

An Approach to Resolving Rocky Mountain Elk Depredation in the Blue Mountains Region of Oregon

1. Factors Influencing Ungulate and Predator Actions

Background

The Blue Mountains Region (BMR) encompasses 23,984 square miles and is the largest ecological region in Oregon. The region is characterized by mountain ranges, plateaus, and valleys that are subject to a broad range of temperature and precipitation gradients. Alluvial valleys contain most of the resident human population, who are primarily engaged in farming, ranching, and wood products operations. These resource-based operations rely upon nearby small towns that provide support and services to the local community.

The overall climate of the BMR is characterized by short, dry summers and long, cold winters. Winter generally brings heavy snowfall which, combined with rugged terrain, makes seasonal movement of wild and domestic ungulates to lower elevation desirable. Most wild ungulates are considered as migratory animals that respond to natural events such as weather by moving to valley and canyon habitat better suited to meeting their survival needs. Winter concentration of wild ungulates on these valley and canyon habitats is common. Most of the higher elevation rangeland (alpine, forest, forest-steppe, and grass-steppe) is spring, summer, and fall range for domestic (Cattle and Sheep) and wild ungulates (Rocky Mountain Elk, Mule Deer, and Bighorn Sheep).

The BMR has the diversity of vegetation types needed to support large populations of ungulates. Forest communities are dominated by pine (Ponderosa and Lodgepole) and mixed-fir (White fir and Douglas fir) communities in different successional stages. Forest-steppe includes forest stands intermixed with natural openings of grass-steppe communities. Forest stands generally have forest overstories with shrub and/or herbaceous understories. Grass-steppe rangelands are generally herbaceous vegetation communities dominated by bunchgrasses such as wheatgrass, fescue, and bluegrass. Invasive annual grasses and perennial forbs are often present on lower elevation rangeland. Riparian communities occur along stream drainages and in naturally occurring moist area meadows.

The economy of the BMR is currently supported primarily by livestock and crop agriculture. Other economic support is derived from seasonal tourism, federal and state government employment, and sportsman activities including hunting and fishing. Formerly, the wood products industry was a major contributor to the economy of small communities in the BMR. At the present time, income from timber harvested on national forests in the region provides little economic support to the region, and, as well, does not support good management of the forest resource. At the same time, large tracts of forest that are owned by private timber investment companies are presently being overharvested, which may deprive local communities of needed economic support in the future.

Grazing lands support the continued economic viability of natural resources dependent communities in the BMR. Most farms and ranches in the region are family owned and operated entities that are integral parts of small, local communities. Livestock ranchers often rely on both public and private grazing lands to sustain their operations. Most ranchers depend on privately owned valley cropland and foothill rangeland to produce winter feed for local livestock, or for sale to other users. Access to higher elevation forest, forest-steppe and grass-steppe summer range that is mostly public land helps make

ranching in the BMR economically viable. The opportunity to access public grazing land during summer and fall allows ranchers to produce and store livestock feed on private land for the winter and spring seasons.

A majority of rangeland in the BMR classified as public land is managed by federal or state agencies. Increasingly, public land is being scrutinized relative to ungulate impacts (especially domestic livestock impacts) on the sustainability of rangeland and on threatened and endangered species in the region. Past management agency response to contentious issues associated with timber harvest and domestic livestock grazing has increased economic uncertainty for public land users. Numbers and dates of livestock grazing USDA-Forest Service or USDI-BLM allotments are declining as permitted stock numbers are lowered, days of use are reduced, allotments are entered into non-use, and allotments are permanently closed. A majority of non-production activities including hunting, fishing, and recreation occur on public land. Consequently, maintaining access to public lands is a high priority for ranchers, sportsmen, and recreationists.

Large Ungulate Timeline

Prior To Settlement: (Prior to 1860)

Large wild ungulates have been an important wildlife component of the BMR for millennia. Although the number of ungulates inhabiting the region prior to European settlement is unknown, evidence suggests they were relatively abundant in the region.

Early European travelers found evidence that Rocky Mountain (RM) Elk were present in the BMR. In 1812, Robert Stuart (a fur trader) described elk antlers covering the ground near Hot Lake in the Grande Ronde Valley. American General and explorer Benjamin Bonneville, who spent the winter of 1834 in the same valley, noted numerous elk wintering there after being driven to lower elevations by snow at higher elevation. In the early 1860s, George A. Waggoner (an Oregon Territory pioneer) hunted elk in the Blue Mountains with Wallowa Nez Perce hunters that included young Chief Joseph (reference in Thomas, J.W., and D.E. Towell 1982).

It is highly probable that RM Elk shared the BMR with native tribes, other large wild ungulates such as mule deer, bighorn sheep, and mountain goats, and large predators that included the mountain lion, black and grizzly bears, and wolves. After local tribes acquired horses in the mid-1700s and cattle in the early 1800s, wild ungulates shared habitat with domestic livestock (J. McCormick, Personal observation).

European Settlement: (ca 1860-1910)

Large scale European settlement of the BMR began with the mining boom in the 1860s. Primary factors associated with settlement that caused large-scale decline in wild ungulate numbers were:

- unregulated hunting, especially market hunting for profit obtained by sale of meat;
- changes to habitat associated with settlement such as mining, logging, farming, livestock ranching, establishment of towns, roads, etc., and
- infectious diseases transmitted by livestock.

Indigenous populations of RM Elk (and mule deer) were reduced to low numbers at the beginning of the 20th Century, but were never extirpated from the region. In 1900, the Lacey Act prohibiting market hunting was passed, and Oregon initiated protection of the few remaining wild ungulates. Hunters were

required to obtain a hunting license and sale of game meat was prohibited. Despite the attempt to provide protection, RM Elk are thought to have reached their lowest numbers about 1910.

