

Elk Mountain Ranch NATURAL RESOURCE MASTER PLAN PART 1



Part 1 includes assessment summaries, management guidelines, and recommendations for improvements on the ground and through management practices. Part 1 is intended to be a tool for budgeting, planning and designing improvement projects.

Part 2 includes background information, the assessment specifics, data, and explanations. It is more voluminous and it provides the foundation upon which recommendations are made. Part 2 can be used as reference information to better understand the resource conditions by species, by vegetative type, or habitat.

Carbon County, Wyoming

September 2006

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 NATURAL RESOURCE MASTER PLAN
 PART 1

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Note: There are photos, maps, tables and charts in the fisheries section labeled on a system only for the fisheries discussion and section.

I. INTRODUCTION (Also in Part 2)

Ranch Management Goals

This is a Natural Resource Master Plan for the privately owned forested areas located on the Elk Mountain ranch. The following are the goals:

- Sponsor range and forestland ecological health,
- Increase habitat for game animals and predators,
- Reduce risk and vulnerability to large forest insect and disease outbreaks,
- Effective livestock management, and
- Increase populations of fish, game animals, and predators.

Location and Description (see map)

The Elk Mountain ranch is approximately 3 miles west of the town of Elk Mountain and seven miles northwest of the Medicine Bow mountain range (Snowy Range). Within the Elk Mountain ranch there are approximately 7,400 acres of BLM Public Domain, 2,640 acres of State land, and 156 acres deeded for Hanna water supply. There are approximately 22,800 acres of deeded land that belong to the ranch and this includes over 600+-acres private trade of use (Section 1, T 20, R82). The grand total of all lands within the ranch is over 33,000 acres.

Primary access route to Elk Mountain ranch from Laramie, WY is north on Interstate 80 approximately 60 miles to Elk Mountain turnoff, exit 255. Turn west on CR 600 Rattlesnake Pass road for approximately one mile to the Ranch entrance.

Topography and Climate

The Elk Mountain Ranch is on the east side of the continental divide and north of the Snowy Range.

The topographic center piece of the ranch is Elk Mountain which rises in elevation to 11,056 feet. The entire mountain is forested with a mosaic of different cover types intermingled with patches of grassland and meadow. The ridges north and west of the mountain are characterized as foothills and are covered with shrub, grassland with a few stringers of aspen woodland. The primary ridge is called Halleck Ridge, elevation 8,047 feet, and it is located roughly north and northwest of Elk Mountain. The other ridge is Sheephead Mountain with an elevation of 8,828 feet and it is west of Elk Mountain. Both Halleck Ridge and Sheephead Mountain are considered to be “crucial winter range” for elk. The lowlands of the ranch between County Road 600 (Rattlesnake Pass Road) and the foot of the mountain on the north side are predominately irrigated pasture and meadow flanked by aspen woodland and divided by stringers of willow. This area is crucial winter range for mule deer.

Elevation and topography are dominant controls of local climates within the Ranch. The combination of elevation and mid latitude interior continent geography results in a cool, dry but invigorating climate. There are large seasonal swings in temperature and large day to night changes. Humidity is generally quite low; this favors rapid evaporation and a relatively comfortable feeling even on hot days. The thin atmosphere allows greater penetration of solar radiation and results in pleasant daytime conditions even during the winter. Outdoor work and recreation can often be carried out in relative comfort year round, but sunburn and skin cancer is a problem due to the intense high-elevation sunlight. At night, temperatures drop quickly, and freezing temperatures are possible in some mountain locations every month of the year.

There is a weather station in Elk Mountain 3 miles east of the ranch. The historical station records cover a 35 year period.

Average maximum temperature at the lower elevations can be expected to be about 53° F with highs in July averaging 79° F and lows in January of 14° F. Average minimum temperature can be expected to be about 30° F. On the mountain the average mean temperature is probably 10 to 15 degrees lower year around.

Total precipitation at the lower elevations averages about 12.3” per year most of which occurs between the months of March and November. The month averaging the most precipitation is May with a 35 year average of 2.26”. The timbered high elevation part of the ranch probably receives 50 to 120% more annual precipitation than occurs at the lower elevations of the ranch.

Conservation Easement

The Conservation Easement was certified in December 1998 and includes all deeded lands with a few exceptions listed in the easement. The Conservation Easement grants the continuation of eleven specific activities to the owners and prohibits seventeen specific activities. Generally, the owners have rights to continue to graze livestock and maintain or install facilities needed for operating the ranch and maintaining the health of the ecosystems as well as to develop within the two building envelopes depicted. In general the Conservation Easement prohibits commercial development and or any major alteration of the ecosystems. All of the specifics are clearly stated within the Conservation Easement and Deed of Conservation Easement. (See Appendices with Part 1 and 2)

The Conservation Easement includes a very well-written report describing the background, history, ecological features, and legal information pertaining to the ranch.

II. ASSESSMENT SUMMARY (expanded in Part 2)

Vegetation and Physical Features

The Elk Mountain Ranch is comprised of twelve primary vegetation types. When considering variations within a vegetation type, there are numerous different units and/or stands to consider. Some vegetation types are forested and some are not forested. None of the vegetation types are homogeneous. In each there are variations. In many cases there are mosaics of sub-types or small patches of different vegetation. However, the vegetation type mapped represents the major vegetation as labeled. See the attached vegetation map.

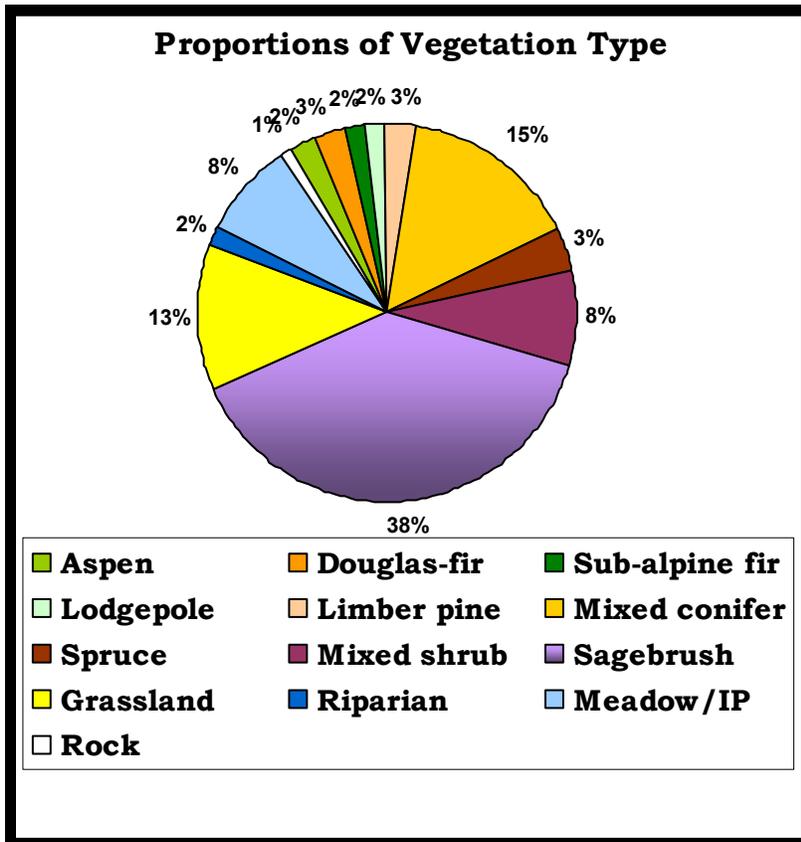


Chart depicts the proportions of vegetation type across all ownerships.

This assessment and management plan with recommendations is primarily for the deeded lands within the Elk Mountain Ranch. The assessment in Part 1 is a brief summary of each of the vegetation types in the forest and non forest areas of the ranch. Vegetative type information for the BLM Public Domain, State and Town of Hanna lands is discussed within Part 2. More in depth

information about each vegetative type is also available in the Vegetation and Physical Features section of Part 2.

Forests

The vegetation patterns that have developed on Elk Mountain landscapes are determined by disturbances as well as by environmental gradients. The effects of the disturbances are important in all landscapes, but in mountain forests they can occur over larger areas and their impacts last longer because of the usually dominant conifers are unable to sprout. Fires, windstorms, insect outbreaks along with human-caused disturbances often lead to tree mortality over large acreages. A forest develops again only after successful establishment

of new seedlings or with the rapid growth of small trees that had been suppressed by the larger trees prior to the disturbance.

The frequency of disturbance varies with elevation and other environmental factors.

Forest vegetation is perhaps best thought of not as a uniform and stable cover but rather as a mosaic, with the character of each patch frequently changing and borders being periodically redefined.

The forests on the Elk Mountain Ranch property are comprised of seven vegetative types. These types each have variations where they are intermixed with other vegetation creating a sort of zoning or mosaic. Vegetation mosaics on this ranch coupled with the adjoining properties, facilitate a wide diversity of habitats and forest environments. Within each forest type there is vegetative variation. The Elk Mountain forests are a mosaic of lodgepole pine, limber pine, mixed conifer, Douglas-fir, aspen, sub-alpine fir, and spruce. They occur in patches or blends of two or more tree species intermingled with openings dominated by a variety of grasses. Within some of the wetter drainages there are small mountain meadows with a variety of forbs, grasses and shrubs. The forest diversity is due to the occurrence of natural disturbances, variations in soil and soil moisture, elevation and constant exposure to lower temperatures, and to different slope aspects facing the sun or away from the sun.

Forests and Woodland Stand Summary (Also in Part 2)

The forested areas have been inventoried as “Stands”. Each stand represents forests with similar characteristics, uniform in species composition, age class arrangement and condition. Each stand also has similar opportunities and limitations for management.

Poor access and slope are the primary factors influencing mechanical operability in the forested area. Operability is rated as follows:

High = 25% of the forested acreage

Medium = 47% of the forested acreage

Low = 28% of the forested acreage

For the purpose of conventional logging or mechanical treatment forested areas on slopes of 0-30% with short rises up to 40% are considered operable. Most of the forests on the south and west sides of Elk Mountain and at the mid-elevation where there are no roads are on slopes too steep for conventional logging operations. On the north, part of the east facing slopes, and in spots on the lower west side logging and applications of mechanical treatment are options depending on the costs and benefits. For recommended prescribed fire treatments there are no slope limitations.

The keys to all of the management issues are stand density and vegetation management. The forest vegetation on the ranch is generally in fair to good health. Stands are too dense in many areas and vulnerable to large scale disturbances from insects, diseases and fire. By prescribing treatment where it is economically feasible and not damaging to wildlife habitat or watersheds, the long term health and conditions can be maintained or improved.

Mason, Bruce and Girard (MBG), a forestry consulting firm out of Oregon conducted a cruise of the Elk Mountain Ranch in 1998. It provided an estimate of forest value and suggested silvicultural actions. There is a significant difference between MBG recommendations and those found here. First the MBG report is an estimate of what “might be obtained by cutting all merchantable sized trees into 16 foot logs”. This is a pretty typical approach when the value of standing timber is to be included in the purchase price of a large tract. If the new owner liquidated all the merchantable timber on the ranch he/she could expect to get the volume described in MBG’s report.

Estimates in this plan are not based on cutting all merchantable volume but rather on harvesting discrete stands for specific resource management goals. See the management recommendations for specifics. In the current instance the present owner wants to enhance wildlife habitat. This goal is much different than a liquidation scenario and will yield a much different outcome than the MBG approach.

MBG mentions and perhaps even emphasizes that management of the timber resource on EMR will be capital intensive to get road systems up to decent standards for access and log truck use. They even infer that forest management on this property will be a “break even” opportunity at best.

Note: There is a good abundance of snags/standing dead on Elk Mountain. There are plenty of cavity nester condos.

Noxious weeds, particularly Canada thistle, are prevalent in areas where timber harvest has occurred and near all travel ways and riparian zones.

There are 15 different forest type stands included with the forests and woodlands on the Elk Mountain Ranch. Treatment specifics are described in stand write ups of Part 2 and in “Recommended Improvement Project” section. Descriptions of the forest type stands follow:

Forest and Woodland Stand Summary Table

Stand Symbol	Forest Type	Total Acres	Deeded Acres	General Treatments Recommended
A	Aspen (70% or more)	572	395	Treat for aspen regeneration and noxious weeds
A/MC	Aspen being succeeded by MC	181	177	Treat for aspen regeneration and noxious weeds
MC	Mixed Conifer (mosaic of three or more species (LP, DF, WP, F))	2,964	1,820	Confine and contain wildfire
MC/A	Mixed conifer with a scattering of aspen all through it	2,160	1,117	Treat for aspen regeneration and noxious weeds
DF	Douglas-fir (70% or more)	743	408	Fuel hazard reduction
DF/A	Douglas-fir dominating with scattering of aspen	98	98	Treat for aspen regeneration and noxious weeds; Fuel hazard reduction
LP	Lodgepole pine (70% or more)	581	307	Confine and contain wildfire
WP	Limber pine (70% or more)	372	208	Confine and contain wildfire; Fuel hazard reduction
WP/MS	Limber pine (40% or more) with mixed shrub	478	348	Confine and contain wildfire
F	Sub-alpine fir (70% or more)	409	155	Confine and contain wildfire
F/LP	Sub-alpine fir/Lodgepole pine	60	60	Treat for insect mitigation and noxious weeds
F/A	Sub-alpine fir with scattered Aspen	42	42	Treat for aspen regeneration and noxious weeds
S	Spruce (70% or more)	651	233	Confine and contain wildfire
S/F	Spruce/Fir with S dominate but neither over 70%	211	154	Confine and contain wildfire
S/LP	Spruce and Lodgepole	280	185	Confine and contain; Fuel hazard reduction wildfire
Total Acres		9,802	5,707	

Note: The forested summary acreage totals are rounded off and do not represent the total acreage of the Elk Mountain geographic area alone. In addition there are 350 acres of rock slides and outcrops (48 acres on deeded lands) and there are alpine grasslands on the mountain but accounted for in the non forest summary and not this one. Also, some of the limber pine and much of the aspen is included in the forested summary but not on the Elk Mountain geographic area.

Aspen

There are approximately 753 acres of aspen woodland on the Ranch. Aspen is found as a forest type in association with other forest types on Elk Mountain and around it's base and as woodland in stringers and patches associated with mountain shrub land and grassland types. Single aspen trees and small stringers and patches are found all over the mountain in association with all the coniferous cover types at all elevations and on all aspects.

Aspen grows in clones that appear as groves, with new trees developing from root sprouts. Seedling establishment is rare. Each grove of aspen develops as a genetically uniform clone. All of the trees are actually part of one or a few plants.

