MT. JUMBO FOREST MANAGEMENT PLAN ON CRITICAL ELK WINTER RANGE

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Photo by: Eric Edlund

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ACKNOWLEDGEMENTS

The City of Missoula Parks and Recreation (MP&R) Board and Staff wish to thank the following citizens, elected and appointed officials and volunteers for the numerous hours devoted in the development of this plan. Missoula's open space system provides countless ecological and social benefits to the Missoula valley. Mt. Jumbo, the largest contiguous open space property managed by the Conservation Land Program, was largely conserved to protect elk winter range. This mountain, and the elk that use it, are important community assets and management of Mt. Jumbo has a long been a community effort. This document continues a legacy of Missoula management plans drafted through significant public input to direct the management of public open space lands.

Conservation Lands Advisory Committee (CLAC)

The CLAC was appointed by the Missoula Park and Recreation Board to advise on implementation of the Conservation Lands Management Plan. Members of the CLAC have personal and professional experience in restoration ecology, recreation management, education, policy implementation, forestry, conservation and business. This group, with significant input from the public, was responsible for developing the guiding principles and goals by which forests along Mt. Jumbo's Backbone will be managed will be managed. These citizens also provided important input from their personal experiences and countless hours of editing and proof reading.

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This plan was written cooperatively with several individuals providing content specific to their areas of expertise. During the development of this plan the Conservation Lands Manager conducted many additional meetings, phone conversations and site visits on topics specific to the development of this plan. These technical advisors offered insightful site-specific details and assisted with edits which were critical to the development of this plan. Their support is greatly appreciated.

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CHAPTER 1

Introduction and Management Goals

1.1 Purpose

Mt. Jumbo is the largest contiguous conservation land managed by the Missoula Parks and Recreation Department (MPR). The 2010 conservation lands management plan designates Mt. Jumbo as a park preserve. Management priorities for parks preserves include preserving and improving native habitats and achieving an appropriate balance between natural resource protection and public use. While these broad priorities guide management of park preserves, more detailed natural resource plans are sometimes needed to direct the management of specific resources.

The purpose of this plan is to direct the long-term management of forest stands in the South Zone of Mt. Jumbo that functions as critical winter habitat for the Mt. Jumbo elk herd.

1.2 Elk Winter Forest Habitat Requirements

Functional elk winter range provides habitat with adequate forage and cover during winter and early spring. Forest cover serves a critical role in elk winter habitat, with canopy cover sheltering animals from above, and ground cover hiding an animal from ground position (USFS and MFWP, 2013). Forest cover is multi-functional and provides snow intercept, thermal cover, wind buffering, and security from predators and humans.

Previous studies have shown elk have predictable preferences for particular bedding and foraging habitats during the winter. Elk bed most often in areas with >75% canopy cover, and tend to forage within a few hundred yards of forest cover (Marcum 1975; Peek 2003).

A closed forest canopy is especially important during periods of inclement weather and/or deep snow. A closed forest intercepts snowfall, making it easier for elk to move through the forest and find forage. Travelling through snow burns more calories; critical energy reserves that are needed to survive through the winter and for cows, produce healthy, strong calves.

Elk prefer to forage on grasses or low shrubs when snow is absent or shallow, but studies have shown that when snow is deep, elk spend more time in forested areas and browse more tall shrubs, conifers and arboreal lichens (Martinka 1976; Knight 1970). Closed forests also provide thermal cover during periods of harsh winter weather, and visual cover from predators and humans. Thermal cover is defined as “a stand of coniferous trees 40 feet or taller with an average crown closure of 70 percent or more” (USDA 1993), a definition not met by most forested areas on Mt. Jumbo.

1.3 The Mt. Jumbo Elk Herd

Mt. Jumbo provides critical winter habitat for the Mt. Jumbo elk herd. Every winter, 50-100 elk migrate from their summer and fall ranges in the Rattlesnake Wilderness and Recreation Area to the Missoula Valley. Two separate groups of elk primarily utilize the mountain—one in the North Zone (areas north of the Saddle) and one in the South Zone along Jumbo’s Backbone (area connecting the peak of Mt. Jumbo to the Saddle). With residential development on the east and west flanks of Mt. Jumbo, the primary access to the Backbone is

through the Mt. Jumbo saddle. Elk on the Backbone are most often seen grazing open grasslands 1,000 feet above the valley floor, and provide exceptional wildlife viewing opportunities for the public. Throughout the winter, elk feed on open hillsides and utilize adjacent densely forested stands for bedding cover, security, thermal cover and snow intercept.

The Mt. Jumbo elk herd was the catalyst for conservation groups, local, state and federal agencies, and the public to protect the mountain from imminent residential development through fee-title acquisitions. In 1995, Five Valleys Land Trust, with support from the Rocky Mountain Elk Foundation, negotiated to buy the majority of the mountain from 4 families for approximately $3 million. Between 1995 and 1998, ~ 1,600 acres of Mt. Jumbo were acquired and placed into public ownership to conserve critical winter range, preserve important elk travel corridors, provide habitat for a variety of other species, protect Missoula's viewshed, and to provide non-motorized recreational opportunities for the public.

In 1996, the first seasonal closure was implemented to restrict contact between humans and elk. Thus far, this closure has proven effective at minimizing external stresses on the elk and has decreased elk exposure to human recreational activity. However, enforcement of the closure continues to be problematic with sporadic public trespass occurring. The cumulative effects of this exposure are unknown, and unfortunately there are behavioral indicators that the Mt. Jumbo elk herd is becoming more habituated to human activity. In the fall of 2013, Montana Fish, Wildlife and Parks (MFWP) received reports of elk attempting to move into the South Zone as early as September, and during the springs of 2011-2013, the elk remained in the South Zone although the mountain had opened to the public.

Keeping elk wild in the wildland-urban interface of the Missoula Valley is an ongoing challenge for MFWP. The more elk are exposed to humans and human activity, the more desensitized and habituated they become to humans and human developed areas. Once elk become habituated to humans, they lose their migratory behavior and become comfortable co-habitating with people. This results in elk becoming year-round residents on their winter range causing: human safety concerns, game damage, property damage, negative impacts to habitat, and elk population management issues. Extreme cases of resident, habituated elk occur in Banff, Canada; Estes Park, Colorado; Jackson Hole, Wyoming; and Gardner, Montana. A local example of ongoing and increasing elk habituation to humans occurs in the North Hills/Evaro elk herd in the Missoula valley.

The especially severe winter of 1996-97 forced the North Hills/Evaro elk herd to lower elevations and into close proximity to humans and developed areas. Since then, the elk have become progressively habituated to humans, and the dynamics of the herd have fundamentally changed. Also, their population has grown dramatically—the herd has increased from 17 elk in 1980 to 452 in 2013, creating multiple management issues in the North Hills area (Edwards pers. com.).

Since 2001, wildlife managers and homeowners in the North Hills area have invested considerable time and money managing the negative effects caused by a habituated elk herd. Game damage hunts, herding, replacing traditional fences with

wildlife-friendly fencing and gates, and public outreach and education are all tools currently being used to manage the North Hills/Evaro elk herd (Edwards pers. com.).

Costly management issues compounded by the multiple biological and social concerns of elk habituation to humans reinforce the need for Missoula Valley land managers to adopt strategies to limit human/elk interactions on winter range. City of Missoula and MFWP staff will continue to work together to create management solutions and strategies to keep the Mt. Jumbo elk herd wild. Providing sufficient visual cover and security for elk is one critical strategy.