Wild Ungulate Recovery: (ca 1910-1980)

RM Elk recovery required protection of the few remaining RM Elk in the BMR and introduction of elk from Yellowstone National Park to Wallowa County in 1912. With protection and active management, elk began a slow recovery. The general time-line for elk recovery in the northeastern BMR was approximately seventy years (1910-1980) as indicated by the following timeline (Coggins V. 2018):

- (1915) Elk numbers were estimated at 37 in the Billy Meadows enclosure and 265 elk throughout Wallowa County.
- (1926) Elk numbers in Wallowa County were estimated at 500-600 head.
- (1933) Elk numbers were estimated at 2,265 on the Wallowa National Forest and 3,080 on the Umatilla National Forest. The first general elk hunting season in Oregon opened in 1933.
- (1960) Elk numbers in Wallowa County were estimated at 6,400 head.
- (1970) Elk numbers in Wallowa County were estimated at 12,200 head.
- (1980) Elk numbers in Wallowa County were estimated at 19,800 head.
- (1981) Rocky Mountain elk numbers in Oregon were estimated at 56, 650 head distributed over 28 game management units,
- (2020) Rocky Mountain elk numbers in Eastern Oregon were estimated at 72,000 head.

By the end of the recovery period, RM Elk numbers approximated current numbers, and had filled most of the available habitat in the BMR and throughout Eastern Oregon. Anecdotal evidence supporting the above premise includes:

- (1958) Elk were expanding their range into other localities of the state. Elk had moved into the Alder Creek area of Baker County southeast of Baker City. During the day, elk remained in timber cover, but in the evening, elk would leave forest cover to graze nearby grain and alfalfa fields (D.P. Sheehy, 1958. Personal observation)
- (1960). Hunting of bull elk on the Lookout Mountain Unit between the lower Burnt River and the Snake River in Baker County was initiated around 1960 (D.P. Sheehy, personal observation).
- (1976) ODFW research biologists recorded sighting 13 cow elk in Big Fir Creek on Steens Mountain south of Burns, Oregon (D.P. Sheehy, personal observation).

Changes in Wild Ungulate Distribution: (ca 1860-1970)

During settlement and early recovery, RM Elk apparently selected rugged mountain or canyon habitat where hunting them was difficult. These areas evidently provided sufficient habitat for the number of elk present in the BMR at that time. Changes to natural habitat that occurred in the BMR during and after settlement did not prevent elk recovery as long as hunting was controlled. However, as elk numbers increased, the need for additional habitat also increased. RM Elk began encroaching on habitat used for grazing by domestic livestock and for crop production. Elk utilizing this expanded habitat generated conflict between elk and stockmen or farmers, and between land owners, hunting organizations, and wildlife management agencies.

During this period, affected farmers and ranchers began to complain about changes occurring to RM Elk distribution. Evidence of the perceived distribution change leading to elk depredation of rangeland and cropland included their observations that elk were:

- not following “traditional migration patterns”,
- choosing private land habitat over public land habitat,
- competing with livestock for forage,
- foraging at night in grain and alfalfa fields instead of moving to summer range, and
- raiding haystacks during the winter.

There was sufficient complaint about elk depredation that studies were initiated to ascertain why apparent change was occurring. Institutions engaged in ungulate studies in the Blue Mountains included the Oregon Dept. of Fish and Wildlife, Oregon State University/Eastern Oregon Agricultural Research Center, and the USDA-Forest Service/Starkey Experimental Forest and Range. Landscape-scale studies of the use of habitat by RM Elk were conducted by the EOARC in the BMR during this period. The research section of ODFW, often in collaboration with the U.S. Forest Service, undertook numerous RM elk and Mule deer studies to gain a better understanding of behavior and habitat needs.

2. Factors Influencing Ungulate Behavior

Satisfying basic needs of RM elk and other large ungulates depends on their access to habitat that provides the security, shelter, and food needed for survival. Although satisfying ungulate needs is a constant activity, the habitat used to satisfy needs is dynamic and constantly changing. In this context, the primary drivers of change include:

- changes to habitat by natural factors such as fire and weather;
- changes to habitat by introduced factors associated with human activities such as livestock grazing, cropland development, recreation, and logging,
- agency management policies relative to ungulates and habitat, and
- management policies relative to large predators that target wild and domestic ungulates as primary food sources.

Factors Affecting Habitat

Impacts of Wildfire:

The BMR is subject annually to numerous forest and rangeland wildfires, especially naturally occurring fires initiated by lightning. Prior to settlement, wildfires were apparently frequent enough to maintain a relatively open forest ecosystem characterized by low fuel loads. As the need for forest products increased during and after settlement, preventing and limiting the scope of wildfire became a priority of landowners and newly created public land management agencies.

Large, uncontrolled wildfires affect both the quantity and quality of ungulate habitat in the BMR. Between 1984 and 2017, over 2.6 million acres of forest, forest-steppe, and grass-steppe rangeland in the six eastern-most counties of the BMR burned due to wildfire. During this 33-year period, 207 wildfires greater than 1,000 acres occurred in the six counties. Sixty-one of the 207 were medium sized fires with burn areas between 1,000 and 20,000 acres, while thirty-seven of the 207 were large fires that

had burn areas between 20,000 and over 100,000 acres. Wallowa and Grant Counties had the highest number, and the largest fires. In both counties, large wildfires often burned:

- the same area in different years,
- occurred in areas previously closed to domestic ungulate grazing, and
- occurred in areas formerly used as winter range by wild ungulates (USDA-NRCS and U. of Montana 2018).

The impact of wildfire on both forest and rangeland is related to the size and intensity of the burn, which are both largely dependent on fuel load and weather-factors. Wildfire in forest and forest-steppe rangeland can:

- alter optimal overstory cover to understory forage ratios,
- allow invasive and/or lower value plants to dominate, and
- initiate long term ecological degradation.

In grass-steppe rangeland, wildfire can kill desirable forage plants, especially bunchgrass plants that have high levels of standing dead litter in the crown. Usually, these plants will be replaced by noxious and/or invasive annuals and perennial plants undesirable to most ungulate grazers. Management agencies, intent on avoiding permanent damage to the post-fire ecology of the burn area, usually require removal of domestic livestock from burned allotments or pastures.

