Vegetation and Wildlife Surveys at the National Renewable Energy Laboratory, South Table Mountain

June 2010 – May 2011

Walsh Environmental Scientists and Engineers, LLC
Boulder, Colorado

NREL Technical Monitor: Tom Ryon

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
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Subcontract Report
NREL/SR-1900-70464
July 2018

Contract No. DE-AC36-08GO28308

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

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Jefferson County, Colorado

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Technical Monitor: Thomas Ryon

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LIST OF ACRONYMS

AIC	Akaike's information criterion
CDOA	Colorado Department of Agriculture
CDOW	Colorado Division of Wildlife
CNHP	Colorado Natural Heritage Program
DOE	U.S. Department of Energy
DRHW	Dinosaur Ridge Hawk Watch
GIS	Geographic Information System
GPS	Global Positioning System
HMANA	Hawk Migration Association of North America
n	Total number of detected birds
NEPA	National Environmental Policy Act
NREL	National Renewable Energy Laboratory
STM	South Table Mountain
T & E	Threatened and Endangered
USFWS	U.S. Fish and Wildlife Service
Walsh	Walsh Environmental Scientists and Engineers, LLC

EXECUTIVE SUMMARY

This year-long wildlife and vegetation study was conducted by Walsh Environmental Scientists and Engineers, LLC (Walsh) to update previous vegetation and wildlife baseline reports for the South Table Mountain Site (STM). This report will be used to support future National Environmental Policy Act (NEPA) analyses. STM is located on the southeastern corner of South Table Mountain in Jefferson County and is home to a laboratory center of the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, and operated by the Alliance for Sustainable Energy, LLC.

NREL has conducted vegetation and wildlife surveys at STM starting in 1987. Prior to the current study, Plantae (2002) completed a site characterization of vegetation communities and noxious weeds, and FORUM (1987) and Science Applications International Corporation (SAIC 2005) conducted wildlife surveys including migratory birds and raptors.

Background research methods included a review of prior studies conducted at STM and species tracked by the Colorado Natural Heritage Program (CNHP). Field methods included walking transects to map vegetation communities and noxious weeds. Numerous wildlife surveys (bird, raptor, large mammal, mammalian predator, small mammal, reptile and amphibian, and terrestrial arthropod) were conducted. Several targeted wildlife surveys were conducted for: breeding bird density, nocturnal wildlife (playback for small owls, amphibian call, and bat acoustical), mule deer, and carnivores (motion-sensing cameras). Special Status Species – those listed as Threatened, Endangered, Candidate, or Species of Special Concern by the U.S. Fish and Wildlife Service (USFWS) or the Colorado Division of Wildlife (CDOW) – were also conducted.

Results include the following:

- The majority of vegetation at STM belongs to the grassland community type. Within that association, there are two distinct community types: short-grass grassland on the mesa top and mixed-grass grassland located on the slopes and toe area. Other mapped vegetation communities at STM include ravine shrubland, tall shrubland, short shrubland, and wetlands.
- Changes in observed vegetation patterns and trends since the 2002 Plantae report include a general increase in noxious weed species diversity and cover throughout the various plant communities.
- Small mammal trapping resulted in a low species richness with only three species captured onsite over two survey periods, Mexican woodrat (*Neotoma mexicana*), deer mouse (*Peromyscus maniculatus*), and western harvest mouse (*Reithrodontomys megalotis*).
- Mammalian predator surveys detected red fox (*Vulpes vulpes*), coyote (*Canis latrans)*, and striped (*Mephitis mephitis*) and spotted skunk (*Spilogale gracilis*). Only coyotes had been detected previously.
- Amphibian call surveys detected one species, Woodhouse's toad (*Bufo woodhousii*), on the northwestern boundary of STM. Playback surveys failed to detect any owls. Motion-detection cameras detected several coyotes. No bat species were detected.
- General wildlife surveys detected common genera and species expected for the habitats and region of STM.
- The seasonal average for wildlife species richness, diversity (dominance) and total number of detections all approximately doubled since reported for 2004/2005.

- One-hundred and two (102) wildlife species were detected: five herptiles, 86 birds, and 11 mammals. In comparison FORUM observed a total of 31 species in 1987, and SAIC observed 69 species in 2004/2005.
- One Special Status Species was observed, the peregrine falcon (*Falco peregrinus*), a State Species of Special Concern.

INTRODUCTION

This year-long wildlife and vegetation study was conducted by Walsh Environmental Scientists and Engineers, LLC (Walsh) to update previous vegetation and wildlife baseline reports for the South Table Mountain Site (STM). This baseline report will be used to support future National Environmental Policy Act (NEPA) analyses. STM is located on the southeastern corner of South Table Mountain in Jefferson County and is home to a laboratory center of the National Renewable Energy Laboratory (NREL), a national laboratory of the U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, and operated by the Alliance for Sustainable Energy, LLC.

STM is situated on approximately 327 acres north of I-70 and west of the I-70 and Denver West Boulevard interchange. The legal description of the current boundary is: T3S, R70W, Sections 36 and T4S, R70W, Section 1 (Figure 1). The STM site includes laboratory and office space, a visitor's center, and 177 acres protected by a conservation easement. NREL has conducted vegetation and wildlife surveys at STM starting in 1987. Prior to the current study, Plantae (2002) completed a site characterization of vegetation communities and noxious weeds, and FORUM (1987) and Science Applications International Corporation (SAIC 2005) conducted wildlife surveys including migratory birds and raptors.

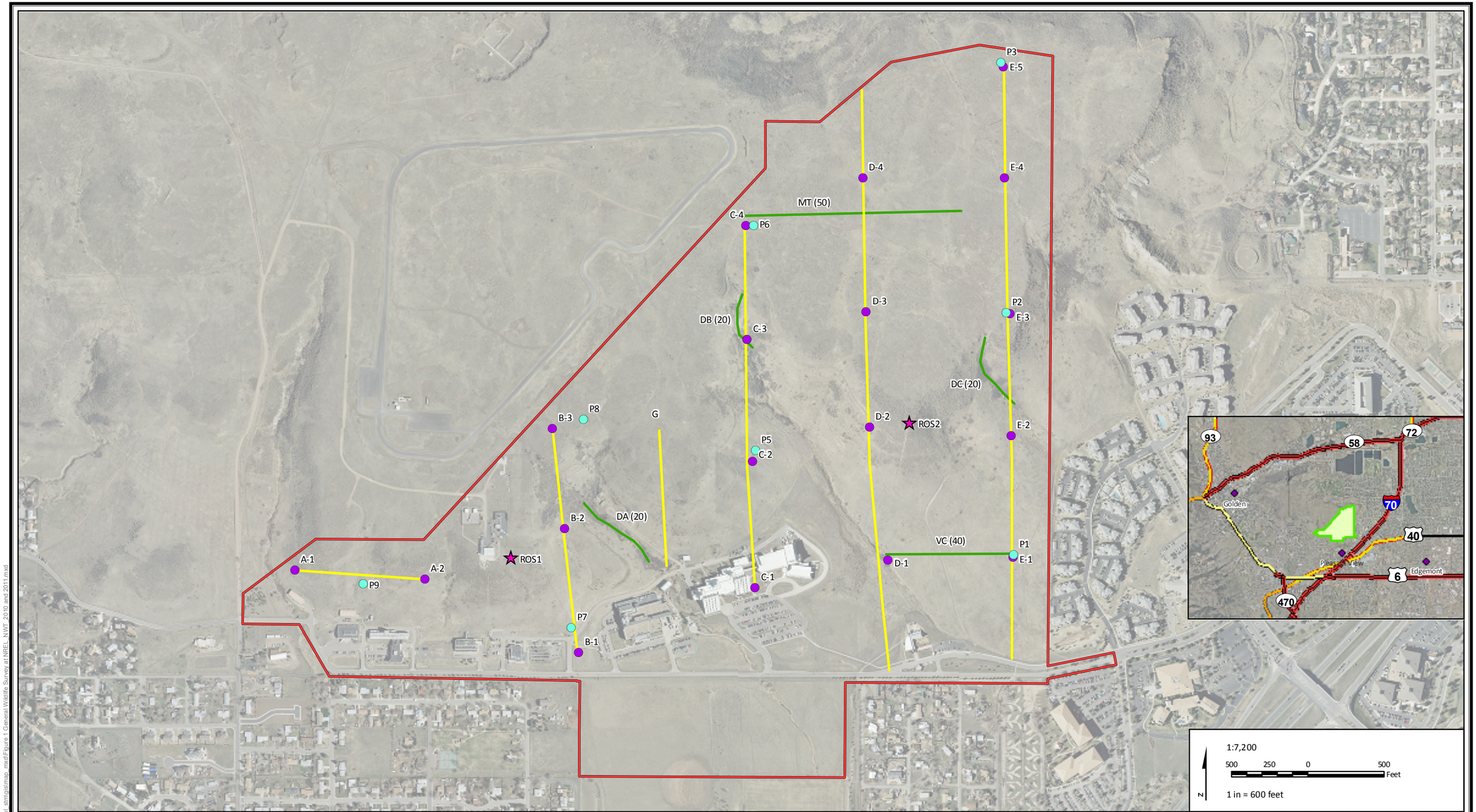
For the current effort, Walsh conducted four seasons of vegetation and wildlife surveys beginning in June, 2010 and ending in May, 2011. This report presents the results of these surveys.

METHODS

For all studies Walsh and NREL agreed to define the seasons as follows: summer (May, June and July), fall (August, September, and November), winter (December, January, and February), and spring (March, April and May). This was to provide continuity with other studies (SAIC 2005) and NREL's National Wind Technology Center in Jefferson County, Colorado. For this effort, Special Status Species are defined as those listed under the Endangered Species Act (ESA) as Threatened, Endangered (T&E), or Candidate Species; State T & E Species; and State Species of Special Concern.

Vegetation Mapping

Vegetation mapping and characterization were performed following methods described in Plantae (2002). Major plant communities were the basis for both efforts. For the current study, the previously characterized location and area of all major plant communities on the site were checked against current rectified aerial photography and ground-truthed in the field on June 22 and 23, 2010; and May 13, 2011. During the ground-truthing effort, transects were walked at variable intervals through each previously-mapped community. Parallel transects were walked through different portions of the more extensive short-grass grassland and the mixed-grass grassland areas. General conditions for each community type were recorded and comprehensive plant species lists for each community were updated, as necessary (Appendix A). Observations of species dominance as well as on-the-ground discrepancies found between the previous mapping effort and current conditions were noted. Representative photographs of all plant communities were collected (Appendix B). Plant taxonomy follows Weber and Wittmann (2001).



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- Bird Survey Stations (A-E)
- Predator Scent Stations (P)
- Raptor Observation Stations (ROS)
- Large Mammal Survey Transects (Plots placed at 50-meter intervals)
- Small Mammal Survey Transects (Number of traps)
- STM Boundary

Figure 1. General Wildlife Survey Stations and Transects, NREL South Table Mountain Site, 2010 and 2011

U:\Projects\907758.001.020_nrel_stmsitemap_mxd\Figure 1 General Wildlife Survey at NREL_NWT_2010 and 2011.mxd

Noxious Weeds

The location of weeds listed by the Colorado Noxious Weed List (Colorado Division of Agriculture [CDOA] 2010) was assessed on June 22 and 23, 2010 by walking the same transects used for the vegetation mapping. Populations of weeds that occurred in a diffuse pattern with individual or small numbers of plants scattered throughout the landscape were noted but not mapped as distinct polygons. Weed populations with a high density of plants per square meter were mapped as such. A threshold density of approximately 3 to 5 plants per 25 ft^2 was used to determine whether an area was mapped. Digital location data were collected using Global Positioning System (GPS) receiver units and downloaded into a Geographic Information System (GIS) database. These data were used to estimate cover of weed populations.

General Wildlife Surveys

Wildlife surveys followed, to the extent practicable, the methods and locations used for the previous survey (SAIC 2005). Note that point count bird surveys are conducted under this section (Bird Surveys), whereas breeding bird density surveys are covered under Targeted Wildlife Surveys (Breeding Bird Density Surveys) and that they use different protocols and produce different types of results.

Bird Surveys

Bird surveys were conducted at 18 survey points, at 250-meter intervals along transects previously established by SAIC (2005) (Figure 1). Points F-1 and F-2 from the SAIC (2005) study were no longer available due to new developments. During a five-minute sampling period at each point, all observed birds, as well as sex, behavior, distance from the center of the point, and habitat type were recorded. Birds detected between points were recorded to capture any species missed during point counts including any Special Status Species. Walsh conducted two surveys per season, on consecutive mornings. Walsh followed the analysis used by SAIC (2005) to estimate diversity. SAIC (2005) used a metric that is correctly termed dominance and is the reciprocal of the Simpson diversity index (Begon et al. 2006; Van Dyke 2008, p. 91). Evenness was also estimated using species richness and diversity (dominance).

Raptor Surveys

During April and September, the regional peaks for raptor migration, all observed raptors were recorded at two points previously established by SAIC (2005) (Figure 1). Raptor surveys were conducted during mid-day survey periods (10 AM to 2 PM), which correspond to the daily peak times of raptor migration flights. Each point was surveyed on two consecutive days using the standard protocol established by the Hawk Migration Association of North America (HMANA 2010). This protocol was also used for counting raptors at the Dinosaur Ridge Hawk Watch (DRHW) four miles to the southwest of STM. Species, flight direction, and flight height were recorded. Weather conditions were recorded hourly. Efforts were made to distinguish local non-migratory raptors from migratory raptors. Calculated variables included number of raptors per hour and per survey.

A site-wide raptor nest survey was conducted in April, each day after migratory raptor surveys were completed. Any raptor nests previously recorded in 2004 were revisited to determine activity status, without causing disturbance to the birds. Additionally, all other appropriate habitats were assessed for nesting activity (trees, buildings, and topographic features).

Large Mammal Surveys

Large mammal surveys were based on pellet-group plots, following Neff (1968) and SAIC (2005). Seventy-six circular plots with a four-meter diameter were spaced approximately 50 meters apart along Transects A, B, C, D, E and G established by SAIC (Figure 1). Wooden stakes marked the center of each plot. Pellets were removed from each plot in February 2011. The pellet-group plots were checked in May 2011, and any new pellets were counted, recorded, and removed. The plots are scheduled to be re-checked and recorded again in November 2011 by NREL staff. Mule deer use and relative abundance surveys were also conducted under the targeted wildlife species surveys.

Mammalian Predator Surveys

Walsh conducted scent-station surveys for predators using the previous methods developed by Linhart and Knowlton (1975) and used by SAIC (2005). Scent stations consisted of a one-meter circle of sifted dirt with a fatty-acid scented predator survey disk (F.A.S. Scented Disk from Pocatello Supply Depot, Pocatello, ID) placed in the center. Nine stations were established, located along the same transects used in the migratory bird surveys, at 300-meter intervals (Figure 1). The scent stations were evenly divided between the mesa top, which consists of short-grass grassland and tall shrubland communities and the mesa toe, which consists of the mixed-grass grassland community. Stations were checked for tracks of mammalian predators. Two surveys, each lasting three consecutive nights, were conducted during each season. Survey months in 2010 included June, July, September, October, and December. Surveys in 2011 were conducted in January, February, and April. Carnivore camera surveys were also conducted as part of the targeted wildlife species surveys.

Small Mammal Surveys

Small mammal live-trapping was conducted along five transects in three vegetation community types: one in short-grass grassland, three in ravine shrubland, and one in mixed-grass grassland (Figure 1). Two survey sessions were conducted: July 12 to 15, 2010, and April 25 to 28, 2011. Each survey took place over three consecutive nights. One hundred and fifty (150) Sherman live traps were placed five-meters apart along the five transects, resulting in a total of 450 trap nights for each survey session, 900 trap nights for the year.

The protocol employed standard field procedures for small mammal trapping and followed the guidelines approved by the Animal Care and Use Committee of the American Society of Mammalogists (Sikes et al. 2011). Traps were baited with sweet horse feed, and a ball of polyester batting was placed inside each trap for insulation and bedding to prevent hypothermia in captured animals.

The traps were inspected each morning, the species, sex, and age of each trapped animal was determined and recorded. The animals were released at the trap station, and the traps were closed, and then reopened late in the day. Traps were washed at the end of the trapping session in a 10 percent bleach solution to prevent transmission of hantavirus (Mills et al. 1995).

Reptile and Amphibian Survey

Any reptiles and amphibians encountered on site during any field efforts were identified to species and recorded.

Terrestrial Arthropod Survey

Surveys for Special Status arthropod genera were conducted in appropriate habitats. Surveys occurred concurrently with, or after, bird surveys during the summer of 2010 and spring of 2011.

Taxa were identified to species where possible, and to genera if not possible. Surveys followed an adapted protocol for butterfly monitoring developed by the Smithsonian Conservation and Research Center (McShea 2008); and were only conducted during optimal conditions of 70° to 90° Fahrenheit, little or no wind, and sky conditions greater than 50 percent sunlight. All occurrence locations were recorded with a GPS receiver unit, along with the number of individuals, habitat, weather conditions, and time of observation. Catch-and-release netting by trained Walsh personnel was to be conducted only when a positive identification could not be obtained visually, thus minimizing the risk of injury to the subject. Photographs of detection sites and individuals were obtained, when time permitted, and camera use was proposed by Walsh and not contractually required.

Targeted Wildlife Species

Targeted surveys were conducted for breeding bird density, nocturnal wildlife (playback for small owls, amphibian call, and bat acoustical), mule deer (in addition to pellet surveys conducted), and carnivores (motion-sensing cameras). Mammalian predator surveys using sifted dirt with a scented predator disc were conducted in the general wildlife surveys. Both the mammalian predator surveys and carnivore camera surveys served to detect predators using two different techniques.

Breeding Bird Density Surveys

Data on breeding birds were collected during five surveys conducted throughout April and May 2011. The survey protocol used in these transect-based bird surveys incorporated data collection methods necessary to analyze bird density with distance sampling (Buckland et al. 1993), which provides estimates of bird densities and recognizes that not all birds present during the sampling are detected.

Eight 250-meter transects were walked during each of the five visits. Previously established bird survey points (SAIC 2005) were selected as origins for these eight transects. The end points of transects were randomly selected to be evenly spaced within the site, including using some parts of previously established transects (Figure 2). All bird species seen or heard along each transect were recorded, and their distance from the transect line was estimated to the nearest meter using a calibrated Bushnell laser rangefinder. The sighting angle was measured from the transect line with a protractor mounted to a clipboard. Sampling occurred for 3.5 hours after sunrise. Sampling was not conducted in inclement weather.

Program DISTANCE (Thomas et al. 2010) was used to generate bird density estimates. Species' detection function was modeled, based on exact distance values, using the robust models suggested by Buckland et al. (2001). A key function (half-normal, hazard, or uniform) with possible adjustment terms (cosine or polynomial) were used to model the detection function. The best model was then selected using Akaike's information criterion (AIC), and by inspecting probability density functions and Chi-squared Goodness-of-Fit statistics (Buckland et al.1993).

Densities could only be generated for five individual species due to inadequate observation numbers for other species. In addition, the breeding bird data were analyzed in program DISTANCE as clusters, rather than individuals, as advised by Buckland et al. (2001). A cluster is defined as more than one individual at the same location. For example, a pair of American robins (*Turdus migratorius*) is considered a cluster of two. Also to remain consistent with distance sampling methods, flyovers were not analyzed. An individual is considered a flyover when it was in the air when first observed.

Nocturnal Surveys

Nocturnal surveys were conducted for owls, amphibians, and bats. Survey locations are shown in Figure 2. Nocturnal playback surveys for owls followed a protocol adapted from the U.S. Forest Service (Francis and Bradstreet 1997) for species likely to occur at STM. Playback stations were located in potential eastern screech-owl (*Megascops asio*) habitat. After discussions with Steve Jones, the coordinator for the metro area portion (Region 16) of the Colorado Breeding Bird Atlas II, Great horned owls (*Bubo virginianus*) were not considered for surveys as this commonly occurring species is widely distributed in Colorado and expected for the site. Playback/response surveys were conducted on March 9 and 10, 2011, corresponding to the regional peak period of calling activity for eastern screech-owls. Playback/response involved playing 30-seconds of a recorded call of the species followed by 30-second intervals of listening, repeated for a total of ten minutes at each point.

Amphibian call surveys, following protocol from the U.S. Geological Survey (Droege 2010), occurred on June 7 and 9, 2010. Surveys were conducted along a series of predetermined stops near wetlands, 30 to 60 minutes after sunset. After a minute of waiting to reduce disturbance, observers started a three- to five-minute listening period. The observers recorded all species heard vocalizing. Each record included a calling index value adapted for use across North America: 0 = no frogs of a given species can be heard calling; 1 = individual calls, not overlapping; 2 = calls are overlapping; but individuals are still distinguishable; 3 = numerous frogs can be heard, chorus is constant and overlapping.

