Washington State

Mule Deer Management Plan

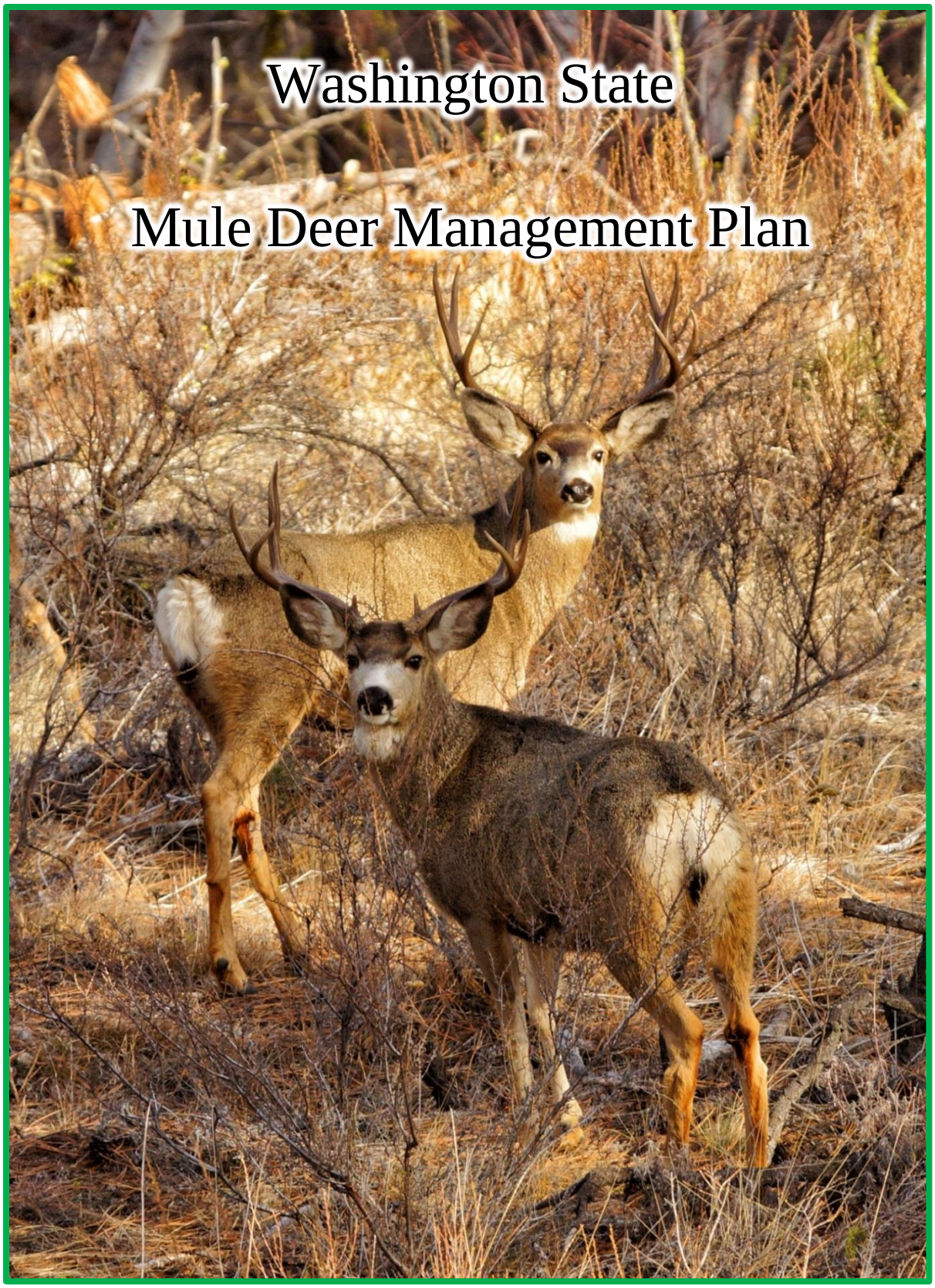

Photo by Justin Haug

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Washington State Mule Deer

Management Plan

Washington Department of Fish and Wildlife
Wildlife Program
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September 2015

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Director, Washington Department of Fish and Wildlife Date

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Washington State Mule Deer Management Plan

Executive Summary

Rocky Mountain mule deer (*Odocoileus hemionus hemionus*) are an icon of the American West. Common throughout much of eastern Washington State, mule deer occur at varying densities along the state's entire north-south extent, from the crest of the Cascade Mountains east to the Idaho border. This widely distributed cervid has considerable interest and is of significant importance to the people of Washington. It provides hunting and viewing opportunities for many, economic support to the state and to local communities and it has long provided food and clothing for native peoples. There are more than 120,000 state-licensed deer hunters in Washington, of which a large portion hunts mule deer, harvesting between 9,500 and 14,000 annually. Mule deer hunters provide an economic boost to many of the communities where Washington's mule deer occur.

The purpose of this plan is to provide background information on the natural history, biology, and status of mule deer herds in Washington State, describe current management issues, and establish objectives and strategies to guide future management. The emphasis is a science-based approach to managing of mule deer populations and factors affecting deer populations. The over-arching goals of this mule deer plan are: 1) Preserve, protect, perpetuate, and manage deer and their habitat to ensure healthy, productive populations; 2) Manage deer for a variety of recreational, educational, and aesthetic purposes including hunting, scientific study, cultural, subsistence, and ceremonial uses by Native Americans, wildlife viewing, and photography; and 3) Manage statewide deer populations for a sustainable annual harvest.

Harvest regulation and management of mule deer in Washington State has been ongoing for 124 years. Annual harvest regulations have ranged from conservative when deer abundance was low, to liberal when deer numbers were elevated or to address agricultural damage concerns. Hunting seasons are now designed to provide equitable opportunities to all user groups (i.e., modern firearm, muzzleloader, and archery). Estimates of statewide mule deer buck harvest remained relatively stable between 2004 and 2014, averaging around 8,000 bucks.

The basic unit for managing mule deer harvest in eastern Washington is the Game Management Unit (GMU). GMU boundaries were designed to assist with management, and were drawn using identifiable physical features such as roads and rivers, to help hunters and law enforcement interpret regulations. Most hunting season dates, resource allocations, and limited entry special permit levels are set at the GMU level; hunter harvest, hunter effort, and hunter success are reported by GMU. Groupings of GMUs also form the Department's District and Regional boundaries. This management plan launches a new approach to mule deer management delineations by dividing eastern Washington into seven Mule Deer Management Zones (MDMZs). Each MDMZ is a grouping of GMUs based upon a combination of local knowledge, physiographic province and ecoregion. These GMUs share common mule deer populations, and vegetative and geographic characteristics, but are not limited by any county or other administrative boundary. Using MDMZs as the largest mule deer management unit ensures that demographics are collected from a complete population (or sometimes metapopulation), and that management is applied at the population level.

Managing mule deer populations to provide opportunities for both hunting and appreciative recreation, and to reduce mule deer-human conflict, is a complex endeavor. Management is most effective when knowledge of current population trajectory, densities, age structures, herd boundaries, survival, and mortality patterns are readily available, along with hunter harvest and effort data, but few of these metrics are available for use by deer managers because of the expense in obtaining such extensive data sets with adequate sample sizes over large areas. Monitoring mule deer populations provides deer managers with information on population trends and/or densities. Current population monitoring efforts in eastern Washington vary according to the landscape and habitat structure. In some zones, aerial surveys are used to count and classify deer by age and sex. In zones where aerial surveys are not cost-effective due to deer distributions, tree cover and topography, ground surveys are commonly conducted on foot or from a vehicle. The Department has strived to improve the quality of mule deer abundance estimates and trend indices. While there is room for improvement, surveys resulting in relatively high precision estimates are currently being conducted across portions of Washington's mule deer range. But the Department will continue to develop, use, and refine aerial survey models where appropriate to produce unbiased abundance estimates.

Although mule deer are highly adaptable as indicated by their wide distribution across eastern Washington, the landscapes used by mule deer vary considerably in vegetative composition and habitat quality and in the ability to support mule deer. Habitat is the key to maintaining mule deer populations. In many areas, habitat has been altered from natural vegetation. Habitat conversions today often remove natural cover, sometimes with major consequences. Recent large-scale fires across Washington's mule deer ranges and climate change will present new challenges to managing mule deer.

Specific mule deer population and habitat management objectives, problems, and strategies are identified in the following sections. These priority objectives reflect key management issues and specific challenges in mule deer management. To accomplish each objective a variety of strategies have been developed. The following objectives have been identified:

Statewide Mule Deer Management Objectives

- By 2021, develop new or refine existing survey designs for each of the seven MDMZs to estimate population levels or trends, pre- and/or post-hunt age and sex ratios, and/or spring fawn to adult ratios
- Within each MDMZ, manage mule deer to ensure stable or increasing populations, as indicated by demographic indicators
- Adaptively manage (Stankey et al. 2005) to attempt to maintain the current level of mule deer hunting opportunity throughout the seven management zones
- By 2027, within each MDMZ maintain or improve the quality of at least 10% of the important seasonal habitats that support mule deer populations
- Maintain or reduce the number of damage prevention permits or kill permits issued to minimize commercial crop damage caused by deer in MDMZs over the period 2016 – 2021
- By 2020, have long-term solutions or plans in place for at least three local communities dealing with urban mule deer populations causing nuisance or damage issues
- By 2018, increase the number of times mule deer are profiled in public outreach and engagement efforts to at least four per year

- Establish and promote public use of at least two mule deer viewing opportunity sites with informational kiosks by 2021
- Raise public awareness about deer-vehicle collisions by hosting a town hall type meeting in each MDMZ by 2023, discussing the selected problem areas described above
- Achieve 90% compliance of regulations during mule deer hunting season by 2018
- Prevent illegal take of mule deer outside of the hunting season and illegal commercialization of mule deer parts from increasing above the current level
- Increase funding for mule deer management and research by 10% by 2022
- Integrate mule deer into the planned, multi-species predator-prey study by 2017

Spending Priorities

Achieving spending levels will be contingent upon availability of funds and creation of partnerships. Department spending priorities for managing mule deer should focus on the following:

Activity	**Priority**	**Future Costs**
Population Monitoring	High	$175,000
Habitat Management	High	$720,000
Public Education/Outreach	Medium	$10,000
Research	High	$30,000

Acknowledgements

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We would like to thank the volunteers from the Inland Northwest Wildlife Council, the Mule Deer Foundation, and students from the West Valley Outdoor Learning Center and across eastern Washington who participated in the eastern Washington Cooperative Mule Deer Project.

It is appropriate that we thank some of the notable mule deer biologists and managers who laid the groundwork and provided some of the cornerstones of Washington's mule deer management; these include Don Zeigler, Roger McKeel, Jerry Bert King, Zeke Parsons, E. Reade Brown, Rolf Johnson, Mark Quinn, Lee Stream, John Musser, Pat Fowler, and Steve Zender. Finally, we would like to thank Jim Kujala, Rocky Spencer, Joey McCanna, Jess Hagerman, Wayne Emmel, and Dave Parker, whose wildlife capture and piloting skills allowed for the collection of information used in this plan.

Environmental Planner Fred Dobler was a major driving force behind the drafting and completion of the plan.

Part 1: Mule Deer Management History, Biology, and Issues

This plan is organized into two chapters. The first chapter provides a history of Washington's mule deer harvest management, general information about mule deer biology and ecology, and a discussion of management considerations and issues in Washington. The second chapter provides specific information about Washington's Mule Deer Management Zones (MDMZ). Eastern Washington's mule deer range has been divided into seven MDMZs using level III and IV ecoregions (Omernik 1987), local knowledge of mule deer biology and distribution, and Game Management Unit boundaries (Figure 1). This is a departure from past planning efforts and reflects the Washington Department of Fish and Wildlife's (Department) move to implement ecoregion based planning.

Introduction

Purpose and goals of plan

The image of a Rocky Mountain mule deer (*Odocoileus hemionus hemionus*) is an icon of the American West. Common throughout much of eastern Washington State, mule deer occur at varying densities along the state's entire north-south extent, from the crest of the Cascade Mountains to the Idaho border (Figure 2). While some mule deer may spend the summer further west than the Cascade Mountains' crest, the units mapped in Figure 2 show where they show up in hunter harvest. Along the crest of the Cascades, the morphological features of deer can range from mule deer to black-tailed deer. This is particularly common along the southern portion of the Cascades from the Columbia River north to I-90, but these are phenotypically considered to be mule deer.