The negative impact of wildfire on ungulate habitat can be reduced by:

- employing logging and thinning practices prior to a wildfire that are designed to improve ungulate shelter habitat (i.e., establishing mosaics of optimal tree density and overstory cover),
- creating small clear-cuts and firebreaks to improve food availability,
- using controlled livestock grazing to reduce burn intensity and fuel loads, and
- using small, controlled fires to improve ungulate habitat on both open rangeland and forest by destroying undesirable annual grass seed and preventing accumulation of standing dead litter in perennial grasses.

In conclusion, large wildfires can cause loss of habitat and forage quality important to both wild and domestic ungulates. Mitigating the impact of wildfire can be achieved when management agencies address the problem with readily available low-cost treatments prior to the fire. Treatments such as presented above should be applied to ungulate winter range that are prone to large, uncontrolled wildfire.

Impact of Cropland Development:

During initial settlement, most cropland development occurred on the most productive portions of valleys and surrounding grass-steppe rangeland. In the BMR, cropland development was facilitated by the Homestead Act of 1862, which gave ownership of 160 acres if the land was “proved-up”. The land claim was increased to 320 acres in 1877, and was further increased to 640 acres in 1909 by enactment of the Desert Land Act. Homestead conversion of valley land to irrigated cropland and surrounding grass-steppe habitat to dryland grain and hay substantially altered lower elevation winter and spring habitat for wild ungulates. Conversion of forest- and grass-steppe rangeland to marginal dryland grain

and hay cropland and/or small-scale livestock homesteads significantly altered habitat used by wild ungulates in the spring and fall seasons prior to settlement.

During the 1930s, the feasibility of dryland crop farming was significantly reduced by low prices paid for commodities and a succession of drought years. Most farms were sold or abandoned, and former grain and hay fields were seeded to introduced species of grass and forbs. The initiation of the Conservation Reserve Program (CRP) in 1980 provided an incentive for land owners to take most of the remaining dryland farm acreage out of production.

A large proportion of current CRP land was formerly used by RM Elk as spring-fall or winter range. Compliance with CRP regulations required the landowner to rehabilitate former dryland crop areas by seeding domesticated pasture mixes and eliminating livestock grazing. Although the seeded land provided a more natural habitat for wild ungulates, much of the nutritive value of the restored habitat diminished quickly without mechanisms in place, such as controlled livestock grazing, to maintain plant vigor. Concentration of wild ungulate grazing on palatable and high nutrient plant species soon eliminated these plants from the stand and allowed invasive, low value plants to dominate. Lack of controlled domestic ungulate grazing at the right time has allowed accumulation of above ground dead biomass, lowering nutrients available to wild ungulates.

In some areas of the BMR, new irrigation techniques and consolidation of farms and ranches into larger production units has fostered the development of large-scale, high-tech agriculture. Significant areas of rangeland previously used by wild ungulates during the winter have been converted to irrigated cropland. Now more productive irrigated areas with high nutrient crops available are attractive to wild ungulates such as RM elk during all seasons.

In conclusion, many landowners engaged in farming or ranching view RM elk use of private land as depredation. Many landowners, while tolerant of some wild ungulate use during severe winters, consider current use by large numbers as non-sustainable. While elk depredation of private land has occurred during and after elk recovery, in the past ODFW was able to mitigate damage to private land through application of damage control programs. At the present time, the funding and personnel available to implement ODFW mitigation programs are both insufficient to achieve the desired results. Recently undertaken programs appear to not have long term effectiveness.

Impact of Forest Management:

The scale of timber harvest in the BMR was low during the mining and early settlement era. Although mines and mining needed lumber, as did houses and settlements, a relatively small amount of locally obtained and processed lumber satisfied the need. During mid to late settlement, harvest of old growth trees accelerated with the development of railroad and truck logging. As the industry grew to meet the national demand for building materials, new technologies facilitated the change from selective harvest, which dominated tree harvest during the early elk recovery period, to clear-cutting harvest methods.

By the 1970s, clear-cutting was the dominant harvest method on both public and private forest land in the BMR. During the Reagan administration (1980-1989), USDA-Forest Service was mandated to harvest timber as an economic stimulus. In Wallowa County, the Forest Service committed to harvesting 60 million board feet (mmbf) per year from public forests. During the peak of timber harvest in Wallowa County (1970-1990), the annual harvest was approximately 120 mmbf of timber. This amount included

30 mmbf from large, private timber company land, 60 mmbf from national forest land, and 30 mmbf from smaller private holdings.

By the 1990s, timber harvest of any type on federally managed forest land essentially ended due to pressure from environmental groups opposed to timber harvest in general and to legal decisions that considered timber harvest detrimental to threatened and endangered species. As timber harvest on national forests declined, timber harvest on privately owned forest land increased. However, the lower volume of timber harvested from privately owned forest and the lower value of timber products at the time caused the closure of most sawmills in the BMR (Wallowa County, which had three medium size sawmills operating at one time, now has only one small sawmill making non-lumber products from small diameter logs). The majority of large diameter logs that enable the few remaining large sawmills in the BMR to operate are obtained from large, investor-owned timber companies or small tracts of privately owned timberland.

Overall, RM elk have demonstrated adaptability to most habitat changes. They appear to readily use new and different kinds of habitat if allowed the opportunity to become familiar with the change. In this regard, RM elk use of private land habitat appears to be increasing, while use of federal and timber company owned forest and forest steppe rangeland appears to be declining from previous levels. The change in elk distribution is negatively impacting ecological condition of privately owned rangeland during the spring, and crop productivity during the summer. Although causes of change in elk distribution are not fully understood, elk would have no reason to discriminate between public and private land habitat, unless factors affecting security, shelter, or food differed between them.

In conclusion, forest habitat is not static; rather it is dynamic and subject to natural and human induced change over short and long-term temporal schedules. In the early 1980s, ODFW evaluated forest habitat on five national forests relative to security needs of RM Elk. The study indicated that, while three forests provided sufficient hiding cover to meet elk security needs, two forests were marginal at that time. Since that time, it is reasonable to assume that forest habitat has changed considerably, whether it now provides better or worse habitat is unknown.