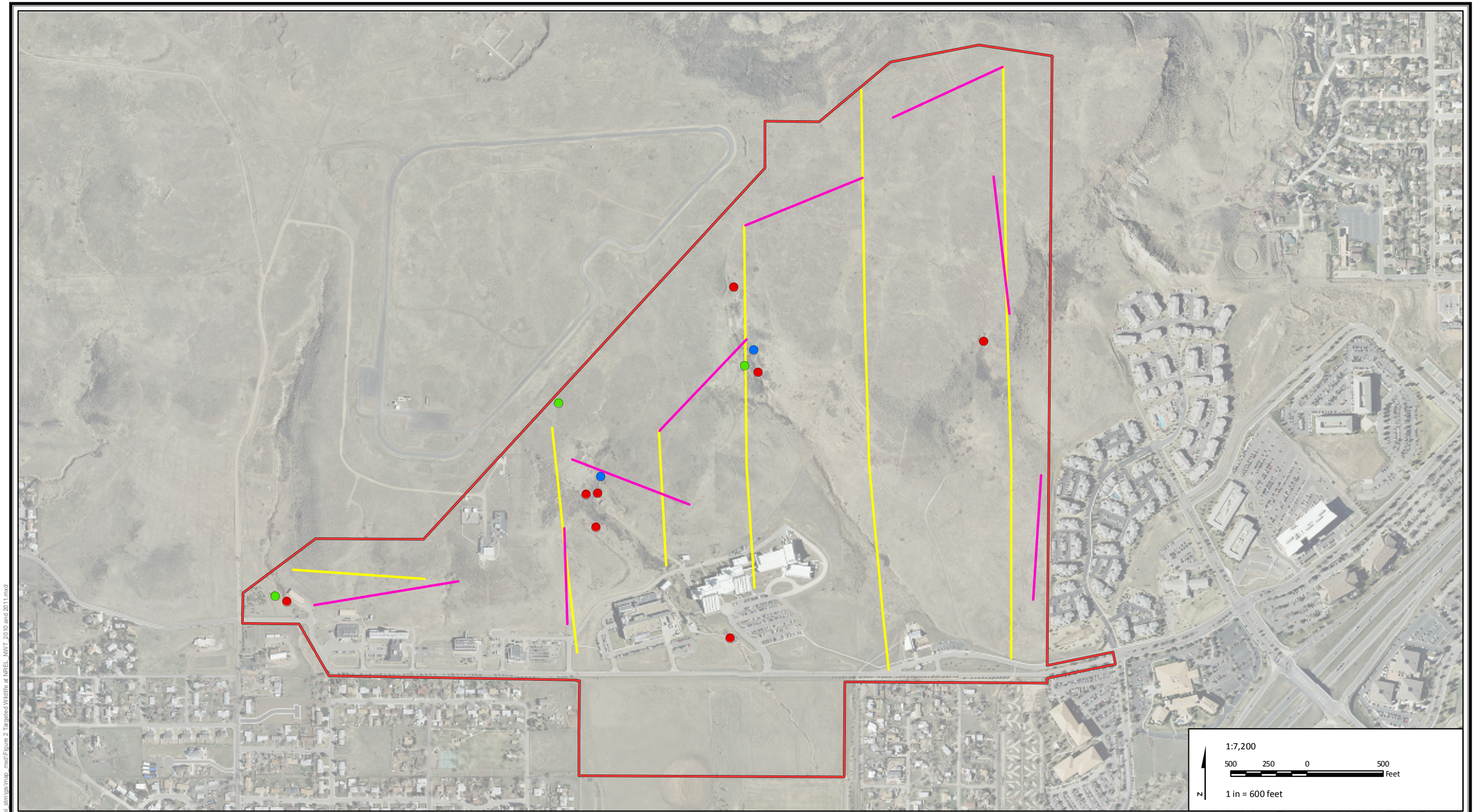
Walsh's acoustical bat monitoring specialists conducted handheld acoustical surveys for bats using AnaBat™ bat detectors. During surveys, hand-held detectors recorded sonograms of any bats detected. Bat surveys occurred concurrently with amphibian call surveys June 7 and 9, 2010.

Mule Deer Surveys

Results of this survey augmented the sampling conducted for large mammal surveys by adding summer and winter surveys for mule deer (*Odocoileus hemionus*) use and relative abundance. Mule deer seasonal use surveys were conducted in the summer and winter. The protocol involve walking the entire site one day each in July 2010 and December 2010 using the previously established six large mammal survey transects, as well as areas in-between, walked to access the next transect (Figure 2). In addition, other areas of mule deer use were included in the survey, as appropriate based on observed activity. Field-map data sheets with aerial coverage of the site were used to document their location and numbers during each survey.

Carnivore Camera Surveys

Walsh used five Trailmaster motion-detecting camera setups with monitors for the carnivore surveys. The monitors are passive sensing units that detect infrared and microwave wave frequencies. Monitors record all interruption incidents of a cone-shaped beam and trigger the camera. Surveys occurred in each of the four seasons: June, September, and December 2010, and April 2011. Five survey locations were selected based on potential carnivore high use areas as evaluated by topography, tracks observed, vegetation, and staff knowledge (Figure 2). The equipment was attached to existing trees using non-permanent straps and clamps. Each survey took place over four consecutive nights. Camera film was developed to assess what animals, including carnivores, were present on the site. Mammalian predator track surveys were also conducted as part of the general wildlife species surveys, and together these two methods gave insight into carnivore presence and use.



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- Nocturnal Owl Stations
- Bat & Amphibian Stations
- Carnivore Camera Stations
- Breeding Bird Density Transects
- Mule Deer Transects
- STM Boundary

Figure 2. Targeted Wildlife Species Stations and Transects, NREL South Table Mountain Site, 2010 and 2011

U:\Projects\090758.0001\020_nrel_stm\gis\mxd\Figure 2 Targeted Wildlife at NREL_NWT_2010 and 2011.mxd

RESULTS

Vegetation Mapping

The majority of vegetation at STM belongs to the grassland community type. Within that association, there are two distinct community types: short-grass grassland on the mesa top and mixed-grass grassland located on the slopes and toe area. Other mapped vegetation communities at STM include ravine shrubland, tall shrubland, short shrubland, and wetlands. The plant communities are described below and mapped as illustrated in Figure 3.

Grasslands

Grasslands are the predominant habitat on the STM site. In general, the grassland areas throughout the site have similar species composition. A list of the plant species found in the STM grasslands is located in Table 1 of Appendix A.

Short-grass grassland

The short-grass grassland is found on the flat top of the mesa. The dominant grass species are blue grama (*Chondrosum gracile*), a native prairie species and cheatgrass (*Anisantha tectorum*), a noxious weed (Photo 1). Populations of diffuse knapweed (*Acosta diffusa*) and Dalmatian toadflax (*Linaria genistifolia* subsp. *dalmatica*) are scattered throughout the whole community. These two noxious weeds comprise approximately one percent of the short-grass. Alyssum (*Alyssum parviflorum*), an introduced species, is the dominant forb. Several species of prickly pear cactus (*Opuntia fragilis, O. macrorhiza, O. phaeacantha,* and *O. polyacantha*) occur throughout the shortgrass mesa top as well as hen-and-chicks (*Echinocereus viridiflorus*) and pincushion cacti (*Coryphantha missouriensis* and *C. vivipara* var. *vivpara*). Well-draining hillocks (small hills) often support thick stands of needle-and-thread grass (*Hesperostipa comata*) and yucca (*Yucca glauca*). Some short shrubs such as rubber rabbitbrush (*Chrysothamnus nauseosus* subsp. *graveolens*), chokecherry (*Padus virginiana*), and skunkbrush (*Rhus aromatica* subsp. *trilobata*) occur infrequently in the shortgrass area and concentrate along the rimrock areas as do several of large hackberry trees (*Celtis reticulata*) at the very edge of the mesa top.

Mixed-grass grassland

The mesa slopes and toe areas on the STM site also support blue grama and cheatgrass but are dominated by a mixed-grass species association of needle-and-thread grass and western wheatgrass (*Pascopyrum smithii*), with smaller amounts of big bluestem (*Andropogon gerardii*), side-oats grama (*Bouteloua curtipendula*), three-awn (*Aristida purpurea*), and green needle grass (*Nassella viridula*) (Photo 2). As in the short-grass areas, a large number of forbs also occur in the mixed-grass grassland.

A few patches of anomalous vegetation occur within the mixed-grassland, where subsurface water appears to be closer to the surface than in most of the area. These areas support wide swaths of mat muhly (*Muhlenbergia richardsonis*). One is located on a southern-facing slope, near the eastern property boundary. The other is located on a southwestern-facing slope of the ravine north of the Visitor Center. This area is notable for a large population of poison ivy (*Toxicodendron rydbergii*), which grows in thickets of tall (one meter and larger) plants that have a woody, shrublike, growth form. A small number of plains cottonwood (*Populus deltoides)* saplings, skunkbrush, chokecherry, and snowberry (*Symphoricarpos occidentalis*) occur in this patch as well.

The mixed-grass areas grade into both the upland and ravine shrublands and contribute the majority of the understory in these areas. Some mixed-grass areas also blend into disturbed areas,

where reclamation species such as crested wheatgrass (*Agropyron cristatum*) and smooth brome (*Bromopsis inermis*) have been planted and have subsequently spread into the mixed-grass community. Crested wheatgrass and smooth brome tend to outcompete native species, form monocultures, and diminish habitat diversity. These two grass species were widely used, historically, in reclamation efforts. However, native grass seeding mixes are now used which no longer include these invasive grass species.

Upland Shrublands

Shrubland habitat occurs along the upper sides of ravines, and on the steeper mesa slopes, becoming more prominent as elevation increases up to the top of the mesa. The upland shrubland habitat, which excludes the shrublands in the ravine bottoms, comprises tall shrubland and short shrubland communities, very similar in overall composition but distinguished by the dominant species. Tall shrublands were dominated by mountain-mahogany (*Cercocarpus montanus*) and cheatgrass and short shrublands were dominated by rubber rabbitbrush and skunkbrush. A list of the plant species found in the STM shrublands is located in Table 2 of Appendix A.

Tall Shrubland

The tall shrubland areas are defined by stands of mountain-mahogany that occur along the rim of the mesa, usually where volcanic cap rock is exposed, and on the upper mesa slopes below rimrock areas (Photo 3). The understory is notably sparse throughout this community, with a large amount of bare soil. Cheatgrass is the most common herbaceous species in these areas, intermixed with needle-and-thread grass, yucca, and many cacti.

Short Shrubland

The short shrublands occur on elevated flat areas amidst the surrounding grasslands, some of which appear to have experienced surficial disturbance in the past (Photo 4). These areas are distinctive because of their dominance by rubber rabbitbrush. The other common location for short shrublands is on the outer slopes of the ravines. Skunkbrush defines these and other short shrublands along the upper portions of the steepest slopes of the mesa. These communities usually grade into the ravine shrublands along the drainage bottoms and the tall shrublands near the top of the mesa slopes. The short shrubland community also has a sparse understory of the same grasses and forbs as the tall shrub community.

Ravine Shrublands

Ravine shrublands are limited to the lower sides and bottoms of the drainages that cut down through the mesa slopes (Photos 5 and 6). These communities support a variety of shrubs such as skunkbrush, chokecherry, and wild plum (*Prunus americana*), often growing in dense, impassible thickets. A few plains cottonwoods and peach-leaf willow (*Salix amygdaloides*) trees occur at the top of the ravine channels and in other portions of the channel where the subsurface water table appears to be relatively high. A diverse herbaceous component is found in these drainages. In one instance near the southeast site boundary, a ravine shrubland grades into an ephemeral drainage at the toe of the mesa. This drainage is vegetated with grassland species and contains only occasional surface water run-off. A list of the plant species found in the ravine shrublands is located in Table 3 of Appendix A.

Wetlands

Five very small communities on the STM site were found to support wetland vegetation. These communities were not examined for the soils and hydrology that would classify them as functioning wetlands; rather they are noted only for their domination by wetland vegetation.

These are limited to very small areas (less than half an acre in total). One is in a shallow swale at the mouth of the ravine at the southwestern corner of the project boundary (Figure 3) where surface water and/or subsurface drainage have created a pocket of saturated soil. Species here include sedges (*Carex* spp.), rushes (*Juncus* spp.), bulrush (*Schoenoplectus* sp.), and peach-leaf willow (Photos 7 and 8). The second wetland could have formed as a result of past construction activities. This linear depression supports wetland vegetation along the central portion of the western site boundary, northeast of the Solar Industrial Mesa Test Area. Perhaps where equipment was once staged, this area appears to hold seasonal water for enough consecutive growing seasons to support some wetland vegetation including arctic rush (*Juncus arcticus*), American speedwell (*Veronica americana*), and broadleaf cattail (*Typha latifolia*) (Photo 9). A list of the plant species found in the wetlands is located in Table 4 of Appendix A.

The wetland at the mouth of the ravine may no longer experience the hydrology that originally allowed these plants to establish there. In 2002, this plant community supported populations of cattails that were not observed in 2010.

Three small seeps are located on the hill slope between the Visitor Center and the public trail on the far eastern boundary of the site. These seeps are dominated with sedges, rushes, and Canada thistle *(Breea arvensis)*.

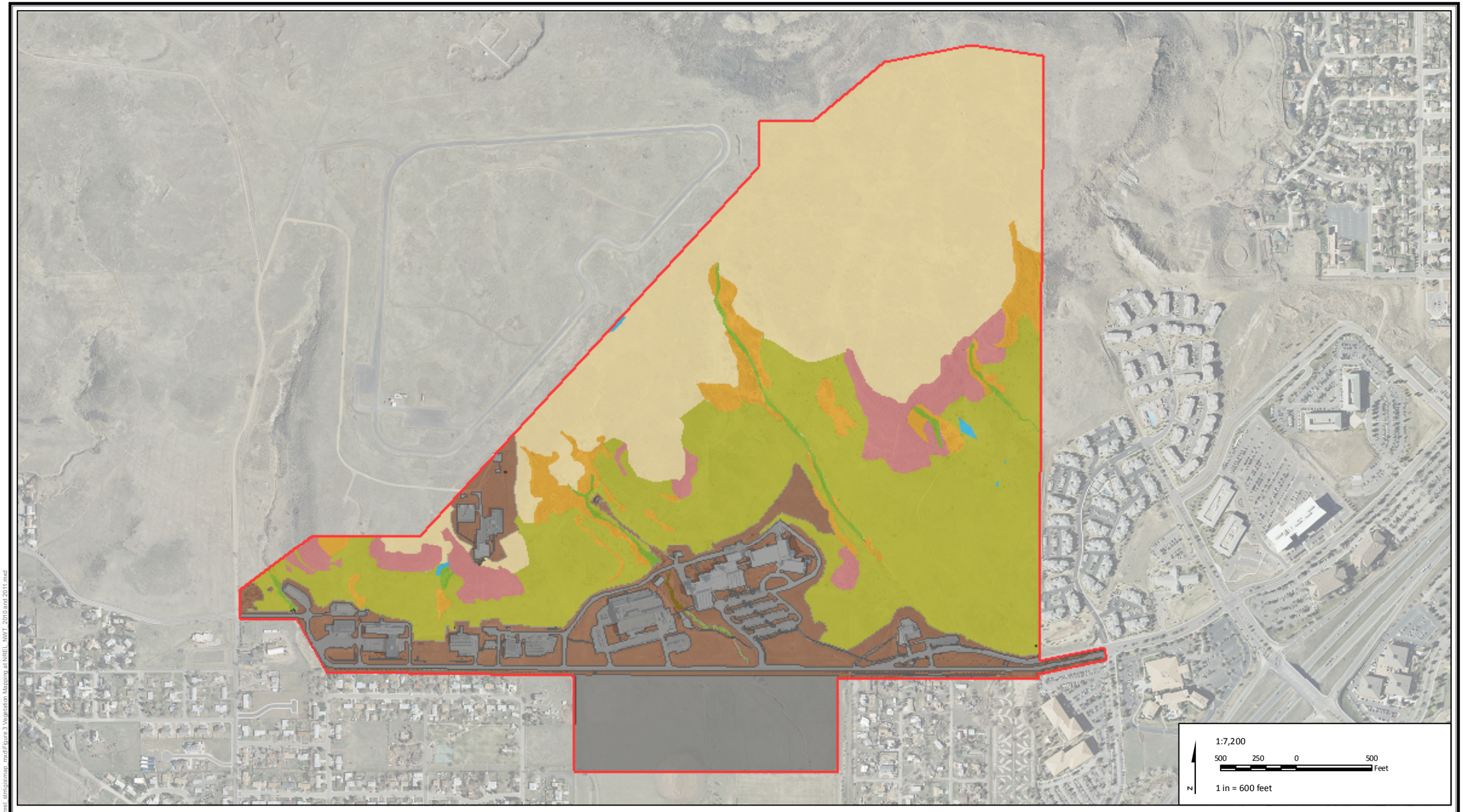
A seventh wetland community that was observed by Plantae (2002), but no longer appears to support wetland vegetation. In 2002, cattail species near an old stocktank in the eastern-most drainage appeared to have been suppored by a pipe coming out of the hillside. Although the stocktank was observed in 2010, it appears the cattails have not persisted in the intervening years.

Disturbed/Reclaimed

This habitat type comprises all of the areas at the site that have experienced surface disturbance to vegetation caused by human activities (Photo 10). These mostly occur on the perimeter of the buildings, roads, parking lots, and soil dumping areas. Most of these areas appear to have been re-vegetated and support a combination of native grassland plants, planted ornamental revegetation species, and native and introduced weeds. The former Forest Service tree farm in the southwestern corner of the site was included in this habitat type because the surface has been disturbed in the past and a number of non-native trees still persist in this area. A list of the plant species found in the disturbed/reclaimed community is located in Table 5 of Appendix A.

Developed

Developed areas comprise the human-constructed, non-vegetated portions of the site. These include parking lots, buildings, and paved roads. Developed areas do not constitute plant communities and are therefore not listed in Appendix A. However, these areas also support trees, shrubs, and herbaceous plants including grasses and forbs.



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STM Boundary
Buildings/Roads/Structures
Disturbed Areas

Plant Communities
Mixed-Grass Grassland
Ravine Shrublands

Short-Grass Grassland
Short Shrubland
Tall Shrubland

Wetlands

Figure 3. Vegetation Map, NREL South Table Mountain Site, 2010 and 2011

U:\Projects\900758.0001.020_nrel_stm\gis\map_mxd\Figure 3 Vegetation Mapping at NREL_NWT_2010 and 2011.mxd

Noxious Weeds

Weed species that occur on the STM site are listed in Table 1. Mapped weed populations are illustrated in Figure 4. The noxious weeds found on the site vary from small isolated populations to species that are widespread and dominate entire plant communities. Myrtle spurge (*Euphorbia myrsinites*), common teasel (*Dipsacus fullonum*), whitetop (*Cardaria draba*), Russian-olive (*Elaeagnus angustifolia*), and scotch thistle (*Onopordum acanthium*) occur in single or isolated populations. By comparison, dalmation toadflax and diffuse knapweed are found throughout the site, frequently occurring as single individuals dotting the landscape. Canada thistle and hound's tongue (*Cynoglossum officinale*) are routinely found in each of the drainages.

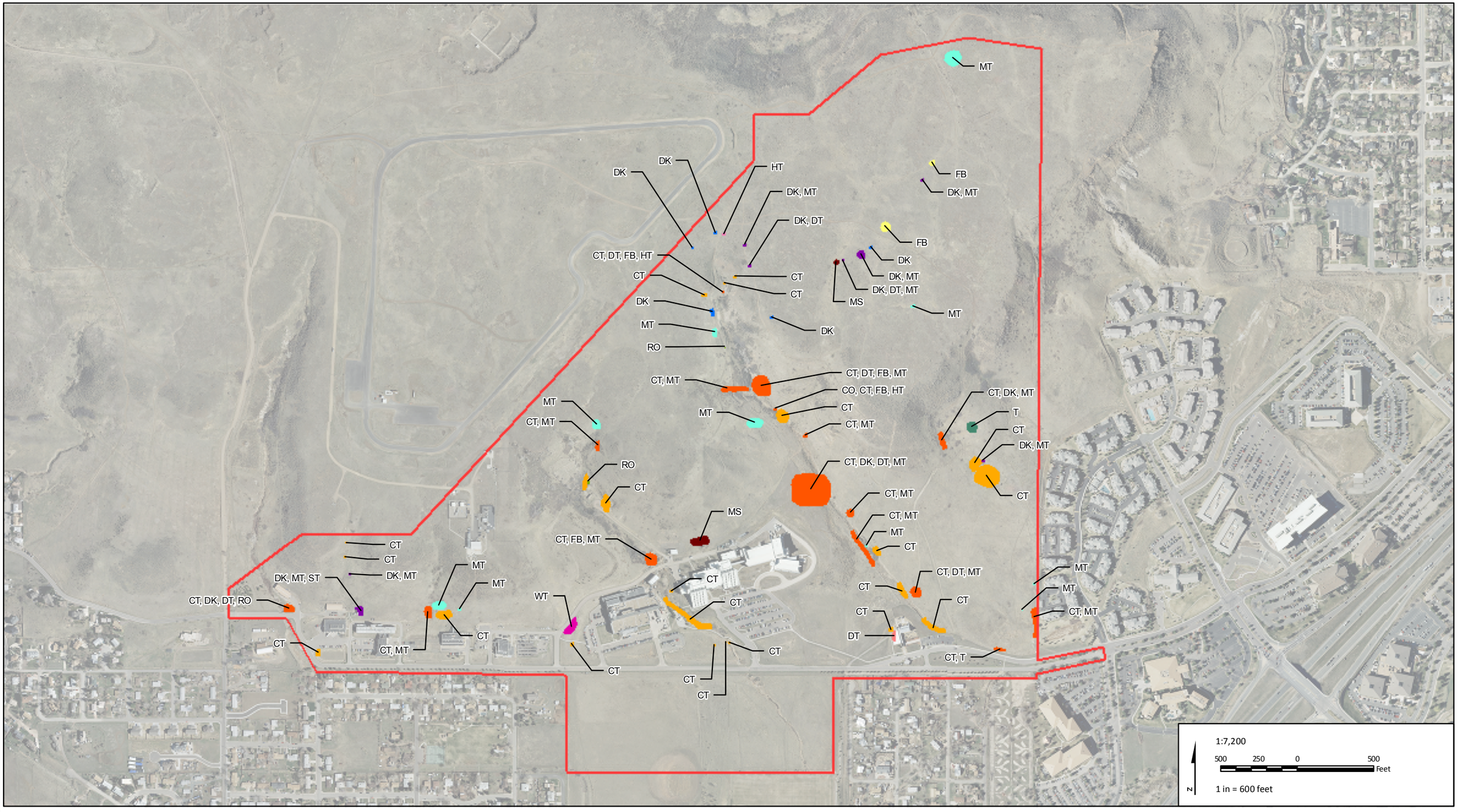
Cheatgrass is found in large populations throughout the entire site and completely dominates the mesa top. This noxious weed has significantly reduced plant diversity and has notably crowded out the short-grass grassland species.