1.4 Historic Influences on Forest Development on Mt. Jumbo

The Missoula Valley has had a long history of human habitation. The Bitterroot Valley Salish used areas surrounding Missoula to harvest food and raise vast herds of horses (Historic Missoula). The use of prescribed fire by aboriginals to manage landscapes has been widely documented across North America (Williams 2000). In lower elevation forests in Western Montana, naturally ignited fires historically burned every 10-20 years on average (Barrett et. al 1997). Fires scars on a stump in the north zone of the Mt. Jumbo Wildlife Management Area record evidence of an eight year average fire cycle between the early 1800's through the first decade of the 20th century (Missoula Parks Conservation Lands Archives). Along with native oral histories, this provides evidence that local tribes used fire to manage the hillsides surrounding the Missoula Valley.

Frequent, low intensity fires stimulated new growth from native bunchgrasses and increased the forage value for both wildlife and domestic horses. Frequent fires would have also improved the safety of crossing Mt. Jumbo's saddle. Mt. Jumbo's saddle was a historic travel corridor for parties interested in avoiding Hellgate Canyon, a narrow canyon on the South end of Mt. Jumbo long used by local tribes to ambush their rivals. These frequent fires reduced the possibility that a rival group intent on ambush could hide, by killing smaller fire-prone trees and clearing brush.

Whether early European settlers understood the impact native-induced fire cycles had on Missoula Valley's viewshed is uncertain. In perhaps the earliest written description of Mt. Jumbo by the famous British explorer, David Thompson, it is blandly labeled a "brown knowl". However, the exact location of Thompson's "brown knowl" is uncertain. What is certain is that all early photographs of Mt. Jumbo show a mountain largely devoid of trees.

The slow rate of forest expansion and densification on Mt. Jumbo during the 20th century serves as an indirect measure of the degree of departure from historical fire regimes. In a photograph taken in the early 1900's a half century after the 1864 founding of Missoula Mills, the first building erected in the present location of Missoula's Downtown, Mt. Jumbo was still largely devoid of woody vegetation (Fig. 1). By the 1940's, aerial photos show that conifers had established on the flanks of Mt. Jumbo, likely due to the suppression of fires and a relatively wet period in western Montana (Arno and Gruell 1986).

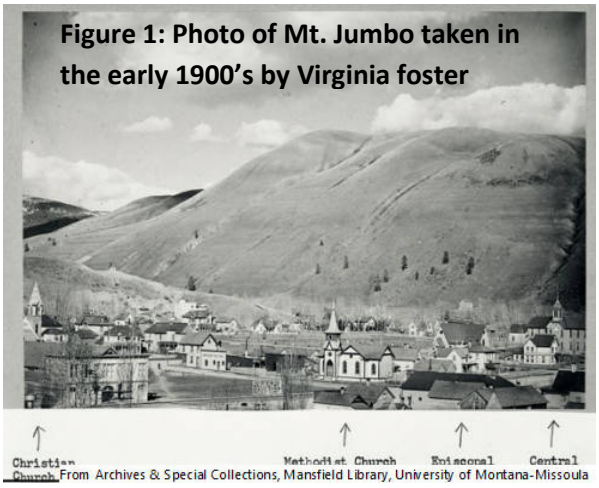


Figure 1: Photo of Mt. Jumbo taken in the early 1900's by Virginia foster

From Archives & Special Collections, Mansfield Library, University of Montana-Missoula

1.5 Current Habitat Conditions

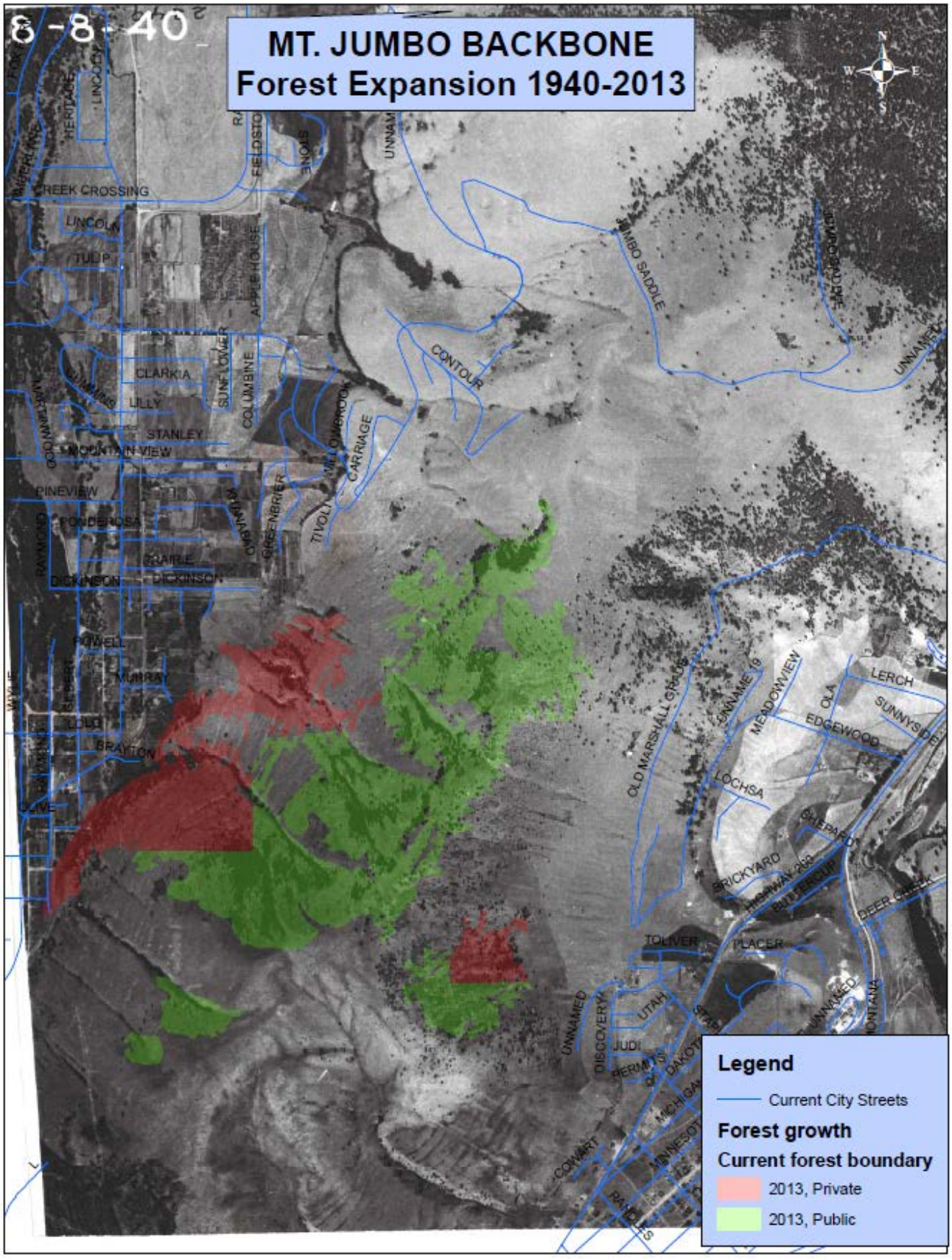
Using historic photos, we see that woody vegetation first established along the multiple draws which punctuate Mt. Jumbo's backbone. Once forests were established in the draws the expansion of conifers from these draws onto adjacent grasslands and the subsequent conversion of these grasslands to forests occurred rather quickly. Between 1940 and 2013 forested areas on City-owned land along the Backbone increased from 54 ac. To 170 ac. respectively (Fig. 2). This translates to an average forest expansion rate of 1.6 acres per year.