Because of its ability to sprout, aspen persists in some coniferous forests until the next disturbance. Sprouting greatly facilitates vigorous aspen regeneration (secondary succession) because the sprouts have more stored energy available to them than do seedlings.

Mixed Conifer

The majority of the forests at the middle elevations are mixed conifer. The mixed conifer is comprised of a mix that varies in proportions between limber pine, lodgepole pine, Douglas-fir, sub-alpine fir, a few ponderosa pine trees, and aspen (which is not a conifer). There are approximately 5,124 acres of the mixed conifer on Elk Mountain- 2,937 acres are on deeded lands (MC+MC/A). Approximately 300 to 400 acres are accessible and operable for timber harvesting. At this time, however, it is not commercially viable.

The mixed conifer stands along the mountain's main access road were recently logged on a small scale.

Prior to when fires were controlled the mixed conifer probably contained much larger proportions of Douglas-fir and ponderosa pine and the stands were much more open than they are today. When logging occurs or when there is disturbance from insects and disease the proportion of lodgepole and aspen increases.

Douglas-fir

In most of the forested areas Douglas-fir is a component within the mixed conifer mosaics. Douglas-fir appears in many spots as a small stand intermingled with the other mixed conifer species. However, on the north end of the mountain at the mid-level elevations there are a few stands where Douglas-fir dominates. Other conifer species are present but in quantities less than Douglas-fir. There are approximately 843 total acres of the Douglas-fir vegetative type on Elk Mountain – 506 acres is on deeded lands.

Most Douglas-fir stands on the ranch are relatively accessible and operable for commercial harvest. However, all of the best Douglas-fir saw timber has been harvested within the past 40 years. Therefore, there are usually two age class generations. One generation has relatively young pole-sized trees and saplings with an average age of 10 to 40 years and an older generation of more notable trees that are two to four hundred years old. These over-mature trees are valuable wildlife habitat and provide a sense of wonder in the casual observer.

Lodgepole pine

There are approximately 581 acres of the lodgepole pine cover type on the Elk Mountain of which 307 acres are on deeded lands. There are places where lodgepole pine may be the dominant species but it often occurs in a variety of

proportions with sub-alpine fir. In addition, all of the mixed conifer includes lodgepole pine as a major component and there are over 5,000 acres of mixed conifer on Elk Mountain.

Most of the lodgepole pine vegetative type on deeded lands is operable, however, it is not commercially viable at this time because of road cost and low timber volume. The best commercial saw timber was harvested in the past 10 to 40 years.

Lodgepole pine is the most common coniferous tree on the slopes of Elk Mountain and is a major component in the mixed conifer vegetative type. It is in the “yellow pine” family. Lodgepole pine trees are known for their straight pole-like growth form. This species often occurs in pure “dog hair” (dense) stands and it occurs in a mixture or blend with Douglas-fir, sub alpine fir, aspen, limber pine and spruce. It is the species most popular for the first railroad ties and building materials as well as firewood.

On the north end of Elk Mountain at the lower and mid-elevations Lodgepole and other tree species were harvested by Union Pacific and the US Army for a variety of products in the 1860s and 1880s. Lodgepole along with other species have recently been logged on a small scale near the mountain’s main access road. In both locations the tree density is relatively open and it is healthier than in the places where no disturbance has occurred.

All around Elk Mountain there is evidence of mountain pine beetle activity but only in small pockets. A 2005 aerial survey indicated less tree mortality from mountain pine beetle than in 2004. More of this is discussed in Part 2.

Limber pine

Limber pine woodland and forested areas occur all around the sides of Elk Mountain, particularly at the lower elevations. Generally, limber pine is too knotty for commercial value. There are approximately 850 acres of limber pine on the Elk Mountain ranch, 556 acres, of which, are deeded. Scattered limber pine trees or small clumps of trees are also associated with the sagebrush type and all the other conifer forest types.

Limber pine is part of the “white pine” family of pines and is characterized by the exceptional flexibility of its twigs large yellow and sappy cones and shrubby or limb dominated growth form.

Limber pine is found in open stands (woodlands) and in association with aspen, Douglas-fir, lodgepole pine and sub-alpine fir in the forest type. The density varies from open to completely closed with under story species density and diversity inversely related to over story closure.

With the absence of fire limber pine is spreading along the foot of Elk Mountain into the shrub land areas.

On Elk Mountain there is significant white pine blister rust mortality. Where this is occurring both lodgepole pine and aspen are filling in the openings formerly occupied by limber pine.

Generally, most limber pine is too knotty for commercial value.

Sub-alpine fir

There are approximately 501 acres of sub-alpine fir cover type on the Ranch of which 257 acres are on deeded lands. Most of this occurs in small patches and stringers scattered around the mountain. The majority of the sub-alpine fir is found in association with other species in the mixed conifer or with just one other species such as lodgepole pine or spruce. Approximately 100 to 200 acres, has commercial value. This association usually develops in cool, moist locations and experiences fire-free intervals of 100 to 150 years. Fire-free intervals are shorter where the type occurs on dryer, warmer sites.

The sub-alpine fir vegetative type association occurs in a variety of forest and habitat types that evolved with a variety of fire regimes. It is characterized by its “Christmas tree” growth form and by its cones standing upright on branches high on the tree crown.

There are numerous small pockets of sub-alpine fir tree mortality caused from Western balsam fir bark beetle.

Spruce

This forest type is most prevalent on the higher elevations of Elk Mountain. There are approximately 1018 acres of the spruce type and spruce-fir mix with aspen and lodgepole. Approximately 572 acres are on deeded lands.

In general, Engelmann spruce may live five hundred years or longer. Its growth form is also “Christmas tree” like. It is characterized by its scaly bark and small elongated cones with thin scales that hang down from the branches at all levels. Some of the spruce near the primary access road on the mountain has been harvested within the past 40 years.

Other trees

Other trees found on and around the mountain but not dominant or in great numbers are ponderosa pine, Rocky Mountain maple, Rocky Mountain juniper, and cottonwood. Ponderosa pine is seen occasionally at the lower elevations. Ponderosa pine was probably more common before logging occurred and before wildfires were controlled in the late 1800s.

Cottonwood is not common but found in small patches and stringers along Rattlesnake Creek and possibly other creeks as part of the riparian.

Non-Forest Land

Non-Forest Land Summary (Also in Part 2)

The non forested areas have been inventoried as “Units”. Each unit represents vegetative type with similar characteristics, uniform in species composition, age class arrangement and condition.

There are 16 different units of non forest vegetation type on the Elk Mountain Ranch. Descriptions of each of units as they occur follow:

Non-Forest Unit Summary Table (Also in Part 1)

Unit Designation	Non Forest Type	Total Acres	Deeded Acres	Treatment Recommendation
MS	Mixed Shrub land	2,424	1,710	Grazing management
MS/ C	Mixed Shrub land with Ceanothus	79	78	Grazing management
MS/A	Mixed Shrub land with Aspen	202	125	Protect springs from livestock grazing
SB	Sagebrush	12,005	8,657	Grazing management, spot prescribed fire and brush beating.
SB/WP	Sagebrush with Limber Pine	813	805	Spot prescribed fire and brush beating
G	Grassland	3,517	2,573	Grazing management
G-alpine	High elevation open grassland	152	0	None
G-Krumholz	High elevation grassland and conifer Krumholz	394	237	None
G/S	High elevation grassland with scattered Spruce	78	63	None
M	Meadow and irrigated Pastureland	2,261	2,030	Grazing management, ditch maintenance, control noxious weeds
MW	Wet Meadow	91	70	Clean ditches to provide drainage
M/R	Mosaic of Meadow and Riparian	205	185	Clean ditches and treat noxious weeds
R	Riparian	593	470	Control noxious weeds
R/A	Riparian dominated by aspen	44	44	Control noxious weeds
Rock	Rock outcrops or rock talus	3	0	None
Rock/WP	Rock outcrops with scattered Limber pine	347	48	None
Total Acres		23,207	17,095	

Note: The non forest summary acreages are rounded off totals and do not represent the total acreage of the lands at the lower elevations away from the geographic area of Elk Mountain. There are several acres of lake and pond surface not included in the above totals and several acres of aspen and limber pine in the lowlands that are included in the forested acreage summary. On top of Elk Mountain there are alpine grasslands, rock slides and rock outcrops accounted for in the non forest acreage totals above.

Shrub lands

There are approximately 16,000 acres of mixed shrub and sagebrush shrub lands or about 48 percent of the land on the Ranch. The shrub land occurs on all the foothills and low lying areas around the foot of Elk Mountain on Halleck Ridge and Sheephead Mountain. The shrub land is a mixed low to high growing shrub community dominated by various sagebrush species. The density varies from open to a closed canopy.

Most of the shrub lands along the foot of Elk Mountain are dominated by sagebrush but in association with dense and scattered patches of mountain mahogany, antelope bitterbrush and a variety of other species such as service berry, snowberry, and even chokecherry.

On Halleck Ridge and Sheephead Mountain the shrub land is dominated by sagebrush with a light scattering of mountain mahogany and other species.

On the lowlands and flats adjacent to the grasslands and irrigated pasture, areas favored year around during the past 10 years by the ranch buffalo, the shrub lands have been heavily browsed and hedged to the detriment of plant health. With the removal of the buffalo this will probably recover.

Grassland

There are approximately 4,100 acres of open grassland on the Ranch. Most of the grassland occurs in the lowlands surrounding the mountain. However, there are several open grassland patches on the mountain intermingled with the forest types.

The foothill and mountain grasslands often develop on windy slopes or plateaus or relatively flat areas where snow does not accumulate in large quantities, where soils are too shallow for various shrub species, or where summer rainfall is higher. Grassland occurs throughout the foothills surrounding the Elk Mountain Ranch and in patches on Elk Mountain.

Irrigated Pastures and Meadows: Most of the irrigated pastures and meadows occur naturally along the lowlands between the Rattlesnake pass Road (CR 600) and the foot of Elk Mountain. Generally the pastures and meadows feature Timothy and a variety of fescues, brome grasses and wheat grasses laced with narrow stringers of willow riparian. Portions that are in low areas or that have not been allowed to dry up have sedges and rushes.

These irrigated pastures and meadows have been used for both livestock grazing and putting up grass hay since the late 1800's and have served as the focal point of the ranch in the past.

Riparian

There is an abundance of thin willow riparian zones associated with all the drainages within and around the lowland pastures and meadows. Halleck Creek is the primary perennial stream that provides irrigation water, some of the drainages are ephemeral and some are long standing irrigation ditches.

Along Rattlesnake Creek the riparian vegetation consists primarily of willow, alder, chokecherry, cottonwood, spruce, sub-alpine fir and aspen. The branches Halleck Creek riparian are primarily willow, alder, chokecherry, and aspen. The Brush Creek riparian is similar to the branches of Halleck Creek with willow, alder, chokecherry, and aspen.

Noxious Weeds

There are several species of noxious weeds found on the ranch. Russian knapweed and spotted knapweed have been identified and are being treated by Elk Mountain Ranch in cooperation with the Carbon County Weed and Pest Control. The knapweeds were located along Rattlesnake Creek riparian areas, roads and in the irrigated pastures. Canada thistle and cheat grass was observed in riparian areas, near springs, mesic areas and, in particular, along disturbed areas, roads and trails and in areas that had been logged on Elk Mountain. Skeleton weed was observed at a few locations in the grasslands and in the sagebrush

Wildfire

Fire has been an important part of the Elk Mountain landscape since lightning and vegetation commingled. Fire scars on an old Douglas-fir stump near the main house indicated the presence of historic wildfires on the Ranch. The tree's origin dates back to 1802. From 1802 until the tree was harvested in 1993 at least six fires burned hot enough to leave a scar in the trees cambium. These fires occurred in 1821, 1828, 1842, 1852, 1869 and 1876. This tells us that the area had an average fire return interval of eleven years before European influence interfered with fire's cleansing action.

Without fire's occasional visit dead woody fuel has accumulated on the forest floor and vegetative cover types have changed dramatically. Some trees and shrubs, like Douglas-fir, aspen, ponderosa pine, mountain mahogany, serviceberry and ceanothus are well adapted to fire and do well in its presence. Other trees like sub-alpine fir and the spruces are less tolerant of fire. A long term absence of fire on the Ranch has allowed less fire tolerant species to gain more prominence and fire dependent species to fade away. This has profound long term effects on vegetative diversity and plant densities.

Fire will come to the Mountain again. When it does it will burn hotter than fires of the past. More tree crowns will be killed and the process of reforestation will take longer.

Wildfire hazard on the Ranch is moderate to high. Table 3 Expected Fire Behavior by Vegetative Type provides some insight into how a fire may spread on the Ranch during periods of high winds and dry conditions.

Table Depicting Expected Fire Behavior by Vegetative Type

VEGETATION TYPE	RATE OF SPREAD FEET/HR	SIZE AFTER 1 HOUR ACRES	FLAME LENGTH FEET	SAFETY ZONE SIZE (AC)	WILDFIRE HAZARD
Grass	22,000	12,151	9	2.13	Moderate
Sagebrush & mixed shrub	12,600	2,940	14	8.83	High
Grass/Dense young conifer	18,678	6,375	37	28.32	High
Spruce, sub-alpine fir	448	4.1	2	0.32	Moderate
Ponderosa pine aspen leaves in fall	2,983	164	7	1.43	Moderate
Plentiful dead/down Debris in forested area	2,092	80	10	2.62	High
Light logging slash or blow-down	1,234	28	6	1.23	High

Note: All fuel models had spotting distances of 0.4 miles. The BEHAVE fire prediction modeling system predicts ground fire activity only. Crown fires are too unpredictable and dynamic to allow for reliable modeling. Sustained crown fires can occur anytime crown cover is greater than forty percent and ground fuels are heavy.

Geology and Soils

The Elk Mountain was initially mapped by Clarence King with the U.S. geological exploration of the Fortieth Parallel, and was published by the US Army in 1876. In 1937, J.T. Isberg, a graduate student at the University of Wyoming published the first detailed account of the geology of the area. Pete W. Jacoby Jr., in his 1971 PhD Dissertation, provided a good summary of the geology of the area.

In general, Elk Mountain is comprised of Pre-Cambrian granite on most of the mountain at higher elevations, and granite mixed with conglomerates (Cloverly) and limestone (Madison) on the mid slopes, and sandstone (Tensleep) formations on the lower watershed and the rolling grasslands. This interface of sandstone and granite along fault lines probably has resulted in the perennial but intermittent nature of Rattlesnake Creek, Halleck, Brush and Johnson creeks.