Table 1. Noxious Weed Species Identified at the NREL South Table Mountain Site, June 2010

Common Name	Scientific Binomial	Estimated Area (acres)
Canada thistle	*Breea arvensis*	2.8
Cheatgrass	*Anisantha tectorum*	*
Common teasel	*Dipsacus fullonum*	0.06
Dalmatian toadflax	*Linaria genistifolia* subsp. *dalmatica*	1.3
Diffuse knapweed	***Acosta diffusa***	1.1
Field bindweed	***Convolvulus arvensis***	0.4
Hound's tongue	*Cynoglossum officinale*	0.001
Musk thistle	***Carduus nutans***	2.1
Myrtle spurge	*Euphorbia myrsinites*	0.1
Russian-olive	*Elaeagnus angustifolia*	0.04
Scotch thistle	***Onopordum acanthium***	0.03
Whitetop	***Cardaria draba***	0.1

Species in bold font are on the list of top ten priority-for-control weeds for Colorado.

*Cheatgrass was pervasive throughout the site and was not specifically mapped. **Diffuse knapweed was found throughout the site and estimated area is for higher densities of plants per square meter.



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- STM Boundary
- CT-Canada Thistle
- Canada Thistle/Other Species (See Label)
- DT-Dalmation Toadflax
- DK-Diffuse Knapweed
- Diffuse Knapweed/Other Species (See Label)
- FB-Field Bindweed
- HT-Hound's Tongue
- MS-Myrtle Spurge
- MT-Musk Thistle
- RO-Russian Olive
- T-Common Teasel
- WT-White Top (ST=Scotch Thistle)

Figure 4. Weed Map, NREL South Table Mountain Site, 2010 and 2011

U:\Projects\000758.0001.020_nrel_stm\gis\mxds_mxd\Figure 4 Weed Mapping at NREL_NWT_2010 and 2011.mxd

Wildlife Survey Results

Thirteen different types of wildlife surveys were conducted over a period of 12 months at STM. Table 2 summarizes the seasons during which each survey was conducted.

Table 2. Wildlife Survey Seasons, NREL South Table Mountain Site, 2010-2011

Survey Type	Season				
	Summer 2010	Fall 2010	Winter 2010-2011	Spring 2011	Summer 2011
Bird	X	X	X	X	
Raptor		X		X	
Large Mammal				X	
Mammalian Predator	X	X	X	X	
Small Mammal	X				
Reptile and Amphibian	X	X	X	X	X
Terrestrial Arthropod	X	X	X	X	X
Breeding Bird Density					X
Nocturnal Owl				X	
Nocturnal Amphibian	X				
Acoustical Bat	X				
Mule Deer	X		X		
Carnivore Camera	X	X	X	X	

Table 3 summarizes all wildlife observations, as well as those from 1987 (FORUM 1987) and 2004/2005 (SAIC 2005), regardless of sampling regime, and includes incidental observations.

In 2010/2011 a total of 102 species were observed for all wildlife surveys conducted on STM. This includes five species of herptiles, 86 species of birds, and 11 species of mammals. Comparisons to earlier surveys are addressed in the discussion.

Table 3. Wildlife Survey Results, NREL South Table Mountain Site, 2010-2011

SPECIES COMMON NAME	Seen in 1987	Seen in 2004/05	SEASON AND VEGETATION TYPE OF OCCURRENCE[1]																										
			Summer 2010 May, June, July							Fall 2010 August September, October							Winter 2010-2011 November, December, January							Spring 2011 February, March, April						
			SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D
REPTILES AND AMPHIBIANS																													
Bull snake	X																												
Plains garter snake	X	X																											
Prairie lizard																									X				
Racer				X																									
Six-lined racerunner		X																											
Tiger salamander		X																										X	
Western rattlesnake	X	X		X	X			X																					
Woodhouse's toad			X																										
BIRDS																													
American crow		X																						X					
American goldfinch												X																	
American kestrel	X	X	X	X	X		X	X		X	X	X		X		X	X	X			X	X			X			X		X
American pipit[3]																													
American redstart							X																						
American robin[2]	X	X					X	X		X																			
American tree sparrow		X																			X								
American white pelican[3]																													
Barn swallow[2]					X			X	X		X	X												X					
Black-billed magpie[2]	X	X	X	X	X		X	X	X				X			X									X	X	X	X		X

SPECIES COMMON NAME	Seen in 1987	Seen in 2004/05	SEASON AND VEGETATION TYPE OF OCCURRENCE[1]																										
			Summer 2010 May, June, July							Fall 2010 August September, October							Winter 2010-2011 November, December, January							Spring 2011 February, March, April						
			SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D
Black-capped chickadee		X																											
Black-crowned night heron		X																											
Black-headed grosbeak[2]																												X	
Blue-gray gnatcatcher[2]					X			X																		X		X	
Blue jay		X							X							X													
Brewer's blackbird[2]	X															X								X					
Brewer's sparrow[2]										X	X	X																X		X
Broad-tailed hummingbird[2]										X		X																		
Broad-winged hawk[2]																												X		
Brown-headed cowbird[2]	X	X			X		X	X	X																	X		X		X
Bullock's oriole[2]		X	X	X		X	X	X	X																X			X		
Bushtit[3]												X																		
California gull		X																											
Canada goose		X															X													
Cedar waxwing					X																									
Cassin's kingbird[3]												X																		
Chestnut-collared longspur										X																				
Chipping sparrow[2]										X	X			X		X										X				
Cliff swallow[2]			X																											
Common grackle									X															X						X

SPECIES COMMON NAME	Seen in 1987	Seen in 2004/05	SEASON AND VEGETATION TYPE OF OCCURRENCE[1]																										
			Summer 2010 May, June, July							Fall 2010 August September, October							Winter 2010-2011 November, December, January							Spring 2011 February, March, April						
			SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D
Common nighthawk	X	X	X																										
Common raven[2]		X																							X				
Wilson's snipe		X																											
Cooper's hawk		X										X				X													
Dark-eyed junco		X																	X		X							X	
Double-crested cormorant[2]																													
Downy woodpecker																													
Eastern kingbird			X	X																									
European starling[2]	X	X		X			X		X					X		X					X				X			X		X
Unidentified flycatcher		X																											
Golden eagle		X																											
Grasshopper sparrow			X																										
Great blue heron		X																											
Green-tailed towhee[2]					X							X	X	X												X				
Hepatic tanager							X																						
Hermit thrush[3]																										X			
Horned lark[2]	X																							X					
House finch[2]		X	X	X			X	X	X	X	X	X		X		X	X	X	X		X	X	X		X	X	X			X
House sparrow[2]		X		X			X	X	X														X							X
House wren[2]							X	X						X														X		
Killdeer[2]	X	X	X																					X						

SPECIES COMMON NAME	Seen in 1987	Seen in 2004/05	SEASON AND VEGETATION TYPE OF OCCURRENCE[1]																										
			Summer 2010 May, June, July							Fall 2010 August September, October							Winter 2010-2011 November, December, January							Spring 2011 February, March, April						
			SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D
Lark bunting	X	X																											
Lark sparrow[2]										X														X		X				
Lazuli bunting			X	X	X		X							X																
Lesser goldfinch				X			X		X		X	X			X															
Loggerhead shrike[2]		X																						X		X				
MacGillivray's warbler		X					X							X																
Mallard[2]		X																							X					
Mountain bluebird[2]	X	X	X																											
Mountain chickadee[3]																														
Mourning dove[2]	X	X	X	X	X		X		X	X		X	X	X		X									X			X		X
Northern flicker[2]	X	X	X					X	X	X				X							X		X	X				X		
Northern goshawk[4]																														
Northern harrier		X								X		X																		
Northern Mockingbird[5]																														X
Osprey		X																												
Peregrine falcon[4]																														
Pine siskin														X																
Prairie falcon		X										X									X									
Red-breasted nuthatch		X																												
Red-tailed hawk	X	X					X																							
Red-winged blackbird[2]	X																							X				X		

SPECIES COMMON NAME	Seen in 1987	Seen in 2004/05	SEASON AND VEGETATION TYPE OF OCCURRENCE[1]																										
			Summer 2010 May, June, July							Fall 2010 August September, October							Winter 2010-2011 November, December, January							Spring 2011 February, March, April						
			SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D
Rock pigeon[2]		X		X					X			X				X							X							X
Rock wren[2]		X								X	X	X	X	X													X	X			
Ruby-crowned kinglet																													X		
Sage thrasher										X		X																X			
Say's phoebe[2]		X		X		X			X	X	X			X										X	X			X	X	X
Sharp-shinned hawk																											X	X			X
Spotted towhee[2]		X			X	X	X						X	X													X				
Swainson's hawk[4]		X																													
Tree swallow																															
Turkey vulture[2]		X																													
Unidentified Buteo sp.[4]																															
Unidentified falcon sp.																															
Unidentified sparrow sp.		X																													
Unidentified sparrow sp.		X																													
Unidentified species																															
Unidentified warbler																															
Vesper sparrow[2]		X	X							X		X	X											X		X	X				
Virginia's warbler														X													X				
Violet-green swallow[2]							X																								X
Western kingbird[2]	X	X	X	X	X		X	X			X													X	X						X
Western meadowlark[2]	X	X	X	X			X			X	X	X												X	X	X	X	X			X

SPECIES COMMON NAME	Seen in 1987	Seen in 2004/05	SEASON AND VEGETATION TYPE OF OCCURRENCE[1]																									
			Summer 2010 May, June, July							Fall 2010 August September, October							Winter 2010-2011 November, December, January							Spring 2011 February, March, April						
			SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D
Western scrub-jay[2]		X					X							X		X					X							X		
White-crowned sparrow[2]		X																			X						X	X		
White-faced ibis[3]																															
White-throated swift[3]																															
Yellow-breasted chat							X																								
Yellow-rumped Warbler												X												X							
Mammals																															
Black-tailed jackrabbit	X		X																												
Bushy-tailed woodrat	X																														
Coyote	X	X	X							X							X	X						X	X						
Deer Mouse	X		X				X																	X				X			
Fox squirrel		X																													
Long-tailed weasel		X																													
Mexican woodrat		X	X				X																					X			
Mountain cottontail	X	X						X											X												X
Mule deer	X	X	X	X	X	X	X			X		X	X	X			X		X	X	X			X		X		X			
Prairie vole	X	X																													
Raccoon	X	X												X																	
Red Fox	X		X						X	X	X	X					X	X	X					X	X						
Striped skunk																	X		X												

SPECIES COMMON NAME	Seen in 1987	Seen in 2004/05	SEASON AND VEGETATION TYPE OF OCCURRENCE[1]																										
			Summer 2010 May, June, July							Fall 2010 August September, October							Winter 2010-2011 November, December, January							Spring 2011 February, March, April						
			SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D	SG	MG	TS	SS	RS	D/R	D
Western harvest mouse	X	X																										X		
Western spotted skunk																										X				
White-tailed jackrabbit		X																												
Yellow-belied marmot	X																													

Notes: This table includes results from wildlife surveys conducted on site in 1987 and 2004-2005, as well as incidental observations of species on site. Vegetation type(s)in which the species were observed is included, if available

[1] Vegetation type codes follow Plantae Consulting Services 2002 and are as follows: SG - Short grass; MG - Mixed grass; TS - Tall shrubland; SS - Short shrubland; RS - Ravine shrubland; D/R - Disturbed/reclaimed; D – Developed

[2] Species observed during breeding bird surveys spring 2011.

[3] Incidental sighting, observed independently of point counts or distance sampling 2010 and 2011.

[4] Raptor species only observed during raptor migration surveys only 2010 and 2011.

[5] Observed by NREL biologists in early summer 2011.

Species observed in this season; no specific vegetation type information available, or flyover.

General Wildlife Surveys

Birds

A total of 65 avian species were detected. The western meadowlark *(Sturnella neglecta)* was the most abundant species detected, and accounted for 12.5 percent of the total number of birds detected during avian point counts in 2010-2011. Rock pigeons *(Columba livia)* accounted for 11.8 percent, house finches *(Carpodacus mexicanus)* accounted for 10.9 percent, and black-billed magpies *(Pica hudsonia)* accounted for 9.2 percent of observations.

Avian species richness, diversity (dominance) and evenness are summarized in Table 4. In fall 2010 and spring and summer 2011, a similarly high richness of approximately 40 species was observed. Fourteen species were observed in winter. The total number of detected birds (n) was also similar in spring, summer and fall (310, 337, and 338, respectively). The species diversity (dominance) was highest in the spring, summer, and fall (15.17, 14.95 and 12.35, respectively) and lowest in winter (3.86).

Table 4. Avian Species Richness, Diversity (Dominance) and Evenness, Point Count Surveys, NREL South Table Mountain Site, 2010-2011

SAIC Avian Point Count Data 2004-2005[5]					Walsh Avian Point Count Data 2010-2011				
Season	Species Richness[1]	n	Species Diversity[2] (Dominance)	Species Evenness[3]	Season	Species Richness[1]	n	Species Diversity[2] (Dominance)	Species Evenness[3]
Spring 2004	20	164	6.5	0.33	Spring 2011	40	310	15.17	0.38
Summer 2004	20	193	7.6	0.39	Summer 2010	41	337	14.95	0.36
Fall 2004	23	121	8.5	0.37	Fall 2010	37	338	12.35	0.33
Winter 2004-2005	13	58	6.1	0.47	Winter 2010-2011	14	191	3.86	0.28

[1] Species richness: the number of species observed.

[2] Species diversity (dominance): a measurement of dominance which assesses the probability that two randomly selected individuals from a community will belong to the same species.

[3] Species evenness: a measure of the relative abundance of the different species making up the richness of an area.

Raptors

A total of 29 individual raptors, comprising 10 species, were observed during the fall 2010 migration surveys (Table 5). Of the 29 individuals, 12 exhibited migratory behavior and 17 were considered local raptors. During the spring 2011 surveys a total of 15 individuals, comprising seven species, were observed. Nine individuals exhibited migratory behavior and six exhibited local behavior. The passage rate for migrant raptors was 1.50 and 1.13 raptors per hour for fall and spring, respectively, with an overall mean passage rate for both seasons combined of 1.31 raptors per hour.

No nesting raptors were found within the boundaries of STM during spring 2011 surveys.

Table 5. Raptor Survey Results, NREL South Table Mountain Site, 2010 and 2011

Species	Fall 2010 Total (local)*	Spring 2011 Total (local)*	Total (local)*
Turkey vulture (*Cathartes aura*)	3 (0)	-	3 (0)
Osprey (*Pandion haliaetus*)	-	1 (1)	1 (1)
Sharp-shinned hawk (*Accipiter striatus*)	1 (1)	3 (0)	4 (1)
Cooper's hawk (*Accipiter cooperii*)	3 (1)	4 (0)	7 (1)
Northern goshawk (*Accipiter gentilis*)	1 (0)	-	1 (0)
Broad-winged hawk (*Buteo platypterus*)	-	1 (0)	1 (0)
Swainson's hawk (*Buteo swainsoni*)	1 (1)	-	1 (1)
Red-tailed hawk (*Buteo jamaicensis*)	5 (5)	3 (3)	8 (8)
Buteo species *(Buteo* sp.)	1 (0)	-	1 (0)
American Kestrel (*Falco sparverius*)	12 (7)	2 (1)	14 (8)
Peregrine falcon (*Falco peregrinus*)	1 (1)	-	1 (1)
Prairie falcon (*Falco mexicanus*)	1 (1)	-	1 (1)
Falcon species *(Falco* sp.*)*	-	1 (1)	1 (1)

Table 5. Raptor Survey Results, NREL South Table Mountain Site, 2010 and 2011

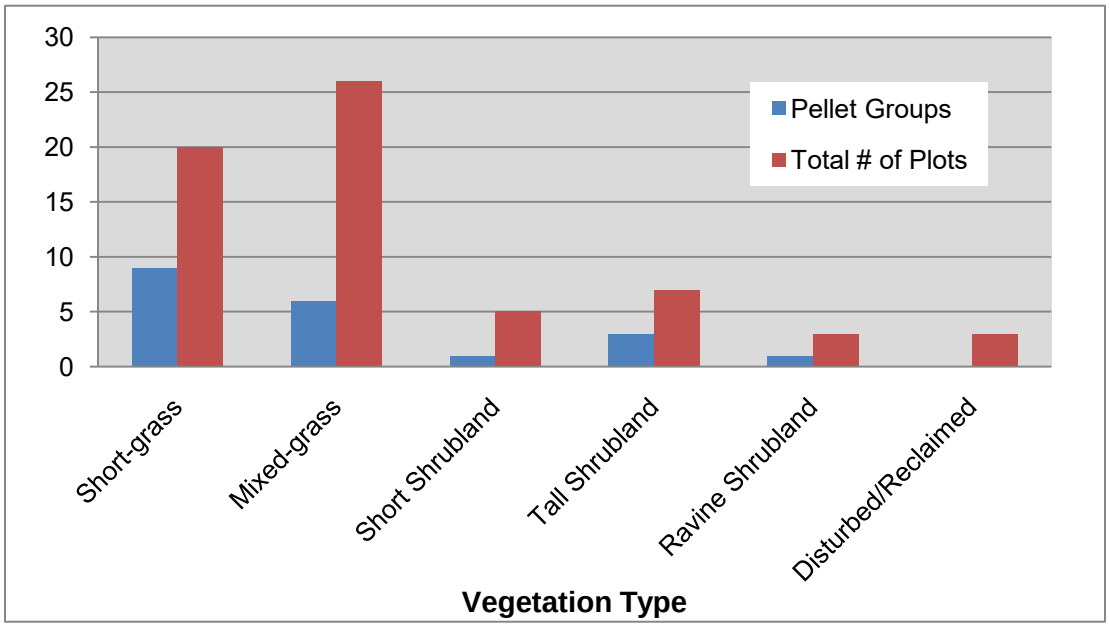
Species	Fall 2010 Total (local)*	Spring 2011 Total (local)*	Total (local)*
Migrant Raptor Total	12	9	21
(Local Raptor Total)	(17)	(6)	(23)
Total Raptors – Migrant and Local	29	15	44
Migrant Passage Rate (raptors per hour)	1.50	1.13	1.31

*Values in parentheses () indicate the subset of total observations that were non-migratory local raptors.

Large Mammals

Results of the large mammal pellet plot counts is summarized by vegetation community in Figure 5. It should be noted that of the 76 pellet plots established 10 plots were vandalized and stakes removed within the short-grass vegetation type on top of the mesa during the spring 2011 survey. In addition, due to the expansion development at NREL, two plots were destroyed from construction activities.

Figure 5. Number of Pellet Groups Observed per Vegetation Type, Large Mammal Surveys, NREL South Table Mountain Site, 2010-2011



The short-grass and mixed-grass grassland vegetation had the highest number of pellets with nine and six groups, respectively. The tall shrubland had three and both the short shrubland and ravine shrubland had one pellet group each.

Mammalian Predators

A total of 40 tracks were detected during the predator surveys (Table 6). These include four species of predators: coyote (*Canis latrans)*, red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), and western spotted skunk (*Spilogale gracilis*). Of the four species, coyote was detected the most with 20 tracks, followed by red fox with 14 tracks, and skunk with four tracks. Two tracks were unidentified. Predator activity was primarily concentrated in the short-grass vegetation on the mesa top with 27 tracks throughout the seasons while the mesa toe had 13 tracks. The winter months had highest activity with 20 different predator tracks detected.

Of the four skunk tracks, one set was noticeably smaller. The three larger tracks are undoubtedly the striped skunk. The third track, observed in April 2011, is attributed to the western spotted skunk.

Table 6. Mammalian Predator Survey Results, NREL South Table Mountain Site, 2010 and 2011

Species	Summer 2010	Fall 2010	Winter 2010-2011	Spring 2011	Total Tracks Observed
Coyote (*Canis latrans)*	1	4	10	5	**20**
Red fox (*Vulpes vulpes*)	2	4	5	3	**14**
Striped skunk (*Mephitis mephitis*)			3		**3**
Western spotted skunk (*Spilogale gracilis*)				1	**1**
Unidentified			2		**2**
Total	**3**	**8**	**20**	**9**	**40**

Small Mammals

Small mammal trapping results are summarized in Table 7. In July 2010, a total of 32 individual small mammals were captured, with seven recaptures over three survey nights. All captures were of Mexican woodrats (*Neotoma mexicana*), with the exception of one deer mouse (*Peromyscus maniculatus*). The woodrats were captured in ravine shrublands on Transects DA and DC (Figure 1), and the deer mouse was captured at the top of Transect DC.

In April 2011, a total of 40 individual small mammals were captured, representing three species (Table 7). There were nine recaptures. Mexican woodrats and deer mice were captured in roughly equal number, and 11 western harvest mice (*Reithrodontomys megalotis*) were captured in ravine shrubland in Transects DA and DB (Figure 1).

The combination of both years reveals a species richness of three: deer mouse, western harvest mouse, and Mexican woodrat. Capture rates were slightly higher in April 2011 than in July 2010.

In 2010, with 450 trap nights and a total of 39 captures (32 individuals and 7 recaptures), there was a 9 percent capture rate. In 2011, there was a total of 49 captures (40 individual captures and 9 recaptures), representing an 11 percent capture rate, and for the two seasons combined, was an overall capture rate of 10 percent.

Table 7. Small Mammal Captures, NREL South Table Mountain Site, 2010 and 2011

Species	Ravine Shrubland	Short-grass Grassland	Mixed-grass Grassland	Total
Summer 2010 (July 12 15)				
Deer Mouse *(Peromyscus maniculatus)*	1	0	0	1
Mexican Woodrat *(Neotoma mexicana)*	30(7)	1	0	31(7)
Total				**32(7)**
Spring 2011 (April 25 28)				
Western Harvest Mouse *(Reithrodontomys megalotis)*	11(1)	0	0	11(1)
Deer Mouse *(Peromyscus maniculatus)*	7	6(3)	0	13(3)
Mexican Woodrat *(Neotoma mexicana)*	16(5)	0	0	16(5)
Total				**40(9)**
2010 and 2011 Combined				
Total				**72(16)**

Values based on 450 trap-nights per season, or 900 trap-nights for both years combined. There were 3 closed traps in 2010 and 10 closed traps in 2011. Values in parentheses ( ) indicate recaptures.

