



Forest Management Plan

Wolf Mountain Ranch

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Executive Summary

Wolf Mountain Ranch (the Ranch) is located approximately 20 miles west of Steamboat Springs and 4 miles east of Hayden, in Routt County, Northwest Colorado. The Ranch consists of various parcels amounting to 18,547 acres. The Wolf Mountain Ranch is a unique and ecologically important property in our local landscape. It is recognized by the Rocky Mountain Elk Foundation and the Colorado Division of Parks and Wildlife as an important corridor for elk migration, and as important habitat for mule deer, elk, grouse and other wildlife species. Approximately 14,732 acres of the ranch are subject to several conservation easements owned by the Nature Conservancy and the Rocky Mountain Elk Foundation. These conservation easements represent a substantial investment of public funding and reflect a strong local and state level of public interest in the conservation values of the Ranch. The proposals in this plan are consistent with the purposes of the easements and should contribute to the diversity and protection of the resource.

This plan divides the Ranch into three management zones to facilitate the discussion on planning and implementation on this relatively large landscape. The three management zones are based on watersheds, general access, use, and, to a lesser degree, vegetation. The western zone consists of the Goose Creek and Yampa River drainages; the central zone consists of Wolf Creek and Tow Creek drainages; and the eastern zone consists of the Deep Creek, Salt Creek and Hot Springs Creek drainages.

Fire behavior within the Ranch is influenced by the topography of the area. A series of ridges run north to south, with a slight east to west orientation as well. The predominant winds are from the west and southwest, but it is possible for a wind driven fire event to line up well with the orientation of the predominant ridges. The local fire history reflects the broader fire history happening on our landscape, with bigger and more intense fires, and a widening fire season, exacerbated by drought and warmer temperatures.

Prescriptions designed to mitigate for fire often result in benefits to forest ecosystem and watershed health and to agricultural, ranch operations and wildlife. Conversely, prescriptions primarily designed to benefit wildlife and forest health may also result in reducing the risk of wildfire. This forest management plan with a fuel reduction focus addresses mainly the forested areas assessed, and its recommendations for vegetation treatments are generally limited by access and slope and defined by values at risk, mostly found in the central management zone. The forest types are mainly mix conifer, aspen and oak, all with varying degrees of overall health. It is important to consider the desired future condition for these forests in the face of warmer and drier weather conditions, and manage them where feasible.

The proposals and recommendations fall into four broad categories:

Prescriptions to Reduce or Change Fuels Structure for Fire Mitigation

This plan focuses on treating, through mastication, the mixed montane shrubland component for a fire mitigation strategy that produces the most effective results for the money. The mixed montane shrubland is the largest cover type on the Ranch, comprising over 7,400 acres, and Gambel oak (*Quercus gambelii*) is the predominant species within this cover type. Gambel oak does not burn readily except under favorable conditions, such as during continued drought or in the fall or early spring when vegetation dries out. Late spring frosts that kill the leaves can cause extreme fire behavior later in the summer; the dead leaves have a tendency to cling to the stem and act as dry aerial fuels¹. When Gambel oak does burn it is capable of producing explosive and difficult to control fires. The plan prioritizes specific treatment areas

¹ Gambel Oak Management, CSU Extension 6.311



that concentrate on expanding road buffers and thus creating safer access and egress while enhancing fuel and firebreaks.

The sagebrush shrubland that is common in the western portion of the Ranch also represents an opportunity to treat significant acres to promote a mosaic of vegetation that breaks up fuel continuity, increases age class diversity, and widens firebreaks along roads. Fire in the sagebrush and grass can be fast moving and dangerous, but is usually more readily controlled than fire that gets established in the mixed montane shrubland. Treatment in both the mixed montane and sagebrush shrublands are usually beneficial to overall wildlife habitat sustainability and maintenance/improvement of grouse habitat through increased production of grasses and forbs, and re-sprouting from woody shrubs.

The plan places a lower priority on treatments within the forest acres of the Ranch for fire mitigation purposes. Although the largest fire on the WMR in recent years (Deep Creek 2017 - 4,222 acres, 1,906 acres on WMR) occurred in the forest, these forests usually burn on a much wider time interval than the adjacent shrubland cover types. Aspen has a lower fire potential than conifer types and can provide effective firebreaks, although that may be less so in drought conditions. Some management is recommended in the plan for the aspen forest type, and some treatments will serve to reduce or mitigate fuels. Some selective harvesting is recommended in the mixed forest type/spruce-fir type where subalpine fir decline is present, while retaining as many trees as possible in the residual canopy. This will serve to reduce fuel loading but might not make much difference in the event of a stand replacement fire.

Prescriptions to Promote Forest Health/Wildlife

Aspen forests in the west are managed for wildlife habitat, livestock forage, watershed protection, aesthetics, and recreation, and these align well with goals of the Ranch. Treatment recommendations are based on maintaining aspen on favorable sites and increasing age class diversity throughout the forested acres. Aspen stands should be managed through even-age silviculture, using total overstory removal within the desired acreage. This can generally be achieved through mastication (if trees are small and mostly dead) or a whole tree harvest mechanized operation in stands of larger trees.

Spruce-fir forests on the Ranch are important for water capture and retention, and they provide important habitat for an array of wildlife species. Both spruce and fir are present. These are shade tolerant and fire intolerant species, and they can grow easily together in multi-aged or multi-storied forests or as climax species (fire return interval 100-800 years). In some cases, management actions can result in drastic changes of the environment, drying out the understory and affecting potential regeneration, even increasing fire risk. The aim of management should be to increase the spatial variability and age class diversity.

Both uneven and even age silvicultural systems can be used in spruce-fir forests, but not all harvest methods are applicable to every stand. These forests are very susceptible to windthrow, so wind direction and location of stand within the broader landscape should be considered when making management decisions. Aspect should also be considered. Treating north facing slopes can increase snow water equivalence and decrease snowmelt rate. The broad management recommendation for the Ranch is to do selective cutting where appropriate.



Point Protection Recommendations to Mitigate Built Values at Risk

The plan contains individual assessments of identified built values at risk on the Ranch, and makes individual recommendations based on those assessments and utilizing the “Home Ignition Zone” concept. Most of these recommendations are simple, low cost, common sense, and effective in the event of a wildland fire. Related measures for the Ranch to consider include improvement of access to key water sources for fire response, dry hydrant installation, and sprinkler installation for high value assets.

Preplanned Response Procedures

The plan recommends a simple written ranch emergency preparedness plan that includes basic emergency response protocols. This would be intended to be shared with staff, visitors, and residents. Some of the items in an emergency preparedness plan might include:

- Evacuation routes, including alternate routes
- One or several safe meeting locations to assist in accounting for people in an event
- Plans for livestock management during an event, gates to open, etc.

Fire is a natural part of the landscape in which we live, and its occurrence is not a question of “if” but rather “when”. Different vegetative cover types have different fire return intervals, and those return intervals may be changing due to warmer and drier conditions. No plan or action can prevent the eventuality of wildland fire occurring, but the recommendations in this plan will assist in mitigating the impacts of any such fire and help the Ranch adapt to living with fire.



Purpose & Introduction

The purpose of this plan is to provide an analysis of the forest composition and conditions within the Wolf Mountain Ranch (the Ranch), with a particular focus on wildland fuel conditions. Mixed shrub, sage, and grassland cover types are also considered as part of the fire mitigation strategies proposed by the plan. It is intended to meet the conservation and stewardship goals of the WMR, and to be consistent with the existing conservation easements on the property. This plan will recommend potential strategies, projects, silvicultural prescriptions and other actions that will assist in mitigating for the potential of wildland fire on the Ranch and the surrounding landscape, enhance wildlife habitat, and improve forest health.

The Ranch owners and managers are acutely aware of the risk of wildland fire. There have been four wildland fires in the vicinity of the Ranch since 2017, and the Deep Creek Fire in 2017 burned 4,222 acres of which 1,906 acres were on the northern central part of the Ranch. There has been a trend towards larger and more frequent “uncharacteristic” fires in Northwest Colorado since the early 2000s (see map in appendices), mostly related to forest health conditions, drought and climate change. The management of the Ranch recognizes that the relatively remote location of the headquarters and living quarters in the central part of the Ranch, and associated response times for ground-based resources, create the necessity for thoughtful preplanning. There is also a certain amount of self-sufficiency on the part of the Ranch, where management staff have been part of the initial response to a wildland fire on the Ranch. This plan is part of a broader strategy on the part of the Ranch to respond to the potential of fire, and the plan will strive to strengthen and focus the previous and ongoing efforts on the Ranch.

This plan is a working document that can and should be modified to accommodate unforeseen changes and disturbances as needed. Major events, like wildfires or insect and disease outbreaks, may alter the properties landscape and potentially this plan.

This plan is designed to be flexible and encourages the use of an adaptive management strategy. Adaptive management is the process of monitoring and analyzing management actions to understand their effects and adjusting plans accordingly. This just gives a name to a process that good land managers utilize to effectively manage natural resources. This plan suggests an intentional and conscious approach to the process, where the local knowledge and experience is passed on through documentation.



Goals and Objectives

Goal 1: Wildland fire hazard reduction

- Manage vegetation to protect values at risk such as agriculture, water rights management, watershed management, wildlife habitat and recreation, including hunting.
- Identify fuel types, mitigation strategies and prioritize implementation
- Mitigate structures and other values at risk
- Simulate or restore where possible natural fire processes
- Maintain access roads and trails

Goal 2: Achieve and maintain a resilient forest

- Maintain and encourage species, structure and age class diversity
- Reduce forest insect and disease
- Achieve and maintain appropriate stocking levels for desired future condition
- Manage for native plant communities
- Maintain an active noxious weeds program

Goal 3: Maintain and enhance wildlife habitat

- Provide for a diversity of habitats, including forage and thermal cover
- Meet and maintain criteria required for existing conservation easements and wildlife management plans
- Protect nesting, calving and rearing areas
- Protect springs, water infrastructure and riparian areas



Property Description and Current Conditions

Property Location and Description

Wolf Mountain Ranch is located approximately 20 miles west of Steamboat Springs and 4 miles east of Hayden, in Routt County, Northwest Colorado. The Ranch consists of a number of parcels acquired over a period of years and currently consists of approximately 18,630 deeded acres. The administrative headquarters are in the SW corner of the property, off County Road 70 and adjacent to the Yampa River. Additional administrative and maintenance building, as well as residences and cabins, are located in the central portion of the property. These are on, or accessed from, CR 52. A Location Map can be found in the Appendix.

The Ranch is located in portions of:

- Sections 3-6 & 8-10, Township 6N, Range 87W
- Sections 1-2, 10-15, 20-25, 27-30, Township 7N, Range 87W
- Sections 4-8, 16-22, 28-30, Township 7N, Range 86W
- Sections 31 and 32, Township 8N, Range 86W

Access Roads and Trails

County Road Access

There are two county roads that provide primary, year-round access to the WMR from US Highway 40 from the south:

- **County Road 52** is a county maintained and winter plowed (approx. 8 miles from Hwy 40) graveled road. It effectively bisects the property from the south and is the main access for the Ranch. County Road 52 is 6.5 miles east of Hayden on Highway 40. The Ranch Headquarters is located on County Road 52, 7.3 miles north of Highway 40 and approximately 13.8 miles from Hayden.
- **County Road 70** is a county maintained and winter plowed gravel road. It provides access to the southwest portions of the Ranch and the Cattle Headquarters. County Road 70 is 5.7 miles east of Hayden on Highway 40.

There are several other county roads that access the property from the north and south, but this access is seasonal as many of these roads are not maintained in the winter:

- **County Road 50** is a county-maintained road that is not plowed in the winter. It provides access to the Ranch from the southern boundary. Maintenance is fairly minimal, and it is not a graveled road from Highway 40 to the southern boundary of the ranch. Approximate mileage up County Road 50 to the property is 3.7 miles.
- **County Roads 80/56/52W.** This combination of roads accesses the Ranch from the northwest, but near the ranch boundaries, these roads are not maintained in the winter. Mileage going



north from Hayden on County Roads 80, east on CR 56 to 46 and finally into the northernmost section of County Road 52 to get to Ranch HQ is approximately 35 miles.

- **County Roads 44/46** accesses the Ranch from the North, but from the eastern, Steamboat Springs side.
- **County Road 52W** accesses the Ranch from the North, from County Road 56 and others from Steamboat Springs and Clark areas. The road is not usually maintained, and is not plowed in the winter.

The Access Overview Map found in the Appendix helps illustrate all these various access points. The Ranch has a well-developed and maintained system of gravel roads within the property, but access and egress for the Ranch is relatively limited, particularly considering the size of the property. This is a vulnerability in terms of wildland fire response and evacuation. It is unlikely that County Road 52 would be closed in response to a fire or other event, but it could happen. If the road was closed during fire, the only practical available access and egress to the Ranch would be County Roads 46 and 52 W to the north, and possibly County Road 50 to the south.

As stated before, the relatively remote location of the central part of the Ranch and associated response times for ground-based resources, create the necessity for thoughtful preplanning as well as a certain amount of self-sufficiency for initially reacting to a wildland fire on the part of the Ranch management.

On Property Access

The Ranch has an extensive, well-developed and maintained system of access roads throughout the property (See Roads and Trails Map in Appendix). Roads have been classified into three categories:

- Category 1 = Primary roads – typically 20 foot gravel
- Category 2 = Secondary roads – typically 20 foot non-hardened
- Category 3 = 2-Track – less than 20 feet, natural surface.

There are approximately 272 miles of roads within the property.

- Primary Roads = 61 miles
- Secondary Roads = 32 miles
- 2-Track Roads = 178 miles



Figure 1. Part of the Ranch's extensive road network

Topography and Climate

Topography

Elevations on the property range from 6,760 to 9,120 feet. Because there is such a broad elevation range, ecosystem and habitat types differ, depending on their geographic location. Elevations are lowest on the southwest side of the property where sage and montane shrubs are commonly found. Elevations are the highest within the eastern portion of the property (more specifically Slippery Sides Mountain) where subalpine forests meet tree line. A Topographic Map can be found in the Appendix.

A broad gradient of slopes reach up to 66% on the property. The Slope/Operability Map found in the Appendix shows operable slopes (<30%) generally concentrated on the southwest side of the ranch. Inoperable slopes (>40%) are generally concentrated near the southeast side. Steep slopes can create difficulties for forest management practices.

Table 1. WMR Slope Distribution.

Slope Category	Acres	% of Total
Good (< 30%)	12,142	65%
Marginal (30 – 40%)	2,980	16%
Inoperable (> 40%)	3,507	19%
Total:	18,630	100%

A mixture of aspects can be found across the property, yet some patterns can be identified. The southern part of the property can be characterized as having more south and west facing slopes. Alternatively, the northern part of the property is where the largest concentration of north and east slopes are located. These can be seen on the Aspect Map found in the Appendices. Major ridges mostly run north to south while prevailing winds come from westerly directions.

Table 2. WMR Aspect Distribution.

Direction (azimuth)	Acres	% of Total
Flat	561	3%
N (337.5 - 22.5)	1,177	6%
NE (22.5 - 67.5)	1,731	9%
E (67.5 - 112.5)	2,387	13%
SE (112.5 - 157.5)	2,528	14%
S (157.5 - 202.5)	2,264	12%
SW (202.5 - 247.5)	3,154	17%
W (247.5 - 292.5)	3,131	17%
NW (292.5 - 337.5)	1,697	9%
Total:	18,630	100%

Topography is one of the three main characteristics that affects wildland fire behavior. Topographic features can help or hinder the spread of fire, characterize flame length, and determine the fire intensity and type. Slope can speed up or slow down the rate of spread. Aspect and elevation can affect fuel types and how hot or dry an area is.

Climate and Weather



In broad terms, climate change has been and continues to affect Colorado's forests. The observed warmer temperatures and hydrological changes, including a shift in winter precipitation from snow to rain and earlier timing of snowmelt, are causing among other things an ongoing 20+ year drought. These hydrological and temperature changes are in turn creating a moisture deficit in forest ecosystems, making them even more susceptible to severe wildfires and insect epidemics.

Although no specific weather data is available for the property, meteorological data is available for the Hayden Weather Station located at approximately 6,500 feet in Hayden, CO. It is assumed the estimated meteorological data for the Ranch is like that of the close by weather Station. Furthermore, climate data from the National Oceanic and Atmospheric Administration (2021) for the Hayden area was analyzed over the last 100 years (1920 to 2020).

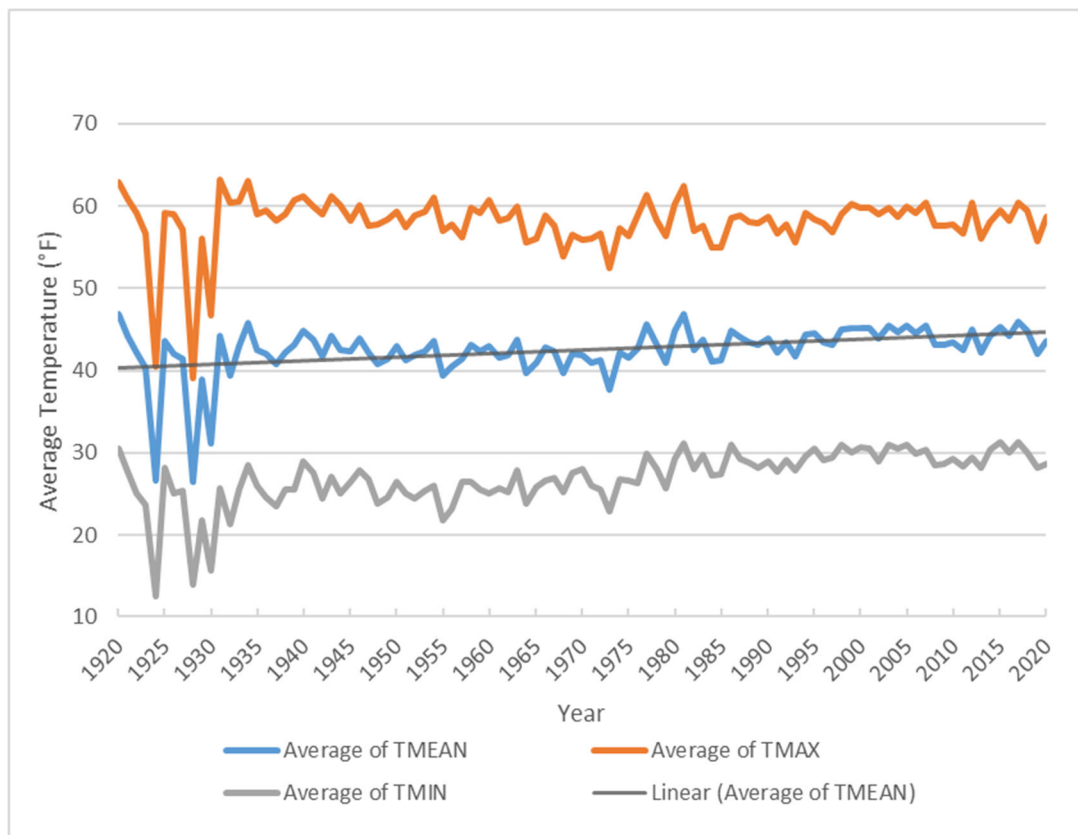


Figure 2. Monthly temperature averages for Hayden, Colorado.²

Annual precipitation and snowfall have remained variable over the last 100 years. Generally, precipitation is happening in more extreme weather events. Although annual precipitation has been variable without a long-term trend, there has been a recent decline in precipitation that has exacerbated the current drought conditions.

