Cheatgrass Challenge Report FY 21- Year 1

Figure 1: Photo of aerial Rejuvra treatment on Minidoka Ranger District September 21, 2021

Cheatgrass Challenge Pre-Treatment Analysis & FY 2021 Report

Cassia Division, Minidoka Ranger District - Sawtooth National Forest

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Introduction

Cheatgrass *(Bromus Tectorum)* is an invasive species that was introduced to North America in the 1800s. It is a non-native annual grass generally found in sagebrush steppe community types. Cheatgrass has an ecological advantage over perennials by germinating earlier, taking all available resources, has prolific seed production, and has altered fire return intervals as well as having accelerated growth post-fire. Seeds from cheatgrass are spread anthropogenically (vehicles, shoes), biogenically (cattle) and naturogenically (wind, water, wild animals).

The 2012 Cave Canyon Fire, located in the South Hills (Cassia County, ID) burned 88,950 acres on lands managed by the USDA Forest Service, Bureau of Land Management, the Idaho Department of Fish and Game (Big Cottonwood Wildlife Management Area), Idaho Department of Lands and private landowners. Precipitation in the fire area varied considerably as a function of elevation, ranging from as low as approximately 9 inches to a high of 21 inches in some areas (USGS Streamstats).

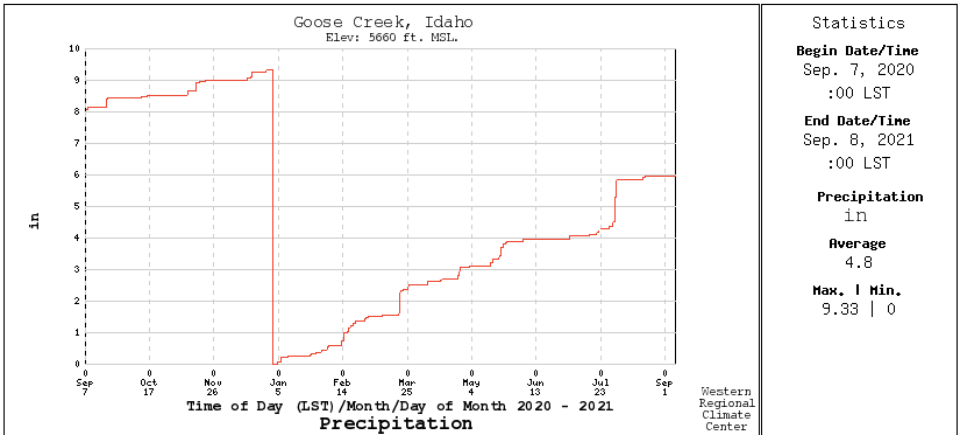

Figure 2- NIFC RAWS data on Goose Creek Site

Following the Cave Canyon Fire, the Bureau of Land Management broadcast seeded both sagebrush and grass seed, as well as planted an additional 6,000 sagebrush and bitterbrush

seedlings (BLM, 2018). The Forest Service did plant shrub seedlings in a few locations post fire but did not seed post fire and in many areas, cheatgrass became dominate and co-dominant. In general, Forest Service lands in the Cassia Division have historically benefitted from being slightly higher in elevation and getting slightly more precipitation than lower and drier BLM lands and natural recovery is/was sufficient in many areas; however, within the Cave Canyon Fire many areas on NFS, especially at lower elevations and south facing aspects were invaded by cheatgrass. The areas invaded by cheatgrass previously provided valuable habitat for mule deer, sage-grouse, elk as well as livestock grazing and recreational uses, all of which have been negatively affected by cheatgrass invasion.

Project Design

Project area site selection criteria for identifying areas for treatment on USFS, IDFG and IDL lands included GIS mapping of expected cheatgrass invasion based on slope, elevation and aspect and vegetation community and then crosswalking that exercise to areas of high resource value i.e. sage-grouse leks, critical mule deer winter range, etc. The identified areas were then field verified by USFS, IDFG and IDL staff. Treatment areas were mapped into three categories: 1) Trace amount of cheatgrass not influencing ecological processes 2) Cheatgrass is co-dominant plant type and influencing ecological processes and 3) Cheatgrass is dominant plant type and dominating ecological processes, i.e. monoculture or near monoculture. Selected treatment areas in Year 1 were selected in sites that were classified primarily as Category 2, co-dominant. The team felt most of these sites had enough perennial bunchgrasses to colonize open spaces left from cheatgrass without the need for an additional seeding treatment. A small percentage of the treatments were selected on sites which were closer to category 1 and category 3 to provide the team the ability to assess the utility of the herbicide over varying extents of cheatgrass invasion. Sites selected were mostly on flatter slopes and ridgetops due to their value to sage-grouse however canyons and steeper side slopes coming out of canyons represent a large proportion of the areas invaded in the south hills; as such, a small percentage of steeper slopes were treated in year 1 to assess the effectiveness of the herbicide on these site types.

Sampling and Study Design

While the goal of the project is to restore functional sage-steppe habitat, a critical component of the project is to evaluate the herbicide Rejuvra, (active ingredient) Indaziflam for effectiveness as well as learn techniques and strategies to apply this herbicide at a landscape scale with measurably effective results. To evaluate treatment effectiveness, the Forest Service employed a Before, After, Impact, Control (BAIC) study approach to be able to control for potential confounding variables such as differences in ecological sites, yearly precipitation, etc. The Forest Service worked with Matthew Germino from USGS on developing a final sampling design that would answer management effectiveness and would be collected in such a manner that the data could be combined and cross walked with other dataset for larger landscape analyses if desired.

Monitoring Protocol

Habitat Assessment Framework Site Selection

The monitoring site selection method was conducted using a randomly generated stratified grid pattern that incorporated known elevation, slope, plant communities and habitat availability. Once the parameters were deployed the program randomly generated a set number of points as potential monitoring locations across both treatment types (Stiver et al., 2015). Sites were assigned a random number and were visited in numerical order to maintain statistical validity; a site rejection criterion was applied to a site and if no site rejection criteria were met, the site was sampled.

Habitat Assessment Framework Methodology

The Sage-Grouse Habitat Assessment Framework (HAF) (Stiver et al., 2015) protocol was used to collect data for pre and post burn data to analyze vegetation response post fire. The HAF protocol is a line point intercept protocol measuring composition, diversity, density and canopy cover of sagebrush, grasses and forbs. Transects were run north off a compass bearing and measured fifty meters in distance. A pin drop was conducted every half meter totaling 100 data points per site. At those pin drops, species and height were recorded of which living plant matter was contacted, as well as the ground cover type. Forb sweeps were conducted every two meters by recording all forbs in a one-meter half circle from the transect line (Stiver et al., 2015). The Minidoka Ranger District also required a Sage Grouse Habitat Characterization survey at each site, in which one takes photos of the plot from each cardinal direction and on the ground, answers questions about land uses such as motor vehicle routes, campsites, water developments, and fences, disturbances such as fire, seeding, flooding, saw work, etc., dominant shrubs, dominant grasses, all other species encountered, noxious weeds and non-native grasses, snow and grazing impacts, wildlife uses, vegetation trends, soil trends, and has a component for adding other site notes.

We collected one HAF site including density protocol for every 100 acres of treatment area. One site will be located within treatment, and one control. Plots will be monitored at 1, 3, and 5 years after treatment. Cheatgrass density was measured utilizing a 50 cm width and length frame that was labeled at a 25 cm by 25 cm frame and a 10 cm by 10 cm frame. Cheatgrass was then counted at every 5 meters on a 50 meter transect tape either within a 10, 25, or 50 cm square frame (depending on density; denser sites were counted at 10 cm for efficiency purposes) and auto-calculated to estimate amount of cheatgrass per meter squared at each site. We decided to add the cheatgrass density protocol to the HAF data as opposed to relying on the LPI (Line-Point Intercept) pin because we wanted to determine density per meter squared and the LPI pin is not sufficient in determining density due to only 100 LPI points at a site and cheatgrass being a small single stemmed plant that is not always sufficiently detected using LPI methods alone. Controls will be random sites adjacent to the treatment units on the same ecological sites, or in some

treatment units, we had pilots skip treatment on a 50 meter strip in a random location within the unit that will serve as a control.

Current Conditions -2021 Year 1 Treatment Data Analysis

Plot Naming Convention

The number system utilized to name each sampling site is based on the fiscal year, name of the project, map the site is in, and site number computed from a random number generator. For example, FY21-CC-FM-1 is within Fiscal Year 2021, is part of the Cheatgrass Challenge project, is in the Four Mile pasture, and is site number 1. Those with STATE as their map site are located on land owned by the State of Idaho.