Reptiles and Amphibians

Only three species of reptiles were found: western rattlesnake (*Crotalus viridis*), racer (*Coluber constrictor*), and prairie lizard (*Sceloporus* sp.). Woodhouse's toad (*Bufo woodhousii*) and tiger salamander (*Ambystoma tigrinum*) were the only amphibians noted. The Woodhouse's toad was detected during the nocturnal amphibian surveys discussed below in the Nocturnal Wildlife section. All reptiles and amphibians detections occurred within the summer season, with the exception of the tiger salamander, which was noted by NREL staff in 2011.

Terrestrial Arthropods

No terrestrial arthropod genera of specific concern were detected during surveys in June 2010.

Targeted Wildlife Surveys

Breeding Bird Densities

A total of 749 individual detections and 450 clusters from 41 different bird species were observed along the eight transects. Eight of the 41 species were defined as flyovers. To remain consistent with distance sampling methods, these flyover data were not analyzed. Density was not analyzed for 28 other avian species due to their sample size (n) being too small (n < 20). Buckland et al. (2001) suggest that a minimum sample size of 60 detections is needed for a reliable estimate of the detection function. Walsh was able to calculate densities for five avian species (Table 8). All species detected during distance sampling are summarized in Table 3.

The avian species with the highest density was by far Western meadowlark, with a density of 0.29 birds per hectare (Table 8). Although European starling *(Sturnus vulgaris)* had the second highest density of 0.22 birds per hectare, the co-efficient of variation of 0.22 was very high, causing the density measure to be unreliable and biased upwards.

Table 8. Breeding Bird Density Estimates, NREL South Table Mountain Site, 2011

Species	Sample size (clusters)	Number of Individuals	Density CV	Density Estimate (Birds/hectare)	Density 95% Lower CI	Density 95% Upper CI
Western Meadowlark (*Sturnella neglecta*)	112	129	0.12	0.29	0.87	1.40
European Starling (*Sturnus vulgaris*)	25	49	0.22	0.22	0.13	0.28
Spotted Towhee (*Pipilo maculatus*)	51	52	0.13	0.20	0.10	0.39
American Robin (*Turdus migratorius*)	40	48	0.20	0.15	0.47	1.03
Black-billed Magpie (*Pica pica*)	34	52	0.21	0.08	0.06	0.11

Nocturnal Wildlife

Nocturnal playback surveys for eastern screech-owl failed to detect or elicit any responses during the March 2011 surveys. No other owl species were detected during nocturnal surveys for other genera. Great horned owls are known to occur in the area, although no nests have been found, they have been observed hunting (Brenda Beatty – NREL, pers. com. 2011).

During the nocturnal amphibian surveys, Woodhouse's toad was detected in the ephemeral ponds on the mesa top northeast of the Solar Industrial Mesa Test Area. The Wisconsin index value assigned to each observation was 2 = calls are overlapping, but individuals are still distinguishable.

No bat species were detected during the acoustical bat surveys conducted in the summer of 2010.

Mule Deer

During the summer 2010 mule deer survey, four bucks, ten does, and two fawns were located (Figure 6). The mule deer concentrated in two groups with one group located on the southwestern facing hillside of the east drainage and the other located in the amphitheater.

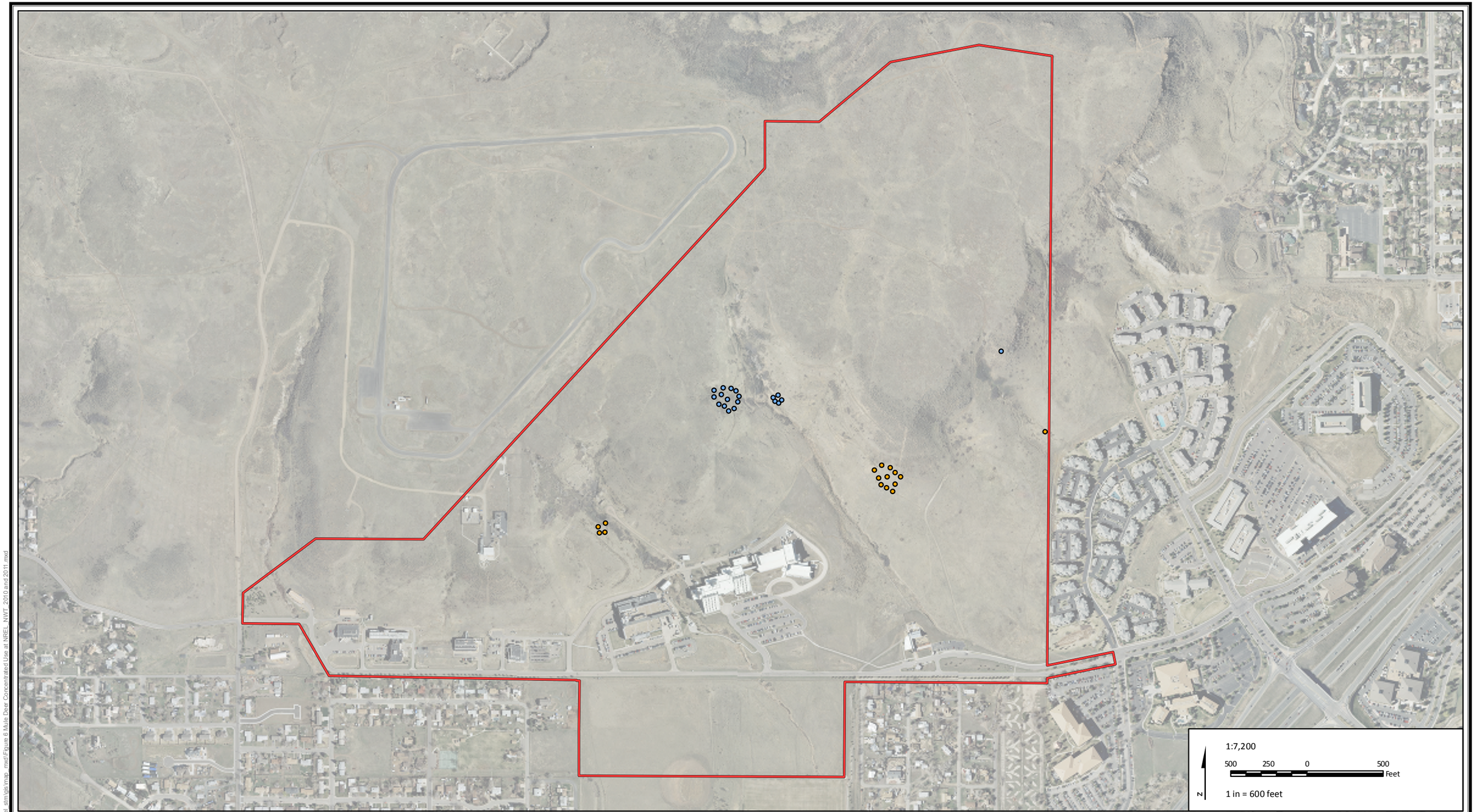
In winter of 2010, three bucks, eleven does, and five fawns were found in the east drainage.

Carnivore Camera

Throughout the four seasons, the Trailmaster monitors with connected cameras took three carnivore photographs, all of one predator species, the coyote. Coyotes were detected in the east drainage in the summer and winter of 2010 and one coyote was detected in the amphitheater in the spring of 2011. In addition, other detections included numerous mule deer, one cottontail (*Sylvilagus* sp.), one Mexican woodrat, and two black-billed magpies.

Special Status Species

A peregrine falcon (*Falco peregrinus*), which is a State Species of Special Concern, was observed. No other wildlife Special Status Species were observed during any surveys.



Walsh
an ecology and environment company

- Mule Deer Survey: Summer, 2010
- Mule Deer Survey: Winter, 2010
- STM Boundary

Figure 6. Mule Deer Concentrated Use Observations, NREL South Table Mountain Site, 2010 and 2011

U:\Projects\090758.0001\020_nrel_stm\gis\map_mxd\Figure 6 Mule Deer Concentrated Use at NREL NWT_2010 and 2011.mxd

DISCUSSION

Vegetation Mapping

Few changes in the plant community boundaries were noted since these areas were previously mapped (Plantae 2002). Observed trends in vegetation patterns include a general increase in invasive and noxious weed species diversity and extent across the site. Some factors that may be contributing to this apparent trend include changes in land use, such as surface disturbing activities since 2002, and drought conditions.

Grasslands

The Plantae (2002) vegetation mapping effort characterized the majority of the mesa top on the STM site as short-grass grassland. The community supports a diverse mix of grass species, as it did in 2002, but percent cover of weeds, especially musk thistle, has increased. One possible reason for the increase in noxious weeds might be drought conditions occurring in many of the growing seasons since 2002.

The current mapping effort found mixed-grass grassland as the dominant community in the central and southern portions of the site. Characteristics of this community appear similar to those observed in 2002. The noxious weed species that has increased the most throughout this community appears to be Canada thistle. Three small seeps that were not observed in 2002 were found in the southeastern portion of this plant community.

Upland Shrublands

Herbaceous layer characteristics, including species composition and areas lacking cover, in both shrubland communities, remains comparable to 2002 observations. The most notable change in the upland shrublands since 2002 is that musk thistle has colonized these areas.

Ravine Shrublands

No significant changes to plant community boundaries were observed in 2010 as compared to 2002. No new noxious weed species were observed here since these areas were last mapped in 2002.

Wetlands

The areas of wetland vegetation have not been jurisdictionally delineated. Due to a dry winter in 2010, followed by a dry spring in 2011, borders of wetland communities were not able to be confirmed with assurance for this report.

The wetland community observed at the top of the southwest drainage in 2002 is still dominated by obligate and facultative wetland plants but the dominant species have changed from cattails to graminoids including sedges, rushes, and bulrush species. The peach-leaf willows observed in 2002 were also observed in 2010. Changes in vegetation composition may be due to land use changes in nearby developed areas.

When visited in late June 2010, the linear depression wetland contained saturated soils and standing water. Field bindweed (*Convolvulus arvensis*) observed in this area in 2010, was not present in the wetland communities in 2002 (Plantae). Field bindweed may have established here as a result of surface disturbance due to construction activities adjacent to this wetland.

Disturbed/Reclaimed

There are more disturbed/reclaimed communities within the STM boundaries than there were in 2002. Likely the increase in surface disturbing activities contributed to the establishment of whitetop, Canada thistle, yellow sweetclover (*Melilotus officinalis)*, and common dandelion (*Taraxicum officinale)*, all species observed for the first time in 2010. These species likely colonized areas of surface disturbance that resulted from construction activities.

Noxious Weeds

The STM site contains 12 plant species found on the State of Colorado Noxious Weed List (Table 1). Of these species, five are included in the top ten priority weeds for Colorado, as listed in the Colorado Weed Management Act. These species are the most widespread and cause the greatest economic impact to the state and should be considered a priority-for-control for the STM site.

Historically, the short-grass grassland found on the mesa top was probably dominated by blue grama grass and other short-grass species such as buffalo grass (*Buchloë dactyloides*). However, this entire mesa-top area has become dominated by cheatgrass, an aggressive noxious weed. This weed is changing the appearance and general species composition of the area by apparently out-competing native plants.

The majority of noxious weed populations have remained unchanged since the site was last surveyed in 2002 by Plantae. However, some weed populations have expanded such as musk thistle, dalmatian toadflax, Canada thistle, and diffuse knapweed. In addition, these weed populations will likely spread in response to the disturbance of large swaths of mixed-grass grassland associated with the construction of additional NREL facilities in 2010 and 2011.

Wildlife Survey Results

During 2010/2011 a total of 102 species of wildlife were observed at STM. In comparison, the 1987 surveys (FORUM 1987) observed 31 species, and in 2004/2005 SAIC (SAIC 2005) observed 69 species (Table 3). In 1987, two reptile species, one bird species, and six mammal species were documented that were not seen in 2010/2011. In 2004/2005, two herptiles, 13 bird species, and six mammal species were documented for STM that were not observed in 2010/2011.

Surveys in 2010/2011 detected 77 species (four herptiles, 70 birds, and four mammals) not documented during surveys conducted in 1987. Forty-seven species were added to the site species list since surveys conducted in 2004/2005 (three herptiles, 41 birds, and three mammals).

The cause of these differences may be attributed to the relative level of effort between different surveys, respectively. They may also be related to differences in observer ability, changes in species composition that affect occurrence of other species, observation conditions during surveys, and/or differences in seasonal weather patterns and recent site development activities.

General Wildlife Surveys

Birds

The seasonal average for avian species richness, diversity (dominance) and total number of detections all approximately doubled since 2004/2005. This drastic increase in the bird community may be due to factors such as change in observers, level of effort, weather patterns, or other causes not apparent.

The total number of birds detected during point counts in 2010/2011 was 1,216 (56 percent more birds detected when compared to 2004/2005). The species richness in 2010/2011 increased

overall by 44 percent since 2004/2005. Avian diversity (dominance) also significantly increased by 38 percent since the 2004/2005. Evenness in spring, summer and fall of 2010/2011 remained similar to 2004/2005. Evenness in the winter 2010/2011 dropped from 47 in 2004/2005 to 28. In winter 2010/2011, rock pigeons made up 46 percent of the total detected birds, thus accounting for the decreased evenness.

The western meadowlark was the most abundant species in spring and summer and remained the most abundant bird overall throughout both studies. In fall the most abundant species was the house finch for all years. In the winter, rock pigeons were most abundant in 2010/2011, while in 2004/2005 the black-billed magpie was most abundant. Declines in population can be related to disease, changes in habitat, and shifts in food resources available to the species.

Although avian diversity (dominance) (Simpson index) was estimated to remain consistent with the SAIC report, NREL may prefer to use the modified Shannon index in the future rather than dominance. Buckland et al. (2005) investigated what features define a good diversity index. Although they conclude that no single index can capture all aspects of diversity change, the modified Shannon index performed better than the Simpson's index. Therefore Walsh recommends using the modified Shannon index in the future to more accurately monitor changes in biodiversity at NREL.

Raptors

Raptor observations during the two seasons of surveys were characteristic of local and migratory species known to occur within the region. In comparison to the 2004/2005 surveys in which 10 species were observed (SAIC 2005), the 2010/2011 surveys detected four additional species for STM: turkey vulture (*Cathartes aura*), northern goshawk (*Accipiter gentilis*), broad-winged hawk (*Buteo platypterus*), and peregrine falcon (*Falco peregrinus*). In 1987 only two species were observed: red-tailed hawk (*Buteo jamaicensis*) and American kestrel (*Falco sparverius*) (FORUM 1987). One species, golden eagle (*Aquila chrysaetos*), was detected in the 2004/2005 raptor surveys and was not observed in the 2010/2011 surveys. Overall the 2010/2011 raptor surveys detected 11 species plus two additional species identified only to genera (*Buteo* sp., *Falco* sp.). One additional species, northern harrier (*Circus cyaneus*) was observed outside the raptor survey periods.

No nesting raptors were detected onsite. In comparison, 2004/2005 surveys detected nesting American kestrel, and 1987 surveys detected nesting red-tailed hawk and American kestrel. Although neither species were detected onsite, red-tailed hawks were known to be nesting just south of STM in Lena Gulch. The high number of non-migrant American kestrels (8) may be indicative of local nesting within habitat adjacent to STM.

Large Mammals

There is difficulty in comparing these data with the earlier SAIC (2005) data for two reasons: the current study collected the data after three months of pellet accumulation from 66 plots, whereas the earlier study collected data after six months from 97 plots. However, the trends of use of the different vegetation communities are similar between the two studies: the greatest use was in short-grass grassland, followed by mixed-grass grassland, tall shrubland, and short shrubland and ravine shrubland. During this and other field efforts, it was apparent that the mule deer use the ravine shrublands for cover and resting sites. The high number of pellet groups in the short-grass may be due to the location of 20 plots in this community type (the second largest number of plots after mixed-grass), and this community represented the type with the least amount of human disturbance. The mixed-grass community type, which had the most plots, had fewer pellet groups probably because this type was closest to the NREL development.

Mammalian Predators

Coyote and red fox are very common predators along the Front Range, and their presence suggests that there is good denning and foraging habitat on site. The presence of the western spotted skunk is of interest as the species is generally present but not commonly detected. They use the short-grass habitat and likely den in the rocky ravine areas. Tracks were observed at Station 2, on the eastern edge of the mesa (Figure 1).

The previous study found only coyotes. With the current study, three additional species have been detected: red fox, western spotted skunk, and striped skunk. The highest number of tracks was found during winter.

Small Mammals

Although results were generally consistent between the July 2010 and April 2011 trapping surveys, densities of small mammals undergo annual fluctuations as is reflected in trapping response and capture rates (Smith et al. 2009). Deer mice are a ubiquitous species, sometimes referred to as a weedy species due to their ability to occur in virtually all habitats except wetlands (Armstrong et al. 2011). What is surprising is the lack of captures of deer mice in 2010, when only one mouse was captured during 450 trap nights; and that deer mice did not dominate the captures in both periods. The reason for this is not clear. Deer mice are susceptible to hantavirus, although there has been no known outbreak of the disease in 2010 or 2011 along the Front Range.

The species richness for three species of small mammals in 2010/2011 combined at STM is low for small mammals. Species richness was higher in 1987 and 2004/2005 when prairie voles were present (FORUM 1987) and in 2004/2005 (SAIC 2005). Prairie voles may have been experiencing a population low during the 2010/2011 surveys. Although prairie voles in Colorado may not experience the population cycles typical of the genus elsewhere, 2 to 4 year cycles have been found in other studies (Armstrong 2011).

It is noteworthy that bushy-tailed woodrats (*Neotoma cinerea*) were found in 1987 (FORUM 1987), but Mexican woodrats were not found. These two species are sympatric along a narrow corridor of the Front Range (Finley 1958). It is not known if the Mexican woodrat displaced the bushy-tailed woodrat or if it was present in 1987 but not detected.

Reptile and Amphibians

Western rattlesnakes, racers, prairie lizards, tiger salamanders, and Woodhouse's toads are all widespread and common in Colorado. Habitats for racer include prairie grasslands, sandhills, open riparian woodlands, and shrubby foothills and canyons. The western rattlesnake occurs in virtually every terrestrial habitat within Colorado (Hammerson 1999). Woodhouse's toad is the state's most commonly encountered amphibian and tiger salamanders occur in virtually any habitat, provided there is standing water such as permanent or ephemeral ponds (Hammerson 1999).

Western rattlesnakes were found in 1987 (FORUM 1987) and again in 2004/2005 (SAIC 2005). However, tiger salamanders were found only in 2004/2005 (SAIC 2005) and Woodhouse's toad, prairie lizards, and racers were all not detected during the previous surveys. The 1987, 2004/2005, and 2010/2011 reptile and amphibian surveys were opportunistic and it is likely that most of these species were present but not detected.

Terrestrial Arthropods

Surveys for terrestrial arthropod genera did not detect any Species of Concern. Records from CNHP do not have any specific sightings from STM; most of the historic records (the most recent

documented in 1991) are located north and west of STM (Appendix C). As most of the species depend on native grasses for larval food, further encroachment of noxious weed species limit the potential for any genera or species of concern to inhabit STM. The limited nature of these surveys should be noted.

Targeted Wildlife Surveys

Breeding Bird Densities

Spring 2011 was the first year distance sampling was performed on the NREL STM avian community to estimate breeding bird densities. There were limitations in estimating breeding songbird densities because of low sample sizes and only one season of data. Continued monitoring of avian species may contribute to a better density estimate and is recommended. With increased sampling over additional years, more comprehensive density estimates may be obtained.

Nocturnal Wildlife

Limited cottonwoods and pine stands on the STM site likely preclude the presence of eastern screech-owl. Even though the eastern screech-owl has the broadest ecological niche of any owl in its range (Gehlbach 1995), they generally prefer mature stands of cottonwoods (Steve Jones personal communication 2011).

Woodhouse's toads were the only amphibians heard on site and they were heard at the only two pools. The lack of other amphibians is not surprising due to the general scarcity of surface water on the STM site.

The absence of bat activity on the site was likely due to the limited sampling (one monitor for two nights) that was conducted in early June. This is not a time period of high bat activity. Typically, bats in Colorado are most active in July, August, and September. Some bats are still arriving at their summer roosts in June. A more comprehensive bat survey, including greater sampling effort and extension of the summer season, would surely be of use in documenting bat activity on the site.

Mule Deer

Mule deer are found throughout the state in every ecosystem with the foothills of the Front Range having one of the highest densities (Armstrong et al. 2011). Large herds of mule deer were noted on the STM site, with the highest concentrations found throughout the seasons in the steep and broken terrain of the shrublands, which provide abundant browse and cover. In the winter months, the size of herds increases in general and large numbers may congregate on wintering grounds (Armstrong et al. 2011). This behavior was consistent with mule deer surveys and observational results found on the STM site. In the summer months, the mule deer were found in small groups with the largest herd containing 14 individuals. Whereas in the winter survey one large herd was found containing 18 deer and an additional observation in January 2011 recorded during other wildlife surveys, noted a herd containing 28 mule deer. This suggests that the STM site is likely used as a wintering ground which is consistent with higher use found in the winter in previous surveys (SAIC 2005). Winter habitat is typically a limiting resource for big game species such as mule deer.

Carnivore Camera

Coyotes were the only predator detected in the mammalian predator surveys with scent stations in surveys done by SAIC in 2005 and the most common predator detected by Walsh in 2010/2011,

so it is no surprise that coyotes were the only carnivore detected with the cameras as well. Coyotes are found in every ecosystem throughout Colorado and are one of the most adaptable carnivores in North America (Armstrong et al. 2011).

A small pack of four coyotes were noted in spring of 2011 above the amphitheater by the solar facility. This pack may have been associated with the nearby den found in the rocky outcrop by SAIC in 2005. The abundant rodents, rabbits, and fawns found on STM provide an essential food resource. In addition, evidence of these coyotes working cooperatively on the predation of a full grown buck in the east drainage was discovered in March of 2011.

Special Status Species

One Special Status Species, the peregrine falcon, was observed during the year-long surveys. Observed during the fall raptor surveys in 2010, it was characterized as a local bird by its behavior. No longer considered endangered by state and federal agencies, it remains a Species of Special Concern (non-statutory) for Colorado due to its specialized breeding habitat (undisturbed cliffs) and low reproductive rates.

