

FOREST STEWARDSHIP PLAN

**Horsetooth Tract
Colorado State University Research Foundation
PO Box 483
Fort Collins, CO 80522
970-482-2916**

Property Legal Description:

**Parcel number: 0726000905 and 0723000934
80 acres in the SW $\frac{1}{4}$ of the NE $\frac{1}{4}$ & the NW $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 26 and
40 acres in the NE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 23
Township 7 N, Range 70 W
6th Principal Meridian
Larimer County, Colorado**

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Purpose of the Plan

This plan was prepared by the Colorado State Forest Service, Fort Collins District, and meets the requirements of the Forest Stewardship Program, HB-1229 "The Managed Forest Land Act", and the American Tree Farm System.

The plan's primary purpose is to provide forest management recommendations that meet the listed objectives. It should be studied for information and used as a reference when implementing forest management activities on the property.

This plan should be updated in 10 years by a professional forester to reflect changes in the forest, owner's objectives, forest product markets and the forest ecosystem.

Objectives

The primary natural resource objectives for this property include:

- 1) Maintain a healthy and aesthetically pleasing woodland property by:
 - Enhancing species diversity
 - Reducing the fire hazard
 - Controlling insects and diseases
 - Improving the habitat for wildlife including wild turkey, grouse, cavity nesting songbirds, and big game
- 2) Provide guidance for protecting critical infrastructure on the property from the risk of wildfire.

General Property Description

Location

The whole Horsetooth Tract owned by Colorado State University Research Foundation (CSURF) consists of 2 pieces of land. The larger piece is 80 acres and is bordered on its northern, eastern, and southern boundaries by the Horsetooth Mountain Park. Its west boundary is bordered by private landowners. The second, smaller piece is 40 acres and is bordered on its eastern and southern boundary by the Horsetooth Mountain Park. The 40 acre piece will be referred to singularly as Mill Creek. Both properties together will be referred to as the Horsetooth Tract.

This property consists of 2 parcels identified as numbers 0726000905 and 0723000934. The 80 acre piece is located in the SW $\frac{1}{4}$ of the NE $\frac{1}{4}$ & the NW $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 26 and the 40 acre piece, Mill Creek, is located in the NE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 23, in Township 7 N, Range 70 W, 6th Principal Meridian, Larimer County, CO. The property's total area is 120 acres.

Map 1 shows the location of the Horsetooth Tract.

Topography

The highest elevation on the 80 acre piece of the Horsetooth Tract is at approximately 7190 feet above mean sea level and is located in the southeastern corner of the property. The lowest elevation is located along the western boundary of the property and is approximately 6500 feet above mean sea level. The topography is highly variable, ranging from gently sloping grassy hills to steep rocky cliffs and narrow drainages.

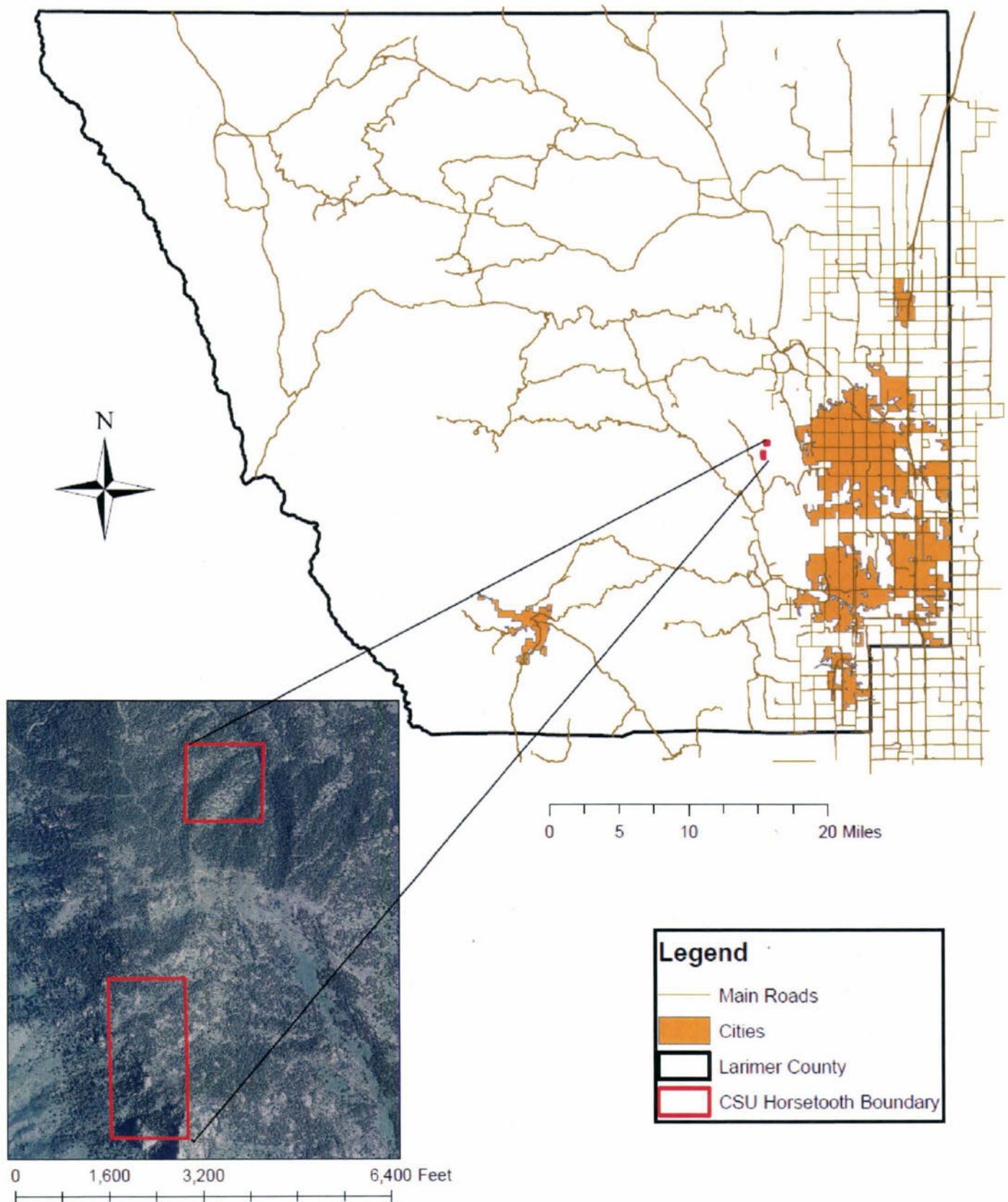
On the Mill Creek portion the highest elevation is at approximately 6780 feet above mean sea level in the southwest corner. The lowest elevation of this portion of the property is in the northeast portion at approximately 6210 feet above mean sea level.

Refer to Map 2 for details of the topography.

Roads and Trails

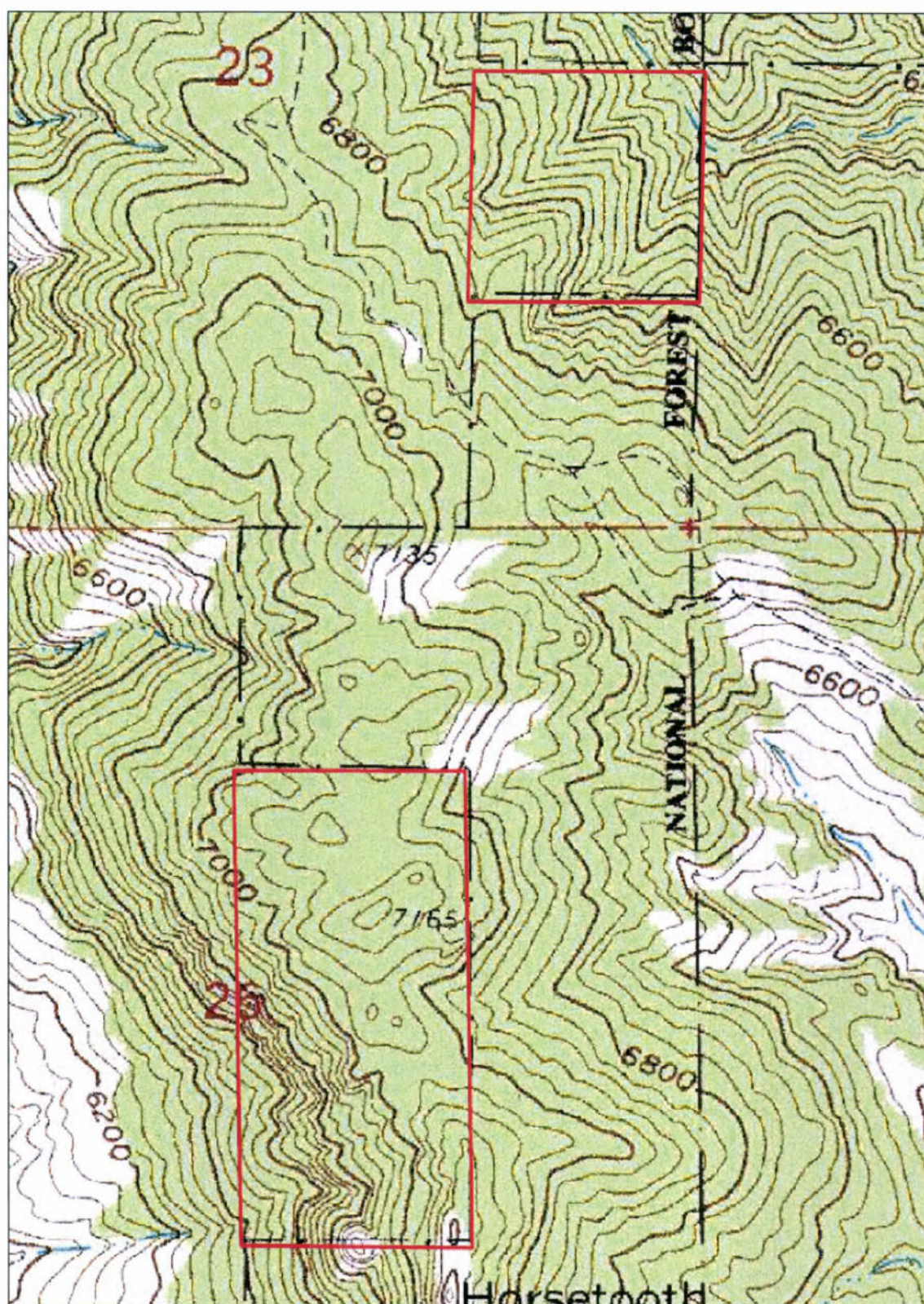
Towers road is accessed through a locked gate on the east side of the park from Shoreline Drive. This road provides access to the towers located on the 80 acre piece of the Horsetooth Tract. There are also some unmarked trails that run north and south through the central part of the property. The Mill Creek portion was accessed via Upper Towers Road.

Map 1. Horsetooth Tract Location





Map 2: Horsetooth Tract Topography



Legend

 Horsetooth Tract Boundaries

Climate

Climate at the Horsetooth Tract is typical of the Front Range foothills, with warm to hot summers and cold winters. Most of the 14 inches of annual precipitation falls as summer showers and thunderstorms. Snow can cover the ground for most of the winter. Chinook winds, which blow down slope and are dry and warm, often melt and evaporate the snow and increase fire danger.

Of the total precipitation, 10.5 inches, or 75 percent, generally falls during the period from April through September. Thunderstorms number about 44 each year, 24 of which occur in July and August. The average seasonal snowfall is about 48 inches. On the average, 18 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

Average relative humidity in mid-afternoon in spring is about 35 percent, and during the rest of the year is about 42 percent. The average relative humidity at dawn is 75 percent.

In winter the average temperature is 29 degrees Fahrenheit and the average daily low is 17 degrees. Summer temperatures average 60 degrees, with an average daily high of 76 degrees, though temperatures above 90 are not uncommon.

Land Use

Prior to Euro-American settlement of the western United States, the Horsetooth Mountain area was used by Native American peoples as a hunting and gathering ground. In the 1800's the land was used for fur trapping and trading, gold prospecting, sandstone quarrying and recreation by early migrants to the area. In more recent years, the property was used regularly for cattle grazing, timber harvesting, quarrying, and farming by some of the areas early settlers such as the Herringtons, Culvers, and Soderbergs.

Colorado State University acquired the property in 1923 through a patent, signed by President Warren G. Harding. The property and its roads must be maintained so that the current land use, communication towers, can work effectively.

Special Sites

No special sites were found in the field survey. Special sites may include: historic burial ruins, old cemeteries, cave entrances, rare mineral outcroppings, and unique ecological communities. These sites can be identified by the landowner or a reliable outside organization. Useful resources to identify special sites can be found here:

http://www.treefarmssystem.org/cms/pages/95_1.html.

Resource Inventory

The variable plot cruising method is used to inventory forest resources. Thirty-three plots were taken on the 80 acre piece and 16 on the 40 acre piece, Mill Creek. The inventory gathers information on stand type, plot location, slope, aspect, tree height and diameter, regeneration, site index, ground cover, fuel loading, wildlife sign, insects and disease. Site tree information was collected and is used as an indicator of land productivity. The field inventory is summarized in the management unit descriptions and in Appendix A. General information on tree species is located in Appendix B.

Insect and Disease

Mountain pine beetle and dwarf mistletoe are two major insect and disease agents impacting both parts of the Horsetooth Tract. Forest management operations should be aimed at mitigating the spread and negative effects of these agents. Management strategies, including control methods are discussed below.

Mountain pine beetle infestations were identified in the inventory in areas throughout the property. These locations have been designated with a red triangle in both Map 3 and 4. In addition, there may be other areas on the property with current mountain pine beetle activity. Trees harboring the beetles should be cut and appropriately treated by the end of June each year to prevent the beetles from infesting surrounding trees. Appropriate treatment includes bark removal (using chainsaw debarker attachment or hand peeler), chipping, solar treatment, milling, or burying under eight inches of soil. If it is not feasible to treat all infested trees, focus on areas where dead trees are a significant safety hazard, such as near access areas.

Dead trees may begin to fall 5-15 years after mortality, and possibly even earlier. Some dead trees with old beetle infestations where the beetles have already flown from the trees may be left for wildlife uses. However, if there are a significant number of these trees they should be removed to reduce the wildfire hazard. The property should be monitored yearly for further activity.

In addition to treating infested wood, there are a few things you can do to increase the chance of survival for currently un-infested trees. Thinning is often recommended. This reduces competition for resources between the trees allowing them to stay healthy and thus less attractive to bark beetles, and more likely to pitch beetles out if they are attacked. See the individual Management Units for thinning recommendations. Also, do not stack firewood or pile slash (branches and tree removal waste) against live trees. This attracts the beetles to those trees. Chipping or lopping and scattering are the best ways to deal with slash so it is the least attractive to beetles. Also, watch for flying beetles or fresh beetle attacks when cutting between July 1st and September 1st, since the mountain pine beetle flight occurs during this time. Lastly, there are preventive sprays available for your most susceptible and highest value trees. For more information on identification, treatment, and prevention of mountain pine beetle see Appendix G.

There are also several locations of the both the portions of the Horsetooth Tract where ponderosa pines are infected with the parasitic plant dwarf mistletoe. These areas can be identified by the

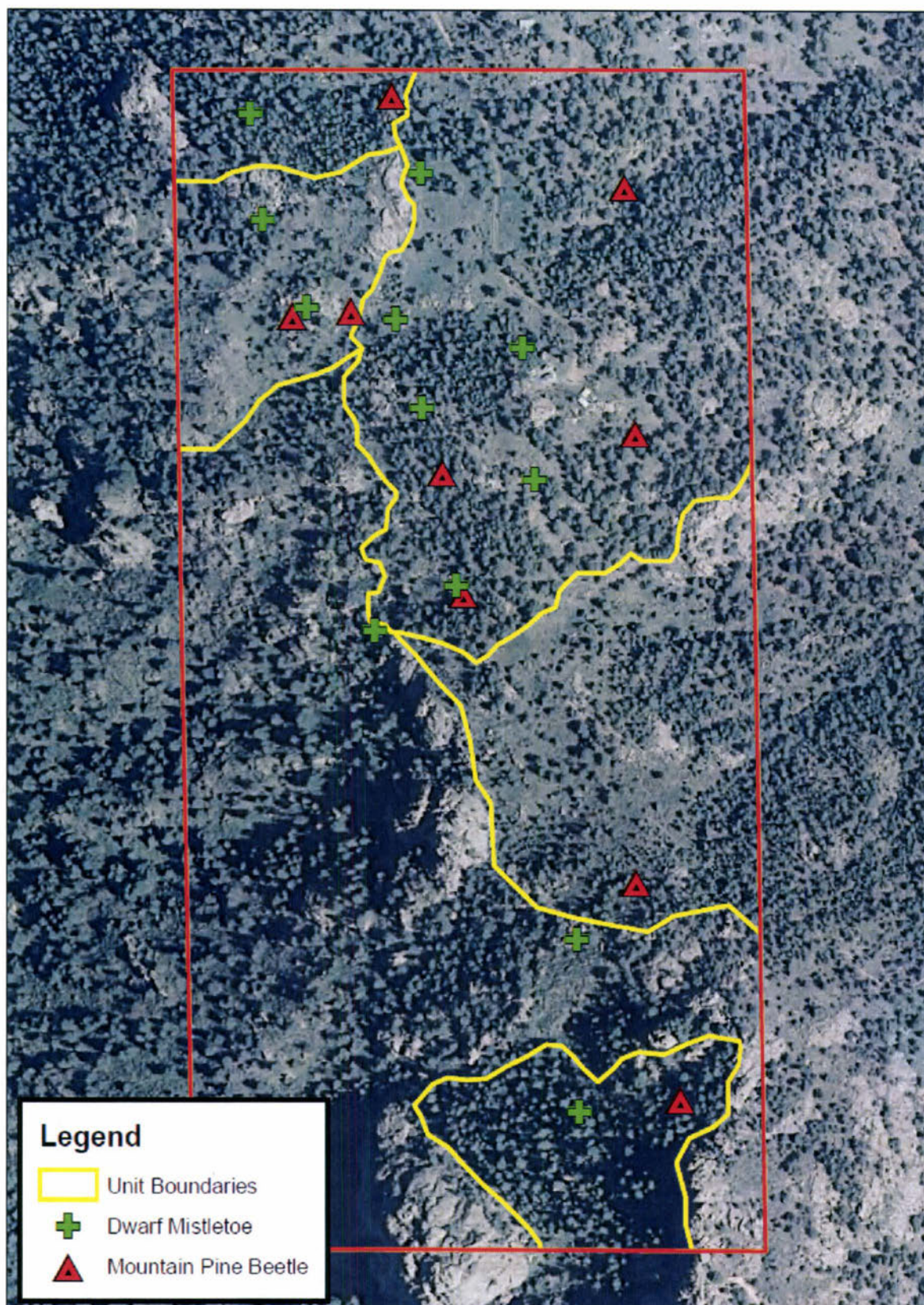
green crosses in Map 3 and 4. Containment of the mistletoe is a priority for the entire Horsetooth Tract, so that it does not spread to the surrounding healthy trees.