² Adapted from *Climate Data Online*, 2021 (<https://www.ncdc.noaa.gov/cdo-web/>)

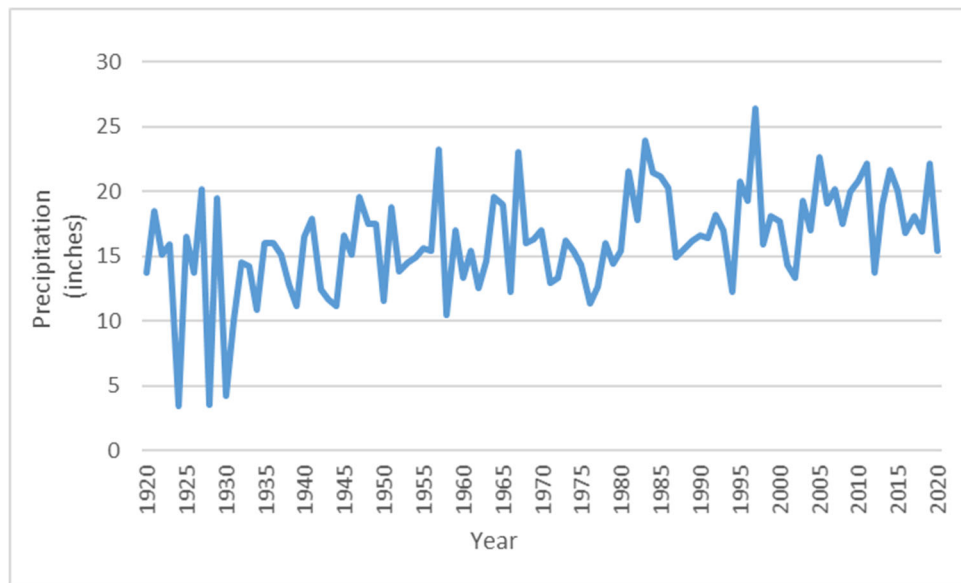


Figure 3. Annual precipitation for Hayden, Colorado.³

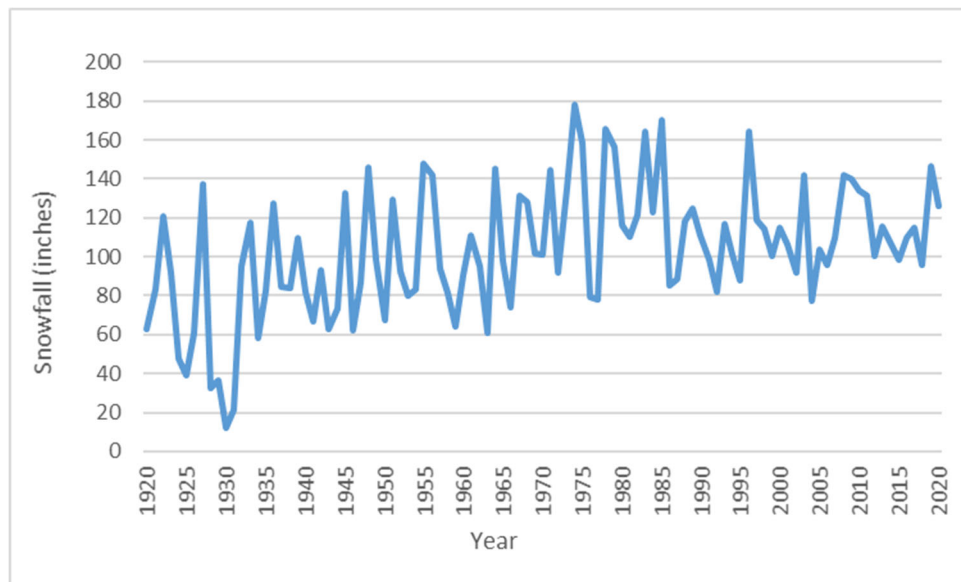


Figure 4. Annual snowfall for Hayden, Colorado.⁴

Monthly climate averages from 1909 to 2016 can be found in Table 1. Data was collected from the Western Regional Climate Center. Precipitation is highest in the late spring and early fall months. Snowfall is the highest on average during December and January.

³ Adapted from *Climate Data Online*, 2021 (<https://www.ncdc.noaa.gov/cdo-web/>)

⁴ Adapted from *Climate Data Online*, 2021 (<https://www.ncdc.noaa.gov/cdo-web/>)

Table 3. Monthly Climate Summary for Hayden, Colorado (1909-2016).⁵

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	30.7	35.3	44.2	57.1	68.4	78.7	85.6	83.3	74.7	62.6	45.3	33.1	58.2
Average Min. Temperature (F)	4.7	8.6	17.6	27.7	35.1	41.5	47.8	46.6	38.1	28.7	18.2	8.6	26.9
Average Total Precipitation (in.)	1.47	1.24	1.30	1.61	1.52	1.17	1.29	1.39	1.53	1.54	1.29	1.50	16.83
Average Total Snowfall (in.)	24.6	18.2	14.6	7.2	1.0	0.1	0.0	0.0	0.7	4.2	13.6	23.7	107.8
Average Snow Depth (in.)	14	16	8	1	0	0	0	0	0	0	2	7	4

Rising temperatures are expected to shift species range, regeneration potential, expand pest and disease ranges, decrease snowpack and early thaw, and increase frequency and intensity of fire.

Topography, fuels and weather affect wildland fire behavior. Weather is the most variable and frequently changing environmental factor. The COWRAP Report (Appendix F) modeled the rate of spread, or the speed in which fire moves horizontally across the landscape, using four historical weather observations: low, moderate, high, and extreme weather days. It was found that most of the property (38% or 7,567 acres) was characterized as having a high rate of spread (12-40 chains/hour).

Water Resources

Water resources are a critical component of the agricultural and recreational uses of the Ranch, and define and directly impact the existing vegetation. In Colorado, the limiting factor for most vegetation establishment and growth depends on water availability. Moreover, water availability will also help define carrying capacity and seasonality for critical wildlife and livestock species.

Since forest health is intrinsically related to overall watershed health, the Ranch was divided into HUC 10 units for vegetation assessment and management implications. Watersheds are delineated areas that capture and flow water into specific rivers, basins, or seas. These areas are classified by the US Geological Survey (USGS) into Hydrologic Unit codes (HUCs). A HUC 2 for example would be a regional area, while a HUC 10 or 12 would be the most localized area. See the Watershed Map located in the Appendix.

Approximately $\frac{3}{4}$ of the property drains into the Yampa River through Goose Creek, Wolf Creek and Tow Creek, while the northeast quarter of the property drains into the Elk River via Deep Creek, Salt Creek and Hot Springs Creek drainages. The Elk River drains into the Yampa River a few miles east of the Ranch on US Hwy 40, so overall, the Ranch water resources all tie back to the Yampa River. The Yampa River, being the main waterway in Routt County, is considered a critical lifeline for the array of ecosystem services it provides. The health of the riparian and wetland ecosystems, as well as water quality and quantity, are critical management concerns on the Ranch. The USGS maintains two

⁵ Western Regional Climate Center, 2021 (<https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?co3867>).



gauging stations relevant to the Ranch, one upstream in Steamboat Springs, and one downstream, in Hayden.

Additionally, lakes, streams, riparian areas, irrigation ditches, storage ponds, wells, and wetlands comprise the vast water resources of the Ranch. There are no upland drainages with permanent flows or well-developed riparian areas, so water storage and development is critical to sustain some of the agricultural and wildlife values discussed earlier. These water rights and water improvements are consistent with existing conservation easements. The well-developed riparian areas on the Ranch are found along the Yampa River on the SW sections of the property, where the river channel is allowed to shift and flood. There is also presence of better developed riparian areas along Wolf Creek, following CR 52.

Deeded Water Rights

Deeded water rights are listed in the Baseline Reports for each Conservation Easement on the property.

Adjacent Lands and Communities

The Ranch is surrounded by private land to the northeast and northwest. There is US Forest Service land to the north and a State Land Board section to the east. There is also private land to the south and east. The Yampa River is the southern border on the southwest area of the property.

The town of Hayden is within four miles of the property's southeast boundary. The community of Milner is approximately 10 miles east of the property on Highway 40. The City of Steamboat Springs is the closest city at approximately 20 miles east of the property on Highway 40.

Historical Uses and Past Management

Pirtlaw Partners Ltd. is the current owner of the Wolf Mountain Ranch. It has been historically used for cattle grazing, hunting, and recreation, and the current owner has continued those traditional activities with a focus on stewardship and conservation. There are several homestead ruins scattered around the Ranch that consist of log buildings, all of which have no roofs and logs largely decomposed⁶. There has been and continues to be mineral development on the ranch. However, no one of the oil production is owned or managed by Wolf Mountain Ranch/Pirtlaw Partners.

⁶ Wolf Mountain Ranch - Phase 5 Easement Documentation Report - Page 48



Conservation Easements

The Wolf Mountain Ranch is a unique and ecologically important property in our local landscape. It is recognized by the Rocky Mountain Elk Foundation and the Colorado Division of Parks and Wildlife as an important corridor for elk migration, and as important habitat for elk and other wildlife species. It is a transitional area between ecosystems⁷ and provides for a number of conservation values that have been deemed important to protect. There were seven conservation easements that were put in place on the ranch over a period of years from 2005 to 2012. The Ranch recently sold one of the easement parcels. The easements currently owned by the Ranch total 14,733 acres on separate parcels and are held by either the Rocky Mountain Elk Foundation or by the Nature Conservancy, as shown in Table 4 below. Wolf Mountain Ranch. These easements protect from development approximately 80% of the property.

Table 4. Wolf Mountain Ranch Conservation Easements.

Easement	Date	Funders *	Funding \$	Easement Holder	Acres
Phase 1A	10/20/05	GOCO, RC PDR	\$ 1,280,750	The Nature Conservancy	486.64
Phase 1B	6/15/05	GOCO, RC PDR	\$ 1,500,000	The Nature Conservancy	1,281.00
Phase 2A	12/20/07	CPW, RC PDR	\$ 967,750	The Nature Conservancy	1,347.00
Phase 2B	12/20/07	CPW, RC PDR	\$ 967,750	The Nature Conservancy	1,347.00
Phase 3	6/03/09	CPW, RC PDR	\$ 1,210,000	The Nature Conservancy	1,613.48
Phase 5	8/31/12	GOCO, CPW	\$ 8,772,440	Rocky Mountain Elk Foundation	8,658.00
<i>Pilots Parcel</i>					1065
<i>Waltrip Parcel</i>					2,457
<i>Turner Parcel</i>					1,418
<i>Guest Parcel</i>					685
<i>Hunt Parcel</i>					3,033
Total:					14,733.12

* GOCO = Great Outdoors Colorado Trust; RC PDR = Routt County Purchase of Development Rights; CPW = Colorado Parks & Wildlife

The Nature Conservancy and the Rocky Mountain Elk Foundation have similar goals in protecting lands on the Ranch, and the public interest conservation values protected in the individual easements are fairly consistent in the individual easement documents. The overall intent is to protect open space and conserve significant relatively natural habitat for wildlife and plants, including particularly sagebrush and mountain shrub communities, Columbian sharp-tailed grouse, and Greater sage grouse, along with substantial populations of elk, mule deer, and other big game species.

These conservation easements represent a substantial investment of public funding. This depth and continuity of funding over a seven year period represents a strong local and state level of public interest in the conservation values of Wolf Mountain Ranch. The Property owner also qualified for state and federal tax deductions and tax credits.

Each conservation easement has specific conservation values that are to be protected, as required by §1.170A-14 of the Treasury Regulations. Consistent with these regulations, all of the Wolf Mountain Ranch conservation easements have "Relatively Natural Habitat" and "Open Space" as the general conservation values. Specific conservation values named in these conservation easements are protection

⁷ The Property is located at south central edge of the Wyoming Basin physiographic province (USDI Geological Survey 2005) and the south central edge of the Wyoming Basins Ecoregion (Freilich, et al.2001 - Wolf Mountain Ranch Parcel 1a Easement Documentation Report Page 73



of narrowleaf cottonwood riparian forest, aspen forest, mixed forest, sagebrush and mountain shrub communities, river channel and floodplain wetlands, bald eagle, sandhill crane, Columbian sharp-tailed grouse, greater sage grouse, and elk, mule deer, and other big game species, and the conservation of agricultural lands and open space. With respect to this forest management plan, those conservation values that are most relevant are aspen forest, mixed forest, sagebrush and mountain shrub communities, Columbian sharp-tailed grouse, greater sage grouse, and elk, mule deer, and other big game species and the conservation of agricultural lands and open space. The other conservation values apply to floodplain resources along the Yampa River and need not be addressed further. Site specific vegetation treatment projects implemented in support of the forest management plan should be reviewed in order to ensure that each project is consistent with the protection of, or ideally enhances, the conservation values. To this end, Colorado Parks & Wildlife should review or participate in the development of each treatment project.

The easements also contain language to regulate the management of vegetation on easement areas. The commercial harvesting of timber is considered inconsistent with the easement, but cutting for forest health, fire mitigation, and other ecological purposes is allowed. The proposals in this plan are consistent with the purposes of the easements and should contribute to the diversity and protection of the resource.

The easement documentation reports prepared to establish baseline conditions were authored by Michael G. Figgs and Nancy D. Lederer of LREP, Inc. They have been an invaluable resource in preparing this plan and provide an excellent reference for any significant resource planning on the Ranch. This plan uses nomenclature from the base line documents whenever possible for clarity.



Social, Economic, and Market Conditions

Routt County has a population of 24,829 people according to the 2020 US Census. Agriculture and mining were historically economic drivers in Routt County, but today Routt County has a relatively diverse economy that is anchored in tourism and associated services and businesses. Agriculture is now a small part of the overall economy. Agriculture, including timber harvesting and the forest products industry, makes up about 1.7 % of the economic output in the County⁸ (That said, agriculture and agricultural activities have a disproportionate positive impact to the local economy through the creation and maintenance of the working landscape that is integral to the character and culture of Northwest Colorado.

There currently are no large wood processing facilities in Routt County, but there are a number of medium and small mills in Northwest Colorado and southern Wyoming that provide commercial outlets for harvested wood. Stumpage refers to the value of trees as a commodity prior to harvesting. Stumpage prices have fluctuated over the past ten years due to the national economic downturn and recovery, competition from imports, and the closing of local and regional mills. The market for wood products is historically subject to market fluctuations. Any description of our local wood market is likely to be quickly out-of-date, but there are some general observations that can be made. The mountain pine beetle (MPB) epidemic that has killed a significant portion of the mature lodgepole pine in the State of Colorado created a large supply of lower value dead wood, resulting in lower stumpage prices. Wood prices have recovered, and the dead lodgepole has retained a surprising amount of commercial value.

Utilizing wood from forest management activities can decrease the amount of fuel left on the ground and reduce treatment costs. There are emerging programs at the state and federal levels to encourage additional utilization of woody biomass. It is likely that new markets and technology will be created over the coming decade.

Stumpage in Northwest Colorado usually involves one or more of the following product categories:

- **Sawtimber** – 9 inch DBH or greater trees that are of good form and free of major defects. Sawtimber trees are the highest stumpage to make dimensional lumber. Sawtimber is usually measured in board feet, cubic feet or tons.
- **Posts** – Trees with 5-8” DBH and straight for at least 6’.
- **Poles** – Trees with 5-7” DBH and straight for at least 8’.
- **Firewood** – Low quality wood that is usually not suitable for other commercial uses.
- **Christmas Trees** – Douglas-fir, subalpine fir, spruce, or other species that have good form and are 6-8’ in height.

⁸ Todd Hagenbuch, Routt County Extension Agent, personal conversation



Data Management and Inventory Methods and Analysis

A forest inventory was conducted in the Spring/Summer of 2020 in the forested areas. Approximately 5500 acres were assessed, with a plot every 50+ acres, for a total of 105 variable plots. Those plots were measured using a 20 basal area factor (BAF) prism. Data collected included tree species, tree diameter, tree height, age, timber quality, and the presence of insects and/or disease. Observations regarding regeneration, the immediate presence of wildlife, signs of wildlife, access, understory composition and noxious weeds were also noted.

All mapping and map analysis functions associated with this plan used the ESRI ARC GIS computer program. For management purposes, the forested acreage was divided into 3 HUC 10 Units based on factors such as slope, species composition, size, stocking, accessibility, and location. These sections are referred to in the plan as units.

The Forest Vegetation Simulator (FVS) program, software developed by the US Forest Service, was used to process inventory data. The program is an individual tree, distance-independent growth and yield model. Selected unit and stocking information from this program is included in the appendices (See Appendix D: Stock and Stand Summary) and summarized in the unit descriptions included in this section. The FVS program adjusts volume for individual tree defect and diseases. This software also allows for certain assertions and predictions within certain statistical parameters. CSFS' statistical standard for private and state plans is a 68% confidence level with a 20% +/- standard error, and this is what is reflected in the following tables and descriptions of stand attributes for the forested areas of the Ranch.



Current Forest Conditions and Inventory

Current Forest Vegetation Types and Discussion

A forest type is a distinct association of tree species distributed across a geographical range. The forest type is usually associated to the dominant trees species characteristics, with other species occurring in lesser numbers. The associated species are fairly predictable for a given area. For example, the quaking aspen forest type can grow as a pure stand of aspen trees, or include Gambel oak in drier southern slopes, or be mixed with conifer species in wetter northern slopes. The Ranch has a good representation of most vegetation types for the area, from sagebrush shrubland on the west to Mixed Forest on the east.

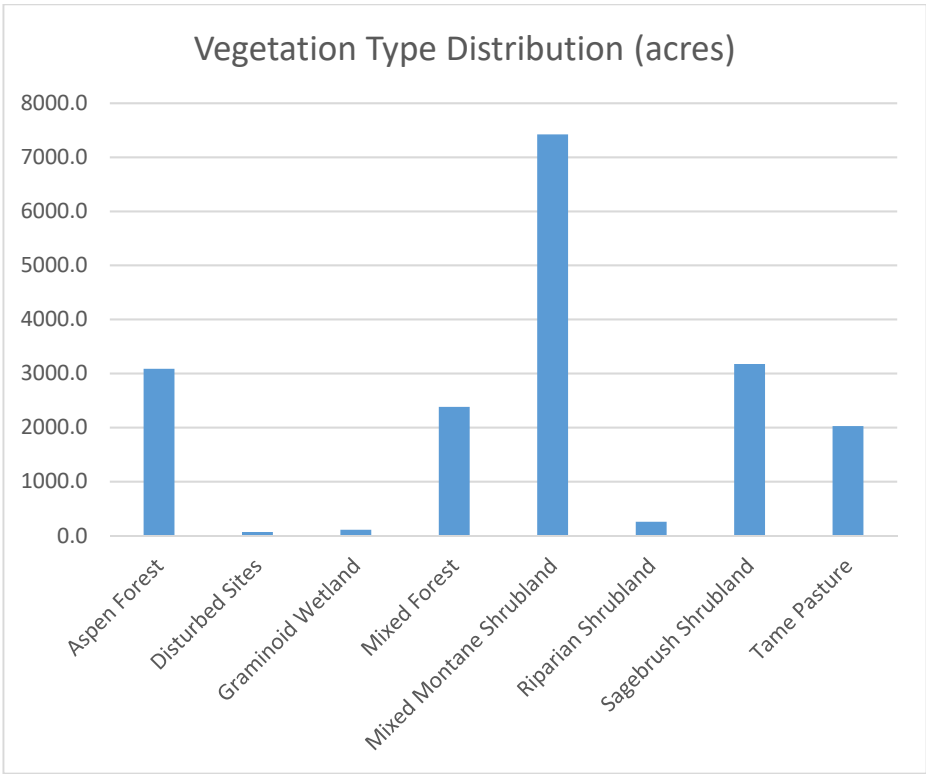
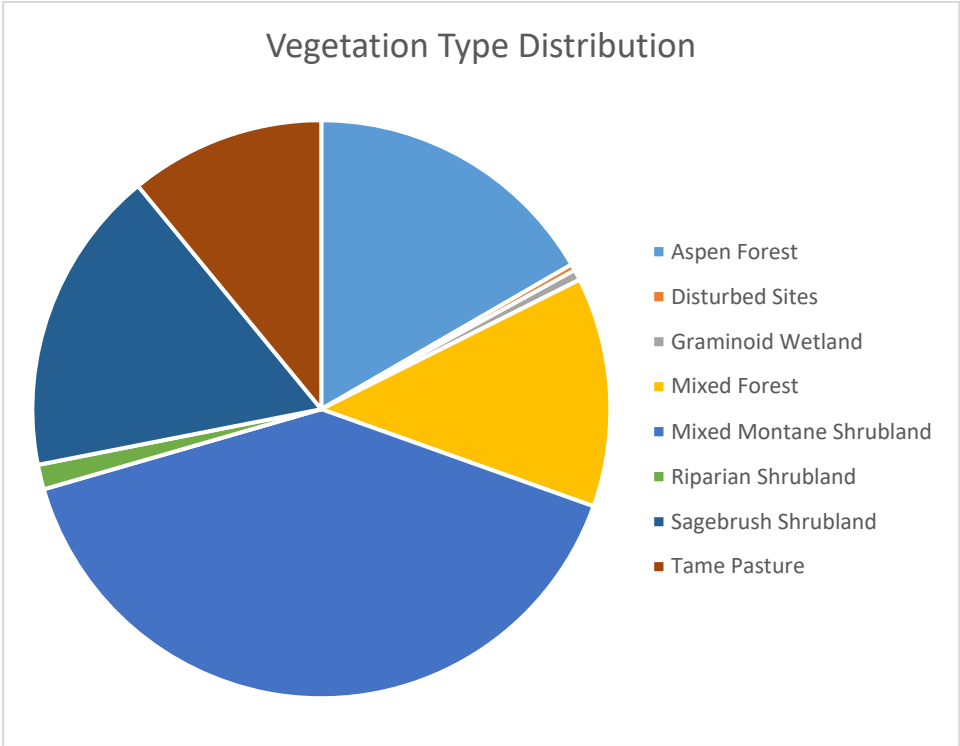
Vegetation Types (Property)

Table 5. Vegetation Types by Acres.