RECOMMENDATIONS

Based on the observations discussed above, there are several measures and recommendations that could minimize impacts to wildlife. These include:

- Develop the smallest possible footprint for buildings, access roads, and other infrastructure.
- Minimize disturbance to native plant communities to benefit native grassland species of amphibians, reptiles, birds, and mammals.
- To protect native plant community biodiversity, eradicate small weed populations, monitor for new weed infestations, and actively manage weeds onsite through NREL's Weed Management Program for the STM (6-2.12).
- Minimize the potential for weed invasions that replace the native grassland plants during construction and ongoing activities in the conservation zones such as recreational activities.
- Seek opportunities for creation of wildlife habitat corridors to connect to other nearby areas of habitat, especially to the open spaces to the north and west, and to Lena Gulch to the south.
- Protect the small hill seeps to the east of the Visitor Center from encroaching construction activities.
- Conduct additional bat surveys, ensuring coverage of July, August, and September, as well as multiple locations on site.
- Continued monitoring of avian species will contribute to more robust density estimates and such surveys should be conducted at intervals shorter than five years.

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APPENDIX A

Plant Community Species List

Legend to classification codes:

Origin:

Refers to origin of species

N Native to the Front Range area

I Introduced or exotic species

Species:

Refers to blooming/production season for grass species

C cold season (spring/early summer)

W warm season (mid to late summer)

Life Form:

Refers to life form/strategy of species

AF annual forb

BF biennial forb

PF perennial forb

AG annual grass/graminoid (includes rushes and sedges)

PG perennial grass/graminoid (includes rushes and sedges)

SU succulent

SS subshrub

S shrub

T tree

V vine

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Adenolinum lewisii	*Linum lewisii*	Wild flax	Linaceae - Flax Family	N	NA	PF
Aegilops cylindrica		Jointed goatgrass	Poaceae - Grass Family	I	C	AG
Agaloma marginata		Snow-on-the-mountain	Euphorbiaceae - Spurge Family	N	NA	PF
Agoseris glauca		False dandelion	Asteraceae - Sunflower Family	N	NA	PF
Agropyron cristatum		Crested wheatgrass	Poaceae - Grass Family	I	C	PG
Allium sp.		Wild onion	Alliaceae – Onion Family	N	NA	PF
Alyssum parviflorum	*Alyssum minus*	Alyssum	Brassicaceae - Mustard Family	I	NA	AF
Ambrosia psilostachya		Western ragweed	Asteraceae - Sunflower Family	N	NA	PF
Andropogon gerardii		Big bluestem	Poaceae - Grass Family	N	W	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Apocynum cannabinum		Indian hemp	Apocynaceae - Dogbane Family	N	NA	PF
Argemone hispida		Hairy poppy	Papaveraceae - Poppy Family	N	NA	PF
Aristida purpurea		Three-awn	Poaceae - Grass Family	N	W	PG
Artemisia biennis		Sagewort	Asteraceae - Sunflower Family	I	NA	PF
Artemisia frigida		Fringed sagebrush	Asteraceae - Sunflower Family	N	NA	SS
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Asclepias pumila		Plains milkweed	Aclepiadaceae - Milkweed Family	N	NA	PF

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Asclepias speciosa		Showy milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Aster porteri		White aster	Asteraceae - Sunflower Family	N	NA	PF
Astragalus drummondii		Drummonds milk vetch	Fabaceae - Pea Family	N	NA	PF
Astragalus shortianus		Milk vetch	Fabaceae - Pea Family	N	NA	PF
Bassia sieversiana	*Kochia scoparia*	Kochia	Chenopodiaceae - Goosefoot Family	I	NA	AF
Bouteloua curtipendula		Side-oats grama	Poaceae - Grass Family	N	W	PG
Brickellia rosmarinifolia subsp. *chlorolepis*	*Kuhnia chlorolepis*	Brickellia	Asteraceae - Sunflower Family	N	NA	PF
Bromopsis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG
Bromus japonicus		Japanese brome	Poaceae - Grass Family	I	C	AG
Carduus nutans		Musk thistle	Asteraceae - Sunflower Family	I	NA	BF
Carex brevior		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex pensylvanica subsp. *heliophila*		Sun sedge	Cyperaceae - Sedge Family	N	NA	PG
Castilleja integra		Indian paintbrush	Scrophulariaceae - Figwort Family	N	NA	PF
Celtis reticulata		Netleaf hackberry	Ulmaceae - Elm Family	N	NA	T
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Chamaesyce glyptopsperma	*Euphorbia glyptosperma*	Ridgeseed spurge	Euphorbiaceae - Spurge Family	N	NA	AF
Chenopodium berlandieri		Goosefoot	Chenopodiaceae - Goosefoot Family	N	NA	AF

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Chondrosum gracile	*Bouteloua gracilis*	Blue grama	Poaceae - Grass Family	N	W	PG
Chrysothamnus nauseosus subsp. *graveolens*		Rubber rabbitbrush	Asteraceae - Sunflower Family	N	NA	S
Breea arvensis	*Cirsium arvense*	Canada thistle	Asteraceae - Sunflower Family	I	NA	PF
Cirsium canescens		Hairy thistle	Asteraceae - Sunflower Family	N	NA	PF
Cirsium undulatum		Wavyleaf thistle	Asteraceae - Sunflower Family	N	NA	BF
Commandra umbellata		Bastard-toadflax	Santalaceae - Sandelwood Family	N	NA	PF
Convolvulus arvensis		Field bindweed	Convolvulaceae - Morning Glory	I	NA	PF
Coreopsis tinctoria		Plains coreopsis	Family	N	NA	PF
Coryphantha missouriensis		Yellow pincushion	Cactaceae - Cactus Family	N	NA	SU
Coryphantha vivipara var. *vivipara*		Nipple cactus	Cactaceae - Cactus Family	N	NA	SU
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Cynoglossum officinale		Houndstongue	Boraginaceae – Borage Family	I	NA	BF
Dalea candida	*Petalostemon candida*	White prairie clover	Fabaceae - Pea Family	N	NA	PF
Dalea purpurea	*Petalostemon purpurea*	Purple prairie clover	Fabaceae - Pea Family	N	NA	PF
Delphinium carolinianum subsp. *virescens*	*Delphinium virescens*	Prairie larkspur	Helleboraceae - Hellebore Family	N	NA	PF
Dyssodia papposa		Fetid marigold	Asteraceae - Sunflower Family	N	NA	PF

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Echinocereus viridiflorus		Hen-and-chicks	Cactaceae - Cactus Family	N	NA	SU
Echinocerus triglochidialis		Claret cup	Cactaceae - Cactus Family	N	NA	SU
Elaeagnus angustifolia		Russian-olive	Elaeagnaceae - Oleaster Family	I	NA	T
Eleocharis elliptica var. compressa		Spikerush	Cyperaceae - Sedge Family	N	NA	PG
Elymus trachycaulus subsp. *trachycaulus*	Agropyron caninum subsp. *majus*	Slender wheatgrass	Poaceae - Grass Family	N	C	PG
Erigeron colo-mexicanus		Fleabane	Asteraceae - Sunflower Family	N	NA	PF
Erigeron flagellaris		Daisy fleabane	Asteraceae - Sunflower Family	N	NA	BF
Eriogonum annuum		Annual eriogonun	Polygonaceae - Buckwheat Family	N	NA	AF
Eriogonum effusum		Spreading wild buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Eriogonum flavum		Yellow wild buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Eriogonum umbellatum		Wild buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Erodium cicutarium		Filaree	Geraniaceae - Geranium Family	I	NA	AF
Erysimum capitatum		Western wallflower	Brassicaceae - Mustard Family	N	NA	BF
Fraxinus pensylvanica var. *lanceolata*		Green ash	Oleaceae - Olive Family	I	NA	T
Gaillardia aristata	*Gaura parviflora*	Blanketflower	Asteraceae - Sunflower Family	N	NA	PF
Gaura mollis		Gaura	Onagraceae - Evening-primrose	N	NA	PF

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Gaura parviflora		Smallflower gaura	Onagraceae - Evening-primrose	N	NA	AF
Geranium caespitosum subsp. *caespitosum*		Wild geranium	Geraniaceae - Geranium Family	N	NA	PF
Grindelia inornata		Rayless gumweed	Asteraceae - Sunflower Family	N	NA	PF
Grindelia squarrosa		Curlycup gumweed	Asteraceae - Sunflower Family	N	NA	BF
Helianthus annuus		Common sunflower	Asteraceae - Sunflower Family	N	NA	AF
Helianthus pumilus		Sunflower	Asteraceae - Sunflower Family	N	NA	PF
Hesperostipa comata	*Stipa comata*	Needle-and-thread	Poaceae - Grass Family	N	C	PG
Heterotheca villosa	*Chrysopsis villosa*	Hairy golden aster	Asteraceae - Sunflower Family	N	NA	SS
Lactuca serriola		Prickly lettuce	Asteraceae - Sunflower Family	I	NA	BF
Lesquerella ludoviciana		Bladderpod	Brassicaceae - Mustard Family	N	NA	PF
Liatris punctata		Dotted gayfeather	Asteraceae - Sunflower Family	N	NA	PF
Linaria genistifolia subsp. *dalmatica*	*Linaria dalmatica*	Dalmatian toadflax	Scrophulariaceae - Figwort Family	I	NA	PF
Lithospermum incisum		Narrowleaf gromwell	Boraginaceae - Borage Family	N	NA	PF
Lupinus argenteus		Silver lupine	Fabaceae - Pea Family	N	NA	PF
Lygodesmia juncea		Rush skeletonplant	Asteraceae - Sunflower Family	N	NA	PF
Melilotus officinalis		Yellow sweetclover	Fabaceae - Pea Family	I	NA	BF
Mertensia lanceolata		Bluebells	Boraginaceae - Borage Family	N	NA	PF

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Muhlenbergia richardsonis		Mat muhly	Poaceae - Grass Family	N	W	PG
Nassella viridula	*Stipa viridula*	Green needlegrass	Poaceae – Grass Family	N	C	PG
Nuttalia nuda		Blazingstar	Loasaceae - Loasa Family	N	NA	PF
Oligosporus pacificus	*Artemisia campestris*	Field sagewort	Asteraceae - Sunflower Family	N	NA	PF
Onopordum acanthium		Scotch thistle	Asteraceae - Sunflower Family	I	NA	BF
Opuntia fragilis		Brittle cactus	Cactaceae - Cactus Family	N	NA	SU
Opuntia macrorhiza		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Opuntia phaeacantha		New Mexican prickly pear	Cactaceae - Cactus Family	N	NA	SU
Opuntia polyacantha		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Oxytropis lambertii		Lambert locoweed	Fabaceae - Pea Family	N	NA	PF
Padus virginiana subsp. *melanocarpa*	*Prunus virginiana*	Chokecherry	Rosaceae - Rose Family	N	NA	S
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG
Paronychia jamesii		James' nailwort	Alsinaceae - Chickweed Family	N	NA	PF
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Penstemon virgatus		Penstemon	Scrophulariaceae - Figwort Family	N	NA	PF
Penstmon angustifolius		Narrow beardtongue	Scrophulariaceae - Figwort Family	N	NA	PF
Phacelia heterophylla	*Phacelia hastata* var. *leucophylla*	Scorpionweed	Hydrophyllaceae - Waterleaf Family	N	NA	PF

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Physaria vitulifera		Fiddle bladderpod	Brassicaceae - Mustard Family	N	NA	PF
Physaria vitulifera		Fiddle bladderpod	Brassicaceae - Mustard Family	N	NA	PF
Plantago patagonica		Woolly plantain	Plantaginaceae - Plantain Family	N	NA	AF
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Poa secunda	*Poa canbyi*	Canby bluegrass	Poaceae - Grass Family	N	C	PG
Podospermum laciniatum	*Scorzonera laciniata*	False salsify	Asteraceae - Sunflower Family	I	NA	AF
Populus deltoides		Plains cottonwood	Salicaceae - Willow Family	N	NA	T
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Pterogonum alatum	*Erigeron alatum*	Winged buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Ratibida columnifera		Prairie coneflower	Asteraceae - Sunflower Family	N	NA	PF
Ratibida tagetes		Coneflower	Asteraceae - Sunflower Family	N	NA	PF
Rhus aromatica var. *trilobata*		Skunkbrush	Anacardiaceae - Sumac Family	N	NA	S
Rosa arkansana		Prairie rose	Rosaceae - Rose Family	N	NA	S
Rumex crispus		Curly dock	Polygonaceae - Buckwheat Family	N	NA	PF
Salsola iberica		Russian-thistle	Chenopodiaceae - Goosefoot Family	I	NA	AF
Schedonnardus paniculatus		Tumblegrass	Poaceae - Grass Family	N	C	PG

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Scrophularia lanceolata		Figwort	Scrophulariaceae - Figwort Family	N	NA	PF
Scutellaria brittonii		Britton's skullcap	Lamiaceae - Mint Family	N	NA	PF
Senecio integerrimus		Grounsel	Asteraceae - Sunflower Family	N	NA	BF/PF
Sisymbrium altissimum		Tumbling mustard	Brassicaceae - Mustard Family	I	NA	AF
Solidago missouriensis		Prairie goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Solidago mollis		Soft goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Sorghastrum nutans		Indian-grass	Poaceae - Grass Family	N	W	PG
Sphaeralcea coccinea		Scarlet globemallow	Malvaceae - Mallow Family	N	NA	PF
Sporobolus cryptandrus		Sand dropseed	Poaceae - Grass Family	N	W	PG
Sporobolus sp.		Dropseed	Poaceae - Grass Family	N	W	PG
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Taraxacum officinale		Common dandelion	Asteraceae - Sunflower Family	I	NA	PF
Thermopsis divaricarpa		Prairie goldenpea	Fabaceae - Pea Family	N	NA	PF
Tithymalus brachyceras		Spurge	Euphorbiaceae - Spurge Family	N	NA	PF
Tithymalus montanus		Spurge	Euphorbiaceae - Spurge Family	N	NA	PF
Toxicodendron rydbergii		Poison ivy	Anacardiaceae - Sumac Family	N	NA	S

Table 1. Grassland Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Tradescantia occidentalis		Spiderwort	Commelinaceae	N	NA	PF
Tragia ramosa		Noseburn	Euphorbiaceae - Spurge Family	N	NA	PF
Tragopogon dubius		Goatsbeard	Asteraceae - Sunflower Family	I	NA	BF
Ulmus pumila		Chinese elm	Ulmaceae - Elm Family	I	NA	T
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Verbena bracteata		Prostrate verbena	Verbebaceae - Verbena Family	N	NA	PF
Vicia americana		American vetch	Fabaceae - Pea Family	N	NA	PF
Yucca glauca		Yucca	Agavaceae - Agave Family	N	NA	SU
Xanthium strumarium		Cocklebur	Asteraceae - Sunflower Family	I	NA	AF

Table 2. Upland Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Adenolinum lewisii	*Linum lewisii*	Wild flax	Linaceae - Flax Family	N	NA	PF
Allium textile		Wild onion	Alliaceae - Onion Family	N	NA	PF
Alyssum alyssoides		Pale alyssum	Brassicaceae - Mustard Family	I	NA	AF
Alyssum parviflorum	*Alyssum minus*	Alyssum	Brassicaceae - Mustard Family	I	NA	AF
Amerosedum lanceolatum		Yellow stonecrop	Crassulaceae - Stonecrop Family	N	NA	PF
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Apocynum cannabinum		Indian hemp	Apocynaceae - Dogbane Family	N	NA	PF
Aristida purpurea		Three-awn	Poaceae - Grass Family	N	W	PG
Artemisia frigida		Fringed sagebrush	Asteraceae - Sunflower Family	N	NA	SS
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Artemisia tridentata		Big sagebrush	Asteraceae - Sunflower Family	N	NA	S
Asclepias viridiflora		Green flowered milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Astragalus drummondii		Drummonds milk vetch	Fabaceae - Pea Family	N	NA	PF
Atriplex canescens		Fourwing saltbush	Chenopodiaceae - Goosefoot Family	N	NA	S
Buchloë dactyloides		Buffalograss	Poaceae - Grass Family	N	W	PG
Campanula rotundifolia		Common harebell	Campanulaceae - Bellflower Family	N	NA	PF
Carduus nutans		Musk thistle	Asteraceae - Sunflower Family	I	NA	BF
Ceanothus fendleri		Buckbrush	Rhamnaceae - Buckthorn Family	N	NA	S
Celtis reticulata		Netleaf hackberry	Ulmaceae - Elm Family	N	NA	T
Cerastrium strictum		Mouse-ear	Alsinaceae - Chickweed Family	N	NA	PF

Table 2. Upland Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Cercocarpus montanus		Mountain-mahogany	Rosaceae - Rose Family	N	NA	S
Chondrosum gracile	*Bouteloua gracilis*	Blue grama	Poaceae - Grass Family	N	W	PG
Chrysothamnus nauseosus subsp. *graveolens*		Rubber rabbitbrush	Asteraceae - Sunflower Family	N	NA	S
Commandra umbellata		Bastard-toadflax	Santalaceae - Sandelwood Family	N	NA	PF
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Drymocallis fissa	*Potentilla fissa*	Cinquefoil	Rosaceae - Rose Family	N	NA	PF
Erigeron colo-mexicanus		Fleabane	Asteraceae - Sunflower Family	N	NA	PF
Eriogonum effusum		Spreading wild buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Eriogonum umbellatum		Wild buckwheat	Polygonaceae - Buckwheat Family	N	NA	PF
Erodium cicutarium		Filaree	Geraniaceae - Geranium Family	I	NA	AF
Gutierrezia sarothrae		Broom snakeweed	Asteraceae - Sunflower Family	N	NA	SS
Helianthus pumilus		Sunflower	Asteraceae - Sunflower Family	N	NA	PF
Hesperostipa comata	*Stipa comata*	Needle-and-thread	Poaceae - Grass Family	N	C	PG
Heterotheca villosa	*Chrysopsis villosa*	Hairy golden aster	Asteraceae - Sunflower Family	N	NA	SS
Ipomopsis aggregata subsp. *candida*		Gilia	Polemoniaceae - Phlox Family	N	NA	PF
Lathyrus eucosmus		Elegant peavine	Fabaceae - Pea Family	N	NA	PF
Liatris punctata		Dotted gayfeather	Asteraceae - Sunflower Family	N	NA	PF
Linaria genistifolia subsp. *dalmatica*	*Linaria dalmatica*	Dalmatian toadflax	Scrophulariaceae - Figwort Family	I	NA	PF

Table 2. Upland Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Muhlenbergia richardsonis		Mat muhly	Poaceae - Grass Family	N	W	PG
Onosmodium molle subsp. *occidentale*		Marbleseed	Boraginaceae - Borage Family	N	NA	PF
Opuntia macrorhiza		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Opuntia polyacantha		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Oreobatus deliciosus	*Rubus deliciousus*	Boulder raspberry	Rosaceae - Rose Family	N	NA	S
Oxytropis lambertii		Lambert locoweed	Fabaceae - Pea Family	N	NA	PF
Padus virginiana subsp. *melanocarpa*	*Prunus virginiana*	Chokecherry	Rosaceae - Rose Family	N	NA	S
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Penstemon virgatus		Penstemon	Scrophulariaceae - Figwort Family	N	NA	PF
Phacelia hastata		Whiteleaf phacelia	Hydrophyllaceae - Water-leaf Family	N	NA	PF
Physaria vitulifera		Fiddle bladderpod	Brassicaceae - Mustard Family	N	NA	PF
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Rhus aromatica var. *trilobata*		Skunkbrush	Anacardiaceae - Sumac Family	N	NA	S
Ribes cereum		Wax current	Grossulariaceae - Current Family	N	NA	S
Rosa woodsii		Woods rose	Rosaceae - Rose Family	N	NA	S
Scutellaria brittonii		Britton's skullcap	Lamiaceae - Mint Family	N	NA	PF
Selaginella densa		Little club moss	Selaginellaceae - Little Club-moss	N	NA	PF
Sisymbrium altissimum		Tumbling mustard	Brassicaceae - Mustard Family	I	NA	AF

Table 2. Upland Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Sphaeralcea coccinea		Scarlet globemallow	Malvaceae - Mallow Family	N	NA	PF
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Taraxacum officinale		Common dandelion	Asteraceae - Sunflower Family	I	NA	PF
Thlaspi arvense		Fanweed	Brassicaceae - Mustard Family	I	NA	AF
Toxicodendron rydbergii		Poison ivy	Anacardiaceae - Sumac Family	N	NA	S
Tragopogon dubius		Goatsbeard	Asteraceae - Sunflower Family	I	NA	BF
Vulpia octoflora		Six-weeks fescue	Poaceae - Grass Family	N	C	AG
Yucca glauca		Yucca	Agavaceae - Agave Family	N	NA	SU

Table 3. Ravine Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Adenolinum lewisii	*Linum lewisii*	Wild flax	Linaceae - Flax Family	N	NA	PF
Aegilops cylindrica		Jointed goatgrass	Poaceae - Grass Family	I	C	AG
Agropyron cristatum		Crested wheatgrass	Poaceae - Grass Family	I	C	PG
Agrostis stolonifera		Redtop	Poaceae - Grass Family	I	C	PG
Alyssum parviflorum	*Alyssum minus*	Alyssum	Brassicaceae - Mustard Family	I	NA	AF
Ambrosia psilostachya		Western ragweed	Asteraceae - Sunflower Family	N	NA	PF
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Apocynum cannabinum		Indian hemp	Apocynaceae - Dogbane Family	N	NA	PF
Arctium minus		Common burdock	Asteraceae - Sunflower Family	I	NA	BF
Aristida purpurea		Three-awn	Poaceae - Grass Family	N	W	PG
Artemisia dracunculus		Dragon sagewort	Asteraceae - Sunflower Family	N	NA	PF
Artemisia frigida		Fringed sagebrush	Asteraceae - Sunflower Family	N	NA	SS
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Asclepias incarnata		Swamp milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Asclepias pumila		Plains milkweed	Aclepiadaceae - Milkweed Family	N	NA	PF
Asclepias speciosa		Showy milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Asparagus officinalis		Asparagus	Asparagaceae - Asparagus Family	N	NA	PF
Aster porteri		White aster	Asteraceae - Sunflower Family	N	NA	PF
Aster sp.		Aster	Asteraceae - Sunflower Family	N	NA	PF
Astragalus drummondii		Drummonds milk vetch	Fabaceae - Pea Family	N	NA	PF
Bassia sieversiana	*Kochia scoparia*	Kochia	Chenopodiaceae - Goosefoot Family	I	NA	AF
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG

