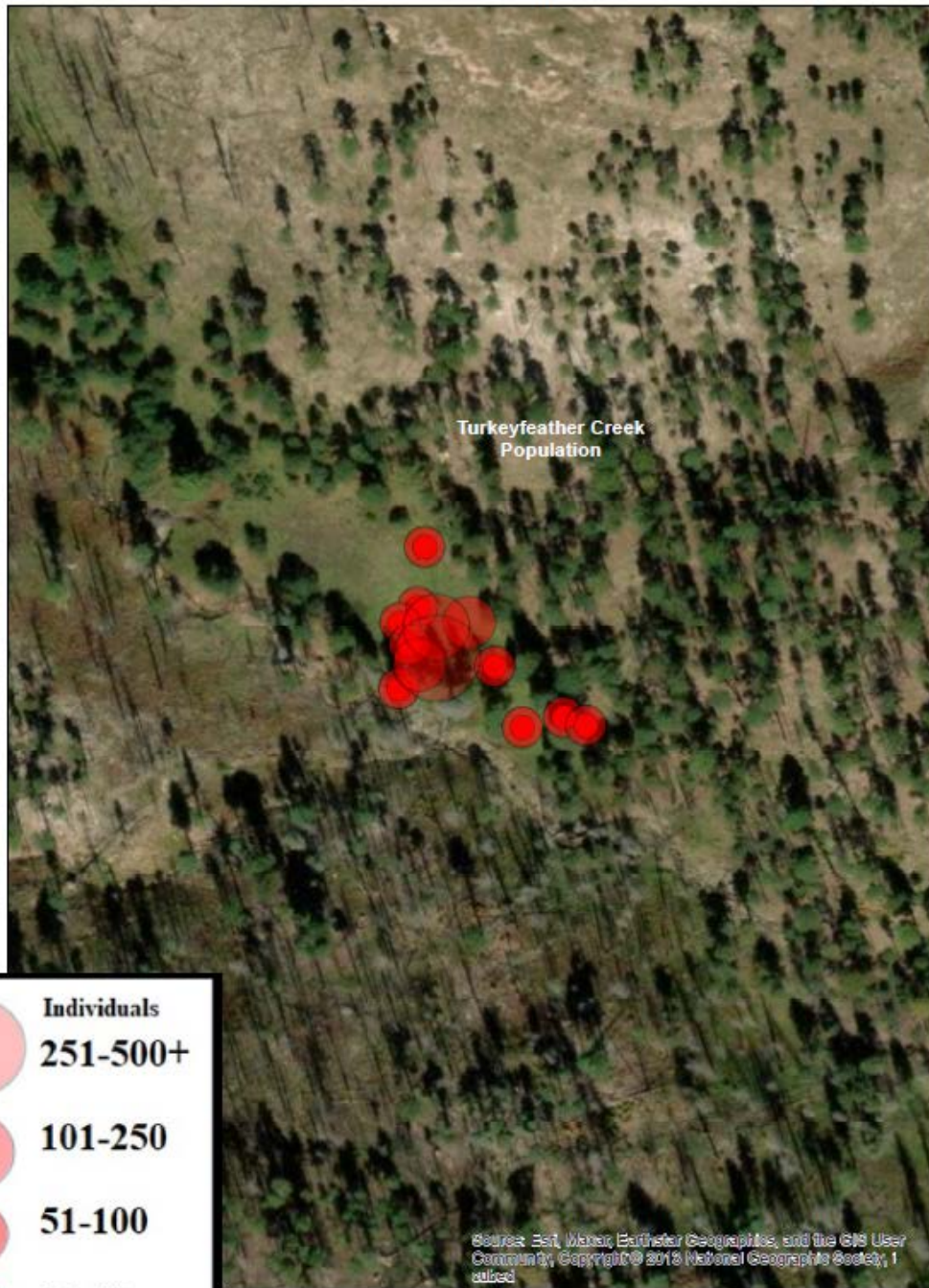
# Iron Creek East Population



## Turkeyfeather Creek Population Density



## Turkeyfeather Creek Population Density



00.0075015 0.03 0.045 0.06 Miles

## Appendix A. Species utilizing *Cirsium grahamii*

Genus	Species	Common Name
<i>Apis</i>	<i>mellifera</i>	Honey Bee
<i>Bombus</i>	<i>flavifrons</i>	
<i>Bombus</i>	<i>centralis</i>	
<i>Bombus</i>	<i>huntii</i>	
<i>Bombus</i>	<i>sonorus</i>	
<i>Bombus</i>	<i>fervidus</i>	
<i>Megachile</i>	<i>Sp.</i>	Leaf-cutter bee
<i>Melissodes</i>	<i>Sp.</i>	Long-horned bee
<i>Vanessa</i>	<i>cardui</i>	Painted Lady
<i>Vanessa</i>	<i>virginiensis</i>	American Lady
<i>Papilio</i>	<i>rutulus</i>	Western Tiger Swallowtail
<i>Hesperia</i>	<i>woodgatei</i>	Apache Skipper
<i>Pyrgus</i>	<i>Sp</i>	White-checked Skipper
<i>Piruna</i>	<i>polingii</i>	Four-spotted Skipperling
<i>Hesperia</i>	<i>pahaska</i>	Pahaska Skipper
<i>Erynnis</i>	<i>pacuvius</i>	Pacuvius Duskywing
<i>Erynnis</i>	<i>icelus</i>	Dreamy Duskywing
<i>Speyeria</i>	<i>nokomis</i>	Nokomis Fritillary
<i>Phyciodes</i>	<i>pulchella</i>	Field Crescent
<i>Phyciodes</i>	<i>mylitta</i>	Mylitta Crescent
<i>Polygonia</i>	<i>satyrus</i>	Satyr Comma
<i>Limenitis</i>	<i>arthemis</i>	Red-spotted Purple