There are major differences in forest composition and structure between forest stands along the Backbone. In draws, where forests are older, a mature overstory of Douglas-fir (*Pseudotsuga menziesii)* with some ponderosa pine (*Pinus ponderosa)* and an understory dominated by chest-high ninebark (*Physocarpus malvaceus)* and snowberry (*Symphoricarpos albus)* is present. While some thickets of juvenile Douglas-fir are present, the majority of the trees in these draws are in excess of 12"diameter at breast height (DBH). Overall, forested draws represent the most diverse forests along the Backbone.

North-facing slopes adjacent to draws are markedly less diverse. While some larger diameter Douglas-fir and ponderosa pines are present, the vast majority of the forest is dominated by tightly-spaced small-diameter (less than 8" DBH) Douglas-fir with an understory of moss and lichens. South facing slopes are still dominated by grasslands with encroaching young ponderosa pine suggesting that these grasslands may eventually become forests.

Along the majority of the Backbone tree stocking densities are currently quite high. In general, where forests are relatively young (less than 70 years old) cohorts of even-aged Douglas – fir dominate both the overstory and understory. Where these conditions exist forests are more susceptible to catastrophic disturbances from forest pathogens, drought, and/or wildfire. While natural disturbances help shape a forest's stand structure, catastrophic disturbances in dense even-aged forests along the Backbone could alter stand density to a point where elk no longer find the area suitable as winter range. In the absence of fire, human intervention to help transition "younger" forests to more open, multi-aged and biologically diverse stands would help buffer against potentially destructive natural disturbances. Although closed canopy forests are a critical component of elk winter range, dense stands of young trees do not serve the same habitat function as older open-grown stands. From an elk energy expenditure reduction perspective, larger trees with multi-layer canopies may provide additional benefits not provided by single layer canopies and smaller trees (USFS and MFWP, 2013).

FIGURE 2: Forest growth on Mt. Jumbo's backbone 1940-2013.



The young forests established on former grasslands on Mt. Jumbo have limited the grassland forage and the number of small openings available for elk. Also, densely treed areas on the mountain support very little understory vegetation, unlike older open forests that support a variety of shrubs. Sustaining elk forage by promoting continued understory development is important to sustaining long-term winter habitat requirements for elk. A reduction in the density, and area of young forests will contribute to the quality of elk winter range by providing additional browse. In areas where we want to encourage forest development, thinning will improve the health of remaining trees and will speed the development of an open-grown stand. However, since critical forest cover in the South Zone of Mt. Jumbo is relatively small, forest management prescriptions will have to be surgical in nature, with established long-term elk and forest monitoring programs established to ensure that forest management prescriptions do not negatively affect the elk and result in the herd moving elsewhere.

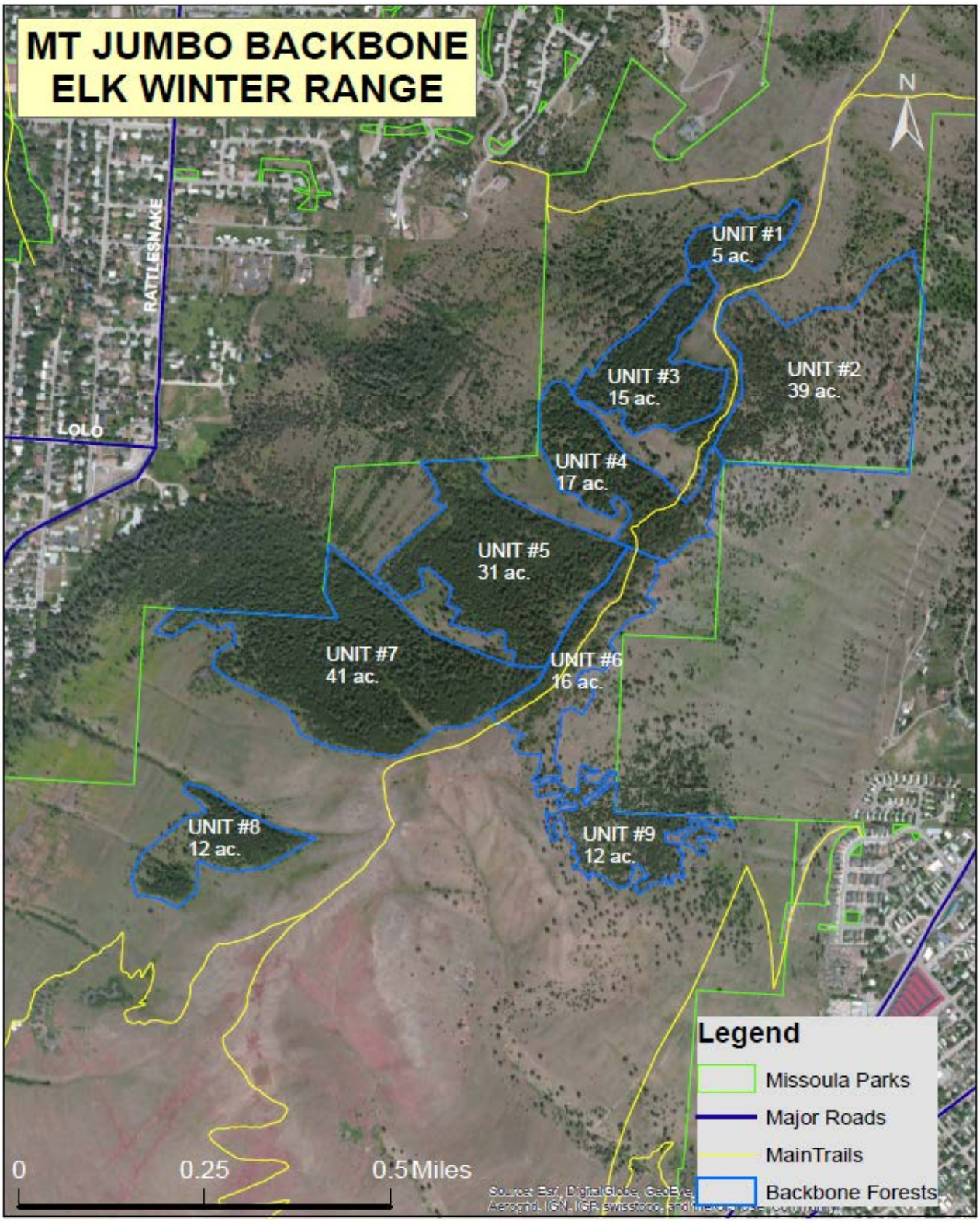
1.6 Elk Distribution and Habitat Utilization

Due to the nature of the Mt. Jumbo seasonal closure and the need to avoid disturbing the elk, very little research has been conducted on the herd outside of annual, aerial surveys by MFWP. In general, we know the approximate size of the herd and can identify areas where they usually congregate; but we know surprisingly little about their utilization of forested areas, how much of Mt. Jumbo they actually use, and how weather events affect the distribution and habitat utilization of the herd.

In the fall of 2013, a preliminary survey of elk scat in forested and unforested areas along the Backbone reveled some differences between areas of high and low elk use. However, this survey was narrowed in scope by early snowfalls that obscured elk scat and provides only a snapshot in time. Additional trend data will need to be collected to better determine winter range utilization.

Based on the 2013 scat survey, data from annual aerial surveys by MFWP, and countless hours of elk watching from the valley floor through a citizen-science based program, we have identified Backbone forests 4, 5, 7, and 8 depicted in Figure 3 as the most critical forested areas for elk security and cover during the winter. Forests numbered 1, 2, 3, and 6 (Fig. 3) provide important travel corridors for elk between Mt. Jumbo's saddle and summit.

FIGURE 3: Important Forests for Elk Security and Cover along Mt. Jumbo's Backbone area



1.7 Management Goals

The following goals were developed by the Conservation Lands Advisory Committee and are specific to management of areas along the Backbone identified as critical winter habitat for Mt. Jumbo's elk herd. These goals should guide the development and implementation of silvicultural prescriptions, restoration practices and policy decisions related to these areas.