Factors Affecting Ungulate Interactions

Domestic Livestock:

Prior to European settlement, native tribes of the BMR had acquired horses and cattle. Records indicate that by the 1850s native people were trading oxen with immigrant trains as they passed through the BMR. By the time the Joseph Band was forced out of the Wallowa Country, the Nez Perce had thousands of horses and hundreds, if not thousands, of cattle that moved seasonally between canyon winter range and higher elevation summer range in a pattern similar to wild ungulates (J. McCormick, personal observation. 2020).

Livestock (beef and dairy cattle, sheep, horses, and free roaming domestic hogs) substantially increased with settlement. Livestock numbers reached their highest numbers during the late settlement and early recovery period. These animals replaced elk and mule deer as the dominant ungulate grazers on forest-steppe summer range and grass-steppe fall, winter and spring range. Domestic sheep were the dominate grazer during the late settlement and early recovery phase, summering in the alpine and high elevation forest and wintering in lower elevation canyon grasslands. By the late recovery phase, beef

cattle had replaced domestic sheep as the dominant grazer of grass- and forest steppe habitat. In Wallowa County, dairy cattle and horses dominated the valley and surrounding low elevation grass-steppe rangeland.

Livestock numbers in the BMR began to decline in the 1960s as domestic sheep operations switched to cattle and/or public land permits were eliminated. In Wallowa County, cattle and sheep grazing were largely eliminated from Wilderness Areas; cattle grazing was eliminated from much of the Hells Canyon National Recreation Areas (HCNRA); and sheep grazing was eliminated from most of the HCNRA and National Forest range.

Major factors in the decline of sheep on public rangeland were:

- the recognition that domestic sheep-transmitted disease caused periodic die-offs of indigenous or transplanted wild sheep,
- legislation that prohibited the use of poison bait to control predators,
- restriction on using dogs to hunt mountain lions and bears, and
- low prices for meat and wool.

High stocking rates of domestic ungulates can compete with wild ungulates for food and shelter in the BMR. Different species of ungulates, whether wild or domestic, can compete among themselves for food and shelter. However, the prevailing idea that most domestic ungulate grazing is detrimental to wild ungulates is incorrect and should be changed. Appropriate livestock stocking rates and timing of use can improve forage quality available to wild ungulates, especially on winter range (Sheehy, D.P., and M. Vavra. 1995, M.Vavra et al. 1989). An example of domestic animal grazing improving RM Elk winter habitat is the Bridge Creek Management Unit (Anderson, E.W., and R.J. Scherzinger. 1977). At Bridge Creek, forest-steppe habitat has been grazed by livestock during summer to improve wild ungulate winter habitat for more than fifty years. Both wild and domestic ungulates have benefitted from the cooperative grazing program.

In conclusion, current numbers of domestic livestock using public land are not generally competing with elk and deer for shelter or food. The exception might be small areas of high-quality feed desirable to both wild and domestic ungulates such as meadows and riparian zones. On these areas, and on grass-steppe rangeland used by elk during winter and spring, elk have a competitive advantage over livestock because livestock are not allowed access to these preferred areas, or elk have access to preferred forage species prior to livestock use. Ungulate competition on privately owned forest-and grass steppe rangeland favors wild ungulates as they can graze early growth of forage before livestock arrive.

Large Predators:

Large predator populations (Cougar and Bear) increased significantly from settlement and early recovery periods after new regulations and restrictions governing hunting and trapping were enacted in the 1970s. These restrictions included protection and prohibition of the widespread use of poisons and tracking animals such as dogs to hunt cougar and bear. In Wildlife Management Areas with declining fawn and elk calf survival, hunting cougar with dogs has occasionally been allowed to reduce cougar populations sufficiently to improve elk calf survival.

The statewide cougar population has rebounded from an estimated 200 individuals in the late 1960s to an estimated 6,200 individuals in 2015 (ODFW 2017). Dietary information from ODFW research studies

indicated that 95% of a cougar's diet comprised deer and elk (about 65% deer, 30% elk, and 5% other) Fawns and calves comprised a high proportion of diet obtained from deer and elk (47% and 75%, respectively). An adult cougar takes approximately one deer or elk per week (Coggins V. 2018). In Wallowa County, the cougar population is estimated to be between 400 and 600 animals (P. Mathews 2019. Personal observation).

Black Bear populations were relatively high during the early settlement period despite being subject to trapping, hunting, and poisoning to protect domestic range sheep. Protection of bears increased predation on domestic sheep and wild ungulates. In 1973, black bears became a game animal with only fall hunting allowed, but a spring hunt was initiated by ODFW in 1985 to improve elk calf survival. Although the current population of black bears is not known, it is thought to be large and increasing (ODFW 2012).

The return of wolves to the BMR around 2000 has significantly increased predator pressure on wild and domestic ungulates (ODFW 2010). There is a possibility that portions of the BMR, such as Wallowa County, did not have a large wolf population prior to, or at the time of settlement. It has been suggested that native tribes used strychnine poison obtained from missionaries to control wolves attacking horse and cattle herds belonging to tribal people. Salmon poisoning has also been suggested as an alternative to strychnine poisoning as a reason for low populations of wolves (referenced in Coggins V. 2018).

Currently, wolf numbers and packs are rapidly increasing in the BMR. In 2020, at least 150 wolves were censused in Oregon, with a high percentage located in the BMR. Wolves are known to have a preference for elk meat, and are considered to be the apex predator in the absence of the Grizzly Bear. Information from Idaho and British Columbia clearly establishes that wolves can devastate wild and domestic ungulate populations if numbers are not controlled.

There is a high probability the three large predators are focusing on elk as their primary food source. Mule deer throughout the BMR have declined significantly since hunting restrictions were placed on cougars and bears, and wolves have reentered the region from Idaho. ODFW has reported fewer calves per cow elk among some elk herds in the BMR.

In conclusion, the increased pressure from predators may be a factor influencing changes in RM Elk distribution and selection of habitat. Most importantly, the pressure from large predators may be impacting the sustainability of the RM Elk population. The potential exists for large predators to increase predation on domestic ungulates if wild ungulate populations decline, or gray wolf and other large predator populations continue to increase.