Vegetation Types	Acres
Aspen Forest	3,084.6
Disturbed Sites	66.1
Graminoid Wetland	109.1
Mixed Forest	2,380.4
Mixed Montane Shrubland	7,422.2
Riparian Shrubland	255.5
Sagebrush Shrubland	3,175.9
Tame Pasture	2,026.3
Grand Total	18,520.2

As can be seen in the figures below, the mixed montane shrubland is the dominant vegetation type, followed by aspen and sagebrush. Below are more detailed ecological descriptions of each forest and vegetation type with some management considerations.





Figures 5 & 6. Vegetation type distribution for entire property.

Aspen Forest Type

Quaking aspen, *Populus tremuloides*, are widespread across the Ranch occurring from the low to high elevation forests. It is the most dominant forest type (56% of total forest composition) and covers 3084 acres. Existing in pure or mixed stands, it prefers moist sites, and relies on disturbances like fire, and insect outbreak to exclude competing tree species. Across the property, it can be commonly found mixed with oak, spruce/fir, or lodgepole pine. It often regenerates and expands through a form of vegetative reproduction known as root suckering. Many large and small stands of aspen are the result of a single tree spreading through production of shoots along an expansive root system. While these aspen clones appear to be a collection of distinct trees, they are in fact a single organism. All species of conifer on the Ranch can establish in the understory of aspen, and without disturbance they would grow up to replace aspen as the dominant overstory species across much of its range.



Figure 7. Taking Site Index measurements.

Aspen forest provides important diversity. The deciduous aspen canopy creates nutrient rich organic matter in the form of dead leaves and allows more sunlight to reach the forest floor. This provides for a rich understory that is usually lush and species diverse. It provides important habitat for a host of species - elk and black bear frequent aspen groves, and gamebirds and small mammals utilize early seral habitat for cover. As aspen stands begin to decline, live rotting trees provide habitat for cavity nesting birds. Aspen seedlings and saplings are heavily browsed by elk and moose.

Site quality, or the productive capacity of a site, is usually expressed as volume production of a given species under a certain management regime for a certain period of time. Site index curves were used to determine site quality and a projection of expected height growth for a given species over time on different sites.

Figure 8 shows an example of a site index curve used for aspen.

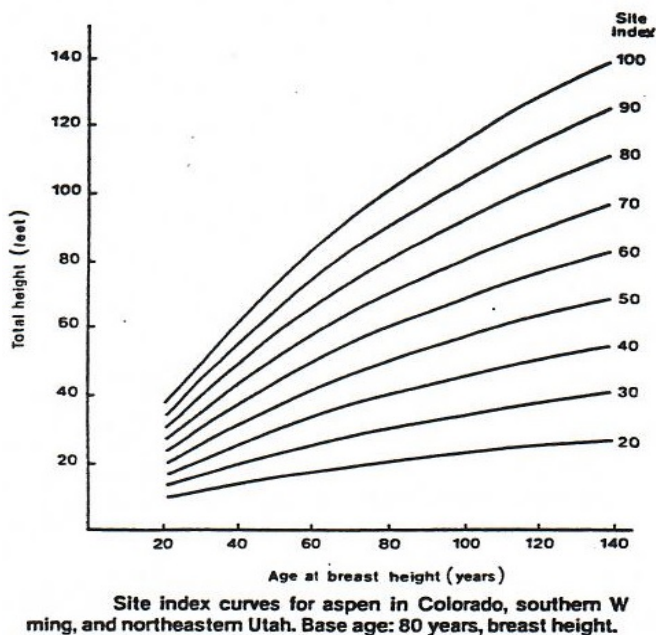


Figure 8. Site Index curve for aspen.

Aspen site indices ranged from 60 to 100. This means that depending on the site, an aspen tree would be expected to reach 60 to 100 feet at 100 years of age. These site index trees were in the dominant and codominant crown classes. The most productive sites were on north facing slopes, while the least

productive sites were commonly found on south facing slopes. Sandy loams, which are typically well drained, were the soil type most commonly associated with productive aspen sites.

Management Considerations

Aspen forests in the west have predominantly been managed for wildlife habitat, livestock forage, watershed protection, aesthetics, and recreation. The Ranch has similar management goals and a variety of aspen stands: mixed with oak and shrubs in the less productive areas, pure aspen stands in places, and mixed with conifers in the more productive wetter sites. Management decisions will be tied to a desired future condition, and whether to retain aspen on a given site that can vegetatively regenerate (mainly through suckers from the root system). Aspen has a lower fire potential than conifer types and can provide effective firebreaks. Management may favor conifers, aspen or a mixed stand composition.

If aspen is the desired seral species on a given site, then conifers, especially shade tolerant conifers such as subalpine fir, should be discouraged from invading by cutting existing stock and removing seed sources. In mostly pure aspens stands, the usual management in the southern Rockies is to diversify the age classes by creating a checkerboard pattern, with 1-5 acre openings, thus resulting in various age blocks.

Because there are no local markets for aspen, the management treatments could be costly; therefore, a priority should be given to areas that maximize habitat value (ability to regenerate densely) and/or target the stands with the most decline to try to stimulate the regeneration of the clone. Aspen stands should be managed through even-age silviculture, using total overstory removal within the desired acreage. This can generally be achieved through mastication (if trees are small and mostly dead) or a whole tree harvest mechanized operation (if trees bigger).

The season of harvest is important. Aspen regenerates best when harvested in the winter. Carbohydrates levels in the roots are higher then, resulting in stronger resprouting. In addition, frozen ground conditions minimize root disturbance. It is important to have browsing pressures in mind when setting up treatments, to disperse the browsing pressures of this preferred forage throughout a broader treatment area. Healthy regeneration should be protected wherever possible.

Slash management will depend on the existing ground conditions of the different openings. Slash should be lopped and scattered and/or piled strategically (to avoid damaging residual vegetation) and should be burned in the winter with snow cover on the ground, a year after harvesting has taken place.



Spruce-Fir Forest Type

Engelmann spruce, *Picea Engelmannii*, and subalpine fir, *Abies lasiocarpa*, prefer cooler and moist sites, and stands are most commonly found at high elevations, on north facing slopes, and in riparian areas. Spruce-fir forests are the most structurally diverse on the Ranch, highly varied in age class and tree size. This multi-storied structure is a result of the ability of both Engelmann spruce and subalpine fir to regenerate under the shade of their own canopy. This means that the forest is continually recruiting new trees, and these numerous small to intermediate trees grow slowly in the understory, waiting for the death of overstory trees to create gaps for them to advance into the canopy.



Figure 9. Typical spruce-fir forest type on property.

Unlike lodgepole and aspen forests, spruce-fir forests do not require large scale disturbance to regenerate. This successional role is classified as “climax”, meaning that in absence of disturbance the forest would maintain current species composition into the foreseeable future. Spruce typically represent a larger percent basal area of large diameter overstory trees and often reach ages of 250 to 450 years. If allowed ample growing space, spruce can maintain relatively steady diameter growth for up to 300 years, longer than any other tree species on the Ranch. Subalpine fir comprises higher percentage of basal area among smaller trees and regenerating individuals in the understory. While subalpine fir competes with spruce in early growth, they are more susceptible to rot, and rarely exceed 200 years in age. Because spruce-fir forests are generally found on wetter, cooler sites, they have a longer fire return interval than either aspen or lodgepole dominated forests. However, a century of fire suppression combined with a rapidly warming climate has resulted in more frequent fires in areas of spruce-fir surrounding the Ranch.

Climate change may have mixed effects on spruce-fir forest cover. The projected shorter fire interval could result in a loss of lower elevation forest in areas where lodgepole is a component of the overstory and will likely outcompete spruce-fir regeneration post-fire. But some of this loss will be mitigated by lodgepole stands on moister sites, with high overstory mortality from mountain pine beetle, transitioning to fir/spruce-fir dominated sites. Reduced snowpack will translate to less late summer soil moisture, which could negatively impact the frequency of years optimal for spruce and fir seedling establishment. Most studies indicate future climatic conditions less optimal for spruce seedling establishment and survival on lower elevation sites, and project an increase in frequency of SBB outbreaks.

Engelmann spruce were sparse throughout the property. Although there were a few identified, none of the 460 inventoried trees within sampling plots were Engelmann spruce. No site index curves are available for subalpine fir.

Management Considerations:

Spruce-fir forest on the Ranch grow on areas of moderate to high productivity. These forests are important water yielding areas, and they provide important habitat for an array of wildlife species. Both spruce and fir are present. These are shade tolerant and fire intolerant species, and they can grow easily together in multi-aged or multi-storied forests or as climax species (fire return interval 100-800 years).

In some cases, management actions can result in drastic changes of the environment, drying out the understory and affecting potential regeneration, even increasing fire risk. The aim of management should be to increase spatial variability and age class diversity. Both uneven and even age silvicultural systems can be used in spruce-fir forests, but not all harvest methods are applicable to every stand. Harvest methods include clearcutting, shelterwood and selection cutting. These forests are very susceptible to windthrow so wind direction and location of stand within the broader landscape should be considered when making management decisions.

Aspect should also be considered. Treating north facing slopes can increase snow water equivalence and decrease snowmelt rate. The overall management recommendation for the Ranch is to do selective cutting where subalpine fir decline is present, while retaining as many trees as possible in the residual canopy. Extensive management in this forest type might be expensive due to access and markets, might have unintended consequences of changing the environment of the forest and might not make much difference in the event of a stand replacement fire disturbance.

Douglas-fir Forest Type

Douglas-fir, *Pseudotsuga menziesii*, was found exclusively in two places on the Ranch: (1) To the west of the Grey Mine, and (2) on the north side of Slippery Sides Mountain. Douglas-fir can be found in pure or mixed stands. In mixed stands, it commonly occupies a site along with subalpine-fir. Douglas-fir prefers north facing slopes with moderate moisture and light availability. With moderate shade-intolerance, Douglas-fir can grow as dominant overstory trees or live in the dense understory, suppressed by the canopies of neighboring trees.



Figure 10. Douglas-fir growing on 60% slopes.

All Douglas-fir found on the Ranch shared a few common characteristics: North facing steep slopes, well-drained soils, moderate light intensity and availability, and a diverse set of age classes.

A site index of 76 was determined for Douglas-fir on the property. The mature Douglas-fir trees aged on the Ranch reached 121 years old.

Management Considerations

The Douglas-fir component is only found in a couple of places on the Ranch. Therefore, management considerations should include monitoring for insects and disease, mainly Douglas-fir beetle, and timely removal of potentially infected individuals to retain this component on the landscape and maintain the forest type diversity. The stands are uneven aged, an attribute that should help sustain the forest type into the future.

Mixed Montane Shrubland

This mesic upland shrub community is found on upper slopes and ridges above 7,000 feet elevation and along drainages. This tall shrubland is dominated by Gambel oak, Saskatoon serviceberry and chokecherry. Mountain big sagebrush and roundleaf snowberry are frequent low shrubs. Dominant forbs and grasses in the understory include Columbia needlegrass, Great Basin brome, showy goldeneye, and fernleaf biscuitroot. In copses where Gambel oak is well developed, it is up to 10 feet tall and often up to 8" in diameter at breast height (DBH), though more typically 2"-6" DBH. Considerable regeneration through sprouting was observed, including some areas with oak dieback that may have been caused by drought. Shrubs on the periphery of shrubland stands have been heavily browsed by deer and elk, but shrubs in the interior of dense patches have been more protected⁹.



Figure 11. Gambel oak on southern aspects and Douglas-fir on northern aspects.

This description from the easement documentation reports also describes three sub-communities within this cover type; this plan is primarily concerned with the Gambel oak component of the type, which is generally dominant throughout the Ranch in this mixed montane shrubland. Gambel oak sprouts readily after cutting or burning, and “thus oak remains one of the most persistent, stable, and common components in the landscape even after severe disturbance”¹⁰.

When Gambel oak reaches its maximum size and density (roughly at 60-80 years), shoot mortality increases and adds fuel, which may lead to increased ease of fire ignition and spread, and higher burn severity. Since Euro-American settlement, mean fire return intervals have probably been well over 20 years and perhaps as long as a hundred years or more unless fire has been used for management purposes. Current fire suppression practices undoubtedly are extending the time between fires. However, because good historical fire data specific to oak are rare, it is not certain how current fire frequencies differ from historical patterns, especially given the wide range of plant communities that occur with a Gambel oak component.

⁹ Wolf Mountain Ranch Parcel 2a Easement Documentation Report Page 20

¹⁰ Gambel Oak Ecology and Management in the Southern Rockies, SRFSN Publication 2016-1

Management Considerations

An array of potential treatments exists for Gambel oak, including herbicide, mechanized and prescribed burn. Due to the variety of locations and sizes of potential treatment area, mechanized treatments should be the preferred option for oak and mountain shrub. Mastication is in general the predominant treatment method.

The mastication will likely be accomplished by tracked or tire-based machinery outfitted with a shredding or mowing type head. Mastication cannot typically be performed on slopes >30%. The treatments will be implemented in a mosaic pattern across the defined project area to provide adequate fuel breaks, breaking the horizontal and vertical continuity, as well as habitat enhancement goals for elk and mule deer. It is usually desired that approximately 60% of the Gambel oak within the Project area will be treated to provide an adequate fuel break. The steeper the slope, the greater the distance needed between fuels. Mastication treatments will target unhealthy Gambel oak (too dense, diseased, dying) over healthy stands, with a minimum of 10 ft. from the edges of the crowns. Masticated fuel in most instances will be generally less than 3 inches in diameter. Spacing requirements between brushes should be 2.5 times the height of the vegetation¹¹. Maintenance of the treatment will be necessary every 10 to 15 years.

Where mastication is not possible or desirable, cutting and felling by a hand crew will be the implemented treatment. Piling and burning of this material might be required.

Lodgepole Forest Type

Lodgepole pine, *Pinus contorta*, forest is the least common forest type found on the Ranch. Much of the lodgepole in Northern Colorado exists in relatively pure, even-aged stands, the structure being a result of historic wildfires. It is also a frequent component of mixed conifer forests, and often occurs in association with aspen. Lodgepole are shade intolerant and rely on disturbance, like a stand replacement fire, to create the conditions which allow for it to exclude competing tree species.

This successional role of forest is classified as “seral”, meaning that without disturbance like fire or insect outbreak, it would be replaced by more shade tolerant species. Lodgepole evolved to tolerate fire through the production and maintenance of both regular and serotinous pinecones; the serotinous cones are generally located on the upper branches of the tree, where they remain sealed by a resin until exposure to temperatures between 113 and 140 F°. Opening of the cones can occur on exposed ground during hot summer days, but it is often correlated with wildfire. Such fire created, heavily overstocked stands (which can exceed 40,000 trees per acre), differ from the more gradual and less crowded recruitment of lodgepole seedling that occurs following disturbances like logging, or insect outbreak.

Lodgepole has a wide ecological amplitude and climate change is unlikely to dramatically alter species distribution in the short term. On the Ranch, increasing temperatures and more intense drought could increase mortality of mature trees and inhibit regeneration at lower elevations. Conversely, increased productivity in non-moisture limited higher elevation sites could allow for lodgepole to colonize sites previously dominated by spruce-fir. Future lodgepole distribution on the Ranch will be regulated by fire activity, harvest rotation and future insect activity. Assuming continued forest management that includes regeneration harvest, and the probable occurrence of more frequent stand replacing fires, lodgepole should remain a significant forest type on the Ranch.

¹¹ Gambel Oak Management, CSU Extension Pub 6.311



Management Considerations:

Lodgepole pine on the Ranch has been affected by the Mountain Pine Beetle or by fire on the Ranch. Only a few lodgepole pine trees were found on the landscape, usually mixed with spruce fir, and usually dead. Lodgepole pine is more drought tolerant than some of the other conifers on the Ranch, so should be considered if replanting is needed in the fire scar.

Sagebrush Shrubland Cover Type

Low shrubland dominated by mountain big sagebrush is a common vegetation community on valley bottoms and lower slopes on the Property. Historically some of these areas were cleared and planted in European pasture grasses; native species are gradually becoming re-established. Other important shrubs are yellow rabbitbrush, rubber rabbitbrush and roundleaf snowberry. Little sagebrush occur on dry exposed knolls. Shrub cover varies from approximately 20-35% in many areas up to approximately 40-50% in a few areas. The forb and grass understory is very similar to that of the Mixed Montane Shrubland, and includes mule ears, showy goldeneye, silvery lupine, basin wild rye, smooth brome, and bluebunch wheatgrass. The less xeric representation of this community, on north-facing slopes, has roundleaf snowberry co-dominant with sagebrush. Grass cover between the shrubs is generally good¹².



Figure 12. Typical example of shrubland on property.

Management Considerations

Sagebrush shrubland offers opportunities for livestock forage with proper rotation planning. It is also a critical habitat for sage grouse leks found on the Ranch. Management strategies, through livestock and/or mechanical mastication, can improve and diversify wildlife habitat and reduce wildfire risk, but can also have an effect on run-off and erosion patterns. Since snow is usually the main supplier of moisture in the sagebrush vegetation type, treatments can also affect snow accumulation, distribution and melt-off patterns.

CPW does not target sagebrush for treatment. If treatment in this vegetation type is warranted for other reasons, then no more than 30% of the sagebrush component should be treated, in a mosaic pattern, while avoiding leaving large areas with no shrubs. The treatments on the SW sections of the Ranch that have sagebrush should be concentrated along existing roads and 2-track trails while avoiding existing lek sites. An updated survey of the lek sites was completed in 2021, which will better inform the exact location of these potential treatments.

Snow is usually the main supplier of moisture in the sagebrush vegetation type and treatments can affect snow accumulation, distribution and melt-off patterns.