<i>Limenitis</i>	<i>weidemeyerii</i>	Weidemeyer's Admiral
<i>Adelpha</i>	<i>eulalia</i>	Arizona Sister
<i>Danaus</i>	<i>plexippus</i>	Monarch
<i>Speyeria</i>	<i>hesperis</i>	Northwest Fritillary
<i>Calastrina</i>	<i>echo</i>	Spring Azure
<i>Leptotes</i>	<i>marina</i>	Marine Blue
<i>Strymon</i>	<i>Melinus</i>	Gray Hairstreak
<i>Zerene</i>	<i>cesonia</i>	Southern Dogface
<i>Eurema</i>	<i>mexicana</i>	Mexican Yellow
<i>Colias</i>	<i>eurytheme</i>	Orange Sulphur
<i>Colias</i>	<i>philodice</i>	Coudeed Sulphur
<i>Phoebis</i>	<i>sennae</i>	Cloudless Sulphur
<i>Colias</i>	<i>alexandra</i>	Queen Alexandra's Sulphur
<i>Gyrocheilus</i>	<i>patrobas</i>	Red-bordered Satyr
<i>Hyles</i>	<i>lineata</i>	White-lined Sphinx
<i>Lambdina</i>	<i>Sp.</i>	
<i>Pterephorida</i>	<i>Sp.</i>	

<b>Genus</b>	<b>Species</b>	<b>Common Name</b>
<i>Chauliognathus</i>	<i>limbicollis</i>	
<i>Miridae</i>	<i>Sp</i>	
<i>Graphocephala</i>	<i>atropunctata</i>	
<i>Tachinidae</i>	<i>Sp</i>	
<i>Meligethinae</i>	<i>Sp</i>	
<i>Meloidae</i>	<i>Sp.</i>	
<i>Homoptera (Aphids)</i>	<i>Sp</i>	
<i>Tapinoma</i>	<i>sessile</i>	
<i>Hyla</i>	<i>wrightorum</i>	Arizona Tree Frog
<i>Selasphorus</i>	<i>platycercus</i>	Broad-tailed Hummingbird
<i>Archilochus</i>	<i>alexandri</i>	Black-chinned Hummingbird