

FOREST STEWARDSHIP PLAN

For

**Pinewood Reservoir State School Section
State of Colorado
1313 Sherman St.
Denver, CO 80203**

Property Legal Description

**640 acres in Section 36,
Township 5N, Range 71W,
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 as communicated by the State Land Board include:

- 1) Maximize revenue over the long term while maintaining productivity of their lands by:
 - Maintaining grazing leases with landowners
 - Firewood sales from diseased and infested wood salvaging
- 2) Maintain a healthy and aesthetically pleasing woodland property by:
 - Improving habitat for wildlife
 - Reducing fire hazard
 - Controlling insects and diseases
- 3) Show "Good Stewardship" by:
 - Accounting for resource values that may not return an immediate dollar
 - Maintain management options for the future

General Property Description

Location

The Pinewood Reservoir State School section is located west-southwest of Loveland, Colorado. From Highway 34, west of Loveland, turn south onto County Road (CR) 29 and travel 2 miles. Turn west onto CR 18E and go 6.7 miles and park at the Pinewood Reservoir parking lot. The State School Section falls on the west side of the reservoir which makes up the eastern edge of the section.

The State School Section is made up of 1 parcel identified as Section 36, Township 5 North, Range 71 West, 6th Principal Meridian, Larimer County, Colorado. The property is 640 acres in size occupying one square mile.

Refer to map 1 for location details of the Pinewood Reservoir State School Section.

Pinewood Reservoir State Section

Parcel number: 15360-00-932

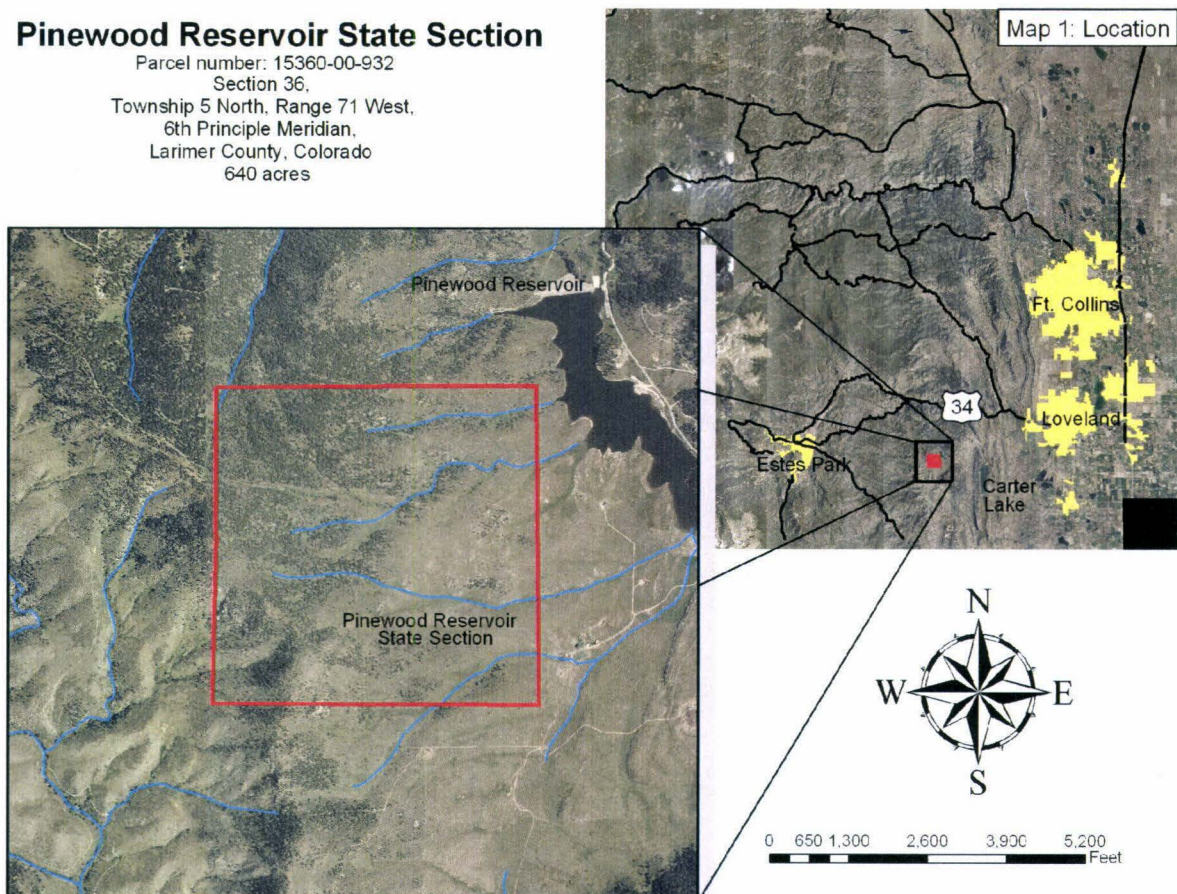
Section 36,

Township 5 North, Range 71 West,

6th Principle Meridian,

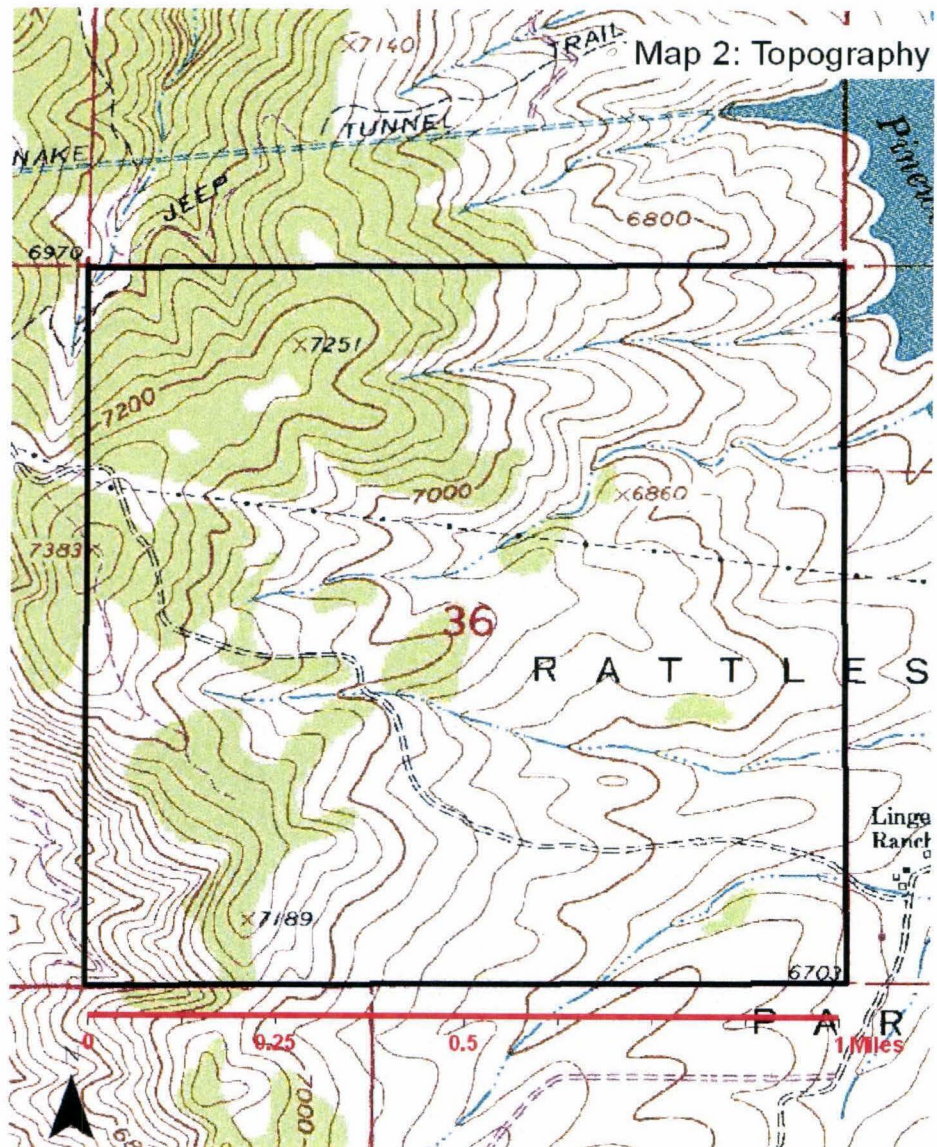
Larimer County, Colorado

640 acres



Topography

The Pinewood Reservoir State School Section includes several intermittent streams which run eastward throughout the property. The highest elevation on the property, which is 7383 feet, is located near the western boundary almost midway between the northern and southern boundaries. From this point the topography decreases in elevation towards the east and south. See Map 2 for details on topography. There are several drainages with slopes ranging from 10-90, percent. The lowest elevation on the State School Section is 6703 feet above mean sea level and is located in the southeastern corner of the property.



Roads and Trails

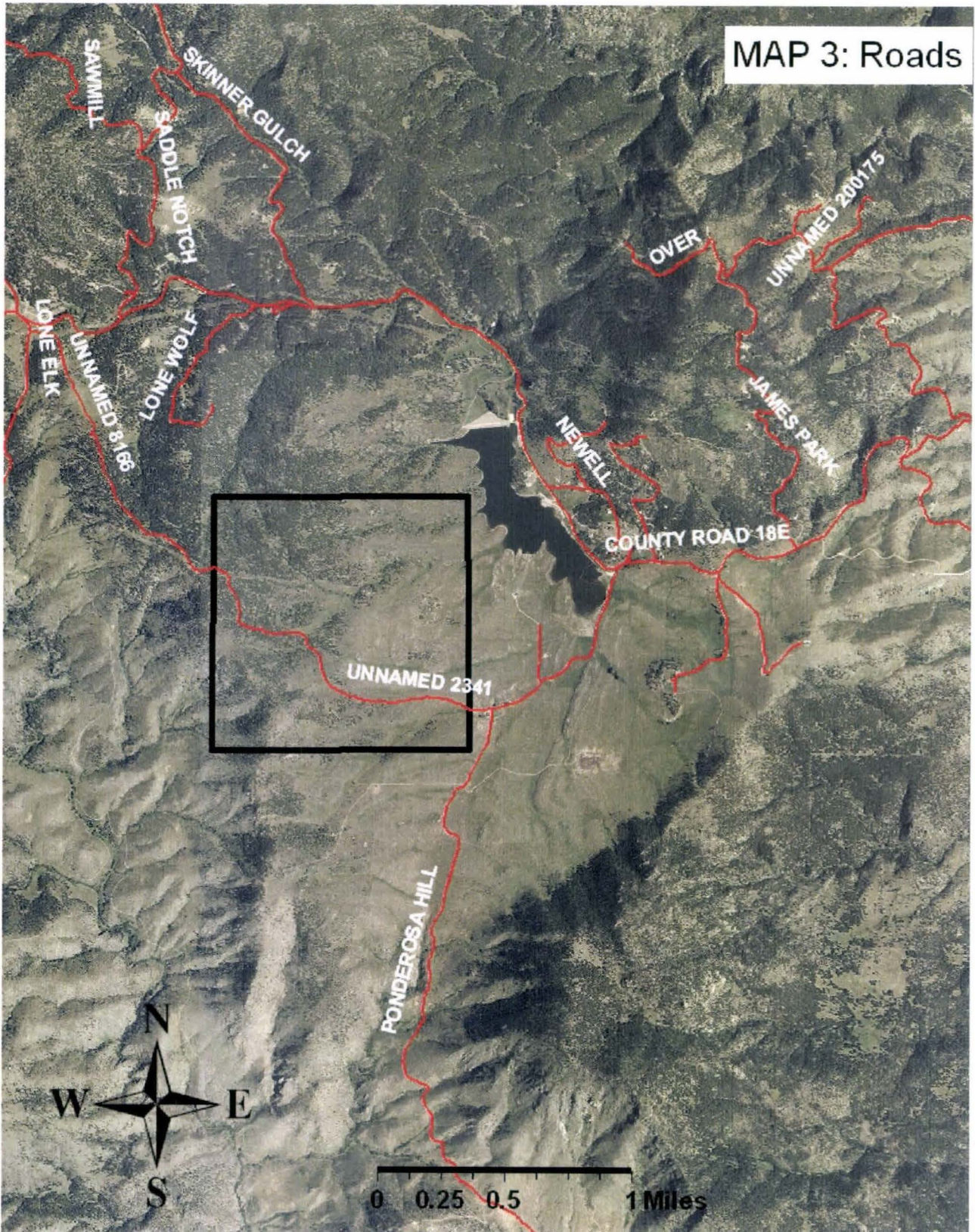
Access to the Pinewood Reservoir State School Section via motorized vehicle is gained from 2 possible routes.