Available soil information is sketchy. Soil inventory within and around the Elk Mountain Ranch has not yet been completed by the Natural Resource Conservation Service (NRCS). However, there is a very limited amount of soil inventory on Halleck Ridge NE of the Elk Mountain Ranch and some of the inventory extends beyond the boundary and is applicable on that part of the Elk Mountain ranch.

In general, there are different soil types throughout the ranch. Soils over granite materials are usually sandy loams, over sandstone are either sandy or sandy loams, and over the conglomerates are clays or sandy clays. On the upper slopes of the ranch, the soils are usually sandy or sandy loams with high erosion potential, but adequate water percolation and retention characteristics for re-vegetation by trees, grasses and forbs. Throughout the foothills of the ranch the soil is a generally deep clay loam, poorly drained and usually moist. Aspen woodland, grassland and shrub land are most often the dominant vegetation type. It can be easily re-vegetated with adaptable (especially on mesic sites) species.

Water Resources and Watershed Conditions

General Watershed Condition

In general, the watersheds on the Elk Mountain Ranch are in relatively good condition. With the exception of road drainage, disturbances from previous management activities, e.g. grazing, logging, and other uses, have or are in the process of recovering. While the mountainous portion of the ranch has shallow soils and steep slopes, ground cover is in good condition to help reduce surface runoff and sedimentation. Most riparian areas are demonstrating good recovery from previous uses (see riparian discussion in this report).

Roads and Trails

Except for the main entrance road all of the roads and trails on the ranch are classified as un-maintained or poorly maintained. They have no surface gravel and their stability depends entirely upon the characteristics of the natural soil and road design. Many of the roads and trails at the lower elevations are vegetated with grass and forbs and most of the ranch roads are for only for ATV or 4x4 wheel drive vehicles.

In some places, at the lower elevations, constructed roadways are blocked by fences causing ATV users to detour around the fence barrier creating potential new travel routes that, in time, will develop into eroded road segments. The erosion damage on these segments will be very difficult, and often times, expensive to repair.

Ranch road use is light and the system is adequate for the current level of use. However, CR 600, because it is a public road, has a potential for heavier use. CR 600 soils are primarily deep clay loam soil texture and lack of surfacing material is causing the road to be impassable in wet weather.

The main access road to the top of the mountain and the connector roads that feed to and from the mountain road would all need surfacing material (gravel) and maintenance to accommodate logging trucks or any heavy traffic. Adequate drainage is poor or non-existent on many roads throughout the ranch, particularly in the mountainous areas. Excessive rill and gully erosion is occurring on some road segments. Most of the drainage structures, e.g. water bars, installed during road construction or logging are no longer functional. Some of the low-water stream crossings need to be modified to reduce erosion and sedimentation.



Eroding roadway that needs water diversion to reduce channeling (north side of Mt.)



Road erosion due to water channeling in roadway for several years

Streams

Elk Mountain lies on the watershed divide between the Medicine Bow River and Pass Creek watersheds, two major tributaries of the North Platte River in south central Wyoming. Within the Elk Mountain Ranch there are four perennial streams and over 25 ponds and lakes. The headwaters of two major streams, Rattlesnake and Halleck Creeks, are found on the ranch. Two other lesser headwater streams, Brush Creek and Johnson Creek, also originate on the ranch. Rattlesnake Creek is one of the larger headwater tributaries in the Pass Creek watershed, and drains the entire western side of Elk Mountain. Brush Creek is a smaller tributary of Pass Creek, and drains the southwestern flank of Elk Mountain. Halleck Creek is a smaller headwater tributary of the Medicine Bow River, and drains the north and northeast flanks of Elk

Mountain. Halleck Creek has four distinct headwater branches, which come together to form the main stem of the creek just below the headquarters of the ranch. Johnson Creek is a lesser tributary of Mill Creek, another of the many Medicine Bow River feeder streams, and drains a small portion of the eastern flank of Elk Mountain.

Assessment Methods and Protocols

For the purposes of this assessment, each stream was delineated into distinct reaches, or segments, based on valley type, channel morphology, perennial vs. intermittent flows, and administrative or physical boundaries. Reaches are numbered consecutively, beginning at the furthestmost downstream ranch boundary, and continuing upstream to the headwaters. Only streams that had detectable flow were assessed for fisheries condition and potential. Many of the dry streams were also assessed for riparian condition. The reach delineations are displayed on Stream Reach Delineation Map.

Wetlands

There are several potential wetlands within this ranch where impacts may need to be considered if logging and the associated road improvement work is planned. They are within all the following drainages particularly Rattlesnake and all branches of Halleck Creek. These sites appear to be waters of the United States, and are subject to regulation Section 404 of the Clean Water Act.

Available soil information is sketchy. Soil inventory within and around the Elk Mountain Ranch has not yet been completed by the Natural Resource Conservation Service (NRCS). However, there is a very limited amount of soil inventory on Halleck Ridge NE of the Elk Mountain Ranch and some of the inventory extends beyond the boundary and is applicable on that part of the Elk Mountain ranch.

There are many different soil types throughout the ranch. Throughout the foothills of the ranch the soil is a generally deep clay loam, poorly drained and usually moist. Aspen woodland, grassland and shrub land are most often the dominant vegetation type. It can be easily revegetated with adaptable (wet location) species.

Cultural and Historical Sites

On the ranch there appears to be several historical and cultural sites some of which date back to the 1860s and before. These sights continue to need protection. Their protection needs to be provided for as management activities on the ranch precede. If the owner is interested restoration would be very beneficial to preserving the artifacts for future generations to appreciate.

Most of the cultural and historical places would not be significantly affected by road improvement or logging activities on the ranch.

The following is a list of most of the known historical and cultural resource sites:

- Ft. Halleck blacksmith shop
- Ft. Halleck Memorial site (1914) and cemetery (1862)
- Stone carvings by Ft. Halleck soldiers (1863)
- Siltamaki Homestead
- Indian burial ground and artifacts
- Huey Cook Homestead (house, well, artifacts)
- Joe Cook relatives homestead
- Soldier firewood gathering area for UP locomotives (1862-1866)
- Old Copper Mine
- United Airlines DC-3 crash site (January 31, 1946)
- Big Nose George shot the Sheriff (August 19, 1878)
- Old Sawmill
- Rattlesnake Ranch
- Spruce Cabin
- Mullen Ranch
- Quaely Homestead (cabin)
- Overland Trail
- Hanna Water supply and site for World War I Army Barracks
- Several Old Cabins of unknown origin

There is more information about some of the historic features in the Conservation Easement Report and in Appendix E. Also, there is more historic information available in local libraries and on the internet, particularly about Fort Halleck and the Overland Trail.

Wildlife

Within the Elk Mountain ranch property there is habitat for numerous species of mammals and birds.

Much of the species occurrence information provided in this document was obtained from the "Atlas of birds, mammals, amphibians, and reptiles in Wyoming", published by the Wyoming Game and Fish Department, Wildlife Division in June 2004. The publication provides the best and latest species occurrence and distribution information available. For species distribution and occurrence, data is displayed in 27-one degree of latitude by one degree of longitude blocks covering the state. The species displayed for this document are those listed as occurring in Latilong Block 26 which covers the southeastern 2/3 of Carbon County and extreme southwestern Albany County. A few species of importance that have been reported in the area have also been

added to the list. Appendix H, Table 1 of Part 2 displays all wildlife species likely to occur on the ranch.

The Elk Mountain Ranch is rich in plant and animal diversity. The forest stringers and islands that are found adjacent to sagebrush/ grasslands provide good diversity of habitat for wildlife species. Their importance as habitat should not be overlooked during ruminations about the best ways to manage the forested areas.

The avian community is the most diverse of all the wildlife groups. Of the 265 species of birds likely to occur in Atlas Block 26, 262 species are likely to occur at some time on the Elk Mountain Ranch. About 70 percent of the birds likely to be observed on the ranch are migratory. Some, like the white-crowned sparrow may only travel a short distance to spend the winter at lower elevations along the Front Range of the Rocky Mountains. Other species like the Wilson's warbler and broad-tailed hummingbird may travel thousands of miles to spend the winter in the tropical rainforests of Central America. Unlike tropical migrants, some bald eagles may nest in the area and others may fly in from more northern regions to spend the winter here. Over half of those species likely to occur here are songbirds and most of them are migratory because they feed on insects and must move south to find a food source during the winter months. Some adjust their feeding habits during the winter months and feed on seeds and other food sources and avoid the long trip south.

Some species have strong ties to certain habitat types. Of the 262 avian species likely to occur on the ranch, 63 species have strong ties to coniferous and deciduous forests, 64 species need open water or marsh habitat, 31 species have strong ties to basin prairie shrub lands and grasslands and 38 species have strong ties to riparian habitats. However, riparian habitats are used to some extent by at least 70 percent of the avian species.

Inhabitants of the area include 8 species of woodpeckers. Each year these primary cavity nesters create new cavities, leaving the old ones for other cavity nesting species. Most of those cavities are created in snags or dead trees. As a tree dies, sections of it decay, creating soft wood where primary cavity nesters like woodpeckers can create cavities. They are very important in the ecosystem because the nest cavities they create are used by at least 21 other species of birds and mammals that occur on the property for nesting and shelter.

Birds of prey comprise at least 24 species of the avian inhabitants here. In addition to the bald eagle that winters in the area, there are several long distance migrants like the burrowing owl, peregrine falcon and Swainson's hawk that fly to the tropics to spend the winter. The Swainson's hawk makes a dramatic post-breeding shift to a diet of grasshoppers and migrates to Argentina to spend the winter (11,000 miles round trip).

At least 6 species of big game mammals are likely to occur on the ranch. They include Rocky Mountain Elk, black bear, mule deer, white-tailed deer, pronghorn, and mountain lion. At least 29 species of medium sized mammals may occur on the ranch. They include upland game mammals like desert cottontail, snowshoe hare and eastern fox squirrel. A number of predators like coyote, gray fox, red fox, swift fox and bobcat may also occur on the property. Furbearers like beaver, muskrat, marten, mink and otter may also occur on the property. At least 31 species of small mammals may occur here.

The reptile and amphibian community is less diverse with only 6 reptile species and 4 amphibian species likely to occur on the range. Elevation exerts its influences on amphibians and reptiles primarily in extremes of environmental conditions. Low oxygen levels at higher elevations may create problems for some egg laying species. These influences result in a short list of amphibian and reptile species inhabiting the area. All four amphibian species listed in Appendix H are strongly tied to small ponds, marshy streams and wet meadow habitats.

The University of Wyoming maintains the Wyoming Natural Diversity Database which tracks Wyoming plant and animal species of concern. Species of special concern for the Elk Mountain area are displayed in Appendix 5, Table 1 of Part 2. The list of species likely to occur on the ranch includes 33 avian species, 4 mammal species and 2 amphibian species. Six of the avian species (peregrine falcon, bald eagle, Clark's Grebe, greater sage-grouse, loggerhead shrike, and northern goshawk) were documented during field surveys. One amphibian (Northern leopard frog) was documented at Wankan Tanka Lake during field surveys.

A series of wildlife surveys was conducted on the ranch from July 27 through August 2. A total of 140 points were sampled, covering most parts of the ranch. Survey routes were set up on roads and two track trails throughout the ranch. Sample points were established at .2 mile intervals. A pause of 2 minutes was used to allow things to calm down prior to the start of each count. The surveys were started at first light and continued until mid morning when the rising temperatures began to influence animal movements and visibility.

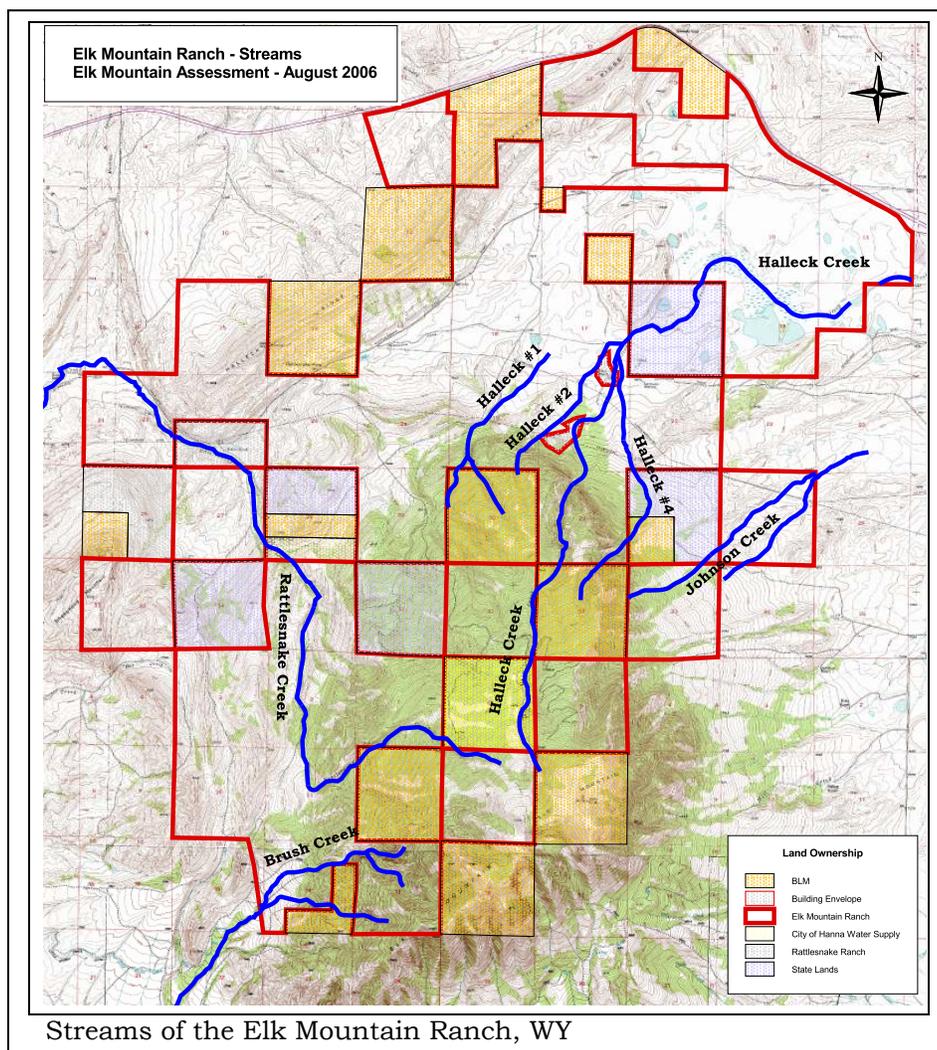
A general description of the vegetation was recorded at each location. A count period of 5 minutes was used at each location and all birds and animals seen and heard were recorded. The survey results are recorded in Appendix H, Table 1 of Part 2. The column entitled "Actual on Elk Mountain Ranch" contains the point count survey information. The number on the left side of the column is the total number of survey points where the species was detected. The number on the right side of the column represents the total number of the species observed at all points for all surveys.