Management Influences

The highest numbers of both wild ungulates and hunters in the BMR probably occurred between 1960 and 1990. By this time, recovery had allowed most wild ungulate populations to reoccupy much of their former habitat. During this period, ODFW focused considerable attention on gaining a better understanding of management and hunting protocols needed to sustain high populations of RM Elk and Mule Deer.

During this period of maximum hunting pressure, ODFW initiated:

- shortened and specialized hunting seasons (i.e., archery season, cow elk only, spike bulls only, two general seasons, damage hunts, etc.),
- numerous studies to gain a better understanding of wild ungulate physiology, behavior, habitat needs, and management requirements,
- management of non -game animals by adding staff and program funding, and
- programs designed to mitigate depredation of private land by RM elk and Mule deer.

Landowners engaged in farming or ranching often view RM elk use of private land as depredation. Many landowners, while tolerant of some wild ungulate use during severe winters, consider current use by large numbers of RM Elk as non-sustainable. In response to landowner complaints, ODFW initiated programs designed to mitigate elk damage on private rangeland and cropland. These programs included:

- winter feeding areas (e.g., Wenaha Management Area, Wolf Creek Management Area),
- winter and early spring reserved grazing areas (e.g., Ladd Marsh, Bridge Creek),
- elk proof fences to separate elk from cropland (e.g., Prairie Creek in Wallowa County),
- seeding buffer zones to high quality forage species (e.g., Green Forage Program),
- developing water sources (e.g., Grande Ronde Valley perimeter),
- establishing salt stations,
- trapping and removal of habituated elk from cropland (e.g., Grande Ronde Valley),
- hazing elk away from cropland and rangeland (e.g., Wallowa Valley, Zumwalt Prairie, Gurdane), and
- using damage hunts to reduce elk numbers or move herds to other areas.

Wild ungulate depredation of private land, which began with herd recovery and expansion, continues throughout the BMR. Private land, which is often located in lower elevation valleys and surrounding rangeland, is often within RM Elk migration pathways and winter ranges. Increasingly, lower elevation cropland is being used by RM Elk as calving and rearing habitat during late spring and early summer.

In conclusion, damage control programs, which are designed to mitigate wild ungulate damage to private land, are generally only partially or temporarily effective. The three programs with highest success appear to be establishment of winter-feeding areas, elk proof fences, and reserved winter-spring grazing areas. Currently, the funding and personnel needed to implement ODFW damage control programs appear to be insufficient to address the problem.

Weather and Memory Influences on Ungulates

Weather.

Weather, which is the interaction primarily of temperature/solar radiation and precipitation, is a major determinant of ungulate well-being. Weather influences include:

- the quality and quantity of food available seasonally during each yearly cycle,
- the timing of seasonal migration to and from winter range,
- seasonal body condition, and
- the success of the breeding/calving/rearing cycle.

Temperature and solar radiation influence an animal's need for shelter to regulate body temperature relative to ambient temperature. In forested areas, shelter can be obtained by using combinations of forest stand density and overstory cover for shade or wind breaks. In grass-steppe habitat, aspect, elevation, and topography can be used to regulate body thermal temperature relative to ambient temperature.

Severe winter weather with cold temperature and deep snow occurs regularly in the BMR. Rocky Mountain Elk survival, especially for younger and/or older animals, is influenced by severity of winter weather. An important weather-related key to survival during hard winters is the body condition (nutrients stored in the body as fat) of animals at the beginning of the winter. Ungulates that have better body condition entering the winter have a higher probability of winter survival than animals in poor body condition. Animals such as RM elk that generally do not have access to high quality feed or forage during winter depend on stored nutrients to mitigate their winter diet.

In the spring, large wild ungulates often follow the "green line" of forage growth as temperature and solar radiation increase. The quality of late summer and fall forage, which is related to weather factors such as precipitation and temperature (fall forage regrowth) influences ungulates winter survival.

During hot, dry summers, shade provided by overstory cover and/or topographic features is an important regulator of ungulate body temperature. In open rangeland, high points of elevation with frequent breeze aid ungulate temperature regulation and provide relief from pests such as flies and mosquitos. Elk will often leave newborn calves in crop fields (especially hay or cover crops) for security during the day while they move to nearby forest overstory cover providing greater security and shelter.

In conclusion, weather is a major factor affecting ungulate behavior and well-being during all seasons. Although weather and its impact on ungulates cannot be directly controlled, effects can be mitigated by animal movement along topographic gradients and selection of habitat, if available. Ungulates will select habitat that is optimal for thermo-regulation and maintaining body condition.

Memory

Ungulate memory as a variable influencing behavior is seldom acknowledged. Large wild and domestic ungulates such as RM elk and cattle appear to have a relatively large memory capacity. Events such as migration and use of seasonal habitat for specific activities may be initiated partially by memory.

Memory in ungulates is not the same as instinct, which motivates newborn to quickly stand, suckle and follow their mother, or to use flight as an immediate response to danger. For both wild and domestic ungulates, memory may be induced as a recall of a learned experience or by role modeling. Memory has to be a major determinate of an ungulate's response to a motivating factor such as returning to high quality hay fields and irrigated pasture.

There are numerous examples of ungulate memory. These include:

- elk calves and deer fawns returning to birth sites as they mature,
- cattle learning and remembering the location of drinking water sources,
- cattle learning and remembering the meaning of specific "calls",
- cattle remembering individual persons (i.e., research trials supposedly found that cattle can remember 26 individual humans), and
- cattle, elk, and deer adjusting to activities which initially cause flight.

Memory loss may also influence ungulate migratory patterns. In some areas of the BMR, elk herds have stopped migrating to their customary winter and summer ranges. Instead, herds began wintering on spring-fall grass-steppe range and subsequently began staying year-round. Despite intense hazing over several winters, the elk herd refused to move to their perceived customary range. Although their behavior may be in response to several different variables, including successive years of easy winters, it is also conceivable that newer generations of elk have no knowledge of the customary winter range or how to get there. The spring-fall range is now their customary range.

In conclusion, large ungulates, including deer and elk, appear to have memory retention. If so, incrementally creating “good memories or bad memories” can be an effective management tool, especially to mitigate ungulate depredation.