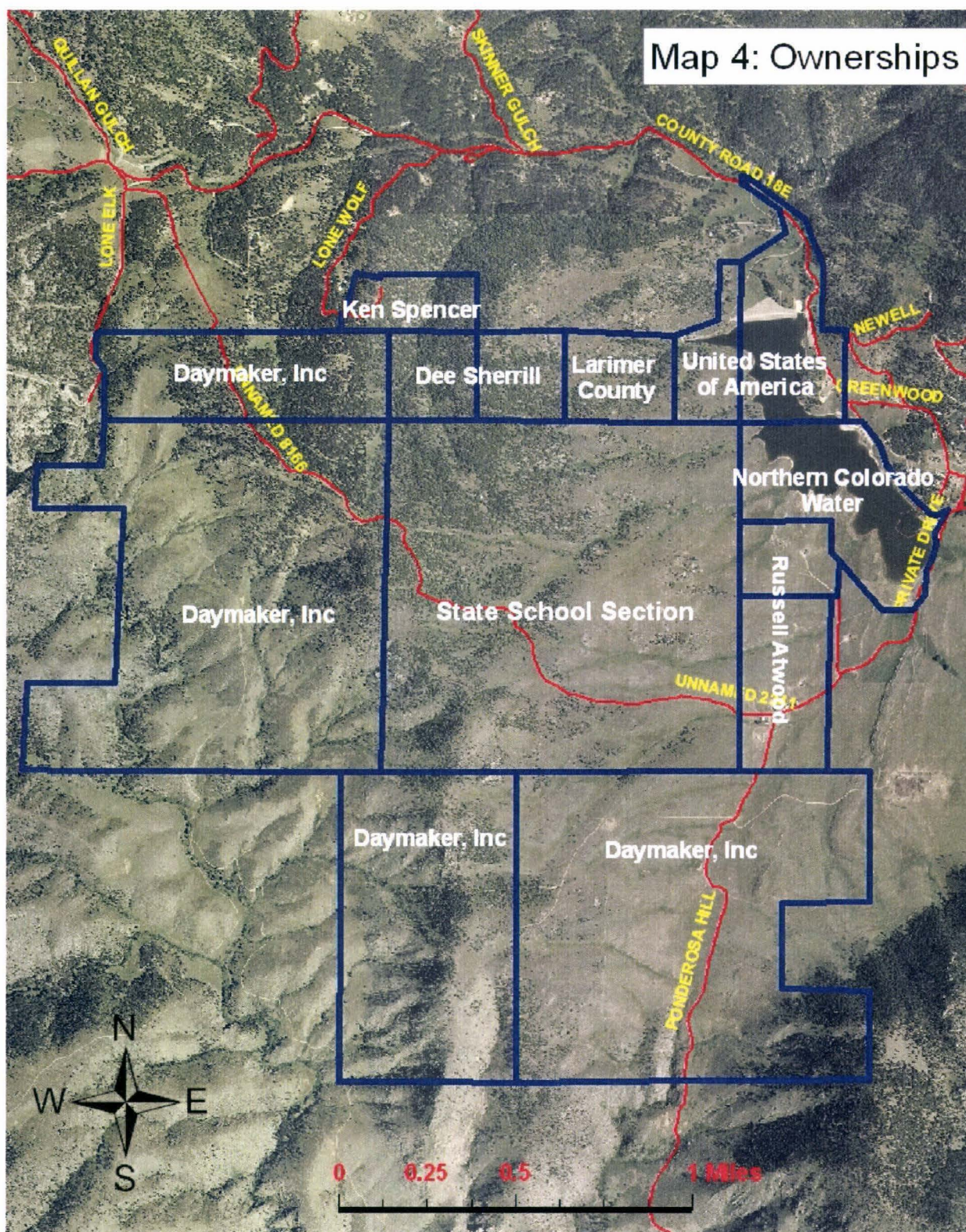
1) Take CR18E, located west of Loveland, to the south end of Pinewood Reservoir. Take the private road owned by Russell Atwood, unnamed 2341, to the large yellow house located on the hill just east of the Pinewood Reservoir State School Section. This house is owned by Mr. Atwood and access through the State Section will be gained from here, by Mr. Atwood.

2) An alternative route to the Pinewood Reservoir State School Section is to continue on CR18E past Pinewood Reservoir for 2.1m. At this point CR18E may also be labeled as Pole Hill Road. Turn left onto Lone Wolf Road and go 0.7m. Be sure to stay to the right at every fork and junction. At the top of the ridge is the Spencer property. From here the road takes a hard right turn and will end at the Sherrill property. These roads are privately owned roads that are not maintained unless done by the land-owner, road conditions may not be passable at times of bad weather. From the Sherrill property the State School Section can be accessed by foot from the northwest corner of the property.

There is much climbing and descending on the road between the Spencer and Sherrill properties. The Pinewood Reservoir State School Section is bordered by several different owners. These owners are Daymaker Inc., Dee Sherrill, Larimer County, USA, Northern Colorado Water, and Russell Atwood (See Map 4). Russell Atwood currently has a grazing lease on the State School Section and access to the property should be coordinated with Mr. Atwood and the State Land Board. Throughout the property are a few old roads, some of which are now being colonized with ponderosa pine regeneration. These roads were most likely used for ranching, logging, and for an alternate route around Pinewood Reservoir. Most of the old roads show signs of heavy use by game animals and made for good reference points during the inventory. It would not take much work to turn these roads into recreational trails or to return them to the natural state of the land.

Refer to map 3 for trail and road details.





Climate

Climate on the Pinewood Reservoir State School Section 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 annually, 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

This 2007 Forest Stewardship Plan is the first plan to be written for this property. Past land use for this property was grazing which is still taking place today. Most leases for grazing are 10 year leases, and the current lease does not expire for Mr. Atwood until 2015. There is also evidence of past cutting and/or logging throughout the property, but the intensity was probably not high. Besides Mr. Atwood's grazing lease there are current leases with the Electric and Power Company (RIGHT OF WAY #1002), Bureau of Reclamation (RIGHT OF WAY #1021), Public Service Gas Company (RIGHT OF WAY #1758), and the Colorado State Forest Service (RIGHT OF WAY #37911). Although these agencies have leases to this property, Mr. Atwood must be contacted prior to land visits at (970)622-0401. Mr. Atwood will assist with opening gates and giving directions to certain areas of the property. Before contacting Mr. Atwood, contact Jeri Leingang with the State Land Board at (303)866-3827.

The Pinewood Reservoir State School Section is approximately 58% forest land and 42% non-forest land. The forested area of the property is located mainly in the northwest and southwest quadrants and the non-forested areas occupy the northeast and southeast quadrants. The northwest quadrant has several drainages and steep slopes which are not ideal for grazing along with the southwest quadrant which is very steep and rocky and also not ideal for grazing. The northeast and southeast quadrants have gentler slopes with grasses and shrubs growing, making for better grazing grounds. These quadrants are easily accessible through Mr. Atwood's property via unnamed road #2341. There are old roads cut through some of the forested areas, however, many parts of these roads are overgrown with young Ponderosa Pine seedlings and saplings.

Resource Inventory

The variable plot cruising method was used to inventory forest resources. Fifty three plots were taken in the forested areas of the property. The entire property of Pinewood Reservoir State School Section is 640 acres in size, 374 acres being forested and 266 acres falling into non-forested lands. The inventory gathered information on stand type, plot location, slope, aspect, tree height and diameter, regeneration, site index, ground cover, fuel loading, wildlife sign, and insects and disease. Site tree information was determined 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.

