Draft Assessment
Forest Plan Revision

Wildlife Species and Habitats of Interest

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for:
Malheur, Umatilla, and Wallowa-Whitman National Forests

February 6, 2024

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Introduction

The Blue Mountains of Eastern Oregon and Washington provide habitat for hundreds of wildlife species. Common large mammals include Rocky Mountain elk, mule deer, black bear, and mountain lion. Many species of small mammals, birds, bats, reptiles, and amphibians are present. This report highlights special habitats that are key to the survival of many endemic wildlife species, such as old growth, snags, and aspen stands. It also highlights elk, deer, and bighorn sheep because they are species commonly enjoyed and used by the public for hunting, in addition to their cultural importance to local Tribes.

See the Species at Risk report for a discussion of ESA listed species and potential Species of Conservation Concern.

Process and Methods

The primary sources of information for this report are the current forest plans for the Blue Mountains national forests (USDA 1990 a, b, and c), the withdrawn Final Environmental Impact Statement for the Malheur, Umatilla, and Wallowa-Whitman National Forests Land Management Plans (USDA 2018), other agency reports and analyses, published literature, and other updated information. All documents were reviewed for best available scientific information and relevancy to current conditions. Geographic Information System (GIS) technology was used where appropriate and available to assess wildlife populations and habitat distribution on each forest. The scale for this assessment is variable but is usually either each national forest or the three national forests collectively (the planning area).

Current Forest Plan Direction

There are many standards and guidelines for wildlife in the current (1990) forest plans that are either applied forest-wide or in specific management areas. Collectively, wildlife standards are based on:

- Management Indicator Species (MIS): Rocky Mountain elk; primary cavity excavators, or snag habitat; pine marten (now American marten); and northern goshawk (now American goshawk).
- Specially designated areas such as big game winter range and dedicated old growth.
- Special habitats that are either designated areas or comprise a small but very important segment of the forests.
- Responsibilities for threatened, endangered and sensitive species; and
- Provisions in the Eastside Screens (USDA 1995a).

More specific current plan direction is provided in sections below.

Old Growth Forest

Existing Conditions

Many wildlife species require the structural complexity typical of mature and old forests for habitat, and the presence of large old trees within a stand can make a substantial difference for wildlife habitat values in both old and young forests (Stine et al. 2014). The relatively rapid decline of old forest as well as larger, older individual trees over the last century is an issue of concern across the globe (Lindenmeyer 2014). Regional landscape assessments indicate declines in the number of large old trees and amounts of old forests in the inland Pacific Northwest (Hessburg and Agee 2003; Hessburg et al. 2005; Hessburg et al. 2016).

While the number of ponderosa pine and Douglas-fir trees in eastside Oregon forests greater than 21 inches diameter at breast height (dbh) have considerably increased since 1995, the total number of old trees has declined. Trees greater than or equal to 150 years in age decreased by approximately eight percent between 2001 and 2017 on six eastside Oregon forests (Deschutes, Malheur, Ochoco, Fremont-Winema, Umatilla, and Wallowa-Whitman) (FIA data). Old trees, especially large old trees, found both within old forest stands and as scattered individuals have great importance as ecological keystones. Large, old trees have often developed physiological and structural features which make them extremely valuable in terms of wildlife habitat, fire and drought resistance, and as genetic resources (Franklin & Johnson 2012). Large trees are also important for carbon sequestration and storage (see Carbon Report).

The extent of old forest single-story structural stage in dry upland forest is the most departed from historical conditions on all three Blue Mountains national forests. This departure is largely due to a combination of past timber harvesting practices and the interruption of the natural historical fire regime. Some structural stages are within range of variation in individual project areas, particularly in moist forest (see Terrestrial Ecosystem Report).

Current Forest Plan Direction

An example 1990 forest plan standard is to "maintain sufficient amounts of old growth forest stands to provide habitat for all wildlife species that may be dependent on or make heavy use of this habitat type" (Umatilla forest plan). The strategy developed to do so consisted of Dedicated Old Growth and Replacement or Managed Old Growth management areas in combination with other protected areas such as wilderness. Timber harvest was not allowed in these areas. Existing plan direction for dedicated old growth management areas with a historic frequent and low intensity fire regime is not sustainable through time. There is also concern that protection of too many large diameter trees may prevent restoration of conditions that are most likely to maintain old trees into the future (Merschel et al. 2019, Johnston et al. 2018, Johnston 2017, Stine et al. 2014).

The forest plans changed significantly with the addition of the interim strategy that better protects and promotes old growth forest. Known as the "Eastside Screens" (USDA 1995a), the interim strategy amended all forest plans in eastern Oregon and Washington. Standards for old forest structure amounts, patch size, distribution, and connectivity were implemented. Additionally, large diameter trees were conserved if the overall amount of old forest was below historical range of variability.

Tracking acres of stands exhibiting old forest structure (see Terrestrial Ecosystem Report) has been a way to consistently measure whether amounts are close to historical or departed from range of variation on all eastside forests in the Pacific Northwest Region. This does not capture the complexity of these areas or how various wildlife and other organisms use the stands.

No one definition represents the diversity of old-growth ecosystems. Past old-growth forest definitions in forest planning have varied, based on the unique biophysical characteristics within different regions of the United States. The definitions often recognize that tree species, climate, soil productivity, and disturbance history all influence the development of old-growth forests (USDA 2023).

In 2022, Executive Order 14072 directed the Forest Service and Bureau of Land Management to develop mature and old-growth definitions and conduct an inventory on federal lands. The result of these efforts will lead to additional policy that will aim to promote the continued health and resilience of our forests, conserve biodiversity, mitigate wildfire risks, enhance climate resilience, and retain carbon storage (USDA 2023).

Working definitions of mature and old growth forest have been developed based mainly on structure and vegetation types to complete a nationwide inventory (USDA 2023, appendices). More work is to come at regional and local levels due to the diversity of structure and function of old and mature forests across the nation.

Snags and Down Wood

Snags and down wood are important components of forested ecosystems (Sallabanks et al. 2001). More than 80 species of birds, mammals, reptiles, and amphibians use snags and down logs within the Columbia River Basin (Bull et al. 1997). These include species such as American marten, woodpeckers (primary and secondary cavity excavators), and bears. Most species of bats use snags and large trees with structural defects for roosting (Sallabanks et al. 2001). Not every stage of a snag or down log's decomposition process is utilized by the same species, instead a variety of species use them at different stages or conditions (Bull et al. 1997). Inputs of decaying wood are also critical to most aspects of stream processes such as channel morphology, hydrology, and nutrient cycling (Johnson and O'Neil 2001).

Existing Condition

Snags and down wood are deficient across most of the Forest Service managed watersheds, in particular snags over 20 inches dbh (Mellen-Mclean et al. 2017) The general trend in abundance of snags greater than 20 inches dbh has remained static, neither increasing nor decreasing overall. However, this is a total for Region 6 eastside national forests and any local variations are likely unnoticeable at that large of a scale.

The two major factors influencing tree cavity density are precipitation and forest management because these both affect fungal heart-rot in trees (Remm and Lõhmus 2011, Bunnell 2013).

Where timber harvest occurs, maintaining sufficient snags and down wood is difficult to achieve where there are not enough snags to begin with and hazard trees snags are removed from timber sale units and along roads. Post-harvest prescribed burning and public fuelwood cutting also reduce the number of snags (Wisdom et al. 2000, Bate et al. 2007).