Goal #1: Increase forest resistance and resilience to disease, fire and climate change

Goal #2: Increase species diversity in areas where diversity is low

- promote and/or actively establish an understory of native shrubs
- actively manage invasive species to prevent colonization of site following management activities.
- Promote ponderosa pines an where applicable quaking aspen and Western larch in areas dominated by Douglas-fir

Goal #3: Maintain and Improve wildlife habitat

- Maintain appropriate visual cover between forested areas and trails
- Maintain appropriate visual and snow intercept cover in elk bedding areas

Goal #4: Promote public safety

Goal #5: Manage public recreation to minimize impacts on habitat

- Remove and restore user created trails which infiltrate critical winter habitat for elk.
- Monitor public trespass into seasonally closed areas to gauge effectiveness of signage, outreach and enforcement on public compliance w/ the closure.
- Utilize data on elk use of the mountain to direct the future reroute of the Backbone trail.
- Periodic evaluations of Mt. Jumbo's seasonal closure may be necessary to ensure closure is addressing wildlife management priorities.

Goal #6: Remain cognizant of and mitigate negative visual aspects for forest management

Goal #7: Ensure forest management prescriptions do not negatively affect the Mt. Jumbo elk herd

- Establish an adaptive forest management strategy based upon analysis of elk distribution, habitat use, and response to previous forest management.

CHAPTER 2
PLAN OF WORK

2.1 Duration and Scope of Activities

In order for us to meet the management goals outlined in Chapter 1, it is imperative that the implementation of the following objectives be directed by site-specific monitoring, critical thought and public involvement. Prescriptive thinning to improve forest health will require treatment at a scale and duration which minimizes impacts to elk use of the area. If thinning does not occur at a level which allows elk to adjust to changes in forest structure it is possible that the elk could discontinue use of Mt. Jumbo winter range (Edwards and Thompson pers. comm.).

To accomplish sivicultural goals (Goals # 2,3 and 6) on the Backbone land managers and City officials should anticipate periodic forest thinning, pruning and revegetation activities across a minimum of 20-30 years. To avoid adverse impacts on elk (Goal #7) individual forest treatments, across the next 20-30 years, will be scheduled based on the results of our monitoring program. In general, no more than 1/3rd (39ac.) of the forested areas deemed critical to elk cover and security (Fig. 3 Units 4-8) should be manipulated per time period. However, this general rule may be adapted adjusted based upon ongoing results and analysis from the elk monitoring program. For the purposes of this plan each time period is described below as a “Phase”.

2.2 Guidelines for Forest Health and Fuels Reduction Treatments

The primary objective of thinning treatments on Mt. Jumbo is to reduce the fuel load and susceptibility of insect and disease in forests within the project area, while continuing to provide critical winter elk habitat. The following language provides general guidelines for thinning prescriptions. This language guides treatment prescriptions within all Backbone stands. Because each forest stand is different, additional site-specific prescriptions are described for individual stands. Site-specific treatments are outlined in section 2.3.

Thinning will reduce competition between over-crowded trees and maintain the health and vigor of residual trees. Leave trees shall be selected based on diameter, species, condition, stem form, genetic traits, and location within the forest canopy. In general, trees over 12” DBH should be left. When selecting smaller trees to cut, Douglas-Fir should be cut rather than ponderosa pines. Dead trees greater than 8” DBH, shall be left as “habitat trees” for cavity-nesting birds and to add structural diversity to the forest.

Early stages of thinning will target young overstocked even-aged stands and conifer regeneration under mature trees. Later stages of thinning may target larger trees after forests have adjusted to initial tree cutting. All thinning should be done with variable spacing between trees (vs. even spacing between trees across the landscape) and pruning should be done at variable heights to maintain a natural appearance.

A diversity of age classes and diameters of trees should be left across all forest units. Treatments should maintain older-growth forests in draws. No cutting of deciduous trees or shrubs should occur except for safety

reasons. Where aspen (*Populus tremuloides*) clumps are found, adjacent small-diameter conifers should be completely removed to promote aspen regeneration. Where topography forms benches on the landscape, or where elk bedding is evident, residual trees should be clumped to maximize snow intercept and visual cover.

Slash generated from thinning operations must be disposed of on-site, as all areas along the Backbone are inaccessible to equipment. Much of this material shall be piled, and burned on site. Up to 50% of small diameter (< 6" DBH) slash generated can be scattered across the site. Scattered material may not be layered and should not cover more than 50% of the ground at any site. No slash shall be scattered beneath the canopy of mature trees. Residual slash depth shall not exceed twelve inches. Logs which are over 6" in diameter, and at least 5 feet in length shall be limbed, and left to lie flat on the ground. Leaving a portion of slash on the ground will reduce erosion, provide wildlife habitat, improve nutrient cycling and limit disposal by burning.

Large amounts of ponderosa pine slash can result in an accumulation of an *Ips* species of engraver beetles. As such, large accruals of ponderosa pine slash at any one location shall be piled and burned. To further reduce *Ips* accumulation pine slash should be cut and piled no earlier than mid-summer or the fall; and be disposed as soon as possible. Piles generated in the spring which are left to cure until fall burning provide nurseries for accumulation of *Ips* beetles.

In younger stands where few understory species exist it may become necessary to seed and/or plant understory species following thinning operations. It is quite possible that in dense, pure stands of Douglas-fir the diversity of the soil seed bank is low. Establishment of monitoring plots in these stands, prior to implementation of the "Phase 1 thinning prescriptions" outlined below, will allow land managers to track regrowth of understory species. Information gained from these monitoring plots will determine if direct planting/seeding of understory species should be included as part of a prescription in subsequent phases.

2.3 Site-Specific Management Treatments

The following outline describes management activities designed to manipulate forest density and composition. Treatments fall into two classes:

> **Class A)** Low-intensity landscape-level treatments may occur annually but implementation should be spread across the entire Backbone area and be limited to approximately 1 ac./year (implementation strategy outlined below)
>
> **CLASS B)** More intensive, stand-level thinning prescriptions affect more than 10 acres at time and should be implemented across multiple years to reduce both visual impacts and potentially negative effects on wintering elk (implementation outlined in "phases" outlined below).

A 10-year lag period between each intensive stand-level thinning activity (class B treatments) is a conservative measure to ensure elk sufficiently acclimatize to the changes in forest

structure produced by one Phase before implementation of the next Phase. A robust research and monitoring program which tracks changes in elk use patterns and forest structure will provide information to ensure the management goals outlined in chapter one are met.

2.3.1 Class A Treatments

Landscape Level Thinning Prescriptions, Annual implementations (limited to a total of 1 ac./year):

1) In areas which were forested in 1940 (Fig. 2) remove small diameter trees that act as ladder fuels from the drip line of mature trees greater than 18" DBH. Daylighting mature trees will increase their vigor by reducing competition and improve their ability to withstand natural disturbances. Cautious implementation of this activity will ensure that changes in stand densities are negligible across years but cumulative changes across decades will be recognizable.

2) Selectively cut suppressed trees within Units #6 & 8 (Fig. 1) to improve stand structure and reduce competition between residual trees. The long-term goals for Units 6 and 8 are to facilitate forest expansion.