Kittitas mule deer buck. *Photo Doug Kuehn*

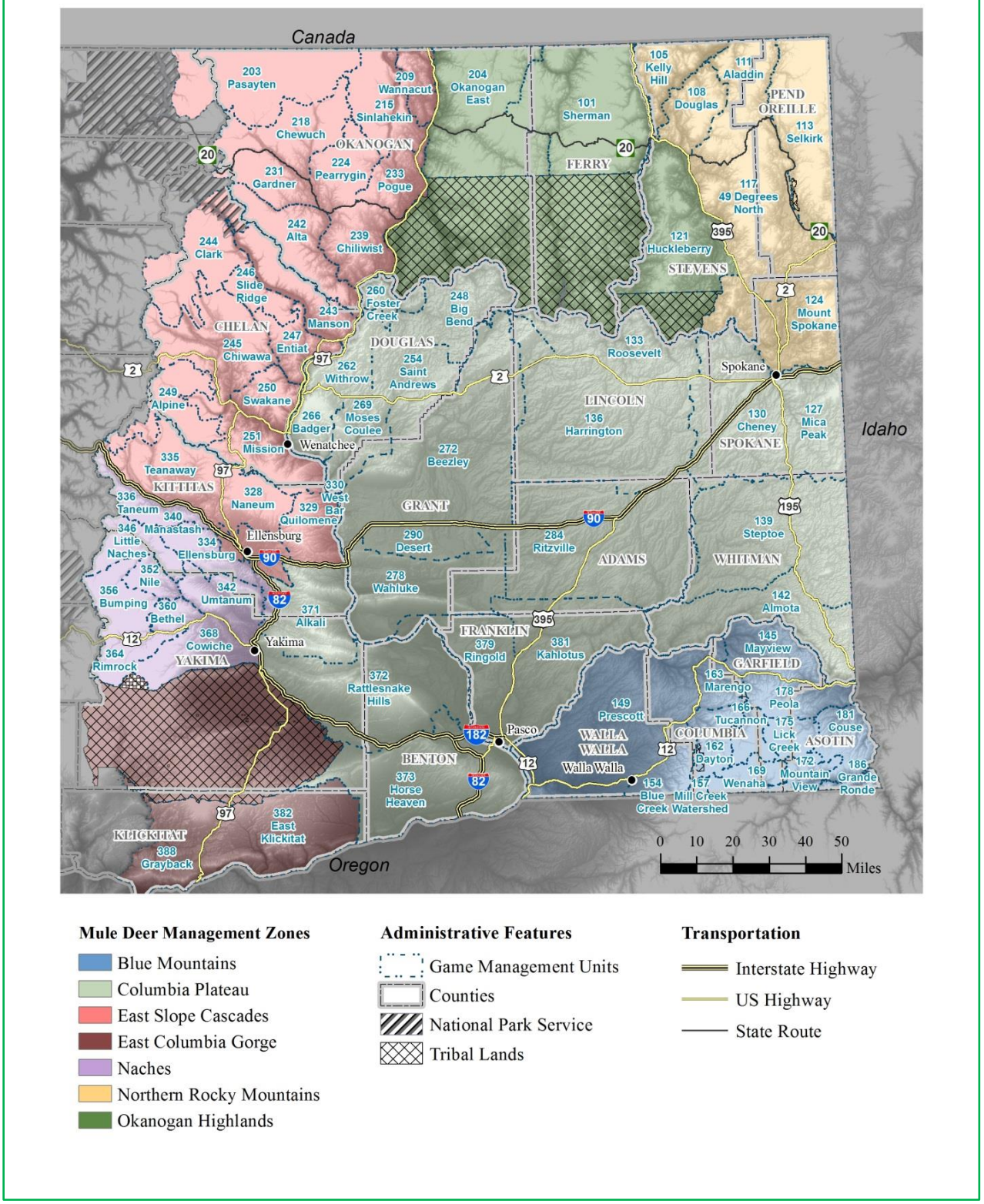


Figure 1. Mule Deer Management Zone boundaries established as part of a framework for mule deer management in Washington State beginning in 2015. Mule Deer Management Zones are based on North American ecoregions identified by Omernik (1987).

This widely distributed cervid has considerable interest and is of significant importance to the people of Washington. It provides hunting and viewing opportunities for many, economic support to the state and to local communities and it has long provided food and clothing for native peoples.

There are currently more than 120,000 state-licensed deer hunters in Washington, of which a large portion hunt mule deer, harvesting between 9,500 and 14,000 annually (WDFW 2014a). Mule deer hunters provide an economic boost to many of the communities where Washington's mule deer occur.Nearly 80% of the public indicate they value viewing, photographing, or simply appreciating the presence of wildlife, including mule deer, while recreating, working, or going about their daily lives (U.S. Fish and Wildlife Service 2011). The management of mule deer populations and a substantial amount of their habitat is the responsibility of the Department. In partial fulfillment of these responsibilities, and to ensure mule deer populations persist into the future, the Department has developed this plan to guide future management of mule deer in eastern Washington.

The purpose of this plan is to provide background information on the natural history, biology, and status of mule deer herds in Washington State, describe current management issues, and establish objectives and strategies to guide future management. The emphasis is a science-based approach to the management of mule deer populations, and factors affecting deer populations. Current population status and management information provide the basis for describing issues and options under this plan. However, this plan is intended to be sufficiently dynamic to facilitate the resolution of emergent issues and allow adapting priorities as new issues arise. As new information becomes available, management strategies may be modified or new ones developed. This long-term plan will be subject to periodic review and revision. Priority actions will be implemented as resources are available.

The statewide management goals for deer are:

1. Preserve, protect, perpetuate, and manage deer and their habitat to ensure healthy, productive populations

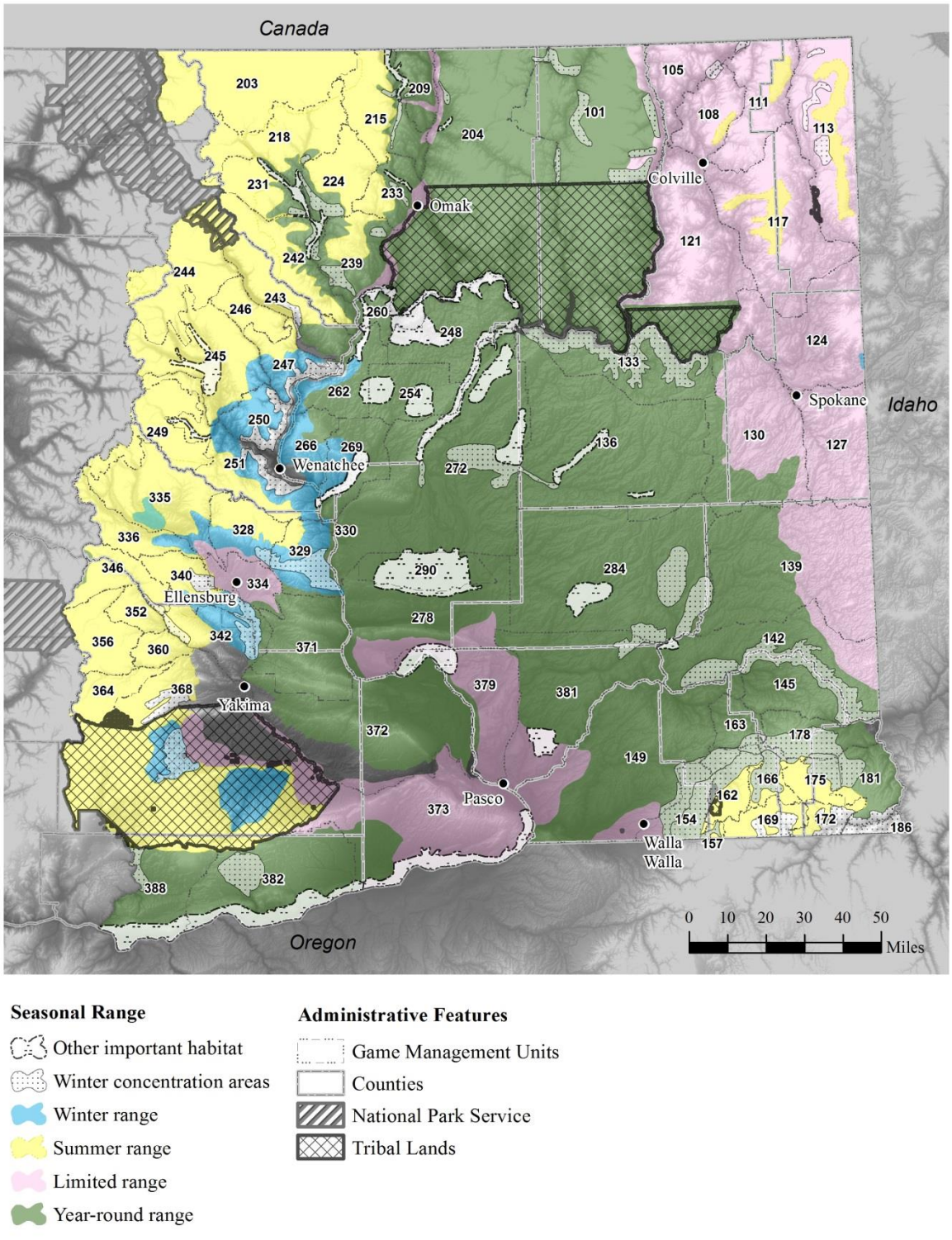


Figure 2. Overview of general mule deer distribution and seasonal ranges in Washington State based on spatial data from the Western Association of Fish and Wildlife Agencies Mule Deer Working Group (WAFWA 2004).

2. Manage deer for a variety of recreational, educational, and aesthetic purposes including hunting, scientific study, cultural, subsistence, and ceremonial uses by Native Americans, wildlife viewing, and photography

3. Manage statewide deer populations for a sustainable annual harvest

Authority

The responsibility and authority for management of hunted game species and establishment of hunting seasons is granted to the Washington Fish and Wildlife Commission (the Commission) and the Department by the Washington State Legislature through Title 77 of the Revised Code of Washington (RCW). Specifically, the Commission and the Department receive their authority and responsibility for the management and protection of fish and wildlife resources and provide recreational opportunities to the state's citizens through RCW 77.04.012. Under this authority, the Commission develops regulations through the adoption of Washington Administrative Code (WAC). In addition, various Commission and Department established policies and procedures guide game management.

The Department's mission statement directs the agency to serve the citizens of Washington by protecting, restoring, and enhancing fish and wildlife and their habitats, while providing sustainable, wildlife-related recreational and commercial opportunities. Development of species management plans is an important part of this process. The Washington State Mule Deer Management Plan is consistent within the broader scope of the 2015-2021 Game Management Plan (GMP; WDFW 2014a), and in accordance with the Department's Hunting Season Guidelines. The GMP (WDFW 2014a) stresses the importance of science as a foundation for developing regulations and conservation approaches to management.

The process of establishing state hunting seasons for mule deer is a multiple-step process. Legislative mandates and Commission guidelines for management of game species require appropriate information such as current distribution, population status and trend, harvest and recreational objectives, and non-hunting mortality sources. Using available information, Department staff develop hunting season recommendations to maximize sustainable hunting opportunities and to promote conservation. The final step in developing hunting seasons for mule deer occurs when the Commission adopts hunting seasons based upon recommendations

from the Department biological staff and public input. Major seasons are set for three-year intervals; minor adjustments occur annually, such as modifying special permit levels to address crop damage or nuisance problems, or sudden unexpected habitat or environmental changes. The process for developing mule deer hunting seasons typically includes:

1. Determination of the status of populations and effects of previous harvest strategies
2. Preliminary discussion of season structure and potential changes with stakeholders including the Department staff, the public, the tribes, and other state and federal agencies
3. Development of season and regulation alternatives
4. Drafting of regulations and establishment of a public comment period
5. Development of final recommendations by the Department staff
6. Adoption of regulations by the Commission

History of Mule Deer Management in Washington

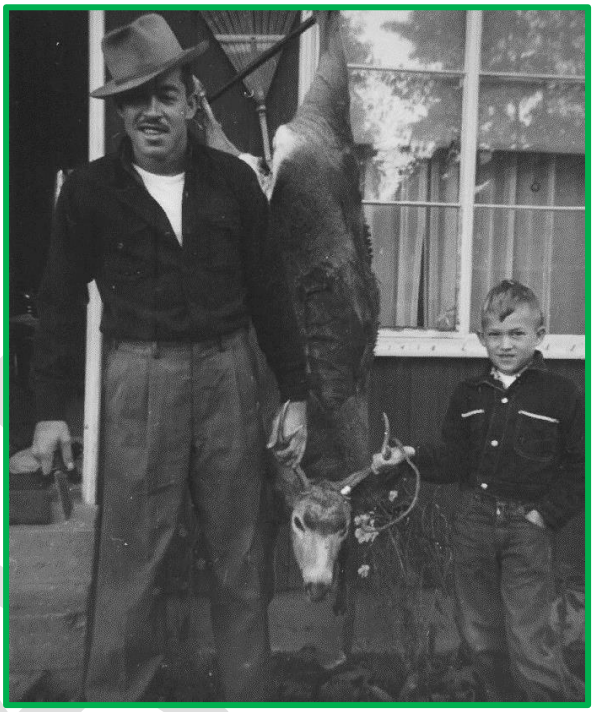
Regulation and Harvest Management History

Harvest regulation and management of mule deer in Washington State has been ongoing for 124 years. Annual harvest regulations have ranged from conservative when deer abundance was low, to liberal when deer numbers were elevated or to address agricultural damage concerns. Hunting seasons are now designed to provide equitable opportunities to all user groups (i.e., modern firearm, muzzleloader, and archery). This brief history provides a perspective on the evolution of deer harvest management in eastern Washington.

Among the final admissions to the Union, the Washington Territory achieved statehood in 1889 and quickly acknowledged the importance of managing its fish and wildlife resources by establishing a Department of Fisheries and Game in 1890. However, this agency's game management authority was superseded in 1903 by a system of county-based regulatory Game Commissions, each funded independently through county license sales. Despite the presence of such regulatory organizations, records of mule deer management and season structures are scarce prior to the formation of the Department of Game in 1932 by the state legislature. Since then, harvest regulations for game species, including mule deer, have been set annually by the state wildlife agency. In 1987, the Department of Game was renamed the Department of Wildlife to

more accurately reflect management responsibilities for all the State's wildlife. In 1994, the Department of Wildlife merged with the Department of Fisheries to become the Department of Fish and Wildlife.

Beginning in 1932, mule deer and white-tailed deer (*Odocoileus virginianus*) were managed under a general deer season from mid to late October each fall, although some counties (Chelan, Ferry, Okanogan, Pend Oreille, Spokane, and Stevens) maintained open seasons that extended into November. Between 1932 and 1949, no fall deer seasons were open in Adams, Benton, Douglas, Franklin, Grant, Lincoln, or Whitman counties. During open seasons, harvest was limited to one buck deer with branched antlers (defined as having at least two points on one side). The first official bow and arrow season was offered in 1949; this archery season was in Chelan County only, during October 7-31 for a deer of either sex.