Snags and down wood are in constant flux and highly variable in time and space. Insects, disease, and fire continually create dead trees, which eventually fall and decay. A balance between these natural processes and a desire to reduce insects and disease, a need to suppress fires to protect communities, and climate change needs to be considered.

Many recent timber harvest projects contain a project design to retain all standing snags 10 inches diameter and larger, unless there is a hazard to workers. Dead logs and slash are also left on the ground for species utilizing them for habitat, such as black bear and American marten, along with their food sources, such as carpenter ants and small mammals. Down wood is also important for rare snails and plant life.

Current Forest Plan Direction

Snag and down wood standards in forest plans were amended nearly 30 years ago by the Eastside Screens (USDA 1995a). These amended standards are no longer valid for snags because they are not based on most recent and best available science. Local projects have been using best available science, such as the Decayed Wood Advisor (DecAID) (Mellen et al. 2017).

Riparian Areas and Meadows

Riparian areas are a vital component of forest ecosystems that wildlife species use at higher proportions than other areas of the forest. Riparian areas across the Blue Mountains and all other national forests within the Columbia River Basin are protected by interim management direction referred to as PACFISH and INFISH (USDA-USDI 1995). PACFISH Riparian Management Objectives (RMO) apply in anadromous fish habitat and INFISH RMO apply in inland (non-anadromous) fish habitat.

Existing Conditions

Riparian areas continue to provide a diversity of habitat conditions that benefit fish, wildlife, plant, and invertebrate species. Riparian areas often serve as travel corridors between old growth stands and provide water source and cover for big game and other species. With listed steelhead, chinook, and bull trout present, the Blue Mountains national forests have been following requirements to maintain and improve water quality and riparian habitat. Many plant, wildlife, and invertebrate species have benefitted from these policies.

Meadows are important biological components in the Blue Mountains, supporting high levels of plant and animal diversity and providing a home for rare and endemic plant and animal species (Crowe and Clausnitzer 1997). Where within forest, montane meadows are important edge habitat for great gray and flammulated owls. Meadows and other forest openings provide pollinator food sources that are critical to maintaining plant diversity. Several species of bumble bees are present, and they are key pollinators that other species depend on for continued existence. Three of the bumble bee species are currently petitioned for federal listing.

Vegetation in many Blue Mountain meadows has undergone significant change due to grazing, mining, logging, road construction, and other practices. These disturbances often cause downcutting of streams, triggering long-term changes in once wet meadow vegetation and hydrologic function. Depth-to-ground water determines what plants occupy a meadow and as ground water is lowered and obligate wetland plant species are displaced, the belowground biomass and soil water-holding capacity is reduced as well. This in turn reduces the capability of the meadow to provide cool subsurface water during summer, which is a critical component of aquatic habitat for federally listed species like Chinook salmon and bull trout. Despite varying degrees of disturbed conditions, meadows retain their significance as forest openings providing forage and habitat for many wildlife and plant species.

Current Forest Plan Direction

Streams are protected from damaging activities by a buffer distance depending on the stream class, called Riparian Habitat Conservation Areas (RHCAs). Harvesting of any size trees within an RHCA must be "to acquire desired vegetative characteristics where needed to attain Resource Management Objectives." Standards and guidelines in individual forest plans also apply where they are more restrictive than PACFISH and INFISH management direction. See the Aquatic Ecosystem report.

The Malheur's forest plan mentions maintaining the integrity of unique habitats including meadows, by incorporating buffers approximately 100 feet in width. The Wallowa-Whitman's forest plan notes that natural grasslands and meadows should be recognized primarily for the forage value and habitat they provide.

Aspen and other unique habitats

Existing Conditions

Aspen stands are a small component of eastern Oregon forests yet provide unique habitat for a wide diversity of wildlife species. The Blue Mountains are near the periphery of the range of aspen in western North America (Perala 1990). Although little is known about the historic distribution of aspen in Oregon, it is believed that stands were once larger and more widely distributed (Shirley and Erickson 2001). Stands in the Blue Mountains have visibly declined due to lack of fire and inability to regenerate. Palatable young aspen stems are highly sought after by elk and other ungulates.

Recruitment and long-term survival of aspen require a combination of episodic disturbances such as silviculture and fire to facilitate recruitment, followed by reductions in grazing pressure by domestic and wild ungulates during the time intervals between disturbances to facilitate establishment, growth, and survival (Endress et al. 2012). Extensive fencing programs on the Blue Mountains national forests have been in place since the early 1990s. An 8-foot fence is required to keep elk out until an aspen stand sufficiently recovers. There remains a need to increase the distribution and recruitment of young age classes.

Because aspen reproduce underground via “suckers” or gametes, stands can live for thousands of years. It is believed that an ancient aspen clone exists on the North Fork John Day Ranger District (Shirley and Erickson 2001).

Unique habitats such as cliffs, cave, and talus remain as they have for decades. Many springs have been piped and routed to livestock water troughs or dammed to provide pond watering. Fencing of springs is a common practice to protect the source from damage from ungulates.

Current Forest Plan Direction

Current plan direction includes broad statements such as “special and unique ecological communities such as aspen… should receive special attention and protection…” (USDA 1990a).

Unique habitats such as caves, cliffs, talus, seeps, springs, elk wallows, raptor nests and bald eagle winter roosts are protected by standards and guidelines in all three forest plans, where applicable. Each forest plan is slightly different, but generally, existing forest plan standards have protected these special areas.

Connective Corridors

The survival of fish and wildlife species depends in part on their ability to move within a habitat or from one habitat to another to find food, reproduce and migrate. This is often termed “habitat connectivity” (WDFW 2010). These movements can occur daily for food, seasonally as some species migrate with changing conditions, or over generations as environmental conditions change. Different species move at different temporal and spatial scales for a wide variety of reasons.

Many wildlife populations are at risk of losing this connectivity because of increasing development pressure and barriers on the landscape. Natural connections between similar habitats and engineered safe passages (such as tunnels or overpasses over highways) are both important. Primary barriers to movement are highways and fencing. In particular, deer that migrate yearly between summer and winter range are frequently killed by motor vehicles. Many fences represent a significant barrier to mule deer migration and movements and studies show mule deer commonly alter behaviors in response to fences (ODFW 2023a). Fence entanglement is also a documented source of mortality for mule deer in Oregon.

The emerging threat of climate change will make the need for habitat connectivity even more critical, as many species will need to adapt to a changing landscape.

Existing Conditions

Maintenance of corridors between all late and old structure forest stands in project areas has gone a long way toward providing habitat connectivity for numerous species. There have been numerous other approaches to managing habitat connectedness suggested, as well as to identify and improve barriers to movement such as highways. Recent collaborative analyses of connective corridors in Oregon (Oregon Conservation Strategy 2016) and Washington (Washington Habitat Connectivity Working group 2010) are available to assist in planning and providing for wildlife habitat connectivity.

Current Forest Plan Direction

The 1990 forest plans currently require connections between all late and old structure forest stands when planning vegetation management activities, where such connections are possible (USDA 1995a). Some areas are not naturally contiguous forest or may have been harvested or burned in the past. Other types of connections are not always included, such as logical connections between roadless areas based on topography and vegetation, and species-specific corridors such as big game migration routes. Existing forest plans also do not address existing barriers, such as highways that cross the forests.