2.3.2 Class B Treatments

Phase 1, Stand-Level Thinning Prescriptions, Implementation between years 0-5 (2014-2019):

1) Create strategic fuel breaks along property boundaries and in between treed areas (Units# 5 & 7, Fig. 4). The purpose of this action is to decrease the chance of crown fire spreading between forested units that form core elk winter habitat. Prescriptions in these stands are designed to reduce surface and canopy fuels to achieve a target fire behavior of a low-intensity ground fire. Well maintained fuel breaks can also act as safer space for personnel involved in any fire suppression that may occur (Agee et. al. 2000). Stocking densities within these units should average a basal area of 40-60 ft^2/ac. With a minimum of 20 ft. between the canopies of overstory trees. All trees should be pruned to height of at least 8 ft. to limit the chance of a ground fire extending into the canopy. The target stand structure in fuel breaks along property boundaries is an open mature forest dominated by large trees with an understory of herbs and/or shrubs. Target stand structure in breaks between Units #5 & 7 is a heterogeneous mix of mostly open grassland, with widely distributed clumps of trees that are large enough to provide hiding cover for small groups of elk or deer. In fuel breaks all slash generated should be burned or removed from site to reduce fuel loads. A 5-10 year reentry period may be necessary to maintain the functionality of these fuel breaks (see Agee et. al. 2000 for more information on the science behind fuel breaks).

2) Thin forests in Units #3 & #4 between Mt. Jumbo's saddle and summit (Fig. 4). Thinning will target smaller overstocked stands and conifer regeneration under mature trees. Target spacing of approximately 20 ft. between mature overstory tree crowns is desired. Residual trees may be left in patches of less than 150

ft. in diameter with density of overstory trees in the patch not to exceed 80 ft^2 per acre of basal area. Each patch must have a minimum of 20ft. spacing between the crowns of adjacent patches. The forest treatment will include retaining buffers along elk travel corridors leaving enough vegetation to hide 80% of a standing adult elk from view of a human on the trail. Also, vertical buffer patches will be created in a mosaic pattern to connect travel corridors, and visual buffers will be retained around natural openings such as meadows to provide visual cover and security.

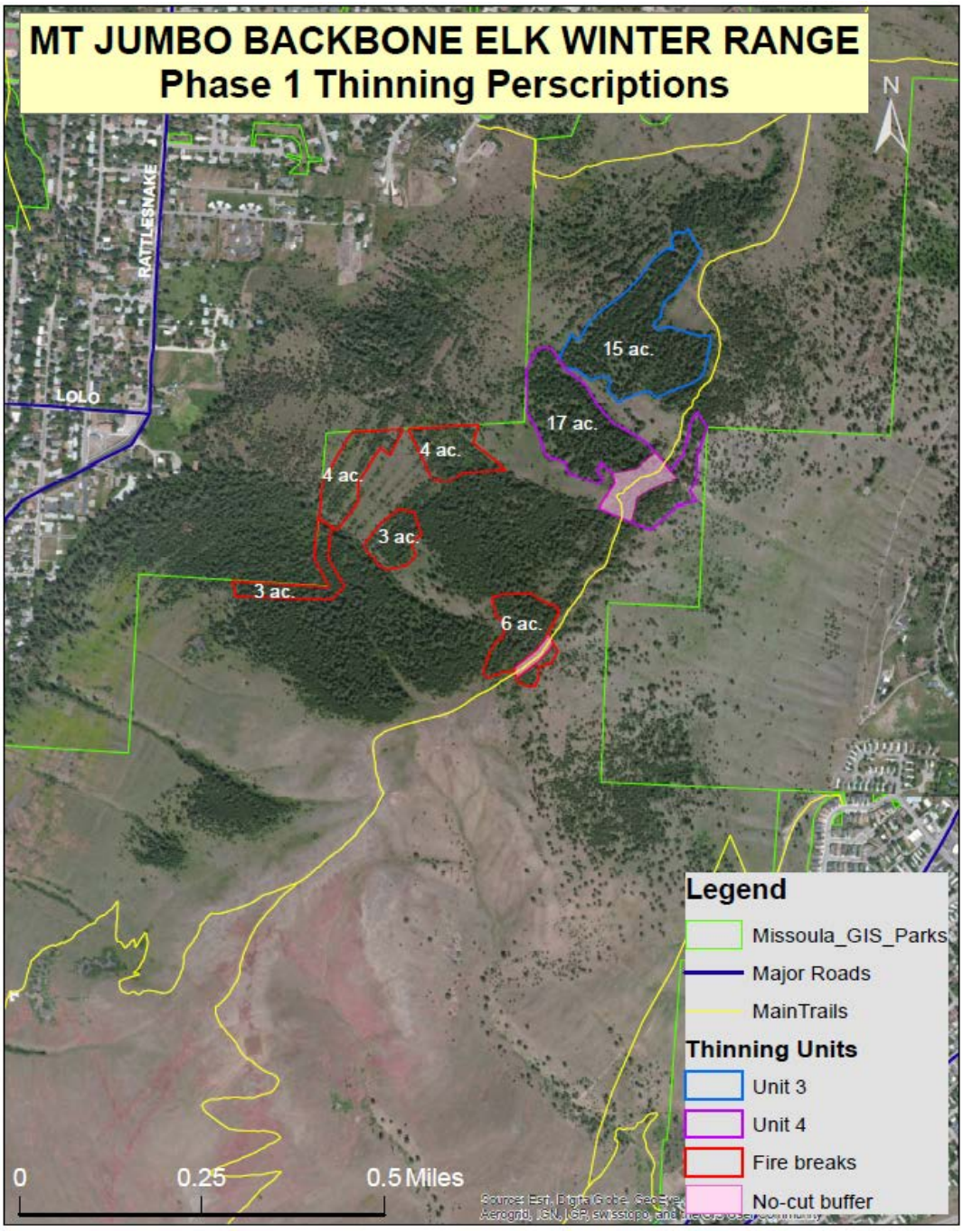
Phase 2, Stand-Level Thinning Prescriptions, approximate implementation between years 10-15 (2024-2029):

The following recommendations serve as a guide to City land managers. Implementation (timing, total area and cutting techniques) of Phase 2 thinning prescriptions will be directed by data collected from scientific studies of elk utilization of Mt. Jumbo and forest response to Phase 1 thinning prescriptions.

1) Thin forests in core elk winter range, forest Units #5 & 7 (Fig. 1). Approximately, 8 acres around the peripheries of Unit #5 will have already been treated in Phase 1 (Fig. 4). During Phase 2 foresters can complete cutting the remaining 23ac. of Unit #5 and treat up to 10 ac. In Unit #7. Data collected on elk use of Unit #7 will direct which 10 ac. Within this unit should be treated. Thinning prescriptions will target smaller overstocked stands and conifer regeneration under mature trees. Target spacing of approximately 10 ft. between mature overstory tree crowns is desired. Smaller trees may be left in patches of less than 150 ft. in diameter with the remaining basal area of overstory trees in the patch not to exceed 80 ft^2/acre. Each patch must have a minimum of 20ft. spacing between the crowns of adjacent patches. Prune all trees at variable heights to avoid appearance of a uniform browse line and to promote growth of understory shrubs.

   The forest treatment will include retaining buffers along elk travel corridors leaving enough vegetation to hide 80% of a standing adult elk from view of a human on the backbone trail. Also, vertical buffer patches will be created in a mosaic pattern to connect travel corridors, and visual buffers will be retained around natural openings such as meadows to provide visual cover and security.

FIGURE 4: Phase One Thinning Prescriptions



2) Reentry into Unit #2. Preliminary data indicates this unit is not highly utilized by the elk, but it does provide a secure travel corridor for ungulates and an effective barrier between private and public forests. Prior to 2010, the Western half of the unit was densely forested by Douglas-Fir. The Eastern half of the unit was composed of both open grasslands and stands of ponderosa pine. This unit was thinned in 2010 with the goals of reducing forest density in the Western half and restoring grasslands in the Eastern half. Reentry work in this unit should focus on maintaining open grasslands and open

forests and removing small diameter trees that act as ladder fuels under mature trees.