Data Analysis Methodology

After collecting data for Habitat Assessment Framework samples in the Vegetation GIS Data System (VGS), we exported the data onto an excel file to determine cover based on ground hits. We found the average of the number of hits based on the number of species between sites.

Cheatgrass Density Discussion:

Cheatgrass density in these sites ranges from 0.8 to 1695.6 cheatgrass plants per m². The average of all the sites is 456 cheatgrass plants per m².

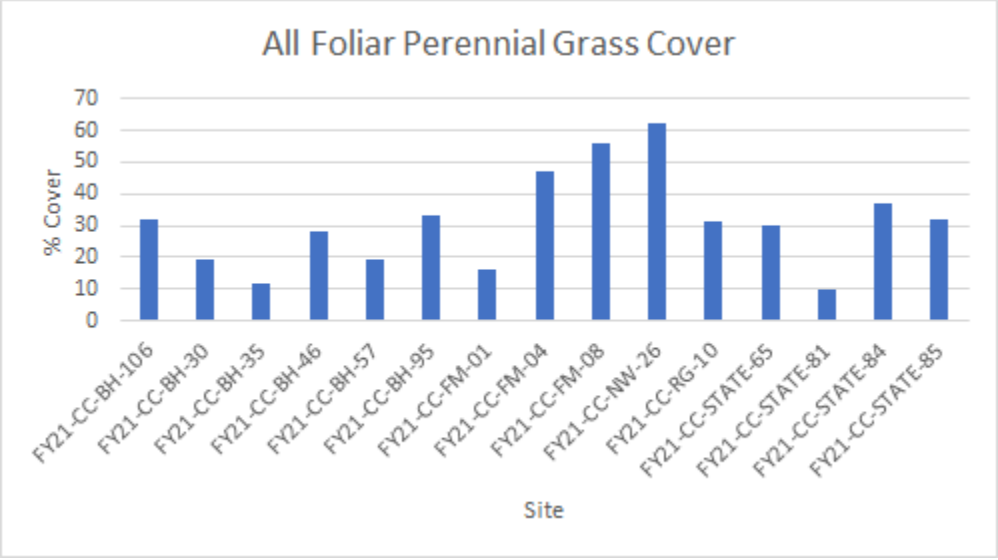

Figure 3: All Foliar Perennial Grass Cover Percentage

Site Number	Perennial Grass Cover Year 0	Cheatgrass Cover Year 0	Perennial Grass Cover Year 1	Cheatgrass Cover Year 1	Perennial Grass Cover Year 3	Cheatgrass Cover Year 3	Perennial Grass Cover Year 5	Cheatgrass Cover Year 5
FY21-CC-BH-106	32%	6%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-BH-30	19%	24%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-BH-35	12%	44%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-BH-46	22%	28%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-BH-57	19%	37%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-BH-95	33%	23%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-FM-01	16%	26%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-FM-04	47%	13%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-FM-08	58%	10%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-NW-26	62%	3%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-RG-10	31%	36%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-STATE-65	30%	30%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-STATE-81	10%	69%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-STATE-84	37%	0%	TBD	TBD	TBD	TBD	TBD	TBD
FY21-CC-STATE-85	32%	12%	TBD	TBD	TBD	TBD	TBD	TBD

Table 1-Foliar Perennial Grass Cover Percentage by site years 0, 1, 3 and 5

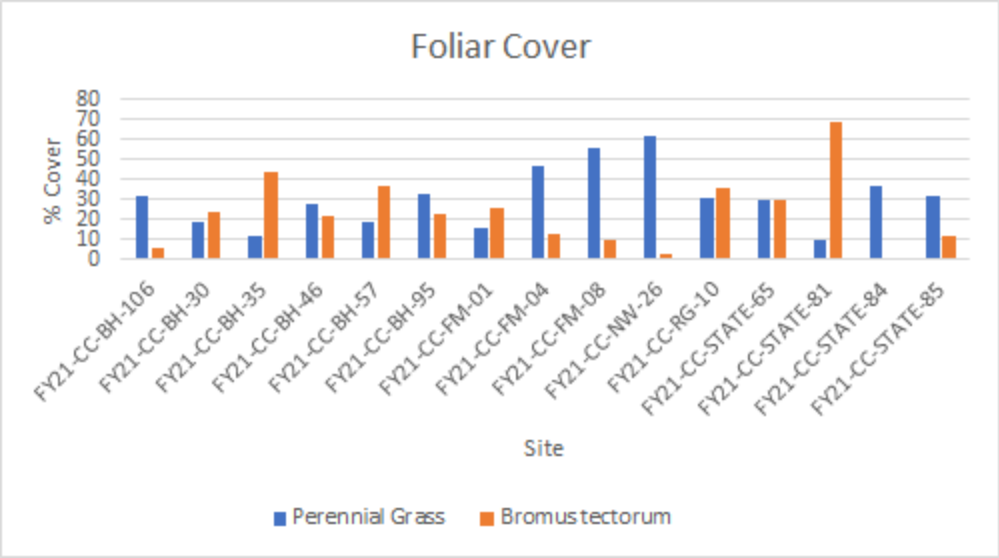

Figure 4- Foliar Cover of Perennial Grasses and Bromus Tectorum in Percent Cover

Foliar Grass Cover Discussion:

In 7 of the 15 sites, perennial grasses are still the dominant grass cover. In 6 sites, cheatgrass has become the dominant grass cover. In one site, FY-21-CC-STATE-65, these grasses are equally dominant. In the site FY-21-CC-STATE-84, cheatgrass was barely detected.

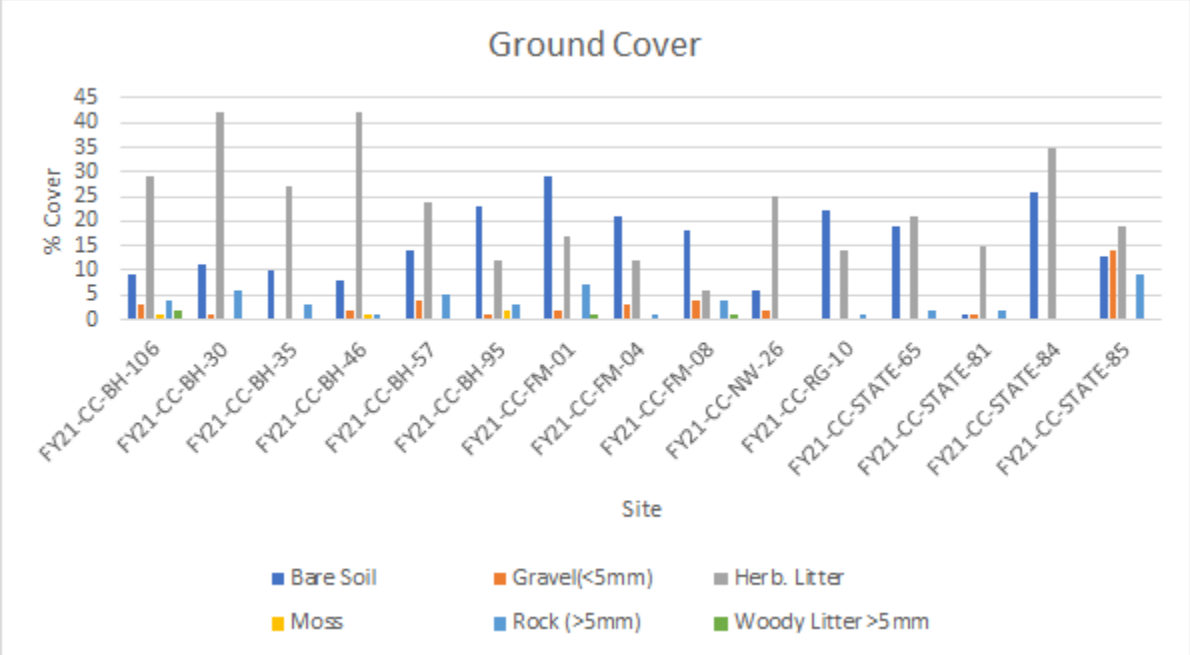

Figure 5- Percent Ground Cover in Each Site

Ground Cover Discussion:

Herbaceous litter and bare soil are the most common ground hits in the sites. The reason herbaceous litter is so high is due to cheatgrass, which turns to litter after it senesces. As cheatgrass invasion increases, perennial grasses decrease and therefore increases in bare ground are observed.