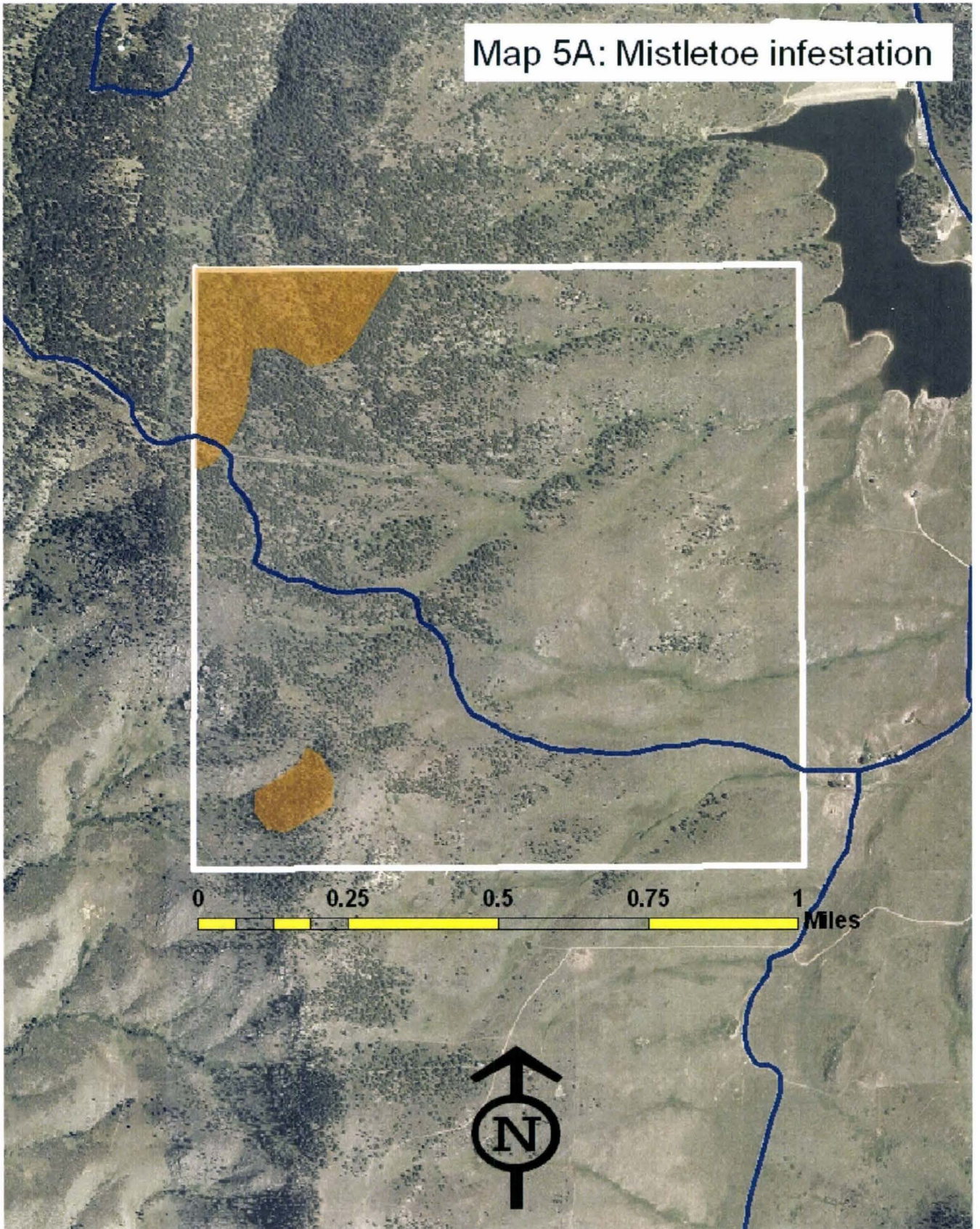
Insect and Disease

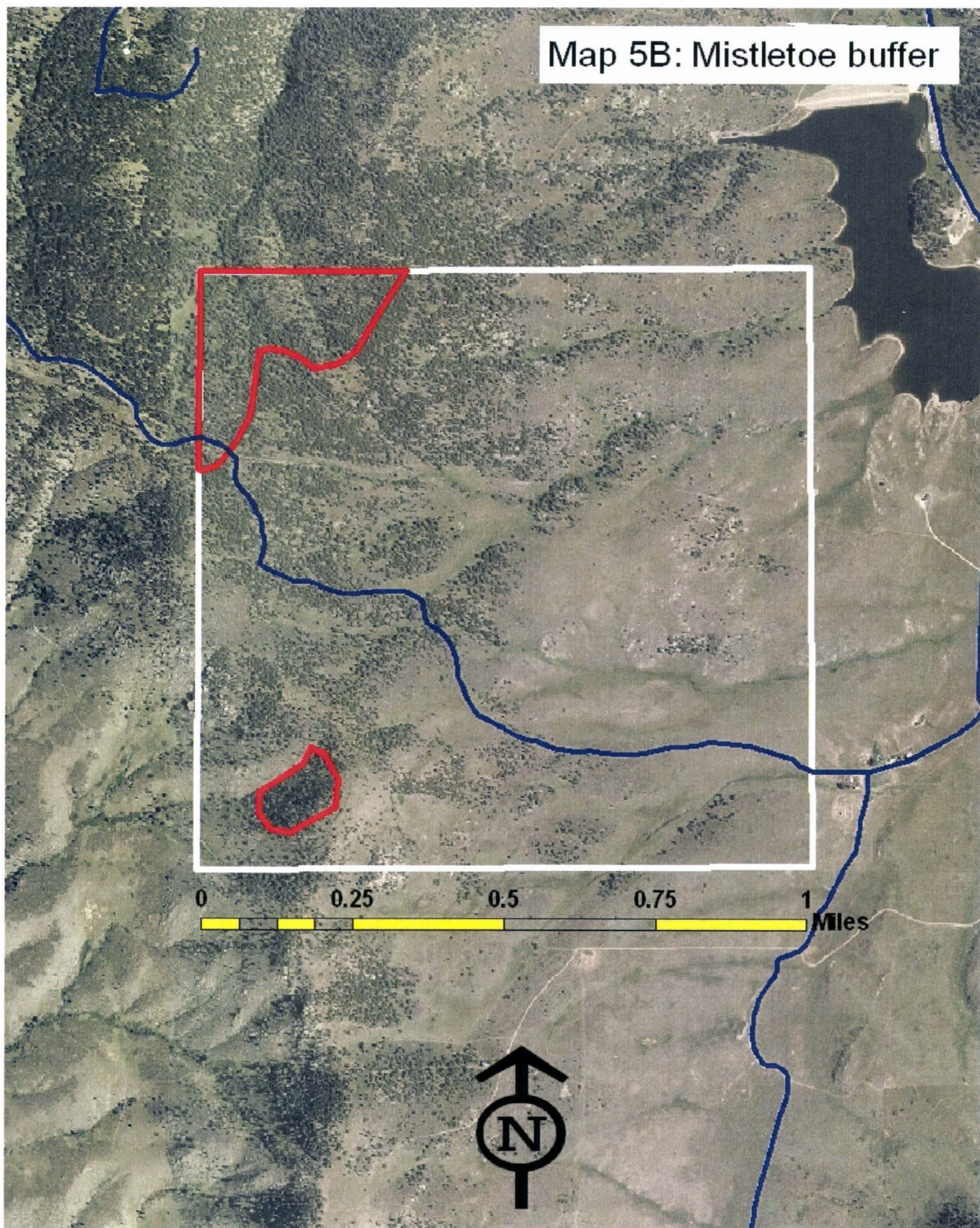
There are approximately 56.5 acres of ponderosa pine that are infected with the parasitic plant dwarf mistletoe. These areas can be identified by the orange/brown shapes in the pictures below. The priority for the Pinewood Reservoir State School Section is to contain the dwarf mistletoe so that it does not spread to the surrounding healthy trees.

Dwarf mistletoe spreads through seed distribution. Seeds can travel up to 60 feet to reach and infect a tree. However, the average distance of travel is usually less than 30 feet. To be on the safe side, any ponderosa pine tree within 50 feet of an infected tree is vulnerable to attack. Therefore, it is recommended that all ponderosa pine trees within 50 or more feet inside the perimeter of the area of infection be removed. Creating this buffer area will help contain the infestation until the remaining acres can be treated. Refer to the individual management units for treatment of the dwarf mistletoe within the infested area. Refer to Appendix G for more information on detection and biology of dwarf mistletoe.

Refer to map 5A for Dwarf-Mistletoe boundaries and map 5B for Dwarf-Mistletoe Buffers.

Map 5A: Mistletoe infestation





During the resource inventory, foresters located one ponderosa pine tree that had been attacked by mountain pine beetle (MPB) in 2006, but had successfully pitched out the beetles (See photographs 1&2). There were other sightings of ponderosa pine mortality in the area caused by MPB. These areas of infestation and mortality can be seen on map 6.

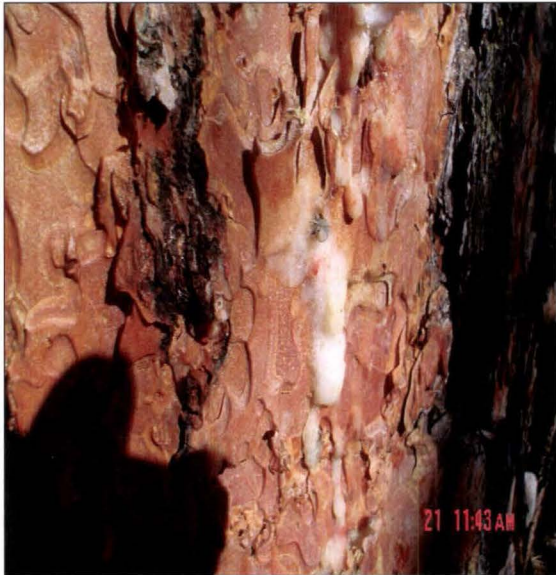


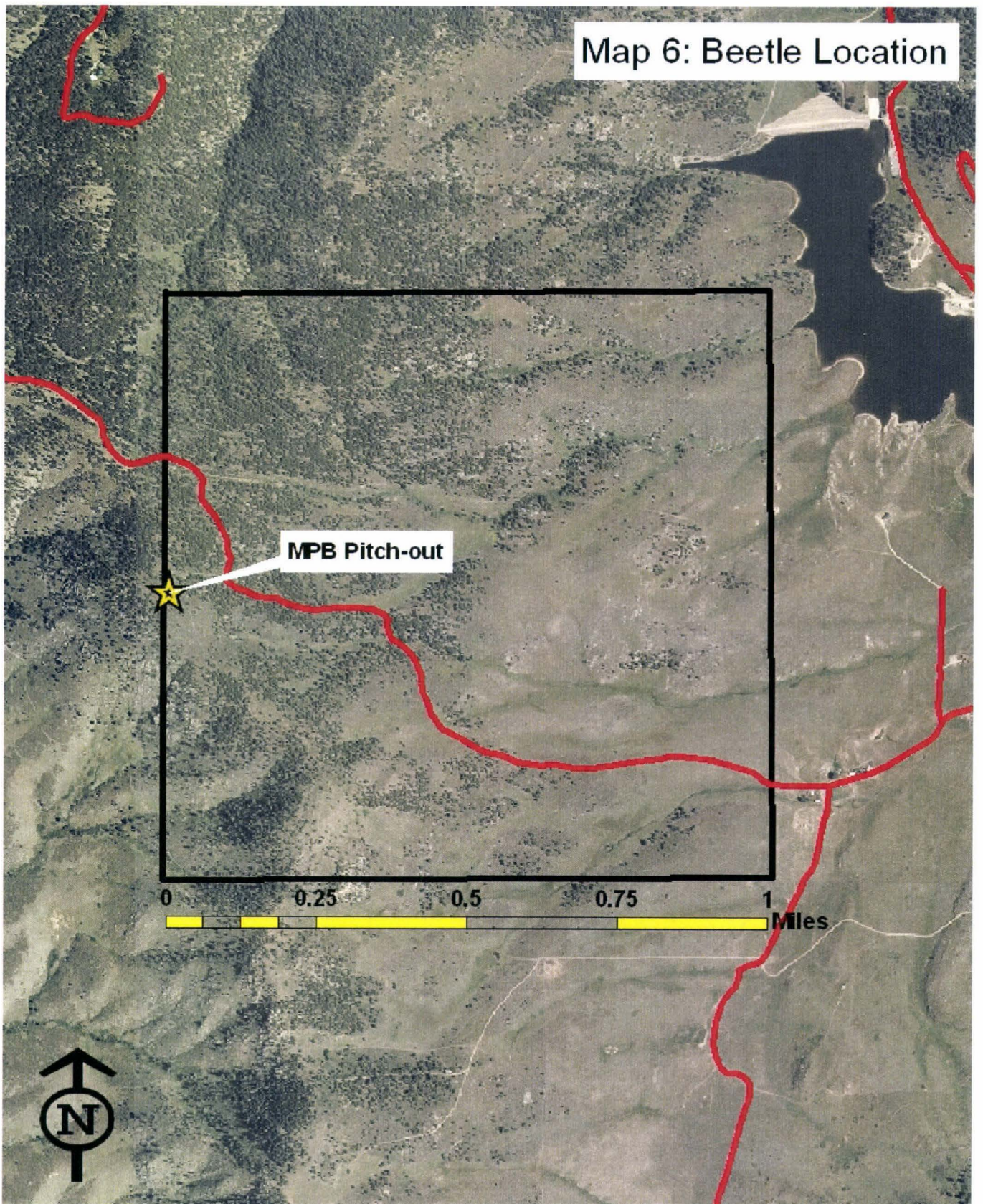
Photo 1



Photo 2

Although this area was the only area with signs of MPB, adjacent lands could be infested with the insect and the State Section should be monitored annually for the encroachment of MPB. Trees harboring the beetles should be cut and appropriately treated by the end of June to prevent the beetles from infesting surrounding trees. Appropriate treatment includes bark removal (using chainsaw de-barker attachment or hand peeler), chipping, solar treatment, milling, or burying under eight inches of soil. 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 annually 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. Regarding all insect and disease problems, maintaining healthy and vigorous trees will encourage tree defense mechanisms.



Wildlife

The Pinewood Reservoir State School Section 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 its 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.

The Pinewood Reservoir State School Section is rich with several species of wildlife. While conducting the forest inventory, we encountered deer, elk, several bird species, rabbits, squirrels, coyotes, and signs of pack rat nests in the rock crevices. This particular area is also known to inhabit bears, mountain lions, bobcats, and snakes. The elevation and topography, along with ample food and water sources make this property very diverse with wildlife.

Signs of wildlife were present in all of the plots taken during the inventory. It is assumed that there is no area within Pinewood Reservoir State School Section that is lacking wildlife or wildlife habitat.

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.