Dwarf mistletoe spreads through seed distribution. Seeds travel 30 feet on average to reach and infect a tree. It is recommended that all pine trees within 50 or more feet inside the perimeter of the area of infection be removed. A 50 foot buffer area will help contain the infestation until the entire area can be treated; however this may not be feasible given the aggressiveness of the parasite on this property. Pruning infested branches and/or planting resistant species are alternative options, though they are much less feasible on a large scale. Refer to the individual management units for the presence and treatment of the dwarf mistletoe. Focus on the areas where dwarf mistletoe is most aggressive and continue to monitor for dwarf mistletoe throughout the property. Refer to Appendix G for more information on detection and biology of dwarf mistletoe.

Regarding all insect and disease problems, maintaining healthy and vigorous trees will encourage tree defense mechanisms. The American Tree Farm System encourages all landowners to “make practical efforts to prevent, eradicate or otherwise control invasive species using a range of integrated pest management methods.” Integrated pest management might consist of pesticide use, physical removal methods and preventative methods.

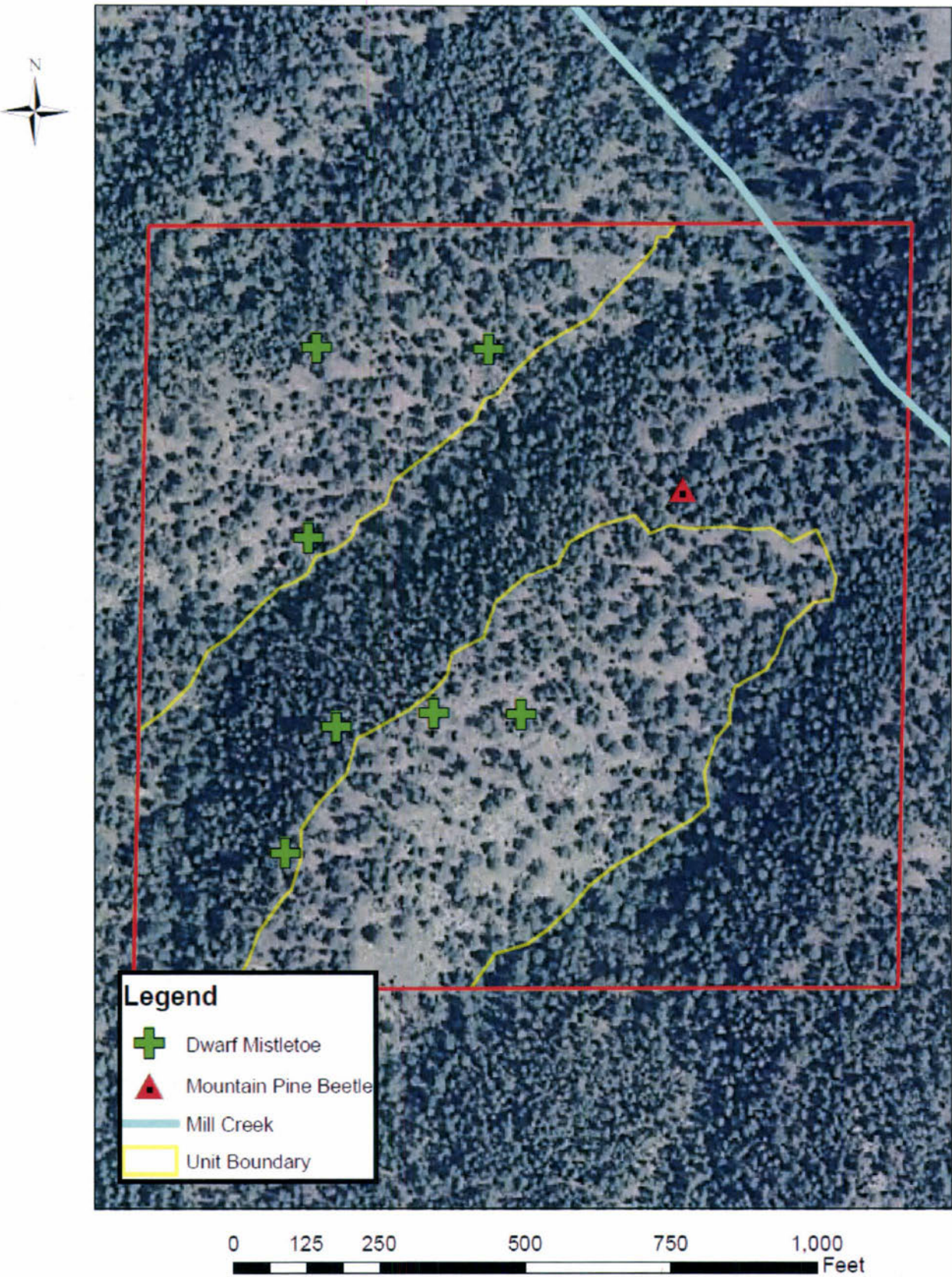
Treatment is scheduled for 2010 in management unit 2 of the Horsetooth Tract, to reduce wildfire hazard. Mountain pine beetle infested trees in the treatment area will be targeted for removal. This treatment was made possible by American Recovery and Reinvestment Act (ARRA) funding and will be performed by Anchor point, a consulting firm, and Larimer County.

Map 3: Horsetooth Tract, 80 Acre, Insects and Disease



0 125 250 500 750 1,000 Feet

Map 4: Horsetooth Tract, Mill Creek, Insects and Disease



Wildlife

The Horsetooth Tract property provides several types of cover and food sources for wildlife. In the commonly used sense, cover is something that protects an animal or bird from weather or enemies, or provides places to rest, reproduce, and to raise young. Trees, shrubs, plants, geomorphic structures, and topographical features provide cover on the property. Plants such as bitterbrush and aspen are also food sources.

During the forest inventory many signs of deer were seen such as droppings, rubs on trees, game trails. Recommendations for forest management activities within this document take into account the various species or groups of species found on the property and are intended to protect or enhance the existing cover and/or food sources. Recommendations address vertical as well as horizontal spatial arrangements of cover. For example, some species have rather demanding vertical cover requirements in terms of nesting, feeding, and roosting (squirrels, turkeys, hawks, eagles) as opposed to those that demand adequate cover for concealment from aerial predators (mice, ground squirrels, rabbits).

Refer to Appendix E for wildlife specifications and a map of Colorado's High Priority Habitats within Private Land Focus Areas. This map can also be found here:

<http://wildlife.state.co.us/NR/rdonlyres/C11416FA-34D7-4876-8206-E192C7BEA190/0/Fig11ColoradoHighPriorityHabitatsPrivateLandFocus.pdf>.

Threatened and Endangered Species

No threatened or endangered (T&E) species were noticed or known to be on this site. The Preble's meadow jumping mouse is found in heavily vegetated, shrub-dominated riparian habitats and immediately adjacent upland habitats along the foothills on the eastern edge of the Front Range of Colorado. This species is listed as threatened on both the federal and state lists, but it is not thought to be a major concern in forested areas. Refer to Appendix E for T&E species lists from the Division of Wildlife (DOW) and the U.S. Fish and Wildlife Service (USFWS).

Please visit this DOW website:

(<http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/ThreatenedEndangeredList/ListOfThreatenedAndEndangeredSpecies.htm>)

Or this USFWS website:

(http://www.fws.gov/ecos/ajax/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=CO&s8fid=112761032792&s8fid=112762573902&s8fid=24012765323362) for more information.

Water

The Mill Creek stream runs across the northeast corner of the property (shown in Map 4). There are also two major drainages that drain to the northeast into Mill Creek; both comprise most of

Unit 7. The first runs from the southwest corner to the northwest corner and does contain a spring and intermittent stream. The second drainage runs across the entire southeast corner of the Mill Creek property.

Refer to Appendix K for more information on water conservation. Information on Best Management Practices (BMPs) to protect water quality is available online:

<http://csfs.colostate.edu/pdfs/ForestryBMP-CO-2010.pdf>.

Wildfire Hazards

Wildfire hazard on this property is mapped from moderate to very high hazard (see Map 5). These hazards are mapped based on the expected fire behavior which is determined by vegetative cover type and habitat structural stage. However, if the aspect is south or southwest, and/or if the slope is greater than 30 percent, increase the hazard class one category. Also, if slash is present and in significant quantities, increase the hazard class one category. Most of the Horsetooth Tract is mapped as very high fire hazard.

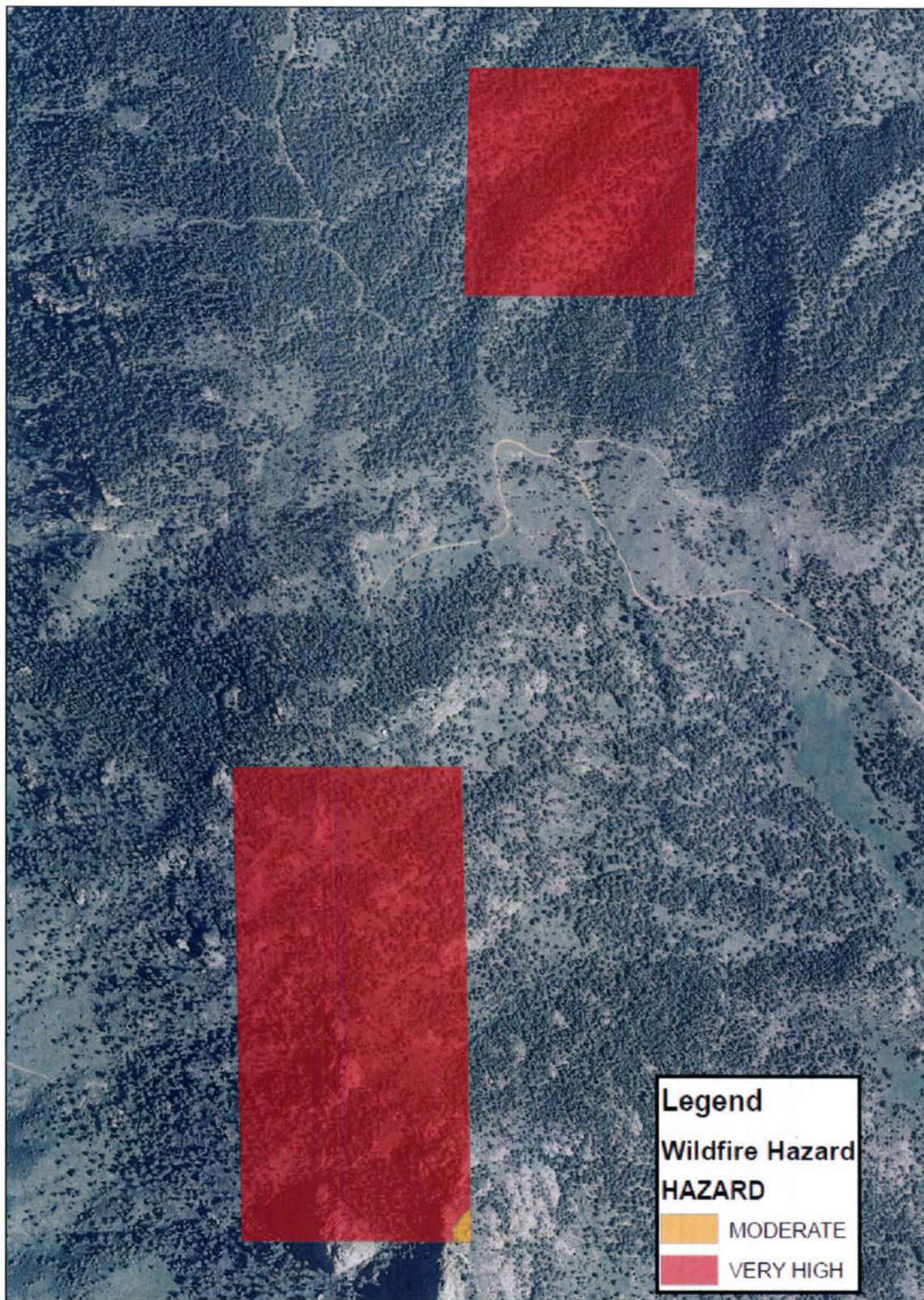
Expected fire behavior of Wildfire Hazard Classes

Hazard Class*	Expected Fire Behavior
Low	Low intensity/short duration fires. Flame lengths 0-4 feet, higher flare-ups rare; duration of highest flames brief; fire spread slow to fast, 1-40 acres per hour; spotting rare, short range.
Moderate	Moderate intensity/longer duration fires. Flame lengths 4-8 feet, intermittent flare-ups occurring to many feet above tree tops; short and medium range spotting common; behavior between flare-ups as in low class.
High	High intensity/medium duration fires. Flame lengths 5-20 feet, of brief duration; fire spread usually fast, at least 40 acres per hour; short range spotting common from blowing leaves.
Very High	High intensity/longer duration fires. Flame lengths greater than 8 feet, flare-ups higher than trees frequent to continuous; spread up to several hundred acres per hour; fire front impassable; spotting several hundred yards common, possible to a mile or more.

* If the aspect is south or southwest, and/or if the slope is greater than 30%, increase hazard class one category. If slash is present in significant quantities, increase hazard class one category.



Map 5: Horsetooth Tract Wildfire Hazard



0 300 600 1,200 1,800 2,400 Feet

Soils

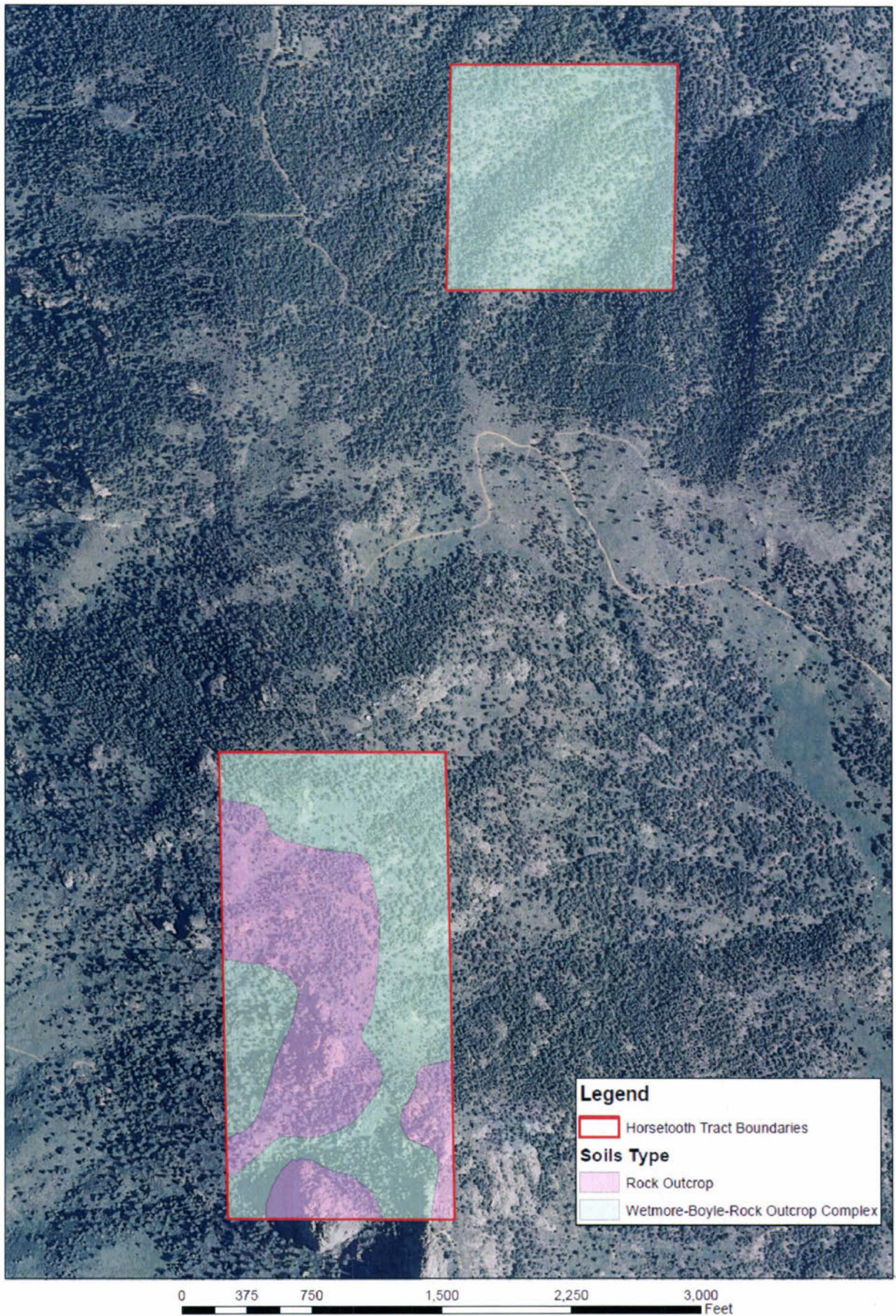
Two different soil types constitute the Horsetooth Tract as seen in Map 6. The soils on the property are made up of Rock Outcrop and Wetmore-Boyle-Rock outcrop complex. Note the runoff rate and hazard of erosion for each soil type. A complete description of each soil type as defined by the USDA soil survey follows:

93 – Rock Outcrop. This type is bare or nearly bare rock. Included in the mapping are areas of shallow and very shallow soils, mainly around the edges of the mapped areas. Runoff is rapid and the hazard of erosion is severe on the included soils and in adjacent areas that receive runoff. This type is used mainly for wildlife habitat and aesthetic purposes. Capability unit VIIIs-1, dry land; not assigned to a range site or a windbreak suitability group.