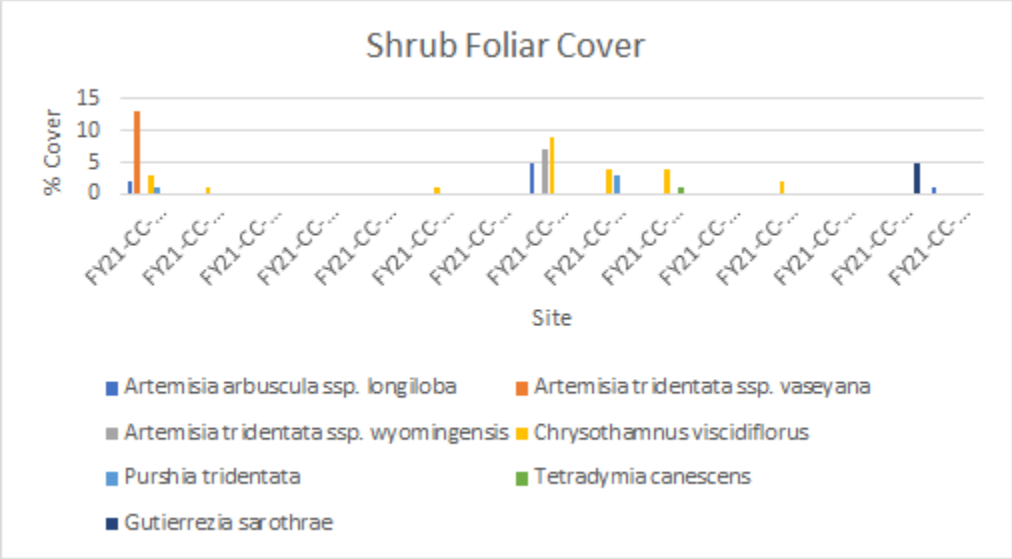

Figure 6- Percent Shrub Foliar Cover by Foliar Type

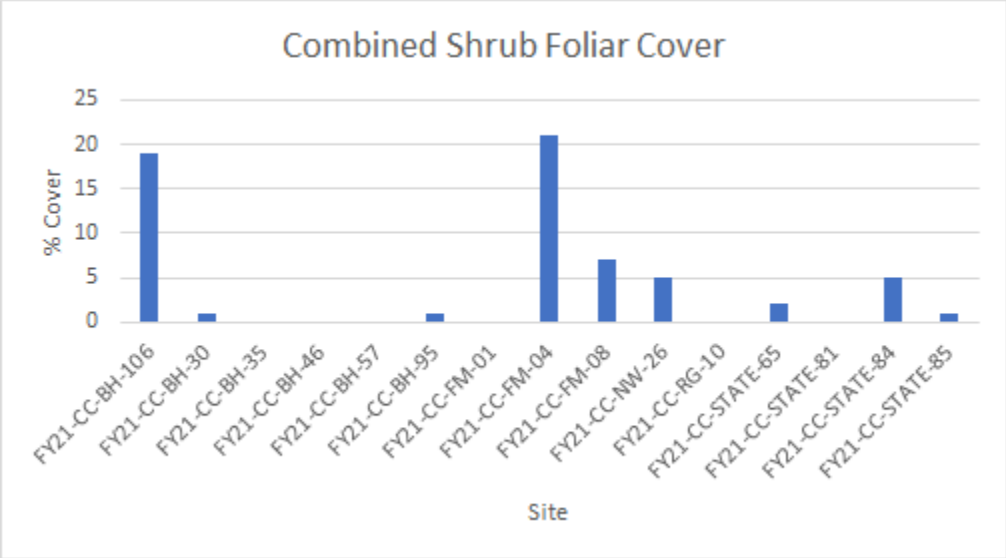

Figure 7- Combined Shrub Foliar Percent Cover by Site

Shrub Foliar Cover Discussion:

The shrubs detected at the sampled sites include Low Sagebrush *(Artemesia arbuscula ssp longlobia)*, Wyoming Big Sagebrush *(Artemesia tridentata ssp. wyomingensis)*, Bitterbrush

(Purshia tridentata), Broom and Threadleaf Snakeweed *(Gutierrezia sarothrae),* Mountain Big Sagebrush *(Artemesis tridentata ssp. Vaseyana),* Yellow Rabbitbrush *(Chrysothamnus viscidiflorus),* and Spineless Horsebrush *(Tetradynua canescens).*

Site Number	Shrub Cover Year 0	Shrub Cover Year 1	Shrub Cover Year 3	Shrub Cover Year 5
FY21-CC-BH-106	19%	TBD	TBD	TBD
FY21-CC-BH-30	1%	TBD	TBD	TBD
FY21-CC-BH-35	0%	TBD	TBD	TBD
FY21-CC-BH-46	0%	TBD	TBD	TBD
FY21-CC-BH-57	0%	TBD	TBD	TBD
FY21-CC-BH-95	1%	TBD	TBD	TBD
FY21-CC-FM-01	0%	TBD	TBD	TBD
FY21-CC-FM-04	21%	TBD	TBD	TBD
FY21-CC-FM-08	7%	TBD	TBD	TBD
FY21-CC-NW-26	5%	TBD	TBD	TBD
FY21-CC-RG-10	0%	TBD	TBD	TBD
FY21-CC-STATE-65	2%	TBD	TBD	TBD
FY21-CC-STATE-81	0%	TBD	TBD	TBD
FY21-CC-STATE-84	5%	TBD	TBD	TBD
FY21-CC-STATE-85	1%	TBD	TBD	TBD

Table 2- Percent Shrub Cover at Each Site Years 0, 1, 3 and 5.

We can see a correlation with sites with 0% shrub cover and those that dominated in cheatgrass in the Year 0 dataset, including FY21-CC-BH-35 that maintained 44% cheatgrass foliar cover, FY21-CC-BH-57 that maintained 37% cheatgrass foliar cover and FY21-CC-STATE-81 that maintained 69% cheatgrass foliar cover.

Data Limitations

This is Year 0 (pre-treatment data collection) for this project which only provided the data of our control plots and treatment plots before treatment occurs. Weather is a limiting factor for this assessment as well. Amount of precipitation can have a profound effect on cheatgrass density and cover and this data (2021) coincides with drought conditions, it is likely that if we see average or above average precipitation and especially if we receive spring precipitation, we will see increased cover and density of cheatgrass. Due to the establishment of control plots, through time, we expect this to have little effect on evaluating treatment effectiveness.

Implementation

Funding was received in July and funding agreements were created and modified shortly thereafter to accomplish work in the fall of 2021. Spraying occurred on September 21, 2021. Thomas Helicopters was awarded the contract with a total cost of $60/acre for herbicide ($40)

and flight time ($20), slightly less than the government cost estimate. Indaziflam was applied at the recommended rate of 5 ounces/acre. After looking at treatments on the Minidoka NWR which used a tank mix of Indaziflam and Imazapic and treatments with Indaziflam only, the technical team decided against using a tank mix with Indaziflam based on the results that they observed (more robust perennial vegetation response with Indaziflam only). In total, 938 acres were sprayed in 2021, for a total cost of $56,280 with spraying taking approximately half a day to complete. Spraying will ramp up in 2022 with the goal of treating additional acres and conducting Year 1 post treatment monitoring.

Conclusion & Future Needs

Collecting data in years 1, 3, and 5 for treated areas and continuing treatments through the lifespan of the project will be critical to complete a thorough evaluation of treatment effectiveness through time as well as to provide a roadmap for how to develop a long-term treatment plan that effectively reduced cheatgrass dominance and provides habitat across the landscape at a meaningful scale for the target species i.e. sage-grouse.

Consistent, accurate and repeatable data collection of the management actions taken will be critical as it serves as the knowledge and information transfer as specialists leave positions and reduced the dependence on anecdotal data and qualitative observations from the few staff and specialists that remain in one area long enough to observe on the ground changes in plant communities at an ecologically relevant temporal scale.

Once this project is completed, an important next step may be to form a working group of partners that can develop a long-term strategy to pool resources and funding to implement treatments across the landscape at ecologically relevant areas in those places where high resource values exist as well as ensure that treatments occur at biologically appropriate times with the goal of developing a treatment plan that occurs year after year through time.