Specific Species on the Blue Mountains

Rocky Mountain elk, mule deer, and bighorn sheep are commonly enjoyed and used by the public for hunting, trapping, observing or sustenance, including cultural or tribal uses. The term “Species of Public Interest” is used in the assessment to organize the descriptions of these species. It is not a specific designation like threatened or endangered species, or species of conservation concern. State fish and wildlife agencies manage these species through hunting regulations and other activities.

Rocky Mountain elk

Rocky Mountain elk (*Cervus elephus*) are a management indicator species in the current 1990 forest plans, intended to represent hunted species and general habitat. They are a highly valued game animal that are important to tribes, local culture, and community economies. With expansive habitat throughout the Blue Mountains, management of elk habitat affects many other wildlife species.

Existing conditions

Populations

Elk were numerous and widely distributed in Oregon prior to arrival of nonnative settlers and occupied the entire Blue Mountains (ODFW 2003) but were nearly extirpated by the late 1800s (Verts and Carraway 1998). By the 1920s numbers had greatly increased in the Blues and elk hunting was allowed beginning in 1933. Recovery and expansion of elk was largely the result of total protection of local remnant populations (ODFW 2003), with re-introductions in some areas. Populations have now grown to the point where they are known to cause damage to vegetation and crops on private lands, near the interface of valley and montane zones (Sallabanks et al. 2001).

Washington Department of Fish and Wildlife estimates 3,900 elk in the Blue Mountain elk management zone, which is 30 percent below the objective of 5,500 elk (WDFW 2022). Estimates indicate the Blue Mountains elk herd was within objective from 2009 through 2017, when a severe winter was predominantly responsible for triggering the decline (WDFW 2022).

Oregon elk surveys in 2022 and 2023 indicate the total number of elk has been close to the sum of the management objective values for management units that overlap the Malheur, Umatilla, and Wallowa Whitman National Forests (ODFW 2023) (Table 1). Some management units are above or below the management objective (Figure 1). Many factors influence population numbers, including hunting, weather, predation, disease, and the availability and nutritional value of forage.

Table 1. Estimated elk numbers by management unit; each was surveyed in either 2022 or 2023.

Management Unit	Management Objective	2022 / 2023 Survey
Beulah East	reduction	1200
Beulah West	500	400
Catherine Creek	1000	2585
Chesnimnus	3500	3000
Desolation	1300	900
Fossil North	600	650
Fossil South	400	1700
Heppner	5000	5100
Imnaha	2000	1500
Keating	400	857
Lookout Mountain	600	1200
Malheur River	1500	1500
Minam	2000	1300
Mt. Emily	5700	3300
Murderers Creek	1700	1900
Northside	2000	2500
Pine Cr	800	1000
Silvies	2200	2200
Sled Springs	2750	1200
Snake River	4500	2400
Starkey	5300	7760
Sumpter	2000	2000
Ukiah	5000	5000
Walla Walla	1800	2746
Wenaha	4250	1500
Total	56,800	55,398

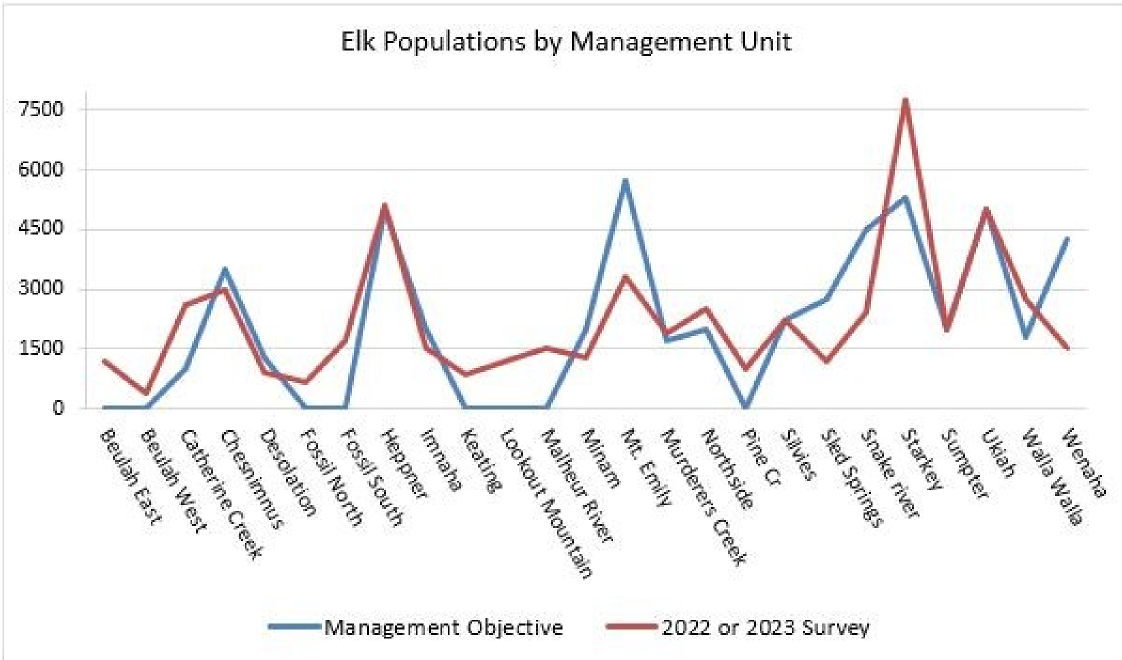

Figure 1. Estimated elk population for Oregon management units that overlap Blue Mountains national forests.

Habitat

Elk use a mixture of habitat types in all successional stages in both forest and grassland vegetation. Their uses of these habitats change in daily and seasonal patterns. Winter is a critical survival period that results in some mortality each year due to cold and snow. Summer range is also an important period while elk are raising young and gaining weight in preparation for the winter.

While cover (tree, shrubs, topography) is still an important habitat consideration for elk, best available science indicates the proximity of open motor vehicle routes (Rowland et al. 2000, Rowland et al. 2004) and the quality, quantity, and availability of forage are key determinates of habitat suitability (Cook et al. 1998, Findholt et al. 2004).

A new model for the Blue Mountains region that evaluates nutritional and habitat conditions for elk at landscape scales will soon be available. The Westside elk model (Rowland et al. 2022) is a comparable model that has been completed for the west sides of Oregon and Washington. The habitat model is typically applied at large scale (greater than 25,000 acres) and across jurisdictional boundaries.

Current Forest Plan Direction

Like many other national forests in the 1980s, maintaining elk habitat focused on providing hiding and thermal cover (Duncan 2000, ODFW 1989, Smith and Long 1987, Thomas et al. 1988, Winn 1985). Specific goals, standards, and guidelines for elk in the Blue Mountains forests existing forest plans focus on providing an interspersion of dense tree cover and open forage areas, as well as limiting motor vehicle access in some key areas such as winter range and calving areas. Recent studies indicate that while thermal cover is important, it should not be at the center of elk habitat management. Instead, attention should shift towards the relationships between herd productivity and nutrition-based attributes of habitat (Cook et al. 2005).

Current forest plans also have standards requiring the use of the Elk Habitat Effectiveness Index (HEI) (Thomas et al. 1988). The HEI index and other elk standards emphasizing dense tree cover are considered outdated science. Desired elk habitat conditions in current forest plans were not well expressed in relation to the landscape's ecological potential, and the difficulty of meeting the standards for elk has resulted in multiple plan amendments.