117 – Wetmore-Boyle-Rock outcrop complex, 5 to 60 percent slopes. This complex consists of strongly sloping to very steep soils on mountainsides and ridges. It is about 35 percent Wetmore gravelly sandy loam, about 30 percent Boyle gravelly sandy loam, and about 25 percent Rock outcrop. Wetmore gravelly sandy loam is in forest, Boyle gravelly sandy loam is in open grassed areas, and Rock outcrop occurs throughout but is commonly near ridges and steeper. The Wetmore soil has the profile described as representative of the Wetmore series. The Boyle soil has a profile similar to the one described as representative of the Boyle series. Included with these soils in mapping are minor areas of Redfeather and Schofield soils. Runoff is rapid, and the hazard of erosion is severe. These soils are suited to woodland or native grasses they are also used for recreation, as sites for summer homes, and for wildlife habitat. Capability unit VIIIs-1, to a range site, and Boyle soil in Rocky Loam range site, woodland suitability group 6x1; not assigned to a windbreak suitability group.



Map 6: Horsetooth Tract Soils



Management Units: Descriptions and Recommendations

This section describes the management units identified on the Horsetooth Tract. General information on management practices, slash disposal, growing stock levels (GSLs), insects, disease, harvesting methods, wildlife management, and wildfire hazard mitigation are found in the Appendices. Technical terms used are defined in the Glossary.

The following recommendations are intended to meet the short and long term objectives for managing the property. As with all management plans, the scheduling and achievement of these activities will depend upon the landowner's resources, environmental conditions, availability of technical assistance, and commercial markets. The landowner should work closely with a professional forester to update this plan as circumstances change and work is accomplished.

Records of accomplishment, time spent on management activities, and income/loss statements should also be kept.

Management Units

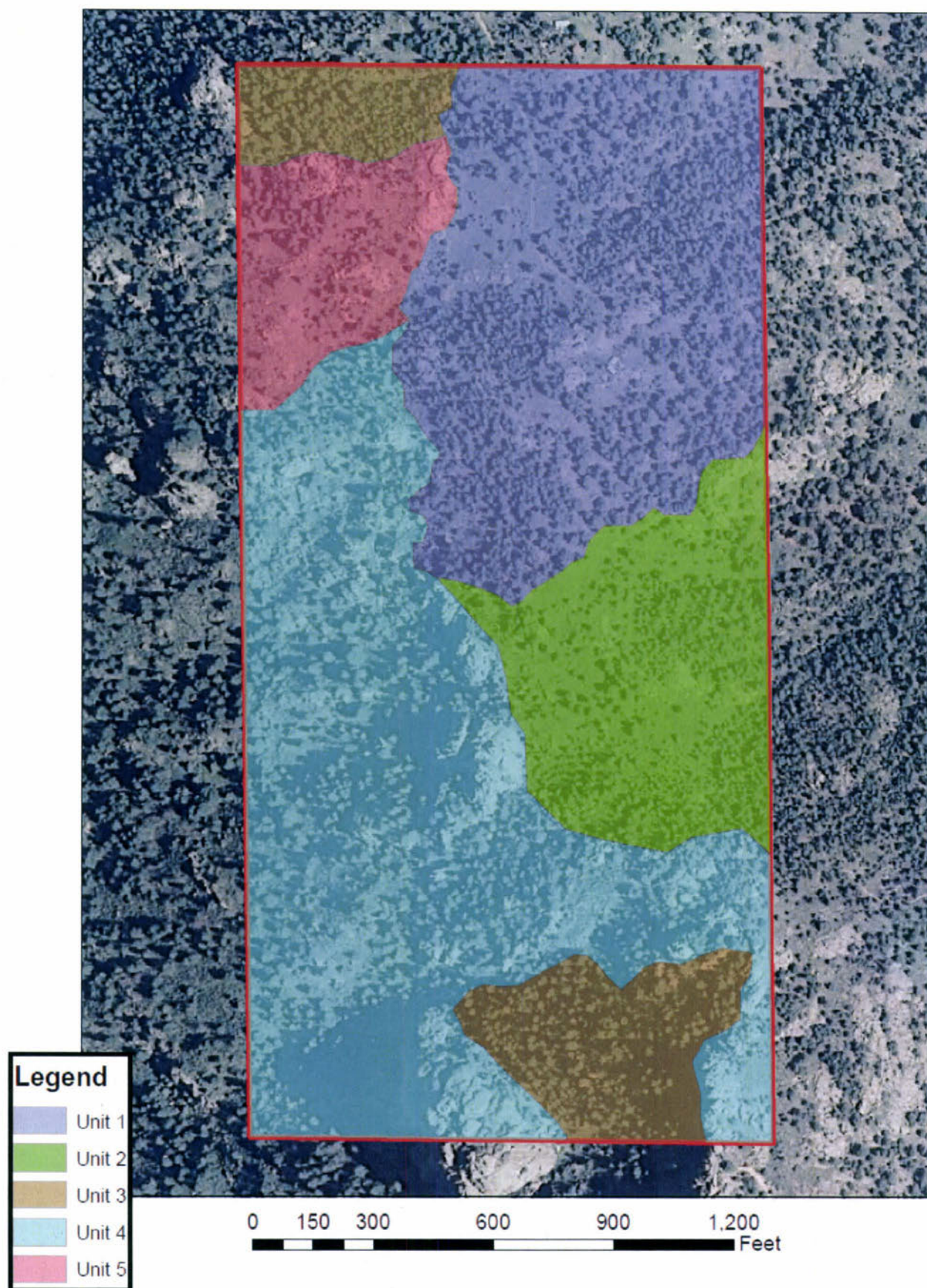
In order to guide management and categorize the various forest types and conditions, the Horsetooth Tract was divided into 7 management units, between both the 80 acre area and the 40 acre, Mill Creek area. The units were delineated based on the current forest conditions that have been influenced primarily by aspect, access and forest cover. The forest cover in Horsetooth Tract consists of mostly ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) with a small component of aspen (*Populus tremuloides*). Units range in density from very open meadow areas to thick Douglas-fir stands. Forest cover types are the result of topographic and soils influences, insect and disease infestations, light and water availability, and previous management activities.

Age was measured on a subsample of the average-sized co-dominant ponderosa pines and Douglas-fir trees. Ages ranged from 65 years to 125 years on the ponderosa pines and from 82 years to 105 years on the Douglas-firs in the 80 acre portion of the Horsetooth Tract. The average age of both ponderosa pine and Douglas-fir was 92 years. The last 10 years of growth on this unit ranged from 1/2" to 7/8" for ponderosa pine and from 5/16" to 1/2" for Douglas-fir; while the best 10 years of growth ranged from 3/4" to 1 and 1/2" for ponderosa pine and from 3/4" to 1 and 3/4" for Douglas-fir. These ranges indicate that not all trees were meeting their growth potential.

In the Mill Creek area, ages ranged from 105 years to 140 years in the ponderosa pines and from 85 years to 155 years in the Douglas-firs. The average age of ponderosa pine was 119 and of Douglas-fir was 112 years. The last 10 years of growth on this unit was 1/2" for ponderosa pine and ranged from 1/4" to 1/2" for Douglas-fir; while the best 10 years of growth ranged from 5/8" to 3/4" for ponderosa pine and from 3/4" to 1 and 1/8" for Douglas-fir. These ranges indicate that not all trees were meeting their growth potential. There certainly are trees on the Horsetooth Tract that are both younger and older than the average sized trees sampled.

Map 7 illustrates the management units in the 80 acre piece of Horsetooth Tract and Map 8 shows the units in the Mill Creek area. These 7 units will be described in the following section. The statistics given are for trees that are 3" DBH or greater unless otherwise noted. Thinning and/or fuels reduction treatments that have occurred over the past 10 years within a unit will be noted, as well as any future management needs.

Map 7: CSU Horsetooth Management Units



Management Unit 1



Description: Unit 1 is 22 acres of ponderosa pine and Douglas-fir. The slopes in this unit range between 10 and 35 percent and have aspects of southwest, south, southeast, east, north, and northeast. Mountain pine beetle infested trees were present in some areas; those noted were designated on Map 3. Dwarf mistletoe was also a serious and fairly widespread problem in this unit. There is also evidence of storm damage, most likely from a late snowfall in the spring of 2009. This area is a proposed treatment area and will be thinned by Larimer County in 2010-2011, through ARRA funding.

The trees have an average DBH of 9.6 inches and an average height of 35 feet. Unit 1 contains areas with open growing trees and also areas with more dense pockets. The average basal area across the unit is 63 square feet per acre, which is a healthy stocking level for this mixed conifer stand. Regenerating trees include 86 ponderosa pine and 79 Douglas-fir saplings, and 57 ponderosa pine and 136 Douglas-fir seedlings per acre.

Some of the shrubs present in the unit include common juniper, bitter brush, currant, mountain mahogany, choke cherry, Rocky Mountain juniper, rabbit brush, and cliff bush. Grasses and

other herbaceous species are present in the understory and include fringed sage, mullein, and prickly pear.

Unit 1 is mapped as having a very high wildfire hazard.

The following table summarizes the stand data:

Forest cover type	Mix of ponderosa pine and Douglas-fir
Unit size	22 acres
Slope	0-35%
Aspect	Southwest, south, southeast, east, north, and northeast
Basal area (average)	63 square feet/acre
Trees/acre ($\geq 3"$ DBH)	83 ponderosa pine 25 Douglas-fir 108 Total
Average tree diameter	9.6" DBH
Average tree height	35 feet
Stocking	Near healthy tree density, treatment is scheduled
Estimated stand volumes	842 cubic feet/acre 3252 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	86 ponderosa pine and 79 Douglas-fir
Seedling trees/acre (<4.5' high)	57 ponderosa pine and 136 Douglas-fir
Wildfire hazard rating	Very high

Recommendations: The priority for this unit is the management for health and diversity and to mitigate wildfire danger to existing transmission towers. This unit should be maintained at a growing stock level (GSL) between 60 and 80. Though the basal area in this unit is within this

range, some thinning is necessary in order to remove trees hit by the mountain pine beetle and dwarf mistletoe and to protect the communication towers from wildfire. Mitigation of both of these issues will involve removing infested trees, in-order to minimize the spread of the mistletoe and mountain pine beetles. See the Insect and Disease section and Appendix G for more information. Treatment is scheduled for this unit in 2010-2011. Treatment will also involve some fuels mitigation to help decrease the potential fire hazard; removal of infested trees will also help to meet this objective.

The tables in Appendix F provide general spacing guidelines based on the desired GSL and the average diameter. While many of the trees to be removed may be smaller and suppressed, be sure to leave a good distribution of healthy trees from all age (or diameter) classes.

The removal of infested trees will serve to help reduce competition for resources, thus allowing the trees to grow at a rate closer to the potential productivity for the land. This thinning will also reduce the fire hazard and the potential for future insect and disease spread. Smaller, stressed, understory trees are often more vulnerable and once infected can introduce disease to otherwise healthy surrounding trees.

The slash generated by the suggested activities can be processed in several different ways. The most cost effective and least labor-intensive method, but also the most unsightly, is to lop and scatter the slash. It is important that the scattered slash be no more than 10" high to ensure a more rapid decomposition and create less of a fire hazard. A second option is to pile and burn the slash in an open area after obtaining a permit. Guidelines for burning slash can be found in Appendix D. The most expensive and labor intensive option is to chip the slash. Because of this, chipping is probably not the best option for a landowner treating large amounts of slash. However, the benefit is that the chips can be sprayed out over the area where they will decompose in the least amount of time. This option is also the least likely to attract and harbor the Ips beetle.

The property boundary should be marked for the entire Horsetooth Tract.

Management Unit 2



Description: Unit 2 consists of 12 acres mixed ponderosa pine and Douglas-fir that was treated in 2009. There is a considerable amount of slash scattered throughout this unit. This unit contains slopes between 5 and 35 percent on northeast, south, and west aspects. Despite past treatment, mountain pine beetle infested trees were still present in several areas. Dwarf mistletoe was not observed in this unit, but it may have been mitigated as part of the treatment.

Rocky Mountain juniper, common juniper, currant, kinnikinnick, and cliff bush, are found in the understory. Grasses are present in Unit 2, as well as fringed sage and junco.

The average tree diameter is 11.4 inches with an average height of 42.9 feet. With an average of 87 square feet of basal area per acre, the unit is near a healthy stocking level for a targeted GSL of 80. Regeneration is moderate with 33 ponderosa pine and 33 Douglas-fir seedlings per acre. There were also patches of aspen regeneration, averaging at 67 seedlings and 67 saplings per acre. Additionally, there are 67 Douglas-fir saplings per acre.

Unit 2 is mapped as having a very high wildfire hazard.

The following table summarizes the stand data:

Forest cover type	Mixed ponderosa pine and Douglas-fir
Unit size	12 acres
Slope	30-35%
Aspect	Northeast, south, and west
Basal area (average)	87 square feet/acre
Trees/acre ($\geq 3''$ DBH)	65 ponderosa pine 53 Douglas-fir 118 all species combined
Average tree diameter	11.4'' DBH
Average tree height	42.9 feet
Stocking	Healthy tree density
Estimated stand volumes	1291 cubic feet/acre 5321 board feet/acre
Sapling trees/acre (<3'' DBH and >4.5' high)	67 Douglas-fir 67 aspen
Seedling trees/acre (<4.5' high)	33 ponderosa pine 33 Douglas-fir 67 aspen
Wildfire hazard rating	Very high

Recommendations: The priority for Unit 2 is management for health and diversity. This unit should be maintained at a growing stock level (GSL) of 80. Though this unit has already been treated some additional thinning is necessary in order to remove trees hit by the mountain pine beetle. Mitigation will involve removing infested trees, in-order to minimize the spread of the mountain pine beetles. See the Insect and Disease section and Appendix G for more

information. This unit should also be monitored for dwarf mistletoe, since adjacent units are infested.

The table in Appendix F entitled *Growing Stock Level 80* has general spacing guidelines based on the desired GSL and the average diameter. While many of the trees to be removed may be smaller and suppressed, be sure to leave a good distribution of healthy trees from all age (or diameter) classes. In general, the same management guidelines and slash treatment should be followed as in Unit 1, which will also help with fuels mitigation.

Management Unit 3



Description: Unit 3 is 8 acres of Douglas fir with some ponderosa pine mixed in. The slopes in this unit range between 25 and 50 percent and include west and southwest aspects. Dwarf mistletoe was present on some ponderosa pines in this unit.

Only Douglas-fir trees were captured in the basal area estimates, these trees have an average DBH of 9.9 inches and an average height of 39 feet. The average basal area in this unit is 60 square feet per acre, which is a healthy overall growing stock level for this stand of trees. However, it appeared that patches in this unit were well above the recommended stocking level and could use some thinning. Regeneration is moderate with 100 ponderosa pine seedlings per acre, and 50 Douglas-fir seedlings per acre.

Some of the shrubs present in the unit include currant and choke cherry. Grass patches were present in the understory.

Unit 2 is mapped as having a very high wildfire hazard.

The following table summarizes the stand data:

Forest cover type	Douglas-fir with some ponderosa pine
Unit size	8 acres
Slope	25-50%
Aspect	West and southwest
Basal area (average)	60 square feet/acre
Trees/acre ($\geq 3''$ DBH)	87 Douglas-fir
Average tree diameter	9.9" DBH
Average tree height	39 feet
Stocking	Healthy tree density, between 60 and 80 square feet/acre
Estimated stand volumes	1172 cubic feet/acre 5546 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	
Seedling trees/acre (<4.5' high)	100 ponderosa pine 50 Douglas-fir
Wildfire hazard rating	Very high

Recommendations: The priority for Unit 3 is management for health and diversity. This unit should be maintained at a growing stock level between 60 and 80 square feet/acre. However, mitigation of dwarf mistletoe trees may require an even lower basal area in some portions of this unit. Dwarf-mistletoe might be managed and contained in this unit if the infected trees are removed. Creating a 50 foot buffer may be appropriate, to prevent spread. Forest management activities will be feasible in the portion of Unit 3 located in the far northwest corner of the property. The remaining piece of this unit, located along the southern boundary, is steep and has very low access, making forest management there a low priority. In general the same slash disposal guidelines should be followed as in Unit 1.

Management Unit 4



Description: Unit 4 is 32 acres of extremely rocky and steep terrain. Large portions of this unit are inaccessible. The slopes in this unit range between 20 and 60 percent and have a west aspect. Mountain pine beetle infested trees were present in some areas. Dwarf mistletoe is a problem in portions of this unit.

The trees have an average DBH of 11.3 inches and an average height of 37 feet. With 80 square feet of basal area, the unit is adequately stocked for the recommended growing stock level (GSL) of 80. Regeneration is moderate with 57 Douglas-fir seedlings and 86 ponderosa pine saplings.

Some of the shrubs present in the unit include currant, bitterbrush, Rocky Mountain juniper, choke cherry, common juniper, and cliff bush. Grasses are present in the understory, as well as prickly pear and mullein.

This unit is mapped as a very high fire hazard, though a small portion of the south west corner is only a moderate fire hazard.

The following table summarizes the stand data:

Forest cover type	Ponderosa pine and Douglas-fir
Unit size	32 acres
Slope	20-60%
Aspect	West
Basal area (average)	80 square feet/acre
Trees/acre (≥ 3" DBH)	78 Ponderosa pine 24 Douglas-fir 102 total
Average tree diameter	11.3" DBH
Average tree height	37 feet
Stocking	Healthy tree density
Estimated stand volumes	1246 cubic feet/acre 5344 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	86 Ponderosa pine
Seedling trees/acre (<4.5' high)	57 Douglas-fir
Wildfire hazard rating	Moderate and very high

Recommendations: The priority for Unit 4 is management for health and diversity. This unit should be maintained at a growing stock level of 80. However, mitigation of dwarf mistletoe trees may require an even lower basal area in some areas. If managed, the same treatment and slash disposal guidelines should be followed as in previous units. This unit was extremely rocky and inaccessible in places, thus it is a low priority for forest management.