Okanogan County mule deer hunter circa 1955. *Photo Mike Jones.*

Starting in 1950, the Department of Game established an Orchard Damage Control Season (ODCS) for portions of Chelan, Douglas, and Okanogan Counties to alleviate concerns from commercial fruit growers for damage caused by deer. ODCS hunts were limited to within a quarter of a mile of an orchard for the harvest of one deer of either sex from November 6 through January 31, 1951.

ODCS hunts were shortened to approximately two months in length (November 5 - December 31) in 1951. These hunts remained unchanged until 1953, when antlerless permits issued by a random drawing were added to the list of available hunts. Most general hunts were similar to previous hunts described above with harvest limited to one buck with branched antlers. This general hunt structure remained until 1955 when the branched antlered buck restriction was

dropped and any buck with visible antlers became the legal harvest during general season deer hunts.

In response to requests from hunters for additional deer hunting opportunities, a North Cascades Deer Season (later known as the High Buck Hunt or Early Buck Hunt) was established in 1959 for the backcountry and primitive areas in remote, roadless parts of Chelan and Okanogan counties running September 12-20. Some general either sex hunts were also added but general season deer hunts for one buck with visible antlers during October and early November remained the same. These seasons continued until ODCS hunts were eliminated in 1965. The years from 1966 through the late 70s were a time of increased deer hunting opportunities; extended late seasons and general either sex seasons were added in select counties and antlerless special permit hunts were expanded. The only deviation to this season and special permit structure took place during the fall of 1969 and 1970, following the unusually harsh winter of 1968 when mule deer populations experienced a sharp decline.

The next major change in deer management occurred in 1984 following concerns expressed by hunters about crowding, competition among hunters, and the declining quality of the hunting experience. The Department responded by implementing a program approach called "Resource Allocation", which was designed to reduce crowding in the more popular modern firearm hunting seasons, provide quality-hunting opportunity and provide early primitive weapon opportunity. Resource Allocation required deer hunters to choose one weapon type (e.g., modern firearm, archery, or muzzleloader) each season, and deer managers were to provide expanded opportunity in the form of early and late archery and muzzleloader hunts. Resource Allocation continues to be a useful approach and its use is expected to persist into the future.

In the fall of 1990, hunters in southeast Washington (in the Blue Mountains MDMZ; Figure 1) were limited to harvesting a mule deer buck with at least three antler points on one side. In 1991, this antler point restriction (APR) was expanded to include one or two Game Management Units (GMUs) within each of the Department's Regions 1, 2, and 3 (WDFW 2014b); the rule was eventually applied throughout eastern Washington in 1997. Buck special permit opportunity was expanded in 1997, with an emphasis on providing "quality". At the same time, numbers of special permits for antlerless only mule deer were drastically reduced and then

eliminated in 1998 as populations declined across their range. Later several "deer area" units were created to address landowner concerns in high commercial crop damage areas, where a small number of anterless deer could be harvested to mitigate that damage. This attempted to focus the harvest effort on the deer causing the actual damage, thereby reducing the risk of limiting the overall population. Since then, little has changed in terms of harvest management strategies and seasons. APRs for the general seasons, with limited antlerless harvest by special permit only, have remained in effect through the present.

Long-term harvest trends

Annual deer harvest has been tracked by the Department of Game since it was formed in 1932. Although long-term harvest estimates exist, changes to the harvest reporting system were begun in 1990 to improve estimates and provide the precision necessary to support effective management. Subsequent improvements have included collection of species- and subspecies-specific harvest data, implementation of hunter harvest report follow-up surveys (to account for generally lower success rates of non-reporting hunters), and mandatory reporting (begun in 2001 to address steady declines in voluntary reporting rates). Harvest estimates produced in conjunction with phone-based follow-up surveys, like those currently used by the Department, are the most effective method available to provide accurate and unbiased estimates (Skalski et al. 2005). Estimates of statewide mule deer harvest during the general season (Figure 3) remained relatively stable between 2004 and 2014.

Long-term mule deer population trends in Washington

Although records of historic mule deer population trends are limited, Julander and Low (1976) reported a marked decline in populations due to severe weather during the winter of 1889. They also reported an increase in population between 1935 and 1968. The wide spread policy of fire exclusion which resulted in changes in plant species composition and an increase in shrub cover, would likely have contributed to this increase (Gruell 1986). Mule deer populations apparently reached very low numbers in eastern Washington during 1969, 1971, and 1972 (Julander and Low 1976), during unseasonably harsh winters. Mule deer populations increased from 1973 until the mid-1980s. Drought conditions developed in eastern Washington starting in 1986 (Shukla et al. 2011), and then eased somewhat in the mid-1990s, and became more pronounced

in the early 2000s. A decrease in mule deer harvest coincided with this drought period across eastern Washington (WDFW 1999).

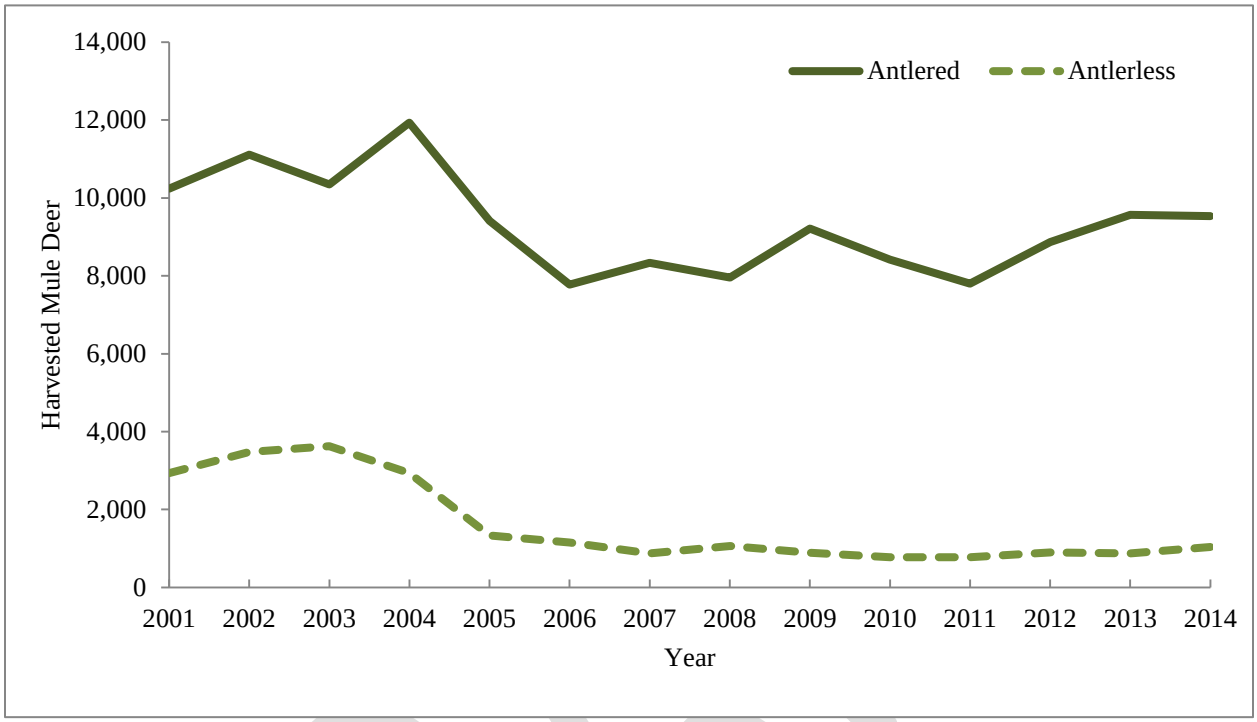


Figure 3. General season harvest estimates (all weapon types) for antlered (solid dark green line) and antlerless (dashed light green line) mule deer in Washington State, 2001 to 2014.

Natural History

Washington's Rocky Mountain mule deer are one of seven subspecies in western North America (Wallmo 1981). Mule deer are members of the deer family, Cervidae, which in North America includes white-tailed deer, elk (*Cervus elaphus*), moose (*Alces alces*), and caribou (*Rangifer tarandus*; Nowak 1991). The deer family appeared during the Miocene in the Old World and probably came to North America late during that epoch via a land bridge between modern day Russia and Alaska (Mackie et al. 1982). However, the genus *Odocoileus* occurs only in the New World (Mackie et al. 1982) and evolutionary processes in western and central-eastern North America, respectively, resulted in two species, the mule deer and the white-tailed deer.

Mule deer derive their name from their characteristic, large mule-like ears; the mule deer Latin species name, hemionus, means half mule. Adult male mule deer, like other members of the deer family, regenerate boney antlers that are shed annually. Mule deer are readily

Mule deer doe and fawns in Yakima County. *Photo Doug Kuehn*

differentiated from white-tailed deer by a number of morphological characteristics. The shape of the tail of mule deer is narrow and rope-like; white-tailed deer have larger, more flag-like tails. The shape and position of the metatarsal gland differs between these deer species; the metatarsal gland on mule deer is long and narrow (~ 12 - 13 cm), and on whitetails it is circular (~ 2.5 cm in diameter). The form of the antlers is different, with adult mule deer antlers typically showing dichotomous branching, whereas white-tailed deer antlers have tines coming off a continuous main beam. Although tribes inhabiting western North America recognized that mule deer were distinct from other deer, mule deer were first described to the rest of the world by Captain William Clark of the Corps of Discovery on September 7, 1804: *"A curious kind of Deer of a Dark gray colour--more so than common, hair long and fine, the ears large and long, a Small recepticle under the eyes like Elk, the taile about the length of the Common deer, round (like a cow) a tuft of black hair about the end, this Species of Deer jumps around like a goat or sheep."*

Biology and Ecology

Reproduction

Mule deer generally reach full sexual maturity at 1.5 years of age. Occasionally, female fawns become sexually mature during their first fall or winter and may be impregnated; it is common

for male fawns to show signs of sexual maturity late their first winter. Early sexual maturation in deer fawns has been correlated with above average body mass supported by high quality habitat (Haugen 1975, Gaillard et al. 1992). The reproductive cycle for adult males begins in spring, with increasing testosterone levels triggering antler growth that continues through late summer when antlers harden prior to velvet shedding (Goss 1983). With the approach of the breeding season, or rut, in early November to December, bucks experience an increase in neck girth and become increasingly active (Relyea and Demarais 1994) and more aggressive towards other bucks (Bowyer 1986). Does begin their estrus cycles at this time of year, and become receptive to breeding (Wong and Parker 1988); cycles occur every 22 - 28 days, with does remaining in estrus for 24 - 36 hours during each cycle. During ovulation, one or more ova are released. After a mean gestation of 203 days (range = 183 to 218 days), fawns are born (Robinette et al. 1973). The peak of parturition in eastern Washington is from early to mid-June. Recently observed pregnancy rates for mule deer in eastern Washington were 92 - 96% and fetal rates were 1.59 - 1.80 fetuses/doe (Table 1). Zeigler (1978) previously observed a mean fetal rate of 1.67 in mule deer from western Okanogan County. Pregnancy and fetal rates in mule deer are related to physical condition of the dams, which in turn is influenced by late summer and early fall habitat conditions (Tollefson et al. 2011). Doe physical condition is also affected by lactation status during the previous growing season because lactating ungulates experience increased energy demands of 17 ─ 32% compared to non-lactating females (Robbins 1993). Ultimately, productivity in mule deer is closely related to habitat conditions.

Table 1. Pregnancy and fetal rates observed in radio-marked mule deer (n = 259, CI = 0.90) in Washington, 2000-2007 (W. Myers, WDFW, unpublished data). Blue Mountains, Naches, and East Columbia Gorge management zones were outside study area and not included.

	Columbia Plateau	East Slope Cascades	Okanogan Highlands	Northern Rocky Mtns	Mean
Pregnancy Rates	0.96 ± 0.05	0.95 ± 0.06	0.93 ± 0.12	0.92 ± 0.10	0.94 ± 0.08
Fetal Rates	1.44 ± 0.24	1.66 ± 0.27	1.44 ± 0.41	1.80 ± 0.32	1.59 ± 0.31

Population ecology

Mule deer densities depend largely on habitat quality (Kie et al. 2002). Populations vary seasonally, peaking shortly after fawns are born in late spring and declining throughout the next year as mortality from malnutrition, disease, predation, hunting, and other sources accrues

(Mackie et al. 1982). Such natural mortality is affected by summer range and drought conditions and winter severity as well as forage availability. Mule deer populations vary annually due to differences in fawn recruitment and seasonal mortality patterns among all age classes. Population growth is classified into one of three categories: stable, increasing, or declining (Caughley 1977). When populations are stable, annual female fawn recruitment equals annual female adult mortality; in increasing populations, annual female fawn recruitment exceeds annual adult female mortality; and when populations are declining, annual adult female mortality exceeds annual female fawn recruitment. A number of factors limit mule deer abundance, including habitat extent and quality. Other factors that affect mule deer populations include weather, legal hunting, collisions with vehicles, predation, diseases and parasites, competition with other ungulates (both wild and domestic), poaching, and human caused disturbance (Bleich and Taylor 1998, Ballard et al. 2001, Robinson et al. 2002, Pojar and Bowden 2004, Myers et al. 2008, Johnstone-Yellin et al. 2009). Recent studies of mule deer populations in eastern Washington identified predation by mountain lions (*Felis concolor*), deer-vehicle collisions, accidents, legal harvest, and poaching as leading causes of mortality (WDFW, unpublished data). However, these mortality sources did not appear to be limiting population growth in portions of the Columbia Plateau, East Slope Cascades, Northern Rocky Mountains, and Okanogan Highlands Mule deer management zones; mean annual survival rate of adult female mule deer was estimated to be 92% (W. Myers, WDFW, unpublished data; Figure 4). At this level of adult female survival, late spring fawn to doe ratios as low as 16 fawns per 100 does would maintain a