Acknowledgements

We would like to thank The Idaho Department of Fish and Game, Idaho Department of Lands, Idaho Office of Species Conservation, Pheasants Forever, Cassia County Commissioners, Natural Resources Conservation Service as well as Charlie Sanford with US Fish and Wildlife Service and Matthew Germino with the US Geological Survey for the technical help and support and funding to make this project a reality. A special thanks to Connor White at Pheasants Forever who helped ensure we were able to get a contract in place on a two-month turnaround from the time funding was received.

Appendix A: Rangeland Analysis Platform Mapping for Project

A review of annual grass invasion two years post Cave Canyon fire using the Rangeland Analysis mapping platform shows a dramatic increase in cheatgrass the second growing season post fire.

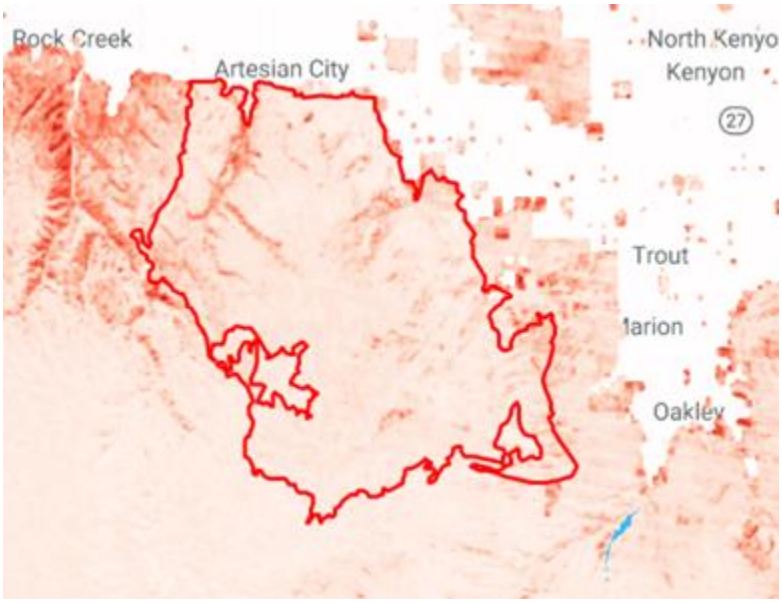

Figure 8- Annual Forb and Grass Cover in Cave Canyon Burn Perimeter, 2013 Imagery

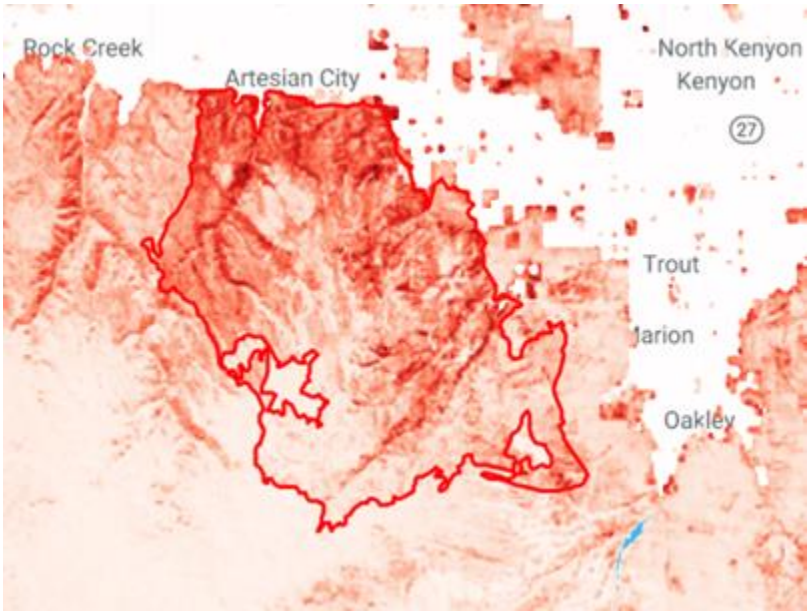

Figure 9- Annual Forb and Grass Cover in Cave Canyon Burn Perimeter, 2014 Imagery

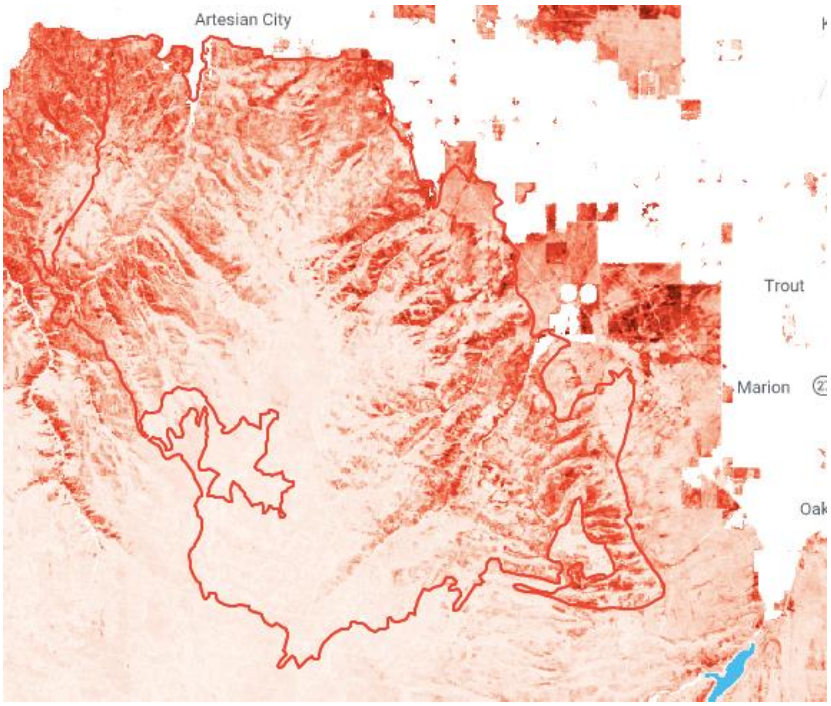

Figure 10-Annual Forb and Grass Cover in Cave Canyon Burn Perimeter, 2020 Imagery

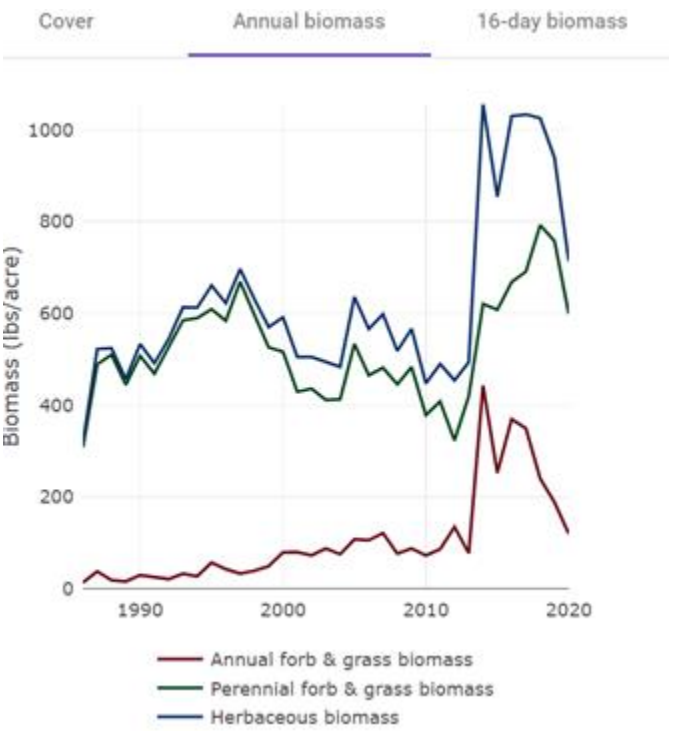

Figure 11- Annual Forb and Grass Cover, Perennial Forb & Grass Biomass, Herbaceous Biomass within Cave Canyon Burn Perimeter