During field surveys 103 bird species, 23 mammal species, 1 amphibian and 2 reptile species were documented on the ranch. The most common and wide spread bird species recorded was the Clark's Nutcracker for which 147 individuals were recorded and they were observed at 48 of the 140 points around the ranch. Flickers were quite common with 89 being observed at 42 locations and 83 mountain bluebirds were observed at 20 locations. Pronghorn was the most common big game species with 186 being observed at 25 locations. Elk were next in abundance with 96 being observed at 7 locations and 32 deer were observed at 9 locations.

Fisheries

Note: There are photos, maps, tables and charts in the fisheries section labeled on a system only for the fisheries discussion and section.

Elk Mountain lies on the watershed divide between the Medicine Bow River and Pass Creek watersheds, two major tributaries of the North Platte River in south central Wyoming. Within the Elk Mountain Ranch there are four perennial streams and over 25 ponds and lakes. The headwaters of two major streams, Rattlesnake and Halleck Creeks, are found on the ranch. Two other lesser headwater streams, Brush Creek and Johnson Creek, also originate on the ranch. Rattlesnake Creek is one of the larger headwater tributaries in the Pass Creek watershed, and drains the entire western side of Elk Mountain. Brush Creek is a smaller tributary of Pass Creek, and drains the southwestern flank of Elk Mountain. Halleck Creek is a smaller headwater tributary of the Medicine Bow River, and drains the north and northeast flanks of Elk Mountain. Halleck Creek has four distinct headwater branches, which come together to form the main stem of the creek just below the headquarters of the ranch. Johnson Creek is a lesser tributary of Mill Creek, another of the many Medicine Bow River feeder streams, and drains a small portion of the eastern flank of Elk Mountain.

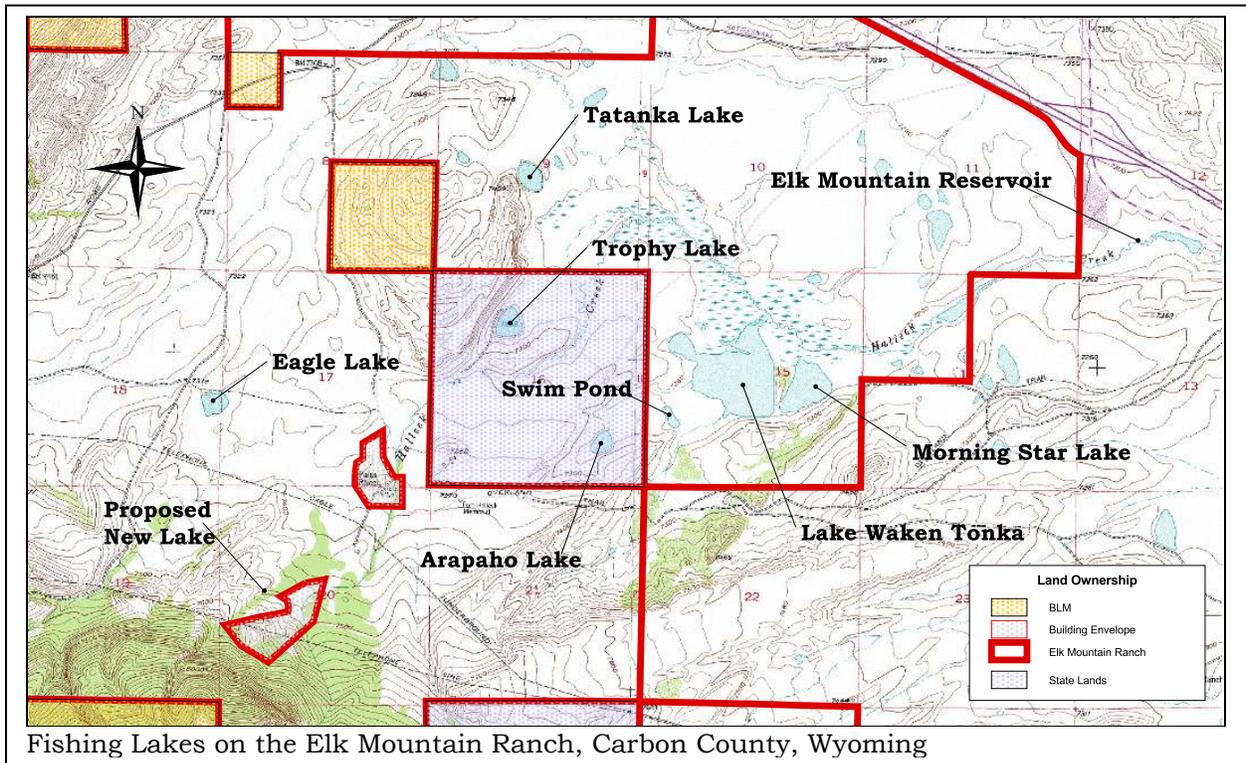


Historically the North Platte River drainage had no native salmonids (Hayden 1871). Native fish in the North Platte included several species of darter, sucker, dace and minnow. Population data on native fish range, assemblages and density has not been collected within streams on the Elk Mountain Ranch. Native amphibians also occur in the region, and include the Northern Leopard frog (*Rana pipiens*) and the boreal toad (*Bufo boreas boreas*).

Stocking by private individuals and State wildlife management agencies over the last century have introduced several species of trout to the headwaters of the North Platte River. The North Platte River, Medicine Bow River, and many of the watershed's headwater tributaries now support populations of brook

trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*) and cutthroat trout (*Oncorhynchus clarki* sp.).

Low flow conditions are a serious limit to all of the streams on the Elk Mountain Ranch. Several reaches of Brush Creek, Johnson Creek and Rattlesnake Creek usually lose their surface flow over a segment in late summer and fall. The resulting fragmentation of aquatic habitat appears to result in all of the headwaters being fishless. No fish were observed in any of these reaches during the course of the assessment in August 2006.



All of the lakes and ponds on the ranch are within the Halleck Creek watershed, at elevations below 7,300 ft. Most of the ponds are primarily for livestock water. Many are shallow and will usually become dry in late summer and fall. However, there are seven ponds that have enough depth and year around water to support populations of trout and other sport species. These ponds capable of supporting fisheries are Lake Waken Tonka, Morning Star Lake, Arapaho Lake, Trophy Lake, Lake Tanaka, Eagle Lake, and the Swim Pond. Additionally, a site has been identified on the 2nd headwater tributary of Halleck Creek where a new pond may be constructed that will support a cold-water fishery.

Over time, lakes change physically and chemically. Aging in lakes involves a progression of changes from deep, nutrient-poor oligotrophic water bodies eventually evolving into shallow, richly organic eutrophic lakes. As lakes

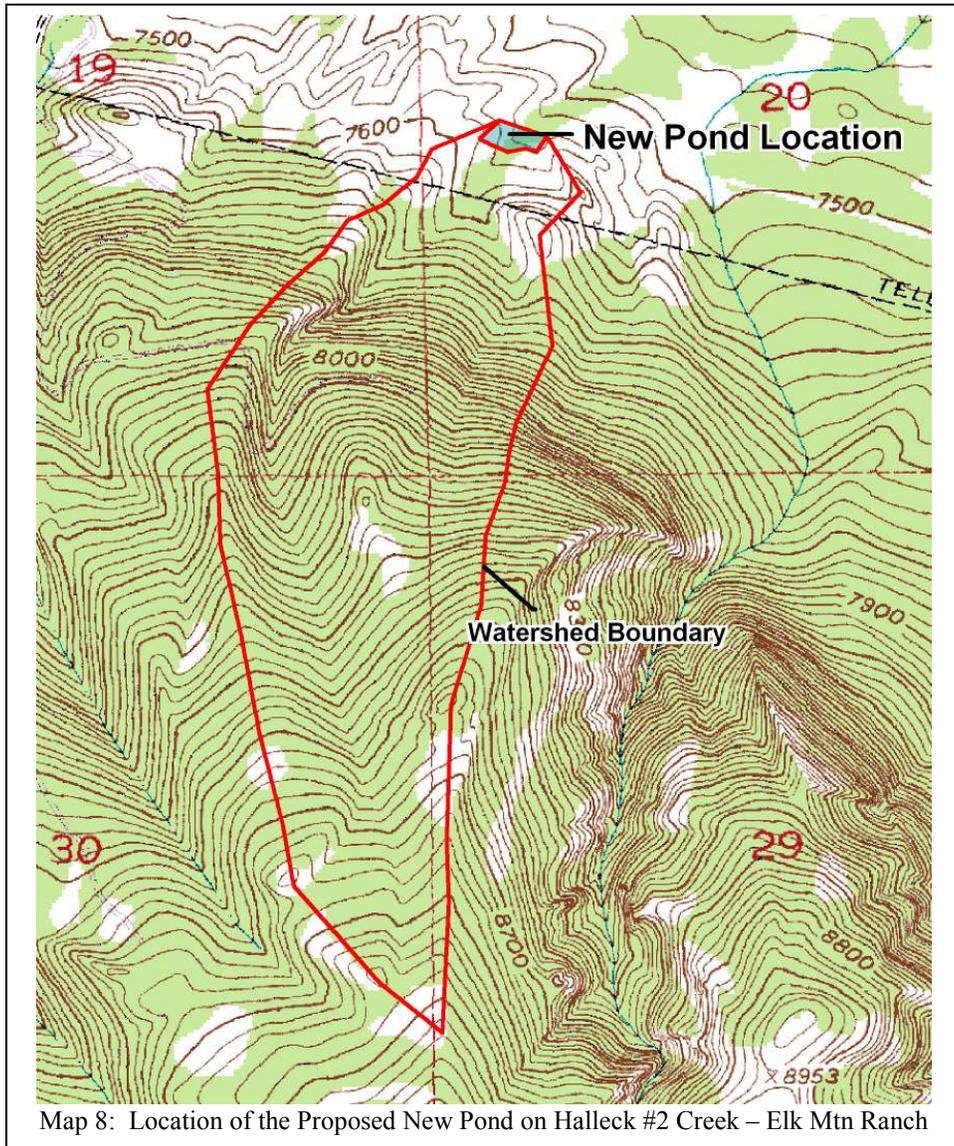
become more eutrophic, higher temperature and other water quality issues begin to affect the lake's capacity to support cold water species such as trout. With greater nutrient loads and temperature, undesirable aquatic plants, such as algae, floating and submerged weeds may become established. Proliferation of aquatic vegetation can lead to loss of suitable habitat for forage species and juvenile trout, higher pH, and temporal crashes of critical dissolved oxygen in the water as dead plants decay and consume the available oxygen in the system.

The seven "fishing" lakes on the property range from 1 to over 90 surface acres. Most of the lakes are located off of the main channel of Halleck Creek and its headwater tributaries, and are fed by underground springs. All of these lakes are surrounded for the most part by relatively dry prairie with no woody vegetation to provide solar shading in the summer months. All of the lakes, with the exception of the recently constructed Swim Pond, exhibit characteristics consistent with older, shallower eutrophic lentic systems, with limited profundal zones, significant aquatic vegetation, and relatively high temperatures.

Five of the lakes were excavator dredged in 2003, creating deep water trenches and islands along the edges of the water bodies. The spoils from the dredging apparently were not re-seeded, and this material is gradually eroding back into the lakes. Additionally, these disturbed areas have created opportunities for noxious weeds such as Canada thistle to become well established along the shorelines of most of these lakes.

New Pond (feasibility)

At the request of the landowner, several sites were examined along Halleck#2 Creek downstream of the new home site for possible construction of a new pond. This area is somewhat limited for construction of a pond, due to being located on an alluvial plain with steeper gradients and unconsolidated soils. We did find one location, immediately downstream of the road to the home site, where it may be possible to construct a small 1.5 acre pond. A site location of the pond is shown in the topographic map (Map 8).



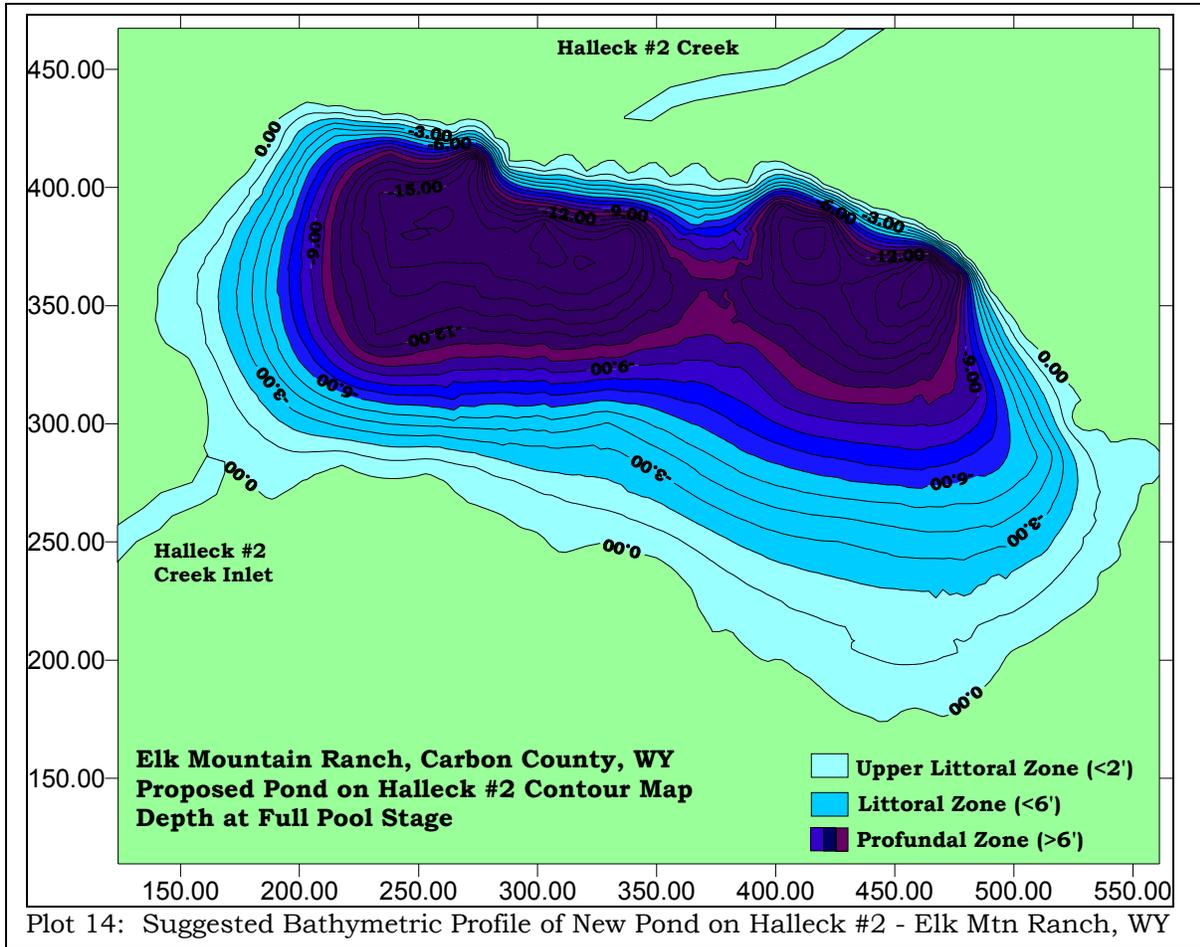
A preliminary plan and bathymetric profile of the proposed pond can be found on Plot 14. This site has an advantage of being located immediately downstream of an existing adjudicated diversion point, possibly simplifying the permitting and authorization process with the Wyoming State Engineers Office.