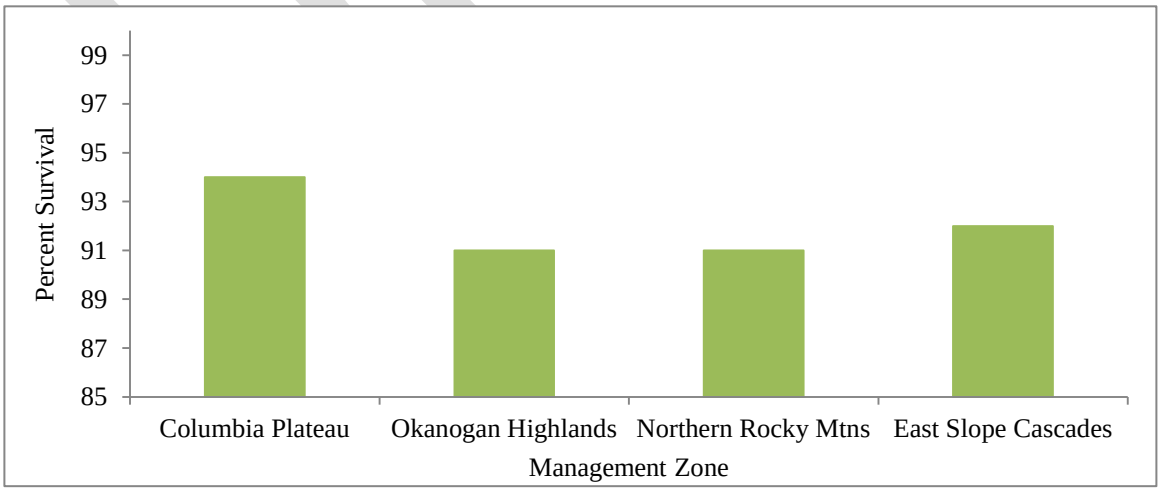


Figure 4. Mean annual survival rates of radio-marked adult female mule deer by Mule Deer Management Zone, 2000-2008. Blue Mountains, Naches, and East Columbia Gorge Management Zones were outside the study area and not included.

stable population (λ = 1.0; DeCesare et al. 2012), assuming a 1:1 fawn sex ratio. More recently, survival rates of 77% have been observed in radio marked adult female mule deer in the Naches MDMZ (D. Vales, Muckleshoot Indian Tribe, unpublished data); a higher level of recruitment (46 fawns:100 does) would be necessary to maintain this population. Lower survival rates were observed in eastern Washington during the late 1980s and late 1990s. McCorquodale (1996) observed survival rates of 81% in the East Columbia Gorge zone and Raedeke et al. (1997) reported survival rates of 69% in adult female mule deer in the extreme western portion of the Columbia Plateau zone.

Mule deer populations are comprised of fawns, yearlings, and adults of various age and sex classes; the number in each age and sex class varies depending on vital rates. In general, growing populations often have greater percentages of younger animals while older deer most often dominate declining populations. Females outnumber males in the population due to differential mortality between the sexes; this is especially true when bucks are the primary legal deer during hunting seasons. While this differential mortality between bucks and does results in biased sex ratios, pregnancy rates and age ratios appears to be unaffected even at relatively low ratios of 10 bucks to 100 does (Mysterud et al. 2002).

Mule deer groups are matriarchal, with an older adult doe leading a small group of adult and yearling does, who are often genetically related, and their young of the year. Yearling bucks will often remain a part of the matriarchal group until the fall breeding season. Adult bucks may be solitary or form bachelor groups composed of multiple age classes, which stay together until their antlers begin to harden.

Habitat

Although mule deer are widely distributed across eastern Washington (Figure 2), the landscape varies considerably, both in vegetative composition and habitat quality, and in its ability to support mule deer. The range of habitats occupied by mule deer across eastern Washington also illustrates the adaptability of mule deer to differing vegetation types and climates. They inhabit open bunchgrass hillsides along the breaks of the Columbia River, Snake River, and foothills of the northern Blue Mountains, as well as portions of the dry shrub-steppe of the Columbia Plateau. They are found in scattered pockets of the temperate forest habitats of northeastern

Washington and in modest densities across the dense conifer forests of the Okanogan Highlands. Perhaps the most productive landscape, supporting the highest seasonal densities of mule deer in eastern Washington, occurs along the east slopes of the Cascade Mountains. Here migrating mule deer have access to high quality forage in higher elevation meadows and forests during the summer growing season and occupy the dry forests and shrub-steppe at lower elevations during winter.

Mule deer doe and fawns in western Okanogan County. *Photo Scott Fitkin*

How well eastern Washington deer habitats meet deer requirements for nutrients and energy determines the density of deer that can be sustained seasonally. While mule deer require different levels of nutrition depending upon their sex, reproductive status, and time of year, meeting these nutritional requirements is tantamount to ensuring reproduction and recruitment, which maintain population levels. Recent studies (Tollefson et al. 2010, Tollefson et al. 2011) indicated that the quality and quantity of available forage could affect fetal rates, fawn birth weight and survival, and doe condition.

Mule deer are able to eat a broad range of forage species; Kufeld et al. (1973) identified 788 plant species eaten by mule deer. They are ruminants and ruminants convert ingested forage into usable energy in a unique way using specialized digestive systems that contain bacteria and protozoa that break down plant cellulose to metabolites (Short 1981). Mule deer have 4-chambered stomachs where fermentation and breakdown of the vegetation to a state that is physiologically usable by the deer occurs.

Forage preferences vary with seasonal availability, palatability, and nutritional needs (Figure 5). During late spring and early summer, deer prefer newly sprouted plants, which are succulent and highly nutritious. As forage senesces in mid-summer and early fall, quality and

availability declines and lactating does experience a nutritional deficit if their nutritional requirements are not met by available forage. During exceptionally dry years when drought conditions extend into the fall, nutritional deficits may last until the following spring. However, in some portions of eastern Washington's mule deer range, there is a "green-up" during the fall when precipitation increases soil moisture conditions, causing annual forbs and grasses to sprout. Fall green-up provides an increase in available forage; these conditions allow lactating does to

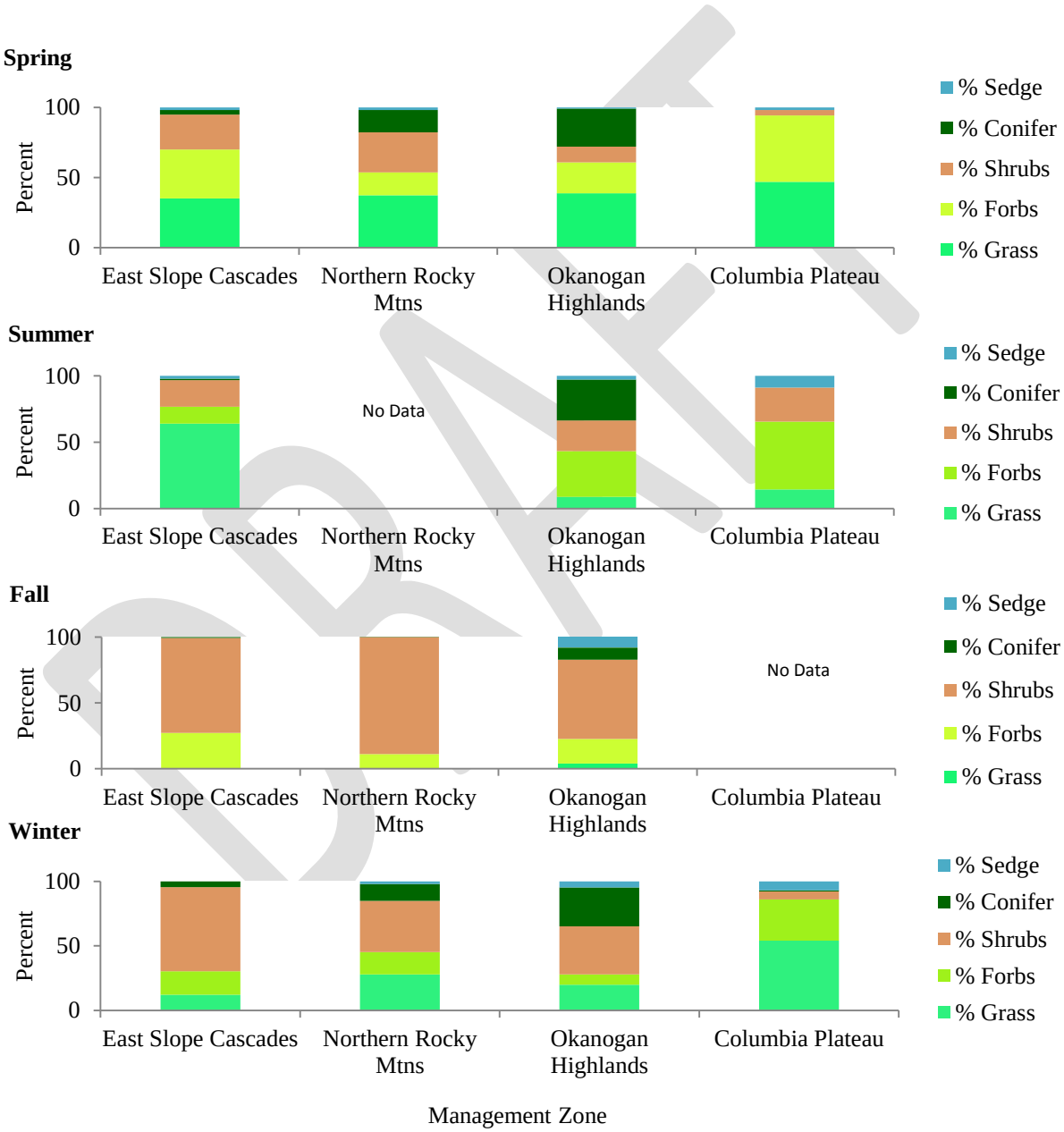


Figure 5. Seasonal composition of mule deer diets within 4 Mule Deer Management Zones (MDMZ) based on fecal analysis of adult does in Washington, 2001 – 2007 (WDFW, unpublished data). Comparable data for MDMZs outside of the original study area were not available.

Mule deer doe and fawn in Okanogan County. *Photo Doug Kuehn*

meet their nutritional requirements and improve the physical condition of deer prior to the breeding season and the onset of winter. During winter, mule deer usually experience a period of nutritional deficit. However, nutritional deficits can be avoided or reversed if deer have access to winter wheat or other highly nutritious agricultural crops. Mule deer have developed physiological strategies to mitigate nutrition deficits of winter. These mechanisms include reduced metabolic rates, limiting movements during periods of extremely low temperatures, and catabolizing stored fat reserves, (i.e., glycogen stored in the muscles and liver). These negative nutritional balances may continue into early spring, but end when new plant growth begins and highly nutritious forage becomes available.

Mule deer have also adopted spatial and temporal strategies for and mitigating limited seasonal forage availability. Radio-marked mule deer have been observed to take advantage of north-facing aspects that provide improved moisture conditions for forage species longer into the growing season (WDFW, unpublished data). Seasonally, mule deer will move to the parts of their annual home range that offer better forage. The longest and most dramatic movement involves seasonal migration, a behavior observed in mule deer herds across the West (Monteith et al. 2011, Lendrum et al. 2013). Seasonal migration occurs in many mule deer populations in eastern Washington, including herds living in the Columbia Plateau, East Columbia Gorge, northeast Washington, Naches, and the Okanogan Highlands. The longest migration distances recorded in Washington were observed along the east slopes of the Cascade Mountains. Approximately 90% of mule deer in this region traveled straight-line distances of up to 90 km

(~50 mi) between summer ranges along the crest of the Cascades to winter ranges along the Columbia River and lower Methow Valley (Zeigler 1978, Myers et al. 1989, McCorquodale 1996, Myers 2003; D. Vales, unpublished data; WDFW, unpublished data).

Good quality habitat also provides mule deer with sufficient cover to ensure thermal regulation and resting needs, and protection from predators and hunters. Thermal regulation needs may be relatively modest provided there is enough cover to afford shade in summer, and allow for additional solar radiation and protection from wind in winter. Security cover needs to be dense and of adequate size to provide protection from predation and disturbance. Pockets of dense brush or trees, large forest tracts, or even just rugged, broken terrain can provide security cover. Inadequate security cover can increase vulnerability to predation and hunting, resulting in excessive mortality. Freddy et al. (1986) found that mule deer less than 334 m (1,100 ft) from persons afoot or 470 m (1,550 ft) from snowmobiles experienced elevated energy demands due to avoidance behavior. In Washington, similar effects would be expected. Does may be especially vulnerable to the cumulative effects of disturbance when lactating during late summer and throughout the winter and early spring when nutritional resources are limited.

Today conversion of habitat is the single most detrimental factor to mule deer populations across eastern Washington. Long-term habitat loss results primarily from land conversion, be it urban-suburban expansion, construction of new roads and dams, agricultural, or invasion by exotic vegetation. In forested habitat, changes resulting from fire, or logging have short-term negative effects to mule deer. Mule deer typically inhabit fire-evolved ecosystems and benefit from early successional forest communities created by fire or logging. It should be noted that in the dry parts of the Columbia Basin, fire removes the shrub and alters the forb component, and south slopes often become cheatgrass (*Bromus tectorum*) monocultures that persist indefinitely. Some shrubs, such as big sagebrush (*Artemisia tridentata*), cannot persist where cheatgrass monocultures substantially reduce the time between fires (Brooks 2008).

Since remaining habitat is limited, it is important to consider mule deer habitat conservation when landscape conversions are being contemplated. In 2004, the population east of the Cascade Crest in Washington was estimated to be 1.37 million people. By 2010, the population increased by 110,000, and by 2040 an increase of an additional 460,000 people is

expected (Washington State Office of Financial Management data). Continued human population growth and associated conversion of mule deer habitat to other uses in eastern Washington will negatively affect mule deer numbers as well as deer-centered recreation in the future.