3) Reenter stands designated as fuel breaks in Phase 1 to remove build-up of surface fuels.

Phase 3, Large-scale Thinning Prescriptions, approximate implementation between years 25-30 (2034-2039):

The following recommendations serve as a guide to City land managers. Implementation (timing, total area and cutting techniques) of Phase 3 thinning prescriptions will be directed by data collected from scientific studies of elk utilization of Mt. Jumbo and forest response to Phase 1 & 2 thinning prescriptions.

1) Complete treatment of forests in core elk winter range. In Phase 3 foresters can thin the remaining untreated 30 acres in forest unit #7 (Fig. 1). Thinning prescriptions will target smaller overstocked stands and conifer regeneration under mature trees. Target spacing of approximately 10 ft. between mature overstory tree crowns is desired. Residual trees may be clumped in patches of less than 150 ft. in diameter with density of overstory trees in the patch not to exceed 80 $ft.^2$/ac. Of basal area. Each patch must have a minimum of 20ft. spacing between the crowns of adjacent patches. Prune all trees at variable heights to avoid appearance of a uniform browse line and to promote growth of understory shrubs.

   The forest treatment will include retaining buffers along elk travel corridors leaving enough vegetation to hide 80% of a standing adult elk from view of a human on the backbone trail. Also, vertical buffer patches will be created in a mosaic pattern to connect travel corridors, and visual buffers will be retained around natural openings such as meadows to provide visual cover and security.

2) Reenter stands designated as fuel breaks in Phase 1 to remove build-up of surface fuels

2.4 Research and Monitoring Needs and Methods

As land managers execute the activities outlined in this plan it is imperative that a system is in place to ensure management goals are being met. At a minimum, a robust long-term monitoring program to track changes in plant communities and patterns of elk use on Mt. Jumbo should be established. Correlating data from vegetation monitoring plots with data collected on elk use will provide the mechanism by which land managers can gauge ungulate response to thinning treatments and determine appropriate timing for implementation of subsequent “Phases”. Incorporating a research component into this program would allow for installation of experiments which would help land managers develop site-specific best-management practices for forest management along the Backbone.

Many of the thinning prescriptions outlined in section 2.3 are designed to set a trajectory by which second-growth stands of Douglas- fir will transition into more biologically diverse, resilient old-growth forests. While no old-growth forest currently exist on the flanks of Mt. Jumbo there are several discrete areas

which have been treed for upwards of 150 years. In these areas natural processes have developed mature forests which meet our criteria for diversity, resilience, and cover. Unit #1(Fig. 3) is one such unit. In this unit, a dense understory of native shrubs provides important habitat for both large and small animals and a developed overstory of mature trees provides snow-intercept and thermal cover for wintering elk. For the purposes of establishing a vision for long-term forest management Unit #1 will be maintained as a reference point for management of Douglas-fir dominated forests on the Backbone.

Local wildlife biologists and foresters agree the stand structure and species diversity in Unit #1 provides both good elk habitat and resilience to natural disturbances (pers. Comm. V. Edwards, E. Norris and A. Gannon). While Unit #1 will provide land managers with valuable information concerning the potential of forests on the Backbone it is important to note that conditions within Unit #1 may not be achievable on other locations. Surveys should be conducted to establish additional reference points on the Backbone in forests which differ in slope, aspect and species composition from Unit #1.

Elk Use Monitoring:

The goal for elk monitoring is to detect changes in the magnitude and spatial patterns of elk use on areas of Mt. Jumbo that have been identified as critical winter range. Throughout the years, aerial surveys by MFWP and two studies to track elk through fecal pellet and visual surveys have been conducted. All of these studies have provided important information on elk use, especially elk foraging, of Mt. Jumbo. However, data collected from elk pellet group counts and the citizen-based visual elk surveys are preliminary until a minimum of 3-years of trend data are collected. To provide continual input to proposed forest management prescriptions, it is recommended that components of each of these studies continue into the future. We have chosen four ways in which we will describe current habitat use, and monitor any potential future changes.

1) During spring green-up the MFWP wildlife biologist conducts an aerial, fixed-wing elk survey. This survey gives us an accurate count of the total herd size of elk populations in the spring and provides long-term spatial-use trend data. This survey does not give much information about spatial patterns of use.

2) Throughout the 2013-2014 winter a citizen-science project was implemented where citizens on the valley floor took accurate counts of elk on Mt. Jumbo. The volunteer "elk spotters" program proved a simple cost-effective way to collect valuable information on winter elk movement while engaging citizens in the management of Mt. Jumbo. See Appendix A for zone maps and elk spotter's data sheet. The volunteer elk spotters program should continue. This data may help revel long-term or weather dependent trends in elk winter-use of Mt. Jumbo. Also, it may provide insight into elk response to forest management practices over time.

3) Install a network of permanent plots before thinning treatments occur to track elk fecal pellet deposition. Fecal pellet group surveys have been used extensively as indicators of ungulate distribution and use. The National Park Service's North Coast and Cascades Network protocols for elk monitoring within the Lewis and Clark National Historic Park

provide good examples of monitoring programs which could easily be adapted to Mt. Jumbo (Griffin et. al. 2011). These plots should be re-monitored immediately after forest treatment and periodically throughout time to track general changes in elk distribution on the mountain over time. This plot network may also function as a platform to monitor changes in understory vegetation.

4) Conduct surveys of elk bedding areas within forested areas along the Backbone which may provide important winter cover. Surveys should be conducted immediately following the opening of Mt. Jumbo's South zone. Knowledge of where elk like to bed-down coupled with data from the elk pellet counts will be critical for implementing all phases of forest management. Additionally, quantification of the site conditions that these elk prefer will allow land managers to set habitat enhancement goals.

Vegetation Monitoring:

In order to write the most effective thinning prescriptions in a given stand, we need more information about the structure, size, composition, and health of forests on Jumbo. A timber cruise will provide essential information about forest structure. A cruise of forests covered by this management plan should be completed prior to establishment of vegetation monitoring plots or implementation of Phase 1 thinning prescriptions.

In order to determine whether management goals have been met it will be necessary to monitor both the structure and composition of plant communities across the project area. Data collected will allow land managers to ensure foresters meet written thinning prescriptions and to track the response of both understory vegetation (shrubs and herbs) and residual trees to management activities. To accomplish our management objectives, Missoula's Conservation Lands Management Program should install the following types of long-term vegetation monitoring plots:

1) Install a network of permanent vegetation plots before treatment occurs. These plots should be re-monitored immediately after treatment and periodically throughout time until management criteria are met. Information from these plots will also help develop a species list for restoration of areas disturbed by thinning operations and for active establishment of understory species in forests where diversity is low. Methods should be developed to track the following forest structural characteristics:
   - Number of trees per acre
   - Percent tree canopy cover
   - Percent cover of grass, forb, shrub, moss and bare ground
   - Understory vegetation composition and productivity
   - Elk browse utilization

2) Establish photo-points throughout the project area to allow for qualitative tracking of changes in vegetation over time.

Potential Research Needs:

There are multiple opportunities for experimental research studies within the project area. Collaborations with professional and student researchers should be actively pursued to enhance our knowledge of how to manage elk winter range in Western Montana.

If funding allows, multiple studies could be developed to prefect best-management practices for forests on the Backbone, and monitor elk response to forest treatments. Experiments exploring techniques for maintaining visual cover on site following forest thinning may help minimize the direct impacts of thinning on elk use of the area. In young forests, establishment of a diverse understory may be expedited by direct planting of native plants. Research studies where varying densities of native understory species are planted on site would be a good way to develop methods to quickly increase cover and browse in core elk winter range. Additionally, a multitude of other research projects to track how forest manipulations improve (or degrade) habitat for other flora and fauna could be implemented. Also, a Mt. Jumbo elk research project with collared GPS data collected from elk would provide fine-scale data on spatial and temporal use of winter habitat on the mountain.