¹² Wolf Mountain Ranch Phase 5 Easement Documentation Report Page 25

Foothills Riparian Woodland Cover Type

This community occupies the drainage of Goose Creek. The tree overstory is mainly narrowleaf cottonwood (*Populus angustifolia*), with scattered aspen (*Populus tremuloides*). There are a few small stands of cottonwoods along the creek with closed canopies, but in general the trees are widely spaced, forming a woodland rather than a forest. Understory shrubs are mainly chokecherry, white stem gooseberry, and roundleaf snowberry, with Gambel oak in the drier reaches. Understory grasses are primarily redbud and timothy. There are several age classes of narrowleaf cottonwood. The largest trees are between 1 and 2 feet diameter at breast height (DBH). There are stands of smaller trees in the 5"- 10" DBH range, and some areas with numerous sprouts a few feet tall. Drier reaches of the creek have many dead cottonwoods and numerous trees with top dieback. The southernmost part of Goose Creek on the property is the driest, and has very few cottonwoods; Gambel oak forms most of the overstory and this area is mapped as Mixed Montane Shrubland.¹³ This is not a significant cover type on the Ranch in terms of area, but it does represent a distinct forest type on the property.

Management Considerations

The Riparian Woodland cover type provides critical habitat to an array of species, through access to water and connectivity to other parts of the Ranch. In a semi-arid state like Colorado, the benefit of riparian areas to wildlife often is much greater than their relative size. These areas should be protected, conserved and expanded if possible.

Cover Type Summary Data for the Ranch

The inventory data collected was run all together to develop data for the whole Ranch and per forest cover type. The tables and graphs below represent the forest composition, density and volume for live and dead trees by species, for the whole ranch and by cover type. This summary represents the averaged output from all the sample points taken on the forested acres of the property. Those forested acres are concentrated in the middle and eastern units.

Table 6. Present Stand and Stock Table.

	Basal Area/acre		Trees/acre		Volume (Bd.Ft./acre)	
	Live	Dead	Live	Dead	Live	Dead
Subalpine fir	19.2	9.9	32.3	19.2	1,642.6	628.5
Quaking aspen	33.1	19.3	68.6	47.9	2,137.1	935.9
Douglas-fir	5.0	0.0	16.0	0.0	245.8	0.0
Lodgepole pine	0.0	0.8	0.0	1.4	0.0	41.3
Subtotal	57.3	30.0	116.9	68.5	4,025.5	1,605.7
Total	87.3		185.4		5,631.2	

In general, the forest on the Ranch tends to be poorly stocked, at under 200 trees per acre. On average, about a third of the trees in the landscape are dead. The recent mortality and fire in the lodgepole pine, and decline in the aspen and subalpine-fir are affecting stocking levels throughout the property. The inventory showed that aspen is the dominant cover type and tree species on the landscape, with the greatest number of trees, dead trees and volume, followed by subalpine fir.

¹³ Wolf Mountain Ranch Parcel 2b Easement Documentation Report Page 20



As can be seen in the table below, at a 68% confidence level, the sampling error is well within the standard of +/- 20 % for the attributes assessed: trees per acre, basal area and volume on a board feet per acre.

Table 7. Distribution of Stand Attributes Among all Sample Points.

	68% confidence			Sampling Error	
	Mean	Limits		%	Units
Trees/acre	116.9	100.9	132.9	13.7	16
Bd.Ft./acre	4,025.5	3,506.1	4,544.9	12.9	519.4
Basal Area/acre	57.3	52.2	62.5	9.0	5.2

Aspen Cover Type

As discussed above, the aspen cover type is the dominant forest type on the Ranch, covering over 3000 acres. Average height and basal area indicate a smaller, less productive forest, probably limited by water availability in this transition zone. Quadratic mean diameter (QMD), the diameter of the tree of average per tree basal area is 9.3 inches. Stand density index is the number of trees per acre at an average 10" DBH. This number is used to determine stocking level adequacy.

Table 8. Aspen Cover Type Data

Coverage Area	3,085 acres
Average Height	55 feet
Average Basal Area	93 ft ² /acre
Quadratic Mean Diameter	9.3 inches
Stand Density Index	170

Table 9. Stand and Stock Table of Timber in Aspen Cover Type (live and dead).

	Basal Area/acre		Trees/acre		Volume (Bd.Ft./acre)	
	Live	Dead	Live	Dead	Live	Dead
Subalpine fir	12.4	3.1	21.7	7.8	823.3	136
Quaking aspen	56.9	18.4	116.4	51.4	3,775.4	679.1
Douglas-fir	2.7	0	3	0	162.4	0
Subtotal	72	21.5	141.1	59.2	4,761.1	815.1
Total	93.5		200.3		5,576.2	

Aspen is the dominant tree in the cover type, with 116 live and 51 dead trees per acre. About a third of the aspen trees are dead, amounting to about a quarter of the basal area and a sixth of the standing volume. Subalpine fir follows with a much lesser representation in the cover type at only 30 trees per acre.

The aspen diameter distribution table shows the majority of the sampled trees around QMD, about 120 trees per acre, but also a wide range of diameters, that can be an indication of site productivity but also age. Approximately 10 trees per acre are in the smaller 4" diameter classes, and about 20+ trees per acre are 12" in diameter and above. About 5 trees per acre are 16" and above.

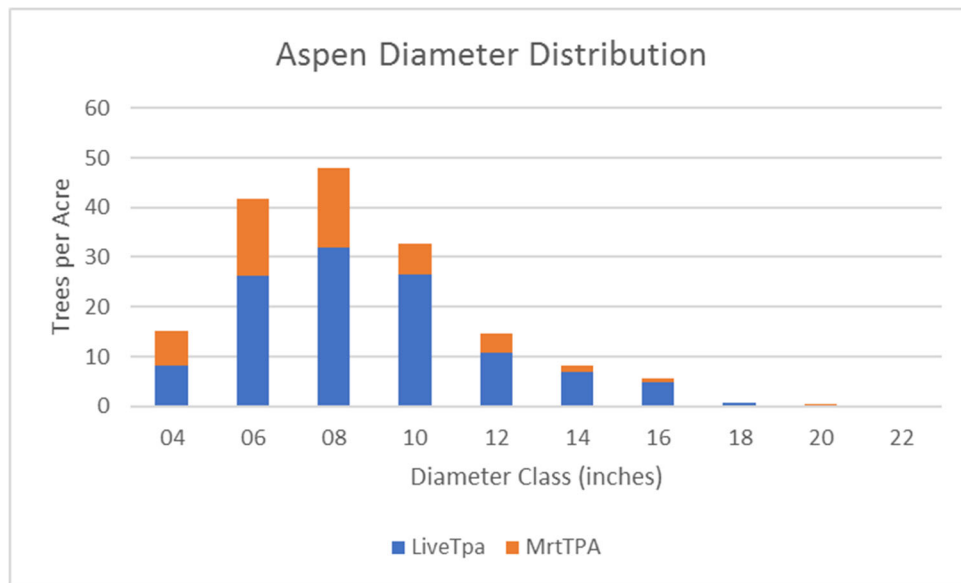


Figure 13. Aspen Cover Type - aspen distribution.

The subalpine fir diameter class distribution, as expected, is concentrated in the lower diameter classes. As discussed, subalpine fir is a shade tolerant species that can come underneath existing aspen.

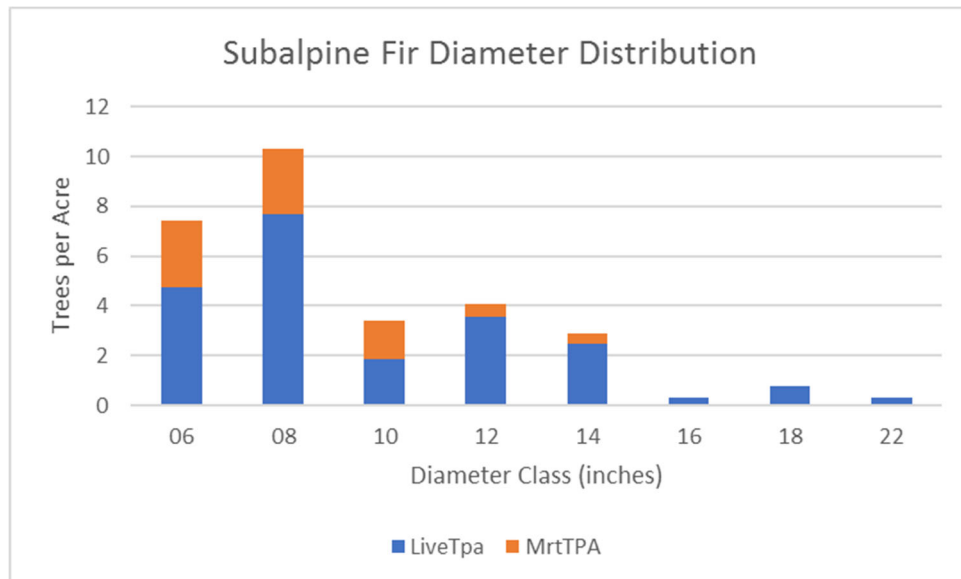


Figure 14. Aspen Cover Type - subalpine fir distribution.

Douglas-fir only represents less than 2 trees per acre, but as seen in the diameter distribution graph, they are all in the bigger diameter classes, representing a mature component of the landscape.

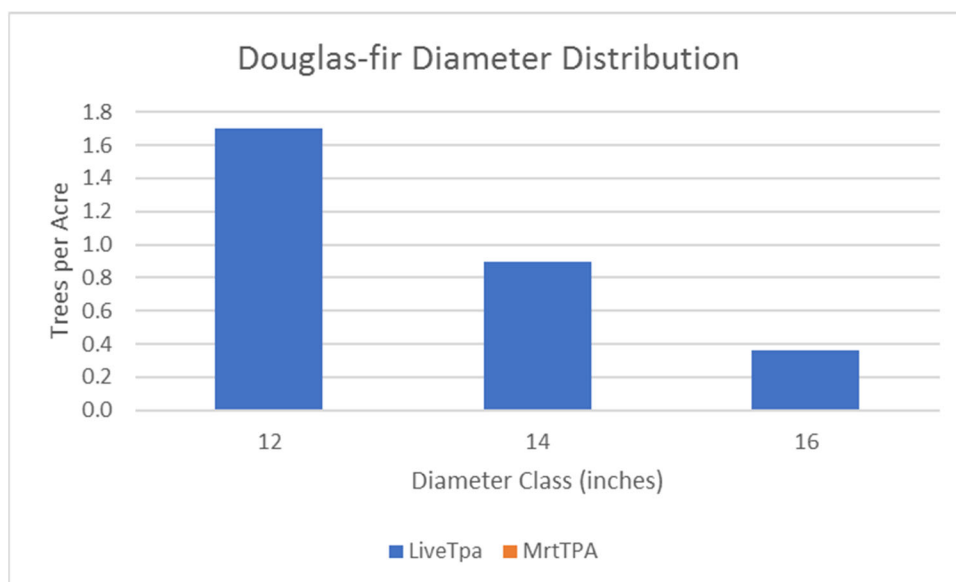


Figure 15. Aspen Cover Type - Douglas-fir distribution.

Aspen Cover Type Regeneration

Regeneration data was taken on select plots throughout the property. Regeneration plots shared the same plot center as some the overstory data plots. Data was collected across 25 plots or roughly 1/4 of the overstory plots, half of the plots were on mixed conifer, and the other half on the aspen type. . A fixed radius plot was used, representing 1/100th of an acre. Every seedling and sapling within the 11.8 ft. radius of the plot was tallied. Seedlings are trees <4.5 DBH and <4 ft. in height. Saplings are trees <4.5 DBH and ≥4 ft. in height. Aspen, subalpine-fir, lodgepole pine, and Douglas-fir were all considered as sample trees.

The regeneration inventoried is a majority of aspen, followed by subalpine fir. 850 trees per acre for regeneration on top of the 180 (141 live) mature trees per acre from main inventory tables would show great growth potential and good stocking overall. The regeneration patterns are seldom consistent throughout a bigger area and need to consider that some areas are more productive than others, with greater potential for sustaining itself forested into the future.

Table 10. Aspen Cover Type Regeneration Data.

Standard Error	14%
Average Lodgepole per Acre	0
Average Aspen per Acre	652
Average Subalpine-Fir per Acre	196
Average Spruce per Acre	0
Average Douglas-Fir per Acre	0
Average Seedlings per Acre	520
Average Saplings per Acre	328
Average Trees Per Acre	848

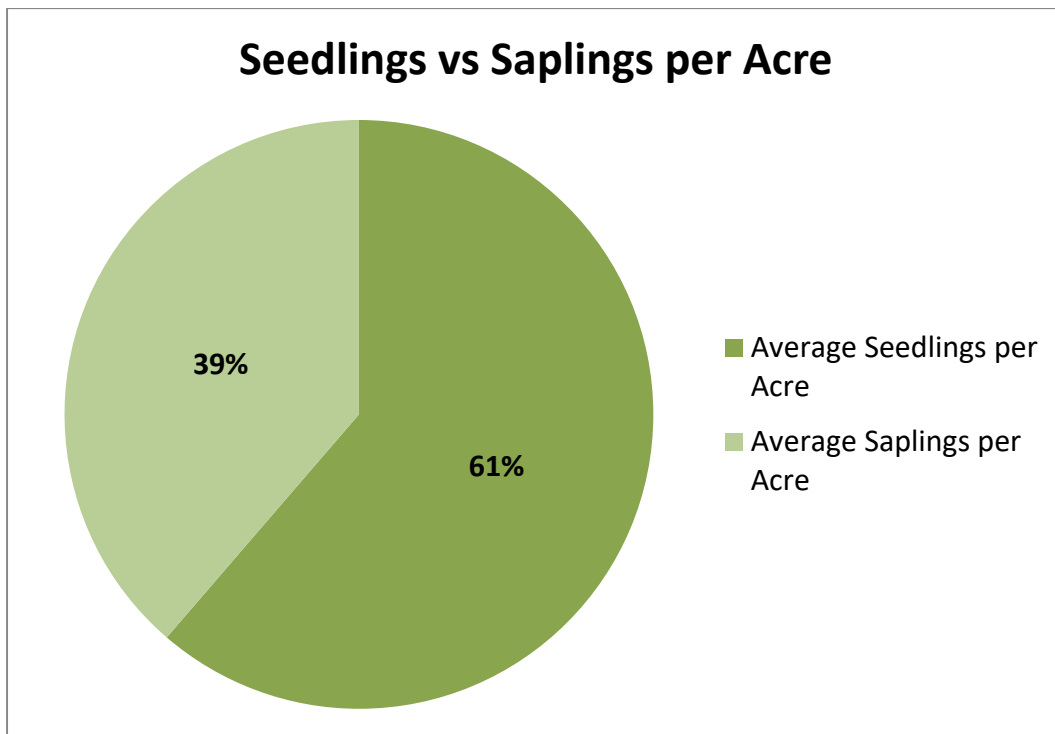


Figure 16. Aspen Cover Type – seedlings/sapling distribution graph.

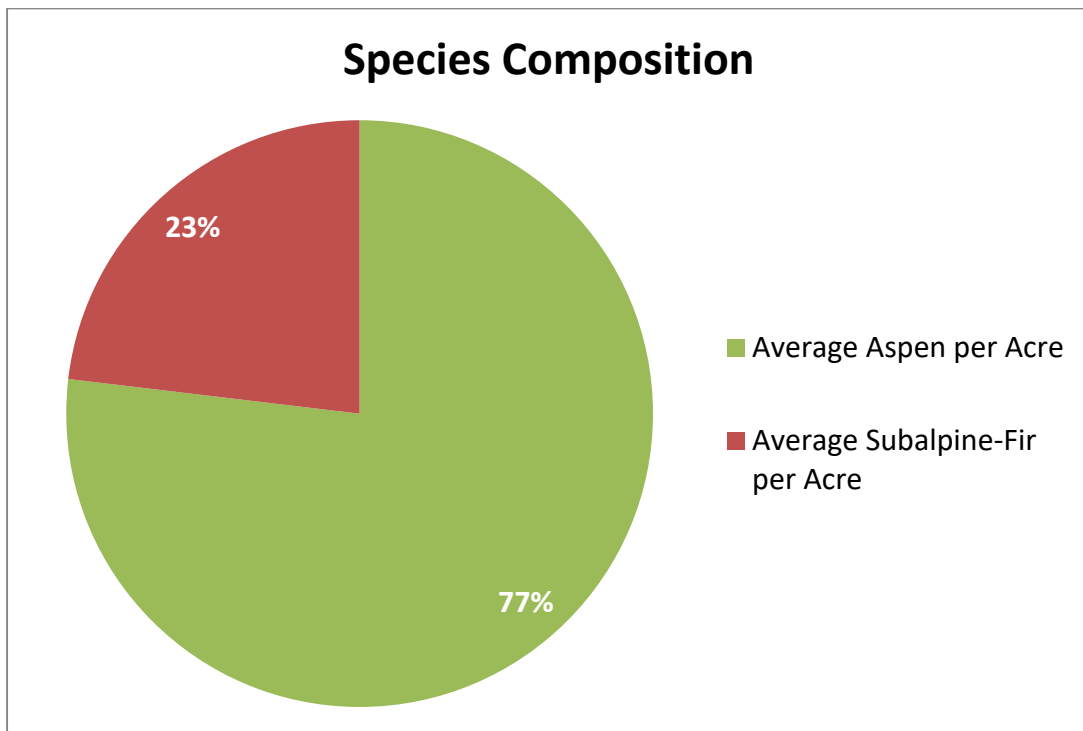


Figure 17. Aspen Cover Type - regeneration species graph.

Mixed Forest Cover Type

The mixed forest cover type is the co-dominant forest type on the Ranch, covering over 2,000 acres. Average height is taller than the aspen cover type at 64 feet, and basal area is also higher at 115 ft²/acre. This seems reasonable, since the mixed forest type grows on wetter cooler areas in this transition zone. Quadratic mean diameter (QMD), the diameter of the tree of average per tree basal area is 9.3 inches. Stand density index is the number of trees per acre at an average 10" DBH. This number is used to determine stocking level and if thinning might be required. In this case, at a SDI of 207, thinning might be required in places. The mixed forest type has a greater number of trees and volume that is dead compared to the aspen cover type.

Table 11. Mixed Forest Summary Data.

Coverage	2,380 acres
Average Height	64 feet
Average Basal Area	115 ft ² /acre
Quadratic Mean Diameter	9.3 inches
Stand Density Index	207

Table 12. Present Stand and Stock Table of Timber in Mixed Forest (live and dead).

	Basal Area/acre		Trees/acre		Volume (Bd.Ft./acre)	
	Live	Dead	Live	Dead	Live	Dead
Subalpine fir	34	20.9	56.3	38.7	3,149.4	1,392.3
Quaking aspen	21.4	27.9	45.7	63.2	1,267.5	1,574.7
Douglas-fir	9.3	0	35.9	0	430.3	0
Lodgepole pine	0	1.9	0	3.5	0	100.8
Subtotal	64.7	50.7	137.9	105.4	4,847.2	3,067.8
Total	115.4		243.3		7,915.0	

Subalpine fir is the dominant tree in the cover type, with 56 live and 39 dead trees per acre. About 2/5 of the subalpine fir trees are dead, with about a third of the basal areas and a quarter of the volume dead. Aspen follows with a greater number of trees per acre total, and greater number of dead trees per acre, but representing less basal area and volume. There is also a component of live Douglas-fir, 36 trees per acre on average, and dead lodgepole pine averaging 3.5 trees per acre.

The subalpine fir diameter distribution table shows a nice distribution of the sampled trees throughout the range of diameters, with the majority of the trees per acre in the smaller diameter classes.