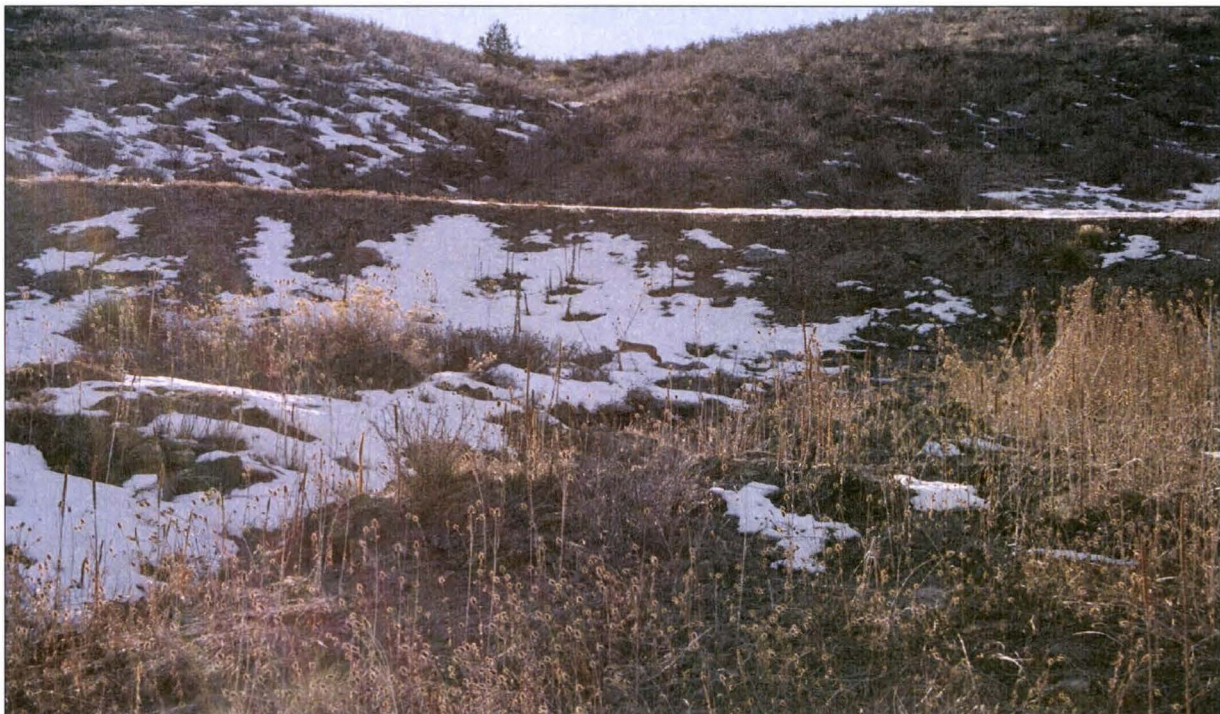
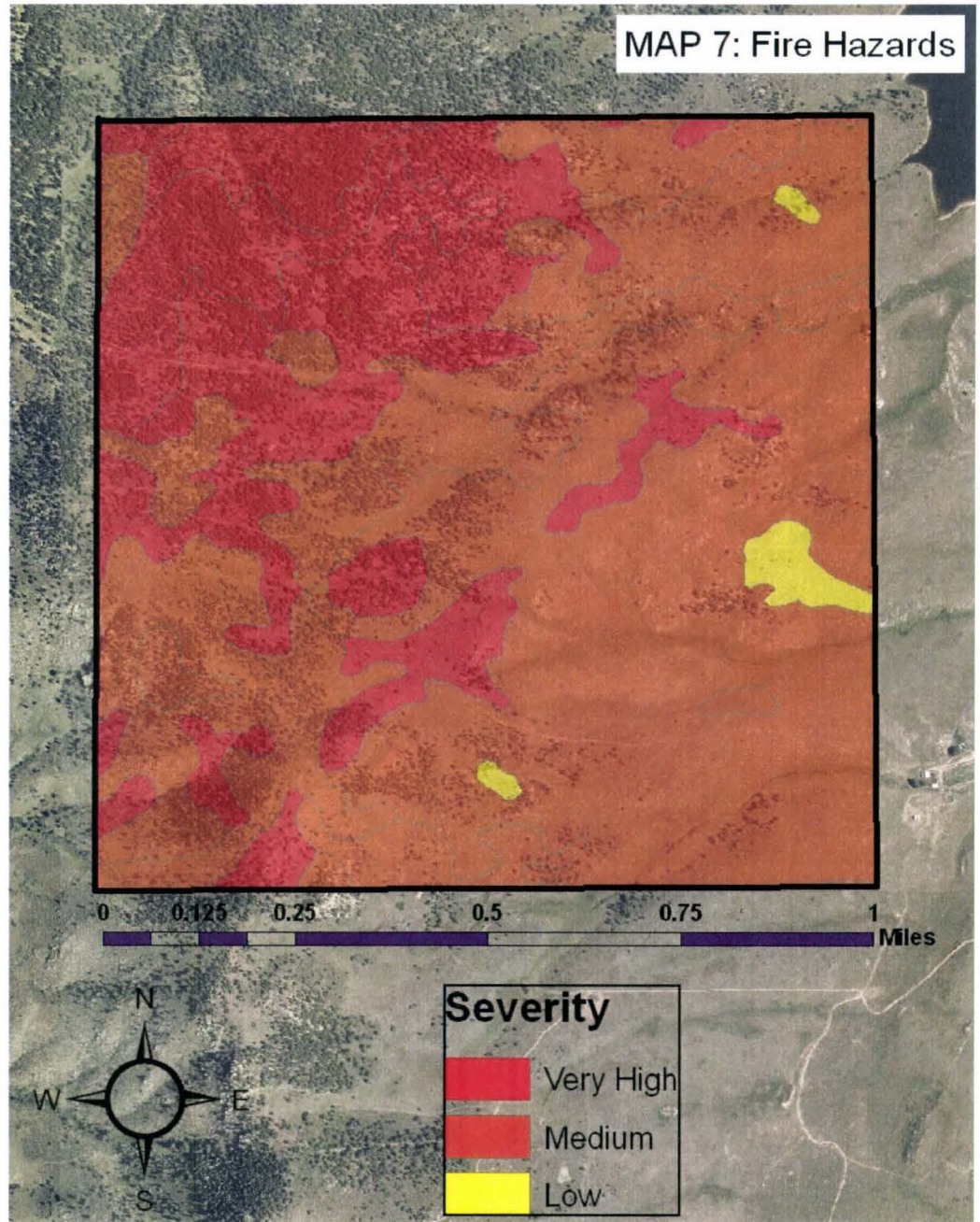


Photo 3: Bobcat near Pinewood Reservoir State School Section

Wildfire Hazards

Wildfire hazard on this property is mapped from low to very high hazard (see Map 7). These hazards are mapped based on the expected fire behavior, which is determined by vegetative cover type and habitat structural stage. The steep terrain found in the northwest and southwest quadrants of the property along with a higher concentration of standing trees, contributes to the very-high wildfire hazard in these areas. Steeper slopes allow fire to move uphill very quickly and can leave exposed soils that are highly erosive. Another contributor to the very-high wildfire hazard is the northern exposure of some slopes. These slopes contain Douglas-fir which retains their lower branches longer than ponderosa pine. These are areas of increased ladder fuels.



Soils

Seven different soil types constitute the Pinewood Reservoir State School Section, which is illustrated in Map 8. Wetmore-Boyle rock outcrop complex and the Trag-Moen complex cover by far the largest amount of area in the Pinewood Reservoir State School Section. The Wetmore-Boyle rock outcrop complex occupies mainly the northern and western boundaries of the property where the terrain is steep and rocky. The Trag-Moen complex occupies the center of the property where slopes are more gradual and the terrain is less rocky. There is also an abundant amount of Haploborolls-Rock Outcrop and Kirtley-Purner complexes which are concentrated at the north and south boundaries of the property. Also found in small quantities are Purner in the southeast corner, Breece in the southwest, and Ratake-Rock Outcrop in the far southwest corner. Despite its name, the area assigned this soil type does sustain trees and shrubs. 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:

19 – The Breece coarse sandy loam, 3 to 9 percent slopes. This gently sloping to strongly sloping soil is on terraces and in valleys. This soil has a profile similar to the one described as representative of the series, but the dark surface layer is about 40 inches thick. Included with this soil in mapping are small areas of soils in which bedrock is at a depth of 40 to 60 inches and a few small areas of soils in which gravel is at a depth of 40 to 60 inches. Also included are a few scattered areas of Rock outcrop on steeper areas. Runoff is medium, and the hazard of erosion is moderate. The soil is suited to native grasses. Capability unit IVE-6, dry-land; Loamy Park range site; not assigned to a windbreak suitability group.

43 – Haploborolls-Rock outcrop complex, steep. This complex consists of steep and 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, dry land; Haploborolls in Stony Loam range site and Rock outcrop not assigned to a 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 valley sides. 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, dry land; Kirtley soil in Loamy Foothill range site and Purner soil in Shallow Foothill range site; not assigned to a windbreak suitability group.

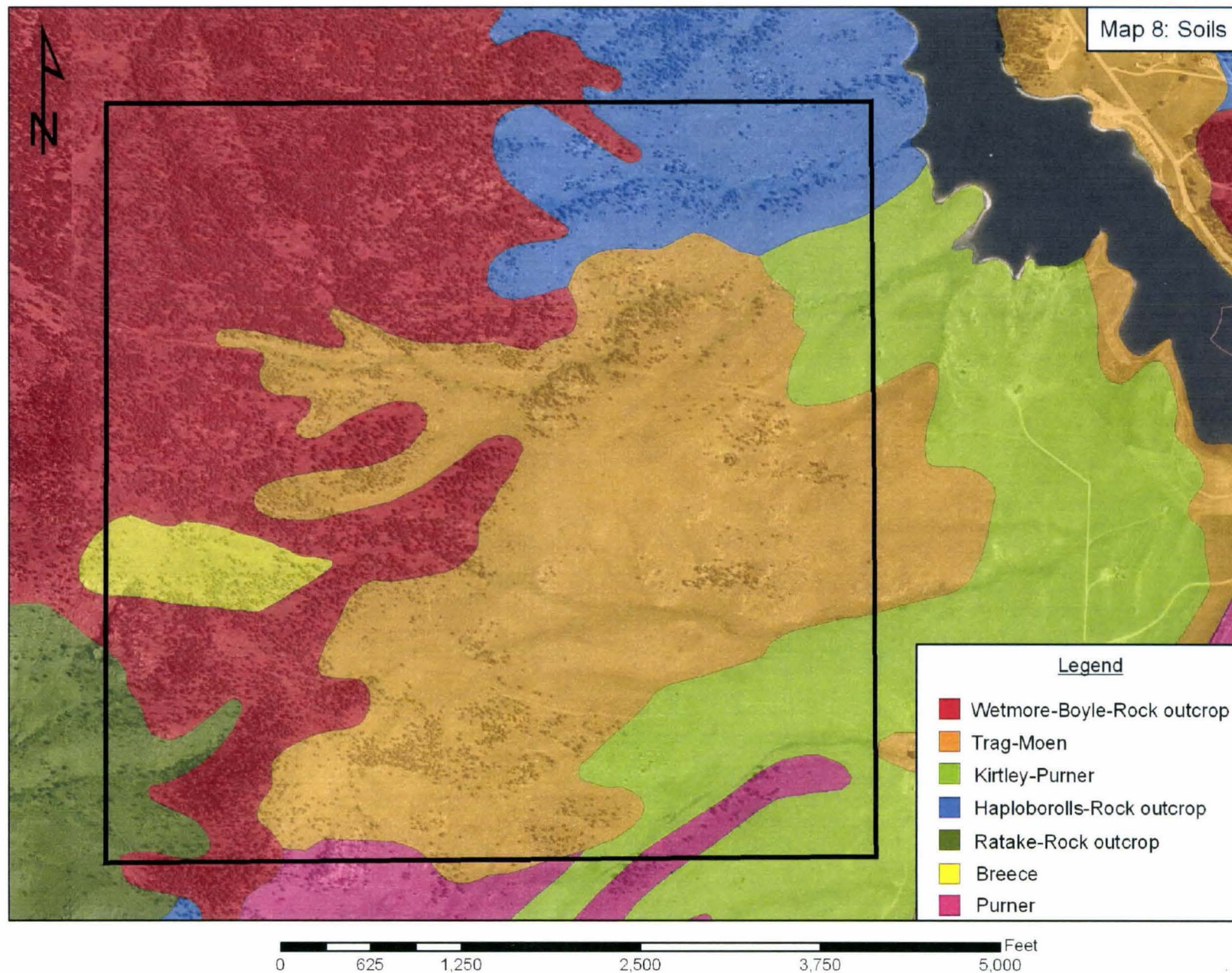
86 – Purner-Rock outcrop complex, 10 to 50 percent slopes. This complex consists of moderately steep or steep soils on uplands and ridges. It is about 55 percent Purner fine sandy loam and about 30 percent Rock outcrop. Purner fine sandy loam is smoother and less sloping, and Rock outcrop is steeper commonly on the western side of ridges. Included with this soil in mapping are 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, dry land; 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 less steep, and Rock outcrop is throughout the complex but commonly is near ridge tops and is steeper. Included with this soil in mapping are about 10 percent areas of Breece soils along drainage ways. Runoff is rapid, and the hazard of water erosion is severe. This soil is suited to native grasses. Capability unit VIIe-1, dry land; Rocky Loam range site; not assigned to a windbreak suitability group.

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 ridge tops 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, dry land; 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 gravely sandy loam, and about 25 percent Rock outcrop. Wetmore gravely sandy loam is in forest, Boyle gravely sandy loam is in open grassed areas, and Rock outcrop occurs throughout but is commonly near ridges and steeper slopes. 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 Red Feather 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.

See Map 7 for soils on Pinewood Reservoir State School Section.



Management Units: Descriptions and Recommendations

This section describes the management units identified on the Pinewood Reservoir State School property. 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 in 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.