Management Unit 5



Description: Unit 5 consists of 6 acres of meadow and open ponderosa pine with patches of regeneration. Blow-down created several openings that are regenerating well. This unit has a 20 percent slope and a west and southwest aspect. Again, mountain pine beetle infested trees were present in some areas. Dwarf mistletoe was extremely aggressive, especially in sapling stage ponderosa pines. These stressors appear to be the cause of a great deal of blow down and woody debris in this unit. There were signs of past management in this unit, though not within recent years.

No basal area of trees greater than 3 inches was recorded on these plots, though there were sparse patches of mature trees in this unit. Basal area was estimated to range from 5-15 square feet per acre.

Some of the shrubs present in the unit include currant and Rocky Mountain juniper. Grasses were abundant in the understory. Sage, mullein, and prickly pear were also present.

Successful regeneration was recorded in this unit. Ponderosa pine regeneration showed approximately 250 seedlings and 50 saplings per acre. Douglas-fir had about 50 saplings per acre.

The following table summarizes the stand data:

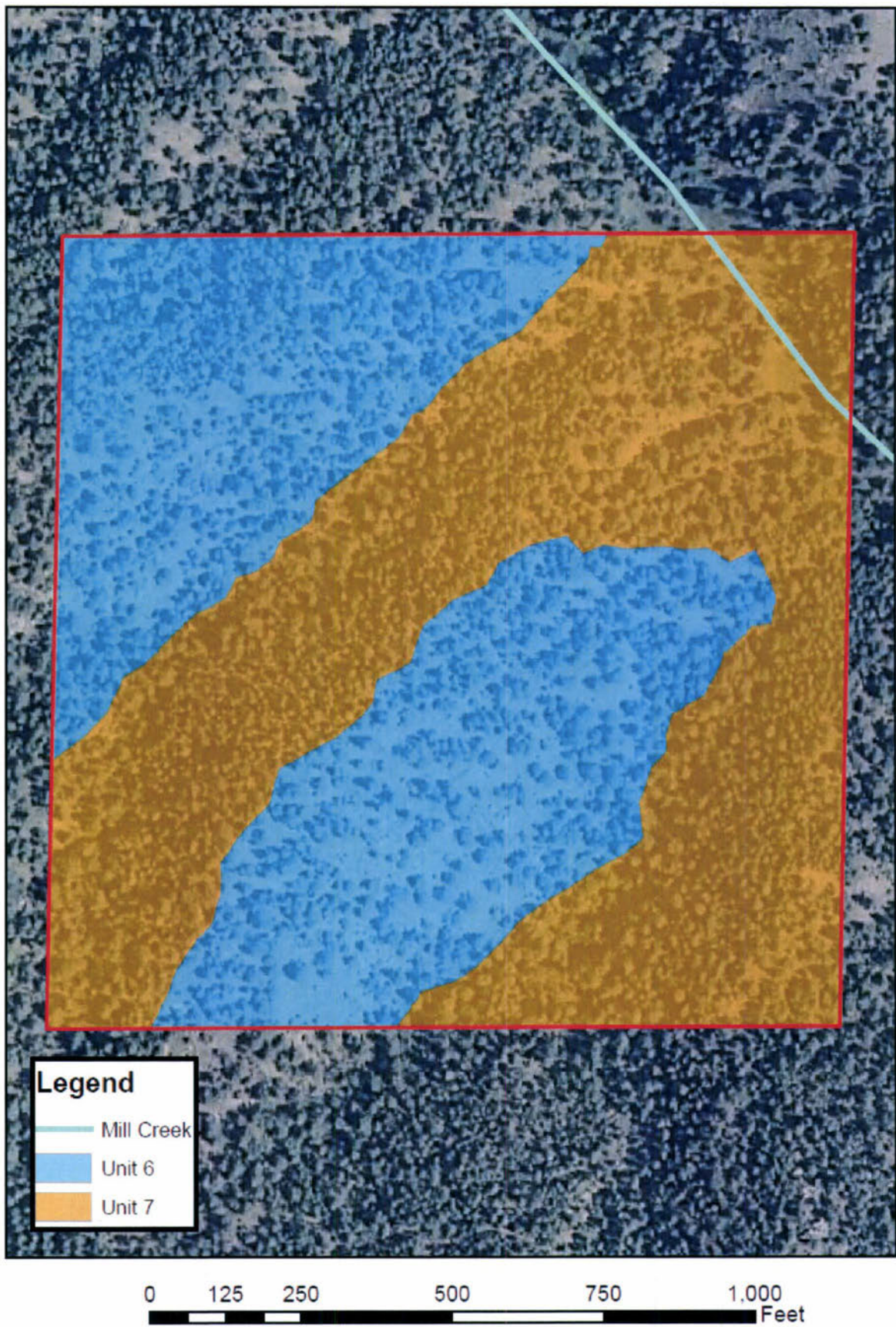
Forest cover type	Open ponderosa pine regeneration and meadow.
Unit size	6 acres
Slope	20%
Aspect	Southwest and west
Basal area (average)	5-15 square feet/ acre
Trees/acre ($\geq 3''$ DBH)	5-15
Average tree diameter	
Average tree height	
Stocking	Very low
Sapling trees/acre (<3'' DBH and >4.5' high)	50 Ponderosa pine 50 Douglas-fir
Seedling trees/acre (<4.5' high)	250 Ponderosa pine
Wildfire hazard rating	Very high

Recommendations: This unit should be thinned concentrating on the ponderosa pine saplings infested with dwarf mistletoe. Creating a 50 foot buffer may be appropriate, to prevent spread. Thinning activities should also be directed to advance Douglas-fir saplings and any other underrepresented species to improve diversity in this unit. This thinning will reduce the potential for further insect and disease infestation. Smaller, stressed, understory trees are often more vulnerable and once infected can introduce disease to otherwise healthy surrounding trees.

The slash generated from the cut should be treated as described in Unit 1.



Map 8: Mill Creek Management Units



Management Unit 6



Description: Unit 6 is 21 acres within the Mill Creek portion of Horsetooth Tract. This unit consists of open ponderosa pine mixed with Douglas-fir. It is less dense overall than the remainder of the Mill Creek property, described in Unit 7. The slopes in this unit range between 30 and 60 percent and aspects include east, northeast, and west (most slopes are east and northeast). Some portions of this unit were heavily impacted by dwarf mistletoe.

The trees have an average DBH of 11.6 inches and an average height of 39 feet. Tree stocking is at a healthy level with an average of 63 square feet of basal area per acre. Regeneration is good with 143 ponderosa pine and 43 Douglas-fir seedlings, and 29 ponderosa pine saplings.

Some of the shrubs present in the unit include currant, Rocky Mountain juniper, cliff bush, and common juniper. Grasses are present in most of the understory, as well as some sedge in the moist areas. Other understory plants include mullein, poison ivy, prickly pear, and fringed sage.

This unit is mapped as a very high fire hazard.

The following table summarizes the stand data:

Forest cover type	Open ponderosa pine and Douglas-fir
Unit Size	21 acres
Slope	30-60%
Aspect	East, northeast, and west
Basal area (average)	63 square feet/acre
Trees/acre (≥ 3" DBH)	66 Ponderosa pine 16 Douglas-fir 82 total
Average tree diameter	11.6" DBH
Average tree height	39 feet
Stocking	Health tree density
Estimated stand volumes	866 cubic feet/acre 3094 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	143 Ponderosa pine 43 Douglas-fir
Seedling trees/acre (<4.5' high)	29 Ponderosa pine
Wildfire hazard rating	Very high

Recommendations: The priority for Unit 6 is management for health and diversity. This unit should be maintained at the current growing stock level. However, mitigation of dwarf mistletoe trees may require an even lower basal area in some areas. Creating a 50 foot buffer may be appropriate, to prevent spread. In general the same management and slash disposal guidelines should be followed as in previous units. In areas that have species other than pine; the management should be to improve growing conditions for these species. This unit was extremely rocky and difficult to access in places, thus it is a low priority for forest management. Forest management is most feasible in the portions of this unit that are in the southwest corner of the property.

Management Unit 7



Description: Unit 7 is 19 acres of Douglas-fir and ponderosa pine within and around the 2 main drainages of this property. Large portions of this unit are very steep, rocky, and inaccessible. The slopes in this unit range between 30 and 60 percent and have a north, northeast, or east aspect. Both dwarf mistletoe and mountain pine beetle were present in portions of this unit.

The trees have an average DBH of 9.6 inches and an average height of 34 feet. With 82 square feet of basal area, the unit is adequately stocked for the recommended growing stock level (GSL) of 80. Regeneration is high with 500 Douglas-fir and 22 ponderosa pine seedlings, as well as 211 Douglas-fir and 100 ponderosa pine saplings.

Some of the shrubs present in the unit include common juniper, currant, cliff bush, snowberry, Rocky Mountain maple, Rocky Mountain juniper, choke cherry, and rose. Grasses are present in the understory, as well as fringed sage.

This unit is mapped as a very high fire hazard.

The following table summarizes the stand data:

Forest cover type	Douglas-fir and ponderosa pine
Unit size	19 acres
Slope	30-60%
Aspect	North, northeast, or east aspect
Basal area (average)	82 square feet/acre
Trees/acre ($\geq 3"$ DBH)	73 Ponderosa pine 64 Douglas-fir 137 total
Average tree diameter	11.27" DBH
Average tree height	34 feet
Stocking	Health tree density
Estimated stand volumes	1211 cubic feet/acre 5020 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	500 Douglas-fir 22 Ponderosa pine
Seedling trees/acre (<4.5' high)	211 Douglas-fir 100 Ponderosa pine
Wildfire hazard rating	Very high

Recommendations: The priority for Unit 7 is management for health and diversity. This unit should be maintained at a growing stock level of 80. However, mitigation of dwarf mistletoe trees may require an even lower basal area in some areas. Creating a 50 foot buffer may be

appropriate, to prevent spread. In general the same management and slash disposal guidelines should be followed as in previous units. In areas that have species other than pine; the management should be to improve growing conditions for these species. This unit was extremely rocky and inaccessible in places, thus it is a low priority for forest management. Forest management is most feasible in the portions of this unit that are in southwest corner of the property.

Lastly portions of this unit include riparian areas, including Mill Creek and at least one intermittent stream. Management efforts should protect these areas; consult the Water section and Appendix K for more information on Best Management Practices.

Ten-Year Work Plan

The following is a suggested ten-year work plan. Management activities are listed in order of priority. Priorities may and should be changed as necessary to meet new opportunities and changing forest conditions. As always, the landowner should work with a professional forester to update and change this plan as needed.

<u>Year</u>	<u>Unit</u>	<u>Recommendations</u>	<u>Acres</u>
2010	All 1	Mark all boundaries well Thin to mitigate fuels and insects & disease (planned ARRA)	- 22
2011	1 2 All	Burn/dispose of slash Thin to mitigate fuels and insects & disease Monitor for insects & disease	22 12
2012	2 All	Burn/dispose of slash Monitor for insects & disease, burn/dispose of slash	22
2013	5 3 All	Thin to mitigate fuels and insects & disease Thin to mitigate fuels, insects & disease in northern portion Monitor for insects & disease, burn/dispose of slash	6 3
2014	6 & 7 All	Thin mitigate fuels, insects & disease in the SW corner Monitor for insects & disease, consider new treatment areas Check and maintain boundaries Burn/dispose of slash where appropriate	3
2015	1 & 2 All	Burn/dispose of any remaining slash Monitor for insects and disease, treat new infestations	
2016	3 All	Burn/dispose of any remaining slash Monitor for insects and disease, treat new infestations	3 19
2017	All	Monitor for insects and disease, treat new infestations	32
2018	5 All	Burn/dispose of any remaining slash Monitor for insects and disease, treat new infestations	6
2019	6 All	Burn/dispose of any remaining slash Monitor for insects and disease, treat new infestations Check and maintain boundaries	3

Glossary of Terms

All Age - In a stand of trees where there are considerable differences in ages of trees and in which three or more age classes are represented.

Artificial Regeneration - Where artificial means such as seeding or planting are used to establish a stand of trees.

Basal Area - A measure of density. It is the square footage of stump tops that would be exposed on an acre if all the trees were cut off at 4 ½ feet above the ground. Often expressed as BA/Acre.

Board Foot - A board foot is 1' x 12" x 1" (l x w x h).

Chipping - Refers to the chipping of logging slash, insect killed material, thinning residue, or potential wildfire fuels into small chips or flakes by a mechanical device. Chips make good mulch if not piled too deep.

Cord - A unit of wood volume equal to a stack 4' x 4' x 8' solid. (128 cubic feet).

Crown Cover (or Canopy Cover) - the ground area covered by the crowns of trees or woody vegetation as delimited by the vertical projection of crown perimeters and commonly expressed as a percent of total ground area

Cutting Cycle - The time interval between treatments.

DBH (Diameter at Breast Height) - The measurement of tree diameter at a point 4 1/2 feet above the uphill ground level. Usually expressed in inches.

Dog Hair - A stand of trees growing so closely together as to give the impression the trees are "as thick as hair on a dog's back."

DMR (Dwarf Mistletoe Rating) - Refers to Hawksworth's 6-point rating level for measurement of differing levels of dwarf-mistletoe infection.

Entry - Actual entering of stands for treatment purposes.

Ephemeral Stream - a stream or portion of a stream that flows only in direct response to precipitation, receiving little or no water from springs and no long continued supply from snow or other sources, and whose channel is at all times above the water table

Even-Aged - A stand of trees in which the dominant trees originated at about the same time. Generally only one age class is represented.

Forage - Food available to grazing livestock or wildlife in the form of grasses, shrubs, and forbs.

Fuel Load – the oven-dry weight of fuel per unit area

-note load is often described by size or timelag class, and as live or dead, herbaceous or woody

Fuel Treatment - Practices used to reduce wildfire hazard by changing the composition of forest fuels.

Fuelwood - Dead woody material that has not begun to decay and that can be utilized for heating purposes.

Group Selection - Removal of a group of mature trees with intent to obtain natural regeneration from seeds produced adjacent to the area occupied by the group.

GSL (Growing Stock Level) - Stand density after treatment is expressed as a relationship between basal area and average stand diameter after cutting. A level is named by the basal area desired when average diameter is 10.0 inches. Basal areas increase with diameter until 10.0 inches diameter is reached, and remain constant thereafter. i.e., GSL 80 = basal area of 80.0 square feet when average stand diameter after cutting is 10.0 inches or larger.

Harvest - Removal of mature (commercial) trees.

Houselog - A portion of a tree which can be manufactured into a log that will be used in the construction of a log cabin. At least 8 feet long and 8 inches in diameter at the smallest end.

Lineal Foot - (Running foot) A unit of measure for houselogs, posts and poles. Only length is measured since diameter is not relevant.

Live Crown Ratio – the ratio of crown length to total tree height

Lop and Scatter - Tops and limbs of downed trees are lopped (cut) into small segments, scattered, and left to decompose. The closer to the ground pieces lie, the more rapid the decomposition.

Management Units - Areas or units with similar tree characteristics and management objectives. Can be a portion of one stand or several stands combined.

Marginal - Where commercial harvest becomes impractical for numerous reasons including: steep slope, transportation costs, tree density, tree quality, species, existing markets, etc.

Mature/Overmature - Trees that have reached their maximum growth potential and are falling victim to insects, diseases, and natural mortality.

Merchantable Material - Portions of a tree which can be processed and sold at a profit.

MBF (Thousand Board Feet) - 1000 - 1" x 1" x 12" boards; common unit of measure in sales of sawlogs.

Natural Regeneration - Tree seedlings which become established without added costs of seeding and/or planting. Seed source comes from existing or adjoining trees.

Patch - An area of trees of relatively uniform density, tree quality, and age structure that is too small to be treated as a stand.

Piling and Burning - Slash or other forest woody fuels is bunched into piles and burned to eliminate fire hazard. Piling can either be done by machine or by hand. Burning should be done under safe conditions by permit from local air quality agency.

Posts and Poles - Generally a product of thinning. Size range from 6 ½ feet to 20 feet in length and 2 ½ to 10 inches in diameter at the small end of the individual piece.

Pruning - Removal of branches to improve tree beauty, increase future lumber value, remove ladder fuels, and remove disease infested limbs.

Reproduction - Synonymous with regeneration. See artificial and natural.

Right-of-Way - Legal access for transporting forest products.

Sawlog - A portion of a tree which can be manufactured into lumber. At least 8 feet long and 6 inches in diameter at the small end of the cylinder.

Seed Cut - Reduction of the density of mature trees to encourage the establishment of natural regeneration over an area large enough to be treated as a stand.

Silvicultural Practices - Tree management techniques and procedures utilized to reach a given desirable stand condition.

Site Index - Relative measure of the potential productivity of an area. Generally it is the height of a tree at 100 years of age. On trees less than 100 years, graphs are used to extrapolate the normal base age.

Skidding - The process of moving felled (cut) trees to a central point for loading on a vehicle for transport to the manufacturing point. Can utilize crawler tractors, 4-wheel drive rubber-tired tractors, cable cranes, horses or mules.

Stand - A subdivision of a treatment area that is several acres in size, usually 5 acres or larger. Applicable to an area of even-aged or all-aged trees that can be regenerated by a single reproduction method.

Suppression - in silviculture, the process whereby a tree or other vegetation loses vigor and may die when growing space is not sufficient to provide photosynthate or moisture to support adequate growth

Thinning - Removal of poorest formed, damaged, suppressed, and crowded trees in a stand to improve growth and form of remaining trees.

Two-Storied Stand - A stand composed of two definite age classes of trees with a significant or noticeable difference in tree heights giving a "layered" effect.

Uneven-Aged - Same as all-aged.

Wolf Tree - A slang term for a poor form, open grown tree which has numerous, large green branches. Another term often used is "apple-orchard" tree. Not a desirable, single-stem, self-pruning, upright tree.

Yarding - Same as skidding.