Climate change is likely to present new challenges to mule deer in the future. Climate projections for the Rocky Mountains and the Upper Columbia Basin likely include an increase in temperature of 1.5 – 2.7°C (2.7 – 3.4°F) with a slightly greater increase in summer. Annual precipitation will likely not change but the pattern will shift with an increase in winter, decrease in summer. It is likely the frequency of drought will increase, (Ashton 2010, reproduced in WDFW and NWF 2011).

Management Considerations and Issues

Managing mule deer populations to provide opportunities for both hunting and appreciative recreation, and to reduce mule deer-human conflict, is a complex endeavor. Management is more effective when knowledge of current population trajectory, densities, age structures, herd boundaries, survival, and mortality patterns are readily available (White and Bartmann 1998), along with hunter harvest and effort data. Generally, few of these metrics are available for use by deer managers because of the expense in obtaining such extensive data sets with adequate sample sizes over large areas (White and Bartmann 1998, Keegan et al. 2011). In eastern Washington, the basic management elements include monitoring population trends, determining harvest objectives, defining season structures and bag limits, and accounting for public input. Throughout this process, deer managers must also weigh landowner issues with hunter access and deer damage. This process begins anew before the current fall hunting season closes, so recommendations can be submitted for the coming year. Harvest levels and hunter success are estimated after the season has closed.

In addition to measuring mule deer population demographics and hunter harvests, there are two other key elements related to a successful management plan: public outreach and enforcement. Outreach is an important component to mule deer management because mule deer are a public resource for hunters and wildlife viewers. Involving and informing the public about mule deer management helps managers gauge public perceptions and desires, helps build

understanding and support for management, and helps shape future management directions. Ongoing public outreach ultimately results in compliance with management rules. Enforcement of mule deer management rules is simpler when the public understands and accepts them. Ensuring a high level of hunting regulation compliance, reducing deer disturbance at critical times, and protecting habitat by enforcing the rules and statutes of the state can all benefit mule deer.

Population monitoring

Monitoring mule deer populations provides deer managers with information on population trends and/or densities. Because a complete census is rarely possible, populations are sampled to produce estimates of true abundance (i.e., the actual number of animals in a population) or an index of relative abundance (i.e., how trends for a population vary between years). The Department has used a number of techniques to estimate mule deer numbers including variations of the Lincoln-Petersen or mark-resight estimators. This technique requires marking mule deer with visible markers like radio collars, color-coded collars, or ear-tags. Population estimates are

Group of migrating mule deer in Okanogan County. *Photo Scott Fitkin*

derived using the ratio of the number marked deer to unmarked deer. Other techniques used to measure population trends in the past include pellet group counts, strip transects, change-in-ratio, distance sampling, or reconstruction models (White 1996, Lancia et al. 2005, Keegan et al. 2011).

Current population monitoring efforts in eastern Washington vary according to the landscape and habitat structure. In some zones, such as the Blue Mountains, Columbia Basin, East Slope Cascades, and Naches MDMZs, aerial surveys are used to count and classify deer by age and sex. In these zones, the seasonal deer range is divided into sampling units delineated by geographic features. A random or stratified random sample of these units is selected and surveys are flown by helicopter to quantify and classify deer in those units. Survey results are corrected for imperfect detection (i.e., animals missed during a survey) based on the probability of sighting deer groups of varying size in different cover types, and estimates of abundance and composition are derived (Samuel et al. 1987). These helicopter surveys are expensive, with helicopter charter costs ranging from $470 – $1,200/hour at the time of this writing.

In zones where aerial surveys are not cost-effective due to deer distributions, tree cover and topography, such as the Northern Rocky Mountains or Okanogan Highlands, ground surveys are commonly conducted on foot or from a vehicle. When repeated before and after the general hunting seasons, ground surveys can provide information on age and sex ratios within a population. This information can provide deer managers with estimates of population structure and survival during the hunting season and trends of relative productivity (WDFW 2014c).

Some ground surveys are conducted during late summer and early fall to estimate age and sex composition prior to the beginning of hunting seasons, but most aerial and ground surveys are conducted after the hunting seasons end, generally in late November or early December before bucks shed their antlers but after deer have moved to winter range. Conducting surveys during November likely increases the probability of observing a greater portion of the bucks in the breeding population due to their increased activity and greater integration with does during the breeding season; however, conducting surveys at this time could be disruptive to hunters in areas with ongoing hunting seasons. In addition to generating abundance data, information from these surveys allows managers to obtain ratios of bucks and fawns per 100 does. These metrics

are an index to buck escapement and fawn survival and recruitment but do not necessarily reflect population trajectory (Caughley 1977). Some mule deer managers also conduct similar surveys in the spring to estimate over-winter survival of fawns.

The Colorado Parks and Wildlife and other state wildlife agencies, have used integrated population models (IPM) to predict and monitor population trends. IPMs require periodic estimates of population size. They then incorporate harvest information and population composition data to predict population response to perturbations like harvest or weather related mortality events. Initial and periodic estimates of survival assist in improving the precision of model outputs. Using this approach, aerial abundance surveys are conducted on a periodic basis to assess the feasibility of using an IPM between survey years to monitor for large population changes over time. If implemented, such efforts may reduce aerial survey costs.

Over the last 25 years, the Department has strived to improve the quality of mule deer abundance estimates and trend indices. Although there is still much room for improvement, surveys resulting in relatively high precision estimates (Hoenes et al. 2013) are currently being conducted across portions of Washington's mule deer range (Table 2). In the future, the Department will continue to develop, use, and refine aerial survey models where appropriate in the Columbia Plateau, East Slope Cascades, Naches, Blue Mountains, and East Columbia Gorge, to produce unbiased abundance estimates. These surveys should reflect each zone's unique environment to increase the precision of results. However, in two zones, Northern Rocky Mountains and Okanogan Highlands, other approaches may need to be developed.

Harvest management

The basic unit for managing mule deer harvest in eastern Washington is the GMU. Generally, most hunting season dates, resource allocations, and limited entry special permit levels are set at the GMU level; hunter harvest, hunter effort, and hunter success (See Appendix A) are reported by GMU.

GMU boundaries were designed to assist with management, and were drawn using identifiable physical features such as roads and rivers, to help hunters and law enforcement interpret regulations. Groupings of GMUs also form the Department's District and Regional boundaries.

Table 2. Current and proposed surveys by Mule Deer Management Zone in Washington State, 2015.

Management Zone	Current Surveys	Proposed Surveys
Northern Rocky Mtns	Vehicle/Hiking surveys for age/sex composition indices	Detection-corrected aerial surveys for composition and abundance estimates
Okanogan Highlands	Vehicle/Hiking surveys for age/sex composition indices	Detection-corrected aerial surveys for composition and abundance estimates
Blue Mountains	Detection-corrected aerial surveys for composition and abundance estimates	Continue and refine current surveys
Columbia Plateau	Detection-corrected aerial surveys for composition and abundance estimates	Continue and refine current surveys
East Slope Cascades	Detection-corrected aerial surveys for composition and abundance estimates	Continue and refine current surveys
Naches	Detection-corrected aerial surveys for composition and abundance estimates	Continue and refine current surveys
East Columbia Gorge	Aerial surveys for age/sex composition and relative abundance indices	Detection-corrected aerial surveys for composition and abundance estimates

This management plan launches a new approach to mule deer management delineations by dividing eastern Washington into seven MDMZs (Figure 1). Each MDMZ is a grouping of GMUs based upon a combination of local knowledge, physiographic province and ecoregion (Franklin and Dyrness 1973, Omernik 1987). These GMUs share common mule deer populations, and vegetative and geographic characteristics, but are not limited by any county or other administrative boundary. Using MDMZs as the largest mule deer management unit ensures that demographics are collected from a complete population (or sometimes metapopulation), and that management is applied at the population level.

As mule deer numbers decreased across the western United States over the last 2 decades, most western states implemented conservative hunting seasons in an effort to increase survival and maintain or increase population levels of mule deer. Mule deer managers in Arizona and Idaho use limited entry permit hunts to manage mule deer harvests in most of their prime mule deer GMUs. All hunts in mule deer GMUs in eastern Oregon are limited entry permit hunts. Nevada and Utah have had limited entry permits hunts for mule deer statewide for many years. California, Colorado, Montana, New Mexico, South Dakota, and Wyoming use a combination of general season and limited entry permit hunts in harvest management of mule deer. Washington uses APRs for mule deer on a statewide basis to meet post-hunt buck to doe ratio objectives while still offering general season opportunity for all mule deer hunters. The Department has

Mule deer buck harvested by youth hunter in Douglas County. *Photo Mike Erickson*

managed mule deer buck harvest for 25 years using APRs in eastern Washington with harvests varying among MDMZs (Table 3).

Since the early 1990s when mule deer numbers decreased across eastern Washington, harvest has been managed conservatively by shortening season lengths, using APRs, and limiting late season quality permits. Hunters participating in all general hunts and most limited entry special permit hunts for bucks, regardless of equipment type, are limited to harvesting a buck with at least three antler points on one side. The Commission initiated APRs with the intent of increasing post-hunt buck to doe ratios and possibly increasing the survival of older aged mule deer bucks through the hunting season and into the breeding season. Since APRs were implemented, annual post-season surveys have generally shown an increase in buck to doe ratios compared to surveys conducted prior to the APRs (WDFW 1999). Some MDMZs (e.g., Blue Mountains, East Slope Cascades, Columbia Plateau, Naches, and Okanogan Highlands) also have shown a higher proportion of older bucks in the harvest. A closer inspection of post-season survey results from some MDMZs or portions there of (e.g., East Slope Cascades, Columbia Plateau, and Blue Mountains) shows that while buck to doe ratios have increased, yearling bucks

Table 3. Estimates of antlered and antlerless mule deer harvest during the general season in Washington by MDMZ, 2001-2014.

MDMZ		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Northern Rocky Mountains	**Antlered**	**86**	**94**	**99**	**163**	**129**	**298**	**151**	**167**	**221**	**115**	**78**	**104**	**99**	**117**
	Antlerless	**6**	**10**	**12**	**10**	**12**	**35**	**8**	**22**	**20**	**2**	**2**	**9**	**9**	**15**
Naches	**Antlered**	**587**	**703**	**828**	**826**	**691**	**390**	**527**	**359**	**664**	**418**	**476**	**488**	**485**	**414**
	Antlerless	**56**	**75**	**485**	**326**	**296**	**155**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Okanogan Highlands	**Antlered**	**512**	**579**	**704**	**969**	**766**	**820**	**749**	**674**	**705**	**667**	**472**	**629**	**660**	**702**
	Antlerless	**25**	**19**	**44**	**47**	**56**	**80**	**64**	**79**	**67**	**61**	**47**	**73**	**46**	**81**
East Columbia Gorge	**Antlered**	**1,500**	**1,360**	**926**	**1,278**	**1,129**	**602**	**877**	**1,040**	**968**	**986**	**696**	**653**	**842**	**788**
	Antlerless	**256**	**226**	**204**	**141**	**125**	**133**	**162**	**164**	**110**	**66**	**82**	**103**	**74**	**103**
Blue Mountains	**Antlered**	**1,504**	**1,605**	**1,379**	**1,179**	**1,054**	**1,104**	**1,011**	**1,218**	**1,221**	**1,336**	**1,199**	**1,432**	**1,746**	**1,547**
	Antlerless	**617**	**621**	**821**	**573**	**149**	**92**	**66**	**76**	**45**	**49**	**42**	**43**	**55**	**91**
East Slope Cascades	**Antlered**	**2,929**	**3,197**	**3,438**	**4,369**	**2,963**	**1,937**	**2,324**	**1,679**	**2,621**	**2,100**	**2,097**	**2,120**	**2,180**	**2,533**
	Antlerless	**688**	**942**	**627**	**564**	**322**	**387**	**312**	**320**	**189**	**237**	**160**	**245**	**244**	**313**
Columbia Plateau	**Antlered**	**3,119**	**3,574**	**2,976**	**3,152**	**2,676**	**2,621**	**2,693**	**2,820**	**2,811**	**2,790**	**2,785**	**3,444**	**3,550**	**3,436**
	Antlerless	**1,289**	**1,582**	**1,432**	**1,274**	**375**	**269**	**259**	**405**	**459**	**363**	**445**	**423**	**449**	**435**

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comprise the majority of bucks observed (WDFW, unpublished data). Interpretation of survey results would suggest that, in areas where vulnerability to harvest is high, APRs have decreased hunting vulnerability for yearling bucks carrying 1- or 2-point antlers and increased hunting vulnerability for bucks with 3-point or greater antlers (presumably older aged bucks). In the open habitats of the Columbia Plateau MDMZ, harvest vulnerability for yearling bucks with three or more antler points has also been high (WDFW, unpublished data).

Sub-legal mule deer under current harvest regulations on winter range in Okanogan County. *Photo Scott Fitkin*

Some hunters have expressed concerns regarding 3-point APRs in eastern Washington. One complaint commonly heard is that some believe this restriction has resulted in increased survival of older aged bucks with only two antler points per side. The agency responded by creating experimental permit hunts in a few select GMUs encouraging hunters to select for older aged bucks with only two antler points per side. Results of these evaluations are not complete but initial reviews suggest most of the bucks harvested during these hunts have been two years of age or less (WDFW, unpublished data).

Many members of the hunting public have embraced the 3-point APR, especially hunters who remember the days when the majority of mule deer bucks killed by hunters were yearlings with 1- or 2-point antlers. In recent opinion surveys, mule deer hunters expressed their continued interest in having the opportunity to hunt each fall, and they voiced a desire for a range of different hunting opportunities.