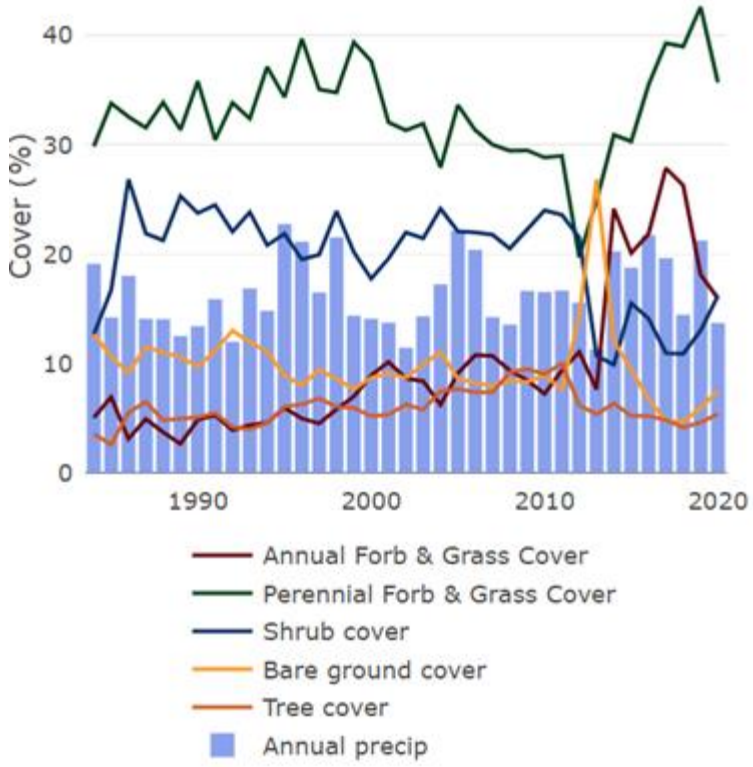

Figure 12- Time Series of Percent Cover with Annual Precipitation within Cave Canyon Burn Perimeter\

We can see that two years post fire we observed a major increase in annual grasses in the Cave Canyon Fire perimeter. In comparing one year post-fire (Figure 8) to two years post-fire (Figure 9), it is evident that annual grasses, especially in the northernmost boundary of the fire, began to thrive in the Cave Canyon Fire perimeter. Over time, though, annual grasses have become reduced within the fire perimeter, but are still prevalent (Figure 10). We can also look at the graphs in Figures 10 and 11 and see the influx of annual forb and grass cover, perennial forb and grass cover, and herbaceous biomass around 2014. Annual forb and grass cover in Figure 10 increased from 77.2 pounds per acre to 442.6 pounds per acre.