Open road density (miles of open roads per square mile) as a basic measure is a way to identify potential high disturbance areas for elk and other wildlife species. A road density metric alone, although important, does not address complexities in patterns of open routes or the frequency of use by motorized vehicles (Rowland et al. 2000 and Rowland et al. 2005). It also does not consider topography, types of vegetation, and capability of areas to improve or not. Examination of these conditions is best done on the ground at the project level.

Mule Deer

Mule deer (*Odocoileus hemionus*) are extremely adaptable and can be found in all major climatic and vegetation zones of the western United States (Boyd and Cooperrider 1986). Although there is overlap in range between Columbian black-tailed deer (*O.h. columbianus*) and Rocky Mountain mule deer (*O.h. hemionus*), for management purposes, ODFW considers mule deer to be distributed east of the crest of the Cascade Mountains (ODFW 2023a).

Mule deer are a species of interest because they are important game animals that also have a prominent place in cultural, economic, and ecological values. They are a food source for apex predators such as mountain lions, as well as people. They have provided food for local tribes for centuries.

Populations

Oregon's mule deer population was estimated to be 39,000 to 75,000 animals from 1926 to 1933 (Bailey 1936). Researchers and wildlife managers generally agree the species achieved its maximum abundance during the 1950s and 60s. Since then, mule deer have declined across the Western United States. The most recent decline happened since the early 1990s and, though not fully understood, it is believed to be primarily due to the combined effects of drought and severe winters, which coincided with increased numbers of predators (ODFW 2021).

In Washington, the estimated number of mule deer in the Blue Mountain mule deer management zone was 18,638 at the end of 2017, and 18,415 at the end of 2018. The management objective is to maintain a stable population based on abundance and harvest estimates each year (WDFW 2019).

Fluctuations in mule deer populations can be attributed to many factors including weather, disease, predation, and hunting. State wildlife departments can change the number of harvest permits allocated, season lengths, and sex to be harvested for each game management units, all of which affect populations.

The combined total mule deer population size for Oregon has never reached the established management objective. This is likely related to the long-term population decline that coincidentally began about when state population objectives were first established in 1981. Research suggests many mule deer herds in Oregon are nutritionally limited and may be at or very near a new, lower carrying capacity, or landscape potential (ODFW 2023a).

In Oregon there are now an estimated 155,500 mule deer, with 78,800 occurring in or near the Malheur, Umatilla, and Wallowa-Whitman national forests (ODFW 2023b) (Table 2). All units overlapping the Malheur, Umatilla and Wallowa-Whitman national forests have been below management objectives for the past 5 years, 2019-2023 (Table 2, Figure 2).

Table 2. Estimated mule deer population for Oregon zones that overlap Blue Mountain forests compared to state management objectives.

Management Unit	Management Objective	2023 Population Estimate
Beulah	15000	7400
Catherine Cr	4300	3055
Chesnimnus	5700	2473
Desolation	1500	615
Fossil	10000	6200
Heppner	12000	6000
Imnaha	7000	1204
Keating	4600	1590
Lookout Mountain	5000	2982
Malheur River	15000	7966
Minam	7000	1131
Mt Emily	5000	3268
Murderers Cr	9000	6637
Northside	15500	3079
Pine Creek	3700	1728
Silvies	12000	8499
Sled Springs	11000	2919
Snake River	6400	1937
Starkey	3000	1342
Sumpter	7000	3244
Ukiah	8500	3391
Walla Walla	1900	1053
Wenaha	4000	1123
Total	174,100	78,836

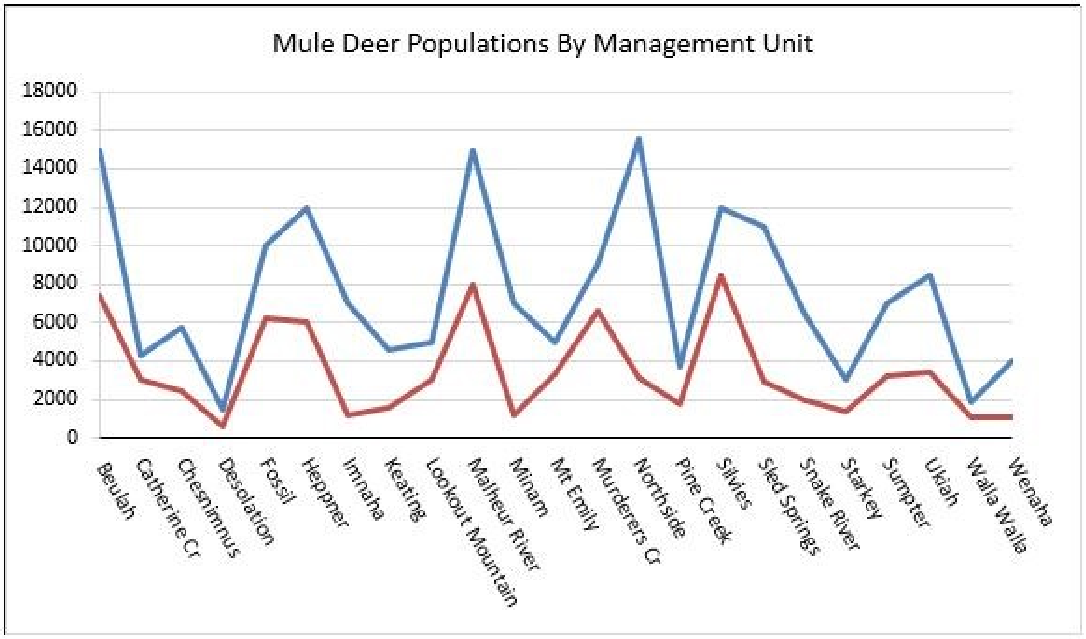

Figure 2. Estimated mule deer population for Oregon zones that overlap Blue Mountain forests compared to state management objectives.

The draft update to ODFW's mule deer management plan (ODFW 2023a) will go before the Oregon Fish and Wildlife Commission for an additional public process, final approval, and adoption in 2024.

Habitat

Summer habitat for mule deer is common throughout Eastern Oregon and can be found in areas varying from lowland agricultural lands to high elevation mountain areas (ODFW 2023a). Summer is an important time to replace body reserves lost during winter and to raise young. Winter habitat is found predominately in lower elevation areas. These areas usually have minimal amounts of snow cover and provide a combination of geographic location, topography, and vegetation that provides structural protection and forage. Due to the low nutritive values of available forage during the winter, deer rely on their body reserves acquired during the summer for winter survival.

Mule deer are habitat generalists but are more likely to be negatively affected by limited forage in their winter ranges than elk (Frisina et al. 2006). They prefer higher quality forage than elk, specifically forbs, shrubs, and trees (Bartmann 1983, Findholt et al. 2004, ODFW 2023a). This could result in increased competition for forage resources with cattle and elk when animal densities are high or when forage production or quality is low (Findholt et al. 2004). In a study conducted at Starkey Experimental Forest, mule deer females that had access to vegetation communities with higher biomass of preferred forage during the spring and summer had higher reproductive success than those that did not (Merems et al. 2020).

Decreasing deer numbers throughout the western United States is complex but can be partially explained by mule deer's need for early and mid-successional habitats that have declined due to a lack of disturbance either from fire or mechanical (timber harvest) treatment. Managing forest stands toward a natural range of variation and increasing the amount of open canopy forest may be beneficial to mule deer but is not expected to cause a perceptible increase in populations. Fuels reduction harvest as a silvicultural practice can provide more abundant, nutritious forage, especially when carefully planning the timing and intensity of treatments (Hull et al. 2020).