FOREST STEWARDSHIP PLAN

For:

Horsetooth Mountain Park
Larimer County Parks and Open Lands
200 W. Oak St.
Fort Collins, CO 80521
(970) 498-7000

Property Legal Description:

Parcel numbers: 07360-00-944, 97310-00-923, 97300-00-901, 07250-00-902, 07260-00-916,
07260-00-933, 07230-00-932, 07240-00-945, 07250-00-904, 97304-00-905, 07350-00-930,
97310-00-902

2400 acres in Sections 24, 25, 26, 30, 31, 35, 36
Township 7 N, Range 69 and 70 W
6th Principal Meridian
Larimer County, Colorado

Prepared by:

Greg Zausen
Fort Collins District
Colorado State Forest Service
Foothills Campus, Building 1052, CSU
Fort Collins, Colorado 80523-5075
(970) 491-8660

March 2010

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Purpose of the Plan

This plan was prepared by the Colorado State Forest Service, Fort Collins District, and meets the requirements of the Forest Stewardship Program, HB-1229 "The Managed Forest Land Act", and the American Tree Farm System.

The plan's primary purpose is to provide forest management recommendations that meet the listed objectives. It should be studied for information and used as a reference when implementing forest management activities on the property.

This plan should be updated in 10 years by a professional forester to reflect changes in the forest, owner's objectives, forest product markets and the forest ecosystem.

Objectives

The primary natural resource objectives for this property include:

- 1) Maintain a healthy and aesthetically pleasing forested property by:
 - Enhancing species diversity
 - Reducing the fire hazard
 - Controlling insects and diseases
 - Improving the habitat for wildlife including wild turkey, grouse, cavity nesting songbirds, and big game
- 2) Provide forest recreation opportunities
- 3) Provide an update to the previous management plan and direction for future forest management on the property

General Property Description

Location

Horsetooth Mountain Park is located in the foothills of the Rocky Mountains just west of Fort Collins, CO. It is bordered to the north by Lory State Park, to the east by Horsetooth Reservoir and private property, and private lands to the south and west. Also bordering Horsetooth Mountain Park are Culver, Hughey, and Soderberg Open Spaces. This plan covers management for Horsetooth Mountain Park as well as Hughey and Soderberg Open Spaces, which cover approximately 2400 acres. Culver Open Space has a separate forest management plan.

The property for which this plan is intended is made up of twelve parcels: **07360-00-944, 97310-00-923, 97300-00-901, 07250-00-902, 07260-00-916, 07260-00-933, 07230-00-932, 07240-00-945, 07250-00-904, 97304-00-905, 07350-00-930 (Hughey), 97310-00-902 (Soderberg)**. These parcels are located in Sections 24, 25, 26, 30, 31, 35, and 36, Township 7 N, Range 69 and 70 W, 6th Principal Meridian, Larimer County, Colorado.

Map 1 shows the location of Horsetooth Mountain Park.

Topography

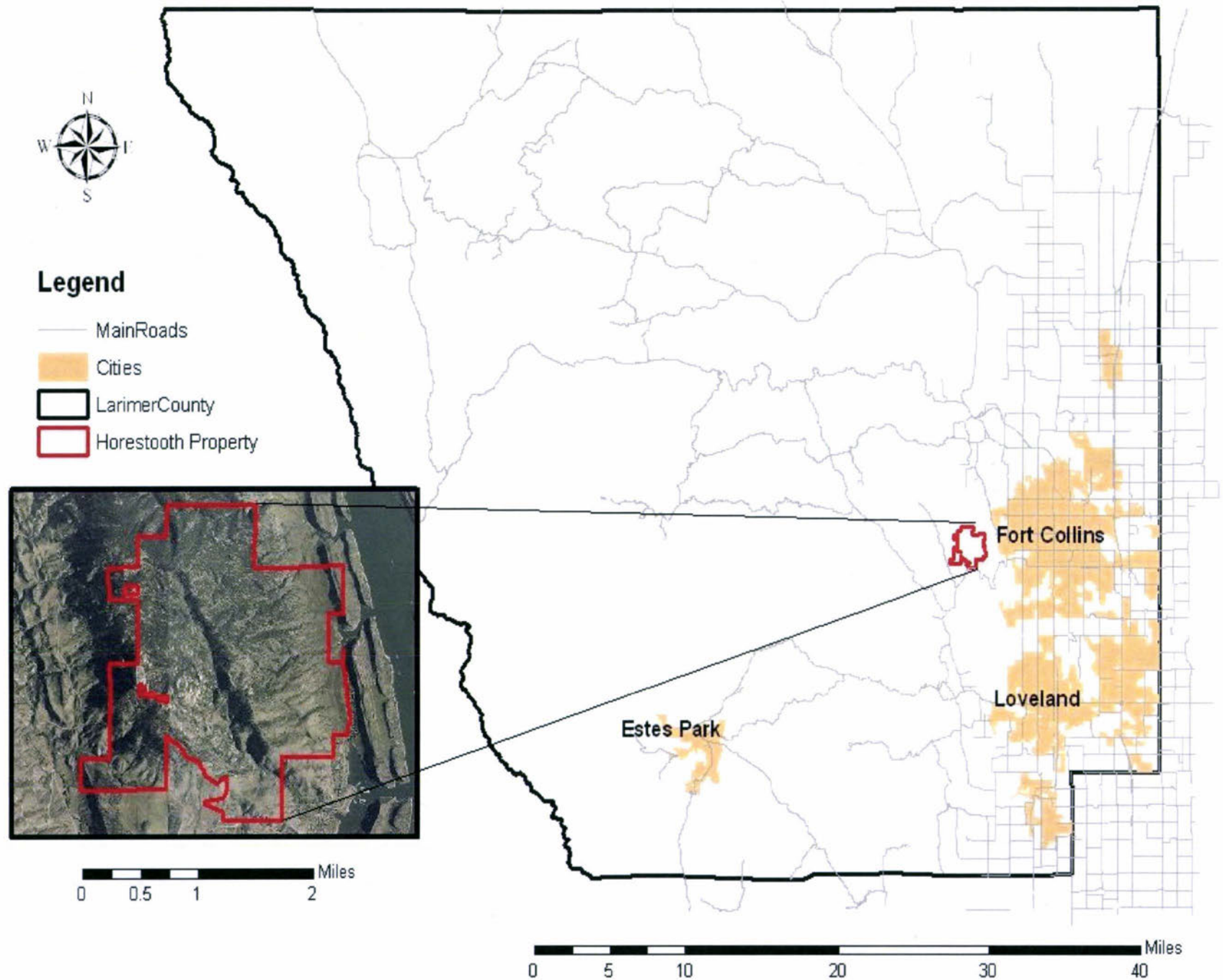
The highest elevation within Horsetooth Mountain Park occurs on top of Horsetooth Rock on the west side of the park and is 7,255 feet above mean sea level. The lowest elevation occurs near Dixon Cove in the northeastern part of the park at 5,440 feet. The topography is highly variable, ranging from gently sloping grassy hills to steep rocky cliffs and narrow canyons. There are numerous sub-drainages throughout the property, but the most prominent drainage is the Spring Creek Valley, which runs from north to south through the center of the park.

Refer to Map 2 for details of the topography.

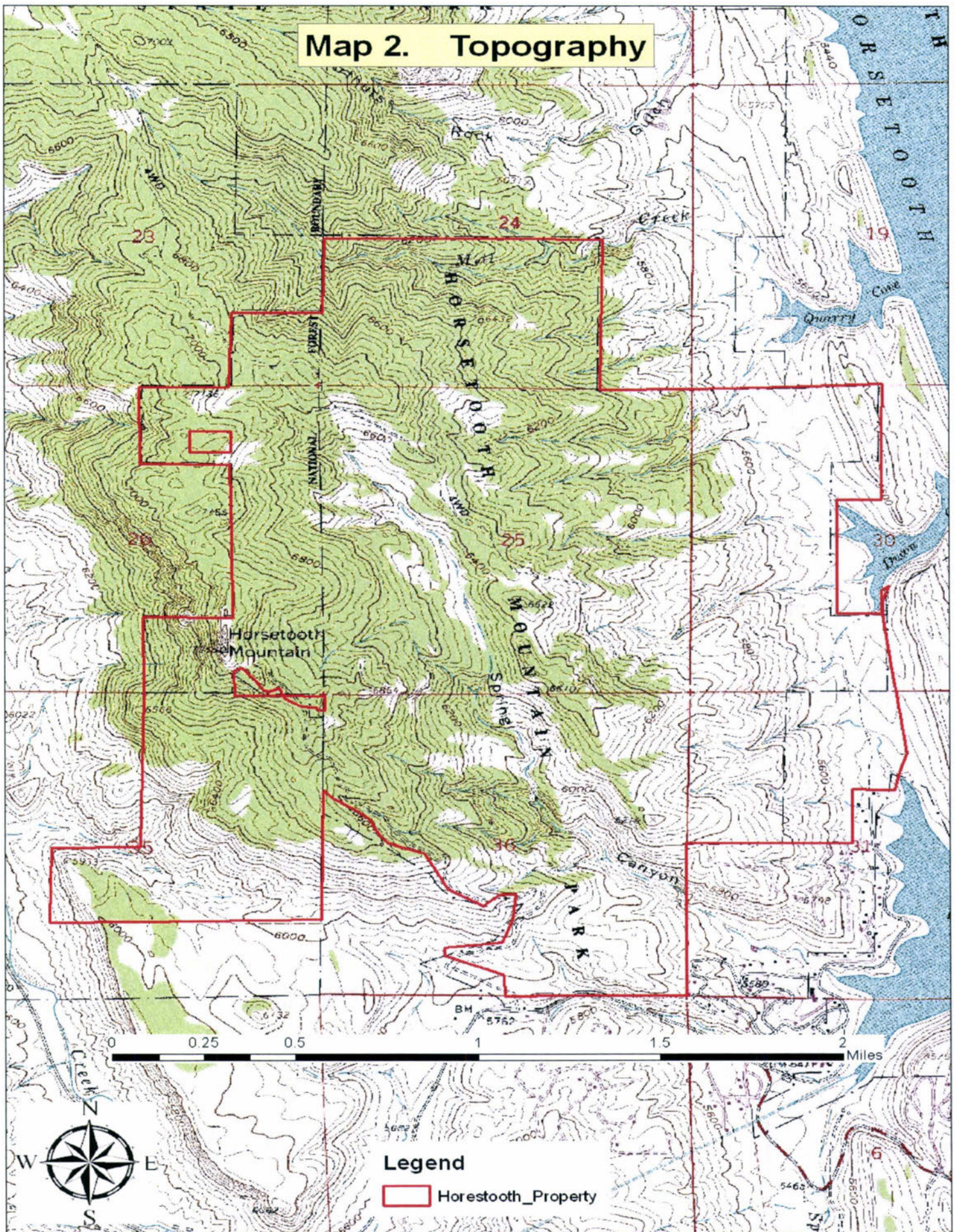
Roads and Trails

Horsetooth Mountain Park is managed as a recreation area and contains an extensive network of trails that are used for hiking, horseback riding, mountain biking, and trail running. A map of the park trails can be obtained from Larimer County or downloaded from the following website: <http://www.larimer.org/naturalresources/Htmp.htm>. There are also two restricted access roads within the park. Towers road is accessed through a locked gate on the east side of the park from Shoreline Drive. This road provides access to upper portions of the park and the towers located on CSU property on the western border of the park. The South Ridge Trail is a jeep trail that is accessed from the Horsetooth Mountain Trailhead on the south end of the park. This road provides limited access to the southern part of the park.

Map 1. Horsetooth Open Space Location



Map 2. Topography



Climate

Climate at Horsetooth Mountain Park is typical of the Front Range foothills, with warm to hot summers and cold winters. Most of the 14 inches of annual precipitation falls as summer showers and thunderstorms. Snow can cover the ground for most of the winter. Chinook winds, which blow down slope and are dry and warm, often melt and evaporate the snow and increase fire danger.

Of the total precipitation, 10.5 inches, or 75 percent, generally falls during the period from April through September. Thunderstorms number about 44 each year, 24 of which occur in July and August. The average seasonal snowfall is about 48 inches. On the average, 18 days have at least 1 inch of snow on the ground, but the number of days varies greatly from year to year.

Average relative humidity in mid-afternoon in spring is about 35 percent, and during the rest of the year is about 42 percent. The average relative humidity at dawn is 75 percent.

In winter the average temperature is 29 degrees Fahrenheit and the average daily low is 17 degrees. Summer temperatures average 60 degrees, with an average daily high of 76 degrees, though temperatures above 90 are not uncommon.

Land Use

Prior to Euro-American settlement of the western United States, the Horsetooth Mountain area was used by Native American peoples as a hunting and gathering ground. In the 1800's the land was used for fur trapping and trading, gold prospecting, sandstone quarrying and recreation by early migrants to the area. In more recent years, the property was used regularly for cattle grazing, timber harvesting, quarrying, and farming by some of the areas early settlers such as the Herringtons, Culvers, and Soderbergs. In 1982 Larimer County acquired Horsetooth Mountain Park and has since been managing the land as an open space and recreation area (source: Resource Management and Implementation Plan for Horsetooth Mountain Park, 2006).

Resource Inventory

The variable plot cruising method is used to inventory forest resources. One hundred fifty-two plots were taken. The inventory gathers information on forest type, plot location, slope, slope aspect, tree height and diameter, tree regeneration, site quality, herbaceous understory cover, fuel loading, wildlife sign, insects and disease. Site tree information was collected and is used as an indicator of land productivity. The field inventory is summarized in the management unit descriptions and in Appendix A. General information on tree species is located in Appendix B.

Insect and Disease

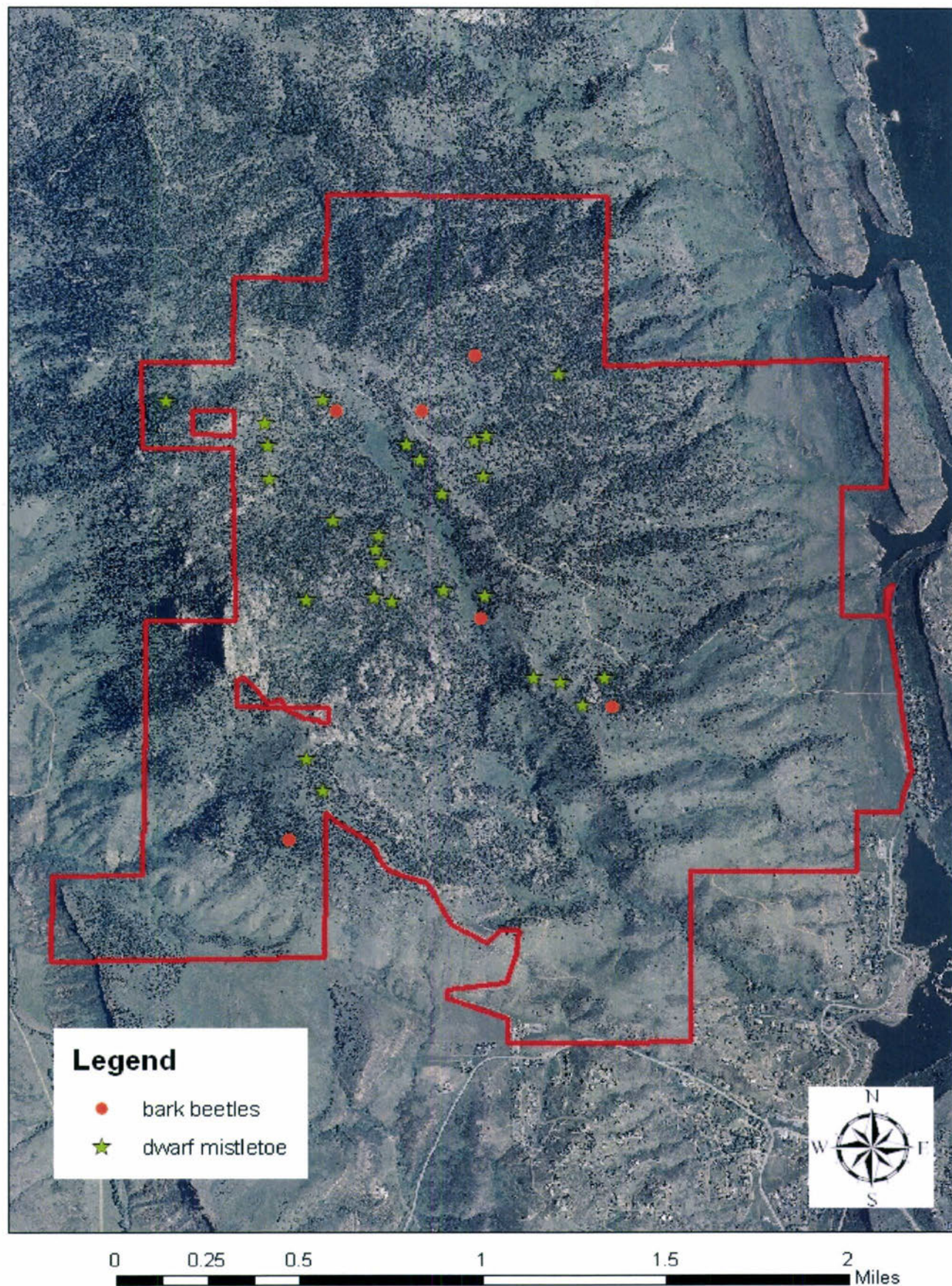
The primary insect or disease concern in Horsetooth Park is dwarf mistletoe, which is affecting much of the ponderosa pine forest. Over the past decade there have been extensive mitigation measures targeting this plant parasite. One of the more notable examples is the sanitation zone along the upper Towers Road that was completed in 2008. Within the sanitation zone most ponderosa pines have been removed in an attempt to control the spread of dwarf mistletoe and eliminate it from that area. In addition to control of mistletoe, this area serves as a fuel break. Regenerating trees should be monitored for presence of mistletoe in all treated areas to ensure good health of the future forest stand.