A pond constructed at this site would be a maximum of 16 feet deep, with approximately 33% of the water body comprising deep water profundal habitat. Of the remaining littoral habitat, 27% will consist of shallow upper littoral zones suitable for juveniles and forage species. The volume of this pond is estimated to be approximately 7 acre/feet. Adequate streamflow was observed in October, 2005 and August, 2006 (normally low flow months) to ensure a fresh-water environment for fisheries.

The watershed upstream of the proposed location is approximately 225 acres, with elevations ranging from 7,550 feet to about 8,900 feet. The mean annual precipitation for the watershed is estimated at 14 to 15 inches, with an average annual snowfall of about 85 inches (estimates extrapolated from the Elk Mountain weather station, continuous data from 1951-1980, 7,265 feet elevation). In general, the watershed is in good condition with primarily forested cover. However, because of shallow soils and steep slopes, surface run-off from high intensity precipitation events can be substantial and, because it will be an "on-line" pond, an adequate emergency spillway needs to be constructed. For design purposes, a 25-year, 24 hour precipitation is 2.4 inches and a 50-year, 24 hour precipitation is 3 inches (NOAA Atlas II, Volume II, Wyoming).

A pond in this location will likely require an engineered clay core, earthen dam constructed to a height of 25 - 30 feet. The length of the dam is estimated to be 250 feet. The dam would probably require a substantial spillway, given that it is located on-channel on Halleck #2 Creek, and for the most part will operate as a "run-of-the-river" reservoir. We recommend that both a bottom and top release be considered, in order to fully utilize management options for maintaining good water quality for the fishery.

The location of the proposed new pond is based solely on observed topology of the landscape and morphology of the stream channel. Additional feasibility studies will need to be undertaken before construction can commence. A soil and geotechnical analysis may be crucial to determine the feasibility of the dam location, and whether the pond could hold water without substantial supplemental lining of the benthic region. Construction of the pond will require approval from the State Engineer's office and a 404 permit from the US Army Corps of Engineers.



III. MANAGEMENT

MANAGEMENT GUIDELINES

Vegetation and Physical Features

Silvicultural Prescription (Forested Lands Only)

To meet the landowner goals, there are several issues that must be addressed. The first issue is to determine current health of forested lands and develop a plan for sustainable management. The second and third issues are managing the forest stands to improve wildlife habitat and prevent large-size disease and insect infestations.

The keys to all of the issues are stand density and vegetation management. The forest vegetation on the ranch is generally in fair to good health. Stands are too dense in many areas and vulnerable to large scale disturbances from insects, diseases and fire. By prescribing treatment where it is economically feasible and not damaging to wildlife habitat or watersheds, the long term health and conditions can be maintained or improved.

Estimates in this plan are not based on cutting all merchantable volume but rather on harvesting discrete stands for specific resource management goals. In the current instance the present owner wants to enhance wildlife habitat.

It is important to note that the cruise done for this management plan is at the planning level intensity and should not be used to sell timber. At best the estimates are good to $\pm 20\%$. A more accurate cruise at the planning stage would not be prudent. When a treatment is actually implemented a more accurate cruise will be needed during the layout process. It will provide a more realistic idea of product to be sold.

The preferred silvicultural system for the operable stands forested with lodgepole pine on the ranch is clear-cutting and overstory removal of the sub-alpine fir and spruce. Clear-cutting aspen stands that have been taken over by sub-alpine fir will stimulate aspen sprouting and regenerate aspen.

The purpose of the clear cuts will be to stimulate aspen growth and encourage long term lodgepole where there is good likelihood for species regeneration. The lodgepole pine stands appear to be holding their own and escaping the vagaries of advancing age. With bark beetles in some of the stands and in the surrounding neighborhood it is only a matter of time before all lodgepole pine is attacked. If a clear cut has aspen sprouts and young pine that need protection from browsing wildlife or livestock a brush fence could be constructed from

aspen stems. After the trees have become reestablished the fences can be burned.

Guidelines for aspen regeneration and sprout protection are as follows:

- Clear cut the entire aspen clone and all conifer trees to attain the best response of sprouts.
- Shape the clear cuts to fit the landscape and undulate the boundaries for a more natural appearance.
- Do not design any cuts on slopes that average over 30%.
- To insure protection of aspen sprouts and young pine from browsing wildlife or livestock construct a brush fence from tree stems.
- After the trees have become reestablished the fences can be burned.
- Make sure all equipment is pressure washed before it comes on the ranch to prevent the spread of noxious weed seed.
- Treat noxious weeds as soon as they become obvious in the cutting area. This will diminish the chances of a large infestation getting started.



Sample of brush fence constructed to Protect aspen sprouts in an area where livestock and elk use are significant. Fence can be burned when sprouts are established.

The purpose of the overstory removal is to salvage the older less vigorous trees in favor of the medium-sized and smaller spruce and sub-alpine fir. An overstory removal harvest is needed on the part of stands F/LP-1 between the clear cuts and patch cuts. Mortality in the overstory is high while the understory is well stocked and appears to be in good condition. Leaving the overstory on site will eventually result in significant dead down woody debris on site that will increase fire hazard and damage the understory when it falls. This will also reduce competition for the younger trees and should result in an acceleration of vigor and growth.

There is also an opportunity to improve some area's resilience to wildfire when it inevitably occurs at lower elevations of the Ranch. Some of the more recently logged Douglas-fir stands will benefit from a general slash cleanup.

Livestock grazing

The ranch has had a long and colorful history of grazing by large herbivores dating back to antiquity. Before European settlement buffalo, elk, antelope and deer grazed the area. Settlement and colonization of the West resulted in a change from these large herbivores to livestock (cattle and horses). The previous land owner converted the grazing program from cattle to buffalo. Recently the current owner has sold the buffalo and is in the process of restocking with cattle.

In the grasslands livestock should be managed to insure that goals are achieved and that grazing use is not detrimental to the ecological health. Livestock grazing should include management practices that allow for short periods of grazing followed by adequate rest (60 to 90 or so depending on growing conditions) to allow plant recovery before re-grazing occurs. In irrigated pastures the time allowed for recovery under good growing conditions can be shortened to 45 to 60 days. Grazing should not remove more than half of the available herbaceous or shrub forage (40 to 50 percent utilization on palatable species). The key to a successful livestock grazing program is to limit the opportunity a cow has to “re-graze” a plant before it has had time to recover from the first grazing.

In the Mixed Shrub and Sagebrush Shrub plant communities that are in the mule deer and elk winter range, livestock grazing management practices should be implemented that allow for grazing in the summer growing season followed by adequate rest to allow plant recovery. Grazing that removes the terminal bud retards stem production and results in a higher concentration of nutrients in the foliage. Forage conditions for wintering deer and elk are improved significantly. Grazing should not remove more than half of the available herbaceous or shrub forage (40 to 50 percent) utilization on palatable species.

Move the salt blocks away from the riparian areas and other favorite livestock use areas, insure growing season rest at least one out of every three years for the riparian areas. This will aid in the long term health of the riparian vegetation as well as help native vegetation compete with noxious weeds after the weeds have been treated.

High elevation grasslands

Grasslands at high elevations on Elk Mountain are scattered and cover only about a section. Due to the harshness of the sites and difficulty accessing the area, they are probably best reserved for wildlife

Irrigated pastures

When irrigated pasture conditions allow (roughness, presence of woody shrubs, boggy areas, etc), livestock grazing should be done in a rotational scheme with

cutting meadows for hay. When an irrigated pasture is allowed to grow up and be cut for hay the plants have a chance to replenish stored food reserves in the roots which significantly improves plant health and productivity. After a couple of years in hay production the pasture can be grazed by livestock and replaced by a pasture that has been in hay production. Pasture irrigation should be followed by a period of about two weeks when the pasture is allowed to dry up before the next irrigation. This drying up period is critical for maintaining grasses and forbs in the vegetation mix of the pasture. Failure to dry up portions of a pasture will usually result in sedges and rushes replacing the forage grasses and forbs and if not corrected it is common for wild iris to become established.

Noxious weeds

The Elk Mountain Ranch is fortunate to have a minimal level of serious noxious weeds that have invaded the natural plant communities. It is critical that the ranch establish an aggressive posture in identifying and controlling noxious weed invasions before they can spread across the ranch. Early detection and aggressive control is the key to success. Priority should be given to controlling Russian and Spotted knapweeds. Control of white top and Canada thistle should be treated seriously as they are very difficult to control once established. Cheat grass is a universal problem in the sagebrush type and should be considered for treatment carefully when disturbances or wildfires occur.

Wildfires

Wildfire should be managed under a “confine and contain” policy to reintroduce fire into the management scheme on the ranch. Naturally occurring fires can be useful in creating openings in the sagebrush and mixed shrub communities and curtailing invasion of woody species such as limber pine into shrub lands and grasslands.

Fences

The ranch has an extensive pasture system with soundly designed electric “let down” fences that has created about 30 small pastures. This network of pastures makes it possible to control the time grazing livestock stay in each pasture. Pasture fences should be restored to working condition. Any new pasture fences should be an electric lay down fence that can be laid down when livestock are not in the area to facilitate free movement by wildlife

Water developments

Where livestock water or water storage is inadequate for the number of cattle being grazed in a pasture, it may be necessary to determine how much water is needed if the herd all comes to water at the same time. Provide additional water storage to accommodate the number of grazing livestock that will need water.

Wetlands

On-site wetland delineation is required to determine if they are wetlands subject to regulation. If needed a wetland delineation consultant could perform the official delineation. More information is available on US Army Corps of Engineers web site for regulations and permits at <http://www.usace.army.mil/inet/functions/cw/cecwo/reg/> .

The ranch can obtain authorization from the US Army Corps of Engineers under Section 404 of the Clean Water Act prior to commencing with any activities that include a discharge of dredged or fill material in wetlands or other waters of the United States.

Roads and Trails

Restrict heavy equipment travel to the dryer colder times of the year to avoid damage during muddy conditions. Unsurfaced roads can have severe wet conditions inhibiting use.

Generally, most of the soil is not good for roadfill, topsoil, or earthen dams.

The soil types on Elk Mountain vary in erosion hazard tolerance for unsurfaced roads and logging activities.

The bottom line is that road use for heavy trucks and equipment will, as a minimum, need to be spot surfaced with gravel in the soft drainage areas and some drainage crossings will need temporary culverts.

All roads being used will need affective water drainage structures. The Wyoming guidelines for Best Management Practices (BMPs) to insure protection of water quality during forest stewardship activities would apply. See the management prescriptions within this plan and BMPs can be found at the following site.

<http://deq.state.wy.us/wgd/watershed/downloads/NPS%20program/silviculture%202004.pdf>.

Historic and Cultural Resources

If interested, the ranch could obtain a heritage resource assessment and clearance through someone authorized to provide this from the Wyoming Division of Forestry or the Natural Resources Conservation Service (NRCS). More information is available on SHPO web site. <http://wyoshpo.state.wy.us/> . If improvement work planned for deeded land affects historical or cultural features on public lands the “heritage resource clearance” is required.

Wildlife Habitat

Birds

- Greater sage grouse – This grouse is listed as a game species in the state and is also on the state species of concern list. In healthy habitats and healthy populations, hunting mortality is not a threat to their viability.
- Summer brood habitat – Sage grouse prefer areas with an abundance of forbs, grasses for hiding cover, and with live sagebrush along the periphery for escape cover. Summer brood habitat exists in the wet meadows in the northeastern part of the ranch (See vegetation map).
- Potential lek sites – Lek sites are openings with an abundance of sagebrush within 100 to 200 yards of escape cover. Lek sites may be in broad valleys or broad ridges, benches, and mesas. Sites used are generally close to or in large stands of sagebrush and have good visibility (to detect predators) and provide good sound carrying qualities. Numerous sites within the sagebrush habitat in the north, west and southwest part of the ranch have those characteristics. No use of any of those sites was documented during the field inventory. The most effective time to document active lek sites is during the spring breeding season (March 15 to May 15).
- Potential winter habitat – Sage grouse are completely dependant on sagebrush for forage and cover during the winter months. Areas available to sage grouse during the winter are largely determined by snow depth. Important areas during winters of deep snow are drainages because of tall, vigorous big sagebrush plants that are consistently available above the snow even during severe winters. Other areas providing important winter habitat include southerly and westerly aspects of slopes greater than 5 percent and flat, low areas with a slope of less than 5 percent.

The optimal conditions for sage grouse wintering habitat would include big sagebrush on slopes with southerly or westerly aspects with a canopy cover of 15 percent minimum and an average height of 12 inches and big sagebrush in drainages with a canopy cover of at least 30 percent and an average height of 20 inches. Numerous sites within the sagebrush habitat in the north, west and southwest part of the ranch have those characteristics. The southern slope of Halleck Ridge, sagebrush dominated southern exposure slopes in Sections 27, 28, 33 and 34 on the west side and Sections 2, 3, 10, 11 and 14 on the southwest side of the ranch contain suitable conditions for sage grouse winter habitat. Sage grouse are likely to move into winter habitat in late fall and remain there until early March depending on snow depth and climatic conditions.

- Bald eagle and other raptors – A bald eagle nest site has been documented in Section 4 in the northeastern part of the ranch and numerous red-tailed

hawk and other raptor nest sites have been documented around the ranch. Protection of active nest sites from human disturbance is important. Active nests should be protected from human disturbance within 250 yards of the nest from early March through July 15.