In some GMUs, general season and quality permit hunts are available. To manage harvests of migratory mule deer, general season hunts for 3-point or greater antlered buck are used during mid-October seasons (pre-migration) when harvest vulnerabilities are low, and

limited entry quality special permit seasons are employed later in November when harvest vulnerabilities are higher after the migration. Limited entry special permit hunts provide deer managers with the flexibility to carefully manage buck harvests and maximize recreational opportunities while maintaining buck populations with a diverse age structure.

When mule deer numbers began to decline in the 1990s, harvest of antlerless mule deer was reduced in eastern Washington. Limited entry special permits have regulated most of the modern firearm antlerless harvest and have typically been issued to control populations or help mitigate agricultural damage. General season archery and muzzleloader antlerless mule deer seasons are currently offered in some areas. This conservative management of antlerless mule deer harvest contributed to the high survival rate (92%) observed for mule deer does during recent field studies (Figure 4). Swenson (1982) found that mule deer does can be quite vulnerable to harvest, especially when they occupy open prairie or shrub-steppe habitats. Given this high vulnerability, modern firearm and muzzleloader seasons are often regulated by limited entry special permit to manage harvest.

Habitat monitoring

Through the years, the Department conducted vegetation surveys and browse transects on select mule deer ranges (Sauve 1977, Morrison et al. 2007), but these have largely been discontinued. Habitat surveys such as these assess the current condition of vegetative communities, use by mule deer, and responses to treatments or changing environmental conditions. While good habitat condition is key to maintaining productive mule deer populations, quantifying habitat status by field sampling plant communities across all mule deer ranges in eastern Washington is impractical. Instead, subsets of critical habitats could be monitored in the future by using permanent vegetation transects, photo points, or remotely sensed data that are measured every 3 to 5 years. Currently the Department does not have the resources to do this in every MDMZ, but efforts have begun on some key areas. The Department is monitoring ecological integrity of plant communities on wildlife areas using remotely sensed imagery (Level 1), rapid field-based assessments (Level 2), and quantitative, plot-based protocols (Level 3; Schroeder et al. 2013); these techniques may provide opportunities to evaluate and monitor condition and trends of mule deer habitats. In addition, measuring body condition of harvested or free-ranging mule deer does (Cook et al. 2007, Cook et al. 2010) or antler diameter of harvested

bucks (Bienz 1991, Strickland and Demarais 2008) during October each fall would provide a habitat condition surrogate. Mapping and monitoring of invasive plant species is a key component of habitat monitoring on Department lands.

Human-mule deer conflict

The Department has been mitigating damage caused by mule deer since the 1940s and 50s, when the first orchard damage control seasons were initiated. Agricultural damage from mule deer includes browsing of orchard trees and vineyards, bucks rubbing their antlers against fruit trees, and grazing on commercial hay and alfalfa fields or other agricultural crops. Mule deer are also involved in numerous vehicle collisions in eastern Washington each year (Myers et al. 2008); these accidents result in costly damage to vehicles.

Urban deer populations ─ An increasing number of mule deer are residing in urban or suburban communities in eastern Washington. Mule deer numbers in several municipalities currently exceed the tolerance of many local residents and landowners, and may be creating public safety issues. These towns include Airway Heights, Clarkston, Colfax, Conconully, Medical Lake, Pomeroy, Republic, west Spokane, Selah, Tum Tum, Yakima, Goldendale, Twisp, and Winthrop. These areas provide deer populations within the city limits protection from hunters and predators, allowing deer numbers to grow. Deer removals in urban settings present new challenges. Techniques employed to date include trapping and translocation, lethal removal using sport archery hunters or master hunters, hunts by special permit, Department personnel, or local law enforcement. However, these techniques are not without controversy. Often there are mixed views among community residents, with some annoyed by deer in their yards, while their neighbors enjoy seeing deer and want them left alone. To date, the Department has provided support to community leaders and city advisory groups dealing with mule deer in residential areas. The Department continues to work with community leaders, residents, and other stakeholders to develop long-term solutions to this issue.

Agricultural damage ─ Wherever mule deer occur within agricultural lands in eastern Washington, the probability of deer-landowner conflict is high. Mitigating mule deer-caused damage can be expensive. Through the years, the Department has employed many techniques and programs to mitigate crop damage by mule deer. The Department has provided deer-proof

fencing materials to landowners to keep deer out of orchards, created "Deer Areas" to increase hunting pressure within specific areas of GMUs, and has made payments to landowners to cover damage costs as required when other means of control have been unsuccessful (RCW 77.36.040). Department staff also works with landowners to gain hunting access and use existing hunting seasons and licensed hunters to control deer numbers or move them off private lands. In some cases, limited entry special permit hunts for antlerless mule deer are used to reduce mule deer numbers and damage. Recently, the Department has used Master Hunters, landowner damage prevention permits, and landowner kill permits to address landowner concerns. Master Hunters, hunters who have taken special training from the Department, are used to remove deer when properties subject to damage are small or located in areas where a high level of concern and sensitivity to neighboring landowners is required.

One of the newest options in the deer damage toolbox is the Damage Prevention Cooperative Agreement (DPCA). A landowner with mule deer-caused property damage may enter into a DPCA with the Department. As part of the agreement, the landowner agrees not to file a claim for damage payments under $5,000 and allows some public hunting during the

Mule deer grazing in an alfalfa field in Okanogan County. *Photo Scott Fitkin*

general hunting seasons. In return, the landowner receives a damage prevention permit, a kill permit, or a combination of both; this facilitates additional opportunity for antlerless harvest or extended hunting seasons. Damage prevention permits are distributed by the landowners to hunters for use on their property outside of an open hunting season; these hunts require hunters to purchase a damage tag, which allows them (or a designated hunter) to harvest an additional deer. The landowner may pass the damage prevention permit to any hunter they choose so long as the hunter has a valid big game license and has purchased a damage deer tag valid during the prescribed damage hunt.

Public Safety ─ The landscape across major portions of mule deer range in eastern Washington has changed over time. Residential, industrial, agricultural, and transportation development have increasingly fragmented large tracts of open land, directly affecting deer ranges, and potentially increasing the risk of interruptions to established movement corridors and migration routes. The eastern Washington landscape is now a complex mix of private, public, and tribal ownership within which seasonal home ranges and migration corridors are increasingly subject to development (Ritters and Wickham 2003, Feeney et al. 2004). Simultaneously, human population levels have increased and associated development has spread across the state, generating greater use of Washington's highway and road system. Statewide, Washington now has 7,046 mi of state and federal highways receiving 31.6 billion mi of vehicle travel annually, a figure that has doubled since 1960 (Washington State Department of Transportation 2005; WSDOT).

With many miles of highway bisecting deer ranges, collisions with vehicles resulting in property damage, human injuries or deaths, and loss of valued wildlife have reached elevated levels. Over 1,200 mule deer are hit by motor vehicles and removed from state highways each year (Myers et al. 2008). While the total number of mule deer-vehicle collisions is unknown, when county and other roads are included, it is considerably higher than the deer mortalities that are documented on state highways alone. The costs to humans resulting from deer-vehicle collisions can be substantial and, in some cases, consequences can be life threatening. Precise numbers of human deaths or injuries and the amount of property damage caused by deer-vehicle collisions in Washington are unknown due to lack of standardized reporting. Nationally, deer-vehicle accidents result in approximately 200 human fatalities each year and insurance payments

of nearly $2 billion annually, but this statistic would include collisions with white-tailed deer, which are far more numerous than mule deer.

Reducing potential for deer-vehicle collisions by providing deer-safe crossing structures, preventing deer from accessing highways, reducing speed limits, or other means would save lives and hundreds of thousands of dollars in property damage. Numerous stretches of roadway experiencing repeated mule deer-vehicle collisions have been documented along state and federal highways across eastern Washington (Myers et al. 2008; Washington State Department of Transportation, unpublished data). There are sites where high-levels of mule deer-vehicle collisions (>10/year) occur regularly. These sites are located along SR 12 in Walla Walla and Yakima Counties), SR 20 in Okanogan County, SR 26 in Adams and Whitman Counties, SR 97 in Okanogan and Chelan Counties, and SR 395 in Stevens County.

The WSDOT recently improved one such site on SR 97 north of Goldendale, WA in Klickitat County, which allows deer to pass under the roadway. This project, partly designed to improve fish passage, built a new bridge over Butler Creek, and installed 8-ft fences to help guide wildlife to cross underneath the highway instead of running through traffic. The likelihood of wildlife-vehicle collisions was reduced, deer now have safer access to habitat on either side of SR 97, and fish have unrestricted access to upstream habitat.

In June of 2015 the WSDOT broke ground on the Price/Noble Wildlife Overcrossing on Interstate 90, east of Snoqualmie Pass. The project, which is budgeted at $6.2 million, is WSDOT's first wildlife overcrossing structure. Construction is scheduled to be completed in 2019. Several major wildlife underpasses have already been completed during Phase 1 of WSDOT's I-90 Snoqualmie Pass East Project, which covers the section of I-90 from Snoqualmie Pass to Easton.

Shed-Antler Hunting – Searching for and collecting shed antlers in the spring has become popular among recreationalists. Collecting antlers naturally shed by mule deer bucks during the winter is legal. However, disturbance to deer on winter ranges by shed antler hunters can create unnecessary and added stress to deer with potentially deleterious results. Shed antler hunting should be limited to late spring when mule deer have left the winter ranges. Trespassing while

Improved wildlife crossing at Butler Creek on SR 97 north of Goldendale, WA. *Photo WSDOT*

searching for shed antlers was addressed by HB 1627, which was passed by the state legislature in 2015, making it a misdemeanor to trespass to collect wildlife parts. The collected parts are subject to seizure and forfeiture.

Supplemental feeding

The Department has maintained a long-term, winter feeding program for elk in conjunction with fencing to prevent damage to agricultural crops in the Department's Region 3. Historically, similar programs were used to keep mule deer out of orchards or to help maintain deer numbers over winter, but those programs were eliminated in recent decades. Extreme prolonged winter weather can cause deer to starve, often within view of the public. Under these conditions, the Department often receives intense pressure from the public to initiate supplemental feeding. Recently following the catastrophic wildfires in eastern Washington, the Department received

requests from the public to provide supplemental feeding to help the deer. Feeding after wildfires does not reduce mortality and may not be needed to maintain deer populations.

Supplemental feeding of mule deer has significant limitations as a management tool. Winter feeding may unnaturally concentrate deer, enhancing the spread of disease and causing overutilization of forage near the feeding site. Unless the feeding operation is extensive, few deer actually gain access to the food provided. In addition, fawns who follow does to feeding stations may suffer higher mortality than those that forage elsewhere, because of competition with adults for the limited food. Deer may return to the feeding site in subsequent years, and concentrate there even though winter conditions do not necessitate feeding. Moreover, to be effective, supplemental winter feeding operations are very costly, both in dollars and staff time. Baker and Hobbs (1985) in Colorado showed that for winter feeding to successfully reduce mule deer doe mortality, feeding operations should begin early in the season (perhaps long before winter conditions become severe) and continue through the winter. Mule deer have developed behaviors and physiological mechanisms that allow them to survive harsh winter conditions without human intervention. These mechanisms include building fat and muscle resources during the summer growing season, migrating long distances, dispersing across the landscape to reduce concentrations, lowering metabolic rates during the winter season, and restricting movements during severe winter conditions to conserve energy. Although deer may still die because of extreme weather conditions in spite of these mechanisms, the best way to help mule deer survive a harsh winter season is to ensure they have quality habitats available during the spring, summer, fall, and winter.

Predation and predator management

Predators are an important component of ecosystems in the Northwest. Many species of large carnivores, including state-managed game species (e.g., black bear [*Ursus americanus*], bobcat [*Lynx rufus*], cougar, and coyote [*Canis latrans*]) and species with federal or state protections (e.g., golden eagle [*Aquila chrysaetos*], grizzly bear [*Ursus arctos*], lynx [*Lynx canadensis*], and wolf [*Canis lupus*]), occur within the diverse landscapes of eastern Washington and share the range with mule deer. Successful management of any ungulate species relies on a thorough understanding of population dynamics and the role of predators in supporting stable populations within an ecosystem. Though historically seen solely as a source of mortality for ungulate

populations, information about the ecological role of large predators has improved and recent research has provided a more sophisticated understanding of predator-prey dynamics in the Northwest.

Predator-prey interactions and their long-term effects on a population are complex and often difficult to quantify. Though it may seem a simple proposition to estimate species-specific deer predation rates and adjust carnivore harvest accordingly, predation rates are actually the product of numerous concurrent factors such as season, forage conditions, deer physical condition, deer densities, vulnerability to predation, alternative prey populations, and weather (Smith and LeCount 1979, Hamlin et al. 1984, Teer et al. 1991, Bartmann et al. 1992, Unsworth et al. 1999a, Ballard et al. 2001, Hurley et al. 2011).

Predation effects on mule deer populations can be either compensatory or additive, or both. Effects depend on the concurrent factors listed above (Smith and LeCount 1979, Hamlin et al. 1984, Teer et al. 1991, Bartmann et al. 1992, Unsworth et al. 1999a, Ballard et al. 2001, Hurley et al. 2011). Compensatory mortality theory assumes that one type of mortality largely replaces another kind of mortality in animal populations, while the total mortality rate of the population remains relatively stable. Conversely, additive mortality from one source results in increased total mortality. Further confounding interpretation of mortality type is that predation could be compensatory under some circumstances and additive under other situations. Hurley et al. (2011) provided an example of these confounding effects of predation and predator removal on mule deer fawn survival and recruitment where coyote and cougar reductions were implemented in southern Idaho. The results reported by Hurley et al. (2011) varied depending upon the number of jackrabbits (*Lepus* sp.) and mice (*Microtus* sp. and *Peromyscus* sp.) available to coyotes each year among other factors. Despite some improvements in survival for fawns and adults depending on treatment (coyote removal; coyote and cougar removal), they did not see an increase in population growth rate of mule deer. Their study results suggest climate and forage are the driving factors influencing mule deer populations in southern Idaho (Hurley et al. 2011). In lieu of conducting long-term, expensive, research studies, Ballard et al. (2003) offered some general guidelines for active predator management to benefit mule deer populations (Table 4).