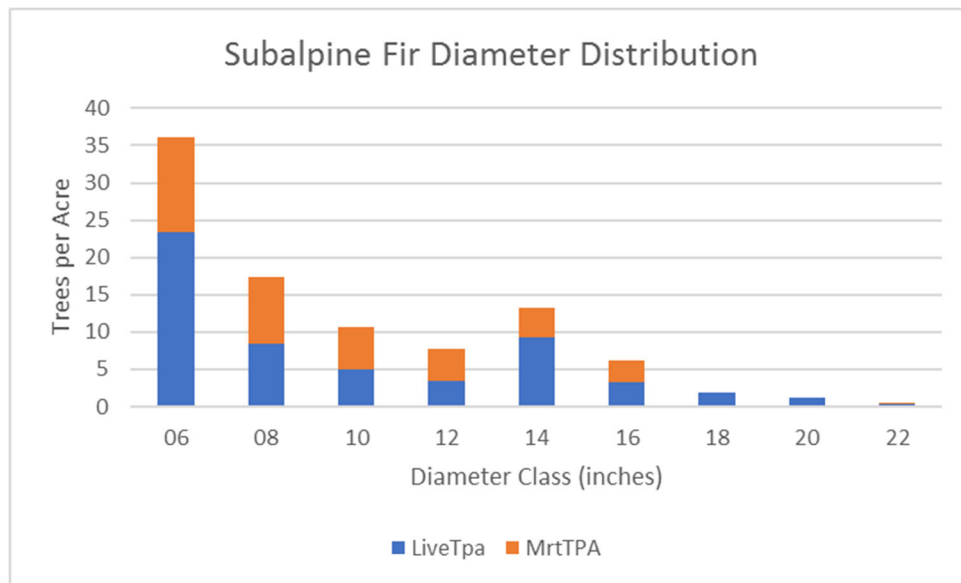


Figure 18. Mixed Forest Cover Type - subalpine fir distribution.

The aspen diameter distribution table shows a similar broad distribution of the sampled trees throughout the range of diameters, with the majority of the trees per acre in the smaller diameter classes.

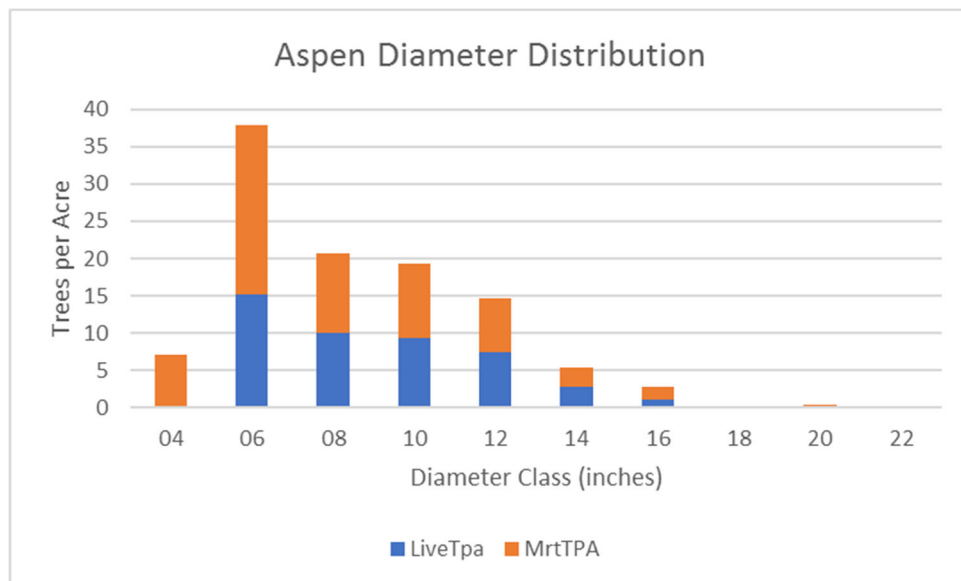


Figure 19. Mixed Forest Cover Type - aspen distribution.

The Douglas-fir diameter distribution table shows a similar broad distribution of the sampled trees throughout the range of diameters, with a concentrated majority of the trees per acre in the 4" DBH diameter class.

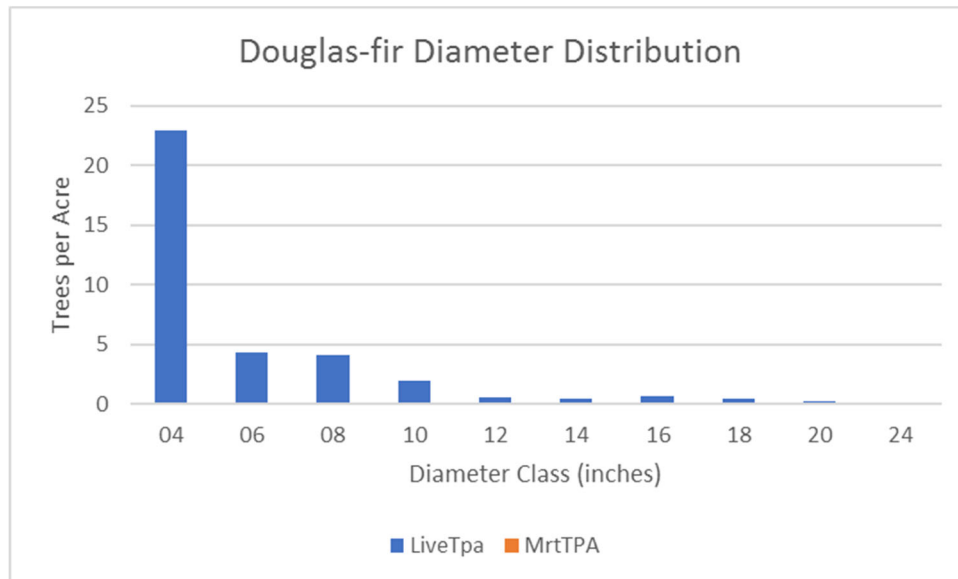


Figure 20. Mixed Forest Cover Type - Douglas-fir distribution.

Mixed Forest Regeneration Data

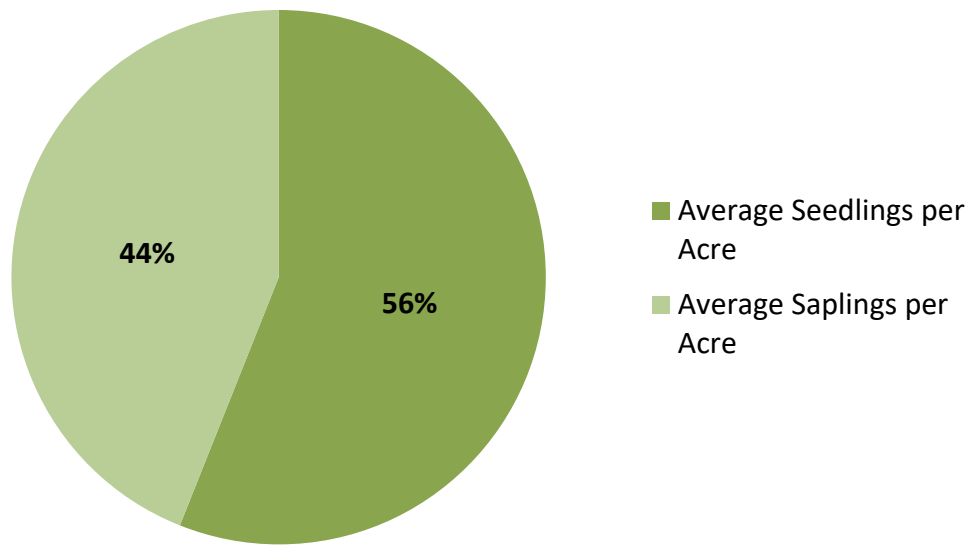
Regeneration data was taken on select plots throughout the property. Regeneration plots shared the same plot center as some the overstory data plots. Data was collected at random across 25 plots or roughly 1/4 of the overstory plots. A fixed radius plot was used, representing 1/100th of an acre. Every seedling and sapling within the 11.8 ft. radius of the plot was tallied. Seedlings are trees <4.5 DBH and <4 ft. in height. Saplings are trees <4.5 DBH and ≥4 ft. in height. Aspen, subalpine-fir, lodgepole pine, and Douglas-fir were all considered as sample trees.

Majority aspen, followed by subalpine fir. 1,028 trees per are for regeneration on top of the 240 (138 live) mature trees per acre on main inventory tables would show great growth potential and good stocking overall. The regeneration patterns are seldom consistent throughout a bigger area and need to consider that some areas are more productive than others, with greater potential for sustaining itself forested into the future, this cover type having a higher number of dead trees compared to aspen type.

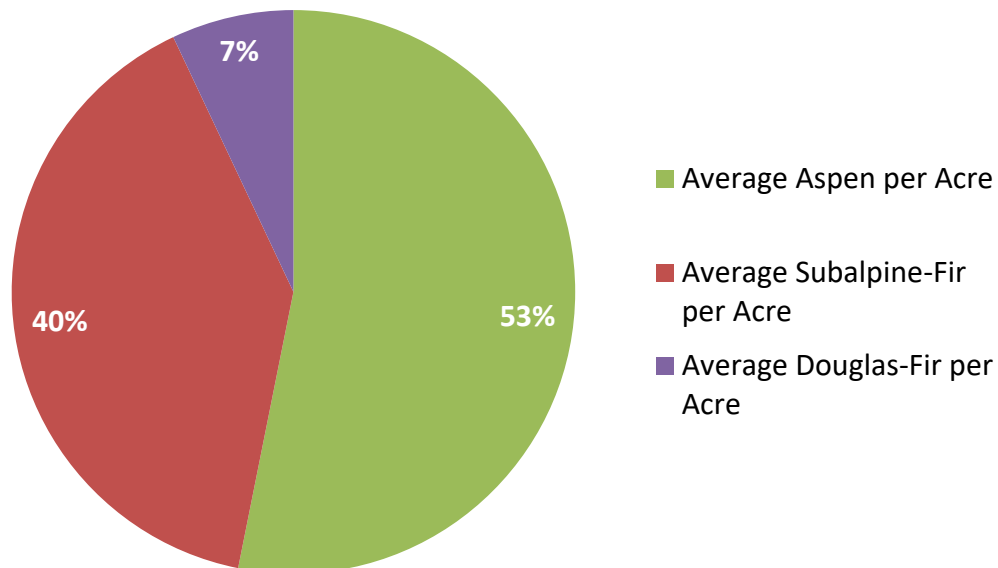
Table 13. Mixed Forest Regeneration Data.

Standard Error	12%
Average Lodgepole per Acre	0
Average Aspen per Acre	243
Average Subalpine-Fir per Acre	182
Average Spruce per Acre	0
Average Douglas-Fir per Acre	32
Average Seedlings per Acre	576
Average Saplings per Acre	452
Average Trees Per Acre	1,028

Seedlings vs Saplings per Acre



Species Composition



Figures 21 & 22. Mixed Forest Cover Type - regeneration graphs.

Deep Creek Fire Area Data

The data gathered in the 2017 Deep Creek Fire area were analyzed to provide a snapshot of current conditions. The data shows that the fire intensity differed throughout the fire scar, showing patchiness on the landscape, and a live component still present after the disturbance.

Table 14. Stand and Stock Table of Deep Creek Fire Area.

	Basal Area/acre		Trees/acre		Volume (Bd.Ft./acre)	
	Live	Dead	Live	Dead	Live	Dead
Subalpine fir	1.7	29.6	1.0	50.8	261.3	2,239.8
Quaking aspen	16.5	32.4	38.3	54.9	818.8	2,542.4
Lodgepole pine	0.0	1.7	0.0	4.6	0.0	69.8
Subtotal	18.3	63.8	39.3	110.3	1,080.1	4,852.0
Total for Stand	82.0		149.6		5,932.1	

The cruised data shows an inverse picture to the live stands not affected by fire. A quarter of the trees per acre are live, with 4/5 of the basal area and volume in dead trees, mainly aspen and subalpine fir.

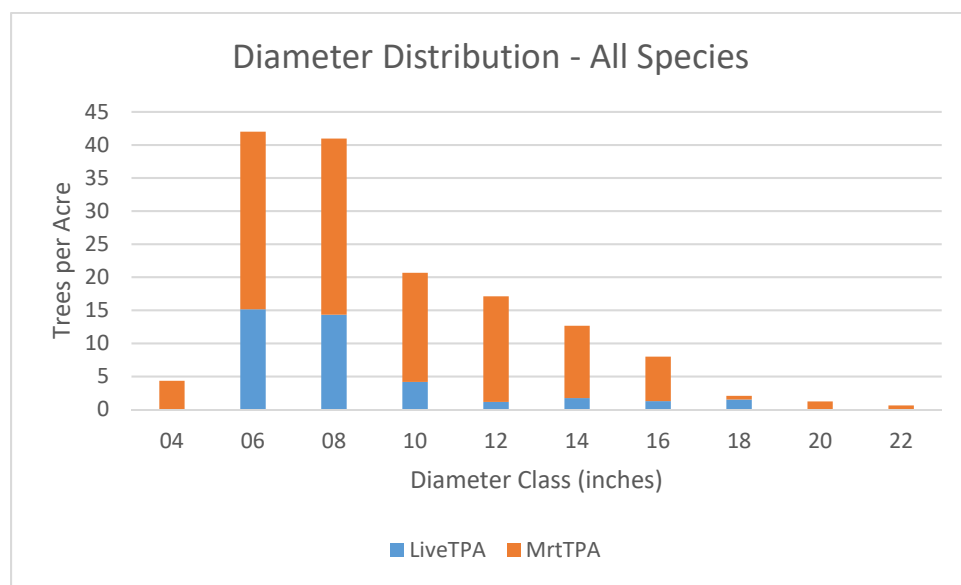


Figure 23. Deep Creek Fire Area - species distribution.

The 2017 Deep Creek Fire burned at variable intensities. Overall, 23 inventory points were taken throughout the fire scar. Inventory data points on the northwest side of the fire scar had a higher percentage of mortality than plots on the southeast side. Figure 18 shows mortality was greatest in the six and eight inch DBH classes. While aspen saw greater mortality in trees per acre, subalpine fir had a higher percentage of tree mortality. Generally, north and east facing slopes had a lower percentage of mortality than south and west facing slopes.

Post-fire conditions resulted in 110.3 snags per acre. Areas with exposed soil, where erosion is an issue were minimal. Herbaceous understory vegetation like western bracken fern was dense in some areas, shading out competitions from other vegetation. Bracken fern, a competitive plant is quick to establish on disturbed sites. They produce and release allelopathic chemicals which inhibit growth of

competing vegetation. Bracken fern is known to be poisonous to livestock throughout the United States¹⁴.



Figure 24: 100% tree mortality in some areas of the Deep Creek fire scar



Figure 25: 5 ft. tall Western bracken fern shading out seedling tree competition

Deep Creek Fire Area: Regeneration Data - Aspen

Of the 25 total regeneration plots, five of the aspen cover type regeneration plots fell within the fire scar. Aspen was the only species regenerating within the aforementioned 1/100th acre plots. It was determined that 680 aspen trees per acre were regenerating. This would be typical of aspen, a pioneer species that quickly establishes following intense disturbance like wildland fire. The graph below shows that half of the regenerating aspen were seedlings and the other half saplings.

Table 15. Deep Creek Fire Area - Regeneration Data (aspen cover type).

Standard Error	45%
Average Lodgepole per Acre	0
Average Aspen per Acre	680
Average Subalpine Fir per Acre	0
Average Spruce per Acre	0
Average Douglas-fir per Acre	0
Average Seedlings per Acre	340
Average Saplings per Acre	340
Average Trees per Acre	680

¹⁴ Utah State University Extension, 2017.

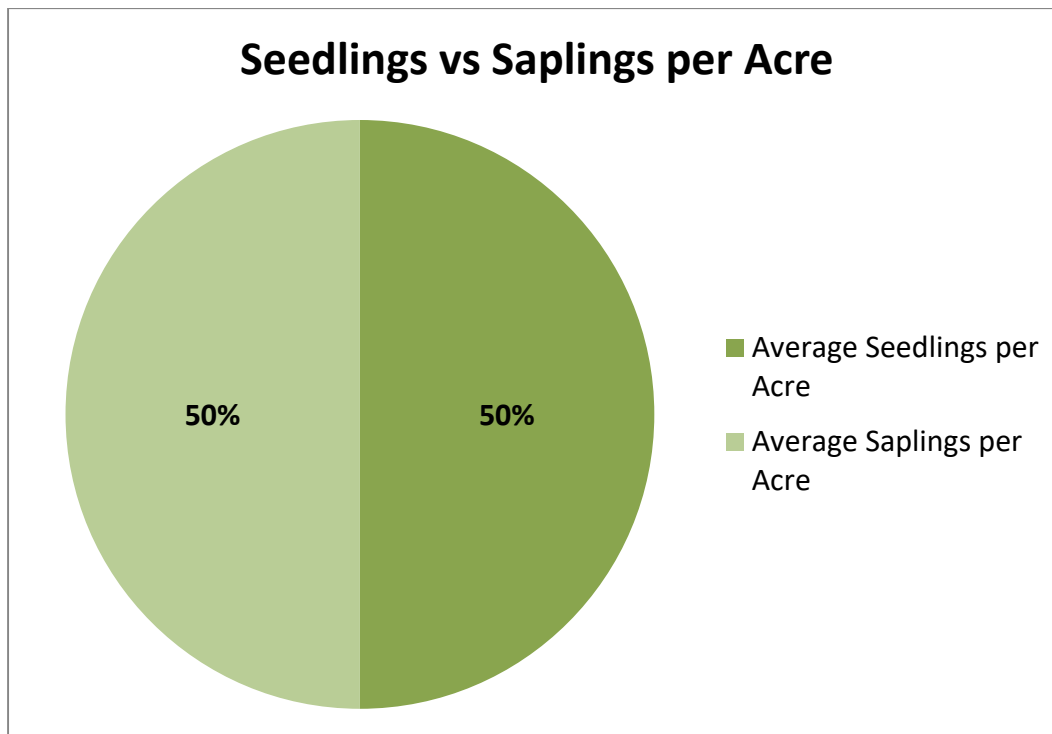


Figure 26. Deep Creek Fire Area: regeneration distribution (aspen cover type).

Deep Creek Fire Area: Regeneration Data – Mixed Conifer/Aspen

Six of the mixed conifer/aspen regeneration plots fell within the fire area. A total of 683 trees per acre were regenerating, with the majority being aspen (253 trees per acre). In this cover type there is potentially a greater subalpine fir seed source, resulting in 68 subalpine-fir trees per acre. Subalpine-fir are late-successional species, meaning regeneration potential will be greater once a canopy establishes overhead. Species composition and seedling to sapling ratio show a relationship. The slightly greater seedling concentration shown in the graph below reflects this mixed species composition. Regenerating subalpine fir tend to grow more slowly than aspen. This slow growth in fir seedlings (<4 ft. in height) could be the reason there were slightly more seedlings than saplings when the inventory was done.

Table 16. Deep Creek Fire Area - Regeneration Data (mixed forest cover type).