Appendix A - Maps

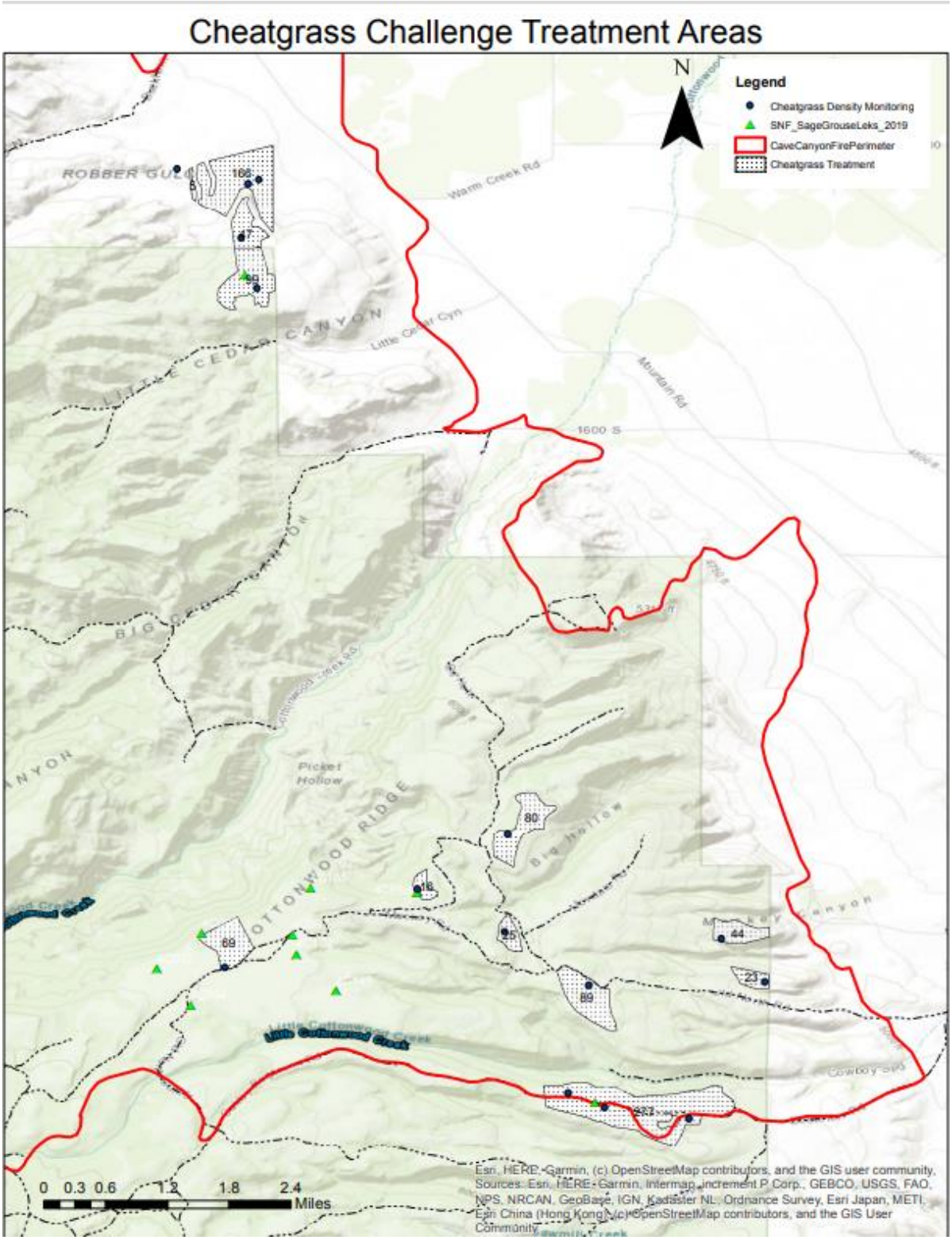

Figure 13- Overall Cheatgrass Site Map

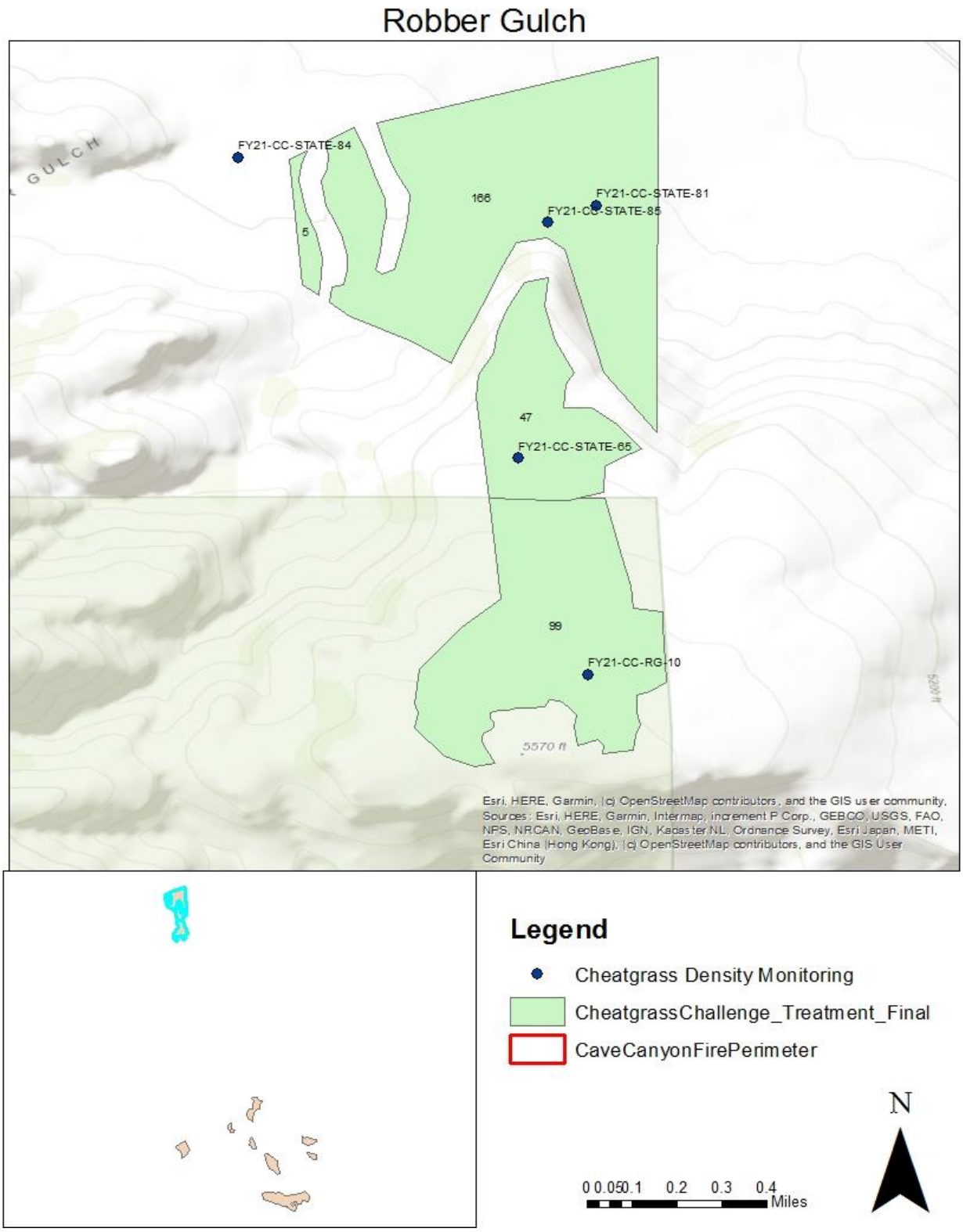

Figure 14- Sites within the Vicinity of Robber Gulch

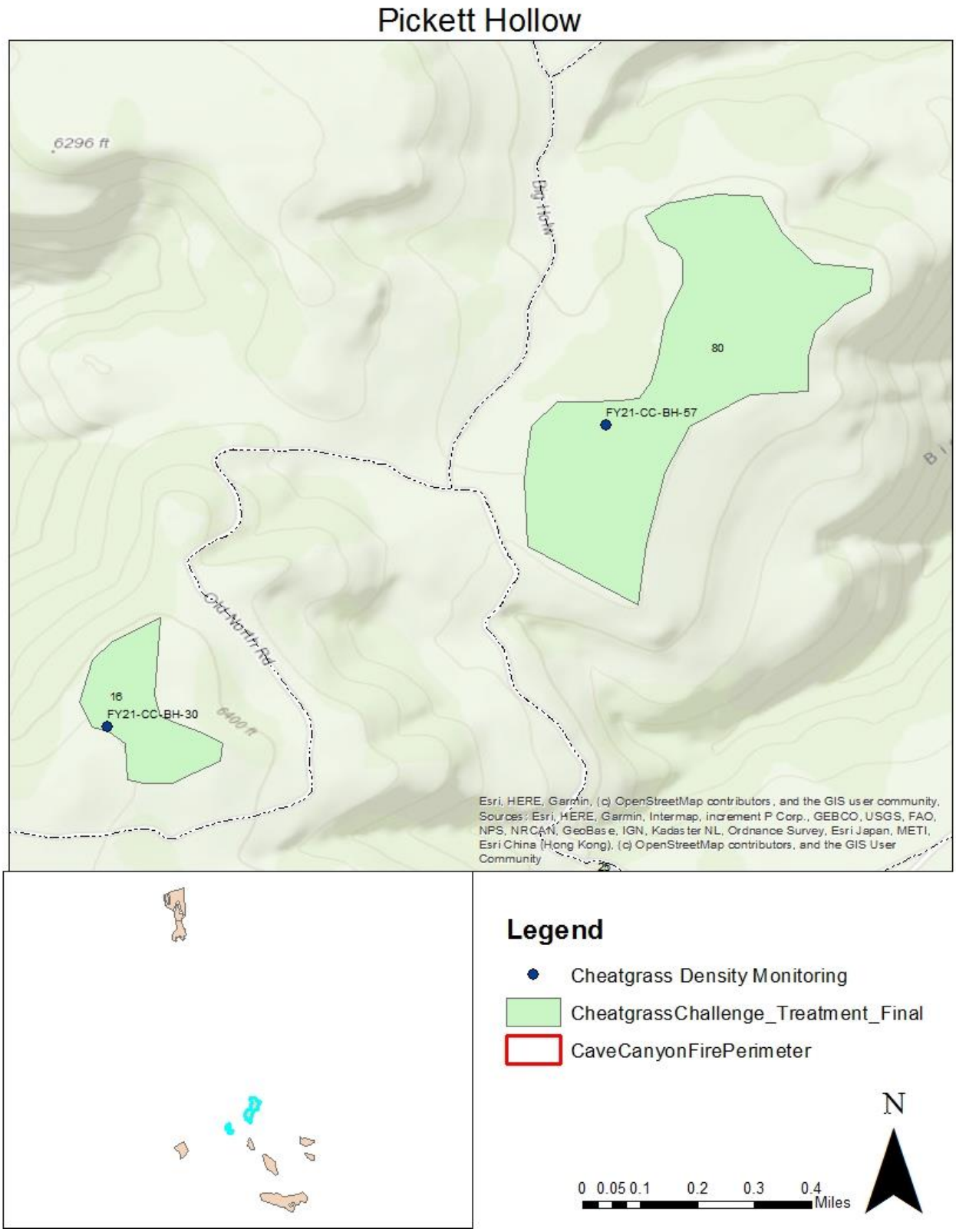

Figure 15- Sites within the Vicinity of Pickett Hollow

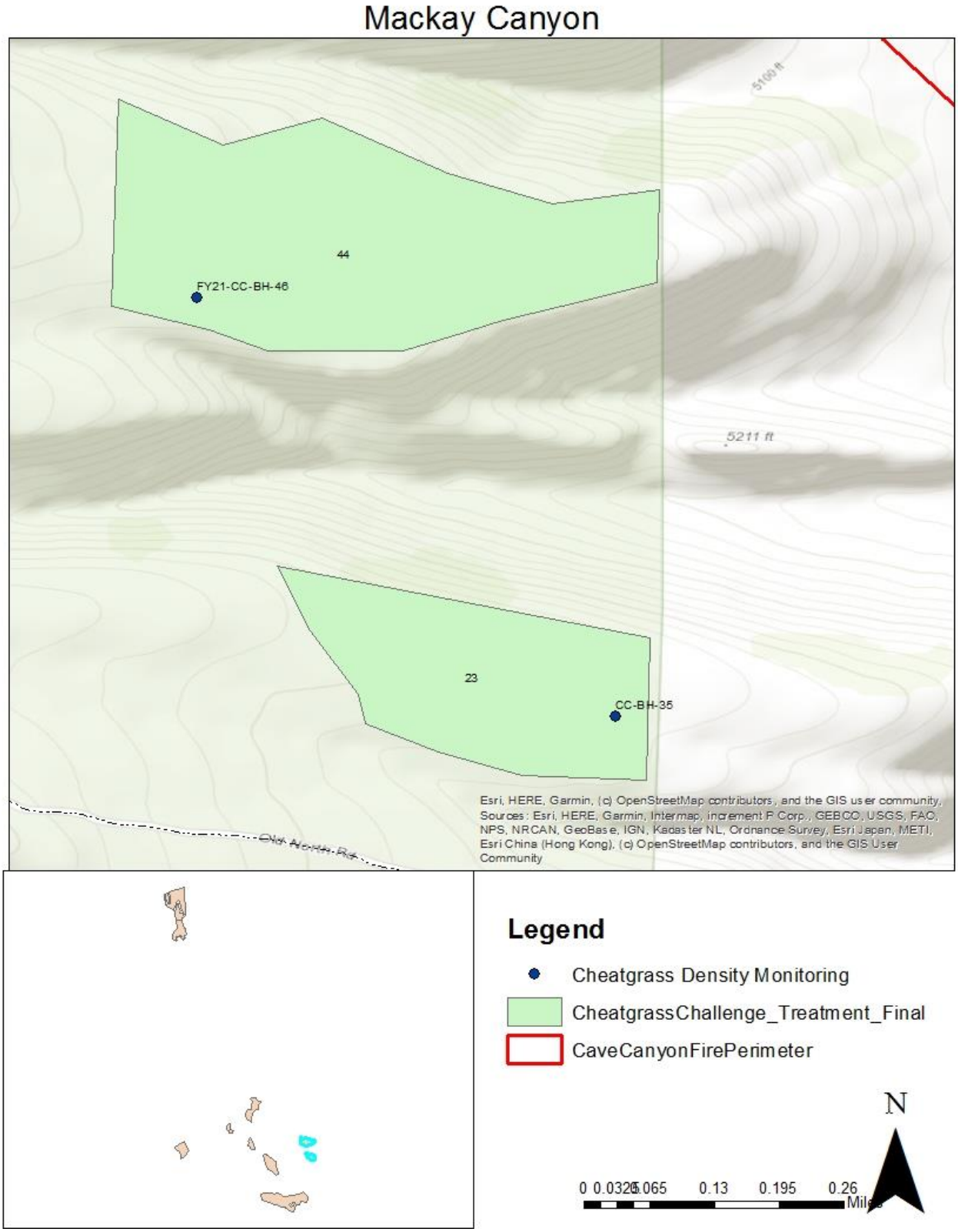

Figure 16- Sites within the Vicinity of Mackay Canyon

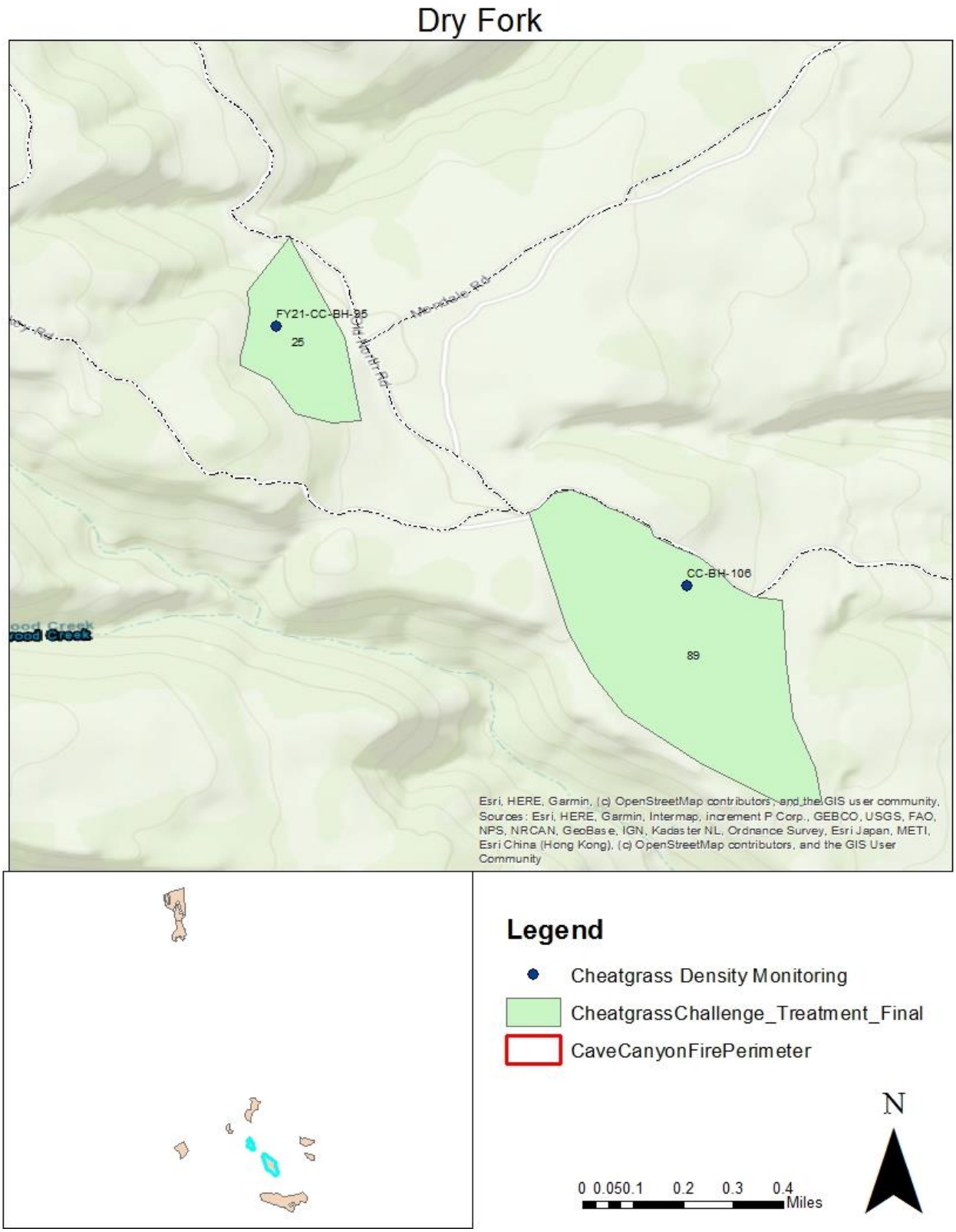

Figure 17- Sites within the Vicinity of Dry Fork

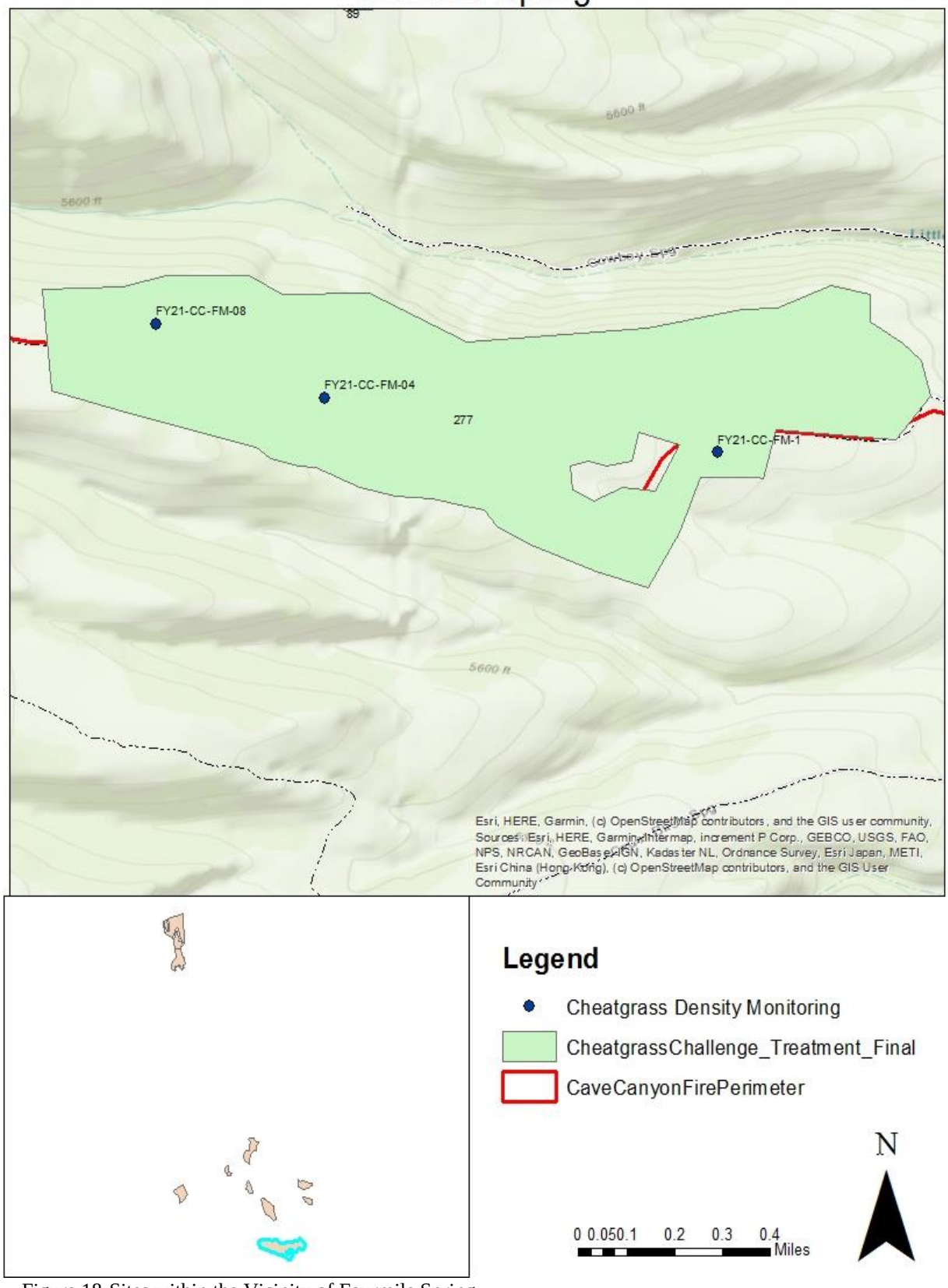

Figure 18-Sites within the Vicinity of Fourmile Spring

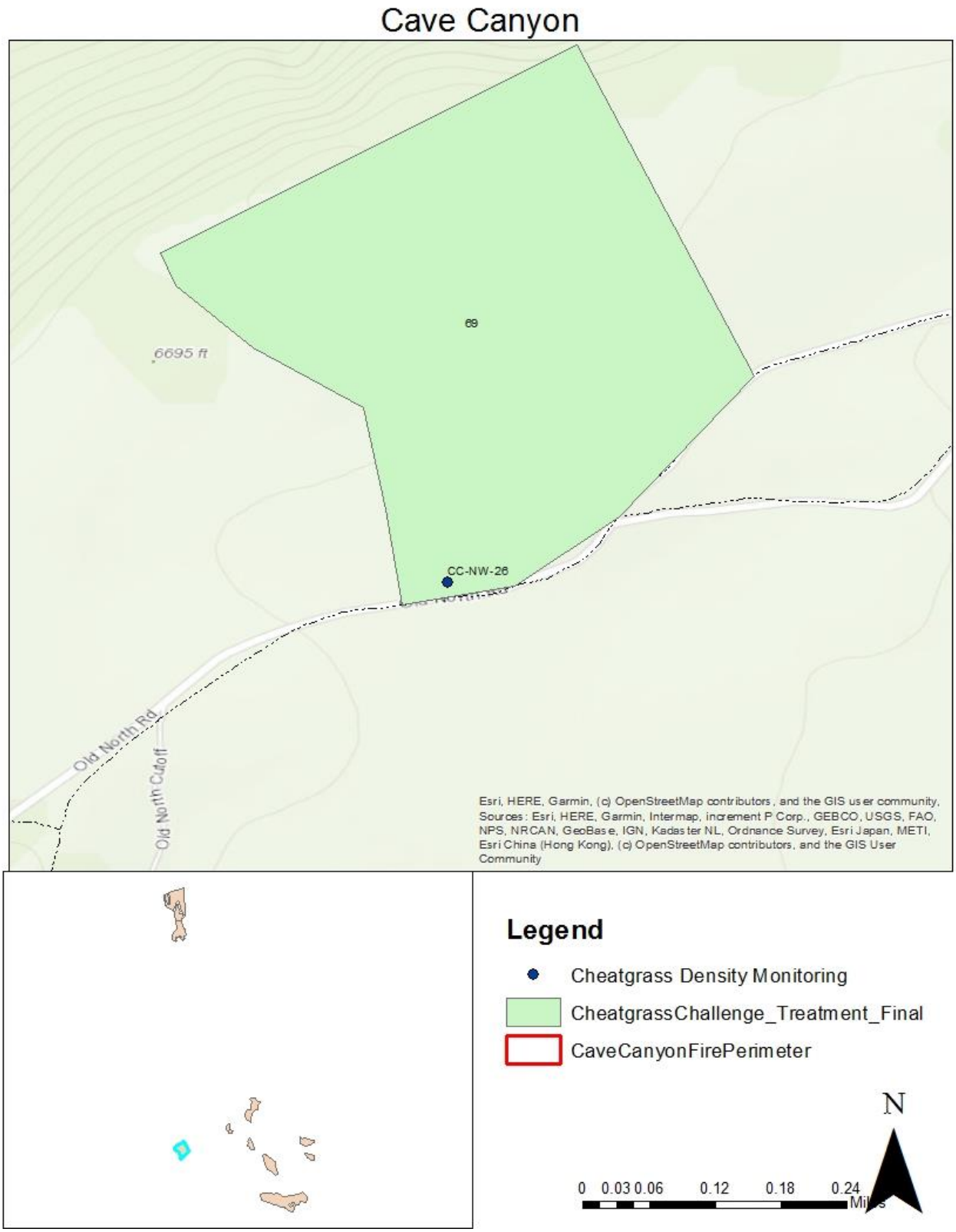

Figure 19- Sites within the Vicinity of Cave Canyon

Appendix B - Site Data Analysis and Plot Photos

Figure 20- FY21-CC-STATE-85 North, 7/15/21

Overall Cheatgrass Density at this site is 334.4 cheatgrass plants per square meter (m^2). Cheatgrass totaled 12% of the cover whereas perennial grasses covered 32% and shrubs covered 1%. Ground cover is dominantly herbaceous litter (19%), bare soil (13%) and gravel (14%).

Figure 21- FY21-CC-STATE-84 North, 7/14/21

Overall Cheatgrass Density at this site is 0.8 plants per m². Cheatgrass totaled 0% of the cover whereas perennial grasses covered 37% and shrubs covered 5%. Ground cover is dominantly herbaceous litter (35%) and bare soil (26%).

Figure 22- FY21-CC-STATE-81 North, 7/14/21

Overall Cheatgrass Density at this site is 811.2 plants per m². Cheatgrass totaled 69% of the cover whereas perennial grasses covered 10% and shrubs covered 0%. Ground cover is dominantly herbaceous litter (15%).

Figure 23- FY21-CC-STATE-65 North, 7/15/21