Mule deer reaction to human disturbance is slightly different than elk (Taylor and Knight 2003). Deer are found closer to roads than elk on shared ranges, which may be a result of mule deer avoidance of elk (Wisdom et al. 2005).

Current Forest Plan Direction

Only the Malheur 1990 forest plan specifically references mule deer. Direction includes an objective to manage cover, forage quality, quantity, and distribution as well as road use to sustain population levels identified by ODFW. There is a standard to provide for 40 percent cover in wildlife emphasis management area (IV-131).

Bighorn sheep

Bighorn sheep are a native species that were extirpated from Hells Canyon and the surrounding area by 1945 (Cassirer 2003) but have been re-established through re-introductions and conservation efforts. They are important game animals that also have a prominent place in cultural, economic, and ecological values. They are a food source for apex predators such as mountain lions, as well as people. They have provided food for local tribes for centuries.

California bighorn sheep (*Ovis canadensis californiana)* and Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) are both established in the Blue Mountains from re-introductions that began in the 1960s. California bighorn sheep were placed in the John Day River basin while Rocky Mountain bighorn sheep are in the Snake River basin and included in the Hells Canyon bighorn sheep metapopulation (Figures 3 and 4). There may have been some intermixing over time, but generally the two subspecies are well separated in the planning area. The two subspecies are collectively referred to as bighorn sheep in this report unless otherwise noted.

Existing Condition

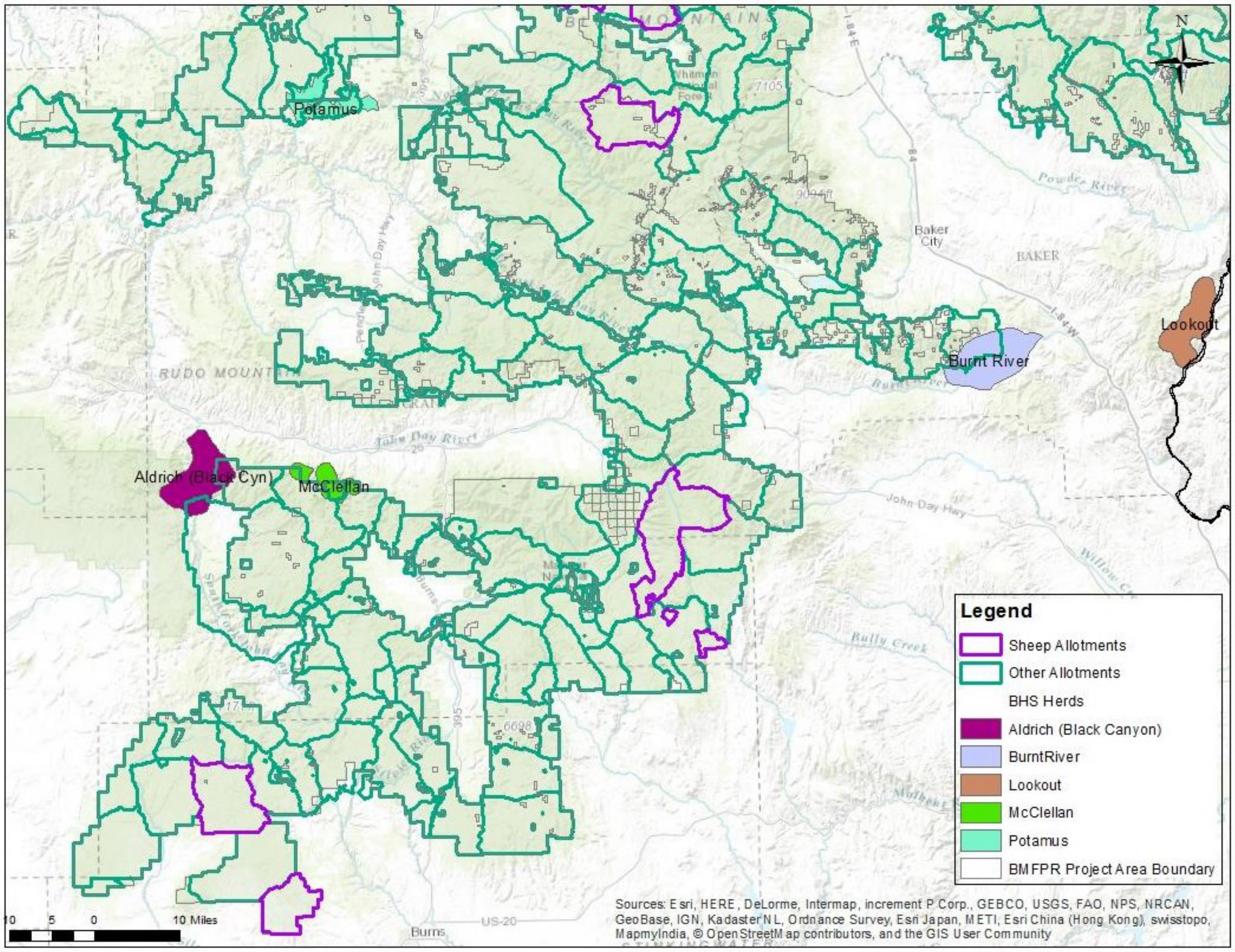

Figure 3 - California bighorn sheep herds (solid fill) and sheep grazing allotments (purple outline) (Lyons et al. 2016)