Despite good efforts to mitigate dwarf mistletoe within Horsetooth Park, many forest stands remain in decline as a result of mistletoe. This plan will identify critical infestation zones and outline future management strategies to continue dwarf mistletoe mitigation within the park. In general, dwarf mistletoe management requires removal of infested trees or pruning of infested branches. Controlling the spread of mistletoe into uninfested stands can be accomplished through effective placement of buffer or sanitation strips that prevent seed spread. Seeds can be dispersed up to distances of 60 feet in some situations, so buffer strips should be at least 60 feet wide. For more information on dwarf mistletoe biology and management, refer to Appendix G.

The mountain pine beetle is currently an insect of major concern throughout Colorado's pine forests. During the forest inventory in early 2010, some areas with recent mountain pine beetle mortality and current infestations were noted. But, overall, pine beetle impacts within Horsetooth Park are currently minimal. Given the high populations of mountain pine beetles further west in Larimer County, there is potential to see increased tree mortality from beetles over the next few years. If large numbers of beetles move into Horsetooth Park, there will be little that can be done to control their impacts. This plan will focus on treatments that mitigate wildfire hazard by reducing tree density as well as the mitigation of dwarf mistletoe. If beetle impacts do increase in the future, a shift in the management strategy targeting beetle infestations and mortality may be optimal. Treatments that target areas where beetles have killed trees can accomplish fuels mitigation goals as well.

Refer to Map 3 for locations of beetle and dwarf mistletoe infestations centers. Additional information on common forest insects and disease can be found in Appendix G.

Map 3. Insects and Disease



Wildlife

Horsetooth Mountain Park provides several types of cover and food sources for wildlife. In the commonly used sense, cover is something that protects an animal or bird from weather or enemies, or provides places to rest, reproduce, and to raise young (see photo below of wildlife snag taken at Horsetooth). Trees, shrubs, plants, geomorphic structures, and topographical features provide cover on the property



During the forest inventory signs of a variety of wildlife were seen such as droppings, rubs on trees, game trails, caches, nesting cavities, and browsing or feeding evidence. Recommendations for forest management activities within this document take into account the various species or groups of species found on the property and are intended to protect or enhance the existing cover and/or food sources. Recommendations address vertical as well as horizontal spatial arrangements of cover. For example, some species have rather demanding vertical cover requirements in terms of nesting, feeding, and roosting (squirrels, turkeys, hawks, eagles) as opposed to those that demand adequate cover for concealment from aerial predators (mice, ground squirrels, rabbits). Refer to Appendix E for wildlife specifications.

Wildfire Hazards

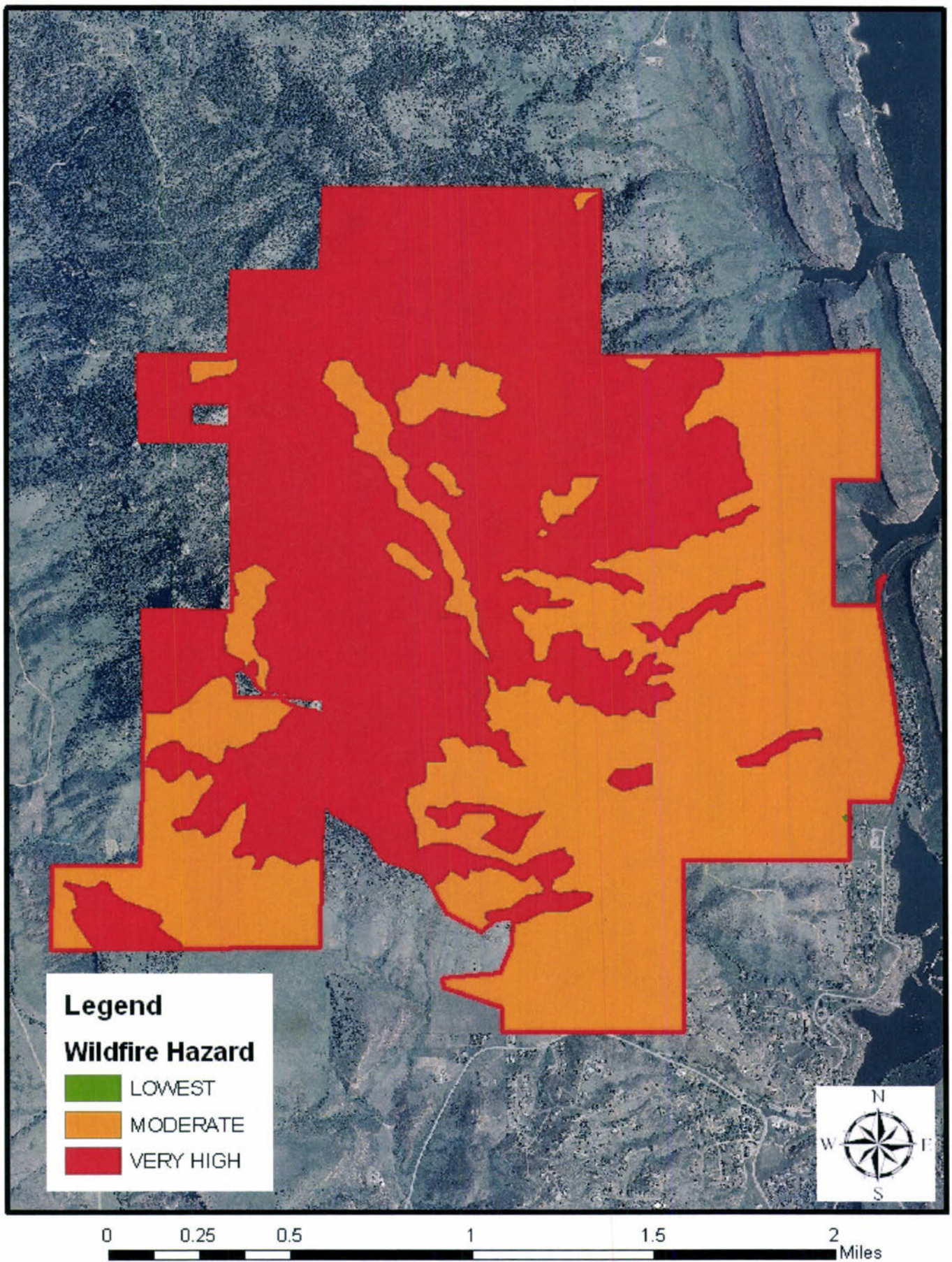
Wildfire hazard at Horsetooth Mountain is mapped as moderate to very high hazard (see Map 4). These hazards are mapped based on the expected fire behavior which is determined by vegetative cover type and habitat structural stage. However, if the aspect is south or southwest, and/or if the slope is greater than 30 percent, increase the hazard class one category. Also, if slash is present and in significant quantities, increase the hazard class one category. Most of Horsetooth Mountain Park is mapped as high fire hazard although forest fuels reduction treatments that have occurred since 2001 have significantly mitigated the fire hazard in the treated units.

Expected fire behavior of Wildfire Hazard Classes

Hazard Class*	Expected Fire Behavior
Low	Low intensity/short duration fires. Flame lengths 0-4 feet, higher flare-ups rare; duration of highest flames brief; fire spread slow to fast, 1-40 acres per hour; spotting rare, short range.
Moderate	Moderate intensity/longer duration fires. Flame lengths 4-8 feet, intermittent flare-ups occurring to many feet above tree tops; short and medium range spotting common; behavior between flare-ups as in low class.
High	High intensity/medium duration fires. Flame lengths 5-20 feet, of brief duration; fire spread usually fast, at least 40 acres per hour; short range spotting common from blowing leaves.
Very High	High intensity/longer duration fires. Flame lengths greater than 8 feet, flare-ups higher than trees frequent to continuous; spread up to several hundred acres per hour; fire front impassable; spotting several hundred yards common, possible to a mile or more.

* If the aspect is south or southwest, and/or if the slope is greater than 30%, increase hazard class one category. If slash is present in significant quantities, increase hazard class one category.

Map 4. Wildfire Hazard



Soils

Sixteen different soil types constitute Horsetooth Mountain Park as illustrated in Map 5. The soils on the property are made up of Baller-Carnero complex, Baller-Rock outcrop, Carnero loam, Connerton-Barnum complex, Haploborolls-Rock outcrop, Haplustols Hilly, Haplustols-Rock outcrop, Harlan fine sandy loam, Kirtley-Purner complex, Purner fine sandy loam, Purner-Rock outcrop, Ratake-Rock outcrop, Rock outcrop, Santana loam, Trag-Moen complex, and Wetmore-Boyle-Rock outcrop. Note the runoff rate and hazard of erosion for each soil type. A complete description of each soil type as defined by the USDA soil survey follows:

11 – Baller-Carnero complex, 9 to 35 percent slopes. This complex consists of strongly sloping to steep soils on ridges. It is about 45 percent Baller stony sandy loam and about 35 percent Carnero loam. The soils are intermingled in an intricate pattern, but Baller stony sandy loam commonly is on the upper part of the ridges and Carnero loam is near the bottom of the slope and is less sloping. The Baller soil has a profile similar to the one described as representative of the Baller series. The Carnero soil has a profile similar to the one described as representative of the Carnero series, but more cobbles and stones are on the surface. Included with these soils in mapping are about 20 percent areas of Rock outcrop and extremely stony soils that are similar to Carnero soils but in which sandstone is at a depth of less than 20 inches. Runoff is rapid, and the hazard of erosion is severe. These soils are suited to native grasses. Capability unit VIIs-1, dryland; Baller soil in Shallow Foothill range site and Carnero soil in Loamy Foothill range site; not assigned to a windbreak suitability group.

12 – Baller-Rock outcrop complex, 15-45 percent slopes. This complex consists of strongly sloping to steep soils on ridges and “hogbacks.” It is about 50 percent Baller stony sandy loam and about 30 percent Rock outcrop. Baller stony sandy loam is mainly on east-facing side slopes on the ridges. Rock outcrop is mainly near ridgetops, but it is scattered throughout. The Baller soil has the profile described as representative of the Baller series. Included with this complex in mapping is about 20 percent Carnero soils and areas of a soil that is similar to the Baller soil but has a clayey subsoil. Runoff is rapid, and the hazard of erosion is severe. This complex is suited to native grasses. Capability unit VIIs-1, dryland; Baller soil in Shallow Foothill range site and Rock outcrop not assigned to a range site; not assigned to a windbreak suitability group.

21 – Carnero loam, 3 to 9 percent slopes. This gently sloping or strongly sloping soil is on the uplands and valleysides. Included with this soil in mapping are some small areas of soils in which bedrock is at a depth of 40 to 60 inches or less. Also included are some small areas of soils that have a subsoil of loam or light clay loam. Runoff is medium, and the hazard of water erosion is moderate. If irrigated, this soil is suited to barley, wheat, and pasture and, to some extent, alfalfa. Under dryland management it is suited to wheat or barley. It is also well suited to pasture and native grasses. Capability units IVE-1, irrigated, and IVE-3, dryland; Loamy Foothill range site; not assigned to a windbreak suitability group.

25 – Connerton-Barnum complex, 3 to 9 percent slopes. This complex consists of gently sloping to strongly sloping soils on terraces and fans. It is about 60 percent Connerton fine sandy loam and about 25 percent Barnum loam. Connerton fine sandy loam is higher and more sloping, and Barnum loam is on lower parts of fan and in areas near streams, swales, and drainageways. The Connerton soil has the profile described as representative of the Connerton

series. The Barnum soil has a profile similar to the one described as representative of the Barnum series, but the surface layer is 6 to 8 inches thick. Included with these soils in mapping are about 15 percent areas of Garrett and Otero soils and small gravelly or cobbly areas. Runoff is medium, and the hazard of erosion is moderate to severe. Gullies in a few areas are active. Some areas of this complex are flooded during spring or early summer, especially in areas near channels and drainageways. If irrigated, these soils are suited to alfalfa, barley, wheat, and pasture. Under dryland management they are suited to pasture or native grasses. Capability units IVe-1, irrigated, and VIe-2, dryland; Connerton soil in Loamy Foothill range site and Barnum soil in Overflow range site; windbreak suitability group 1.

43 – Haploborolls-Rock outcrop complex, steep. This complex consists of steep and very steep, cool soils and Rock outcrop on mountainsides and fans. The soils are extremely variable; about 50 to 70 percent of the unit, however, is stony and cobbly, dark colored soils that range from shallow to deep. These soils mainly have a surface layer and subsurface layer of sandy loam or loam that contain 10 to 25 percent cobbles and 20 to 35 percent stones. Stones that are on the surface are mainly boulders of granite, gneiss, and schist. About 30 to 50 percent of the mapped area is Rock outcrop. It is mainly on the steeper parts of the area, but it is scattered throughout. Runoff is rapid, and the hazard of water erosion is severe. These soils are used for a limited amount of grazing and are also used for wildlife habitat and watershed. Capability unit VIIe-1, dryland; Haploborolls in Stony Loam range site and Rock outcrop not assigned to a range site; not assigned to a windbreak suitability group.

44 – Haplustolls, hilly. These strongly sloping to steep slopes are on fans and lower side slopes of ridges in the foothills. The surface layer and subsurface layer are mainly loam or clay loam, but texture is extremely variable, often within short distances. Some areas of these soils have a cobbly and stony surface layer and subsurface layer. Content of cobbles ranges from 15 to 30 percent and content of stones ranges from 10 to 25 percent in these areas. Soil depth ranges from shallow to deep. A few areas of Rock outcrop are included in mapped areas. Runoff is rapid, and the hazard of water erosion is moderate to severe. Gullies occur in places. These soils are used for native grasses. Capability unit VIe-1, dryland; Loamy Foothill range site; not assigned to a windbreak suitability group.

45 – Haplustolls – Rock Outcrop Complex, Steep. This complex consists of strongly sloping to steep soils and Rock outcrops. It is on colluvial slopes and hillsides. About 60 to 80 percent of the unit is extremely variable, dark colored soils that have a sandy loam, loam or clay loam surface layer and subsurface layer. They contain about 10 to 20 percent cobbles and 10 to 20 percent stones. Sandstone boulders, 5 feet or more in diameter, cover about 10 to 35 percent of the surface in most areas. Depth to underlying material, generally sandstone or shale, ranges from 10 to 60 inches or more. About 20 to 40 percent of the mapped area is Rock outcrop. It is generally near the top and middle parts of the slopes, but it is intermingles throughout. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. These soils are suited to native grasses. They are also used for wildlife habitat. Capability unit VIIe-1, dryland; Haplustolls in Rocky Foothill range site and Rock outcrop not assigned to a range site; not assigned to a windbreak suitability group.

47 – Harlan fine sandy loam, 3 to 9 percent slopes. This gently sloping to strongly sloping soil is on terraces, fans, and valleysides. This soil has a profile similar to the one described as representative of the series, but the combined thickness of the surface layer and subsoil is about 20 to 24 inches. Included with this soil in mapping are small areas of soils that have a surface layer of loam or sandy clay loam. Also included are a few small areas of soils that are more sloping or less sloping and a few small areas of Otero, Connerton, And Barnum soils. Runoff is medium, and the hazard of erosion is moderate to severe. If irrigated, this soil is well suited to pasture and, to a lesser extent, wheat, barley, and alfalfa. Under dryland management it is suited to pasture and native grasses and , to a lesser extent, wheat and barley, Capability units IVE-2, irrigated, and IVE-6, dryland; Loamy Foothill range site; not assigned to a windbreak suitability group.

58 – Kirtley-Purner complex, 5 to 20 percent slopes. This complex consists of strongly sloping to moderately steep soils on uplands and valleysides. It is about 45 percent Kirtley loam and about 40 percent Purner fine sandy loam. Kirtley loam is smoother and less sloping, and Purner soil is steeper. The Kirtley soil has the profile described as representative of the Kirtley series. The Purner soil has a profile similar to the one described as representative of the Purner series. Included with these soils in mapping are some small areas of soils that are similar to Kirtley and Purner soils but in which more sandstone fragments are in the profile. Also included are areas of Rock outcrop. These inclusions make up about 15 percent of the complex. Runoff is rapid, and the hazard of erosion is severe. These soils are suited to pasture or native grasses. Capability unit VIe-1, dryland; Kirtley soil in Loamy Foothill range site and Purner soil in Shallow Foothill range site; not assigned to a windbreak suitability group.

85 – Purner fine sandy loam, 1 to 9 percent slopes. This nearly level to strongly sloping soil is on uplands and ridges. This soil has the profile described as representative of the series. Included with this soil in mapping are some small areas of soils that have a surface layer of loam. Also included are small areas of soils that have more stones in the surface layer, small areas of Rock outcrop, and a few small areas of Kirtley soils. Runoff is rapid, and the hazard of erosion is severe. This soil is suited to pasture and native grasses. Capability unit Vie-3, dryland; Shallow Foothill range site; not assigned to a windbreak suitability group.

86 – Purner-Rock outcrop complex, 10 to 50 percent slopes. This complex consists of moderately steep or steep soils on uplands and ridges. It is about 55 percent Purner fine sandy loam and about 30 percent Rock outcrop. Purner fine sandy loam is smoother and less sloping, and Rock outcrop is steeper commonly on the western side of ridges. Included with this soil in mapping is about 15 percent areas of Kirtley soils. Runoff is rapid and the hazard of erosion is severe. This soil is suited to native grasses. Capability unit VIIe-1, dryland; Purner soil in Shallow Foothill range site and Rock outcrop not assigned to a range site; not assigned to a windbreak suitability group.

87 – Ratake-Rock outcrop complex, 25 to 55 percent slopes. This complex consists of steep or very steep soils on mountainsides and ridges. It is about 60 percent Ratake channery loam and about 30 percent Rock outcrop. Ratake channery loam is about 30 percent Rock outcrop. Ratake channery loam is less steep, and Rock outcrop is throughout the complex but commonly is near ridgetops and is steeper. Included with this soil in mapping is about 10 percent areas of Breece soils along drainageways. Runoff is rapid, and the hazard of water erosion is severe. This soil is suited to native grasses. Capability unit VIIe-1, dryland; Rocky Loam range site; not assigned to a windbreak suitability group.