Overall Cheatgrass Density at this site is 508 plants per m². Cheatgrass totaled 30% of the cover and perennial grasses covered 30% and shrubs covered 2%. Ground cover is dominantly herbaceous litter (21%) and bare soil (19%).

Figure 24- FY21-CC-RG-10 North, 7/14/21

Overall Cheatgrass Density at this site is 173.2 plants per m². Cheatgrass totaled 36% of the cover whereas perennial grasses covered 31% and shrubs covered 0%. Ground cover is dominantly herbaceous litter (14%) and bare soil (22%).

Figure 25- FY21-CC-BH-95 North, 7/14/21

Overall Cheatgrass Density at this site is 534 plants per m². Cheatgrass totaled 23% of the cover whereas perennial grasses covered 33% and shrubs covered 1%. Ground cover is dominantly herbaceous litter (12%) and bare soil (23%).

Figure 26- FY21-CC-BH-57 North, 7/14/21

Overall Cheatgrass Density at this site is 542.8 plants per m². Cheatgrass totaled 37% of the cover whereas perennial grasses covered 19% and shrubs covered 0%. Ground cover is dominantly herbaceous litter (24%) and bare soil (14%).

Figure 27- FY21-CC-BH-46 North, 7/14/21

Overall Cheatgrass Density at this site is 747.2 plants per m². Cheatgrass totaled 28% of the cover whereas perennial grasses covered 22% and shrubs covered 0%. Ground cover is dominantly herbaceous litter (42%) and bare soil (8%).

Figure 28- FY21-CC-BH-30 North, 7/14/21

Overall Cheatgrass Density at this site is 524.8 plants per m². Cheatgrass totaled 24% of the cover whereas perennial grasses covered 19% and shrubs covered 1%. Ground cover is dominantly herbaceous litter (42%) and bare soil (11%).

Figure 29- FY21-CC-NW-26 North, 7/13/21