Standard Error	20%
Average Lodgepole per Acre	0
Average Aspen per Acre	253
Average Subalpine Fir per Acre	68
Average Spruce per Acre	0
Average Douglas-fir per Acre	0
Average Seedlings per Acre	367
Average Saplings per Acre	317
Average Trees per Acre	683

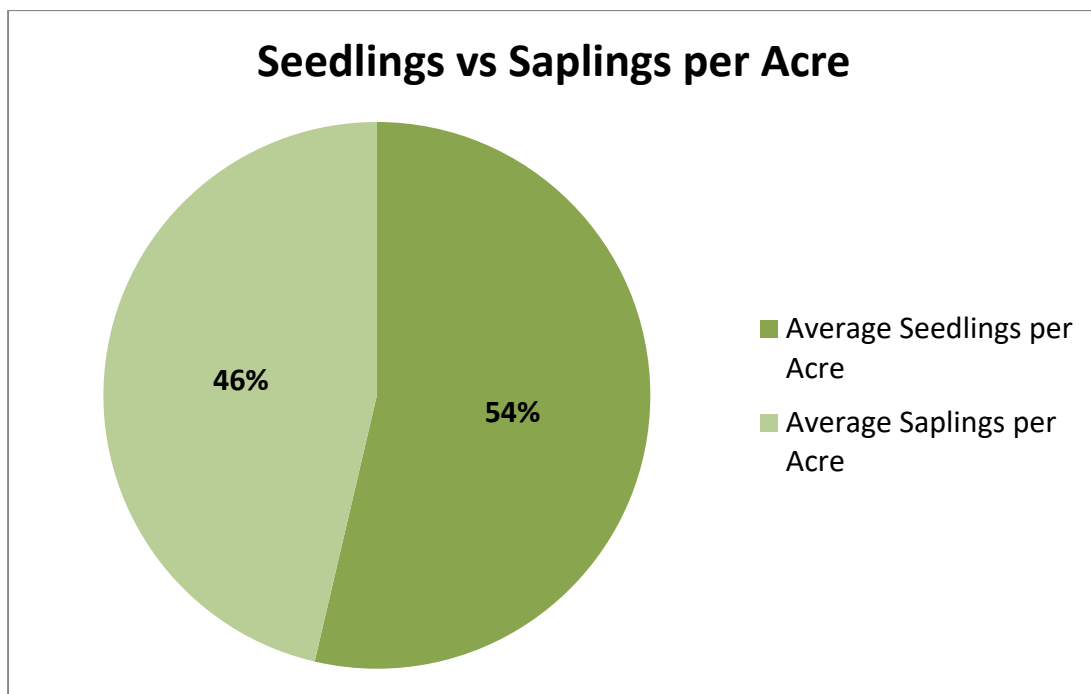


Figure 27. Deep Creek Fire Area: regeneration distribution (mixed forest cover type).

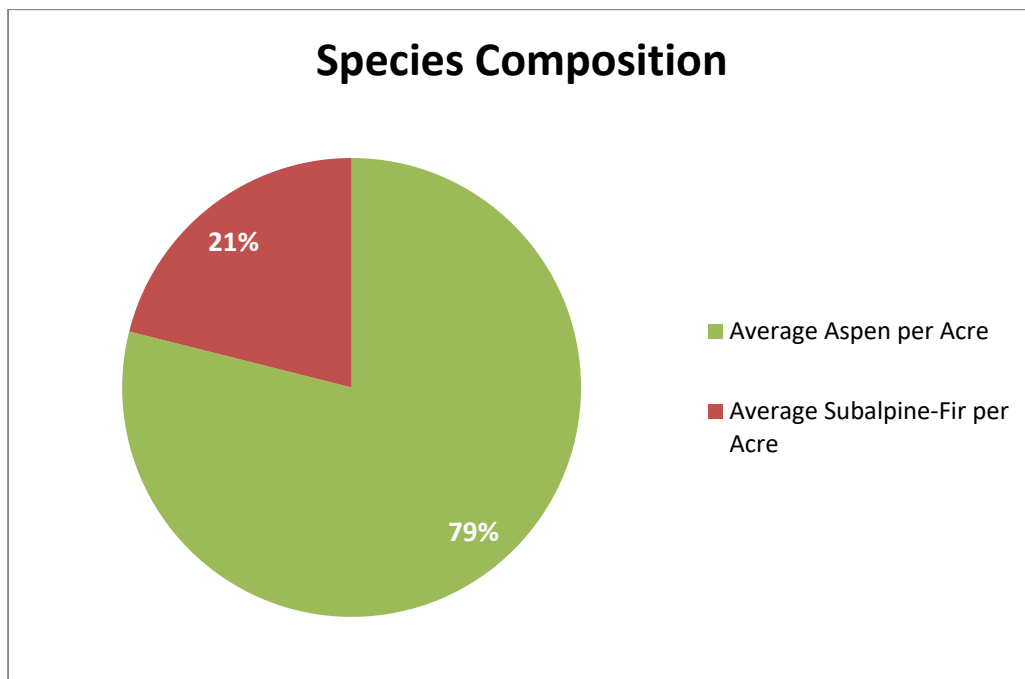


Figure 28. Deep Creek Fire Area: regeneration species distribution (mixed forest cover type).

Noxious Weeds

Canada thistle (*Cirsium arvense*) and houndstongue (*Cynoglossum officinale*) are found throughout the property. These noxious weeds are especially prevalent along roads, trails, fence lines and in some of the meadows and meadow edges throughout the forested areas. Both of these species are very difficult to control. They are deep-rooted perennials that can reproduce from root segments and seeds. They can be controlled effectively with herbicides, but their application has to be controlled and completed at the right time, in order to be effective. Monitoring of noxious weeds on the existing fire scars on the Ranch is also recommended, as any disturbed areas are prime grounds for noxious weeds establishment. Cultural and mechanical ways of control exist, but are not as effective as herbicides. More details in terms of prevention and control can be found in the Appendix - Noxious Weeds.



Figure 29: Dense thistle in the Deep Creek burn scar

Wildlife

Many big game species exhibit annual migrations by moving along traditional routes between seasonal ranges, often associated with plant phenology and weather, from higher elevations in the summer to lower elevations as winter approaches. The plant communities of the property as a whole provide habitat for many animal species including; bear, moose, elk, deer, antelope, coyote, mountain lion, sandhill crane, Columbian sharp-tailed grouse and the Greater Sage grouse, together with a variety of raptors and songbirds and small mammals. The forested areas of the property provide thermal cover and forage for a wide array of species. Riparian forests are corridors of life, providing water, food and shelter to resident and migratory birds, small mammals, reptiles and amphibians, mountain lion, deer and elk, and bears.

The aspen and mixed conifer stands provide thermal and hiding cover for deer and elk, while the serviceberry and Gambel oak areas provide a good source of browse for these same species. Quaking aspen forests provide important breeding, foraging, and resting habitat for a variety of birds and mammals. Wildlife and livestock utilization of quaking aspen communities varies with species composition of the understory and relative age of the quaking aspen stand. Young stands generally provide the most browse. Quaking aspen crowns can grow out of reach of large ungulates in 6 to 8 years. Although many animals browse quaking aspen year-round, it is especially valuable during fall and winter, when protein levels are high relative to other browse species. Browse lines and bedding areas from both elk and deer were evident in many parts of the property. Bear signs, such as claw marks on trees, were observed as well. Rodents, rabbits and a great variety of birds were also observed on the property, primarily in the Gambel oak (*Quercus gambelii*) and serviceberry.



Figure 30. Riparian areas act as travel corridors for bears and other wildlife.



Figure 31. "Dark timber" provides thermal cover for bedding elk and deer.

"Colorado's mountainous terrain creates winter ranges that are in closer proximity to summer ranges, which often leads to shorter dispersed migration pathways rather than long, narrow corridors."¹⁵ The Ranch has been identified as an important contiguous habitat for resident and migratory wildlife, and the owner continues to work with CPW to implement best practices that benefit wildlife. CPW will be consulted on final project designs in order to ensure that the most important wildlife species will not be unduly impacted by the forest plan, and to the contrary, their habitat will be improved and made more sustainable. In particular, CPW to sign off on any project that impacts grouse habitat (sagebrush and mixed montane shrubland habitats).

Climate change and warmer weather pose challenges not only to the forest ecosystems, but to the wildlife that uses them. Some of those challenges found in CPW's State Wildlife Action Plan are listed below:

- Increasing temperatures and changes in precipitation regimes may shift species and habitats in elevation and latitude.
- Although fluctuation between wet and dry years is normal, as temperatures warm more frequent and intense droughts are expected and such events impact plant vigor.
- Fewer and shorter cold spells accompanying warming temperatures, will fail to control the insect populations in many ecosystems.
- Warmer temperatures will produce earlier snowmelt and peak runoff, affecting insect and wildlife life cycles as well as seed production and germination.
- A changing climate is likely to increase the frequency and intensity of weather events, potentially impacting vulnerable species and their habitats.

Threatened and Endangered Species

¹⁵ <https://cpw.state.co.us/>

Colorado Parks and Wildlife (CPW) have identified state and federally listed threatened, endangered, and special concern species within Routt County (see Appendix). Although no current inventory has been performed for T&E species specific to the Ranch, species on this list may exist.

An “endangered species” is one that is in danger of extinction throughout all or a significant portion of its range. A “threatened species” is one that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range. A “special concern” species is any species that does not meet the criteria as threatened or endangered but is particularly vulnerable and could become a threatened, endangered, or extirpated species due to restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors. In some cases, these species can be deserving of threatened or endangered status, but for which sufficient data is currently unavailable. A “Candidate species” is a species that has been proposed for threatened and endangered status. These categories fall under both state and federal listings.



Wildfire and Fuels Discussion

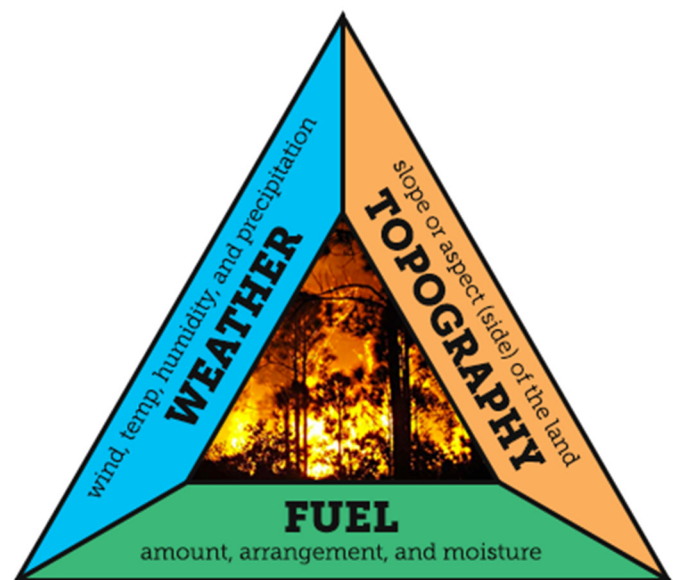
The following is a discussion of the factors that determine probability and behavior of wildfire on the Ranch, and the values on the Ranch that a wildfire potentially threatens. It is a snapshot of the conditions and the associated risks that exist on the Ranch today based on remote sensing and on the ground assessments. The strategies and actions to mitigate those risks will be considered in the following Prescriptions and Implementation section.

Wildfires in Colorado are a natural part of ecosystem disturbances, and they can help restore and maintain healthy forests. The wildland-urban interface (WUI) can be described as the area where structures and other human development meet and intermingle with wildland vegetative fuels. Where homes and other infrastructure have been built in this WUI, it is important to mitigate these built features against the inevitable risk of wildland fire.

The forests in the Routt County area have evolved with fire as an agent of change and renewal, and fire is the most significant factor in shaping the forest landscape seen today. Generally speaking, the return interval, or the number of years between major fire events, increases as elevation increases, but fire remains a significant risk in the WUI. When considering fire in these ecosystems, it is crucial to assess the current stand conditions because they will define fire behavior and, consequently, potential fire hazard.

Wildfire is primarily influenced by fuels, weather, and topography. The following is a brief review of those factors and how they relate to potential wildfire on the Ranch.

Fuels are all living and dead plant materials, and buildings and other structures that can burn. The type of fuels, the quantity of fuels, and the orientation (vertical or horizontal) and location of fuels are important factors in assessing wildland fire risk. Ground fuels consist of flammable materials on the forest floor. The amount and continuity of ground fuels will influence the direction and rate at which a fire will spread. Ladder fuels are those above the forest floor such as shrubby vegetation and tree limbs. These fuels provide a pathway for a fire burning on the ground to move into the crowns of trees. Wildfire fuels are organized into fuel models based on their characteristics for predictive modeling purposes. There are a variety of fuel model systems, and a variety of models to run them. This plan uses the program BEHAVE to do fuel modeling to help assess wildfire risk and hazard.



Fire Behavior Triangle

Weather includes factors such as wind, temperature, and humidity that contribute to fire behavior. Wind is an important factor because it can bring a fresh supply of oxygen to the fire and push the fire toward a new fuel source. Temperature influences the ignitability of fuels, and fuels ignite more readily at high temperatures than at low temperatures. Humidity is the amount of water vapor in the air and it directly

affects the moisture level of a fuel. Fuels dry out when humidity is low, and dry fuels catch fire more easily and burn more quickly. A cool, moist day with high humidity will restrict rate of fire spread in comparison to a hot, dry, windy day. Periods of hotter and drier weather are more common in recent years and thus contribute directly both to the probability of wildfire occurring, and the severity of fire when it does occur. The weather discussion in the plan, illustrates that continued warmer and drier weather should be expected and prepared for.

Topography describes land shape and includes elevation, slope, aspect, and features, such as canyons, valleys, and ridges. These features can help or hinder the spread of fire. Rocky slopes can act as natural fire breaks due to a lack of fuel, and drainages with moist vegetation can do the same. Aspen stands have often been thought of as less likely to burn, and thus safer, in wildfire. This has not proven to be the case in drought conditions. North and east facing slopes are cooler and moister than south and west facing slopes, consequently, fires on west and south slopes are expected to be more severe and move faster. Slope affects fire hazard by affecting rate of fire spread. Fires on steep slopes spread faster than those on moderate or flat slopes because heat rising from fire preheats and dries fuels thus increasing the rate of ignition and fire spread.

The topography of the Ranch is “rugged and varied”¹⁶. Slopes over 30% account for approximately 6,300 acres, roughly a third of the Ranch. Fuels on steep southern and western slopes are going to be more receptive to ignition and more likely to support relatively rapid rates of fire spread. Fire growth is additionally supported where these slopes line up with the Valley’s prevailing westerly and southerly winds. Steep slopes also present challenges for fire control (see Slope Map in Appendix), and for mitigating fuels through mechanical equipment.

Wildfire Hazard and Risk Assessment

The terms “hazard” and “risk” are commonly used when discussing wildfire mitigation. Hazard is, simply put, the potential to cause harm. A tree leaning over a house may represent a hazard to that house because, if it falls, it could cause harm to the house. The house in this example is a value at risk. Risk is the likelihood of harm taking place to that house, the value at risk. Vegetation types, ranging from grass to mature trees, are the fuels of wildland fire and are thus, to varying degrees, hazards. The level of risk is influenced by several factors that include the flammability of the fuel type, aspect, slope, and weather patterns.

This plan uses several spatial analysis tools to provide a coarse scale analysis of the hazards and associated risks on the Ranch. These are helpful tools, but context should be considered when viewing the results of any modeling. Models depend on historical data and become less reliable when making predictions in a time when we are experiencing more frequent fires, and hotter and drier weather conditions.

One such spatial tool is the Colorado Wildfire Risk Assessment Portal (CO-WRAP). CO-WRAP was used to generate the maps and data regarding wildfire risk included in this plan. The Colorado Wildfire Risk Assessment (WRA) products included in this report are designed to provide the information needed to inform our mitigation measures and priorities. These include identifying areas that are most prone to wildfire and identifying the degree of suppression difficulty on the landscape. The wildfire risk map and the suppression difficulty map are included in this section of the plan. A summary report was generated

¹⁶ Wolf Mountain Ranch Phase 5 Easement Documentation Report



for Wolf Mountain Ranch using the Colorado Wildfire Risk Assessment Summary Reporting Tool (See Appendix).

CO-WRAP uses a statewide database (LANDFIRE) of vegetation to analyze wildfire risk on the Ranch. It provides a broad view of fire risk on the landscape. It is useful as a relative measure of risk but may not capture some factors accurately in absolute terms. The CO-WRAP wildfire risk map shows the majority of the property is at low risk of burning when considered in the landscape context. In fact, the Ranch experienced a significant fire event with the Deep Creek Fire in 2017, and fire frequency and size has increased in the area of the Ranch, and in the greater Routt County area in the past five years. Assessments performed as part of this planning effort indicate the both the forest and shrub types are relatively old, have not burned in at least decades, and contain fuel loading from accumulated dead and down materials. The fire risk on the Ranch can be more accurately described as on the high side of “moderate”.

A summary of acres by fire behavior fuel model and brief descriptors for the relevant fuel models on the Ranch can be found below. A map corresponding to these fuel models is included in this section.

Fuel models identified

Table 17. WMR. Fuels Model Breakdown *

Fuels Model	Sq Meters	Acres	% of Total
FBFM 1	2,140,200	528.9	2.9%
FBFM 2	9,021,600	2,229.3	12.0%
FBFM 3	-	-	0.0%
FBFM 4	25,200	6.2	0.0%
FBFM 5	16,033,500	3,962.0	21.4%
FBFM 6	18,054,900	4,461.5	24.1%
FBFM 7	-	-	0.0%
FBFM 8	24,345,000	6,015.8	32.4%
FBFM 9	560,700	138.6	0.7%
FBFM 10	4,192,200	1,035.9	5.6%
FBFM 11	-	-	0.0%
FBFM 12	-	-	0.0%
FBFM 13	-	-	0.0%
Urban	105,300	26.0	0.1%
Agriculture	232,200	57.4	0.3%
Water	250,200	61.8	0.3%
Barren	103,500	25.6	0.1%

* LANDFIRE 30m data using 13 Anderson fuel models.



Fuel Model Descriptions¹⁷

Grass Group

Fire Behavior Fuel Model 1

“Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one third of the area”

Fire Behavior Fuel Model 2

“Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead/down stemwood from the open shrub or timber overstory, contribute to the fire intensity. Open shrub lands and pine stands or scrub oak stands that cover one-third to two-thirds of the area may generally fit this model; such stands may include clumps of fuels that generate higher intensities and that may produce firebrands.” (Anderson 1982)

Fire Behavior Fuel Model 3

“Fires in this fuel type are the most intense of the grass group and display high rates of spread under the influence of wind. Wind may drive fire into the upper height of the grass and across standing water. Stands are tall, averaging about 3 feet (1 m), but considerable variation may occur. Approximately one-third or more of the stand is considered dead or cured and maintains the fire. Wild or cultivated grains that have not been harvested can be considered similar to tall prairie and marshland grasses.”

Shrub Group

Fire Behavior Fuel Model 4

“Fires intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Besides flammable foliage, dead woody material in the stands significantly contributes to the fire intensity. Height of stands qualifying for this model depends on local conditions. A deep litter layer may also hamper suppression efforts.”

Fire Behavior Fuel Model 5

“Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands with no dead wood would also qualify”

Fire Behavior Fuel Model 6

“Fires carry through the shrub layer where the foliage is more flammable than Fuel Model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h) at midflame height. Fire will drop to the ground at low wind speeds or at openings in the stand. The shrubs are older, but not as tall as shrub types of Fire Model 4, nor do they contain as much fuel as Fire Model 4. A broad range of shrub conditions is covered by this model. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. Even hardwood slash that

¹⁷ Anderson Fuel Models, 1982



has cured can be considered. Pinyon-juniper shrublands may be represented but may overpredict rate of spread except at high winds, like 20 mi/h (32 km/h) at the 20-foot level.”

Timber Group Fire Behavior

Fire Behavior Fuel Model 7

“Fires burn through the surface and shrub strata with equal ease and can occur at higher dead fuel moisture contents because of the flammability of live foliage and other live material. Stands of shrubs are generally between 2 and 6 feet”

Fire Behavior Fuel Model 8

“Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional “jackpot” or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Representative conifer types are white pine, and lodgepole pine, spruce, fir, and larch.”

Fire Behavior Fuel Model 9

“Fires run through the surface litter faster than Fire Model 8 and have longer flame height. Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting, and crowning.”

Fire Behavior Fuel Model 10

“The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch (7.6-cm) or larger limb wood resulting from over maturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation, leading to potential fire control difficulties. Any forest type may be considered if heavy down material is present; examples are insect- or disease-ridden stands, windthrown stands, over mature situations with deadfall, and aged light thinning or partial-cut slash.”