Mammals

- Elk – Elk are primarily inhabitants of the forested areas on the ranch during the spring, summer and fall months and move down to the sagebrush shrub lands and grasslands during the winter months.

Parturition – Cow elk with calves isolate themselves from the remainder of the herd for two to three weeks in parturition areas. Cow elk carefully select the calving grounds and they are generally in locations where cover, forage and water are in close proximity. Cow elk appear to prefer calving areas on slopes of less than 15 percent with adequate hiding cover and food near by. Water is usually in close proximity. Elk calving areas are typically found on south facing slopes of rolling terrain with aspen benches and dense understory of shrubs. An elk parturition area has been identified on the west side of Elk Mountain that encompasses parts of Sections 1, 12 and 13, T19N, R82W and Sections 6 and 7, T19N, R81W. (See Wildlife Feature Map). Because elk are sensitive to harassment from people, dogs, and predators during calving, traditional parturition areas that can be identified should be afforded maximum protection from disturbance during May and June.

Summer – After several weeks on the parturition area, the elk begin to gather up into herds. By mid-July herds of 400 animals are common on some summer ranges. During the spring and summer adult bulls usually segregate from cows, calves and younger bulls and are alone or form small herds of five or six animals. Younger bulls are usually mixed with cow-calf herds. A summer elk range has been identified near Johnson Creek on the east side of Elk Mountain in parts of Sections 28, 29, 32, and 33, T20N, R81W. (See Wildlife Feature Map). Summer ranges should be offered protection from excessive disturbance from July through September

Crucial winter range – Elk tend to inhabit higher elevations during spring and summer and migrate to lower elevations for winter range. When early winter snows begin to accumulate, cows, calves and most bulls begin to move down to winter ranges where they usually stay from December through March. An area of crucial elk winter range has been identified on the north part of the ranch covering Halleck Ridge and the area north to I-80 and a second area on the west side of the ranch (See Wildlife Feature Map).

Winter ranges should be offered protection from excessive disturbance from December through March.

- Mule Deer – Deer are primarily inhabitants of the forest and mountain shrub communities on the ranch during the spring, summer and fall months and move down to the sagebrush shrub lands and grasslands during the winter months. The mixed shrub communities in the coves on the south facing slope of Halleck Ridge and other similar areas are important summer habitats for deer and a variety of other wildlife species.

Summer – Mule deer fawning may occur on the ranch from April into June. Mule deer summer ranges are much more diverse and less defined than for elk. They inhabit virtually all of the forest and mountain shrub habitats on the ranch.

Crucial winter range – As winter approaches the size of mule deer herds increases and large numbers may congregate on wintering grounds. They generally stay on their wintering grounds from mid-November to mid-March and the area should be protected from excessive human disturbance during that time. A known mule deer winter range exists on the ranch (See Wildlife Feature Map). Winter ranges should be offered protection from excessive disturbance from mid-November through mid-March.

Vegetation Treatments

- Forests -The following are guidelines for vegetation intended to preserve forest habitat diversity on Elk Mountain for the majority of wildlife species that occur there. The diverse forest stands appear to be due in part to past logging activities and in part due to the diverse physical features of the mountain (soils, slope, aspect, topographic relief etc.).

Conifer – Continue to create small patch cuts and thinning operations in the conifer stands on Elk Mountain. This will allow for an even flow of age classes and conditions to maintain the habitat diversity important to wildlife species over time.

Aspen – A number of aspen stands are showing signs of decadence, probably due to their extended age. Other stands of aspen are being succeeded by spruce and fir. Some of those stands should be clear cut to allow for generation of new stands. This will help to maintain habitat diversity and future visual quality.

Snags – All snags that are not a safety hazard, should be left standing. They provide important habitat for cavity nesting species.

- Mixed shrub and grasslands – In the sagebrush community, small, spring prescribed burns would likely increase habitat diversity. Also in areas where the sagebrush has become decadent, brush beating of small strips on contour, less than 200 yards wide may regenerate sagebrush and increase habitat diversity. This would benefit sage grouse, elk, deer, pronghorn, livestock and many wildlife species.

Winter range – Use carefully timed, summer livestock grazing on winter range that results in termination of growth prior to culm production to trap nutrients in to the foliage and increase digestibility of the plants for wintering elk and deer.

Wet meadows – Domestic livestock use of riparian areas used by brooding sage grouse should be avoided if possible or minimized. In mid to late summer the livestock feed heavily on grasses, forbs and green leaves of riparian shrubs and consequently directly impact the food and cover value of these areas for sage grouse. Such impacts can result in reduced survival of sage grouse on their summer range.

Fisheries

Rattlesnake Creek:

Rattlesnake Creek has the greatest potential for sustaining a cold water trout fishery on the Elk Mountain Ranch. Management of this stream should focus on treating the actively eroding banks, either through mechanical treatments such as toe-slope stabilization and re-vegetation, or through natural processes. The riparian zone should be managed to encourage robust willow growth and regeneration. With good riparian management, the stream in the vicinity of the Rattlesnake Ranch may see beaver return and create pond habitats that will support a viable cold-water fishery.

The severe down-cutting occurring in Reach 1 needs to be immediately addressed. The active head-cuts can be controlled through the installation of rock or large wood cross-vanes to control their migration upstream. If allowed to continue, this vertical instability will result in significant loss of adjacent riparian vegetation and wetlands as the stream abandons the existing floodplain for a new, lower elevation.

Rattlesnake Creek upstream of the Rattlesnake Ranch has several steep banks that are slowly beginning to return to a sustainable angle of repose. Recovery of these banks may be accelerated by mechanically sloping back the banks, stabilizing the toe of the slope, and transplanting willow clumps. Reach 5 and 6 present the best opportunities for aquatic habitat manipulation and enhancement to dramatically improve the fishery. The stream upstream of

Rattlesnake Ranch appears to currently support a viable, self-sustaining population of brook trout, and therefore no supplemental stocking is recommended until such time as stream habitat enhancements can be undertaken. After this work is complete, the landowner may choose to supplemental stock more brook trout or perhaps introduce brown trout in order to produce hybrid Tiger trout within the reach.

Halleck Creek and Tributaries

A significant portion of Halleck Creek downstream of the headwater gorge is influenced by irrigation practices and water diversion. This seasonal dewatering and augmentation may result in negative effects due to variation of the natural hydrograph of the stream and fragmentation of aquatic habitat. Additionally, historic and current agricultural practices may be limiting the potential of the stream to sustain a viable aquatic ecosystem. Historic data indicates that a self-sustaining brook trout fishery was once present on this stream, but current observations would indicate that this may no longer be the case. Aquatic habitat conditions throughout this watershed range from good in the upper wet reaches of the stream to extremely poor in a few of the lower reaches. Management of this watershed should focus on riparian health and in-stream flows.

Halleck Creek below the ranch headquarters and Halleck #1 exhibit some of the poorest aquatic habitat and riparian conditions on the Elk Mountain Ranch. Habitat conditions are so poor on these streams that these segments most likely create a barrier to fish movements and migration through the watershed. A riparian enclosure might be considered to encourage new willow regeneration, re-establish riparian function, and allow the stream banks to heal and the stream to redefine the channel and pool/riffle habitat. Hardened watering sites could be installed at strategic points along the stream, using cobble to armor the stream bank, or upland watering sites may be considered.

The ranch access road crossing the large wetland upstream of Lake Waken Tanka may be adversely affecting the health and function of the wetland. Water level monitoring wells should be established in the wetland meadow upstream and downstream of the access road (see Part 2 for details). In addition to monitoring the water table above and below the road, simple photo-points may be established to determine over time whether the vegetation in the wetland below is beginning to convert to drier, upland species. A gradual encroachment of upland plant species along the edges of the meadow may be a good indicator that the sponge-filter function of the wetland is being inhibited. If water table and vegetation monitoring indicate the wetland downstream of the road is drying out, additional drainage will need to be installed in the fill material along the access road. This may be as simple as installing multiple culverts along the 1/3 mile length of the road through the wetland.

Upstream of the diversions, the stream does present an opportunity for aquatic habitat enhancement and re-establishing a trout fishery. Habitat enhancement could be undertaken upstream of the headquarters, with the goal of reintroducing brook trout to the stream. Additionally, it may also be possible to introduce trout such as cutthroat into the stream above the headwater gorge, although this would not be without risk, due to the severe wintertime conditions at this altitude.

Brush Creek

Brush Creek exhibits no surface flow during the late summer and fall where it flows across the alluvial plain near the ranch boundary. This seasonal barrier to migration and resulting fragmentation of aquatic habitat most likely limits Brush Creek to support a wild trout fishery in the headwaters without supplemental stocking. There may be some feasibility in establishing a brook trout fishery in the reach upstream of the "Secret Meadow". It may be desirable to enhance pool and pocket water habitats in the reach before attempting to stock the reach. Improvements could include removing armor (cobble) from the bottom of existing pools to enhance scour, improve residual pool depth, and deepen these habitats.

Johnson Creek

Johnson Creek flows across a large alluvial plain and pasture land on the east side of Elk Mountain Ranch. The stream becomes intermittent, and then ephemeral before exiting the property at approximately 7,400 foot elevation. The lack of a definable channel downstream of the ranch would indicate that Johnson Creek only very infrequently flows into Mill Creek. This seasonal barrier to migration and resulting fragmentation of aquatic habitat severely limits Johnson Creek to support a sustainable trout fishery on the Elk Mountain Ranch.

Ranch managers have indicated a desire to develop water resources for irrigation and agricultural use at a point near the ranch boundary on Johnson Creek. If a stock pond is developed at this site, the pond may serve a secondary use of recreational fishing if habitat requirements of depth and water exchange are incorporated into the pond design.

Several very small fish (2" - 3") were observed during this assessment in Reach 1. These were most likely native dace or darters that migrated into the reach during at some time when the stream flowed into Mill Creek. No electro-fishing data has been collected on Johnson Creek. Before any trout species are introduced into this watershed, a population sample should be conducted in order to determine the species of fish currently present in Reach 1.

Lakes

There is a severe noxious aquatic weed infestation in all of the "fishing" lakes on the Elk Mountain Ranch, and this may be the single greatest aquatic

resource management challenge for the ranch. These weeds have severely reduced available habitat for existing fish in these ponds, have altered the water quality, and may result in significant fish-kills from lack of oxygen in several of the lakes as the vegetation dies off in the fall and begins to decay in the bottom of these lakes. The weed infestation is severe in all of the lakes except Swim Pond and Morning Star (which is dry). Of particular concern is the presence of Eurasian Watermilfoil in Trophy Lake. This weed is a particularly aggressive species that is very difficult to control. Once established, Eurasian Watermilfoil may be difficult to eradicate, and can easily spread to other water bodies. Until such time as it is controlled, it would be advisable to quarantine Trophy Lake. The quarantine should include a ban on boat use and contact with the water (waders, boots, etc.)

Mechanical removal is a preferred method of removing submerged weeds, since it does not require the application of herbicides and other potentially hazardous chemicals to the lentic environment, and poses the least risk to resident aquatic life. Unfortunately, the infestation of weeds in the lakes on the Elk Mountain Ranch has become so severe that mechanical treatments may be nearly impossible. Several years of periodic chemical treatments, using granular or liquid herbicides containing either 2,4-dichlorophenoxyacetic acid, dipotassium endothall, or diquat; combined with light absorbing water colorants such as AquaShade, may be necessary to bring the weeds under control. Copper based herbicides should not be used, due to the risk to remaining resident trout populations in the lakes.

Chemical applications should be done in the spring, as soon as the plants begin to emerge from the benthos. These herbicides are restricted in Wyoming, and a local, Wyoming certified aquatic herbicide applicator should be contracted to develop a weed control strategy for the ranch and apply the herbicides to the lakes. The terrestrial weeds along the shorelines also need to be brought under control, and it may be advantageous to hire a single contractor to do both the terrestrial and aquatic weed control work. In the short term, the lakes should be monitored this fall for indications of dissolved oxygen problems developing due to decaying vegetation. Signs to look for include fish quickly swimming back and forth along the shore of the lake while "piping", or gasping. Preventive action can include installing wind driven aerators. Several were observed near some of the lakes, but did not look to be in functional condition. In a worse-case scenario, a motor boat may be used to "churn-up" the surface of the lake and introduce additional oxygen into the system. Additional stocking of trout should not take place on the affected lakes until such time as the aquatic nuisance weeds are brought under control.

Water depletion and evaporative loss is the next most significant limit to the fishing lakes on the ranch. All of the lakes, except Waken Tanka and Morning Star, exhibit an acceptable ratio of deep/shallow habitat at full-pool, but all were habitat limited at the water levels observed in August 2006. It may be

useful to investigate the possibility of further developing springs or drilling supplemental wells nearby to augment water in the lakes in the summer months. Additional water exchange should improve overall water quality and reduce daytime temperatures in the lakes. Any augmentation plan will require authorization and permitting from the State of Wyoming Engineers Office, and additional water rights may need to be acquired.

Although a limited dredging effort was undertaken by the previous owner, several of the lakes appear to be nearing the end of their useful life as cold water fisheries. Lake Waken Tanka, has likely already past this point, and may best be managed for waterfowl nesting, amphibian and native minnow habitat.

RECOMMENDED ACTIONS AND IMPROVEMENT PROJECTS

Vegetation, Physical Features, and Wildlife

Forest Management

Given the primary goal of providing and or enhancing wildlife habitat on the Ranch and the poor condition of most the roads in the forested portion of the Ranch, there isn't any significant commercial harvest planned. Economics was the final factor that cinched the relatively low silvicultural activity recommended.

However, there are a few forest treatment recommendations that met the ranch goals.

The following table is a summary with forest treatment priorities.

Priority	Purpose of Treatment	Stand Numbers	Approximate Acres
1	Wildfire Hazard Mitigation near house	DF-3	272 acres
2	Aspen Regeneration for aspen health and future presence and for maintenance and improvement of wildlife habitat.	A/MC-3 & F/A-1 Small patches only within MC/A-3 & MC/A-7 & DF/A-1 Other small Aspen stands at foot of mountain	50 acres 408 acres
3	Insect and Disease Mitigation	F/LP-1 and 2	60 acres
4	Wildfire and Fuel Hazard Mitigation in general	All past timber harvest areas except where there are historical values (i.e. cavalry wood piles)	Several hundred acres

Wildfire Hazard Mitigation Near House

Stand DF-3 lays immediately adjacent to the new house. It was high grade logged in 1993. Logging debris was left and smaller trees are still thick enough to carry crown fire. A thinning and slash disposal project should be planned for this area.