Recent studies of survival in eastern Washington mule deer found cougar to be the most common source of mortality of adult does, whereas coyotes were responsible for the majority of fawn deaths (Johnstone-Yellin et al. 2009). Domestic dogs are a common source of mortality to female white-tailed deer (W. Myers, unpublished data) and are a source of harassment and potential for mortality to mule deer. Predator management specifically designed to increase mule deer populations is an intricate undertaking, which is confounded by conflicting societal views of predator harvest. Many Washington residents believe apex predators should be naturally regulated without interference or manipulation by humans, and some believe predator removal to enhance mule deer numbers is a necessity (Duda et al. 2014). With such dichotomous views, it is difficult to achieve consensus on management approaches.

Table 4. Guidelines for determining whether reducing predators can be expected to increase mule deer numbers (from Ballard et al. 2003).

Increased deer numbers are likely when:	**Increased deer numbers are unlikely when:**
Populations are below carrying capacity	Populations are near carrying capacity
Predation is a major cause of mortality	Predation is not a major source of mortality
Predator management can reduce predator numbers substantially	Predator management cannot reduce a predator population
Predator management is timed to occur just prior to predator or prey reproductive periods	Predator management occurs throughout the year
Predator management efforts are focused on a small area	Predator management efforts across large areas

The Department currently manages carnivore game populations at sustainable levels through harvest regulation to achieve carnivore population objectives, safeguard mule deer and other prey populations, facilitate landowner tolerance levels, and provide recreational opportunity. For those species managed as game, the Department will be consistent with the predator-prey management guidelines in the Game Management Plan (2014a). Because wolves are not currently classified as a game species and are subject to federal and state protections, management specific to wolf-ungulate populations will be conducted according to guidelines explained in the Washington Wolf Conservation and Management Plan (2011).

Coyote ─ Coyotes are ubiquitous in Washington and occur throughout mule deer range. Coyotes prey on fawns in the spring, typically in the first few weeks of life. They are usually not

predators of adult deer except under unique circumstances when snow conditions allow coyotes to move on the surface but deer break through the crust; when these conditions occur, coyotes are capable of running down even adult deer.

Currently, there are no closed seasons or bag limits related to coyote hunting. Coyote hunters must possess either a small game license or a big game license to hunt coyotes. Coyote harvest is usually ancillary to another active hunting season occurring at the time. Hunters that specifically target predators like coyotes are most active during the winter months, but those numbers are likely small. The Department assesses the coyote harvest via the small game harvest survey and trapper catch reports. Reported coyote harvest has declined since 2000 when Voter Initiative 713 made trapping more restrictive.

Gray Wolf—Wolves colonizing Washington have been documented to come from resident packs in Idaho, Oregon, and British Columbia. Since 2006, the Department has documented numerous wolf observations across eastern Washington. As of March 2015, there are 16 confirmed wolf packs residing in Washington, all on the east side. Wolves likely kill mule deer where their ranges overlap, and as wolves expand their range in eastern Washington, wolves are likely to become a more common source of mortality in mule deer populations. However, wolves select larger ungulates such as elk or moose as prey when available (Stahler et al. 2006).

In May of 2011, wolves were federally delisted in the eastern one-third of Washington (east of SR 97 from the Canadian border to SR 17, east of SR 17 to US 395, and east of US 395 to the Oregon border). However, the gray wolf remains listed as a state endangered species throughout Washington.

In December of 2011, the Washington Fish and Wildlife Commission adopted the final Wolf Conservation and Management Plan. It outlines three recovery regions: Eastern Washington, Northern Cascades, and Southern Cascades-Northwest Coast. It indicates the Department will manage for healthy ungulate populations through habitat improvement, harvest management, and reduction of illegal harvest. It also directs the Department to manage ungulate harvest to benefit wolves only in localized areas if research has determined wolves are not meeting recovery objectives and prey availability is a limiting factor. While the wolf remains a

listed species, if the Department determines that wolf predation is a primary limiting factor for at-risk ungulate populations and the wolf population in that recovery region has at least four successful breeding pairs, it could consider moving wolves, lethal control, or other control techniques in localized areas to benefit at-risk ungulate populations (Wiles et al. 2011). The status of wolves statewide, as well as within a specific wolf recovery region where ungulate impacts are occurring, would be considered in decision-making. Decisions will be based on scientific principles and will be subsequently evaluated by the Department after implementation.

Black Bear and Grizzly Bear ─ Washington is divided into nine black bear management units (BMU) of which six BMUs overlap mule deer habitat in Washington. Black bears typically would only prey upon neonates. The same is likely true for grizzly bears, but grizzly bear numbers in Washington are extremely low and unlikely to affect deer populations. Grizzly bears are capable of preying on adult mule deer, but probably rarely do. Black bears are classified as game animals and are hunted under the big game hunting season structure. The current black bear hunting season guidelines are designed to maintain black bear populations at their current levels, and those population levels are not expected to result in increased impacts to mule deer populations. The black bear harvest guidelines are specified in the Game Management Plan (WDFW 2014a). Grizzly bears are state and federally protected and are not legally hunted in Washington.

Bobcat and Lynx ─ Bobcats are distributed throughout the range of mule deer. Lynx are found in the northern portion of eastern Washington. Bobcats will readily kill mule deer fawns and even adults under certain conditions such as deep snow. Lynx will kill mule deer fawns and occasionally an adult, but due to their low density and limited distribution, lynx-mule deer encounters are likely low. The bobcat hunting season runs from September 1 to March 15. A small game license is required to hunt bobcat. The Department assesses the bobcat harvest via trapper catch reports and Convention on International Trade in Endangered Species (CITES) carcass checks. Reported bobcat harvest has declined since 2000 when Voter Initiative 713 made trapping more restrictive. Lynx are state and federally protected and are not legally hunted or trapped in Washington.

Cougar ─ The 2015 Big Game Hunting Seasons and Regulations pamphlet describes 25 cougar hunt areas that encompass GMUs containing mule deer in Washington. Cougar are capable of preying on both juvenile and adult mule deer. Cougars are a game animal and are hunted under the big game hunting season structure. General cougar seasons consist of an early season and a late season. The late season closes early when harvest quotas are reached. Cougar harvest levels have been set as a proportion of the population, and the number of adult females in the harvest. Across eastern Washington, the management objective for cougars is to maintain a stable population except for the Columbia Plateau, where the habitat is not suitable, and cougars are more likely to present safety concerns (WDFW 2014a). During the 2014 cougar hunting season, the most recent season with data available, 114 cougars were harvested in eastern Washington overlapping the mule deer management zones (WDFW 2015).

Mule deer interactions with white-tailed deer and elk

When very similar species such as mule deer, white-tailed deer, and elk are sympatric across portions of eastern Washington, competition for space and resources may occur. Competition between species takes one of two forms: exploitative competition in which one species uses available resources to the point that those resources are no longer available to another species; or interference competition where one species prevents another species access to resources through mere presence or aggression. The presence of elk moving into mule deer range, causing mule deer to leave the area, thus making the area no longer suitable mule deer range, would be an example of interference competition.

Increased forest canopy and density have occurred in parts of north central Washington over the last 30 years as a result of decreased logging and increased fire suppression. Such landscape level habitat changes to former mule deer range have benefitted white-tailed deer over mule deer. During this time, white-tailed deer have expanded into areas formerly dominated by mule deer. The reasons for this expansion are speculative, but likely include changing habitat conditions. Although white-tailed deer and mule deer diets can over-lap, each species tends to be spatially separated through habitat partitioning which limits direct competition. Studies of sympatric white-tailed and mule deer in eastern Montana showed little evidence of direct competition between the species (Wood et al. 1989).

Over the last 30 years, the Department has maintained either sex elk harvest opportunities in north-central Washington GMUs dominated by mule deer. However, recent changes in the Department's elk harvest regulations now restrict antlerless elk harvest to limited entry permit, allowing elk numbers to increase in many of these GMUs. Constituents who favor mule deer have expressed concern about the expansion of the elk distribution and increasing numbers. A review of studies investigating mule deer-elk interactions found no clear consensus (Lindzey et al. 1997). However, some studies investigating interactions among elk, mule deer, and cattle have documented potential competition (Skovlin et al. 1968, Mackie 1970, Dusek 1975, Knowles and Campbell 1982, Nelson 1982, Austin and Urness 1986, Wallace and Krausman 1987, Loft et al. 1991, Peek and Krausman 1996, Wisdom and Thomas 1996, Wisdom 1998); other studies have inferred commensalism (Anderson and Scherzinger 1975, Frisina and Morin 1991, Peek and Krausman 1996). Elk may affect mule deer populations through diet overlap as well as mere presence (Coe et al. 2005). Elk are dietary generalists, able to forage successfully on a wide variety of plants of varying nutritional quality, while mule deer exhibit diets that are more specialized and require nutritionally high quality forage; thus, elk can consume mule deer forage but mule deer generally cannot utilize all elk forages (Wickerstrom et al. 1984). Johnson et al. (2000) reported that mule deer tend to avoid elk when they are present thereby effectively reducing available habitat for mule deer where they share the range with elk. Although influences of elk presence on mule deer ranges are not completely clear, management of each species will require knowledge of present and historic species densities, range quality, recreational opportunities, and hunter interests.

Disease and parasites

A number of factors including diseases and parasites can affect mule deer populations (deVos et al. 2003). Several mule deer populations in eastern Washington have been surveyed for the presence of select diseases, parasites, and trace elements. Blood samples collected from 97 mule deer in Washington were tested for exposure to selected pathogens in 2001 and 2002. Results among these individual deer samples were seropositive for a number of diseases commonly found in cattle including leptospirosis (13%), bluetongue (25%), EHD (25%), and brucellosis (0%; Myers et al. 2015). Similar surveys of parasite presence in fecal samples collected from free-ranging mule deer (n = 97) across Washington documented the occurrence of common intestinal parasites (Myers et al. 2015). The widespread presence of these intestinal parasites

(dorsal-spined larvae [40%], abomasal nematode eggs [1%], Capillaria sp. eggs [1%], Nematodirus sp. eggs [26%], Moniezia sp. eggs [1%], and Eimeria sp. [2%]) does not present a threat to mule deer populations (Myers et al. 2015).

Mule deer in Okanogan County with benign multiple fibroma tumors. *Photo Dale Swedberg*

While EHD has been implicated in local die-offs of mule deer, it is not likely to have population level effects. However, the presence of an exotic louse found on mule deer in Yakima and Kittitas counties that is associated with clinical Hair Loss Syndrome (HLS) is of great concern to mule deer managers in southcentral Washington (Mertins et al. 2011). HLS has become wide spread among mule deer populations within Klickitat, Yakima, and Kittitas counties and may have been a factor in an observed population decline since 2006. However, HLS afflicts mostly fawns and the rapid decline seemed to be associated with an all age die-off. (J. Bernatowicz, WDFW, personal communication). HLS has now spread north into Chelan County (D. Volsen, WDFW, personal communication) and HLS has been present in Okanogan County since in 2010 (M. Monda, WDFW, personal communication). In 2015, survey estimates in two GMUs in northern Yakima and southern Kittitas counties showed mule deer numbers had returned to slightly over 80% of the numbers seen before the dramatic decline. It is important that these and adjacent mule deer populations be monitored closely for the presence and spread of HLS.

It is nearly impossible for managers to treat free-ranging mule deer when disease or parasite loads become excessive and affect population levels. However, as a side benefit of wildfire, fire may provide short-term effects by reducing the numbers of external and internal parasites that affect mule deer (Innes 2013).

Illegal harvests and wildlife law enforcement needs

McCorquodale (1997) reported that 20% of the deaths of radio-marked mule deer were classified as illegal and that nearly all mortality was associated with hunting. The illegal kill was comprised of females and yearling males killed during the fall 2-point buck only season in Klickitat County. Most of the deer killed illegally occurred during open seasons and was related to misidentification of deer by state licensed hunters (McCorquodale 1997). Smith et al. (1994) observed most elk poaching activity across Washington to occur during general hunting seasons, similar to findings reported by McCorquodale (1997). Illegal mule deer harvests throughout eastern Washington may follow similar spatial and temporal patterns. It is important that Enforcement activities and emphasis patrols are conducted during times of known increased illegal activity.

Observations of mortality patterns in Washington mule deer between 2000 and 2007 indicated illegal harvests of adult female mule deer were very low (8% of deaths of radio marked female mule deer for an annual cause specific mortality rate of 1% (WDFW, unpublished data).

A Department law enforcement officer contacting a legal hunter with a mule deer buck in Chelan County. *Photo WDFW*

This rate is lower than that reported by McCorquodale in Klickitat County mule deer populations and cause specific mortality rates of 8-10% were attributable to poaching of elk in Washington (Smith et al. 1994). While illegal harvest of the adult doe segment of mule deer populations is low, illegal harvest information is lacking for the male segment of populations, leading hunters to express concerns about poaching of adult male mule deer. Large mule deer antlers are highly valued, and dealers will pay large sums of money to obtain sets of trophy- quality antlers. Unfortunately, commercialization of limited resources like large-antlered mule deer bucks leads to an increase in illegal harvests to satisfy those markets, and can affect recreational opportunity. The Department's Enforcement Program works diligently to reduce the commercial trade of illegally harvested mule deer.

Information, education, and outreach

The Department considers support from the public to be key to effective and responsive wildlife management. As such, an important component of mule deer management is to ensure that the public is well informed about mule deer management issues. Providing information about mule deer biology, natural history, and current management increases support for the Department's mule deer management. The Department's education and information sharing effort takes many forms, including participating with citizen advisory groups, social media, publishing an agency website, and using press releases, radio, television, and newspapers to provide news and updates to the public.