Table 3. Ravine Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Calochortus nuttallii		Sego lily	Liliaceae – Lily Family	N	NA	PF
Camelina microcarpa		Small-seeded false flax	Brassicaceae – Mustard Family	I	NA	AF
Carduus nutans		Musk thistle	Asteraceae – Sunflower Family	I	NA	BF
Carex praegracilis		Slender sedge	Cyperaceae – Sedge Family	N	NA	PG
Carex sp.		Sedge	Cyperaceae – Sedge Family	N	NA	PG
Celtis reticulata		Netleaf hackberry	Ulmaceae – Elm Family	N	NA	T
Centaurea diffusa	*Euphorbia*	Diffuse knapweed	Asteraceae – Sunflower Family	I	NA	BF/PF
Chamaesyce glyptopsperma	*glyptosperma*	Ridgeseed spurge	Euphorbiaceae – Spurge Family	N	NA	AF
Chrysothamnus nauseosus subsp. *graveolens*		Rubber rabbitbrush	Asteraceae – Sunflower Family	N	NA	S
Cirsium arvense		Canada thistle	Asteraceae – Sunflower Family	I	NA	PF
Clematis ligusticifolia		Virgin's bower	Ranunculaceae – Buttercup Family	N	NA	V
Conium maculatum		Poison hemlock	Apiaceae – Parsley Family	I	NA	BF
Convolvulus arvensis		Field bindweed	Convolvulaceae – Morning Glory Family	I	NA	PF
Crataegus macracantha var. *occidentalis*	*Crataegus succulenta*	Western hawthorn	Rosaceae – Rose Family	N	NA	S
Cynoglossum officinale		Houndstongue	Boraginaceae – Borage Family	I	NA	BF
Dactylis glomerata		Orchard grass	Poaceae – Grass Family	I	C	PG
Dalea candida	*Petalostemon candida*	White prairie clover	Fabaceae – Pea Family	N	NA	PF
Descurainia pinnata		Tansy mustard	Brassicaceae – Mustard Family	N	NA	AF
Descurainia sophia		Tansy mustard	Brassicaceae – Mustard Family	I	NA	AF/BF
Dipsacus sylvestris		Teasel	Dipsacaceae – Teasel Family	I	NA	BF
Echinochloa crusgalli		Barnyard grass	Poaceae – Grass Family	I	W	AG
Elaeagnus angustifolia		Russian-olive	Elaeagnaceae – Oleaster Family	I	NA	T

Table 3. Ravine Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Eleocharis palustris		Spike-rush	Cyperaceae – Sedge Family	N	NA	PG
Elymus canadensis		Canada wild rye	Poaceae – Grass Family	N	C	PG
Elymus lanceolatus subsp. *psammophilus*	*Agropyron riparium*	Streambank wheatgrass	Poaceae – Grass Family	N	C	PG
Fraxinus pensylvanica var. *lanceolata*		Green ash	Oleaceae – Olive Family	I	NA	T
Galium spurium		Cleavers	Rubiaceae – Madder Family	I	NA	PF
Gaura mollis	*Gaura parviflora*	Gaura	Onagraceae – Evening-primrose Family	N	NA	PF
Gaura parviflora		Smallflower gaura	Onagraceae – Evening-primrose Family	N	NA	AF
Glycyrrhiza lepidota		American licorice	Fabaceae – Pea Family	N	NA	PF
Grindelia squarrosa		Curlycup gumweed	Asteraceae – Sunflower Family	N	NA	BF
Helianthus pumilus		Sunflower	Asteraceae – Sunflower Family	N	NA	PF
Heterotheca villosa	*Chrysopsis villosa*	Hairy golden aster	Asteraceae – Sunflower Family	N	NA	SS
Juncus arcticus		Rush	Juncaceae – Rush Family	N	NA	PG
Juncus interior		Rush	Juncaceae – Rush Family	N	NA	PG
Juncus sp.		Rush	Juncaceae – Rush Family	N	NA	PG
Lactuca serriola		Prickly lettuce	Asteraceae – Sunflower Family	I	NA	BF
Lactuca tatarica subsp. *pulchella*		Siberian lettuce	Asteraceae – Sunflower Family	N	NA	PF
Lathyrus eucosmus		Elegant peavine	Fabaceae – Pea Family	N	NA	PF
Liatris punctata		Dotted gayfeather	Asteraceae – Sunflower Family	N	NA	PF
Linaria genistifolia subsp. *dalmatica*	*Linaria dalmatica*	Dalmatian toadflax	Scrophulariaceae – Figwort Family	I	NA	PF
Mertensia sp.		Bluebells	Boraginaceae – Borage Family	N	NA	PF
Medicago sativa		Alfalfa	Fabaceae - Pea Family	I	NA	PF
Melilotus officinalis		Yellow sweetclover	Fabaceae - Pea Family	I	NA	BF

Table 3. Ravine Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Melilotus sp.		Sweetclover	Fabaceae - Pea Family	I	NA	BF
Monarda fistulosa		Bee balm	Lamiaceae - Mint Family	N	NA	PF
Muhlenbergia richardsonis		Mat muhly	Poaceae - Grass Family	N	W	PG
Negundo aceroides	*Acer negundo*	Box elder	Aceraceae - Maple Family	N	NA	T
Nepeta cataria		Catnip	Lamiaceae - Mint Family	I	NA	PF
Opuntia polyacantha		Plains prickly pear	Cactaceae - Cactus Family	N	NA	SU
Oxybaphus nyctagineus	*Mirabilis nyctaginea*	Wild four-o'clocks	Nyctaginaceae - Four-o'clock Family	N	NA	PF
Padus virginiana subsp. *melanocarpa*	*Prunus virginiana*	Chokecherry	Rosaceae - Rose Family	N	NA	S
Panicum capillare		Witchgrass	Poaceae - Grass Family	N	W	AG
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Persicaria maculata	*Polygonum persicaria*	Lady's thumb	Polygonaceae - Buckwheat Family	I	NA	AF
Phacelia heterophylla	*Phacelia hastata* var. *leucophylla*	Scorpionweed	Hydrophyllaceae - Waterleaf Family	N	NA	PF
Phleum pratense		Common Timothy	Poaceae - Grass Family	I	C	PG
Physalis virginiana		Virginia ground-cherry	Solanaceae - Nightshade Family	I	NA	PF
Plantago major		Common plantain	Plantaginaceae - Plantain Family	I	NA	PF
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Populus deltoides		Plains cottonwood	Salicaceae - Willow Family	N	NA	T
Populus x acuminata			Salicaceae - Willow Family	N	NA	T
Prunus americana		Wild plum	Rosaceae - Rose Family	N	NA	S
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF

Table 3. Ravine Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Pyrus malus	*Malus pumila*	Apple	Rosaceae - Rose Family	I	NA	T
Ranculus abortivus subsp. *acrolasius*		Buttercup	Ranunculaceae - Buttercup Family	N	NA	PF
Ratibida columnifera		Prairie coneflower	Asteraceae - Sunflower Family	N	NA	PF
Rhus aromatica var. *trilobata*		Skunkbrush	Anacardiaceae - Sumac Family	N	NA	S
Ribes aureum		Golden current	Grossulariaceae - Current Family	N	NA	S
Ribes cereum		Wax current	Grossulariaceae - Current Family	N	NA	S
Rosa arkansana		Prairie rose	Rosaceae - Rose Family	N	NA	S
Rosa woodsii		Woods rose	Rosaceae - Rose Family	N	NA	S
Rumex crispus		Curly dock	Polygonaceae - Buckwheat Family	N	NA	PF
Salix amygdaloides		Peach-leaf willow	Salicaceae - Willow Family	N	NA	T
Salix exigua		Sandbar willow	Salicaceae - Willow Family	N	NA	S
Salix fragilis		Crack willow	Salicaceae - Willow Family	I	NA	T
Salix lutea		Yellow willow	Salicaceae - Willow Family	N	NA	S
Shepherdia argentea		Silverberry	Elaeagnaceae - Oleaster Family	N	NA	S
Sisymbrium altissimum		Tumbling mustard	Brassicaceae - Mustard Family	I	NA	AF
Solidago mollis		Soft goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Sphaeralcea coccinea		Scarlet globemallow	Malvaceae - Mallow Family	N	NA	PF
Stipa viridula		Green needlegrass	Poaceae - Grass Family	N	C	PG
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae - Honeysuckle Family	N	NA	S
Taraxacum officinale		Common dandelion	Asteraceae - Sunflower Family	I	NA	PF
Thlaspi arvense		Fanweed	Brassicaceae - Mustard Family	I	NA	AF
Toxicodendron rydbergii		Poison ivy	Anacardiaceae - Sumac Family	N	NA	S

Table 3. Ravine Shrubland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Tragia ramosa		Noseburn	Euphorbiaceae - Spurge Family	N	NA	PF
Tragopogon dubius		Goatsbeard	Asteraceae - Sunflower Family	I	NA	BF
Typha angustifolia		Narrow-leaved cattail	Typhaceae - Cattail Family	N	NA	PF
Typha latifolia		Common cattail	Typhaceae - Cattail Family	N	NA	PF
Ulmus pumila		Chinese elm	Ulmaceae - Elm Family	I	NA	T
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF
Veronica catenata		Speedwell	Scrophulariaceae - Figwort Family	N	NA	PF
Vicia americana		American vetch	Fabaceae - Pea Family	N	NA	PF
Yucca glauca		Yucca	Agavaceae - Agave Family	N	NA	SU

Table 4. Wetland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Asclepias incarnata		Swamp milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Asclepias speciosa		Showy milkweed	Asclepiadaceae - Milkweed Family	N	NA	PF
Carex praegracilis		Slender sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex sp.		Sedge	Cyperaceae - Sedge Family	N	NA	PG
Carex utriculata	*Carex rostrata*	Sedge	Cyperaceae - Sedge Family	N	NA	PG
Celtis reticulata		Netleaf hackberry	Ulmaceae - Elm Family	N	NA	T
Clematis ligusticifolia		Virgin's bower	Ranunculaceae - Buttercup Family	N	NA	V
Comiun maculatum		Poison hemlock	Apiaceae - Parsley Family	I	NA	BF
Convolvulus arvensis		Field bindweed	Convolvulaceae – Morning glory Family	I	NA	PF
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae – Grass Family	N	C	PG
Cynoglossum officinale		Houndstongue	Boraginaceae - Borage Family	I	NA	BF
Eleocharis elliptica var. *compressa*		Spikerush	Cyperaceae - Sedge Family	N	NA	PG
Dipsacus sylvestris		Teasel	Dipsacaceae - Teasel Family	I	NA	BF
Eleocharis palustris		Spike-rush	Cyperaceae - Sedge Family	N	NA	PG
Elymus lanceolatus subsp. *psammophilus*	*Agropyron riparium*	Streambank wheatgrass	Poaceae - Grass Family	N	C	PG
Fraxinus pensylvanica var. *lanceolata*		Green ash	Oleaceae - Olive Family	I	NA	T
Glycyrrhiza lepidota		American licorice	Fabaceae - Pea Family	N	NA	PF
Juncus arcticus		Rush	Juncaceae - Rush Family	N	NA	PG

Table 4. Wetland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Juncus balticus		Baltic rush	Juncaceae – Rush Family	N	NA	PG
Juncus interior		Rush	Juncaceae - Rush Family	N	NA	PG
Juncus sp.		Rush	Juncaceae - Rush Family	N	NA	PG
Lithospermum incisum		Narrowleaf gromwell	Boraginaceae - Borage Family	N	NA	PF
Melilotus sp.		Sweetclover	Fabaceae – Pea Family	I	NA	BF
Mentha arvensis		Fieldmint	Lamiaceae - Mint Family	N	NA	PF
Mertensia lanceolata		Bluebells	Boraginaceae - Borage Family	N	NA	PF
Monarda fistulosa		Bee balm	Lamiaceae - Mint Family	N	NA	PF
Muhlenbergia richardsonis		Mat muhly	Poaceae - Grass Family	N	W	PG
Nepeta cataria		Catnip	Lamiaceae - Mint Family	I	NA	PF
Padus virginiana subsp. *melanocarpa*	*Prunus virginiana*	Chokecherry	Rosaceae - Rose Family	N	NA	S
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Poa compressa		Canada bluegrass	Poaceae - Grass Family	I	C	PG
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Populus deltoides		Plains cottonwood	Salicaceae - Willow Family	N	NA	T
Populus x acuminata	Prunus americana	Wild plum	Salicaceae - Willow Family Rosaceae - Rose Family	N N	NA NA	T S
Ribes aureum		Golden current	Grossulariaceae - Current Family	N	NA	S

Table 4. Wetland Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Ribes cereum		Wax current	Grossulariaceae - Current Family	N	NA	S
Rosa woodsii		Woods rose	Rosaceae - Rose Family	N	NA	S
Rumex sp.		Dock	Polygonaceae – Buckwheat Family	N	NA	PF
Salix amygdaloides		Peach-leaf willow	Salicaceae - Willow Family	N	NA	T
Salix exigua		Sandbar willow	Salicaceae - Willow Family	N	NA	S
Salix fragilis		Crack willow	Salicaceae - Willow Family	I	NA	T
Salix lutea		Yellow willow	Salicaceae - Willow Family	N	NA	S
Scirpus sp.		Bulrush	Cyperaceae - Sedge Family	N	NA	PG
Shepherdia argentea		Silverberry	Elaeagnaceae - Oleaster Family	N	NA	S
Symphoricarpos occidentalis		Western snowberry	Caprifoliaceae – Honeysuckle Family	N	NA	S
Taraxacum officinale		Common dandelion	Asteraceae - Sunflower Family	I	NA	PF
Typha angustifolia		Narrow-leaved cattail	Typhaceae - Cattail Family	N	NA	PF
Typha latifolia		Common cattail	Typhaceae - Cattail Family	N	NA	PF
Ulmus pumila		Chinese elm	Ulmaceae - Elm Family	I	NA	T
Veronica Americana		American brooklime	Scrophulariaceae – Figwort Family	N	NA	AF
Veronica catenata		Speedwell	Scrophulariaceae - Figwort Family	N	NA	PF
Vibernum lantana		Wayfaring tree	Caryophyllaceae - Pink Family	I	NA	S

Table 5. Disturbed/Reclaimed Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Agropyron cristatum		Crested wheatgrass	Poaceae - Grass Family	I	C	PG
Agropyron intermedium		Intermediate wheatgrass	Poaceae - Grass Family	I	C	PG
Alyssum parviflorum	*Alyssum minus*	Alyssum	Brassicaceae - Mustard Family	I	NA	AF
Ambrosia psilostachya		Western ragweed	Asteraceae - Sunflower Family	N	NA	PF
Ambrosia trifida		Giant ragweed	Asteraceae - Sunflower Family	I	NA	AF
Andropogon gerardii		Big bluestem	Poaceae - Grass Family	N	W	PG
Anisantha tectorum	*Bromus tectorum*	Cheatgrass	Poaceae - Grass Family	I	C	AG
Arctium minus		Common burdock	Asteraceae - Sunflower Family	I	NA	BF
Aristida purpurea		Three-awn	Poaceae - Grass Family	N	W	PG
Artemisia frigida		Fringed sagebrush	Asteraceae - Sunflower Family	N	NA	SS
Artemisia ludoviciana		Prairie sagewort	Asteraceae - Sunflower Family	N	NA	PF
Aster porteri		White aster	Asteraceae - Sunflower Family	N	NA	PF
Atriplex canescens		Fourwing saltbush	Chenopodiaceae - Goosefoot Family	N	NA	S
Bassia sieversiana	*Kochia scoparia*	Kochia	Chenopodiaceae - Goosefoot Family	I	NA	AF
Bouteloua curtipendula		Side-oats grama	Poaceae - Grass Family	N	W	PG
Breea arvensis	*Circium arvense*	Canada thistle	Asteraceae – Sunflower Family	I	NA	PF
Brickellia eupatorioides		Brickellia	Asteraceae - Sunflower Family	N	NA	PF
Bromopis inermis	*Bromus inermis*	Smooth bromegrass	Poaceae - Grass Family	I	C	PG

Table 5. Disturbed/Reclaimed Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Bromus japonicus		Japanese brome	Poaceae - Grass Family	I	C	AG
Buchloë dactyloides		Buffalograss	Poaceae - Grass Family	N	W	PG
Acosta diffusa	*Centaurea diffusa*	Diffuse knapweed	Asteraceae - Sunflower Family	I	NA	BF/PF
Cardaria draba		Whitetop	Brassicaceae – Mustard Family	I	NA	PF
Chamaesyce glyptopsperma	*Euphorbia glyptosperma*	Ridgeseed spurge	Euphorbiaceae - Spurge Family	N	NA	AF
Chenopodium album		Common lambsquarters	Chenopodiaceae - Goosefoot Family	I	NA	AF
Chondrosum gracile	*Bouteloua gracilis*	Blue grama	Poaceae - Grass Family	N	W	PG
Chrysothamnus nauseosus subsp. *graveolens*		Rubber rabbitbrush	Asteraceae - Sunflower Family	N	NA	S
Comiun maculatum		Poison hemlock	Apiaceae - Parsley Family	I	NA	BF
Convolvulus arvensis		Field bindweed	Convolvulaceae - Morning Glory Family	I	NA	PF
Critesion jubatum	*Hordeum jubatum*	Foxtail barley	Poaceae - Grass Family	N	C	PG
Dyssodia papposa		Fetid marigold	Asteraceae - Sunflower Family	N	NA	PF
Echinochloa crusgalli		Barnyard grass	Poaceae - Grass Family	I	W	AG
Elaeagnus angustifolia		Russian-olive	Elaeagnaceae - Oleaster Family	I	NA	T
Epilobium brachycarpum	*Epilobium paniculatum*	Willowherb	Onagraceae - Evening-primrose Family	N	NA	AF
Erodium cicutarium		Filaree	Geraniaceae - Geranium Family	I	NA	AF
Festuca sp.		Fescue	Poaceae - Grass Family	N	C	PG
Glycyrrhiza lepidota		American licorice	Fabaceae - Pea Family	N	NA	PF

Table 5. Disturbed/Reclaimed Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Gutierrezia sarothrae		Broom snakeweed	Asteraceae - Sunflower Family	N	NA	SS
Helianthus annuus		Common sunflower	Asteraceae - Sunflower Family	N	NA	AF
Hesperostipa comata	*Stipa comata*	Needle-and-thread	Poaceae - Grass Family	N	C	PG
Lactuca serriola		Prickly lettuce	Asteraceae - Sunflower Family	I	NA	BF
Linaria genistifolia subsp. *dalmatica*	*Linaria dalmatica*	Dalmatian toadflax	Scrophulariaceae - Figwort Family	I	NA	PF
Lophopyrum elongatum	*Agropyron elongatum*	Tall wheatgrass	Poaceae - Grass Family	I	C	PG
Malva neglecta		Common mallow	Malvaceae - Mallow Family	I	NA	PF
Melilotus officinalis		Yellow sweetclover	Fabaceae – Pea Family	I	NA	BF
Muhlenbergia richardsonis		Mat muhly	Poaceae - Grass Family	N	W	PG
Negundo aceroides	*Acer negundo*	Box elder	Aceraceae - Maple Family	N	NA	T
Nepeta cataria		Catnip	Lamiaceae - Mint Family	I	NA	PF
Onopordum acanthium		Scotch thistle	Asteraceae - Sunflower Family	I	NA	BF
Oxybaphus linearis	*Mirabilis linearis*	Narrowleaf umbrellawort	Nyctaginaceae - Four-o'clock Family	N	NA	PF
Panicum capillare		Witchgrass	Poaceae - Grass Family	N	W	AG
Panicum virgatum		Switchgrass	Poaceae - Grass Family	N	W	PG
Pascopyrum smithii	*Agropyron smithii*	Western wheatgrass	Poaceae - Grass Family	N	C	PG
Phleum pratense		Common Timothy	Poaceae - Grass Family	I	C	PG
Physalis virginiana		Virginia ground-cherry	Solanaceae - Nightshade Family	I	NA	PF

Table 5. Disturbed/Reclaimed Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Pinus edulis		Pinon pine	Pinaceae - Pine Family	N	NA	T
Pinus ponderosa		Ponderosa pine	Pinaceae - Pine Family	N	NA	T
Poa pratensis		Kentucky bluegrass	Poaceae - Grass Family	I	C	PG
Poinsettia dentata	*Euphorbia dentata*	Toothed spurge	Euphorbiaceae - Spurge Family	I	NA	AF
Populus deltoides		Plains cottonwood	Salicaceae - Willow Family	N	NA	T
Psoralidium tenuiflora		Slimflower scurfpea	Fabaceae - Pea Family	N	NA	PF
Sabina scopulorum		Rocky mountain juniper	Cupressaceae - Cypress Family	N	NA	T
Salix amygdaloides		Peach-leaf willow	Salicaceae - Willow Family	N	NA	T
Salsola iberica		Russian-thistle	Chenopodiaceae - Goosefoot Family	I	NA	AF
Schizachyrium scoparium	*Andropogon scoparius*	Little bluestem	Poaceae - Grass Family	N	W	PG
Setaria viridis		Green floxtail	Poaceae - Grass Family	I	W	AG
Seteria glauca		Yellow foxtail	Poaceae - Grass Family	I	NA	AG
Solidago missouriensis		Prairie goldenrod	Asteraceae - Sunflower Family	N	NA	PF
Sorghastrum nutans		Indian-grass	Poaceae - Grass Family	N	W	PG
Sphaeralcea coccinea		Scarlet globemallow	Malvaceae - Mallow Family	N	NA	PF
Stipa viridula		Green needlegrass	Poaceae - Grass Family	N	C	PG
Taraxicum officinale		Commondandelion	Asteraceae – Sunflower Family	I	NA	PF
Tragopogon dubius		Goatsbeard	Asteraceae - Sunflower Family	I	NA	BF

Table 5. Disturbed/Reclaimed Plant Community

Plant Species List NREL South Table Mountain Site						
Scientific Binomial	**Synonomy**	**Common Name**	**Family**	**Origin**	**Season**	**Life Form**
Tribulus terrestris		Puncturevine	Zygophyllaceae - Caltrop Family	I	NA	AF
Ulmus pumila		Chinese elm	Ulmaceae - Elm Family	I	NA	T
Verbascum thapsus		Common mullein	Scrophulariaceae - Figwort Family	I	NA	BF

APPENDIX B

Photos

Photo 1. December 6, 2010. Short-grass grassland and tall shrubland (upper right). Two mule deer are resting in the grassland on the South Table mesa top. A pocket of mountain mahagony can be seen beyond the deer.