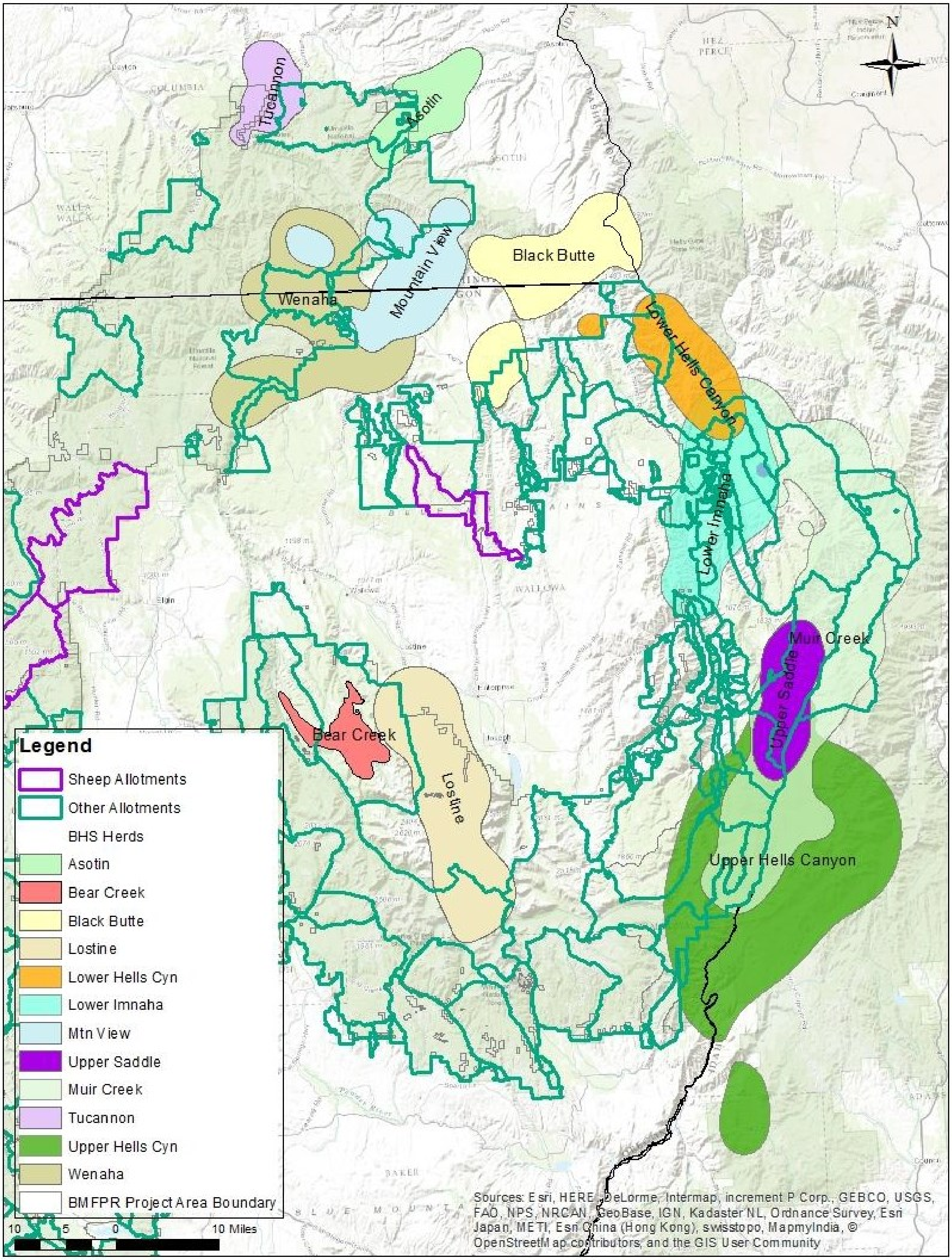

Figure 4. Rocky Mountain bighorn sheep herds (solid fill) and sheep grazing allotments (purple outlined) (Lyons et al. 2016).

Populations

A conservative estimate of bighorn sheep numbers prior to European settlement is upwards of 500,000 in North America (Beecham 2007). Bighorn sheep were vulnerable to unregulated hunting and transmission of diseased from domestic sheep introduced in the 1800s. As the number of domestic sheep increased, the number of bighorn sheep drastically decreased to 15,000 to 20,000 in 1960. Today Rocky Mountain bighorn sheep number around 30,000 individuals. However, many individual herds remain small and susceptible to extirpation (Beecham 2007). The Blue Mountains have the only Rocky Mountain bighorn sheep population in Oregon.

Four herds of California bighorn sheep (Table 3) and 13 herds of Rocky Mountain bighorn (Table 4) have become established following transplants from Canada and other established herds in Idaho, Montana, and Colorado (Cassirer 2003, Coggins and Mathews 1996). The California subspecies herds are separated spatially (Figure 3), while the Hells Canyon Rocky Mountain bighorn sheep herds are connected by source habitat. The Hells Canyon herds function as a meta-population made up of many relatively small herds that experience minor amounts of inter-herd contact, typically during the rutting season (Figure 4). Four herds in the Hells Canyon metapopulation are below the suggested minimum viable threshold of 50 (Berger 1990) (Table 4).

Table 3. California bighorn sheep populations and most closely associated forest (ODFW 2022a).

Herd Name	Initial transplant year	2003 Population Estimate	2021 Population Estimate	State	Nearest National Forest
Potamus	2003	20	175	OR	Umatilla
Aldrich Mountain	1978	90	150	OR	Malheur
McClellan	1988	120	100	OR	Malheur
Burnt River	1987	80	65	OR	Wallowa-Whitman
Blue Mountain total		310	490	OR	

Table 4.Rocky Mountain bighorn sheep populations and most closely associated forest (ODFW 2022b).

Herd Name	Initial transplant year	2003 Population Estimate	2021 Population Estimate	State	Nearest National Forest
Tucannon	1964		20	WA	Umatilla
Asotin	1973	45	65	WA	Umatilla
Mountain View		20	103	WA, OR	Umatilla
Black Butte		60	80	WA, OR	Umatilla
Wenaha	1984	65	219	WA, OR	Umatilla
Bear Creek (Minam)	2000	35	95*	OR	Wallowa-Whitman
Lookout			274	OR	Wallowa-Whitman
Lostine	1971	80	71	OR	Wallowa-Whitman
Lower Hells Canyon	1993	35	45*	OR	Wallowa-Whitman
Lower Imnaha	1979	165	110*	OR	Wallowa-Whitman
Muir Creek	1997	25	11	OR	Wallowa-Whitman

Upper Hells Canyon	1971	45	5	OR	Wallowa-Whitman
Upper Saddle		10*	60	OR	Wallowa-Whitman
Hells Canyon totals		350	1158		

* Latest estimate from 2019

Habitat

Bighorn sheep primarily live in open grasslands and shrub steppe with steep rocky slopes, ridges, rimrocks, cliffs, and canyon walls (Verts and Carraway 1998). Densely forested areas provide little forage and poor visibility and are rarely used by bighorn sheep, except for respite from wind, extreme temperatures, and insects (Beecham 2007). They will also occasionally forage in forest areas with openings created by fire or clearcuts. Rams have been observed in atypical habitat in the Blue Mountains, but rarely (J. Ratliff, H Harris, pers. comm.).

Different habitats are used for foraging, resting, mating, lambing, thermal cover, and predator avoidance. Steep slopes, talus, rock outcrops, and cliffs provide habitat for resting, lambing, and escape. Visibility is important to detect the presence of predators, which are primarily mountain lions and coyotes. Ewes often use the same lambing grounds year after year, where escape terrain is critical. Both ewes and lambs are vulnerable to predation immediately prior to and for 1 to 2 days after parturition.

Recent habitat models use escape terrain defined by Sappington et al. (2007) combined with a horizontal visibility component (USDA 2010) to define summer source habitat. In 2023, Pacific Northwest Region Forest Service staff developed a new spatial habitat map using updated vegetation data (Stratton 2022). This updated map reflects changes in habitat due to recent fires and appears to better detect ruggedness such steep rocky areas than prior efforts. An overlay of extensive bighorn sheep telemetry shows a good fit of the habitat model with known bighorn sheep presence in most cases (Figure 5).