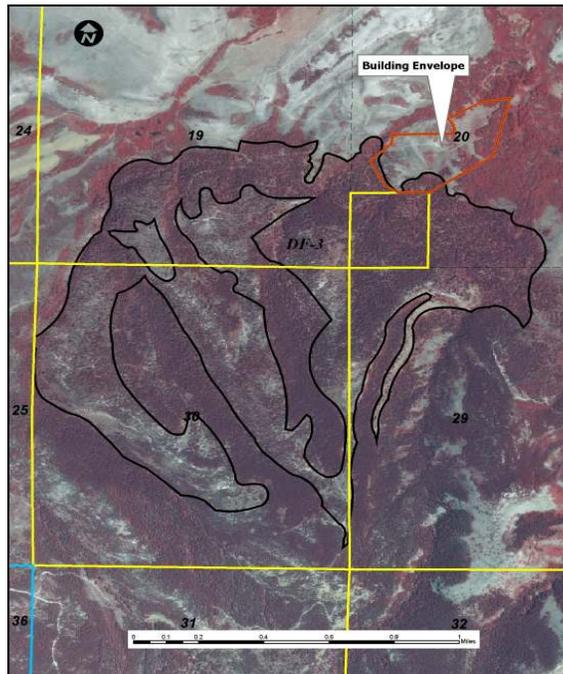
Two specific issues need to be addressed in this stand. There are too many small trees providing a fuel ladder directly into the tops of the larger trees and there is too much logging debris on the ground. Small trees should be removed and all the dead-down woody debris should be hand piled and burned on slopes less than thirty percent.

Stem Count/Acre:

DBH (INCHES)	5	6	9	10	11	13	15	16	TOTAL
Stems before treatment	293	102	45	37	30	21	32	14	574
Stems after treatment	0	0	45	37	30	21	32	14	179
# Removed	293	102	0	0	0	0	0	0	395

This treatment will enhance forest health and reduce the fire hazard substantially. Fire intensity will be reduced and the remaining trees will be more likely to withstand the next wildfire in the area. It will also improve the aesthetic back drop for the new home.

Canada thistle is present in the stand. It will be important to check the areas charred by the burn piles and treat any emerging noxious weeds as they appear.



DF-3 is adjacent to and south of the building envelope for the owners house and it includes a small parcel of BLM

See stand write up in Part 2 for more information.

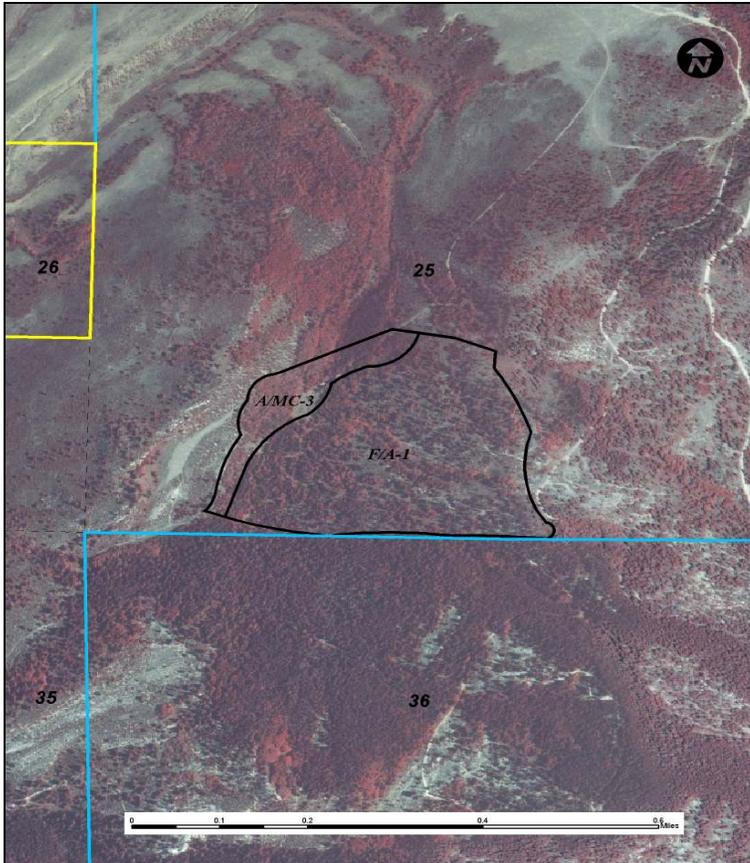
Aspen Regeneration

Aspen is a very important vegetative type on the Ranch. Where aspen and conifer ranges coincide, aspen is being replaced by shade tolerant sub-alpine fir and spruce. Without some sort of dramatic perturbation this trend will eventually result in significantly less aspen habitat. To counteract this disturbing migration stands F/A-1 & A/MC-3 are scheduled for clear-cutting. This fifty acre patch lays low on the mountain and occupies a very important zone for transitional wildlife use. An estimated 315,000 board feet of aspen and sub-alpine fir will be produced from this clear-cut with an estimated value of \$12,600.00. Road reconstruction will reduce the value to near zero.

Clear-cut this entire stand to rejuvenate aspen and recover what meager value is in the conifer. Shade tolerant sub-alpine fir is replacing much of the aspen in the forested zone of the ranch. Aspen provides important wildlife habitat, especially when the stands are found adjacent to openings and conifer stands. This treatment will assure that aspen is still present in the future. NOTE: Aspen sprouts are highly palatable to elk and deer. Clear cuts elsewhere in the central Rockies have had to have some means to reduce critter browsing on the young aspen sprouts for three to four years. After much experimentation we have found that brush fences constructed from logging waste material provides the surest protection for the least investment. Once the aspen sprouts become saplings over an inch in diameter they are capable of withstanding browsing pressure and the fence can be removed or allowed to deteriorate. Burning the debris windrow is not difficult and can be done with a good cover of snow to reduce fire escape potential.

DBH	6"	8"	10"	12"	14"	TOTAL
Stems/Ac	10,710	6,762	3,066	630	378	21,546
Cubic Volume/Ac	20,622	31,836	34,440	10,542	11,550	108,990
Board feet	1,386	82,992	135,072	42,756	53,172	315,378

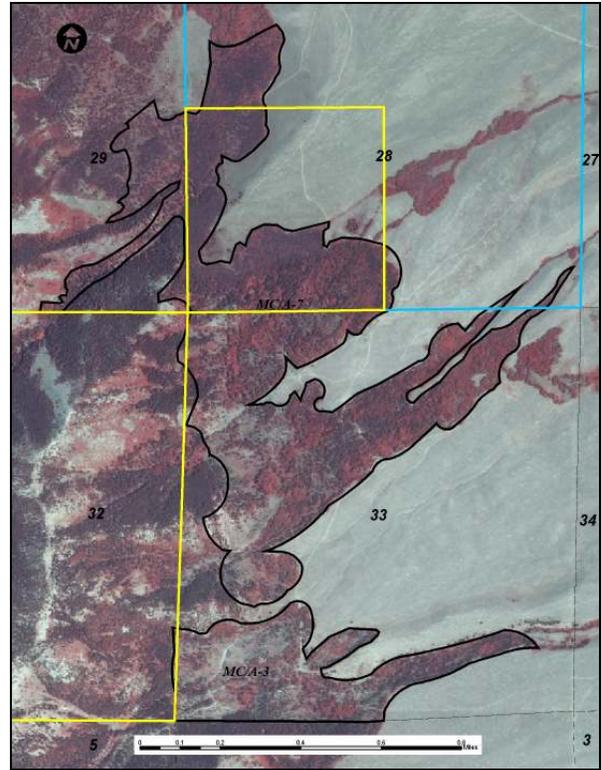
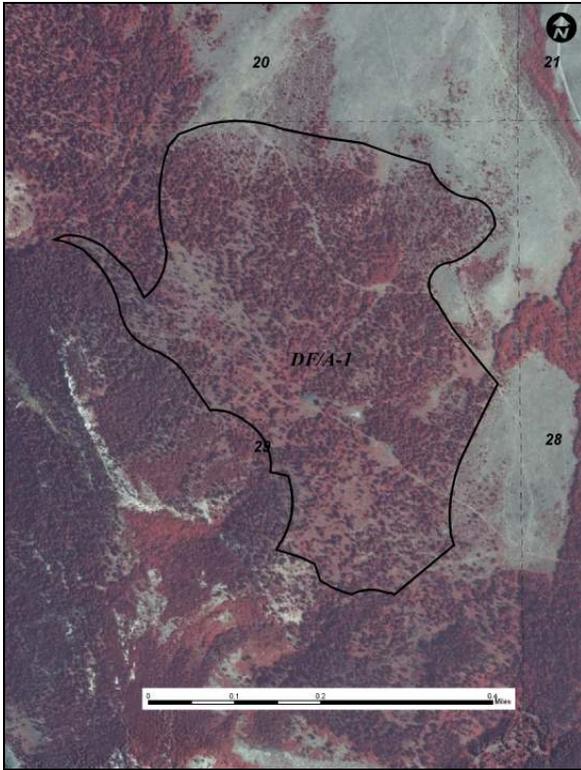
See stand write up in Part 2 for more information.



AMC-3 and F/A-4 are near the Elk Mountain access road on the NW side of the mountain. Generally they are within the SE quarter of Section 25, T20N, R81W

In other stands such as DF/A-1 and MC/A-3 and 7, shown on the next page, patch cuts are recommended for the benefits of stimulating aspen to maintain and improving wildlife habitat.

More detail is included in the stand write ups included in Part 2.



Stands DF/A-1, MC/A3 and 7 are all on the NE side of the mountain in the lower elevations between Halleck and Johnson Creek drainages. There are several opportunities for patch cuts to maintain aspen presence and conditions.

Throughout the aspen type designated with an (A) and or (A/MC) on the map there are several small and very small stands where small clear cut patches of 2 to 5 acres would be good improvements for reversing aspen succession by sub-alpine fir or stimulating aspen for regeneration and sprout protection with bush fences. See the guidelines for this.

Insect and Disease Mitigation

Insect and disease activity is prevalent throughout most of the forested areas. Most of the activity will level off or follow multi-year weather cycles coupled with some of the natural thinning that is taking place. Most of the stands affected by insect and disease are inaccessible and not feasible for action. Except for limber pine and sub-alpine fir the past logging activity has helped some of the species in some of the accessible stands resist high mortality. Sub-alpine fir and limber pine are not usually preferred for commercial use and have not been harvested much in the past. There are two small stands comprised primarily of sub-alpine fir recommended for treatment.

Stands F/LP – 1 and 2 are heavily infested with Western Balsam Fir Bark Beetle and Mountain Pine Beetle and they are along the road within the Rattlesnake Creek drainage near the historical monument for the Big Nose George murder incident. Following is the recommended treatments. The timber volume and market price can be used to off set the cost of potential road work and cost of the treatment.

Clear cut all of Stand F/LP-1 and 9 acres on the east end of F/LP-2 and patch cut 20% of the acreage in the other units to provoke a fresh start for aspen and to reduce fuel continuity. An overstory removal harvest is needed on the part of stands F/LP-1 between the clear cuts and patch cuts. If mortality from the insect activity is advanced more acres may need to be clear cut.

Debris fences should be installed around clear cut patches for protection of aspen sprouts.

Approximately 39,600 cubic feet or 152,832 board feet (Scribner) of sub-alpine fir and lodgepole pine will come off 24 acres in these stands. Rot/cull should be fairly low given the size class of the trees to be removed. If the entire 60 acres is clear cut the volume could be as high as 99,000 cubic feet available for harvest or 382,080 board feet. The following table depicts the total volume for the clear cut acres only.

DBH	8"	10"	14"	20"	TOTAL
Stems	2,280	94	216	120	2,710
Cubic Feet Volume	13,416	9,384	8,376	8,400	39,576
Board feet Volume	37,992	33,384	39,912	41,544	152,832

Potential volume from the overstory removal would primarily involve, but not be limited to, the trees 20" dbh and larger. This is estimated to be another 12,600 cubic feet or 62,316 board feet raising the total volume available to 52,200 cubic feet or 215,148 board feet.

Stem Count: Stem count ranges from 300 to 1600 stems/acre for all sizes. For the merchantable trees only the stem count averages around 150 stems per acre.

The stands need to be treated for noxious weeds before and after treatments.



F/LP -1 and 2 straddle the Rattlesnake Creek drainage within the NE quarter of Section 11, T19N, R82W near where the Big Nose George murder incident took place

See stand write up in Part 2 for more information.

Wildfire and Fuel Hazard Mitigation

For wildfire mitigation all logging slash should be completely disposed of by piling and burning or lopped and scattered to within 24 inches of the ground. Small stands of lodgepole and sub alpine fir, that come up within 5 to 7 years, will be thinned to 12-15 feet spacing when their stems are small.

Defensible space around structures is critical to their survival of a hot fire in their vicinity. Most the structures on the Ranch are located in relatively open areas of grass and some willows. Willows and grass are usually not very flammable during the peak of the summer fire season. They can be very flammable during dry periods in the spring and fall while they are dormant.

To improve defensible space around the new house under construction the following things need to be done:

- Thin and dispose of the flammable debris on the southeast corner of the structure.
- Thin conifer trees on the south and west quadrants to reduce crown cover to 40%. Prune the limbs on the remaining trees to a height of eight feet. This will reduce crown fire potential and protect the visual quality in the area surrounding the house. It will also provoke aspen sprouting. Aspen trees actually ameliorate fire behavior and are good have in defensible space zones.

- Remove all dead, down woody debris in a radius of three hundred feet of the house

Remove the willow vegetation within 20 to 50 feet of the office, bunkhouses and all other ranch buildings.

Fire Use

Most tree species on the Ranch are intolerant of fire and likely to be killed in all but the lowest intensity fire. Prescribed burning under carefully prescribed conditions can be a useful tool to invigorate important wildlife browse such as Mountain mahogany and ceanothus.

It has been a long time since a significant wildfire has burned on the Ranch. When the inevitable happens it will be tempting to take aggressive, Herculean action to control the fire at the smallest possible size. That normal response should be avoided if possible. A wildfire suppression strategy that uses natural barriers and roads for control features will allow fire to once again start to influence vegetative patterns and also be a safer more economical approach to wildfire control.

Fire has been such an important part of ecosystem dynamics in the past that it should not be stigmatized with the traditional European view of it as the reincarnation of the Devil.

Rangeland and Shrub land Management

Recommended improvement projects are presented at the planning level with the understanding that more specific project planning will be required before budgeting and implementation can occur. Project planning can be accomplished by the ranch staff or by obtaining outside help to define the specific locations of projects and the work that will be done. LSA is available to help with this level of planning.