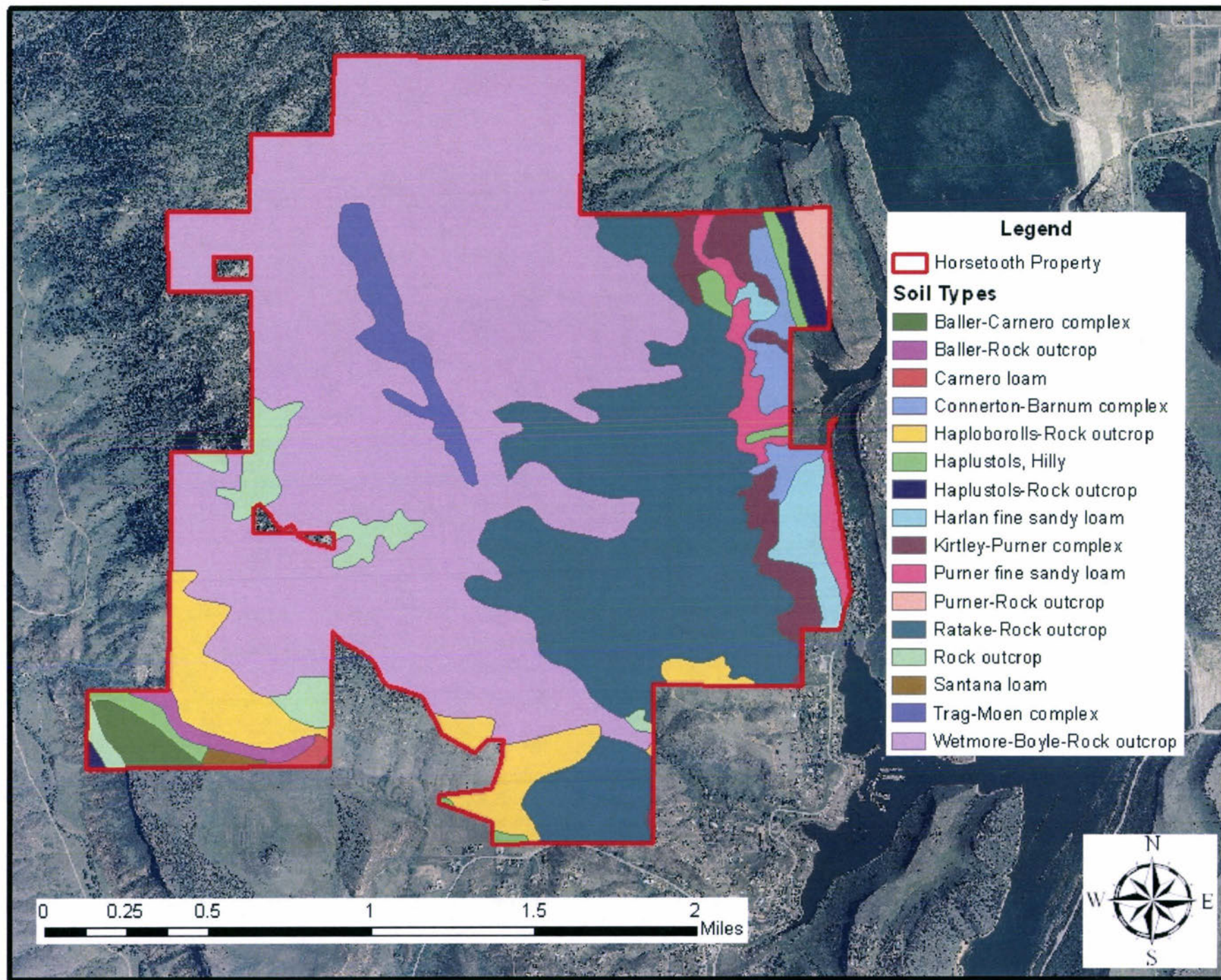
93 – Rock Outcrop. This type is bare or nearly bare rock. Included in the mapping are areas of shallow and very shallow soils, mainly around the edges of the mapped areas. Runoff is rapid and the hazard of erosion is severe on the included soils and in adjacent areas that receive runoff. This type is used mainly for wildlife habitat and aesthetic purposes. Capability unit VIIIs-1, dryland; not assigned to a range site or a windbreak suitability group.

96 – Santana loam, 3 to 5 percent slopes. This gently sloping soil is on terraces and uplands. This soil has a profile similar to the one described as representative of the series, but the combined thickness of the surface layer and subsoil is about 18 inches. Included with this soil in mapping are some small areas of soils that are more sloping or less sloping. Also included are small areas of Fort Collins, Nunn, and Altvan soils. Runoff is medium, and the hazard of erosion is moderate. If irrigated, this soil is suited to barley, wheat, and alfalfa and, to a lesser extent, corn, sugar beets, and beans. Under dryland management it is suited to wheat and barley. It is also well suited to pasture and native grasses. Capability units IIIe-2, irrigated, and IIIe-7, dryland; Loamy Foothill range site; windbreak suitability group 1.

112 – Trag-Moen complex, 5 to 30 percent slopes. This complex consists of strongly sloping to steep soils on mountainsides and ridges. It is about 45 percent trag sandy loam and about 40 percent Moen Loam. Trag sandy loam is more nearly level and at the base of slopes, and Moen loam is on ridgetops and higher side slopes. Included with this soil in mapping are about 15 percent areas of Breece soils and Rock outcrops. Runoff is medium to rapid, and the hazard of erosion is moderate to severe. These soils are suited to pasture and native grasses. Capability unit VIe-5, dryland; Loamy Park range site; not assigned to a windbreak suitability group.

117 – Wetmore-Boyle-Rock outcrop complex 5 to 60 percent slopes. This complex consists of strongly sloping to very steep soils on mountainsides and ridges. It is about 35 percent Wetmore gravely sandy loam, about 30 percent Boyle gravelly sandy loam, and about 25 percent Rock outcrop. Wetmore gravelly sandy loam is in forest, Boyle gravelly sandy loam is in open grassed areas, and Rock outcrop occurs throughout but is commonly near ridges and steeper. The Wetmore soil has the profile described as representative of the Wetmore series. The Boyle soil has a profile similar to the one described as representative of the Boyle series. Included with these soils in mapping are minor areas of Redfeather and Schofield soils. Runoff is rapid, and the hazard of erosion is severe. These soils are suited to woodland or native grasses they are also used for recreation, as sites for summer homes, and for wildlife habitat. Capability unit VIIs-1, to a range site, and Boyle soil in Rocky Loam range site, woodland suitability group 6x1; not assigned to a windbreak suitability group.

Map 5. Soils



Management Units: Descriptions and Recommendations

This section describes the management units identified on Horsetooth Mountain Park. General information on management practices, slash disposal, growing stock levels (GSLs), insects, disease, harvesting methods, wildlife management, and wildfire hazard mitigation are found in the Appendices. Technical terms used are defined in the Glossary.

The following recommendations are intended to meet the short and long term objectives for managing the property. As with all management plans, the scheduling and achievement of these activities will depend upon the landowner's resources, environmental conditions, availability of technical assistance, and commercial markets. The landowner should work closely with a professional forester to update this plan as circumstances change and work is accomplished.

Records of accomplishment, time spent on management activities, and income/loss statements should also be kept.

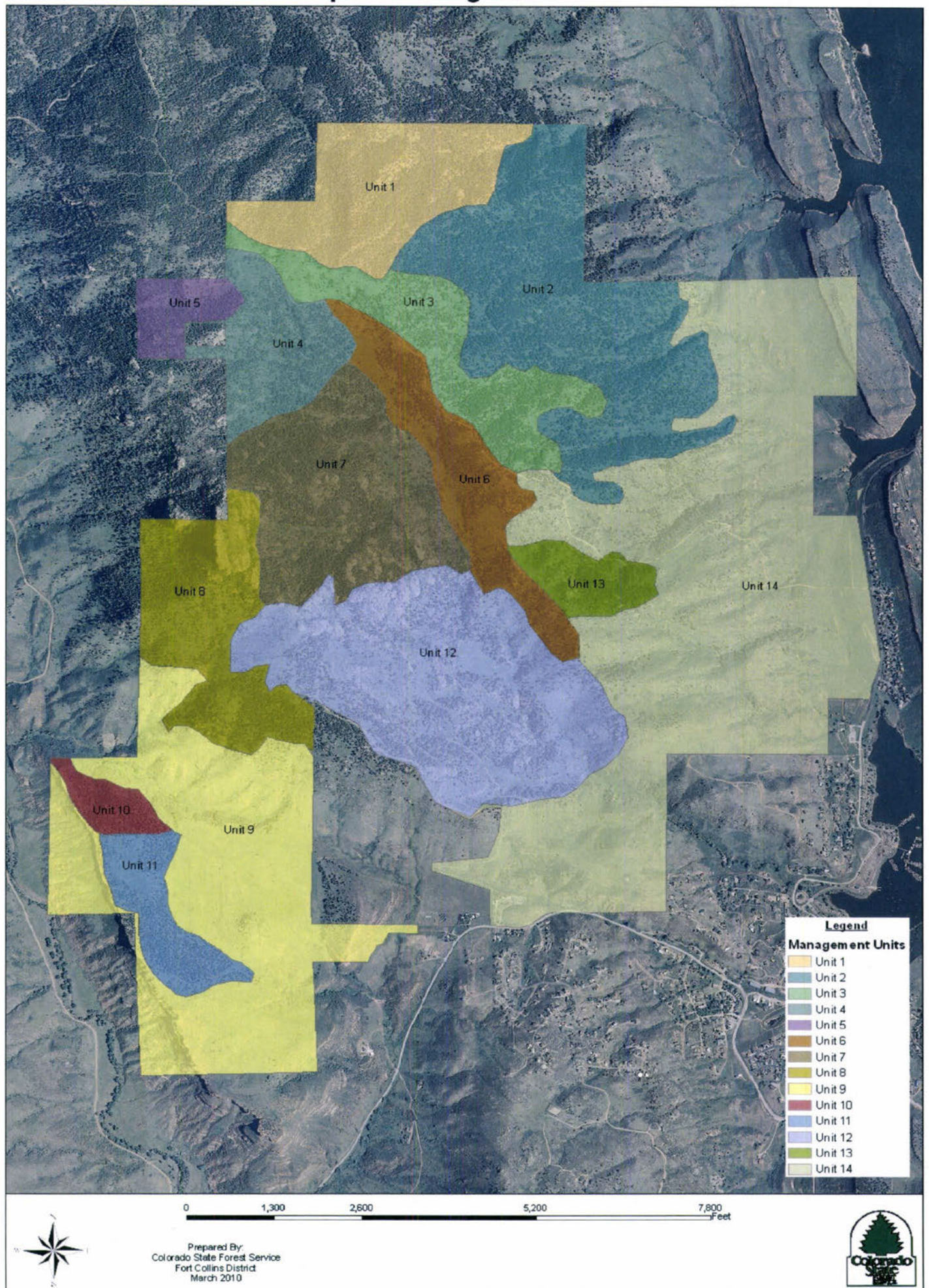
Management Units

In order to guide management and categorize the various forest types and conditions throughout Horsetooth Mountain Park, the property was divided into 14 management units. The units were delineated based on the current forest conditions that have been influenced primarily by aspect and past management practices. The forest cover in Horsetooth Park consists of ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*). Rocky Mountain juniper (*Juniperus scopulorum*) also grows throughout the property although it was not measured in the forest inventory as it is not a timber species. Two of the units are not forested, therefore they will not be described in detail.

Age was measured on a subsample of the average-sized co-dominant ponderosa pines and Douglas-fir trees. Ages ranged from 90 years to 124 years on the ponderosa pines that were measured, and from 88 years to 133 years on the Douglas-firs. These ranges estimate the average age of the majority of trees within the park. There are certainly some trees that are much older and much younger than those that were measured.

Map 6 illustrates the management units that will be described in the following sections. The statistics given are for trees that are 3" DBH or greater unless otherwise noted. Thinning and/or fuels reduction treatments that have occurred over the past 10 years within a unit will be noted, as well as any future management needs.

Map 6. Management Units



Management Unit 1



Description: Unit 1 consists of 146 acres of dense Douglas-fir and a small component of ponderosa pine. The generally north-facing slopes in this unit are steep and range from 20 to 70%. Some areas have moderate to heavy accumulations of down woody material and the tree density is high.

The trees have an average DBH of 9.7 inches and an average height of 41 feet. Average basal area is 107 square feet per acre, which is typical of a Douglas-fir stand growing on a cool, moist, north-facing slope. Unit 1 contains abundant regeneration with 673 Douglas-fir and 45 ponderosa pine seedlings, and 36 Douglas-fir and 27 ponderosa pine saplings per acre.

Some of the shrubs present include common juniper, currant, cliff bush, Rocky Mountain maple, and choke cherry. There is minimal grass cover in this unit.

This unit is mapped as very high fire hazard because of the high tree density and steep slopes. Additionally, heavy fuel loads in this unit would likely contribute to aggressive fire behavior in dry conditions.

The following table summarizes the stand data:

Forest cover type	Douglas-fir
Unit size	146 acres
Slope	20-70%
Aspect	North
Basal area (average)	107 square feet/acre
Trees/acre ($\geq 3"$ DBH)	131 Douglas-fir 61 ponderosa pine 192 Total
Average tree diameter	9.7" DBH
Average tree height	41 feet
Stocking	adequate
Estimated stand volumes	1575 cubic feet/acre 6185 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	36 Douglas-fir 27 ponderosa pine
Seedling trees/acre (<4.5' high)	673 Douglas-fir 45 ponderosa pine
Wildfire hazard rating	Very High

Recommendations: Poor accessibility and steep terrain will likely limit management in this unit, although, from a wildfire mitigation standpoint, the forest stand would benefit from some removal of down woody fuels and some thinning. Because extensive thinning treatments have occurred on Unit 3 which borders Unit 1 to the south, the thinned area would act as a fuel break to prevent the spread of any fire that occurred in Unit 1. Therefore, Unit 1 will not be a priority treatment area although some thinning may be considered in future years.

Management Unit 2



Description: Unit 2 consists of 305 acres of ponderosa pine forest with some Douglas-fir in the drainages and interspersed with small meadows. This unit has an eastern aspect with slopes between 10 and 60 percent. The primary forest health concern across Unit 2 is dwarf mistletoe. Refer to Map 3 to identify centers of infestation.

Mountain mahogany, yucca, rabbit brush, choke cherry, common juniper, prickly pear, Rocky Mountain juniper, and sage brush are found in the understory. There is abundant grass cover in some areas, especially in the open meadows.

The average tree diameter is 9.0 inches with an average height of 33 feet. Average basal area is 93 square feet per acre, which is higher than the recommended growing stock level (GSL) of 60 for a ponderosa pine stand. There is good regeneration across Unit 2 consisting of 162 ponderosa pine and 46 Douglas-fir seedlings, and 38 ponderosa pine and 14 Douglas-fir saplings per acre.

Unit 2 is mapped as having wildfire hazards of moderate and very high.

The following table summarizes the stand data:

Forest cover type	Ponderosa pine
Unit size	305 acres
Slope	10-60%
Aspect	East
Basal area (average)	93 square feet/acre
Trees/acre ($\geq 3"$ DBH)	155 ponderosa pine 29 Douglas-fir
Average tree diameter	9.0" DBH
Average tree height	33 feet
Stocking	Overstocked for recommended GSL of 60
Estimated stand volumes	1128 cubic feet/acre 4083 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	38 ponderosa pine 14 Douglas-fir
Seedling trees/acre (<4.5' high)	162 ponderosa pine 46 Douglas-fir
Wildfire hazard rating	Very High

Recommendations: The priority for Unit 2 should be controlling the spread of dwarf mistletoe into uninfested portions of the stand. Some heavily diseased trees exist along the border between Unit 2 and 3 (see Map 6). There are also some areas along the Logger's Trail that have heavy dwarf mistletoe (see Map 3). The lower (eastern) portion of Unit 2 is largely free of insect or disease and should be protected. By strategically placing some sanitation or buffer strips on the

edges of infested areas, mistletoe spread can be mitigated. A good starting point for buffer strip creation would be along or near the Logger's Trail. The trail provides easy access by foot and is conveniently located along the leading edge of mistletoe infestation. The Carey Springs Trail could be another starting point for similar treatments. To minimize visual impacts to trail users, buffer creation should occur about 50 feet on either side of the trail, depending on where the infested trees are located. The goal should be stopping the downhill spread of mistletoe because a mistletoe sanitation zone already exists on the uphill side in Unit 3.

In addition to dwarf mistletoe mitigation, pruning to minimize ladder fuels would be advantageous to this stand of ponderosa pine. An example of this activity was observed in the area around the old logger's cabin. The goal of this type of treatment is to mitigate crown fire potential. Pruning lower branches and dead branches also creates a more open-looking stand that is visually pleasing. Much of Unit 2 could use pruning treatment.

Slash from thinning and pruning should be piled and burned when conditions are safe for burning. Chipping would also be a suitable slash treatment method if this is feasible and desirable to the managers.

Management Unit 3



Description: Unit 3 is 125 acres of open ponderosa pine and some Douglas-fir. The stand conditions result from recent fuels and dwarf mistletoe mitigation thinning treatments that occurred in 2008. Some dwarf mistletoe still exists, but it has been largely eliminated. Some storm breakage and windthrow has occurred on residual trees, but overall, this unit contains healthy trees and favorable tree densities. Many slash piles remain to be burned and some logs and log sections remain on site. The slopes in this unit range between 10 and 50 percent with aspects of south, east, and northeast.

Residual trees have an average DBH of 9.2 inches and an average height of 34 feet. Current stand basal area averages 53 square feet per acre, although some areas across Unit 3 are much more open. Regeneration consists of 159 ponderosa pine and 95 Douglas-fir seedlings, and 36 ponderosa pine and 5 Douglas-fir saplings per acre.

Some of the shrubs present in the unit include mountain mahogany, prickly pear, currant, Rocky Mountain maple, Rocky Mountain juniper, common juniper, and bitter brush. Grasses are abundant and increasing as a result of recent thinning on this unit.

Prior to the thinning treatments Unit 3 was mapped as having moderate to very high fire hazard ratings (as shown in Map 4). Due to significant reduction in fuels and tree density, this unit currently has a fire hazard of moderate at most.