CHAPTER 3
IMPLEMENTATION

Responsible management of forests along the Backbone will require commitment from land managers and public administrators. The phased implementation of management activities outlined in this plan will require concentrated periods of resource allocation and revaluations of maintenance activities based on scientific data collected from long-term monitoring plots. Inter-agency coordination and significant public-involvement will also be required to meet the goals outlined in Chapter 1.

Current management of the Missoula's Conservations Lands is guided by the Conservation Lands Management plan. The Mt. Jumbo Forest Management Plan for Critical Elk Winter Range should be adopted as a component of Missoula's Conservation Lands Management Plan to be implemented as such.

A variety of funding sources are available for individual forest thinning and habitat improvement activities outlined in this plan.

Applying for grants to fund portions of this project should be encouraged but City officials should not rely solely on grant funds to complete the management activities in this plan. Grant dollars are not always available, are competitively awarded and most require some level of matching funds. In short, reliance solely on soft dollars to protect and improve critical elk winter range on Mt. Jumbo may be unsustainable in the long-run. Furthermore, as few outside funding sources exist for monitoring, dedicated funding for long-term research and monitoring will be critical for the successful implementation of this plan.

Tables 1 & 2 outlines base costs for supplies & materials and contracted services necessary for implementation of this plan. All costs are based on amounts paid between 2010 and 2014 for similar work across 200ac. of forests on the saddle of Mt. Jumbo.

3.1 Costs

Table #1 Cost of Phased Thinning: Includes Contracted services and Parks employee labor only

PHASE 1	ACRES	COST/AC.	TOTAL COST	FUNDING SOURCE
Units # 3 & 4	32	$555	$17,760	Paid at 100% by DNRC grant
Fire breaks	20	$900	$18,000	Funding not determined
PHASE 2				
Units # 5 & 7	33	$800	$26,400	Funding not determined
Reentry Unit #2 west	20	$350	$7,000	Funding not determined
Reentry Unit #2 east	19	$200	$3,800	CL employee labor
PHASE 3				
Unit # 7	31	$800	$24,800	Funding not determined
SMALL-SCALE ACTIVITIES				
Unit # 8	12	$450	$5,400	CL employee labor
Unit# 6	16	$450	$7,200	CL employee labor
TOTAL PROJECT COST IN 2014 DOLLARS:			**$110,360**	

Table #2 Cost of Rehabilitation: Includes supplies/materials and contracted services only

PHASE 1	QUANTITY	UNIT	COST	TOTAL COST	FUNDING SOURCE
Seed for disturbed areas	400	lbs.	$14	$5,600	CLM budget
Weed control	2	weeks	$5,000	$10,000	CLM budget
PHASE 2					
Seed for disturbed areas	300	lbs.	$14	$4,200	CLM budget
Weed control	3	weeks	$5,000	$15,000	CLM budget
Native shrubs (if required)	3000		$3	$9,000	CLM budget
PHASE 3					
Seed for disturbed areas	600	lbs.	$14	$8,400	CLM budget
Weed control	4	weeks	$5,000	$20,000	CLM budget
Native shrubs (if required)	3000		$3	$9,000	CLM budget
SMALL-SCALE ACTIVITIES					
Seed for disturbed areas	200	lbs.	$14	$2,800	CLM budget
Weed control	3	weeks	$3,000	$9,000	CLM budget
TOTAL PROJECT COST IN 2014 DOLLARS:				**$93,000**	

The costs depicted in Table 2 for each phase are conservative estimates. Monitoring of noxious weed densities on site and recolonization rates for native vegetation could increase or decrease the costs needed to establish healthy understory vegetation. While it may be possible to find grant dollars for some materials (eg. seed, shrubs, and herbicide application) in Table 2, given the scope and duration of this project it is unlikely that an outside funding source would cover a significant portion of these costs. If the current budget of Missoula's Conservation Lands Program remains relatively static, reallocation of supplies, materials and staff labor from other Conservation Lands management projects would be necessary implement the activities in Table 2. Consistent periodic increases in the operating budget of the Conservation Lands Program to fund restoration and rehabilitation of plant communities will be required to meet the goals outlined in this plan.

3.2 Coordination

This plan was developed with significant input from Mt. Fish Wildlife and Parks, the Department of Natural Resources and the Conservation Lands Advisory Committee. In 2014, the Conservation Lands Manager worked closely with these three groups as well as the Montana Conservation Corps, the Missoula County Weed District, the University of Montana Society of American Foresters, City of Missoula Fire Department, multiple professors and students in the University of Montana's College of Forestry and countless citizen volunteers to manage forests and collect elk use

data on Mt. Jumbo. The projects described in this plan provide ample opportunities to continue this culture of collaboration

While this management plan is specific to forests owned and managed by the City of Missoula the management of natural resources along the Backbone are also the responsibility of adjacent private property owners. Over 80 acres of forests along the Backbone are on privately owned land (Fig. 1). The forested areas downhill from Units #5 & 7 (Fig. 2) have the potential to directly impact the health and integrity of critical elk winter range. Natural disturbances in these privately-owned forests could easily spread onto adjacent City-owned lands. Additionally, it is highly likely that the some of these private forests, especially those below Unit #7 also provide cover and security for elk during the winter.

Efforts should be made by the Conservation Lands Manger to contact neighboring landowners to involve them in management activities on the Backbone. While the Conservation Lands Program has no resources available to assist adjacent landowners with management of their lands the Conservation Lands Manager may offer advice on land management practices and direct neighbors to other agencies or organizations who could provide help. Given the importance of some of these areas for maintenance of healthy habitats along the Backbone it is also recommended the City consider entering into cooperative management agreements, easements or direct purchase of these private lands.

3.3 Updates

It is expected that our knowledge of best-management practices for native habitats and wildlife will progress significantly during the implementation of this plan. As new scientific discoveries are published and/or revealed by our site-specific monitoring it may become necessary to update this plan.

Minor editorial changes and corrections should be performed by the Conservation Lands Manger at his/her discretion. Such changes should be communicated to the Conservation Lands Advisory Committee and the general public to ensure continuity between shared drafts of this plan. Substantive changes to the scope or thinning prescriptions outlined in this plan should be evaluated by MFWP prior to official adoption of said changes by the Missoula Park Board and the Missoula City Council.