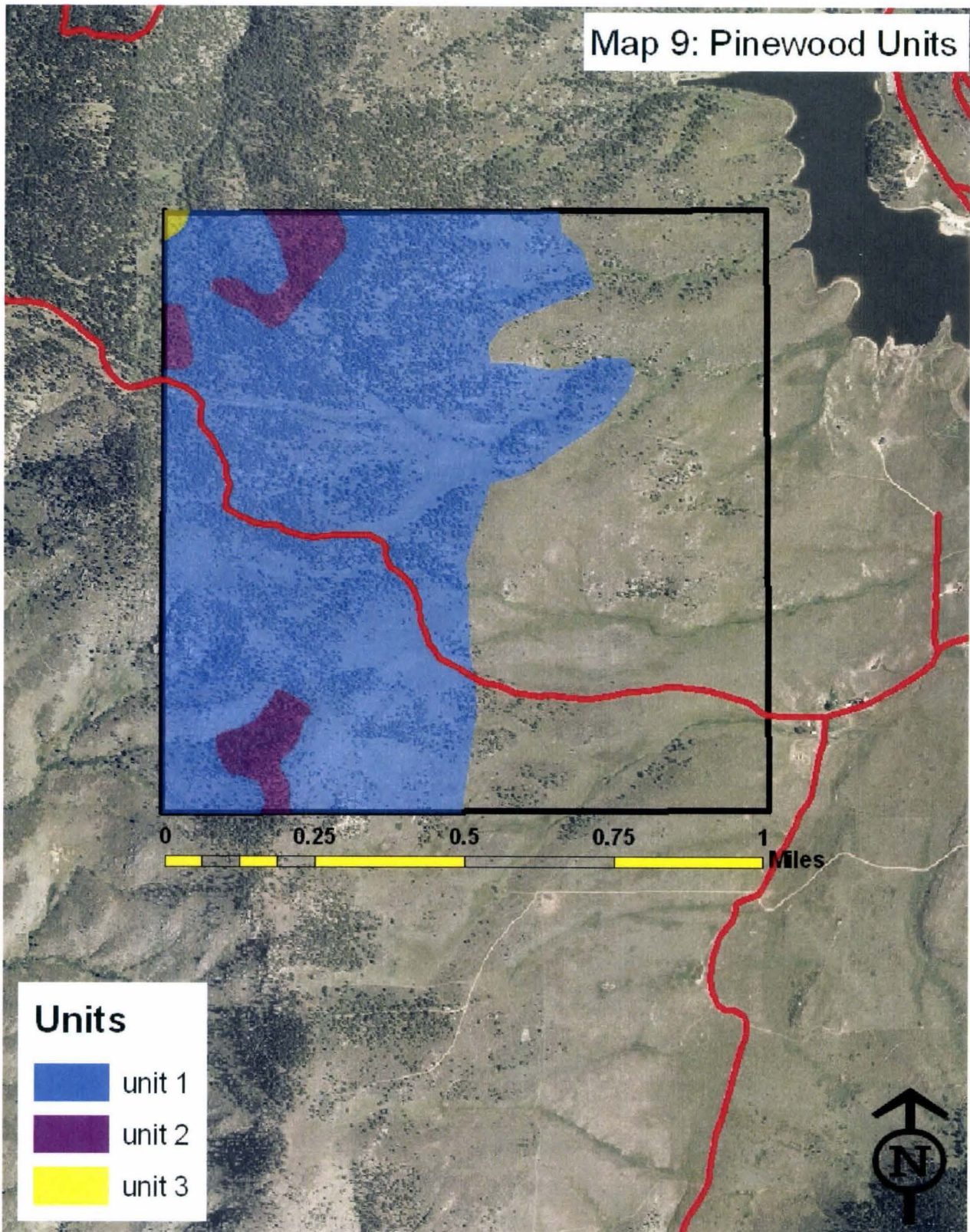
The Pinewood Reservoir State School Sections forest cover consists primarily of ponderosa pine (*Pinus ponderosa*), followed by Douglas-fir (*Pseudotsuga menziesii*). At least one clone of very young quaking aspen (*Populus tremuloides*) can be found growing in the northwest corner of the property. Rocky Mountain juniper (*Juniperus scopulorum*) can be found distributed very sparsely throughout different areas of the property, though it was not measured in the forest inventory because it is not a timber species. Mountain mahogany (*Cercocarpus montanas*) was found in high density across most of the property. Other shrub species found on the property are currant (*Ribes spp*) and cliff brush (*Jameisha americana*). Forest cover types are the result of topographic and soil influences, insect and disease infestations, light and moisture availability, and previous management activities.

The average age of the dominant and co-dominant ponderosa pine and Douglas-fir trees, as well as the average site potential, was calculated from the site tree information gathered. The average age of the ponderosa pine is 100 years, which is actually considered young for ponderosa pine. The Douglas-fir's average age is 99 years. The average last ten years of diameter growth for the ponderosa pine is 22/50ths of an inch, while the average best ten years of growth is 68/50ths of an inch, as indicated by past growth rings. For the Douglas-fir the average last ten years of diameter growth is 36/50ths of an inch and the average best ten years of growth is 69/50ths of an inch. The differences indicate that in most cases the trees could be growing much better.

Management Unit Breakdown

The property has been broken down into three unit types that each dictates its own specific management needs (see Map 9). The statistics given are for trees that are 3" DBH or greater unless otherwise noted.

Map 9: Pinewood Units



Management Unit 1

"Ponderosa Pine"



Description: Unit 1 is 348 acres of generally open canopy (less than 50% closed) ponderosa pine with some Douglas-fir. This unit is where the majority of the ponderosa pine was found. As with most of the property, this unit contains some rocky areas and rock outcrops. Dwarf mistletoe is present in this unit, but is found only in small patches. These small patches can be helpful when using a buffer strategy to control the parasitic plant. It was observed that Unit 1 has select trees with some type of canker; however the disease did not look epidemic at this time (2007). This unit is separated by several ridges that run east and west, dividing the unit nearly even with north and south aspects. The southern aspects of this unit are much dryer than the northern aspects and they are inhabited by dry condition species such as cactus and yucca. This unit has slopes that range from 2 to 70 percent; with an average slope of 21 percent.

There are small areas throughout Unit 1 that show signs of past fire. The cause of these fires is unknown but it appears that the fire was a low intensity fire or even a spot fire. There are also areas in Unit 1 which have a significant amount of dead and downed trees. The cause of the mortality is due to the combination of dwarf-mistletoe, drought stress, and in some cases, mountain pine beetle.

The trees in this unit have a large average dbh of 9.36 inches, which is typical of more open-grown stands, and an average height of 31.5 feet. With 72 square feet of basal area, the unit is overstocked for the recommended growing stock level (GSL) of 60. Regeneration is moderate with 69 ponderosa pine and 2 Douglas-fir seedlings per acre, and 23 ponderosa pine saplings per acre. These less-than-optimal numbers could be due to lack of soil disturbance and water, poor soils, and shading within the clumps of trees. Ponderosa pines prefer full sunlight for establishment and proper growth form. On the other hand, Douglas-firs often establish and thrive in the under-story of ponderosa pine stands. If the stand is deprived of fire for long enough, the Douglas-fir can shade out the ponderosa pine.

The most common under-story plant found in this unit is mountain mahogany, however, juniper, Rocky Mountain juniper, fringe sage, current, kinnikinnick, common mullen, carex, poa, big sage, prickly pear cactus, yucca, cliff brush, and several species of aster.

This unit is mapped as Moderate to Very High wildfire hazard. This is an accurate assessment given that the area has some steep slopes and dense pockets of timber. There are higher volumes of live fuels on the north aspects of Unit 1 due to a higher moisture level, and more dead down fuels due to insects, diseases, and drought stress. See following table for a summary of the stand data.

The following table summarizes the stand data:

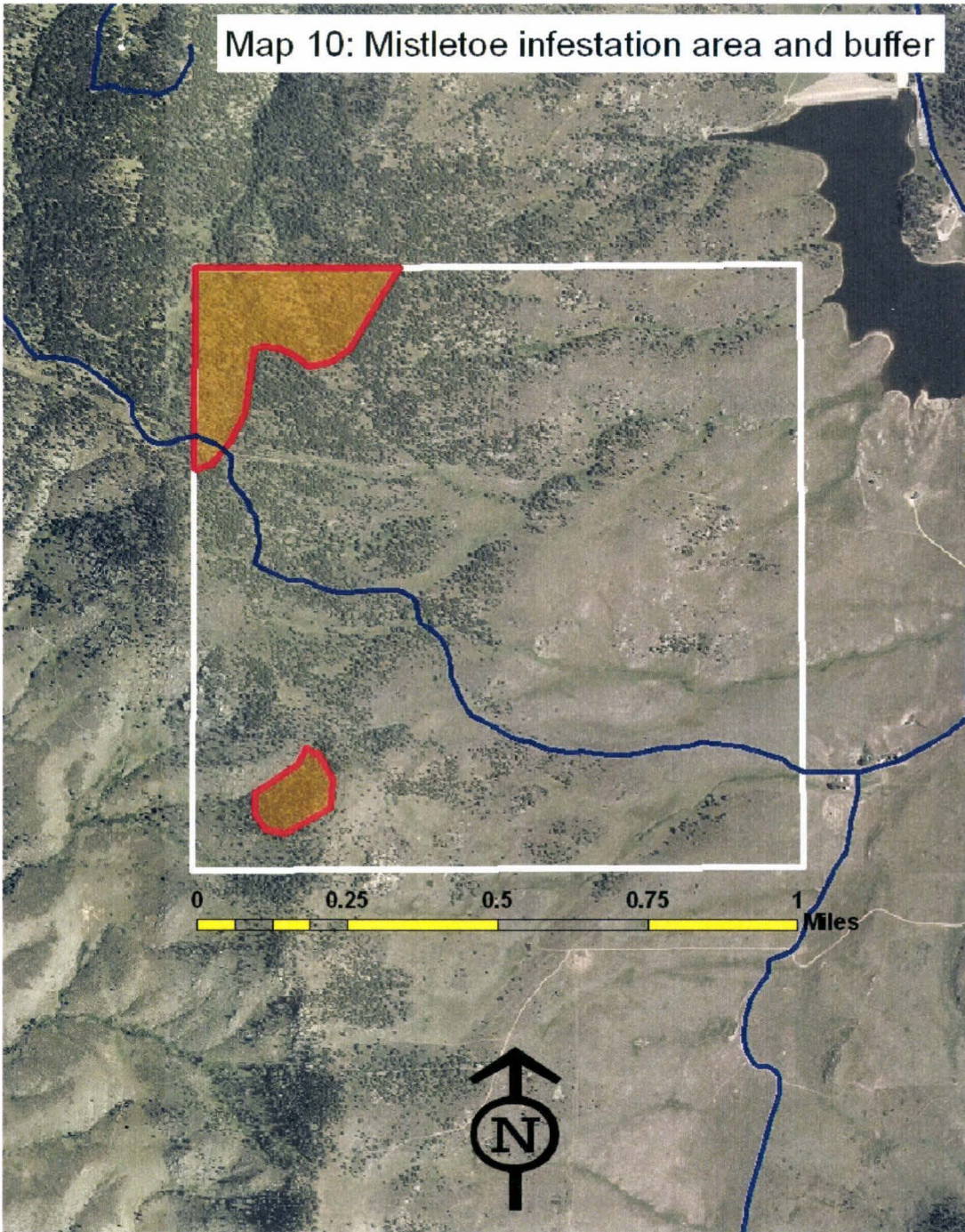
Forest cover type	Uneven aged open ponderosa pine, dwarf-mistletoe abundant
Unit size	348 acres
Slope	2-70%
Aspects	N, S, E, W, NE, NW, SE, SW
Basal area (average)	72 square feet/acre
Trees/acre ($\geq 3"$ dbh)	360 Ponderosa Pine 360 Total
Average tree diameter	9.36" dbh
Average tree height	31.5 feet
Stocking	Overstocked for GSL 60
Estimated stand volumes	702 cubic feet/acre 2257 board feet/acre
Sapling trees/acre ($< 3"$ dbh and $> 4.5'$ high)	53 ponderosa pine
Seedling trees/acre ($< 4.5'$ high)	69 ponderosa pine 4 Douglas-fir
Wildfire hazard rating	Moderate and Very High

Recommendations: The priority for this stand is to remove the dwarf mistletoe so it does not spread to the surrounding healthy trees and the new regeneration can thrive. Once the dwarf mistletoe is eradicated new ponderosa pine regeneration will grow without the certainty of becoming infected with the parasitic plant. Refer to appendices "G" for more details on insects and diseases.

Though the average basal area per acre is slightly more than the recommended GSL of 60, removing the infected trees will bring the GSL down to an adequately stocked GSL of 60 or less. Some of the healthier trees within dense clumps could benefit from the removal of competing trees. Refer to the tables in Appendix F for general spacing guidelines. The trees should not be evenly spaced, but should be kept in a more natural slightly clumped pattern. The larger the tree is, the more "growing room" that should be left around it. The thinning should concentrate on the dead, damaged, diseased (if any), and poor form trees (such as a forked top or bent stem).