3. Approach to Resolving Elk Depredation

Depredation (economic loss or ecological damage caused by elk to forage and crops, natural resources, and facilities) of private land by elk has been an ongoing issue between landowners and the Oregon Department of Fish and Wildlife (ODFW). Currently, many landowners consider ODFW's response to escalating depredation as inadequate. Landowners complain that large numbers of elk are causing damage and financial loss and that, at the very least, they should be compensated for their losses.

Depredation by elk of private land is a problem that is not easily resolved. Elk use of private land is widespread, it is not confined to a single or a few landowners, and it can occur in multiple locations at multiple times and seasons. There is not one cause of RM elk depredation in the Blue Mountains Region; rather it appears most related to:

- high numbers of RM elk (Note: ODFW currently estimates 72,000 head of RM Elk in Eastern Oregon),
- the inherent nature of elk to find and stay in higher quality habitat,
- a decline in quality of forest and grassland habitat, and
- the large and increasing number of large predators (wolves, cougars, and black bear) that prey on elk.

Forest and Grassland Habitat Restoration.

Assumption: Restoration of elk habitat condition on public and private land is necessary to resolve elk depredation of private land.

Historical Evidence. There is considerable evidence that the quality of forest and grassland habitat in the BMR has declined since the 1970s. An ODFW research study between 1976 and 1982 evaluated structural attributes of forest habitat (i.e., overstory cover, stand density, overstory vs. feeding area ratio, distances to hiding cover, etc.) that met the needs of RM elk on five BMR national forests (Leckenby, D.A. 1984). Study results confirmed that while three of the national forests had satisfactory habitat for elk, two forests (i.e., North Fork of the John Day River and the Chesnimnus) had marginal structural habitat available.

Other evidence of forest and grassland condition was obtained by repeat photography at 44 locations in the BMR (Skovlin J.M. 1995). Photos at these locations, taken at intervals between 1901 and 1992,

indicated changes to forest and grassland habitat that had occurred during the previous 90 years. The three general conclusions reached from analysis of the photos were:

- there had been a gradual but wholesale shift from herbaceous communities to communities of woody shrubs and trees across all landscapes,
- human disturbances arising from modern management practices during the 1980s and 1990s had overlain earlier disturbances (primarily livestock grazing and logging impacts) to create a complicated mosaic of landscape patches in fragmented stages of succession,
- the vast acreage of forest devastated by large wildfire between 1982 and 1992 was the result of drought conditions, insect damage, fuels buildup, and ladder fuels that enabled crown fires to develop.

The above conclusions accurately describe current forest and grassland condition in the BMR. However, management (or lack of management) of forest and grassland habitat by federal management agencies between the late 1990s and the present has exacerbated the decline in condition. The lack of management arose primarily from legislative and judicial decisions that created a “preservation mandate” to close forests to most commercial activities and eliminate domestic ungulate use on large areas of public land. As a result, this “preservation mandate” promoted:

- the continuing shift in forest and grassland habitat from herbaceous to woody communities such as juniper and Lodgepole pine, with high fuel-loads and high water requirements,
- retention of forest habitat in fragmented stages of succession comprised of over-mature and diseased trees,
- increased size and intensity of wildfires.

Other research into ungulate habitat needs that was conducted in the BMR between 1970 and 2000 provides useful information relative to improving the condition of forest and grassland habitat. Awareness and use of this information can assist in selection and application of treatments that are most effective for restoring habitat to a better condition for elk and other ungulates.

Habitat Improvement. Prior to European settlement of the BMR, condition of forest and grassland habitat was determined by naturally occurring events such as periodic wildfire, ungulate grazing, and environmental events. Since settlement, both artificial and natural events have determined forest and grassland condition. Since elk recovered, artificial methods were preferred to manage forest and grasslands while natural methods such as fire were suppressed.

Public recognition of the devastation being caused by intense, out of control wildfires is only now allowing public land management agencies to address forest and grassland problems in Oregon and throughout the western United States. As a result, new federal and state policies are focusing management towards fuels reduction and the creation of fuel breaks as an appropriate and cost-efficient method to reduce the severity and area of wildfire. This new focus can be used to transform forest and grassland into habitat mosaics that better meet security, shelter and food needs of elk and other ungulates.

The primary management treatments that are available to restore forest and grassland habitat to a condition optimal for both wild and domestic ungulates include:

- mechanical vegetation management (thinning, selective logging, clear-cutting),

- ungulate vegetation management (targeted or controlled ungulate grazing),
- ungulate access management (hazing, fencing, feeding, water development), and
- vegetation control management (herbicide, seeding, fertilization, burning). (Appendix 1a).

Treatment Implementation. Selection and implementation of habitat treatments on public land should be made by the responsible federal management agency, with agreement, input and guidance from ODFW and landowners. Implementation of some treatments (i.e., targeted or controlled grazing on closed or vacant grazing allotments) may require policy amendments or changes by the responsible agency. Most treatments available to restore habitat quality for elk also provide additional benefits to forest and grassland ecosystems including:

- enhanced plant and ecosystem health,
- enhanced carbon sequestration and/or reduction of atmospheric carbon,
- lowered forest and grassland fuel loads to reduce impacts of large, uncontrolled wildfire, and
- improved water flow in streams and springs.

Habitat Improvement Guidelines. Guidelines to ensure that treatments to improve forest and grassland condition actually benefit elk and other ungulates should be developed. Guidelines can be formulated by: i) assess current habitat condition to determine the need for improvement, ii) obtaining the expert opinion of knowledgeable stakeholders, and iii) reviewing findings of previous studies concerning ungulate use of habitat in the BMR (Appendix 2). Habitat improvement guidelines will support selection of treatments that will improve ungulate habitat in general, especially critical habitat for RM Elk. Although all stakeholders will be responsible for developing habitat guidelines, implementing treatments will be the responsibility of respective management agencies and land users or private landowners, with input from other stakeholders. The effect of treatments relative to improving elk access to security, shelter, and food, should be evaluated annually by stakeholders.

Predator and Ungulate Interaction

Assumption: Reduction of large predator numbers may be necessary to reduce elk depredation of private land and/or prevent decline in wild ungulate populations.