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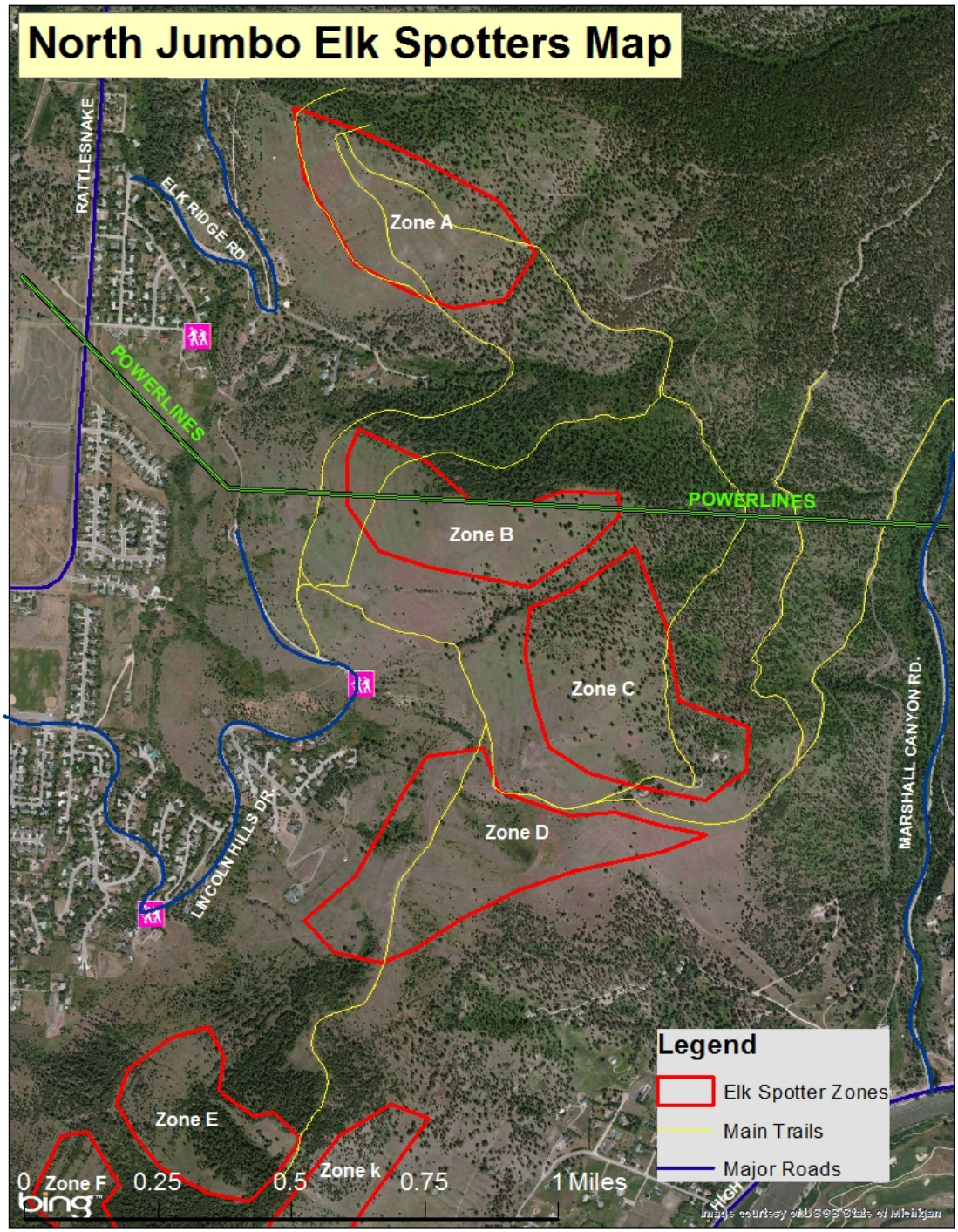
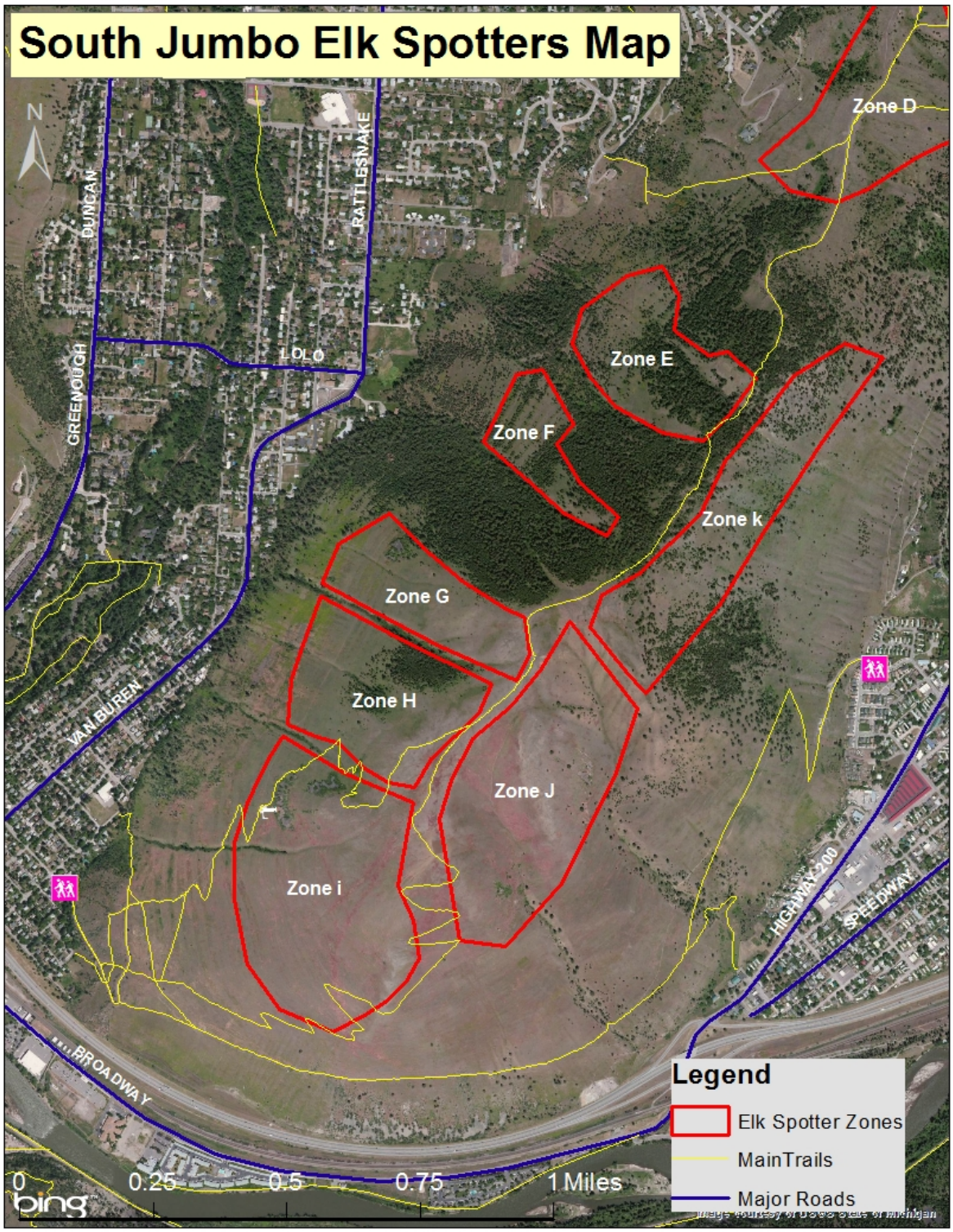
APPENDIX A:

2013 volunteer elk spotter zones and data sheets




South Jumbo Elk Spotters Map
N
DUNCAN
RATTLESNAKE
LOLO
GREENOUGH
VAN BUREN
BROADWAY
HIGHWAY 200
SPEEDWAY
Zone D
Zone E
Zone F
Zone k
Zone G
Zone H
Zone J
Zone i
Legend
Elk Spotter Zones
MainTrails
Major Roads
0
0.25
0.5
0.75
1 Miles
bing

Mount Jumbo Elk Herd Citizen Monitoring Project
Winter 2013-2014 (December 1st - May 1st)

Instructions: Fill in each required field
Try to make your observations at the same time each day
If elk are in >1 zone, make an entry for each zone they occupy
If elk are totally absent from view, record a 0
If elk are not visible due to weather, record a W for the day

Observer(s) name:
Observation address:
Observer email:

Required	Reqd.	Reqd.	Reqd.	Optional	Optional	Optional	optional
Date	**Time**	**Zone Number**	**# of Elk**	# Males	# Females	# Juveniles	Notes
example	required columns in **bold**						
5/15/2005	**15:30**	**Zone B**	**100**	10	60	30	Mixed group on border btw zone b and c