Logging Slash Group

Fire Behavior Fuel Model 11

“Fires are fairly active in the slash and herbaceous material intermixed with the slash. The spacing of the rather light fuel load, shading from overstory, or the aging of the fine fuels can contribute to limiting the fire potential. Light partial cuts or thinning operations in mixed conifer stands, hardwood stands, and southern pine harvests are considered. Clearcut operations generally produce more slash than represented here. The less-than-3-inch (7.6-cm) material load is less than 12 tons per acre (5.4 t/ha). The greater-than-3-inch (7.6-cm) is represented by not more than 10 pieces, 4 inches (10.2 cm) in diameter, along a 50-foot (15-m) transect.”

Fire Behavior Fuel Model 12:

“Rapidly spreading fires with high intensities capable of generating firebrands can occur. When fire starts, it is generally sustained until a fuel break or change in fuels is encountered. The visual impression is dominated by slash and much of it is less than 3 inches (7.6 cm) in diameter. The fuels total less than 35 tons per acre (15.6 t/ha) and seem well distributed. Heavily thinned conifer stands,



clearcuts, and medium or heavy partial cuts are represented. The material larger than 3 inches (7.6 cm) is represented by encountering 11 pieces, 6 inches (15.2 cm) in diameter, along a 50-foot (15-m) transect.”

Fire Behavior Fuel Model 13:

“Fire is generally carried across the area by a continuous layer of slash. Large quantities of material larger than 3 inches (7.6 cm) are present. Fires spread quickly through the fine fuels and intensity builds up more slowly as the large fuels start burning. Active flaming is sustained for long periods and a wide variety of firebrands can be generated. These contribute to spotting problems as the weather conditions become more severe. Clearcuts and heavy partial-cuts in mature and over mature stands are depicted where the slash load is dominated by the greater-than-3-inch (7.6-cm) diameter material. The total load may exceed 200 tons per acre (89.2 t/ha) but fuel less than 3 inches (7.6-cm) is generally only 10 percent of the total load. Situations where the slash still has “red” needles attached but the total load is lighter, more like model 12, can be represented because of the earlier high intensity and quicker area involvement.”

The other fire model used for this plan is BehavePlus. The BehavePlus fire modeling system is a computer program that was developed by the US Forest Service to model fire behavior and effects. It uses mathematical models that describe fire behavior and the fire environment based on a series of factors pertaining to the fire triangle. The program simulates rate of fire spread, spotting distance, scorch height, tree mortality, fuel moisture and other variables used to predict fire behavior.

Fire Modeling Synopsis

The Behave modeling done for this plan uses the actual stand data on the Ranch, aggregated into different fuel models than CO-WRAP. This is more accurate than the statewide data utilized by CO-WRAP and provides a finer level of detail for determining fire behavior, and thus indirectly risk, on the Ranch.

The Behave runs were focused on elements of the fire triangle, like Fuel and Topography, and used Wind as the driving force under the Weather component. Wind and Topography were manipulated, and fuel moisture was kept consistent. The output interpretation is focused on the triangle. This model does not include the modeling of crown fire spread, only surface fire. However, surface fire is the type of fire that models are useful in management considerations, working under the assumption that no model can ever exactly predict the future.

The full report for the BehavePlus runs can be found in the Appendix. Below are some discussion points per vegetation type to be considered:

Mixed Forest

- At 40 mph winds the fire in this vegetation type is moving a chain a minute (0.75 mile/hour)
- There was no plateau with wind speed but it can be expected that wind gusts would increase the rate of spread
- Potential for crowning and torching occur with 5-10 mile per hour winds as flame lengths start getting above head height at that point
- This is surface fire modeling and not crown fire but the amount of slope has a much smaller impact on rate of spread (ROS) and Flame Length than wind speed. Wind speed is the driver in this system
- The model assumes average fuel loading in this system. Areas with higher fuel loading than average can expect increases in ROS and Flame Length.



Sagebrush Shrubland

- Fuel moisture content (dryness) is the main driver of ROS and flame length in this system, not wind and slope.
- ROS of 6 chain (about 400ft)/H+ 6.6 feet per minute.
- Primary fire driver is the grass and not the sage.
- An important consideration in this system is the Moisture of Extinction, in this case, 15% relative humidity (RH). So, in this fuel type, when grasses cure, or there is a high ratio of dead to live grass, and RH gets below 15%: it will burn and be a receptive fuel bed for spots. However, these extreme conditions would subside in the evening, with RH recovery, and should have the burning in this system slow dramatically if not have the fire go completely out (hotspots might remain in the sage). If weather forecast predicts RH below 15% combined with Red Flag events, operations that might cause sparks or ignition (welding, grinding even sparking and heat associated with manifolds and parking in the grass) in these areas should be stopped until conditions change. If RH is 20%, it would be difficult to get this system to burn.

Mixed Montane Shrubland

- Slope and wind speed can really impact ROS in this vegetation type. The model predicted ROS of over 110 chain/hour (1.4 miles/hr.) at midflame wind speeds of 30 mph, and 60-70 ch/h at any slope. This is the most volatile fuel on the ranch by far and should be a management priority.
- The mixed montane shrubland is really impacted by the ratio of live to dead fuel: The more dead fuel (older brush stands), the more volatile.
- The live to dead fuel ratio can also be impacted by frost kill. If there is brush frost kill, the potential for significant fire behavior increases dramatically.
- As this vegetation type starts mixing with overstory trees, the potential for needle drape occurs, which can add to the live/dead fuel ratio and become a significant ladder fuel.
- Flame length usually maxes out at about 2.5 times the height of fuel. This plateau in flame length can be seen both on the slope and wind speed runs. Therefore, the fuel breaks in this vegetation type need to be at a minimum as big as those modeled flame lengths, and twice that at slope because of convection. The model assumes an average fuel depth of 4-6 feet. If the brush is taller assume flame lengths 2.5 times the height of the fuel.
- Spotting into this system is difficult as the shrubs carry the fire there are fewer receptive fuel beds. However, if it gets started, this is the most extreme of the surface fires that was modeled.
- This condition changes post leaf drop and pre snowpack, making dry falls a dangerous time for this vegetation type.

Tame Pasture

- Fire behavior runs for this vegetation type was at 10% moisture content. Below 10% increases in ROS and Flame Length can be expected as RH goes down.
- Moisture of Extinction in this vegetation type is 15%. Daily swings in RH will have the greatest impact to fire in this vegetation type. Live grass will not get down to 15% moisture content until it cures or frost kills. This fuel type will swing within an hour or less to the moisture in the air. As relative humidity drops below 15% this fuel becomes available.
- If weather forecast predicts RH below 15% combined with Red Flag events, operations that might cause sparks or ignition (welding, grinding even sparking and heat associated with manifolds and parking in the grass) in these areas should be stopped until conditions change. If RH is 20%, it would be difficult to get this system to burn.

Assessing Values at Risk

A property as large and varied as the Ranch has a number of values at risk. The strategies to mitigate those risks will vary as well. The term “values at risk” usually connotes physical things to which a value can be placed on, but human life is always the first priority to protect in any fire planning.

Values at risk for the Ranch include:

- Life
- Livestock
- Homes and cabins
- Shops, garages, and other outbuildings
- Oil and gas wells
- Range
- Watershed
- Historical structures and sites
- Fences
- Aesthetics

Colorado and other western states have seen a trend towards larger and more destructive wildfires. Eight of the ten most destructive fires in Colorado history have occurred since 2010. The Marshall Fire of December 2021 is the most destructive fire the state has ever experienced, with almost 1000 homes destroyed. The understanding of how and why structures burn during wildfires has continued to evolve.

The concept of “defensible space” involves removing vegetation near structures to avoid direct contact with the fire and extreme heat. Research and experience in recent years has shown that ember ignition, essentially ignition from airborne fire embers, is a significant cause of structures burning. A relatively new concept known as the “Home Ignition Zone” (HIZ) emphasizes the potential of a structure to ignite as well as the quality of the defensible space surrounding it.



Home Ignition Zone (HIZ) Assessments

The CSFS evaluated structures on the Ranch utilizing the HIZ concept and a standardized assessment form. Those assessments are included below. The Home Ignition Zone publication is included in the Appendices. There are 19 oil well sites on the Ranch. The CSFS assessed two sites as examples of illustrating potential mitigation for all well sites. These well sites usually have large bladed areas free of vegetation surrounding them and thus are not considered to be at high risk from wildfire.

Bechard Place



Overgrown vegetation immediately around structures needs tending. Vegetation >100 feet from the structure is mostly pasture.

Access/Egress

- Fair with good turn around
- Encroaching vegetation on road

- Shooting targets
- Metal roofs

Vegetation

- Heavy contiguous vegetation needs thinning; break up continuity
- Maintain grasses
- Remove dead trees
- Prune dead branches or branches touching structures or power lines

Water Sources

- Pond located downstream of the drainage

Aspect & Slope

- Eastern aspect and flat slopes

Structures

- Two structures



Guest House



Well maintained guest house and garage. Immediate vegetation around structures is healthy and has good spacing.

Access/Egress

- One way
- Adequate turnaround space for emergency vehicles
- Unpaved road with good signage from County Road 52

Vegetation

- Irrigated and maintained grass around structures
- Good spacing and pruning on trees <100 feet from structures
- Oak/shrubs growing on adjacent steep slopes
- Adjacent aspen stand with high mortality

Aspect & Slope

- Flat with adjacent steep slopes
- Mixed aspects

Structures

- Wood deck around guest house
- Garage
- Metal roofs
- Propane tank

Water Sources

- Water tanks and nearby pond

Ranch Headquarters & Shop



Multiple structures in the central part of the ranch. Good wildland fire mitigation measures.

Access/Egress

- Near county road. Good access for first responders

Vegetation

- Surrounded by irrigated meadows
- Maintain grasses around structures
- Some adjacent aspen with mortality. Falling risk on buildings
- Prune dead branches or branches touching structures

Aspect & Slope

- Flat with predominately southern aspect on north side of structures

Structures

- Multiple wood structures with metal roofs
- Propane tanks nearby structures

Water Source

- Nearby reservoir
-



Pilot's Cabin



The structure is of low use. Some equipment storage nearby.

Access/Egress

- One-way, with an improved gravel road circling the structure. Good turn around and parking.
- Close to CR 52

Vegetation

- Tall grasses need maintenance within the gravel road the circles the structure
- Noxious weeds

Aspect & Slope

- North to northwest
- Flat around structure, moderate slopes >100 feet away.

Structures

- One structure with propane tank
- Pond pump, electric box, power lines

Water Sources

- Adjacent pond

Hunting Camp



Several structures make up the Hunting Camp. The camp is used as a scouting and hunting base for several months in the summer/fall each year. Gravel driveway starts off CR 52. On the north side of the driveway, there are 4 small cabins and a meeting hall. Adjacent structures are found on the south and east side of the driveway.

Access/Egress

- One-way, with an improved gravel road providing access to the structures. Good turn around and parking.
- Address: 45370 CR 52 – Structures are close to CR 52 (approx. 0.5 miles)

Vegetation

- Tall grasses need maintenance within the gravel road thhat provides access to the structures
- Noxious weeds

Aspect & Slope

- North to northwest
- Flat around structure, moderate slopes >100 feet away to the south.

Structures

- One structure with propane tank
- Electric box, power lines

Water Sources

Pond to the NE

Cattle Headquarters



The cattle headquarters are of high use. There are offices and equipment storage on site. .

Access/Egress

- Driveway off CR 70. Improved gravel driveway circling all structures. Good turn around and parking.
- On CR 70 there are 2 ways to egress, north or south, on a maintained and improved gravel county road good turn around and parking.

Vegetation

- Tall grasses need maintenance within the close proximity to structures
- Irrigated hay meadows to be maintained

Aspect & Slope

- No concerns as slopes are flat within compound.

Structures

- Office building, barns and shed for equipment. Pond pump, electric box, power lines

Water Sources

- Adjacent pond
- Yampa River

Oil Well #1



First oil site. Furthest structure from CR 52

Access/Egress

- Long, climbing, moderately maintained gravel road
- Encroaching vegetation along buffer
- Good turn around

Vegetation

- High elevation
- Maintain grasses immediately around structures
- Well maintained fence lines

Aspect & Slope

- High elevation
- Generally southern aspect
- Flat immediately around structures

Structures

- Pump, storage tank, and outbuilding

Water Sources

- Water source about ¼ mile down the road

Oil Well #2



Second oil well site. Adequate protection from wildland fire.

Access/Egress

- Gravel road off of CR 52
- Good turnaround
- Maintained road

Vegetation

- No immediate trees and shrubs. Only low grasses.
- Aspen to the north
- Oak to the south
- Maintained fence lines

Aspect & Slope

- Slight southern aspect.
- Flat

Structures

- 4 oil tanks, well, outbuilding

Water Sources

- Pond about ¼ mile down the road

Prescriptions and Implementation

The prescriptions and recommendations fall into four broad categories:

- Prescriptions to Reduce or Change Fuels Structure for Fire Mitigation
- Prescriptions to Promote Forest Health/Wildlife
- Point Protection Recommendations to Mitigate Built Values at Risk
- Preplanned Response Procedures

Prescriptions designed to mitigate for fire often result in benefits to forest health and to wildlife. Conversely, prescriptions primarily designed to benefit wildlife and forest health may also result in reducing the risk of wildfire. This forest management plan with a fuel reduction focus addresses mainly the forested areas assessed, and its recommendations for vegetation treatments are generally limited by access and slope and defined by values at risk.

Colorado Parks & Wildlife will be consulted on final project designs in order to ensure that the most important wildlife species will not be unduly impacted, and that their habitat will be improved and made more sustainable. In particular, consultation with CPW on any project that impacts grouse habitat (sagebrush and mixed montane shrubland habitats).

Management Zones

In order to better facilitate, discuss and manage the prescriptions on such a large landscape, the Ranch has been divided into three management zones. These zones are based on watersheds, general access, use, and, to a lesser degree, vegetation. Since forest health is intrinsically related to overall watershed health, the Ranch was divided into HUC 10 units for vegetation assessment and management implications. Watersheds are delineated areas that capture and flow water into specific rivers, basins, or seas. These areas are classified by the US Geological Survey (USGS) into Hydrologic Unit codes (HUCs). A HUC 2 for example would be a regional area, while a HUC 10 or 12 would be the most localized area. See the Watershed Map located in the Appendix.

The western zone consists of the Goose Creek and Yampa River drainages; the central zone consists of Wolf Creek and Tow Creek drainages; and the eastern zone consists of the Deep Creek, Salt Creek and Hot Springs Creek drainages.



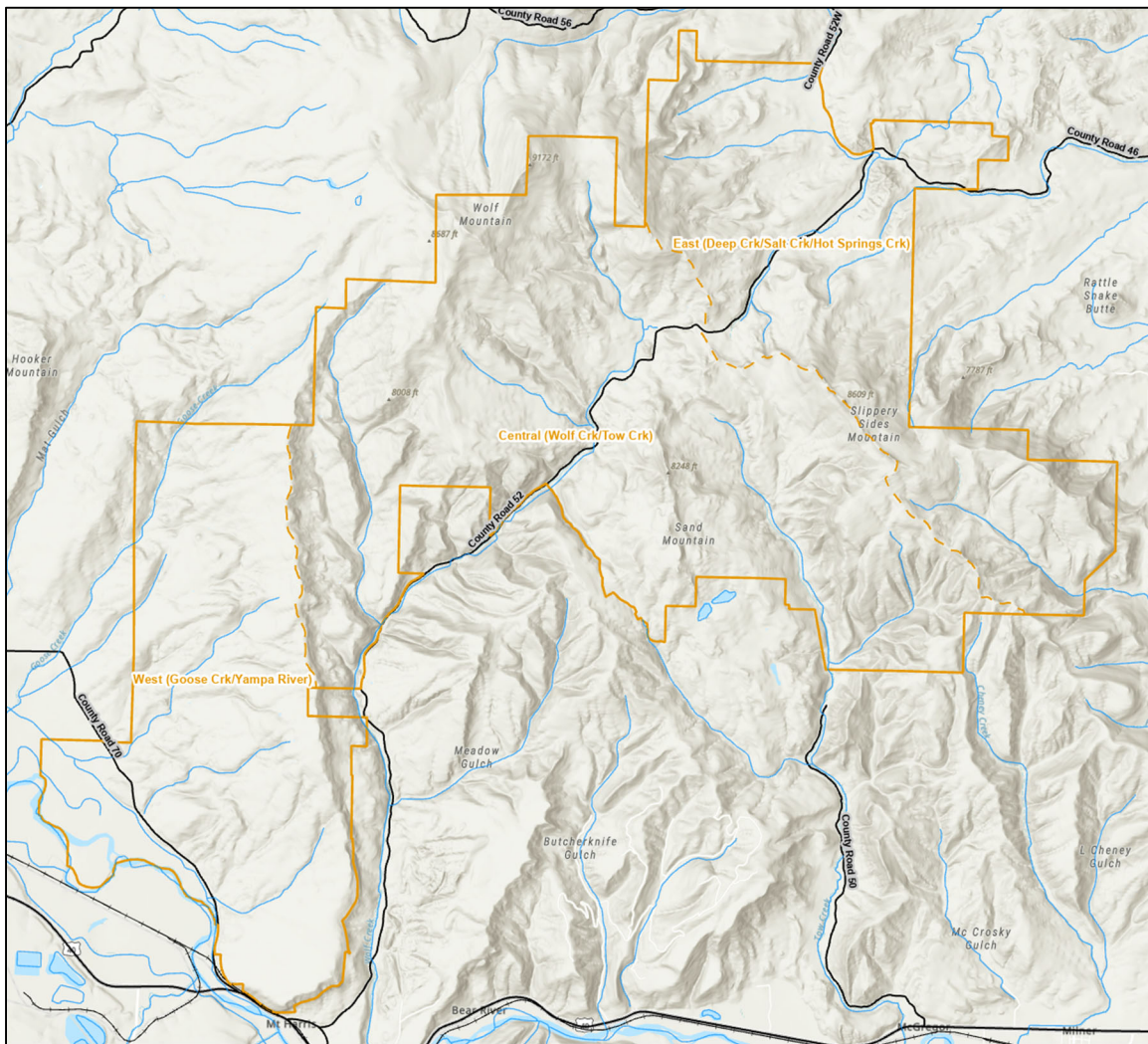


Figure 32. Management Zone Overview

West Zone – 4,971 acres west of the prominent ridge line and consisting of shrubland.

Central Zone – 8,750 acres in the central portion of the property including Wolf Mountain and the western portion of Slippery Sides Mountain. The majority of structures, and oil and gas wells and infrastructure is in this area.

East Zone – 4,825 acres in the easternmost portion of the property, east of Slippery Sides Mountain.

Table 18. Vegetation Type Breakdown by Management Zone.