Some uniquely deformed "character" trees may be left. Two large (greater than 10" diameter) standing dead trees per acre should be left for wildlife purposes. 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 these trees will serve to reduce competition for resources, thus allowing the trees to grow at a rate closer to the potential productivity for the land (site index). This thinning will also reduce the fire hazard and the potential for insect and disease infestation. Smaller, stressed, under-story trees are often more vulnerable and once infected can introduce disease to otherwise healthy surrounding trees.

Depending of the slope, fuel loading, and natural barriers in unit 1, prescribed fire could be a useful resource for management in this unit. Prescribed fire will reduce the fuel loads in this unit as well as promoting new vegetative growth. Prescribed fire will also help control noxious weeds.



Containment of the entire infected area is described in the “Insect and Disease” section. After this buffer area is completed, all of the infected trees within need to be removed (See map 10). If there are any lightly infected trees that the landowner wishes to save, they can be pruned. Pruning should be limited to trees with a rating of 1 or 2 and should remove all infected branches. A dwarf mistletoe rating explanation is included in Appendix G. Removal of more than 50 percent of the crown is not recommended. Large diameter trees heavily infested with mistletoe can be girdled and left as wildlife trees.

The worst situation is when older/tall infected trees can shower seeds down on young trees and cause numerous infections. Continue to monitor the pines surrounding the buffer and any that were left inside the buffer for mistletoe shoots, as it takes 2-3 years after infection for them to develop. Pruning and removing heavily infested trees is the best measure available to reduce infections. Also see the "Dwarf Mistletoe" section in Appendix G.

If there are any large areas left without trees during or after the buffer or sanitation cut, Douglas-fir seedlings and Rocky Mountain juniper can be hand planted to reforest the area, improve the aesthetics, and reduce soil erosion. After dwarf mistletoe is removed from all units, ponderosa pine seedlings can be planted for the same purpose. The Colorado State Forest Service Nursery sells tree seedlings that are excellent for this purpose.

When planting, be cautious of the invasive weed cheat grass. If cheat grass is found take precautions to avoid disturbing the soil as cheat grass will rapidly occupy disturbed areas. Contact the Larimer County Weed District for advice on managing noxious weeds.

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 not create 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 spread 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.

Be cautious when cutting between July 1st and September 1st due to the mountain pine beetle flight.

Management Unit 2

“Ponderosa Pine/Douglas-Fir”



Description: Unit 2 consists of 25 acres of generally open ponderosa pine and Douglas-fir. Rocky Mountain juniper is scattered throughout as well. This unit is also being infested with dwarf-mistletoe. This infestation has led to some dead and downed trees. Evidence of mountain pine beetle mortality trees is also present, but only present on older dead trees. There was one ponderosa pine with MPB but it had appeared that the tree successfully pitched out the beetles in 2006. See Photographs 1 and 2 under the insect and disease section.

Located in the under-story are common juniper, mountain mahogany, fringe sage, big sage, yucca, carex, poa, current, Rocky Mountain juniper, cliff brush, and prickly pear cactus. There are also a couple of clumps of very young aspen found in this unit. The invasive weed common mullein is present in the unit as well.

The average tree diameter is 7.4 inches with an average height of 29 feet. With 55 square feet of basal area, the unit is under stocked for a GSL of 60. Regeneration is adequate with 187

Ponderosa Pine and 37 Douglas-Fir seedlings per acre. There are 137 Ponderosa Pine saplings per acre and 25 Douglas-Fir saplings per acre in Unit 2.

Unit 2 is mapped mostly as a wildfire hazard of Moderate and Very High. With the high abundance of fuels, dry condition of the unit, and the steep terrain, the whole unit should be classified as Very High.

The following table summarizes the stand data:

Forest cover type	Open ponderosa pine and Douglas-fir, dwarf-mistletoe abundant
Unit size	25 acres
Slope	14-51%
Aspect	NW, SW
Basal area (average)	55 square feet/acre
Trees/acre ($\geq 3''$ dbh)	250 Ponderosa Pine 25 Douglas-Fir 275 Total
Average tree diameter	7.4'' dbh
Average tree height	29 feet
Stocking	Under-stocked for GSL 60
Estimated stand volumes	564 cubic feet/acre 1728 board feet/acre
Sapling trees/acre ($< 3''$ dbh and $> 4.5'$ high)	137 Ponderosa Pine 25 Douglas-Fir
Seedling trees/acre ($< 4.5'$ high)	187 Ponderosa Pine 37 Douglas-Fir
Wildfire hazard rating	Moderate and Very High

Recommendations: The first recommendation for this unit is the removal of the dwarf mistletoe-infected pines. After performing the buffer cut as previously discussed, the infected trees within should be removed.

The second management action that should be taken in Unit 2 is prescribed fire. This will reduce the fuel loading that is present and decrease the risk of wildfire. Prescribed fire can also stimulate the regeneration of ponderosa pines by reducing competition and allowing resources to be more available.

The common mullein in this unit should be controlled as it can easily pioneer disturbed sites. Mullein plants are easily hand pulled on loose soils due to relatively shallow tap roots. This is an extremely effective method of reducing populations and seed productivity, especially if the plant is pulled before seed is set. If blooms or seed capsules are present, reproductive structures should be removed, bagged, and properly disposed of in a sanitary landfill. Care should be taken, however, to minimize soil disturbance since loose soil will facilitate mullein seed germination. Another option is to use herbicides. Contact the Larimer County Weed Control District Office at (970) 498-5768 for more information on the control of this noxious weed.

Though the average basal area per acre is slightly under-stocked for the recommended GSL of 60, some of the healthier trees within the dense clumps could benefit from the removal of competing trees. Refer to the tables in Appendix F for general spacing guidelines. The trees should not be evenly spaced, but should be kept in a more natural slightly clumped pattern. The larger the tree is, the more “growing room” that should be left around it. The thinning should concentrate on the dead, damaged, diseased (if any), and poor form trees (such as a forked top or bent stem). Some uniquely deformed “character” trees may be left. Two large (greater than 10” diameter) standing dead trees per acre should be left for wildlife purposes. 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 these trees will serve to reduce competition for resources, thus allowing the trees to grow at a rate closer to the potential productivity for the land (site index). This thinning will also reduce the fire hazard and the potential for insect and disease infestation. Smaller, stressed, under-story 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 not create 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 slash generated from the cut should be treated as described in Unit 1. Be cautious when cutting between July 1st and September 1st due to the mountain pine beetle flight.

Management Unit 3

"Aspen"



Description: Quaking aspen is what is found on the 1 acre of Unit 3. The only other timber species found in this area is ponderosa pine, and neither is infested with dwarf mistletoe. This is the only unit of the Pinewood Reservoir State School Section that is lacking the parasitic plant. The most likely reason for this is that dwarf-mistletoe does not infest aspen. The slopes range from 14% to 23% with aspect of north and northeast. Shrubs found in this unit are mountain mahogany, Rocky Mountain juniper, rose, and current. Common mullein is also found in Unit 3. Other under-story vegetation found in Unit 3 are carex, poa, and several species of Aster.

With a 4.9 inch average diameter and 119 square feet of basal area, the stand is overstocked for the recommended GSL of 80. The average height for the stand is 33 feet. There are 2150 aspen seedlings per acre in Unit 3. Due to the moisture content of this area aspens are growing, but their health is not very good. There are signs of cytospora canker and much die-off within this unit.

This unit is mapped as having a Very High fire hazard due to the abundance of aspen seedlings and saplings. The abundance of grasses would enable this unit to burn very hot and fast during a fire.

The following table summarizes the stand data:

Forest cover type	Dense Aspen
Unit size	1 acre
Slope	14-23%
Aspect	N, NE
Basal area (average)	119 square feet/acre
Trees/acre ($\geq 3"$ dbh)	550 Aspen 50 Ponderosa Pine 600 Total
Average tree diameter	4.9" dbh
Average tree height	33 feet
Stocking	Overstocked for GSL 80
Estimated stand volumes	660 cubic feet/acre 910 board feet/acre
Sapling trees/acre (<3" dbh and >4.5' high)	350 Aspen
Seedling trees/acre (<4.5' high)	2150 Aspen
Wildfire hazard rating	Moderate and Very High

Recommendations: This unit could be thinned to a growing stock level of 80. The average spacing recommended for this stand is 11 feet between trees. The table in Appendix F entitled "Growing Stock Levels 80" has general spacing guidelines based on the desired GSL and the average diameter. The trees should not be evenly spaced, but should be kept in a more natural, slightly clumped pattern, as aspens typically grow. The larger the tree is, the more "growing room" that should be left around it. Thinning in sensitive areas such as aspen stands should be carefully planned and care should be taken so as to not damage healthy trees surrounding removal trees. Aspen stands are usually wet sites with sensitive soils and several seedlings and saplings that will also be at risk during thinning operations.

The removal of these trees will serve to 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 insect and disease infestation, particularly diseases such as cytospora canker, conks, and rot causing fungi. This unit would benefit from prescribed fire as well. A low intensity surface fire would reduce the ladder fuels, remove less vigorous saplings, and provide bare mineral soil for aspen regeneration. Invasive weeds should be addressed as mentioned for previous units. The slash generated from the cut should be treated as in Unit 1.

Some of the aspen trees are infected with cytospora canker and black canker. Symptoms of cytospora canker are usually an elongate orange, yellow, or red-brown canker on the trunk or limb. This fungus typically attacks stressed or damaged trees through bark wounds, dead tips of twigs or branch stubs. Cytospora causes decline or death in the trees. Refer to the "Cytospora Canker" fact sheet in Appendix G for more information.

Black canker is typically characterized by large, black, swollen callus ridges with the target-like appearance of concentric rings. Diseased trees can also be identified by black swollen areas at the branch stubs. This canker can kill twigs, branches and the trunk by girdling, though it mainly stresses trees, allowing insect borers and other cankers to kill the trees. Decay fungi also enter the tree at cankers and weaken the tree.

Since the aspens are not in a highly visible area, one management option is to clear-cut infected aspen clones. However, doing nothing is also an option. If single trees can be removed without damage to residual trees, then this is a time-consuming option. But remember that aspen need full sunlight to regenerate. Do not leave any damaged aspens as they will likely be infected by one of these diseases. Also, preventing stress will improve the health of the aspens and decrease incidence of these diseases. Stress includes being deprived of full sunlight and water. Therefore removing encroaching conifers would improve the aspens' disease resistance.

In some areas the aspen are being shaded out by encroaching conifers. If the landowner wishes to sustain or improve the integrity of these aspen stands, the conifers within them should be removed as well as all the conifers within 12-15 feet or more of the aspen stands. Remove some of the aspens around the edges of the stands, focusing first on dying, diseased, wounded, or damaged trees to promote new sucker growth. When removing the conifers and aspen, be careful not to wound the residual aspen as they become vulnerable to a number of airborne diseases (including cytospora canker and black canker) at the wound site. If residual aspen are wounded then remove these trees as well. Leaving the cut aspen on the ground around the new aspen sprouts will help discourage browsing on them by deer and elk. The rustic furniture market may serve as an outlet for the aspen logs.

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. Prescribed fire is the recommended management action for some of the units at Pinewood Reservoir State School Section. Due to the sensitive nature of prescribed fire, it is not included in the ten year work plan. Windows of opportunity to burn should be looked at on a shorter time scale.

Year	Unit	Recommendations	Acres
2008	1&2	Contain all dwarf mistletoe with 50-foot buffer	10
		Remove dwarf mistletoe within 50-foot buffer (SW)	11
	3	Thin/Remove diseased and infected aspens	1
	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2009	1	Remove dwarf mistletoe within 50-foot buffer (NW)	36
	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2010	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2011	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2012	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2013	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2014	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2015	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2016	All	Control noxious weeds	640
		Monitor all units for insect and disease	374
2017	All	Control noxious weeds	640
		Monitor all units for insect and disease	374

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 sustained 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.

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Colorado Conservation Exchange – Big Thompson Watershed Ramsay Shockey Open Space / State Land Board Forest Restoration Project Treatment Plan

Introduction and Purpose

The Colorado Conservation Exchange (CCE) is a community-based, collaborative initiative that formed in 2010 to help improve watershed health and sustain ecosystem services in the Cache la Poudre and Big Thompson Watersheds of the northern Colorado Front Range. The CCE aims to develop an innovative funding mechanism to support forest restoration in the upper reaches of the watersheds for the benefit of users in the lower portions of the watersheds, including the cities of Fort Collins, Greeley, and Loveland. The mission of the CCE is:

To create a watershed investment fund where community members support land stewards who conserve and enhance nature's ability to provide clean and abundant water, healthy food, productive soils, carbon storage, wildlife habitat, and inspiring open spaces for all community members to enjoy.