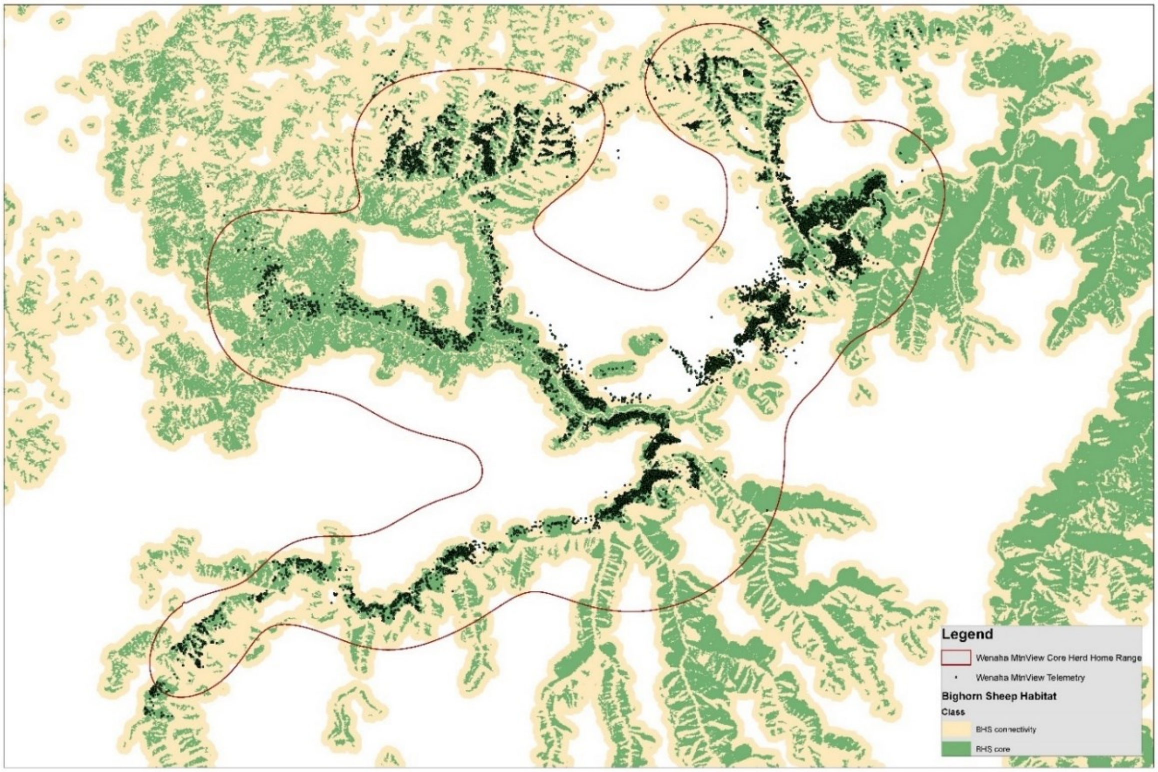

Figure 5. Wenaha bighorn sheep herd telemetry and modeled habitat. Black dots are 5 years of sheep locations. Green is primary habitat and tan is connective habitat.

Current Forest Plan Direction

Each forest plan differs on this topic. The Umatilla National Forest mentions a goal to provide available forage to meet requirements of desired populations of elk, deer, and bighorn sheep (p. 4-58). The Wallowa-Whitman 1990 forest plan refers to a 1982 document regarding avoidance of conflict between bighorn sheep and domestic sheep (p. 4-45). And the Malheur 1990 forest plan has a forest wide standard to maintain the openness that is characteristic of bighorn sheep habitat, and to not stock domestic sheep allotments within bighorn sheep range (p. IV-41).

Current forest plans do not identify areas unsuitable for domestic sheep grazing, and there are no restrictions for establishing new sheep grazing allotments or changing from cattle to sheep. Management direction does not reflect most recent science regarding disease transmission between domestic sheep or goats and bighorn sheep.

Risks and Stressors for Bighorn Sheep

Some challenges for bighorn sheep (Beecham 2007) include:

- Disease transmission from domestic sheep and goats to bighorns and between bighorn herds.
- Loss of genetic variability in small herds.
- Habitat deterioration, loss, and fragmentation.
- Human disturbance on critical winter and lambing ranges.
- Competition for forage and space with livestock and other ungulate species.

- Cougar predation on adult female sheep in remnant or recently reintroduced herds.

Predators, primarily cougars and coyotes, can focus on bighorn sheep and suppress recruitment at a localized scale. The exclusion of fire can reduce available habitat as plant succession reduces sight distance and changes the context and effectiveness of escape terrain. Invasive plants can replace native vegetation, rendering foraging areas unusable for bighorn sheep. These and other factors combine to alter the habitat and population dynamics of bighorn sheep, but the Forest Service has limited capability to influence these factors.

The Forest Service plays a major role in conserving, protecting, or manipulating habitat to ensure that habitat is available and capable of supporting viable bighorn sheep populations. At the same time, the Forest Service also administers a livestock grazing program that can directly or indirectly affect bighorn populations through potential disease transmission. Although several factors affect bighorn sheep populations and habitat, the potential for disease transmission from domestic sheep or goats represents the most significant factor that can be effectively managed on National Forest System lands.

The disease that has the most widespread and severe impacts on bighorn sheep population abundance is a pneumonia triggered by the bacterium *Mycoplasma ovipneumoniae (M.ovi)*. Initial exposures are usually accompanied by acute all-age mortality events where, on average, about half the population dies, although mortality rates vary widely between outbreaks (Cassirer et al. 2018). Some survivors of the initial outbreak may become chronically infected and contagious. They can maintain infectious for long periods of time within populations of this highly social species. Newborn lambs are unprotected from infection and exposure of young lambs to *M.ovi* by chronically infected carrier adults leads to spread through nursery groups, usually causing high rates of mortality in juveniles, especially during summer. In some cases, sporadic low levels of adult mortality are also observed (Besser et al. 2013, Cassirer et al. 2018). Some populations recover relatively rapidly after initial exposure (Coggins and Matthews 1992), while others experience decades of low recruitment because of recurring disease epizootics in lambs (Cassirer and Sinclair 2007).

There is broad agreement within the scientific community that spatial and temporal separation between bighorn sheep and domestic sheep and goats is the most prudent management approach to reduce the possibility for transmission of disease-causing pathogens to bighorn sheep (WSWG 2012). The Wild Sheep Working Group (WSWG), a committee sanctioned by the Western Association of Fish and Wildlife Agencies, defines effective separation as “spatial or temporal separation between wild sheep and domestic sheep or goats to minimize the potential for association and the probability of transmission of diseases between species” (WSWG 2012). Many factors play into effective separation, including the distance, topography, and vegetation, and dynamics of sheep movements.

Interactions between domestic and wild sheep occur when a bighorn sheep travels and meets a domestic sheep, or a domestic sheep travels and encounters bighorn sheep. Either way there is a potential for disease transmission between the two that can have devasting consequences to bighorn sheep populations. Bighorn sheep typically stay in their home range but occasionally individuals, especially males, will move around. As herds become larger in number, there are more chances that individuals or groups of bighorn sheep might wander or 'foray' and encounter domestic sheep or goats.

Currently the bighorn sheep risk of contact tool (O'Brien et al. 2021) is considered the best way to estimate the potential that a bighorn sheep 'foray' might result in contact with a sheep allotment. The Risk of Contact (ROC) tool relies on three components: (1) bighorn sheep core herd home range estimation; (2) foray analysis; and (3) contact analysis. It does not address potential movements of straying domestic sheep.

Although empirical data are currently lacking on recommended disease outbreak intervals that are necessary for long-term population persistence, a moderate level of outbreak events (0.25) has been suggested as a benchmark. The Wild Sheep Working Group has suggested that results of ROC may be interpreted as follows: "Given the potential severity of die-off resulting from interspecies contact, we recommend management scenarios that allow for disease free intervals of at least 50 years. If we assume a moderate probability of contact with an allotment resulting in an interspecies contact that will result in a disease transmission outbreak event (0.25), then we would need to see a rate of contact of less than 0.08 contacts per year (or less than 0.8 contacts per decade)" (WSWG 2012).

None of the existing Forest Service sheep grazing allotments within the Blue Mountains national forests intersect core herd home range of bighorn sheep. An analysis of all allotments in the planning area using Risk of Contact tool indicated the potential rate of contact ranged from 0 to 0.02 contacts per year, all less than the suggested threshold of 0.08 contacts per year (Lyons et al. 2016).