Area	Vegetation Type	Acres	Percentage
West (Goose Crk/Yampa River)	Aspen Forest	16.7	0.34%
	Disturbed Sites	12.8	0.26%
	Graminoid Wetland	10.7	0.22%
	Mixed Forest	9.5	0.19%
	Mixed Montane Shrubland	1,420.5	28.57%
	Riparian Shrubland	176.0	3.54%
	Sagebrush Shrubland	2,466.7	49.62%
	Tame Pasture	858.5	17.27%
		4,971.5	100.00%
Central (Wolf Crk/Tow Crk)	Aspen Forest	2,276.9	26.05%
	Disturbed Sites	26.1	0.30%
	Graminoid Wetland	49.1	0.56%
	Mixed Forest	1,300.6	14.88%
	Mixed Montane Shrubland	4,219.4	48.27%
	Riparian Shrubland	58.4	0.67%
	Sagebrush Shrubland	276.4	3.16%
	Tame Pasture	533.6	6.10%
		8,740.4	100.00%
East (Deep Crk/Salt Crk/Hot Springs Crk)	Aspen Forest	791.1	16.45%
	Disturbed Sites	27.3	0.57%
	Graminoid Wetland	49.3	1.02%
	Mixed Forest	1,070.3	22.26%
	Mixed Montane Shrubland	1,782.3	37.07%
	Riparian Shrubland	21.1	0.44%
	Sagebrush Shrubland	432.8	9.00%
	Tame Pasture	634.2	13.19%
		4,808.2	100.00%
Grand Total:		18,520.1	

Management Zone 1 (West) Prescriptions

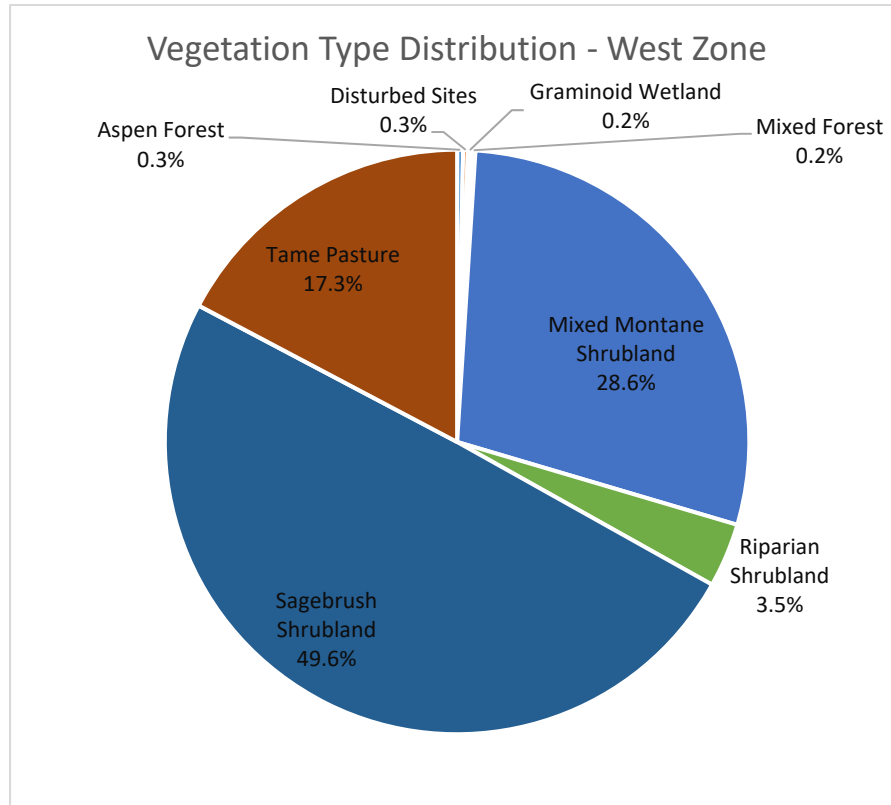


Figure 33. West Zone Vegetation Type Distribution.

Prescriptions to Reduce or Change Fuels Structure for Fire Mitigation

This management zone is dominated by sagebrush, montane shrubland and pasture lands. The Ranch Headquarters to the south of CR 70 is a low area near the Yampa River. The buildings generally have good defensible space and are surrounded by gravel or short grass. The Ranch Headquarters area is of low concern to any threat from wildfire and no management is recommended. There is no significant forest cover type in this Zone.

A fire start in this zone has the potential to move upland, west and north, towards the central and eastern sections of the Ranch. The fire modeling for this area (see appendices) indicates that, under moderate conditions, fire behavior would not be extreme. With moderate slopes and winds, the predicted rate of spread in the sagebrush would be just over 6 chains an hour (chain = 66 feet), or about 415 feet per hour. This is reinforced by the CO-WRAP analysis mapping. The CO-WRAP Suppression Difficulty Map shows low suppression difficulty through most of this West Zone, with the area of highest suppression difficulty for this portion of the Ranch to be along the ridge line that delineates the eastern side of the West Zone.

Recommendations

- High Priority - There is a two-track road that runs along the top of this ridge. Create a fuel break and safe travel corridor along this two-track by masticating the brush component in a mosaic pattern. A fuel break can be defined as a strip of land where fuels are removed or

modified to control or stop the risk of fire spreading across that area. See prescription map for potential treatment area.

- Medium priority – Implement fuel reduction treatments in the sagebrush. Projects in sagebrush habitats usually target either large stature mixed mountain shrub stands (serviceberry primarily), or Gambel oak brush sites to promote big game browse availability. In those areas, 100% of the mountain shrub above sage height should be targeted, and 50-80% removal in the oak creating mosaics. Sagebrush is usually a non-target shrub. If targeted for fuel reduction reasons, no more than 30% should be removed in a mosaic pattern.

Prescriptions to Promote Forest Health/Wildlife

No specific treatments for wildlife, but the fuel treatments recommended above and shown on the prescription map will benefit wildlife by promoting age class diversity in the shrub component and encourage grasses, forbs, and shrub sprouting. More extensive treatments in the sagebrush shrubland component in this zone may be assessed in the future to promote forage and age class diversity in this cover type, with particular attention to sage grouse habitat protection considerations.

Point Protection Recommendations to Mitigate Built Values at Risk

The building within the Ranch Headquarter facilities south of CR 70 have good defensible space and are surrounded by gravel or short grass. In addition to these facilities south of CR 70, there are four oil wells in this zone.

Recommendation: Maintain defensible space/Home Ignition Zone standards as needed. Vegetation along access roads to the oil well may be assessed for treatment as needed.

Preplanned Response Procedures

Access is limited on this side of the Ranch and, aside from the Ranch Headquarter facilities, there are no occupied facilities.

- Any fire should be reported immediately to 911.
- The Ranch Headquarter facilities south of CR 70 should provide a safe location to gather in case of emergency on this side of the Ranch.
- Develop a preplan for opening appropriate gates to allow livestock to move out of harm's way in a rapidly developing situation.
- Develop a brief summary of critical information ahead of time for first responders. Include water sources, critical infrastructure, roads, and key contacts.
- Develop and prioritize a list of documents, items, and equipment that should be removed to safety in the unlikely event that a structure was threatened.



Management Zone 2 (Central) Prescriptions

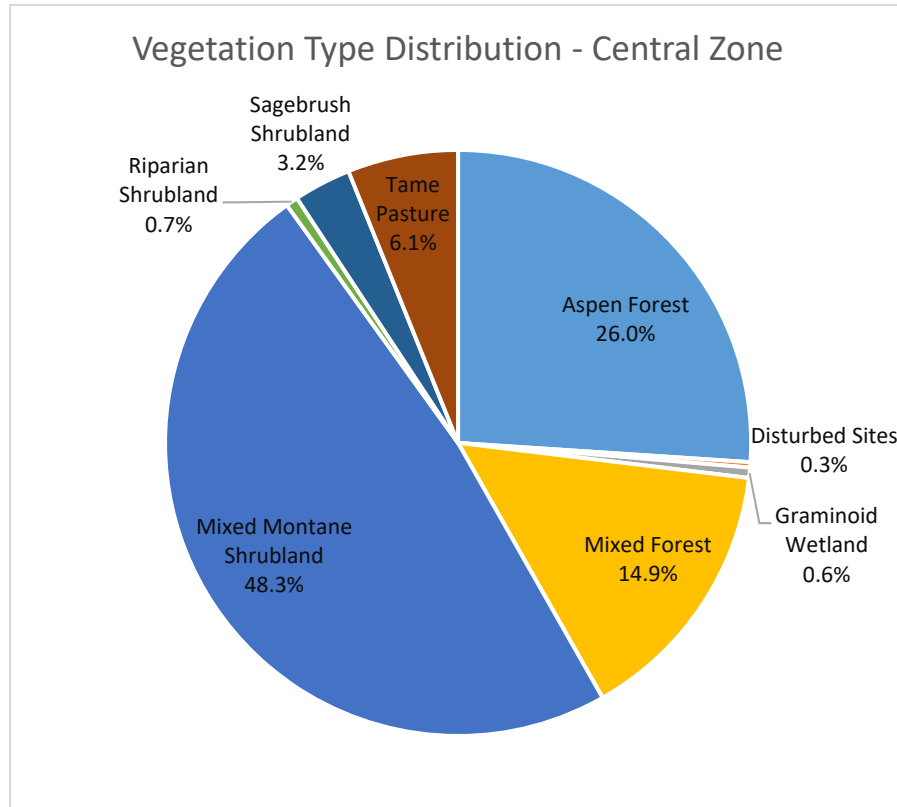


Figure 34. Central Zone Vegetation Type Distribution.

Prescriptions to Reduce or Change Fuels Structure for Fire Mitigation

The Central Zone contains a mix of forest land and shrubland in relatively equal proportions. The aspen component does not contribute significantly to fire risk. The mixed forest does have significant fuel loading in some locations and has burned recently during the 2017 Deep Creek Fire. The BehavePlus fire modeling runs confirm the potential for extreme fire behavior and rates of spread as high as a chain a minute in this forest type. The mixed montane shrubland presents the highest hazard fuel on the Ranch because of its potential volatility and because it is often located near the roads and infrastructure. Fire modeling indicates rate of spread could exceed over 110 chains per hour in this fuel type on the Ranch, the equivalent of almost a mile and half of fire growth in one hour.

Recommendations

- High Priority – Masticate mixed montane shrubland type along critical access/egress roads to meet life safety objectives and aid in suppression efforts. See prescription map for potential treatment areas. This particular work will be slope limited, but units could be expanded on steeper slopes utilizing hand work.
- Low Priority – Selectively harvest dead standing trees and reduce surface fuels in the mixed forest cover type through pile and burning larger woody debris. Extensive management in this forest type might be expensive due to access and markets, might have unintended consequences of changing the environment of these stands by opening them up and drying them while not significantly change outcomes in the event of a stand replacement fire disturbance.

- Contour falling of snags in the Deep Creek Fire scar. Especially snags that have been structurally compromised (Figure 29). Tree falling should occur perpendicular to the slope to add erosion control value. Priority areas should include high-use roads, high-use areas, and areas with bare soil where overland flow is greatest. Seeding, water bars, or straw wattles can also reduce soil erosion.
- Planting of native tree species in areas where natural regeneration is minimal. Species diversity is encouraged as aspen and subalpine fir are the only naturally regenerating species. Lodgepole pine, Engelmann spruce, and Douglas-fir would be ideal tree species depending on light and water availability.
- Chemical or mechanical control should be considered in areas with dense western brackenfern and artificial regeneration is desired. Intermediate mechanical treatments like cleaning or weeding around regenerating trees should be used. Brush hogs or clearing saws are commonly used to reduce fern density around seedlings and saplings. Chemical treatments using Glyphosate or dicamba can also be effective. These treatments should only persist until tree height is greater than frond height.
- Noxious weed control is important in post-fire conditions. Control of noxious weeds is best accomplished through an integrated pest management system that includes chemical, biological, mechanical, and cultural controls.



Figure 35: A "Catface", or a tree with a burned interior acts as a falling hazard

Prescriptions to Promote Forest Health/Wildlife

Promote age class diversity in the aspen forest component of this zone through either masticating or harvesting, or operations that combine both these treatments.

Point Protection Recommendations to Mitigate Built Values at Risk

The majority of the structures that may be considered at risk on the Ranch are located within this zone. Each of these structures has been individually assessed and evaluated for potential mitigation measures. Most of these structures, particularly near CR 52, are at a low risk of burning in a wildfire because they are located within an area of lighter fuels, have good defensible space, and have water sources nearby. Although surrounding fuels may not be potential sources for sustained ember showers, embers or fire brands can be carried distance up to a mile or more.

Recommendation: Review structure assessments and implement recommended mitigation measures. Maintain defensible space/Home Ignition Zone standards as needed. Consider sprinkler systems with independent power sources for high value structures.

Preplanned Response Procedures

This zone of the Ranch is the most likely area to have a number of guests, residents, and staff on any given day during the fire season.

- Establish a predetermined meeting place and other measures to provide accountability and safety for people on the ranch
- Develop a preplan for managing livestock in an emergency, including but not limited to opening appropriate gates to allow livestock to move out of harm's way in a rapidly developing situation, or gathering and moving animals to safety.
- Develop brief summary of critical information ahead of time for first responders. Include water sources, critical infrastructure, roads, and key contacts.
- Develop and prioritize a list of documents, items, and equipment that should be removed to safety in the unlikely event that a structure was threatened.



Management Zone 3 (East) Prescriptions

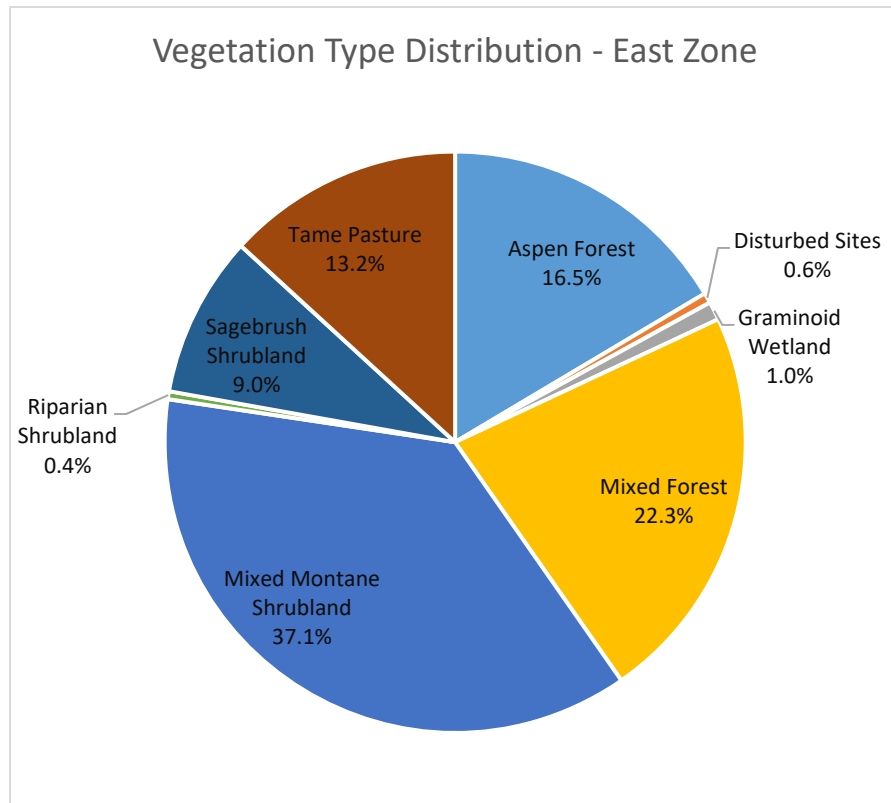


Figure 36. East Zone Vegetation Type Distribution.

Prescriptions to Reduce or Change Fuels Structure for Fire Mitigation

Similar to the Central Zone, the Eastern Zone contains a mix of forest land and shrubland in relatively equal proportions. The aspen component does not contribute significantly to fire risk. The mixed forest does have significant fuel loading in some locations and has burned recently during the 2017 Deep Creek Fire. The BehavePlus fire modeling runs confirm the potential for extreme fire behavior and rates of spread as high as a chain a minute in this forest type. The mixed montane shrubland presents the highest hazard fuel on the Ranch because of its potential volatility and because it is often located near the roads and infrastructure. Fire modeling indicates rate of spread could exceed over 110 chains per hour in this fuel type on the Ranch, the equivalent of almost a mile and half of fire growth in one hour.

Recommendations

- High Priority – Masticate mixed montane shrubland type along critical access/egress roads to meet life safety objectives and aid in suppression efforts. See prescription map for potential treatment areas. This particular work will be slope limited, but units could be expanded on steeper slopes utilizing hand work.
- Low Priority – Selectively harvest dead standing trees and reduce surface fuels in the mixed forest cover type through pile and burning larger woody debris. Extensive management in this forest type might be expensive due to access and markets, might have unintended consequences of changing the environment of these stands by opening them up and drying

them while not significantly change outcomes in the event of a stand replacement fire disturbance.

Prescriptions to Promote Forest Health/Wildlife

Promote age class diversity in the aspen forest component of this zone through either masticating or harvesting, or operations that combine both these treatments.

Point Protection Recommendations to Mitigate Built Values at Risk

Each of these structures has been individually assessed and evaluated for potential mitigation measures. Most of these structures, particularly near CR 52, are at a low risk of burning in a wildfire because they are located within an area of lighter fuels, have good defensible space, and have water sources nearby. Although surrounding fuels may not be potential sources for sustained ember showers, embers or fire brands can be carried distance up to a mile or more.

Recommendations

- Review structure assessments and implement recommended mitigation measures. Maintain defensible space/Home Ignition Zone standards as needed. Consider sprinkler systems with independent power sources for high value structures.
- Maintain defensible space/Home Ignition Zone standards as needed. Vegetation along access roads to the oil well may be assessed for treatment as needed.

Preplanned Response Procedures

This zone of the Ranch is the most likely area to have a number of guests, residents, and staff on any given day during the fire season.

- Establish a predetermined meeting place and other measures to provide accountability and safety for people on the ranch
- Develop a preplan for managing livestock in an emergency, including but not limited to opening appropriate gates to allow livestock to move out of harm's way in a rapidly developing situation, or gathering and moving animals to safety.
- Develop brief summary of critical information ahead of time for first responders. Include water sources, critical infrastructure, roads, and key contacts.
- Develop and prioritize a list of documents, items, and equipment that should be removed to safety in the unlikely event that a structure was threatened.



Maintenance of Past & Future Work

Vegetation management refers to the targeted control, management, and, in some cases, the elimination of unwanted vegetation – spanning from weeds and bushes to branches and trees. Vegetation, however, continuously grows, and depending on the species, might respond vigorously after a given treatment through resprouting and regrowth (oak and aspen). Therefore, maintenance of previous and future projects is needed in order to sustain the achieved goals and objectives related to wildfire risk reduction. For example, for the mixed montane shrubland, that cycle of needed maintenance is about every 10-15 years.

Prioritization and Implementation Tables

Table 19. Implementation Summary Table for Wolf Mountain Ranch.

Priority	Management Zone	Treatment Activity Short Description	Approximate Acreage	Season	
				Planned	Completed
High	1	Fuel break along two track road on top of ridge	65	Summer 2022	
High	2 & 3	Masticate along critical access/egress roads and maintain defensible space around structures to meet life and safety objectives	209	Summer 2022 & beyond	
Medium	1,2 & 3	Develop an evacuation plan for people and livestock	N/A	Spring 2022	
Medium	1	Fuel reduction treatments in the sagebrush - west side	3,100	Fall 2022- Summer 2023	
Medium	2 & 3	Harvesting and mastication in Slippery Sides area	1068	Summer 2023 & beyond	
Medium /Low	1,2 & 3	Masticate along less critical access/egress to meet life and safety objectives	500	Summer 2023 & beyond	
Low	2	Fire scar monitoring and replanting	1902	Ongoing	



Table 20. Implementation Summary by Management Zone for Wolf Mountain Ranch.

Management Zone	Priority	Acres
West (Goose Crk/Yampa River)	High - Access/Egress, Point Protection	94.6
	High - Mastication	414.8
	Medium - Mastication	3132.0
		3641.4
Central (Wolf Crk/Tow Crk)	High - Access/Egress, Point Protection	174.4
	High - Mastication	18.5
	Medium - Access/Egress, Point Protection	17.3
	Medium - Harvesting/Mastication	418.2
	Low - Access/Egress, Point Protection	305.0
	Low - Harvesting/Mastication	39.4
	Low - Monitoring	1122.1
		2095.0
East (Deep Crk/Salt Crk/Hot Springs Crk)	High - Access/Egress, Point Protection	35.2
	Medium - Harvesting/Mastication	650.6
	Low - Access/Egress, Point Protection	179.6
	Low - Monitoring	780.4
		1645.8
Total		7382.2