Central to the CCE is the establishment of demonstration sites where forest restoration treatments can be implemented and monitored, and where the concepts of the CCE regarding return on investment calculations can be worked out on the ground. In February 2016, the CCE identified demonstration sites in both the Cache la Poudre and Big Thompson Watersheds based on criteria such as wildfire hazard, proximity to important water resources, and accessibility for use as a demonstration site.

This document describes the project area and the treatment approach for the CCE demonstration project in the Big Thompson Watershed.

Project Location and Existing Conditions

The project is located in the Big Thompson Watershed on the Ramsay-Shockey Open Space and adjacent State Land Board land off CR 18E approximately 18 miles west of Loveland, CO (Figure 1). The Ramsay-Shockey Open Space is 177 acres in size and is managed by the Larimer County Department of Natural Resources. The adjacent State Land Board land covers 640 acres and is managed by the Colorado State Forest Service. Both properties are located upslope of Pinewood Reservoir, an important water resource managed by Northern Water as part of the Colorado-Big Thompson Project (Figure 2).

The project area covers approximately 70 acres across both the Open Space and State Land Board properties. The project falls within Management Unit 4 of the Ramsay-Shockey Open Space, designated as such in the Ramsay-Shockey Forest Stewardship Plan (FSP).

The project area occurs within the ponderosa pine belt of the Colorado Front Range at an elevation of approximately 6,800 feet. Historically this elevational zone was characterized by frequent surface fire that maintained open forest conditions and diverse forest structures consisting of openings and randomly arranged tree groups (i.e., trees with overlapping crowns), and scattered individual trees (Figure 3; Sheriff and Veblen 2007; Larson and Churchill 2012; Brown et al. 2015). A combination of fire exclusion, past logging, and grazing have together led to increases in forest density and an overall more uniform forest condition in lower elevation settings of the Front Range (Veblen and Donnegan 2005).

These conditions increase the susceptibility of Front Range ponderosa pine forests to large-scale disturbances such as wildfire or insect and disease outbreaks.

The project area is currently characterized dense, mostly by young (< 80 years old), ponderosa pine trees, and lacks the stand complexity and diversity expected to be present under an intact low-severity fire regime (Figure 4). Average basal area is currently 63 ft² per acre, based on stand inventory data provided in the Ramsay-Shockey FSP, with most trees ranging in size from 6 to 20 inches in diameter at breast height. Understory vegetation consists primarily of shrubs (mostly mountain mahogany) and an herbaceous layer consisting of a variety of grasses and forbs.

Management Goals and Desired Conditions

Forest management within the project area is aimed at creating an open, low-density ponderosa pine stand that is characteristic of historical stand conditions, is not at risk of high-severity wildfire, and is resilient to future disturbance. Management goals for the project area include:

- *Wildfire* – create and maintain long-term forest structural conditions that support characteristic low to mixed-severity fire;
- *Forest Health* – create and maintain conditions that support resilience and resistance to insect and disease by managing for openings and complex forest structure;
- *Hydrologic Function* – ensure long-term conditions that support water quality and quantity appropriate to the soils and hydrology of the site;
- *Wildlife* – maintain habitat structural elements such as old trees, snags, and coarse woody debris to benefit multiple wildlife species and guilds, such as ungulates, Abert's squirrel, Merriam's turkey, and cavity nesting birds;
- *Aesthetics and Recreation* – maintain a visual pleasing forest structure by promoting complex forest management to achieve non-uniform (e.g. no “straight lines”) outcomes; remove hazards to users of the property for a variety of recreational activities consistent with allowed uses of the property;
- *Forest Products* – provide forest products such as firewood, saw logs, and biomass to the extent practicable to offset costs of the treatments and maintain a working forest;
- *Demonstration and Outreach* – provide a sound demonstration of forest management that restores forest structure and reduces hazardous fuels to bolster support for forest restoration work as part of the CCE.

The desired condition for the project area after treatment is as follows:

- Species composition will be almost entirely ponderosa, with sparse and inconsistent distribution of Douglas-fir in protected areas; some Rocky Mountain juniper may occur occasionally and is of value for species diversity;
- Groups of trees occur throughout the unit, with a group defined as 2 or more trees with overlapping crowns; groups typically contain 2-5 trees, with larger groups on wetter microsites such as swales;
- Single trees make up the remainder of the trees in the unit and are scattered randomly throughout the unit;
- Openings and interspaces between trees occur throughout the unit and are characterized by diverse understory vegetation, including grasses, forbs, and mountain shrubs; opening size, shape, and spatial distribution are highly variable and irregular; large openings (> 1 acre) may occur;

- A range of tree age and size classes is present; age class distributions approximate a reverse-J distribution, with more young trees present in the unit than old trees; large and/or old trees occur throughout the unit;
- Large snags and downed woody material are randomly scattered throughout the unit.

Management Units and Description of Work

The project is divided into three management units designated as Units A, B, and C (Figure 1). Unit A is located on the Ramsay-Shockey Open Space and comprises 11 acres. Unit B is located on State Land Board land and covers 22 acres. Unit C is located on State Land Board land and covers 35 acres. The project area was divided into these three units based primarily on the difference in ownership (Unit A being on Ramsay-Shockey and Units B, C being on State Land Board land), as well as treatment of residual materials. Units A and B are designated for piling and burning of residual material whereas residual material will be lopped and scattered within Unit C. *Units A and B should be treated prior to Unit C to allow piles more time to cure so that they can be burned during winter 2016-2017.* Beyond treatment of residual material, the treatment approach is the same across units.

The following **general management guidelines** should be followed across units:

- Stand Density and Spatial Distribution – Reduce overall stand density by removing trees across size classes, though with emphasis on small tree removals, < 6" in diameter at breast height (dbh). Residual density should not be uniform but rather should vary with terrain and soil moisture. Dry, south-facing slopes should have low residual tree densities whereas north-facing slopes may retain higher residual densities. Enhance spatial heterogeneity by establishing openings and retaining groups of trees and scattered individual trees. Residual basal area should range from 0 ft² per acre to 80 ft² per acre, with an overall average of ~40 ft² per acre. Trees should be cut at or below at a maximum of 12 inches above ground, measured from the uphill side. Trees shall be completely severed from the stump.
- Openings – Enhance existing openings by removing the majority of conifer encroachment < 6" in dbh. Establish new openings throughout the project area wherever possible, especially in dry portions of the unit. Openings should be irregularly spaced and should be variable in size, ranging in size from 0.1 acres to 1+ acre. The total area of openings should make up >25% of the project area.
- Species Composition – Preferentially retain ponderosa pine over Douglas-fir. Retain healthy aspen and any other conifers (e.g., Rocky Mountain juniper) if they occur in the unit.
- Size Class Distribution – Focus removals on small diameter stems, < 6" in dbh. Do not remove anything over 18" in diameter unless it is a hazard tree or has health issues. Maintain a balance of size and age classes overall.
- Disease and Insects – Remove trees infected with mistletoe and those that are infested with Mountain pine beetle. Remove beetle-killed trees except for larger diameter trees that would make good wildlife trees.
- Snags – Retain an average of 1 snag per acre to provide wildlife value.

- Old trees – Retain all old trees, identified as such based on morphological characteristics. Old trees tend to have “flat tops” whereby the upper portion of the crown flattens out and is characterized by large branches (Figure 5).
- Coarse Woody Debris – Retain modest amounts of coarse woody debris on the forest floor for wildlife.
- Understory Vegetation – Identify areas that have well-developed yet suppressed understory vegetation and attempt to daylight those areas in order to stimulate an understory response. Minimize disturbance of understory vegetation throughout the unit.
- Slash Treatment – Leave boles as they are felled. Fell trees in the same direction to the extent possible so that felled trees do not create “jack straw”. Leave log length for potential future harvesting as firewood. See detailed guidance below for piling versus lop and scatter of limbs and brush.

Treatment of Residual Material

The following **piling guidelines** should be followed in Units A and B:

- Small diameter material less than 6” diameter resulting from felling operation (activity fuels) should be piled.
- When possible, material greater than 6” diameter (e.g., tree boles) should be cut to 16’ lengths and moved to the road for removal.
- Material greater than 6” diameter, not within a reasonable distance from the road, should be piled.
- Dead ground fuels greater than 3” diameter and sound should be cut and piled.
Exception: an average of 2-3 large diameter logs per acre should be left on site.
Preference for retention will be given to large diameter logs, greater than 10’ in length, in advanced stages of decomposition.
- Pile placement:
 - Piles should be placed in existing or created openings. They should not be within the drip-line of leave trees. Pile size should correlate with opening size (i.e. smaller piles should be placed in smaller openings and vice-versa).
 - Piles should not be placed within 10’ of another pile.
 - When possible piles should be placed in areas with bare, rocky soils.
 - Piles should not be placed within 30’ of riparian areas.
- Pile construction
 - Piles should be no smaller than 4’ x 4’ x 4’ and no larger than 12’ x 12’ x 12’ (Figure 6).
 - Piles should be at least as tall as they are wide.
 - The core (center/bottom) of the pile should consist of small diameter (<3”) material especially sticks, twigs, and branches with needles. Progressively larger material should be placed on pile with tree-boles and heavy materials on top to ensure the pile is compact.
 - Piles should not contain branches, logs, or other material extending more than 2-3’ beyond the outside edge of the pile. This material should be cut and placed on top.

- Dragging material – this project will require moving material to common locations over and over again. When possible try to avoid taking the same path to minimize soil/ground disturbance especially when dragging tree-boles to the road.

The following **lop and scatter guidelines** should be followed in Unit C:

- Depth of scattered material should be less than 12 inches from the ground level.
- Do not cover more than 50 percent of the surface area per acre with slash.
- Avoid spreading slash from treated areas into adjacent meadows.

References

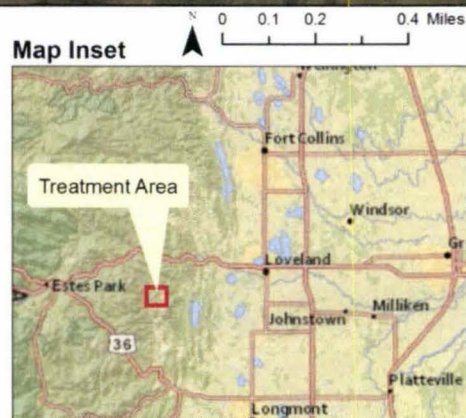
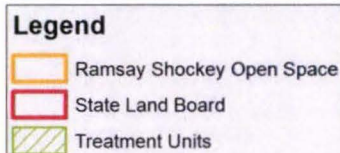
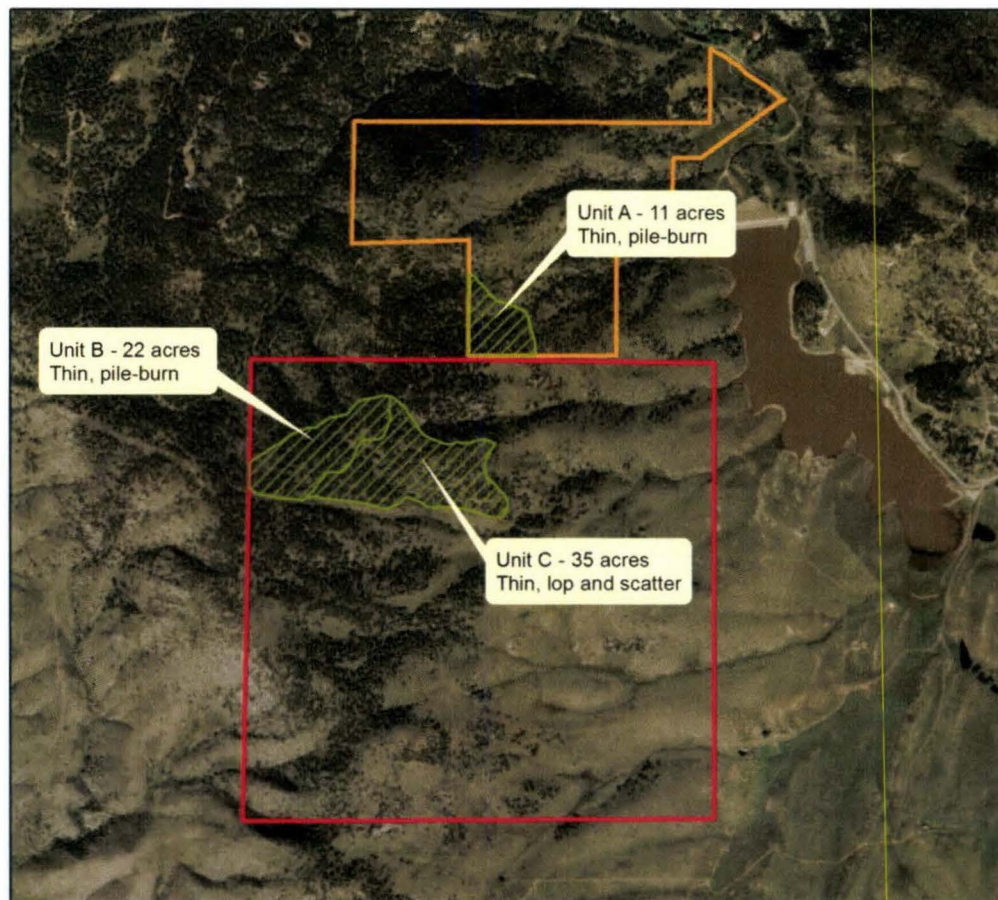
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Ramsay-Shockey / State Land Board Treatment Area Conservation Exchange - Big Thompson Watershed



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Figure 1. Map of the Ramsay-Shockey / State Land Board project area depicting treatment units A, B, and C.