Some bighorn herd populations have increased since the 2016 analysis. This strongly affects the ROC calculation, which assumes there is a higher chance that individual bighorn sheep will travel simply because there are more of them. However, this is not always true. Bighorn sheep have travelled into grazing allotments on the Umatilla National Forest when the populations were low and have not been documented moving in years when the populations were high. It is highly variable and difficult to track. Despite many assumptions and caveats in the ROC model, it is considered the best science to inform potential rates of contact, for all areas and situations.

Using the 2022 updated habitat map (Stratton 2022) and telemetry data from 2016-2021 obtained from the state of Idaho, model runs now indicate an increased potential contact rate with the two closest Forest Service sheep grazing allotments since the last analysis in 2016. In addition, there are flocks of sheep on private land exacerbating the potential for contact. While the Forest Service has no control over private sheep operations, it does have a responsibility to minimize potential encounters with permitted domestic sheep on National Forest System land, as well as permitted sheep straying into areas occupied by bighorn sheep.

Accounts of disease transmission to bighorn sheep from domestic goats are less frequent than from domestic sheep, but respiratory pathogens that can cause disease in bighorn sheep, including *Mycoplasma ovipneumoniae* are regularly detected in apparently healthy domestic goats (Heinse et al.

2016). The genetic strain of *M. ovipneumoniae* that appears to be host specific to goat species and less virulent in bighorn sheep in penned studies (Besser pers. com. 2016).

Pack goats are typically used in small (six or less) numbers and are less likely to escape control of their owner/handler than goats used for weed control. For goats that are used for weed control or as pack animals in BHS habitat, appropriate management practices should be used to minimize the risk of interactions between goats and bighorn sheep [WSWG 2012). Although there seems to be a low prevalence of *M. ovipneumoniae* in pack goats, there are risks of pack goats contracting it through co-mingling with other domestic sheep or goats. Keeping pack goats from contact or association with bighorn sheep is a prudent management approach considering: (1) non-zero prevalence of *M. ovipneumoniae* in pack goats; (2) the uncertainty around pack goats co-mingling with other domestic sheep and goats; (3) other pathogens and parasites of concern that may exist; and (4) the social attraction that exists between members of the sheep and goat families.

Conclusions

Risks and Stressors

Key wildlife stressors include roads, changing forest structures (tree density, tree species composition, age class, snag and down wood abundance and distribution), wildfire, lack of habitat connectivity, invasive species, and climate change. Competing natural resource uses such as timber harvest, grazing, recreation, and roads can reduce quality and quantity of some habitats. Disturbance related to these activities can also cause wildlife to move around. Managing the spread of invasive plants is critical to prevent large scale changes to vegetation that wildlife depend on.

Precise stressors and barriers to connectivity are highly variable. The Washington analysis helps to prioritize areas that need additional attention to address important habitat connectivity concerns at a more localized ecoregional scale. Fine resolution data and field assessment is still needed (Washington Habitat Connectivity Working Group 2010). A reasonable start to effectively restore or maintain multi-level landscape patterns is to help forest landscapes return to natural disturbance regimes and allow the future climate to adapt them (Hessberg 2012).

Climate change has the potential to cause substantial impacts to species and their habitats (see Climate Change Impacts Report). Changes may include loss of habitat and food supply, altered disturbance regimes, extreme air temperatures, and stream temperature changes.

Trends and Drivers

Forest management practices as well as recreation and cultural use of the forests will continue to affect wildlife and their habitats in various ways. Current management is working to manage forest landscapes towards its natural range of variation. The quality and quantity of special habitats is not expected to worsen based on current management direction. Coordination with state fish and wildlife agencies and local tribes is essential to managing habitat connectivity and habitat for deer, elk, and bighorn sheep.

Retention of elk cover stands under the 1990 forest plans has provided undisturbed dense tree cover, insects, and snags for many nesting birds. In some areas it has also contributed to an overabundance of dense trees and fuels, outside the natural range of variation, particularly in dry forest types.

Although bighorn sheep and other hunted species will always face disease issues, populations appear to be stable in most areas. Circumstances for bighorn sheep can change rapidly and unexpectedly, with outbreaks of pneumonia having dire effects over many years. Continued practices to deter contact with domestic sheep, as well as intensive monitoring, is essential to their survival.

Climate change effects to water and vegetation could add another stressor to bighorn sheep populations, but currently is not thought to be a major stressor in comparison to disease and genetic issues. Occasional low or mixed severity fires may benefit bighorns by improving forage conditions, moderating tree encroachment into their open habitats, and reducing predation.

Information Needs

Continual assessments of key habitats such as snags, old growth, aspen, etc., would be to monitor the effects from forest management, fires, and other disturbances. More field review of mature and existing old growth is needed as well as a strategy to maintain it into the future.

Deer and elk are monitored by the states through hunting regulations and success statistics, yearly population surveys, and research projects. Monitoring information is quite robust for the Hells Canyon bighorn sheep, with active radio collaring and research programs in place under the direction of the Hells Canyon Bighorn Sheep Restoration Committee. Continued monitoring is essential to maintaining bighorn herds on the landscape.

Recent changes to some sheep grazing permits on Forest Service allotments have required practices to deter and reduce the potential for contact between the species. Additional monitoring of permitted sheep grazing is needed.

Key Benefits to People

Special habitats are culturally valued components of national forests. They provide forest diversity that is appreciated by birders, hunters, hikers, and those seeking scenic views.

Public comments about the old and mature forest inventory effort illustrated the many ways that human life and well-being are tied to natural systems, from climate regulation and nutrient cycling to food provision and spiritual connection (USDA 2023). While the concept of “forest use values” captures the importance of the tangible forest resources humans use, such as timber, nontimber forest products, recreation, or tourism, “nonuse values” capture the value people attach to the mere existence of forests or the ability of future generations to experience them. The role of place attachment or identity, meaning “the symbolic importance of a place as a repository for emotions and relationships that give meaning and purpose to life" is also relevant in our understanding of how people relate to and value old-growth forests (Williams and Vaske 2003).

Hunting and fishing are traditional recreational, subsistence and treaty uses within the national forests in the Blue Mountains. They are important aspects of local lifestyles and cultures, attract broad regional participation, and provide recreational and economic opportunities to surrounding communities including Tribes, family groups, and individuals to socialize and harvest food for their own use. Hunting was identified by the 2019 National Visitor Use Monitoring as the number one primary activity on the national forests in the Blue Mountains.

Bighorn sheep are a challenging and highly sought after big game species. Drawing a tag in Oregon can be a once in a lifetime opportunity. Recreational viewing of bighorn sheep is also a popular activity.

Rocky Mountain elk and mule deer are important economically, ecologically, socially, and culturally within the planning area. Bolon (1994) reported that the value of elk hunting within the Blue Mountains of Oregon and Washington ranges between 17 and 20 million dollars per year.

Oregon's total hunter related expenditures for all hunting activities is estimated to be $227.8 million in 2019 dollars, with $125.4 million occurring in eastern Oregon (ODFW 2023a).

Key Findings

Special habitats and big game species are biologically and culturally important components of national forests. Special habitats provide forest diversity that is appreciated by birders, hunters, hikers, and those seeking scenic views. Special habitats such as old growth forest, riparian areas, and aspen should continue to be protected, promoted, or restored to benefit the multitude of wildlife species that are associated with them.

Species that are hunted provide traditional recreational, subsistence and treaty uses within the national forests in the Blue Mountains. They are important aspects of local lifestyles and cultures, attract broad regional participation, and provide recreational and economic opportunities to surrounding communities including Tribes, family groups, and individuals to socialize and harvest food for their own use.

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