Prescribed burns and brush beating

Spot treatments using small prescribed burns in the spring when soils are moist or using a brush beater on slopes that are 12 percent or less should be designed and implemented to create additional diversity and edge effect that will improve livestock forage, wildlife habitat and improve the area's potential for sage grouse habitat. Brush beating in the sagebrush type should be done to create open strips with undulating boundaries on the contour that are not more than 200 yards wide. Vegetation recovery will probably favor grasses and forbs with a remnant of the surviving shrub type. Sites that appear to have potential for treatment were observed in the Frenchies and Waterworks

pastures in the southwest part of the ranch. Sagebrush and mixed shrub stands around Sheephead Mountain and on Halleck Ridge also offer potential for these types of treatment to improve diversity and open up areas dominated by sagebrush. These sites appear to have deep soils and adequate available moisture that make treatment success probable.

In the sagebrush/limber pine vegetation type in the southwestern part of the ranch, spot treatments using prescribed burns in the spring when soils are moist should be designed and implemented to create additional diversity and edge effect and kill as much limber pine that is invading these productive sagebrush stands as possible. The prescribed burns could be started low on the slope and allowed to burn uphill into the residual snow near the top of the ridge. The target should be relatively narrow linear burns with undulating edges that maximize edge effect without converting large areas of sagebrush to grass. Done correctly, grasses and forbs will increase in these new clearings in the sagebrush that will improve livestock forage, wildlife habitat and improve the area's potential for sage grouse habitat. Sites that appear to have potential for treatment were observed in the Frenchies and Waterworks pastures in the southwest part of the ranch. These sites appear to have deeper soils and more available moisture than on the dryer part of the ranch

There does not appear to be a need for mechanical treatments or prescribed burns to alter the species composition of the grassland type.

Irrigation ditches

Annual maintenance for irrigation ditches should include burning the accumulated vegetation in ditches in the spring to prevent silt accumulation. Before the irrigation season begins accumulated silt and vegetation should then be plowed out of ditches on an "as needed basis" and washouts from the previous year should be repaired. When burning ditches adequate help and a source of water and fire fighting tools should be close at hand

Irrigated pasture improvements

Control of wild iris on wet sites in meadows should be a priority to restore productivity. Basically this involves allowing the site to "dry up" between irrigations and to fertilize with nitrogen with (80 to 100 pounds per acre) before irrigation begins in hay meadows to give the grasses a competitive advantage. For pastures that are to be grazed early in the season, fertilization should be done after livestock grazing has occurred so that plants have time to benefit from the increased nitrogen. If fertilization occurs shortly before grazing the plant is stimulated and nitrogen is incorporated in the leaves that are then removed by grazing. Fertilization with nitrogen and phosphorus in the fall will stimulate root development and improve plant vigor and health the following spring. Changing use of the meadow from livestock grazing to hay production

where the pasture is allowed to dry up between irrigations will also help with the conversion. In more difficult situations where it may not be possible to dry up the site or where wild iris persists, it may be necessary to use a herbicide to control the wild iris and then inter-seed a seed mixture that includes grasses and clovers that can tolerate wet meadow sites such as Garrison foxtail, timothy and desirable legumes such as white or red clover.

Improve the quality of meadows and irrigated pastures by introducing legumes, forbs and desirable grasses. Reducing the competition from the existing grasses, sedges and rushes by using a light disking or heavy grazing in the early spring will increase success. White or red clover broadcast in front of a harrow at 3-4 pounds per acre following a treatment to reduce competition will often result in the successful establishment of clovers. Seeding grass or alfalfa into existing pastures is more difficult. Successful establishment of these plants requires a severe reduction in competition from existing pasture species. This can be from herbicide or mechanical treatments. As a general rule, unless significant bare ground exists in the pasture or the existing grasses are killed, inter-seeding with more desirable grasses or alfalfa will not be successful.

Seeding more productive species in a seed mixture that includes the desirable species that are suited for the site is necessary. The seed mix should include species like the following: timothy, fescue, brome grass, Garrison creeping foxtail, orchard grass, white and red clover. Sites that are hard to dry up or that are alkaline may require a different seed mixture. Pulling a harrow over the pasture again to cover the seed will improve the chances of success. In particularly difficult situations it may be necessary to treat with a herbicide like Roundup that will kill the existing grasses and forbs and re-plant the area after about 2 weeks with a seed mixture that includes the desired species. Most forage species should be not be planted more than ¼ inch deep.

Specific assistance in defining a seed mixture that fits your management goals is usually available from the local Natural Resource Conservation Service office. The Intermountain Pasture and Hay Meadow Handbook University of Nevada, Cooperative Extension Bulletin EB-00-02 offers a well thought out discussion on the subject that would be a useful reference.

Noxious weeds

An inventory of noxious weeds on the ranch should be developed to serve as the foundation for an aggressive weed control program. Ranch staff should be trained in the identification of weeds that are known to occur on the ranch and those that are known to be in the local area, particularly Russian knapweed, spotted knapweed, diffuse knapweed, hound's tongue, white top, musk thistle and Canada thistle. Each time noxious weeds are observed, they should be identified or carefully collected and pressed for later identification. Ranch staff should be provided with GPS units and the GPS location of weed occurrences

should be recorded on the spot and posted on a map. Treatment with the appropriate herbicide should be implemented when the plants are most vulnerable.

A program of preventative maintenance should be put together for the ranch. It should include a requirement that all outside heavy equipment and ranch equipment that has been used in noxious weed stands be thoroughly washed to remove any accumulated soil that could contain noxious weed seed from the last place it was used before entry into the ranch. A wash rack should be constructed on the ranch and “outside” ATV’s and field going vehicles should be washed to remove any noxious weed seed before allowing them to be used.

Noxious weed treatment should be accomplished regularly and continuously with a focus on controlling weed invasions when they are found to prevent their spread. Weed control is much like wildfire control efforts where the most threatening part of the weed invasion should have the highest priority for control and containment. Spots and new discoveries are equally important to control while they are small and before they have a chance to spread

Rattlesnake Creek riparian areas and irrigated pastures should be the highest priority area to continue treatment. The infestations of Canada thistle in the wet mixed shrub/aspen stands and at springs on Halleck Ridge should be the next priority for treatment. See the attached Noxious Weed map for identification of current critical areas needing treatment.

Road Erosion

Over a 2 to 5 year period, the Ranch should inspect the road network and develop a program and schedule to improve drainage on appropriate sections of the road system.

Wyoming’s “Best management Practices” guidelines should be used to insure watershed and soil protection for increased road use and new road development.

As a minimum, water bars that will drain the road surfaces should be installed.

Where roads will be used by heavy trucks or equipment the surfaces should be built up and possibly covered with gravel in the low and soft spots.

Fisheries

Streams

Rattlesnake Creek

Reach 1

The severe down-cutting occurring in this reach needs to be immediately addressed. The active head-cuts can be controlled through the installation of rock or large wood cross-vanes to control their migration upstream. If allowed to continue, this vertical instability will result in significant loss of adjacent riparian vegetation and wetlands as the stream abandons the existing floodplain for a new, lower elevation.

Reach 3

Treat the actively eroding banks, either through mechanical treatments such as toe-slope stabilization and re-vegetation, or through natural processes. In particular, the downstream portion of the reach near Rattlesnake Ranch has several steep banks that are slowly beginning to return to a sustainable angle of repose. Recovery of these banks may be accelerated by mechanically sloping back the banks, stabilizing the toe of the slope, and transplanting willow clumps.

Reaches 5 & 6

A detailed habitat enhancement plan for the reaches should be developed with the primary goal of increasing pool depth and complexity, stabilizing the actively eroding banks, providing enhanced "pocket water" cover habitats in the riffles, and addressing the road/stream interactions in the reach.

Recommended treatments would include improving scour in the pools using boulder and/or large wood cross vanes, large wood for toe slope stabilization of actively eroding or collapsing banks, installation of boulder micro-vortex pocket water structures in some of the riffles, and reconstruction of the old wooden bridge across Rattlesnake Creek at the crossing. The appendix contains schematic drawings and photographs of some of these treatment types. River restorations of this nature typically require the approval of an enhancement plan by the relevant State of Wyoming Aquatic Biologist as well as an authorization under Section 404 of the Federal Clean Water Act of 1972 from the US Army Corps of Engineers. These projects are usually considered to be relatively insignificant, and typically fall under the Corps' Nationwide Permitting authority for stream and wetland restoration (NWP27). An additional Section 401 certification from the State Dept. of Health may also be required, due to the proximity of the work to the Hanna Public Water Intake.

The large beaver pond upstream of the road crossing in Reach 6) may be carefully enhanced to provide for additional pool habitat and over-wintering

capacity in the reach. This work would entail a greater risk than the stream enhancement project, due to the fragile nature of the old beaver dam forming the pond. If augmentation of this beaver pond is attempted, care must be taken not to disturb the dam face, and the pond should not be deepened to a level lower than the surrounding valley profile. Enlargement should be limited to removing the sedge mats that have formed along the upstream perimeter of the pond and transplanting these to the eroding banks downstream. Improvement of the in-flow channel and armoring the out-flow channel on the dam with large cobble will assure a good exchange of water in the pond and help minimize the algal blooms in late summer. Any dredged material from the pond will need to be completely removed from the site, and will require authorization under Section 404 of the Federal Clean Water Act of 1972 from the US Army Corps of Engineers.

The beaver pond enhancement and stream enhancement projects will require consultation with the Conservation Easement holder (the Nature Conservancy) to ensure compliance with restrictions contained in that document.

Reaches 5, 6, & 7

The road parallels the dry stream channel throughout most of Rattlesnake Creek, and crosses it at several points. Three of these crossings are negatively influencing the stream, and probably result in additional sedimentation downstream. Ideally, these low water crossings should be replaced with bridges. One crossing actually follows the creek channel for more than one hundred feet, and in this case, the road will need to be relocated in order avoid the stream.

Halleck Creek

Reach 6

Upstream of the diversions, the stream does present an opportunity for aquatic habitat enhancement and re-establishing a trout fishery. The old logging road on the east side of the stream in the upper half of the reach may allow for a small excavator to access the stream to improve existing pool habitats and create new ones. A detailed habitat enhancement plan for the reach would need to be developed with the goal of increasing pool depth and complexity, as well as providing enhanced "pocket water" cover habitats in the riffles. Recommended treatments would include improving scour in the pools by removing large cobble and boulder armoring the bottom of the channel. These excavated materials may be used to construct boulder cross vanes to focus flow and scour in the pools, installation of boulder micro-vortex pocket water structures in some of the riffles. At the same time, the diversion structures may be reconstructed as boulder cross vanes in order to eliminate aquatic organism migration barriers, reducing yearly maintenance needs and cost, and providing additional habitat for fish. The project will likely require the approval of an enhancement plan by the relevant State of Wyoming Aquatic

Biologist as well as an authorization under Section 404 of the Federal Clean Water Act of 1972 from the US Army Corps of Engineers. These projects are usually considered to be relatively insignificant, and typically fall under the Corps' Nationwide Permitting authority for stream and wetland restoration (NWP27).

Brush Creek

Reach 2

It may be desirable to enhance pool and pocket water habitats in the reach before attempting to re-establish a brook trout fishery. Improvements could include removing armor (cobble) from the bottom of existing pools to enhance scour, improve RPD, and deepen these habitats. This work could be done by hand, possibly negating the need for a 404 authorization. Additionally, trees could be cross-felled into the channel to create log and woody debris dam habitats. This large wood would also add roughness to the channel, and help dissipate energy from high flows during spring snow melt.

Lakes

All of the lakes exhibit some level of shoreline erosion due to wind and wave action along the leeward shores. In many instances, this shoreline erosion is further filling in important lake habitat and should be stabilized. Root-wad revetments are useful for hardening of the shoreline to protect from erosive wave action. Root-wads could be obtained locally from harvest areas planned on the ranch. Mats of carex, rushes, sedge and willow can be harvested from adjacent riparian wetland areas and transplanted behind and on top of the root-wad revetments to create a natural looking and well armored shoreline.

Morning Star Lake may need to be excavated before it is refilled. Otherwise, it should be managed under the same strategy as Lake Waken Tanka for waterfowl and other aquatic/riparian obligate species. At some point, it will likely become necessary to drain and excavate Eagle, Arapaho, Tatanka and Trophy Lakes. If this work is considered, dredging efforts should focus on creating contiguous profundal zones of at least 12 foot depth near the center of the lakes instead of along trenches near the shoreline. Proper permits should be applied for, and all dredged materials will need to be completely removed from the lake and disposed of in a manor consistent with the conservation easement.

Management Considerations

- Put together a land exchange or two or three smaller land exchanges with the BLM and/or State of Wyoming to insure more effective and efficient ranch management.
- Move forward with installing the new pond near the new house by exploring possibilities for a permit from the State Engineer's office and a 404 permit from the US Army Corps of Engineers.
- Acquire a small ranch tractor with a roll bar and attachments to do road maintenance and drainage work as well as fire suppression and slash piling.
- Acquire a small 4x4 wheel drive fire suppression engine with high volume pump and a 4x4 wheel drive water tanker truck. Both would be useful for burning ditches in the spring, control of small wildfires and structure fires, for prescribe burning of old slash piles, and for other purposes.
- Obtain fire suppression training through the Wyoming State Forest Service or BLM.
- Install an energy generator supplied by a wind energy, solar energy or both (hybrid) and battery storage for augmenting ranch energy needs and achieving some ranch self-reliance.
- Consider, in the future, entering the Carbon Sequestration Program where the ranch can receive revenue for carbon credits by increasing carbon storage through forest, range and hay management. This program is just developing across the nation and requires commitments from numerous neighboring property owners across a large landscape involving several hundred thousand acres.
- Consider, when a market develops, selling small wood products for wood bio- energy chips. This could facilitate installing the patch cuts for wildlife habitat improvements as well as fuel hazard reduction where there are thickets of small-size trees.
- If interested, the ranch could obtain a heritage resource assessment and clearance through someone authorized to provide this from the Wyoming Division of Forestry or the Natural Resources Conservation Service (NRCS). If improvement work planned for deeded land affects historical or cultural features on public lands the “heritage resource clearance” is required. More information is available on SHPO web site.
<http://wyoshpo.state.wy.us/> .

- Consider leasing a Halleck Ridge location for a commercial wind energy development. The area would need access to a power transmission line and to be assessed for 1 to 2 years to assure its suitability. The State Agriculture Department should be consulted to insure that your Wind Energy Development rights are protected.

Future Management

This plan should be updated within 10 to 20 years unless there has been a significant change on the landscape or new strategies for management.

IV. APPENDICES

APPENDIX A: GLOSSARY

APPENDIX B: DEED OF CONSERVATION EASEMENT

APPENDIX C: RANCH FACILITY MAP