Photo 2. June 23, 2010. Mixed-grass grassland north of the Visitor Center. On the rolling slopes and the flat land on either side of the ephemeral drainage, mixed grass grassland is the dominant plant community. In the upper reaches of the drainage, ravine shrublands are surrounded by grassland and grade into grassland plants toward the lower reaches of the east drainage.

Photo 3. December 6, 2010. Tall shrubland (background) and short-grass grassland (foreground) on the mesa top, upslope and northeast of the amphitheatre drainage. Several species of upland tall shrubs, dominated by mountain mahagony can be seen beyond the grazing mule deer.

Photo 4. June 9, 2010. Short shrubland along the east project boundary. One tall shrub of mountain mahagony was observed but this community is dominated by skunkbrush in this area.

Photo 5. June 23, 2010. Ravine shrubland along the upgradient portions of the east drainage north of the Visitor Center.

Photo 6. June 23, 2010. Ravine shrubland overstory in the upper reaches of the amphitheatre drainage

Photo 7. June 23, 2010. Wetland at the top of the drainage in the southwest of the project boundary.

Photo 8. June 23, 2010. Same wetland as in Photo 7 (above) slightly further upgradient with various obligate wetland graminoids in the foreground and peachleaf willows in the background.

Photo 9. June 23, 2010. Linear depressional wetland northeast of the solar facilty along the northern project boundary.

Photo 10. June 9, 2010. A disturbed community on the perimeter of the Solar Energy Research Facility near the central portion of the southern project boundary.

APPENDIX C

Colorado Natural Heritage Program Data Query Response

Colorado State University

Knowledge to Go Places

June 25, 2010

Colorado Natural Heritage Program
Colorado State University
8002 Campus Delivery
Fort Collins, Colorado 80523-8002
(970) 491-1309
FAX: (970) 491-3349
www.cnhp.colostate.edu

Janetta Shepard, P.W.S.
Restoration Ecologist
Walsh Environmental Scientists & Engineers, LLC
4888 Pearl East Circle, Suite 108
Boulder, Colorado 80301

Dear Janetta:

The Colorado Natural Heritage Program (CNHP) is in receipt of your request for information regarding the NREL South Table Mountain site of interest in Jefferson County, Colorado. In response, I have searched our Biodiversity Tracking and Conservation System (BIOTICS) for natural heritage elements (occurrences of significant natural communities and rare, threatened or endangered plants and animals) documented from the vicinity of the area specified in your request, specifically within a two-mile buffered radius of the proposed project area as described by the shapefile provided to CNHP for the purposes of this review.

The enclosed report describes natural heritage resources known from this area and gives location (by Township, Range, and Section), precision information, and the date of last observation of the element at that location. This report includes elements known to occur within the specified project site, as well as elements known from similar landscapes near the site. Please note that "precision" reflects the resolution of original data. For example, an herbarium record from "4 miles east of Colorado Springs" provides much less spatial information than a topographic map showing the exact location of the occurrence. "Precision" codes of Seconds, Minutes, and General are defined in the footer of the enclosed report.

The report also outlines the status of known elements. We have included status according to Natural Heritage Program methodology and legal status under state and federal statutes. Natural Heritage ranks are standardized across the Heritage Program network, and are assigned for global and state levels of rarity. They range from "1" for critically imperiled or extremely rare elements, to "5" for those that are demonstrably secure.

You may notice that some occurrences do not have sections listed. Those species have been designated as "sensitive" due to their rarity and threats by human activity. Peregrine falcons, for example, are susceptible to human breeders removing falcon eggs from their nests. For these species, CNHP does not normally provide location information beyond township and range. Please contact us should you require more detailed information for sensitive occurrences.

There are no CNHP designated Potential Conservation Area (PCAs) and no Network of Conservation Areas (NCAs) located within the project area, but multiple PCAs are in the general vicinity (see enclosed shapefile and PCA site reports). In order to successfully protect populations or occurrences, it is necessary to delineate conservation areas. These conservation areas focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Conservation areas may include a single occurrence of a rare element or a suite of rare elements or significant features.

Natural Heritage Program COLORADO

The goal of the process is to identify a land area that can provide the habitat and ecological processes upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is hypothesized that some activities will cause degradation to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the preliminary conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

The Colorado Division of Wildlife has legal authority over wildlife in the state. CDOW would therefore be responsible for the evaluation of and final decisions regarding any potential effects a proposed project may have on wildlife. If you would like more specific information regarding these or other vertebrate species in the vicinity of the area of interest, please contact the Colorado Division of Wildlife.

The information contained herein represents the results of a search of Colorado Natural Heritage Program's (CNHP) Biodiversity Tracking and Conservation System (BIOTICS), and can be used as notice to anticipate possible impacts or identify areas of interest. Care should be taken in interpreting these data. Sensitive elements are currently known from within the vicinity of the proposed project area (see enclosed Adobe PDF species report). Additionally, we also searched our observations database for species watch-listed but not fully tracked by CNHP and found no observations in the vicinity of the project area. Please note that the absence of data for a particular area, species, or habitat does not necessarily mean that these natural heritage resources do not occur on or adjacent to the project site, rather that our files do not currently contain information to document their presence. CNHP information should not replace field studies necessary for more localized planning efforts, especially if impacts to wildlife habitat are possible.

Although every attempt is made to provide the most current and precise information possible, please be aware that some of our sources provide a higher level of accuracy than others, and some interpretation may be required. CNHP's data system is constantly updated and revised. Please contact CNHP for an update or assistance with interpretation of this natural heritage information.

The data contained in the report is the product and property of the Colorado Natural Heritage Program (CNHP), a sponsored program at Colorado State University (CSU). The data contained herein are provided on an as is, as available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, CSU and the state of Colorado further expressly disclaim any warranty that the data are error free or current as of the date supplied.

Sincerely,

Michael Menefee
Environmental Review Coordinator

Enc.

Locations and Status of Rare and/or Imperiled Species and Natural Communities known from or likely to occur within a two-mile radius of 327 acres at NREL's South Table Mountain facility in Jefferson County, CO

Report generated: 25 June 2010

EO_ID	major group	scientific name	common name	Prec	last obs	Town/ Range	Sec	TRS Note	grank	srank	eo-rank	ESA	fed stat	st stat
8,530	Birds	*Seiurus aurocapillus*	Ovenbird	G	1989-07-04	004S070W	07		G5	S2B	H	-		
8,251	Insects	*Atrytone arogos*	Arogos Skipper	M	1979-99-99	004S070W	13		G3	S2	H	-		
9,371	Insects	*Atrytone arogos*	Arogos Skipper	M	1991-08-10	003S070W	27		G3	S2	E	-		
						003S070W	28							
						003S070W	29							
						003S070W	32							
						003S070W	33							
						003S070W	34							
						004S070W	03							
						004S070W	04							
						004S070W	05							
8,014	Insects	*Callophrys mossii schryveri*	Moss's Elfin	G	1969-04-20	003S070W	20		G4T3	S2S3	H	-		
5,505	Insects	*Callophrys mossii schryveri*	Moss's Elfin	M	1982-04-11	003S070W	33		G4T3	S2S3	H	-		
9,842	Insects	*Doa ampla*	A Moth	M	9999-99-99	004S070W	04		GNR	S1	E	-		
6,874	Insects	*Erynnis martialis*	Mottled Dusky Wing	G	1980-04-27	003S070W	20		G3	S2S3	H	-		
202	Insects	*Grammia sp. 1*	A Tiger Moth	M	9999-99-99	004S070W	04		G2G3	SNR	E	-		
11,317	Insects	*Polites origenes*	Cross-line Skipper	G	1984-07-03	003S071W	36		G5	S3	H	-		
9,600	Vascular Plants	*Aquilegia saximontana*	Rocky Mountain columbine	G	1947-99-99	003S070W	28		G3	S3	H	-		
8,878	Vascular Plants	*Carex saximontana*	Rocky Mountain sedge	G	1920-05-29	004S070W	35		G5	S1	H	-		
4,986	Vascular Plants	*Carex torreyi*	Torrey sedge	G	1903-99-99	003S070W	28		G4	S1	H	-		
7,430	Vascular Plants	*Spiranthes diluvialis*	Ute ladies' tresses	S	2008-07-28	003S069W			G2G3	S2	B	LT		
						003S069W								
						003S069W								

precision codes: S = "seconds", location known within 100m; M = "minutes", location known within 1 mile; G = "general", location known within 5 miles

Locations and Status of Rare and/or Imperiled Species and Natural Communities known from or likely to occur within a two-mile radius of 327 acres at NREL's South Table Mountain facility in Jefferson County, CO

Report generated: 25 June 2010

EO_ID	major group	scientific name	common name	Prec	last obs	Town/ Range	Sec	TRS Note	grank	srank	eo-rank	ESA	fed stat	st stat
1,310	Insects	*Callophrys mossii schryveri*	Moss's Elfin	G	1982-04-28	003S071W	36		G4T3	S2S3	H	-		
7	Insects	*Celastrina humulus*	Hops Feeding Azure	M	1982-07-03	003S070W	33		G2G3	S2	H	-		
9,087	Insects	*Polites origenes*	Cross-line Skipper	M	1929-07-04	003S070W	33		G5	S3	H	-		
468	Vascular Plants	*Carex saximontana*	Rocky Mountain sedge	G	1878-06-20	003S071W	36		G5	S1	H	-		

precision codes: S = "seconds", location known within 100m; M = "minutes", location known within 1 mile; G = "general", location known within 5 miles

Data Dictionary for
Potential Conservation Area
Transcription Reports from the
Colorado Natural Heritage Program

This Data Dictionary defines terms used in Potential Conservation Area (PCA) Reports exported by the Colorado Natural Heritage Program (CNHP) from our Biodiversity Tracking and Conservation System (BIOTICS) database.

Introduction to Potential Conservation Areas
In order to successfully protect populations or occurrences, it is necessary to delineate conservation areas. These potential conservation areas focus on capturing the ecological processes that are necessary to support the continued existence of a particular element of natural heritage significance. Potential conservation areas may include a single occurrence of a rare element or a suite of rare elements or significant features.

The goal of the process is to identify a land area that can provide the habitat and ecological processes upon which a particular element or suite of elements depends for their continued existence. The best available knowledge of each species' life history is used in conjunction with information about topographic, geomorphic, and hydrologic features, vegetative cover, as well as current and potential land uses. The proposed boundary does not automatically exclude all activity. It is hypothesized that some activities will cause degradation to the element or the process on which they depend, while others will not. Consideration of specific activities or land use changes proposed within or adjacent to the preliminary conservation planning boundary should be carefully considered and evaluated for their consequences to the element on which the conservation unit is based.

Element Occurrence
An Element Occurrence (EO) is defined as a specific example of an Element at a geographic location characterized by a habitat capable of sustaining or contributing to the survival of the species, or by a landscape that supports the ecological integrity of the community.

Element
A biodiversity unit of conservation attention and action for which a Heritage Conservation Status Rank is assigned.

Elements may be recognized at any taxonomic level (although typically are only recognized at the species level and below for organisms, and the Ecological System, Alliance, and Association levels for communities).

Elements may also be recognized for biodiversity units for which there is no systematic hierarchy (e.g., animal assemblages, community Complexes).

Elements may be native or exotic at a particular location and collectively represent the full array of biological and ecological diversity for the geographic area covered. Elements may serve as the targets of Heritage inventory. Typically, these targets include native, regularly occurring vulnerable species (including infraspecific taxa and populations) and exemplary ecological communities.

REPORT HEADER

Name
The official CNHP site name, usually corresponding to a local place name or nearby geographic feature.

Site Code
Unique identifier previously used in the BCD for a site record.

IDENTIFIERS

Site ID
Unique identifier for a site.

Site Class
Value that indicates whether a site is a Potential Conservation Area (PCA) or Network of Conservation Areas (NCA).

Domain values for Site Class are:

PCA
NCA

Site Alias
Other names commonly associated with the PCA. These can include informal names, old site names, names used by other offices or cooperating organizations, or the original survey site name.

Network of Conservation Areas (NCA)

A Network of Conservation Areas (NCA) will fit one of the following definitions:

A. A landscape area that encompasses Potential Conservation Areas (PCAs) that share similar species or natural communities and ecological processes. NCAs include unoccupied or unsurveyed areas that are within the same ecological system that the species or natural communities require. NCAs contain PCAs with an obvious repeating pattern (that is, the same species or natural communities are in each associated PCA).

B. A mostly intact, lightly fragmented landscape that supports wide-ranging species and large scale disturbances. NCAs include unoccupied or unsurveyed areas that demonstrate the connectivity of the landscape. NCAs contain PCAs that may occur at a variety of ecological scales.

NCA Site ID
Site ID of the NCA associated with this PCA.

NCA Site Code
Site code of the NCA associated with this PCA.

NCA Site Name
Official CNHP site name of the NCA associated with this PCA.

Site Relations
Comments that explain the relationship between this site and any nested, overlapping, or adjacent sites.

LOCATORS

Nation
State

Latitude
Degrees, Minutes, Seconds. Datum is NAD 27. Calculated in GIS.

Longitude
Degrees, Minutes, Seconds. Datum in NAD 27. Calculated in GIS.

USGS 7.5 Minute Quadrangle
Calculated in GIS.

- **Quad Code**
- **Quad Name**

County
Calculated in GIS.

Watershed Code
8 digit U.S.G.S. hydrological unit code. Calculated in GIS.

Watershed Name
U.S.G.S. watershed name. Calculated in GIS.

Township/Range/Section (TRS) - Public Land Survey System
Calculated in GIS.

- **Township/Range**
- **Section**
- **Meridian**
- **TRS Note**

Site Directions *[provided with Level 1 data only]*
Specific directions to the site provided by the designer or version author.

SITE DESCRIPTION

Minimum Elevation
Minimum elevation provided by the designer or version author.

Maximum Elevation
Maximum elevation provided by the designer or version author.

Site Description
General visual description (or word picture) of the principal physical and natural features on the site.

Key Environmental Factors
Description of the driving factors or key environmental variables that are known to exert a major influence on the biota at the site (e.g., seasonal flooding, wind, soil type).

Climate Description
General comments concerning climate and weather patterns, wind patterns, seasonal and annual variations, as well as temperature and precipitation patterns characteristic of the site.

Land Use History
Comments concerning past land uses on this site (such as mining, logging, shifting cultivation, etc.).

Cultural Features
Comments concerning any historic, cultural, or archaeological features found on the site (e.g., pictographs, petroglyphs, burial mounds, prehistoric artifacts).

SITE DESIGN

Site Map
Indicates whether a site boundary was field verified or drawn from desktop references.

Domain values for Site Map are:

P – partial; drawn from desktop references
Y – field verified by CNHP personnel

Mapped Date
Date site boundary was last redrawn.

Designer
CNHP biologist responsible for drawing the site boundary.

Boundary Justification
Explanation of the biological rationale used to determine the ecological boundaries for the site.

Primary Area
Area of PCA polygon. Calculated in GIS.

SITE SIGNIFICANCE

Biodiversity Significance Rank
Value that indicates the rating that best describes the significance of the site in terms of its biological diversity.

Domain values for Biodiversity Significance are:

B1: Outstanding Biodiversity Significance
B2: Very high Biodiversity Significance
B3: High Biodiversity Significance
B4: Moderate Biodiversity Significance
B5: General interest/open space
B?: Unknown

Biodiversity Significance Comments
Comments that justify the rating assigned for the site in the Biodiversity Significance field.

Other Values Rank
Value that indicates the rating that best describes the significance of the site in terms of its aesthetic, recreational, open space, and other ecological values; this includes its role in maintaining ecosystem health (e.g., by providing game and wildlife habitat, aquifer recharge functions, erosion control).

Domain values for Other Values are:

V1 - Outstanding values
V2 - High values
V3 - Moderate values
V4 - No known values
V5 - Negative or counter values
V? - Unknown
(null) - Not assessed

Other Values Comments
Comments that justify the rating assigned for the site in the Other Values field.

Protection Urgency Rank *[provided with Level 1 data only]*
Value that indicates the rating that best describes the urgency to protect the site. The urgency for protection action (not to be confused with the urgency for management action) will generally increase with impending threats to the site until legal, political, or other administrative measures are taken.

Domain values for Protection Urgency are:

P1 - Immediately threatened/outstanding opportunity
P2 - Threat/opportunity within 5 years
P3 - Definable threat/opportunity, but not within 5 years
P4 - No threat or special opportunity
P5 - No action to be taken on this site
P? - Unknown

Protection Urgency Comments *[provided with Level 1 data only]*
Comments that justify the rating assigned for the site in the Protection Urgency field.

Management Urgency Rank *[provided with Level 1 data only]*
Value that indicates the rating that best describes the urgency to manage one or more Elements at the site. The urgency for management action (not to be confused with the urgency for legal protection action) requires stewardship intervention in order to maintain EOs at the site.

Domain values for Management Urgency are:

M1 - Essential within 1 year to prevent loss
M2 - Essential within 5 years to prevent loss
M3 - Needed within 5 years to maintain quality
M4 - Not needed now; no current threats; may need in future
M5 - Not needed; no threats anticipated
M? - Unknown

Management Urgency Comments *[provided with Level 1 data only]*
Comments that justify the rating assigned for the site in the Management Urgency field.

LAND MANAGEMENT ISSUES

Land Use Comments
Description of the current and past land use, improvements, and structures on the site.

Natural Hazard Comments
Description of the potential natural hazards (e.g., cliffs, caves, waterfalls) on the site, along with any precautions that should be taken by stewards.

Exotics Comments
Description of potentially damaging exotic (i.e., alien) flora and fauna (e.g., kudzu, honeysuckle, purple loosestrife, periwinkle, English ivy, feral goats, pigs) on the site.

Offsite
Description of off-site land uses (e.g., farming, logging, grazing, dumping, watershed diversion), and how these uses might affect the site, Elements on the site, and management of the site.

Information Needs
Summary of the information that is still needed in order to effectively manage the site and Elements on it.

Management Needs *[provided with Level 1 Data only]*
Summary of the expected management needs for the site and the Elements on it.

Managed Area Relations *[provided with Level 1 Data only]*
Explanation of the site/Managed Area relationship, if a Managed Area has been (or will be) established to protect the site.

Protection Comments *[provided with Level 1 Data only]*
Summary of the general level of protection currently afforded the site that indicates the current protection status of component Tracts.

ASSOCIATED ELEMENTS OF BIODIVERSITY

(Tracked Elements known from the area of a given PCA.)

Element
A biodiversity unit of conservation attention and action for which a Heritage Conservation Status Rank is assigned.

Elements may be recognized at any taxonomic level (although typically are only recognized at the species level and below for organisms, and the Ecological System, Alliance, and Association levels for communities).

Elements may also be recognized for biodiversity units for which there is no systematic hierarchy (e.g., animal assemblages, community Complexes).

Elements may be native or exotic at a particular location and collectively represent the full array of biological and ecological diversity for the geographic area covered. Elements may serve as the targets of Heritage inventory. Typically, these targets include native, regularly occurring vulnerable species (including infraspecific taxa and populations) and exemplary ecological communities.

Element State ID
Unique state identifier for an Element.

State Scientific Name
State scientific name for an Element having occurrences associated with this PCA.

State Common Name
State common name for an Element having occurrences associated with this PCA.

Global Rank
The global element rank that best characterizes the relative rarity or endangerment of the element worldwide. Factors other than the number of occurrences may be considered when assigning a global rank. Global ranks are derived primarily by staff at the Central Heritage Conservation Science Department, unless CNHP has lead responsibility for that element.

Domain values for Global Rank are:

G1 - Globally critically imperiled; typically 5 or fewer occurrences
G2 - Globally imperiled; typically 6 to 20 occurrences
G3 - Globally vulnerable; typically 21 to 100 occurrences
G4 - Globally apparently secure; usually > 100 occurrences
G5 - Globally demonstrably secure although it may be rare in parts of its range
G#G# - A range between two of the numeric ranks; indicates uncertainty about the rarity of the element
G? - Unranked; element is not yet ranked globally
GU - Unrankable; not enough information is known
GH - Historically known with hopes of rediscovery
GX - Extinct; unlikely to be rediscovered
T# - Rank applies to a subspecies or variety
Q - Taxonomic status is questionable

C - Element is extant only in captivation or cultivation
GNR - Not ranked globally

State Rank
The state element rank that best characterizes the relative rarity or endangerment of the element statewide. Factors other than the number of occurrences may be considered when assigning a state rank. State ranks are derived by CNHP staff.

Domain values for State Rank are:

S1 - State critically imperiled; typically 5 or fewer occurrences
S2 - State imperiled; typically 6 to 20 occurrences
S3 - State vulnerable; typically 21 to 100 occurrences
S4 - State apparently secure; usually > 100 occurrences
S5 - State demonstrably secure
S#S# - A range between two of the numeric ranks; indicates uncertainty about the rarity of the element
S? - Unranked; element is not yet ranked in the state
SU - Unrankable; not enough information is known
SH - Historically known with hopes of rediscovery
SX - Extinct; unlikely to be rediscovered
SE - An exotic established in the state; native to a nearby region
SA - Accidental; includes species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or thousands of miles outside their usual range
B - Rank refers to the breeding population of the element
N - Rank refers to the nonbreeding population of the element
C - Element is extant only in captivation or cultivation
SNR – Not ranked in the state

Driving Site Rank
Yes or No, indicates whether this EO is the EO which is driving the biodiversity rank of this PCA. A combination of Global Imperilment Rank, State Imperilment Rank, and EO Rank factors determine if a given EO drives the biodiversity rank of a PCA that supports it.