Overall Cheatgrass Density at this site is 27.2 plants per m².

Cheatgrass totaled 3% of the cover whereas perennial grasses covered 62% and shrubs covered 5%. Ground cover is dominantly herbaceous litter (25%).

Figure 30- FY21-CC-FM-08 North, 7/12/21

Overall Cheatgrass Density at this site is 55.2 plants per m². Cheatgrass totaled 10% of the cover whereas perennial grasses covered 58% and shrubs covered 7%. Ground cover is dominantly bare soil (18%).

Figure 31- FY21-CC-FM-04 North, 7/12/21

Overall Cheatgrass Density at this site is 74 plants per m². Cheatgrass totaled 13% of the cover whereas perennial grasses covered 47% and shrubs covered 21%. Ground cover is dominantly herbaceous litter (12%) and bare soil (21%).

Figure 32- FY21-CC-FM-01 North, 7/12/21

Overall Cheatgrass Density at this site is 716.8 plants per m². Cheatgrass totaled 26% of the cover whereas perennial grasses covered 16% and shrubs covered 0%. Ground cover is dominantly herbaceous litter (17%) and bare soil (29%).

Figure 33- FY21-CC-BH-106 North, 7/13/21

Overall Cheatgrass Density at this site is 96 plants per m². Cheatgrass totaled 6% of the cover whereas perennial grasses covered 32% and shrubs covered 19%. Ground cover is dominantly herbaceous litter (29%) and bare soil (9%).

Figure 34- FY21-CC-BH-35 North, 7/14/21

Overall Cheatgrass Density at this site is 1695.6 plants per m². Cheatgrass totaled 44% of the cover whereas perennial grasses covered 12% and shrubs covered 0%. Ground cover is dominantly herbaceous litter (27%) and bare soil (10%).

References

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