The following table summarizes the stand data:

Forest cover type	Open ponderosa pine – recently thinned
Unit size	125 acres
Slope	10-50%
Aspect	South, East, Northeast
Basal area (average)	53 square feet/acre
Trees/acre ($\geq 3"$ DBH)	90 ponderosa pine 12 Douglas-fir 102 Total
Average tree diameter	9.2" DBH
Average tree height	34 feet
Stocking	Good
Estimated stand volumes	654 cubic feet/acre 2460 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	36 ponderosa pine 5 Douglas-fir
Seedling trees/acre (<4.5' high)	159 ponderosa pine 95 Douglas-fir
Wildfire hazard rating	Moderate

Recommendations: Regenerating pine seedlings and saplings in Unit 3 should be monitored for the presence of dwarf mistletoe. Any regenerating tree observed with dwarf mistletoe should be removed to ensure the health of the future forest stand. Some mistletoe was spotted on seedlings within Unit 3 during the forest inventory.

Piles should be burned and all logs and log sections should be removed. Those logs that are difficult to move should be bucked into firewood sized rounds and stacked. Some logs may remain if they serve a habitat or erosion control function. And leaving some slash piles can serve as habitat for small mammals. There is still the need for much cleanup of forest thinning debris within this unit.

Overall, the fuels mitigation and dwarf mistletoe sanitation treatment within Unit 3 was executed appropriately and should serve to enhance health of the future forest stand and the surrounding forest.

Management Unit 4



Description: Unit 4 is 90 acres of mixed ponderosa pine and Douglas-fir forest. This area received fuels mitigation thinning treatment in 2009. Most slash and logs remain on site and have yet to be piled and burned or removed. The slopes in this unit range between 15 and 60 percent and have aspects of south and east. Dwarf mistletoe is present throughout this unit in some of the residual trees.

The trees have an average DBH of 9.8 inches and an average height of 36 feet. Average basal area across Unit 4 is 68 square feet per acre. This is a desirable GSL for this forest stand. Regeneration consists of 117 ponderosa pine and 50 Douglas-fir seedlings, and 8 ponderosa pine and 8 Douglas-fir saplings per acre.

Some of the shrubs present in the unit include mountain mahogany, common juniper, Rocky Mountain juniper, and currant. There is variable grass and forb cover across Unit 4. Non-native thistle and mullein were observed in some areas.

This unit is mapped as very high fire hazard. Upon removal of thinning debris and burning of slash, this hazard rating should decrease.

The following table summarizes the stand data:

Forest cover type	Ponderosa pine/Douglas-fir mix
Unit size	90 acres
Slope	15-60%
Aspect	South, East
Basal area (average)	68 square feet/acre
Trees/acre ($\geq 3"$ DBH)	110 ponderosa pine 4 Douglas-fir 114 total
Average tree diameter	9.8" DBH
Average tree height	36 feet
Stocking	Good
Estimated stand volumes	990 cubic feet/acre 4173 board feet/acre
Sapling trees/acre ($< 3"$ DBH and $> 4.5'$ high)	8 ponderosa pine 8 Douglas-fir
Seedling trees/acre ($< 4.5'$ high)	117 ponderosa pine 50 Douglas-fir
Wildfire hazard rating	Very High

Recommendations: Areas that had trees felled in 2009 need to be cleaned up. Piling and burning of slash is recommended and should take place over the next few years. Also, logs and log sections should be removed. Any future thinning should target trees containing dwarf mistletoe.

Management Unit 5



Description: Unit 5 consists of 34 acres of mixed Douglas-fir and ponderosa pine forest. The eastern portion of this unit was part of the thinning that occurred in 2009. Slopes range from 10 to 40 percent with aspects of north to northeast with some southern exposure on the west side of the unit.

Some of the shrubs present in the unit include common juniper, Rocky Mountain juniper, cactus bitter brush, and currant. A variety of grasses and forbs occur in the understory.

The average tree diameter is 8.2 inches with an average height of 34 feet. Stand stocking level is good at 83 square feet per acre, which is a healthy density. Regeneration is good with 167 Douglas-fir and 17 ponderosa pine seedlings, and 300 Douglas-fir and 83 ponderosa pine saplings per acre.

Unit 5 is mapped as moderate to very high fire hazard. The recent thinning that has taken place should mitigate the fire risk once the residual fuels are burned or removed.

The following table summarizes the stand data:

Forest cover type	Douglas-fir/ponderosa pine mix
Unit size	34 acres
Slope	10-40%
Aspect	North, Northeast, South
Basal area (average)	83 square feet/acre
Trees/acre ($\geq 3''$ DBH)	91 ponderosa pine 102 Douglas-fir 193 Total
Average tree diameter	8.2'' DBH
Average tree height	34 feet
Stocking	Adequately stocked for GSL of 80
Estimated stand volumes	1151 cubic feet/acre 4567 board feet/acre
Sapling trees/acre ($< 3''$ DBH and $> 4.5'$ high)	300 Douglas-fir 83 ponderosa pine
Seedling trees/acre ($< 4.5'$ high)	167 Douglas-fir 17 ponderosa pine
Wildfire hazard rating	Moderate & Very High

Recommendations: Recent forest thinning in the eastern part of Unit 5 has improved the forest condition of that area in terms of tree growing density and wildfire risk. Residual slash piles and other woody materials should be burned or removed over the next few years.

The western portion of this stand, which has not received any recent forest management, could use some thinning even though current average basal areas are reasonable. Thinning this area would be advantageous because this is the western border of the park and could act to buffer any advancing fire or insect/disease that moves in from adjacent property. Dwarf mistletoe is present across this unit, so infected trees should be targeted for removal.

Management Unit 6



Description: Unit 6 consists of 115 acres of ponderosa pine forest. Recent thinning that occurred in 2003 and 2009 has resulted in a fairly open stand of healthy trees across this area of the property. Slopes on this generally west-facing aspect range from 20-40 percent. Some dwarf mistletoe infested trees are present, but overall this is a healthy stand of trees.

Understory vegetation is currently minimal, but will likely increase as a result of recent tree thinning. Common juniper and yucca as well as some grasses can be found in the understory.

The average tree diameter is 10.6 inches with an average height of 38 feet. There is a healthy stocking level of 73 square feet per acre. Regeneration is minimal with 53 ponderosa pine seedlings per acre.

Unit 6 is mapped as having moderate to very high wildfire hazard. Recent thinning has mitigated this potential.

The following table summarizes the stand data:

Forest cover type	Ponderosa pine
Unit size	115 acres
Slope	20-40%
Aspect	West
Basal area (average)	73 square feet/acre
Trees/acre ($\geq 3''$ DBH)	108 Ponderosa pine 108 Total
Average tree diameter	10.6" DBH
Average tree height	38 feet
Stocking	Good
Estimated stand volumes	989 cubic feet/acre 3880 board feet/acre
Sapling trees/acre ($< 3''$ DBH and $> 4.5'$ high)	0
Seedling trees/acre ($< 4.5'$ high)	53 ponderosa pine
Wildfire hazard rating	Moderate & Very High

Recommendations: Burn remaining piles. Monitor dwarf mistletoe and target infested trees in future thinning treatments.

Management Unit 7



Description: Unit 7 consists of 200 acres of mixed ponderosa pine and Douglas-fir. Slopes are steep and range from 20 to 65 percent on a generally east facing aspect. There has been no recent forest management within this portion of the park. Some areas in this unit contain heavy dwarf mistletoe and down woody fuels.

Some of the shrubs present in the unit include common juniper, Rocky Mountain juniper, currant, Rocky Mountain maple, and mountain mahogany. Grasses occur throughout the understory in most places.

The average tree diameter is 8.9 inches with an average height of 33 feet. Average basal area is 80 square feet per acre. There is abundant regeneration with 900 Douglas-fir and 79 ponderosa pine seedlings, and 36 Douglas-fir and 36 ponderosa pine saplings per acre.

Wildfire hazard rating is very high for Unit 7. In addition to heavy fuel loads and presence of ladder fuels, steep slopes contribute to increased fire hazard.

The following table summarizes the stand data:

Forest cover type	Mixed ponderosa pine and Douglas-fir
Unit size	200 acres
Slope	20-65%
Aspect	East
Basal area (average)	80 square feet/acre
Trees/acre ($\geq 3"$ DBH)	98 ponderosa pine 53 Douglas-fir 151 Total
Average tree diameter	8.9" DBH
Average tree height	33 feet
Stocking	Good
Estimated stand volumes	1033 cubic feet/acre 4110 board feet/acre
Sapling trees/acre ($< 3"$ DBH and $> 4.5'$ high)	36 ponderosa pine 36 Douglas-fir
Seedling trees/acre ($< 4.5'$ high)	79 ponderosa pine 900 Douglas-fir
Wildfire hazard rating	Very High

Recommendations: Fuels mitigation thinning should be conducted in Unit 7 starting in the upper (western) portions of the stand and moving downhill. Although the average basal area across the unit is acceptable, there are many areas with high tree densities. Additionally, dead woody fuel accumulations across this unit are high. Thinning and pile burning of slash and accumulated down fuels will increase the health of this forest stand and mitigate fire potential. Tree removal should target pines infested with dwarf mistletoe or any tree with growth defects or signs of suppression. Trees that are not removed should be pruned up to minimize ladder fuels.

Lower portions of Unit 7 near Spring Creek Meadow contain heavy dwarf mistletoe infestations (See Map 3). Mitigation by creation of buffer zones is recommended. The lower portions of this unit are fairly open, therefore buffer creation should be attainable through strategic removal of few trees.

As of March 2010 there are plans to do a fuels mitigation thinning treatment on the CSU-owned property that borders this unit to the west. The goal of this project is to protect the radio towers that are located on this section. This treatment should also benefit the neighboring Horsetooth property. Any fuels/forest health treatments that occur within Unit 7 would be a good complement to the proposed work on the adjacent land. In terms of priorities for future use of fuels mitigation grant funds and 'new' acres treated, Unit 7 should be the top priority.

Management Unit 8



Description: Unit 8 consists of 146 acres of ponderosa pine and open meadows. Slopes range from 5 to 60 percent on generally west, southwest aspects. Most of the eastern portion of this unit was thinned in 2005 and 2006. The western portion and the area surrounding Horsetooth Rock is fairly inaccessible and rocky.

Shrubs present include mountain mahogany, Rocky Mountain juniper, bitter brush, and yucca. Grass cover is abundant.

The average tree diameter is 9.1 inches with an average height of 30 feet. Average basal area of the forested portions of Unit 8 is 92 square feet per acre. There are approximately 20 ponderosa pine seedlings per acre.

Wildfire hazard is moderate in the open areas of this unit and very high within the forested portions. Recent thinning and fuels mitigation has likely moderated this fire risk.

The following table summarizes the stand data:

Forest cover type	Ponderosa pine
Unit size	146 acres
Slope	5-60%
Aspect	South & Southwest
Basal area (average)	92 square feet/acre
Trees/acre (≥ 3" DBH)	182 ponderosa pine
Average tree diameter	9.1" DBH
Average tree height	30 feet
Stocking	Good
Estimated stand volumes	970 cubic feet/acre 2904 board feet/acre
Sapling trees/acre (<3" DBH and >4.5' high)	0
Seedling trees/acre (<4.5' high)	20 ponderosa pine
Wildfire hazard rating	Moderate & Very High

Recommendations: Burn any piles that remain from recent treatments over the next few years. Continue dwarf mistletoe mitigation where there are infestations.

Management Unit 9



Description: Open grassy slopes with scattered pockets of low density ponderosa pine. No inventory plots were taken in this unit because it is not forested.

Management Unit 10



Description: Unit 10 consists of 25 acres of ponderosa pine and Douglas-fir forest on the lower flats of Hughey Open Space. The majority of this unit is relatively flat except for the portion sloping toward the drainage on the northeast side. The general aspect is east to northeast with slopes of 0 to 40 percent. Rocky Mountain juniper is a large component of the understory and mid-story vegetation. Remnants of old stone walls and some rock piles can be found in this area, which indicate some historical significance. These cultural remnants should be considered when making management decisions for this portion of the property.

Average tree diameter is 9.7 inches and average height is 41 feet. Stand basal area is 107 square feet per acre, which is somewhat overstocked for a recommended GSL of 60 to 80.

In addition to juniper shrub, yucca plants occur throughout the understory of Unit 10. Regeneration is minimal and consists of about 40 ponderosa pine seedlings per acre. Wildfire hazard is rated as moderate to very high.

The following table summarizes the stand data:

Forest cover type	Ponderosa pine/Douglas-fir mix
Unit size	25 acres
Slope	0-40%
Aspect	East & Northeast
Basal area (average)	107 square feet/acre
Trees/acre ($\geq 3''$ DBH)	61 ponderosa pine 131 Douglas-fir 192 Total
Average tree diameter	9.7'' DBH
Average tree height	41 feet
Stocking	Overstocked
Estimated stand volumes	1575 cubic feet/acre 6185 board feet/acre
Sapling trees/acre ($< 3''$ DBH and $> 4.5'$ high)	0
Seedling trees/acre ($< 4.5'$ high)	40 ponderosa pine
Wildfire hazard rating	Moderate & Very High

Recommendations: It does not appear that any recent forest management has occurred within Unit 10. Some fuels mitigation work would be beneficial to this stand. This would complement the work that was done in 2005 and 2006 on the adjacent Culver forest. Be sure to maintain the juniper component because it provides unique wildlife habitat, but some thinning of juniper to reduce ladder fuels is recommended. Also, focus on the lesser quality pines for removal. Any forestry treatments should not disturb the cultural artifacts that remain on this site. Therefore, use of vehicles or heavy equipment should be avoided in culturally significant areas. Hand felling and piling would be suitable method for this unit.

Management Unit 11



Description: Unit 11 is located on the Culver Open Space. There is a separate management plan for this unit.

Management Unit 12



Description: Unit 12 consists of 323 acres of open ponderosa pine forest and meadows on sloping rocky terrain. Slopes range from 20 to 60 percent on generally west, southwest aspects. There are few pine seedlings and saplings present, but none were recorded on the inventory plots.

Average tree diameter is 12.1 inches and average height is 29 feet. Stand basal area is 53 square feet per acre in the forested portions of this unit. This is a healthy stocking level considering the dry growing conditions in this part of Horsetooth Park. Shrubs present across Unit 12 include; yucca, mountain mahogany, prickly pear, sage brush, and common juniper. Wildfire hazard is rated as moderate to very high.

The following table summarizes the stand data:

Forest cover type	Open ponderosa pine and meadow
Unit size	323 acres
Slope	20-60%
Aspect	West & Southwest
Basal area (average)	53 square feet/acre
Trees/acre ($\geq 3''$ DBH)	62 ponderosa pine 62 Total
Average tree diameter	12.1" DBH
Average tree height	29 feet
Stocking	Good
Estimated stand volumes	528 cubic feet/acre 1842 board feet/acre
Sapling trees/acre ($< 3''$ DBH and $> 4.5'$ high)	0
Seedling trees/acre ($< 4.5'$ high)	0
Wildfire hazard rating	Moderate & Very High

Recommendations: No management necessary.

Management Unit 13



Description: Unit 13 is 42 acres of mixed ponderosa pine and Douglas-fir forest. Parts of this stand were thinned in 2006. Slopes are steep at 25 to 60 percent and generally north, northeast facing. There are some pockets of bark beetle throughout this stand and also some heavy dwarf mistletoe.

Average tree diameter is 9.3 inches and average height is 32 feet. Stand basal area is 100 square feet per acre. Understory shrubs include cliff bush, mountain mahogany, Rocky mountain maple, and common juniper. There are approximately 20 ponderosa pine and 10 Douglas-fir seedlings per acre. Wildfire hazard rating is moderate to very high.

The following table summarizes the stand data:

Forest cover type	Ponderosa pine with some Douglas-fir
Unit size	42 acres
Slope	25-60%
Aspect	North & Northeast
Basal area (average)	100 square feet/acre
Trees/acre ($\geq 3"$ DBH)	141 ponderosa pine 40 Douglas-fir 181 Total
Average tree diameter	9.3" DBH
Average tree height	32 feet
Stocking	Slightly Overstocked
Estimated stand volumes	1230 cubic feet/acre 4615 board feet/acre
Sapling trees/acre ($< 3"$ DBH and $> 4.5'$ high)	0
Seedling trees/acre ($< 4.5'$ high)	20 ponderosa pine 10 Douglas-fir
Wildfire hazard rating	Moderate & Very High

Recommendations: This stand could use addition fuels mitigation and insect/disease mitigation treatments. The upper portion or western part of this stand contains heavy dwarf mistletoe infestations and some bark beetles (see Map 3). Focus on dwarf mistletoe or bark beetle mortality for tree removal in these areas. Removal of infested trees will reduce basal area to a more desirable level and mitigate fuel density.

Management Unit 14



Description: Open grassy slopes with scattered pockets of low density ponderosa pine. No inventory plots were taken in this unit because it is not forested.

Ten-Year Work Plan

The following is a suggested ten-year work plan to be used as a general guide to the priorities of this plan. It is intended to help distribute the work load and identify critical priorities. The land manager is not required to follow this plan directly, but should refer to this as a guide. Priorities may and should be changed as necessary to meet new opportunities and changing forest conditions. As always, the landowner should work with a professional forester to update and change this plan as needed.

<u>Year</u>	<u>Unit</u>	<u>Recommendations</u>	<u>Acres</u>
2010	7	Fuels mitigation thinning (new acres)	50
	4	Pile and stack thinning residue	
	13	Insect and Disease mitigation thinning	20
	3,6	Burn piles	
2011	7	Fuels mitigation thinning (new acres)	50
	4,5	Burn piles	
2012	5	Fuels mitigation thinning (new acres)	10
	7,13	Burn piles	
2013	2	Dwarf mistletoe buffer along trail (new acres)	20
	5	Burn piles	
2014	10	Fuels mitigation thinning (new acres)	25
	2	Burn piles	
2015	2,3	Monitor seedlings in treated areas for mistletoe	
	10	Burn piles	
2016	2	Aesthetic/fuels pruning	50
		Burn remaining piles	
		Monitor all units for insect and disease	
2017		Burn remaining piles	
		Monitor all units for insect and disease	
2018		Burn remaining piles	
		Monitor all units for insect and disease	
2019		Burn remaining piles	
		Monitor all units for insect and disease	