Large Predators. Populations of large predators (wolves, cougars, black bears) in Oregon have recovered from low numbers prior to their classification as protected or semi-protected game animals. Current ODFW estimates of statewide large predator populations are:

- the cougar population in 2017 was 6,493, with the population centered in SW Oregon and the BMR in Northeast Oregon. (Note: The current Cougar population in Wallowa County is estimated to be approximately 600 animals),
- the Black bear population in 2012 was estimated to be between 25,000 and 35,000 animals, with the population centered in the Oregon Coast Range and the BMR in northeastern Oregon, and
- the known Oregon wolf population in 2020 was 158 observed animals (Note: ODFW acknowledged the probable presence of more wolves), with 19 of 22 recognized packs located in the BMR of northeastern Oregon. The total number of large predators in the BMR is unknown, but it is probable that large predator numbers are high and expanding.

Historical Evidence. The primary food source for large predators in the BMR is wild ungulates, especially RM elk (*Cervus canadensis nelsoni*) and Mule deer (*Odocoileus hemionus*). Mule deer populations throughout the BMR have significantly declined from high numbers in the 1970s. (Note: In Wallowa County, the estimated current population of Mule deer is 24,000 deer compared to 60,000 in the 1970s).

ODFW research indicates that elk, especially elk calves, are a major food source of the three large predators. While elk in general are yearlong prey for opportunistic large predators in the BMR, calves are most vulnerable during and following parturition. During this time, calf vulnerability increases due to isolation of the cow and lack of calf mobility following parturition. Vulnerability of adult elk to predation increases when animals are concentrated on winter and spring range, especially when winters are severe. Evidence supporting this contention is:

- Although Mule deer are considered to be the preferred cougar prey species, the largest source of juvenile elk mortality in Northeastern Oregon is caused by cougars. Research indicates that high densities of cougars alone can cause a decline in elk herd recruitment;
- Although Black bear are considered to be omnivores and, as such, eat a wide variety of food types, Black bears can readily catch and eat available Mule deer fawns and elk calves during and following parturition;
- Elk are the primary prey for wolves in areas where they occur together. Constant hunting pressure from wolves can affect elk use of habitat, state of vigilance, movement rates, and migration rates. Mule deer are considered to be a secondary prey species for wolves.

There have been reports of wolves causing significant decline in wild and/or domestic ungulate populations in other states and countries. Evidence supporting this contention includes:

- Wolves naturally established populations in central British Columbia during the 1930s at approximately the same time that cattle were introduced to the region. During their initial establishment period, wolves and cattle generally co-existed as wolves concentrated on moose as their primary prey species. Wolf packs that did select cattle as their primary prey were eliminated, while wolf packs selecting moose were not bothered. However, by the 1950s wolves and Grizzly bears (the apex predator in the region) had reduced both wild and domestic ungulate numbers to non-sustainable population levels. At that time, British Columbia initiated wolf reduction programs to allow recovery of wild and domestic ungulates in the region (Hobson R.P., 1995);
- Idaho and other states have reported significant predator induced declines in northern Idaho elk herds;
- In parts of Europe, wolf predation of domestic livestock has been reported as increasing since wolves re-established populations in the region (Smithsonian Magazine 2018);
- Following the demise of buffalo in the northern Great Plains, livestock introduced to the region at approximately the same time became the primary prey species for the large population of wolves (Knowlton C., 2017).

The well-being of wild ungulates, domestic livestock, and large predators is linked together in the BMR. Wild ungulates in the BMR are the primary food source for large predators while livestock are, currently, a secondary and relatively minor food source. However, if the total population of large predators, or the

population of any large predator, increases to a level that affects satisfactory herd recruitment of juvenile elk, maintaining elk numbers at, or near, desired current levels may not be feasible without reducing the numbers of large predators. Predator populations should be kept at the level that will sustain elk populations at the desired management objective (MO) levels, encourage elk to use public land, and assist recovery of Mule Deer populations.

Predator Control Contingency Plan. There appears to be a growing concern among some wildlife biologists that current populations of large predators are adversely affecting elk herd sustainability. There is also concern that Chronic Wasting Disease (CWD), which is known to affect elk, deer, and moose in 21 states and two Canadian provinces east of the Rocky Mountains, may gain a foothold west of the Rocky Mountains. If that happens, the combination of CAD and high and increasing numbers of large predators, could have a devastating impact on both deer and elk. ODFW, as the state agency responsible for wildlife, needs to have, or prepare, a contingency plan to remove large predators.

The contingency plan should define the methods used to:

- monitor predator, disease and ungulate population trends,
- determine elk calf mortality rate at intervals between birth and recruitment to the herd, and
- assess and assign calf and adult winter mortality to different large predator species.

Control of large predators should be “triggered” when monitoring indicates calf survival, recruitment of two-year old females into the herd, and adult cow elk survival through winter are declining, either from take by predators, or disease, or by both disease and large predators. Measures to reduce numbers of large predators should be initiated at critical times and places such as late spring calving areas and on winter range during severe winters. A third trigger event would be a rising trend in predator take of domestic ungulates (Appendix 1b).

Implementing Predator Control. Although special interest groups may be opposed to “lethal take” of large predators, ODFW has clearly stated in ungulate and predator management plans their position relative to active management of large predators. The three indicators of the need for lethal removal or reduction of predators relative to sustainability of ungulate populations are:

- removal is needed to allow the affected ungulate population to meet established objectives or herd management goals,
- removal of predators is needed to sustain herds on important winter ranges or feeding areas that congregate elk in specific areas or that serve to draw elk away from agriculture lands, and
- reducing and maintaining a low predator population will benefit sustainability of the elk population (ODFW, 2017).

Predator-Ungulate-Habitat Management Areas (PUHMA)

Assumption: Resolving the elk depredation issue will require a coordinated and focused effort by landowners, federal and state land management agencies, and the Oregon Dept. of Fish and Wildlife.

The creation of Predator-Ungulate-Habitat Management Areas (PUHMA) will allow landowner, federal and state land management agencies and state wildlife agencies to focus on habitat improvement and predator control (Appendix 1c). PUHMAs would comprise one or more Wildlife Management Units

(WMU) which are the geographical and administrative units employed by ODFW to manage wildlife. Wildlife Management Units also often coincide with Conservation Opportunity Areas (COA).