Figure 2. View of the project area from Pinewood Reservoir.

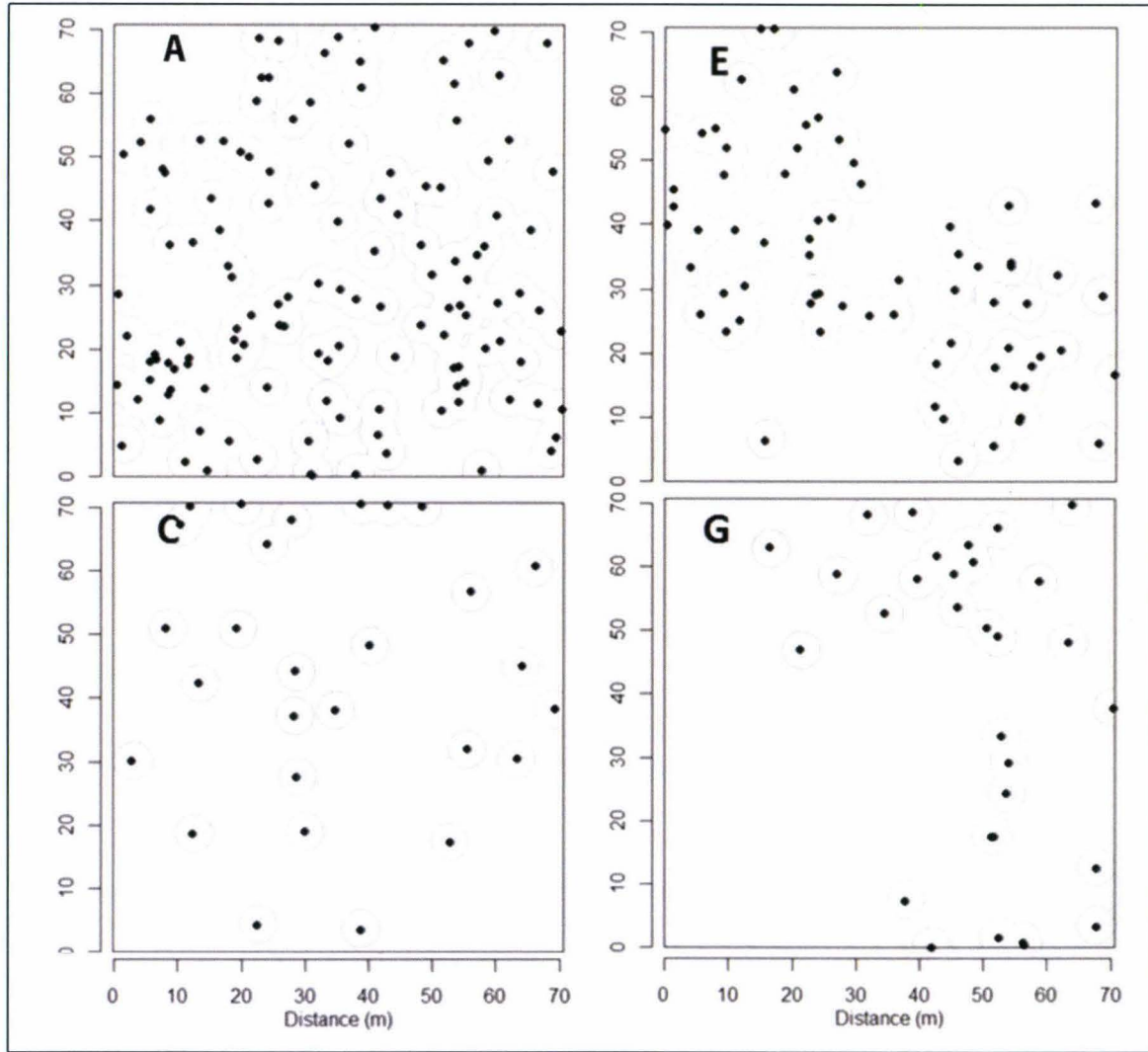


Figure 3. Stem maps from Brown et al. (2015) representing the range of variability in historical (1860) tree spatial patterns at Hall and Heil Valley Ranches in Boulder County at a similar elevation to the Ramsay-Shockey / State Land Board project area. Black dots represent individual trees with 20 ft diameter tree crowns projected (gray circles). Historical basal areas ranged from 0 to 75 ft² per acre tree density ranged from 0 to 130 trees per acre. Forest treatments should reduce stand densities while restoring complex tree spatial patterns representative of historical conditions.



Figure 4. Representative high-density stand conditions within the project area.

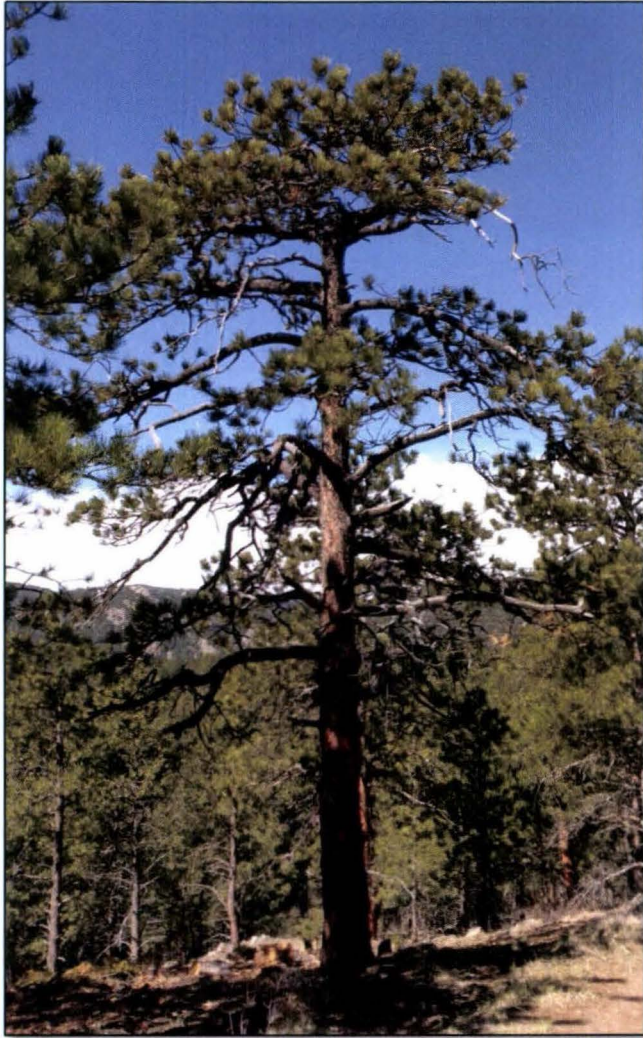
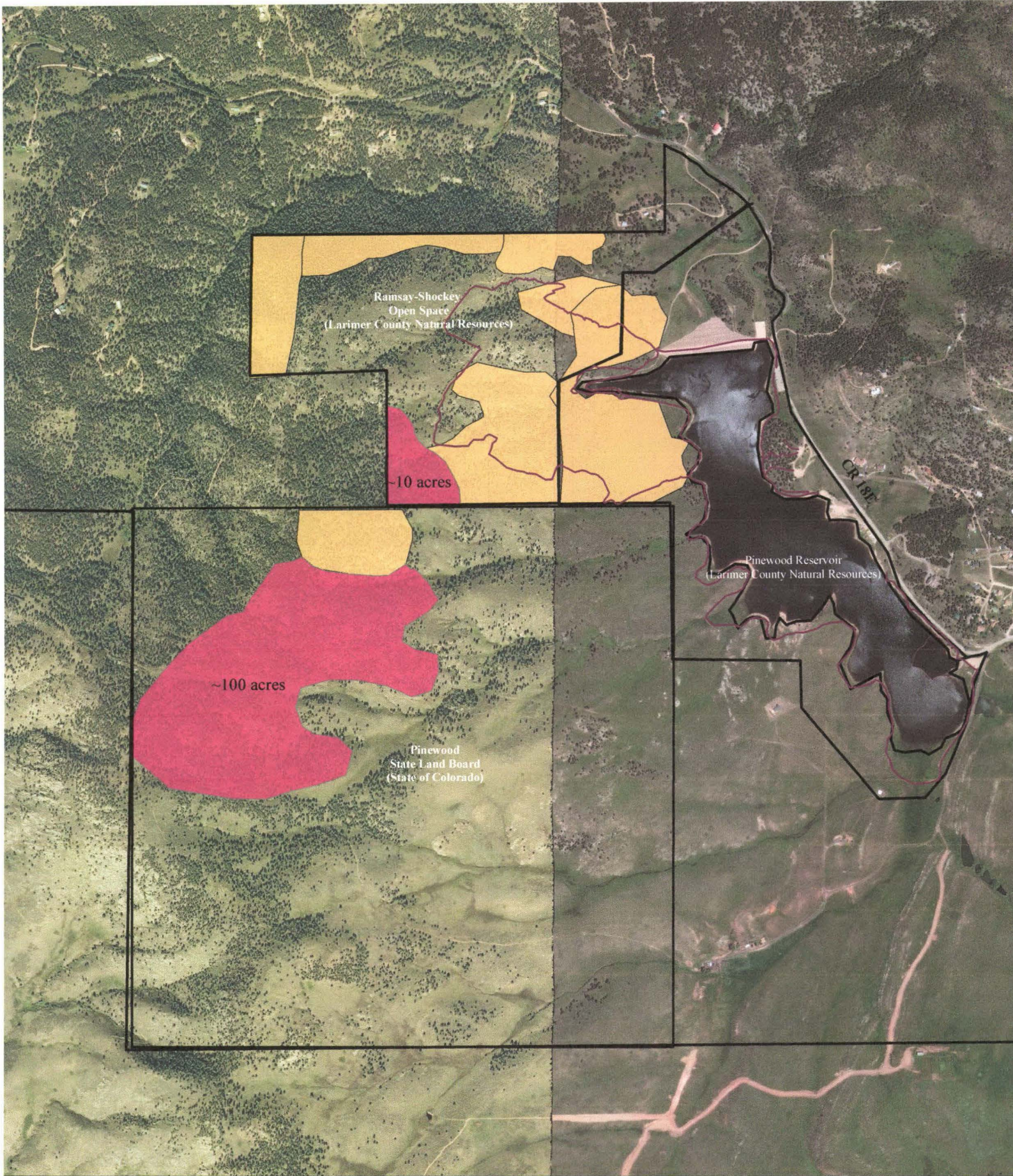


Figure 5. Example old tree found just north of the Ramsay-Shockey Open Space. Old trees should be retained within the treatment units and can be identified based on morphological characteristics, such as large branches and flat-topped crowns.



Figure 6. Example of a well-constructed brush pile.



Forest Management

 Proposed CCE Forestry Pilot Project Areas

 Forest Management Phases by Year

 Larimer County Trails

0 0.075 0.15 0.3 Miles



Pinewood State Land Treatment

Ramsay-Shockey
Open Space

- Pinewood State Land Board - 12 acres
- Previously Treated Areas

Map Created by CSFS
Fort Collins District
January 2016

0 0.075 0.15 0.3
Miles