REFERENCES

Reference ID
The identifier for a reference available for this PCA.

Full Citation
Formal citation for a reference associated with the PCA.

ADDITIONAL TOPICS

Additional Topics
Specific comments on any significant additional nonstandard topics that have not been formally addressed by one of the standard fields in this record.

VERSION

Version Date
Date report information for the PCA was last reviewed or updated.

Version Author
Author of the current version of the transcription in this report.

Potential Conservation Area (PCA) Report

Name Clear Creek to Golden **Site Code** S.USCOHP1*1928

IDENTIFIERS

Site ID 1928 **Site Class** PCA

Site Alias Clear Creek Waterfront

Site Alias Clear Creek at 6th Avenue

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
-		No Data

Site Relations Shares a boundary with Deadman Gulch (S.USCOHP1*2016) and Indian Gulch (S.USCOHP*1705).

LOCATORS

Nation United States **Latitude** 394446N

State Colorado **Longitude** 1051818W

Quad Code	Quad Name
39105-F3	Evergreen
39105-G3	Ralston Buttes
39105-G2	Golden
39105-F2	Morrison

County

Watershed Code	Watershed Name
10190004	Clear

Township/Range	Section	Meridian	Note
003S071W	35	6P	
003S071W	36	6P	
004S071W	01	6P	
004S070W	05	6P	
003S070W	29	6P	
003S070W	32	6P	
003S070W	31	6P	
004S070W	06	6P	
003S070W	33	6P	
003S070W	28	6P	

SITE DESCRIPTION

Minimum Elevation - **Feet** - **Meters**

Maximum Elevation - **Feet** - **Meters**

Site Description

The site includes a narrow band of riparian vegetation along Clear Creek and adjacent slopes in the canyon.

Key Environmental Factors

No Data

Climate Description

No Data

Land Use History

No Data

Cultural Features

No Data

SITE DESIGN

Site Map P - Partial **Mapped Date** 09/11/2008

Designer Panjabi, S.S.

Potential Conservation Area (PCA) Report

Name Clear Creek to Golden **Site Code** S.USCOHP1*1928

Boundary Justification

Includes the plant occurrences and significant up and downstream areas. Although most local ecological processes are included in the boundary, the largest scale forces that support the plants originate upstream; therefore, watershed management strategies that support the conservation of the elements will be necessary for long-term viability.

Primary Area 845.03 **Acres** 341.97 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B2: Very High Biodiversity Significance

Biodiversity Significance Comments

This site includes a good (B-ranked) and a fair (C-ranked) occurrence of a globally imperiled (G2G3/S2) and federally listed plant species, Ute ladies' tresses (*Spiranthes diluvialis*). The downstream occurrence in good condition is the type locality. There is also an unranked occurrence of a state rare plant, blue-eyed grass (*Sisyrinchium demissum*).

Other Values Rank No Data

Other Values Comments

No Data

LAND MANAGMENT ISSUES

Land Use Comments

No Data

Natural Hazard Comments

No Data

Exotics Comments

No Data

Offsite

No Data

Information Needs

No Data

ASSOCIATED ELEMENTS OF BIODIVERSITY

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
17998	*Spiranthes diluvialis*	Ute ladies' tresses	G2G3	S2	No
24424	*Sisyrinchium demissum*	blue-eyed grass	G5	S2	No
17998	*Spiranthes diluvialis*	Ute ladies' tresses	G2G3	S2	Yes

REFERENCES

Reference ID	Full Citation
-	No Data

ADDITIONAL TOPICS

Additional Topics

Original site design by Pague, C.A. 1994-09-12.

VERSION

Version Date 09/11/2008

Version Author Panjabi, S.S.

Potential Conservation Area (PCA) Report

Name Deadman Gulch **Site Code** S.USCOHP1*2016

IDENTIFIERS

Site ID 1323 **Site Class** PCA

Site Alias Lookout Mountain

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
-		No Data

Site Relations No Data

LOCATORS

Nation United States **Latitude** 394327N

State Colorado **Longitude** 1051406W

Quad Code	Quad Name
39105-G2	Golden
39105-F2	Morrison
39105-F3	Evergreen

County

Watershed Code	Watershed Name
10190004	Clear
10190002	Upper South Platte

Township/Range	Section	Meridian	Note
004S070W	04	6P	
004S070W	06	6P	
004S070W	07	6P	
004S070W	10	6P	
004S070W	17	6P	
003S070W	32	6P	
004S070W	16	6P	
004S070W	08	6P	
004S070W	15	6P	
004S070W	05	6P	
003S070W	33	6P	
004S070W	03	6P	
004S070W	09	6P	
003S070W	34	6P	

SITE DESCRIPTION

Minimum Elevation	5,800.00	**Feet**	1,768.00	**Meters**
Maximum Elevation	7,220.00	**Feet**	2,201.00	**Meters**

Site Description

[Pineda 1998:] Elevation: 5800 to 7220 feet (1767 to 2200m). The geology of this area is mostly of the Ratake-Cathedral-Rock outcrop complex containing slopes and ridges that face east, west or south, with 25 to 60 percent slopes. The soils in this complex are mostly formed in clayey and loamy material derived from sedimentary rocks. Soils are suitable for wildlife habitat, woodland, recreation areas, pasture, grazing, community development, and some crops. Soils are typcially shallow and well drained. Soil blowing is minimal, and rock fragments make up about 35 to 80 percent of the soil volume. A mosaic of plant communities exists here. The higher areas are mostly Ponderosa pine communities with a graminoid understory, most of which is young growth, and no fire scars are apparent. Midslopes are dominated mostly by mountain mahogany shrubland communities and yucca with big blue stem grass in the understory. Bottoms of slopes are typically of shrubland/grassland communities, mostly plum, chokecherry, sumac andbuckbrush, with an abundant accumulation of exotic flora at this level. Hillsides are definitely much less weedy than upslope. Graminoids at all levels include one or more of the following: big blue stem, little blue stem, blue grama, western weat, and buffalo grass.

Potential Conservation Area (PCA) Report

Name Deadman Gulch **Site Code** S.USCOHP1*2016

Key Environmental Factors

Fire, erosion, low annual precipitation.

Climate Description

Average annual precipitation is 17 to 20 inches (43 to 50 cm). Average annual air temperature is 43 to 47 degrees Fahrenheit (6.1 to 8.3 C). Average frost-free season is 76 to 125 days, depending on elevation.

Land Use History

At least within the last 100 years, this area was used for grazaing of livestock.

Cultural Features

No Data

SITE DESIGN

Site Map P - Partial **Mapped Date** 01/11/1999

Designer Pineda, P.M.

Boundary Justification

The boundaries are meant to enclose a small watershed, and management should consider what upslope management has on the lower slopes. It is meant to allow for genetic exchange to occur between rare element occurrences. Areas adjacent or encompassing residential development are included to manage for weedy floral invasions.

Primary Area 4,865.77 **Acres** 1,969.12 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B3: High Biodiversity Significance

Biodiversity Significance Comments

This site contains occurrences of a G2 butterfly, as well as a diverse variety of butterfly and skipper occurrences that are peculiar to mixed grass communities of the Colorado Front Range.

Other Values Rank No Data

Other Values Comments

No Data

LAND MANAGMENT ISSUES

Land Use Comments

Historically probably used for grazing of livestock, and more recently has been found to be suitable for residential development.

Natural Hazard Comments

No Data

Exotics Comments

Bromus tectorum, Bromus japonicus, Alyssum, Linaria dalmatica, and very thick, impenetrable stands of Carduus nutans, especially at the bottom of the slopes.

Offsite

Housing developments, roads, freeways, highways, trails, retail development, water diversions, City of Denver, City of Golden, quarries, agricultural develompent, livestock grazing.

Information Needs

No Data

ASSOCIATED ELEMENTS OF BIODIVERSITY

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
17076	*Grammia* sp. 1	A Tiger Moth	G2G3	SNR	No
16895	*Atrytone arogos*	Arogos Skipper	G3	S2	No
16895	*Atrytone arogos*	Arogos Skipper	G3	S2	No
20146	*Celastrina humulus*	Hops Feeding Azure	G2G3	S2	Yes
22043	*Doa ampla*	A Moth	GNR	S1	No
19678	*Erynnis martialis*	Mottled Dusky Wing	G3	S2S3	No

Potential Conservation Area (PCA) Report

Name Deadman Gulch **Site Code** S.USCOHP1*2016

REFERENCES

Reference ID	Full Citation
173854	Field Survey (temporary placeholder citation)

ADDITIONAL TOPICS

Additional Topics

No Data

VERSION

Version Date 01/11/1999

Version Author Pineda, P.M.

Potential Conservation Area (PCA) Report

Name Indian Gulch **Site Code** S.USCOHP*1705

IDENTIFIERS

Site ID 1301 **Site Class** PCA

Site Alias None

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
-		No Data

Site Relations No Data

LOCATORS

Nation United States **Latitude** 394520N

State Colorado **Longitude** 1051547W

Quad Code	Quad Name
39105-G3	Ralston Buttes
39105-G2	Golden
39105-F3	Evergreen

County

Watershed Code	Watershed Name
10190004	Clear

Township/Range	Section	Meridian	Note
003S070W	32	6P	
003S071W	25	6P	
003S070W	29	6P	
003S070W	31	6P	
003S070W	30	6P	
003S071W	36	6P	
003S070W	28	6P	

SITE DESCRIPTION

Minimum Elevation - **Feet** - **Meters**

Maximum Elevation - **Feet** - **Meters**

Site Description

Indian Gulch drains into Clear Creek just above the City of Golden and provides an excellent example of the lower timberline transition zone. It is an area with extreme topography. Indian Gulch drops over 1,400 ft in elevation in less than 1.5 miles, producing steep slopes and occasional 100 ft cliffs. The dry, low elevation slopes are dominated by needle grass, or more commonly a mountain mahogany / needle grass community with occasional patches of skunkbrush. Towards the upper end of Indian Gulch (7,000 ft), the slopes become less steep and gradually become scattered amongst the mountain mahogany shrubs, with big bluestem, little bluestem, and needle grasses dominating the ground layer. Large patches of big bluestem dominate a few of the gentle slopes, while the ridgetops are forested with a mature ponderosa pine stand.

Key Environmental Factors

No Data

Climate Description

No Data

Land Use History

No Data

Cultural Features

No Data

SITE DESIGN

Site Map P - Partial **Mapped Date** 09/12/1994

Designer Pague, C.A.

Potential Conservation Area (PCA) Report

Name Indian Gulch **Site Code** S.USCOHP*1705

Boundary Justification

Includes all the significant plant associations and rare plants plus the mature ponderosa pine forest. The watershed boundaries and slightly beyond are used as the best approximation of a means of assuring the protection of the integrity of the ecosystem. Zoological inventory was not conducted at this site, but is highly recommended.

Primary Area 1,640.05 **Acres** 663.71 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B2: Very High Biodiversity Significance

Biodiversity Significance Comments

Site hosts good to fair (B-ranked, BC-ranked) occurrences of globally imperiled (G2/S2) natural community types (*Pinus ponderosa / Cercocarpus montanus / Andropogon gerardii* and *Cercocarpus montanus / Hesperostipa comata*) as well as a poor (D-ranked) occurrence of a globally imperiled (G2/S2), federally Threatened plant species, Ute ladies' tresses (*Spiranthes diluvialis*).

Other Values Rank No Data

Other Values Comments

No Data

LAND MANAGMENT ISSUES

Land Use Comments

No Data

Natural Hazard Comments

No Data

Exotics Comments

No Data

Offsite

No Data

Information Needs

No Data

ASSOCIATED ELEMENTS OF BIODIVERSITY

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
24587	*Pinus ponderosa / Cercocarpus montanus / Andropogon gerardii* Wooded Herbaceous Vegetation	Foothills Ponderosa Pine Scrub Woodlands	G2	S2?	No
17998	*Spiranthes diluvialis*	Ute ladies' tresses	G2G3	S2	No
24531	*Cercocarpus montanus / Hesperostipa comata* Shrubland	Mixed Foothill Shrublands	G2	S2	Yes

REFERENCES

Reference ID	Full Citation
-	No Data

ADDITIONAL TOPICS

Additional Topics

No Data

VERSION

Version Date 09/12/1994

Version Author Pague, C.A.

Potential Conservation Area (PCA) Report

Name North Table Mountain **Site Code** S.USCOHP1*1927

IDENTIFIERS

Site ID 255 **Site Class** PCA

Site Alias None

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
-		No Data

Site Relations No Data

LOCATORS

Nation United States **Latitude** 394652N

State Colorado **Longitude** 1051236W

Quad Code	Quad Name
39105-G2	Golden

County

Watershed Code	Watershed Name
10190004	Clear

Township/Range	Section	Meridian	Note
003S070W	21	6P	
003S070W	23	6P	
003S070W	28	6P	
003S070W	15	6P	
003S070W	16	6P	
003S070W	14	6P	
003S070W	27	6P	
003S070W	22	6P	

SITE DESCRIPTION

Minimum Elevation - **Feet** - **Meters**

Maximum Elevation - **Feet** - **Meters**

Site Description

The North Table Mountain is a prominent landmark in the Denver-Golden area and has little development on the slopes or on top of the mesa. The mountain is a mesa that is surrounded by the Great Plains except for it's counter part, South Mountain. North Table Mountain consists of rolling hills, extensive grasslands, shrublands, riparian areas, rock outcrops, and small ponds. The top of the mountain is primarily grassland with several types of grass. The slopes are densely vegetated with shrubs on the upper slopes and grasses on the lower slopes. There are three ponds on the top, one of which is naturally formed. Cattle have compacted the soil around all ponds, although tiger salamanders continue to breed in the natural ponds. The current use is light grazing, although certain areas show intensive past grazing. Mineral extraction has affected a number of sites, including a noticeable area on the southwest corner of the mesa. Prairie Falcons feed and probably breed on the cliffs of the mountain, although the nest could not be located. Two nests of Red-tailed Hawks were observed, only one active. Other raptures use the area during migration. It is worthy to note that a large number of ground-nesting birds use this site, including some short-grass prairie species such as the Lark Buntings. The butterfly community contained no rare species; rather, it showed the effects of disturbance. Kilburn and White (1992) give extensive coverage to this area and should be consulted for additional information.

Key Environmental Factors

No Data

Climate Description

No Data

Land Use History

Historically the area has been used for homesteading, grazing, and mining.

Potential Conservation Area (PCA) Report

Name North Table Mountain **Site Code** S.USCOHP1*1927

Cultural Features

No Data

SITE DESIGN

Site Map P - Partial **Mapped Date** 09/12/1994

Designer Pague, C.A.

Boundary Justification

The boundary includes top of the mountain and surrounding slopes. The slopes are included as habitat for important components of the North Table Mountain ecosystem, including large colonies of White-Throated Swifts, Violet-Green Swallows, and at least occasional raptors. In addition, the slopes also provide a buffer from extensive transfers of invasive and weedy plants and animals.

Primary Area 1,799.11 **Acres** 728.08 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B3: High Biodiversity Significance

Biodiversity Significance Comments

The site supports a fair (C-ranked) occurrence of a globally imperiled (G1G2/S1S2) *Hesperostipa comata* Great Plains mixed grass prairie. Current field surveys could elevate the biodiversity rank.

Other Values Rank No Data

Other Values Comments

No Data

LAND MANAGMENT ISSUES

Land Use Comments

No Data

Natural Hazard Comments

No Data

Exotics Comments

No Data

Offsite

No Data

Information Needs

No Data

ASSOCIATED ELEMENTS OF BIODIVERSITY

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
24703	*Hesperostipa comata* Colorado Front Range Herbaceous Vegetation	Great Plains Mixed Grass Prairie	G1G2	S1S2	Yes

REFERENCES

Reference ID	Full Citation
158822	Kilburn, P. and S. L. White. 1992. North Table Mountain its history and natural features. Jefferson County Natural Association.

ADDITIONAL TOPICS

Additional Topics

No Data

VERSION

Version Date 09/12/1994

Version Author Pague, C.A.

Potential Conservation Area (PCA) Report

Name Prospect Park **Site Code** S.USCOHP*352

IDENTIFIERS

Site ID 1633 **Site Class** PCA

Site Alias None

Network of Conservation Areas (NCA)

NCA Site ID	NCA Site Code	NCA Site Name
-		No Data

Site Relations No Data

LOCATORS

Nation United States **Latitude** 394627N

State Colorado **Longitude** 1050726W

Quad Code	Quad Name
39105-G1	Arvada
39105-G2	Golden

County

Watershed Code	Watershed Name
10190004	Clear

Township/Range	Section	Meridian	Note
003S069W	20	6P	
003S069W	22	6P	
003S069W	21	6P	
003S069W	29	6P	
003S069W	14	6P	
003S070W	25	6P	
003S069W	19	6P	
003S069W	30	6P	
003S069W	28	6P	
003S069W	26	6P	
003S069W	23	6P	
003S070W	24	6P	
003S069W	27	6P	

SITE DESCRIPTION

Minimum Elevation	5,280.00	**Feet**	1,609.00	**Meters**
Maximum Elevation	5,450.00	**Feet**	1,661.00	**Meters**

Site Description

Clear Creek flows through the the Prospect Park site from west to east. The site includes the Wheat Ridge Greenbelt, and a narrow area of connectivity to the Jefferson County Open Space to the west, which is evidently used by wildlife such as mountain lions. The overpass at Kipling Street fragments the site, and marks the eastern limit of the wide part of the greenbelt where residential development has not proliferated on the floodplain. From Kipling to the 44th Street overpass, the floodplain is more developed but significant areas of the riparian corridor and floodplain remain, with good examples of cottonwood riparian woodlands and marginal habitat for Ute ladies'-tresses (*Spiranthes diluvialis*). Most of the area was floodplain historically. The dominant vegetation types are cottonwood riparian woodlands and non-native grasslands dominated by smooth brome (*Bromus inermis*). There are many former creek channels which are typically dominated by wetland vegetation such as cattails (*Typha* spp.) and coyote willow (*Salix exigua*). Small creeks flow across the floodplain throughout the summer that are fed by seeps along the ridge to the south and by storm water runoff. Many of these creeks flow through dense vegetation that is virtually impenetrable, such as thickets of common buckthorn (*Rhamnus cathartica*). One occurrence of Ute ladies'-tresses is found within the site and is composed of approximately 18 subpopulations. Counts of over 400 individuals have been obtained in past years (i.e. 1999, a very good year at this location) for the two large subpopulations. A species of earth star (*Mycenastrum* sp. nov.) that is new to science has also been recently documented in the greenbelt west of

Potential Conservation Area (PCA) Report

Name Prospect Park **Site Code** S.USCOHP*352

the Miller Trailhead, and thus far is known only from this location. This report has yet to be verified, and the species description has not yet been published. Two areas in the site have components of rare communities. These include the Plains cottonwood - chokecherry woodland and the Plains cottonwood - snowberry woodland. The size of these areas is small and the condition is affected by the presence of non-native and invasive species. However, these examples may be remnants of the community type that naturally occurred there. Although their quality is poor, these areas could serve as references for restoration of these community types in other parts of the greenbelt where conditions would be appropriate for their establishment.

Key Environmental Factors

No Data

Climate Description

No Data

Land Use History

Grazing, haying, homesteading, gravel mining, and recreational open space.

Cultural Features

No Data

SITE DESIGN

Site Map Y - Yes **Mapped Date** 01/17/2001

Designer Anderson, D.G.

Boundary Justification

The boundary encompasses a broad area known to support *Spiranthes*, inlcuding areas that the species is apparently expanding its range into appropriate habitat. Due to the occasional presence of potential habitat along the riparian corridor of Clear Creek, and the presence of several small subpopulations, all of the corridor east to a historically known location for the state-rare *Ribes americana* is included. The extensive cottonwood riparian woodland in the floodplain is circumscribed due to the potential for restoration to high quality natural communities throughout the area. The area west of the Miller Trailhead is included due to the presence of an undescribed species of earth star (*Mycenastrum* sp. nov.). In general, the entire floodplain, both private and public portions, between Youngsfield Street and 44th Street is included to encompass a functional portion of the riparian system on which the plants depend.

Primary Area 3,860.84 **Acres** 1,562.43 **Hectares**

SITE SIGNIFICANCE

Biodiversity Significance Rank B2: Very High Biodiversity Significance

Biodiversity Significance Comments

This site is drawn for the Ute ladies'-tresses (*Spiranthes diluvialis*), a federally listed plant species. This site contains a good (B-ranked) occurence of this globally imperiled (G2G3/S2) species.

Other Values Rank No Data

Other Values Comments

No Data

LAND MANAGMENT ISSUES

Land Use Comments

No Data

Natural Hazard Comments

No Data

Exotics Comments

Exotic species that are threatening Ute ladies'-tresses (*Spiranthes diluvialis*) in order of priority are teasel (*Dipsacus laciniatus*), leafy spurge (*Euphorbia esula*), Canada thistle (*Breea arvensis*), Russian olive (*Elaeagnus angustifolia*), and yellow toadflax (*Linaria vulgaris*).

Offsite

No Data

Information Needs

No Data

ASSOCIATED ELEMENTS OF BIODIVERSITY

Potential Conservation Area (PCA) Report

Name Prospect Park **Site Code** S.USCOHP*352

Element State ID	State Scientific Name	State Common Name	Global Rank	State Rank	Driving Site Rank
17998	*Spiranthes diluvialis*	Ute ladies' tresses	G2G3	S2	Yes

REFERENCES

Reference ID	Full Citation
167313	Anderson, D. and J. Stevens. 2001. Wheat Ridge Open Space Biological Inventory. Prepared for the City of Wheat Ridge.

ADDITIONAL TOPICS

Additional Topics

No Data

VERSION

Version Date 01/17/2001

Version Author Anderson, D.G.