PUHMAs will be established in “hotspot” areas of escalating elk depredation. Three such hotspots are located in three northeastern Oregon counties. Two of the three counties (Wallowa and Morrow) have “hotspots” with the following characteristics:

- high and expanding numbers of large predators,
- forests that have been extensively logged in the past which are now showing extensive growth of woody shrubs and small trees,
- public land forest and grassland habitats that are no longer grazed by livestock and/or elk, and are often subject to frequent wildfire,
- public and private land holdings represented across the landscape, and
- a large and growing RM Elk depredation issue. Elk depredation in the third county (Union) primarily revolves around seasonal use by elk of a high-intensity agriculture production area in the Grande Ronde Valley. The Grande Ronde Valley “hotspot” includes the surrounding forest and grassland habitat.

Establishment of Predator-Ungulate-Habitat Management Areas (PUHMA) will allow private landowners and federal and state agencies to focus efforts to resolve the depredation issue. Each PUHMA will:

- form management coalitions of federal and state resource management agencies, private landowners, and state wildlife management agencies,
- establish advisory groups with representatives from federal, state and tribal management agencies, private land owners, non-government organizations, and other entities which have vested interests in resolving the depredation issue,
- improve forest and grassland condition for elk and other ungulates on both public and private land,
- develop contingency plans to control numbers of large predator populations, if necessary, to reduce predation pressure on wild ungulates,
- continue to employ active management tools such as hazing and damage hunting to minimize depredation damage of private land while improving forest and grassland habitat on public land,
- devise and use new forms of landowner compensation, and
- monitor the impact that improved habitat condition and large predator control has on elk distribution.

Coalitions

Effective implementation of predator control and habitat improvement on a PUHMA will require cooperation and coordination among landowners, wildlife management agencies, and federal, state, county, and tribal resource management agencies. The formation of Advisory and Working Groups is needed to ensure the cooperation and coordination needed to resolve depredation. The two groups and their proposed role is:

Advisory Group. The primary role of the advisory group relative to each PUHMA is providing to the working group:

- advice and support,
- guidelines to ensure habitat treatments benefit elk, and
- resolution of problems associated with implementation of predator control and habitat improvement measures.

Members of the advisory group will generally include representatives from entities such as the Rocky Mountain Elk Foundation, Oregon Cattlemen's Association, The Nature Conservancy, and other vested interest groups; private landowners; and representatives from federal and state agencies responsible for resource and animal management in the BMR. Advisory groups already exist for the proposed PUHMAs in Morrow and Wallowa counties.

Working Group. Effectively implementing treatments on the PUHMA will require forming a coalition of private landowners, federal, state and tribal resource management agencies, and state wildlife management agencies. The purpose of the coalition will be:

- reaching agreement on activities to be undertaken,
- scheduling treatment implementation,
- resolving policy issues affecting treatment implementation, and
- coordinating treatment implementation among management agencies and with private landowners.

Federal agencies responsible for the public land component of the three PUHMA are the USDA-Forest Service and the USDI-BLM/BIA. The federal agency responsible for the private land component of the three PUHMA is the USDA-NRCS. The state agency responsible for the wildlife component of the three PUHMA is the Oregon Dept. of Fish and Wildlife.

Monitoring and assessment of outcomes in each PUHMA will be the responsibility of both the Advisory and Working Groups.

Compensation to Private Landowners

Elk depredation of private land is not directly the fault of the elk, landowner, or the state. However, since the state has legal and management responsibility for elk and other wildlife, damage to private land or crops should be compensated by the state. Monetary compensation to private landowners for wildlife caused damage has always been resisted by ODFW. Paying direct compensation for wildlife damage could be a never-ending obligation because wildlife is not aware of boundaries between public and private land. Instead, ODFW has opted for “in-kind” compensation to affected landowners by providing materials to protect private land resources, temporarily removing depredating animals from private land, and/or creating alternative habitats attractive to deer and elk.

Compensation as a component of elk management would benefit both elk and private landowners. Resolving the depredation issue should not require elimination of all elk use of private land. Weather or other events may occur which compel elk to temporarily use private land to prevent large scale mortality. Most landowners do not seek total elimination of elk use of private land; rather they want the use reduced to levels compatible and sustainable with livestock and crop production.

The reasons monetary compensation paid directly to the private landowner should be re-evaluated include:

- the state funded wolf-livestock depredation compensation program, although inadequately funded as the wolf population expands throughout the state, has established a precedent for direct compensation to owners of livestock killed or wounded by wolves,
- private insurance companies are now ensuring owners of livestock against losses related to predation as part of a total ranch insurance program,
- private insurance companies are now administering federal risk aversion programs, and
- federal conservation programs are monetarily compensating landowner's efforts to improve sustainability of private land resources.

The PUHMA should be used to test and evaluate the feasibility of state-private or state-federal-private programs that directly or indirectly compensate landowners affected by elk depredation (Appendix 1d).

Monitoring

Predators and ungulates in each PUHMA should be monitored annually to determine population trends. ODFW would be responsible for monitoring large predators and wild ungulates during the annual wildlife census. Domestic ungulate numbers would be monitored by the livestock owners on private land. Livestock owners and federal land management personnel would be responsible for monitoring livestock on public land.

Forest and grassland in the PUHMA should be monitored annually to establish condition and trend of habitat. ODFW will be responsible for monitoring forest and grassland habitat on both private and public land to ensure treatments improve security, shelter and food needs of elk and other ungulates. Landowners will be responsible for monitoring trend and condition of forest and grassland habitat on private land. Federal land management agencies would be responsible for monitoring condition and trend on public land.

Conventional methods can be used to monitor condition and trend of forest and grassland habitat. Additionally, new tools that facilitate monitoring habitat condition and the interaction between ungulates and habitat over large spatial scales are available (Note: two of the monitoring apps are established on the proposed Wallowa County PUHMA). The initial cost of acquiring and installing these tools is usually offset by the ease with which future information can be acquired and evaluated (Appendix 3).