Because the Department manages mule deer for the people of Washington State, it is important that the Department clearly understands the needs and expectations of all Washington's citizens, including both hunters and appreciative users. To determine the opinions of the state's citizens, the Department periodically conducts public opinion surveys and provides opportunities for public involvement through citizen advisory groups, public meetings, and workshops.

Economic effects from Washington's mule deer

Mule deer hunting related recreation is an important source of economic benefits for the local economies of eastern Washington. The 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation reported that big game hunters spent an average of $1,160 annually in trip

and equipment expenditures in 2011 (U. S. Department of Interior et al. 2011). In 2014, roughly 35,000 hunters hunted mule deer in eastern Washington. Using the $1,160 average expenditure per hunter from the National Survey, mule deer hunters in Washington added approximately $40 million to local and state economies in 2014.

Management assessment and research needs

Future research and management assessments of mule deer will focus on providing the knowledge needed to manage mule deer in eastern Washington in a changing landscape. Management needs can be divided into four primary areas: 1) estimating population abundance or population trends, 2) documenting survival rates (including cause-specific mortality rates), 3) documenting movement patterns and herd boundaries, and 4) improving habitat. There is a strong need to continue to refine survey methodologies and population models. This work is ongoing and continues to be a priority in all MDMZs. Future survival studies should consider evaluating tribal harvest effects on sustainable deer harvests and population dynamics.

Planning and preparation for multi species predator-prey work involving mule deer, white-tailed deer, moose, and elk has begun, but details are not yet available. Studies will potentially occur in the Department's Regions that overlap with MDMZs. The work will be conducted in conjunction with the Department, universities, and other entities. An effort will be made to understand the multiple interactions involving wolves, cougars, coyotes, and black bears as they affect the ungulate prey community. Harvest monitoring that can inform our effort to understand predation effects on deer and elk will continue as well.

Washington's Mule Deer Initiative

With the implementation of this plan, it is anticipated that Washington's Mule Deer Initiative (WMDI) will be developed and launched to assist in executing this plan. WMDI will be a cooperative venture of the Department, other state and federal agencies, The Mule Deer Foundation, and other NGOs and sports groups dedicated to implementing the goals, objectives, and strategies of this plan. WMDI will be project-oriented with both short- and long-term goals. Both site-specific and landscape level projects will be considered. The Department's eastern Washington Regional Wildlife Program Managers, District Biologists, Private Lands Biologists, Habitat Biologists, and Wildlife Area Managers will coordinate with volunteers to complete

997 WMDI projects. Under the WMDI, operations will be conducted in all MDMZs as funds,
998 volunteer participation, and staffing constraints allow. The goals of WMDI are to increase and
999 improve mule deer habitat, sustain or increase mule deer numbers, provide public outreach
1000 regarding mule deer and their habitats, and improve access for mule deer hunters.

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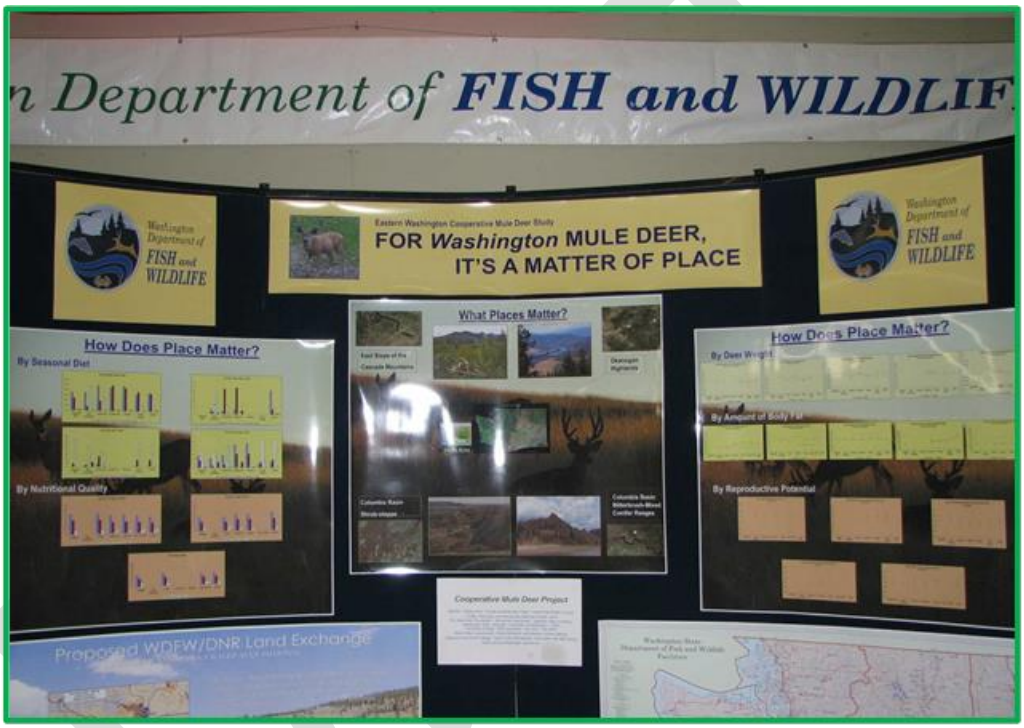

Public outreach display about mule deer at the Big Horn Outdoor Adventure Show in Spokane, WA. *Photo Woody Meyers*

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Mule deer bucks on summer range in Asotin County. *Photo Paul Wik*

Objectives and Strategies

Effective management of mule deer in Washington requires: 1) ensuring that mule deer have adequate levels of quality habitat year around, 2) ensuring that mule deer managers have adequate information regarding population demographics to make informed management decisions, and 3) maintaining public support for management objectives and harvest regulations. The issues below are key to fulfilling these needs, and essential to conserving mule deer in eastern Washington into the future. The objectives and strategies addressing each issue form the foundation for future work plans and budget requests and allocations.

Population estimation

Each MDMZ is unique and, while some similarities exist among them, management regimes must recognize the individual differences. For example, surveys are conducted by helicopter with highly reliable results in some MDMZs, but in others, topography and cover present survey challenges. In most cases, such as in the Columbia Plateau, East Columbia Gorge, East Slope Cascades, and Naches MDMZs, and portions of the Blue Mountains MDMZ, there are large tracts of mule deer winter range and open canopy forest. Helicopter surveys of randomly selected sampling units covering the winter use areas are used with good success. Detection probabilities are applied to adjust for missed animals (sightability bias; Unsworth et al. 1999b).

Existing sightability models have been adapted to work better in some MDMZs. New survey methods will need to be used to effectively survey portions of the Northern Rocky Mountains and Okanogan Highland MDMZs where forest canopies are dense.

Objective 1:

By 2021, develop new or refine existing survey designs for each of the seven MDMZs to estimate population levels or trends, pre- and/or post-hunt age and sex ratios, and/or spring fawn to adult ratios.

When research or project work allows collection of the appropriate data, also estimate over-winter fawn survival, adult female survival, body condition, and adult doe age structure.

Strategies:

A. Estimate mule deer abundance within each MDMZ or portions of MDMZ every 3 years using aerial sightability models wherever possible and appropriate
B. Use ground survey in areas where aerial surveys are not practical as a population trend index
C. Collect data to estimate age and sex ratios each fall or winter using appropriate surveys including driven road transects
D. Develop Integrated Population Models (IPM) to simulate population status during non-survey years
E. Use available radio-telemetry (already approved or active studies) to document herd boundaries, estimate survival of adult and juvenile mule deer, and identify cause-specific mortality sources as opportunity exists
F. Explore using other techniques like mark-resight, distance sampling, etc., in difficult-to-survey MDMZs like the Northern Rocky Mountains and the Okanogan Highlands

Population management

In addition to population estimation, the Department measures population parameters that provide insight into productivity and survival of mule deer populations. Estimates of these parameters support inference about overall population growth and decline. Using these estimates, the Department can manage for desired population trajectories without always having

an estimate of total population. The Department's primary tool to increase or decrease deer numbers is manipulating harvest via hunting regulations.

Hunting can influence the structure of the post-hunting season buck population. The current 3-point APR favors escapement of younger bucks that are sublegal, resulting in younger bucks in the post-hunt breeding population but also more bucks in the post-hunt population, which helps meet the post-hunt buck ratio objectives. In an unhunted population, the age structure of the breeding buck population would look considerably different from a hunted population, with a broader array of all ages of bucks present. It is important to have a diversity of age classes in late fall populations because mature bucks support a natural dynamic for breeding and herd behavior. On the winter ranges of the East Slope Cascades MDMZ, where the post-hunt buck population contains a diversity of age classes due to the lower harvest vulnerabilities afforded migratory bucks, local deer managers report a short breeding season. A substantial portion of hunters has also expressed a value of having older aged bucks in the population. Older aged bucks, with large antlers, are also of high interest to wildlife viewers and appreciative users.

In most years, normal forage abundance will provide adequate nutrition carry deer through the winter with little stress. However, at times when winters are harsh or forage scarce, some deer may starve. When the number of deer mortalities is above normal for a local area, the public may expect the Department to help increase deer survival by using supplemental feeding. To help mule deer survive a harsh winter season, it is always best to ensure they have quality habitats available during the spring, summer, fall, and winter. If the Department decides to feed mule deer during extreme winter weather conditions, winter feeding operations will be consistent with the Department's winter feeding policy (See Appendix B).

Objective 2:

Within each MDMZ, manage mule deer to ensure stable or increasing populations, as indicated by demographic indicators.

Strategies:

A. Monitor deer population trends and harvest in each MDMZ
B. Coordinate with tribes with off-reservation rights to share regulations and harvest data.
C. Where population declines are apparent, through mandatory hunting reports, surveys, or other means focus efforts to determine the cause
D. When hunting appears to be a major cause of low populations, consider implementation of more conservative hunting season approaches
E. When data are available, attempt to maintain total annual adult female mortality rates from all sources to allow for stable to increasing populations unless this action exacerbates problems such as wildlife conflict issues
F. Use harvest management of antlerless mule deer when appropriate to achieve desired population trajectory, minimize agricultural damage, and provide recreational opportunities
G. Develop the goals and guidelines of the Washington Mule Deer Initiative
H. Implement multi-entity projects consistent with Washington Mule Deer Initiative and the Mule Deer Management Plan
I. Identify critical information needed to improve mule deer management
J. Monitor the general health of mule deer and monitor for nutritional condition and disease when possible
K. Consider emergency winter feeding only when consistent with agency policy

Hunting opportunity

The Department is always mindful of mule deer population conditions when developing hunting seasons. Hunting season structures for mule deer are influenced by maximizing opportunity, retaining general seasons, timing of the breeding season, weather, migration, wildlife conflict, APR, and desired population trajectory, to name a few. There are 73 GMUs in eastern Washington. At present, 69 eastside GMUs are open for early archery mule deer buck hunts and 15 GMUs are open for late archery buck. Fifty-three GMUs are open for early muzzleloader mule deer hunting and four are open for late muzzleloader. General season modern firearm hunters may hunt mule deer in 65 GMUs. In addition, there are special permits available for

quality buck hunts, permits for any buck in select GMUs for every weapon type, and permits available for youth, senior and disabled hunters.

Washington's Treaty Tribes exercise their right to hunt on open and unclaimed land per their respective treaties. State harvest objectives may be adjusted to account for the tribal harvest. The level of coordination with tribes varies making the level of these adjustments sometimes difficult to gauge.

Objective 3:

Adaptively manage (Stankey et al. 2005) to attempt to maintain the current level of mule deer hunting opportunity throughout the seven management zones.

Strategies:

A. Maintain sustainable general season and special permit mule deer hunting opportunities
B. Maintain multiple weapon type mule deer hunting opportunities
C. Offer special permit hunts for youth, senior, and hunters with disabilities
D. Explore potential mule deer hunting opportunities that would enhance hunter recruitment and retention
E. Adjust seasons and special permit levels in response to mule deer population changes while striving to maintain current mule deer hunting opportunity across eastern Washington
F. Add special permit hunting opportunity when and where mule deer populations are able to support additional hunting opportunity

Habitat

Habitat is the key to maintaining wildlife populations, and mule deer are no exception. In some MDMZs, much of the habitat has been altered from natural vegetation. Mule deer populations likely benefited initially from this conversion, since irrigated fields provide better quality forage than natural vegetation. However, the key is diversity and year-round food and cover. Habitat conversions today often remove natural cover, sometimes with major consequences. Establishment of residential areas results in an increase in human/deer conflict and usually leads to a reduction in mule deer population numbers. Mule deer must have the food and cover that

they need to survive, and the Department will actively work to protect and enhance the remaining natural vegetation in each MDMZ. Identifying movement corridors by telemetry studies or connectivity modeling (Myers et al. 2012) and protecting the corridors that ensure connectivity between key habitats is an important component of habitat management.

The Mule Deer Working group has summarized habitat guidelines for each ecoregion in the western United States. Many of the important issues described in this plan such as forest management, non-native plants, and human encroachment, are included in the habitat guidelines for the Northern Forest ecoregion in Hayden et al. (2008). Grazing of livestock is a common use of land within eastern Washington. Specific habitat guidelines for livestock grazing are given in Cox et al. (2009) for the Intermountain West ecoregion.

Objective 4:

By 2027, within each MDMZ maintain or improve the quality of at least 10% of the important seasonal habitats that support mule deer populations.

Strategies:

Inventory

A. Use permanently established transects, photo points, or other accepted methods to inventory important mule deer ranges and monitor habitat change, every 2 – 5 years
B. Throughout eastern Washington, identify and prioritize important mule deer seasonal habitats and migration corridors for protection, restoration, enhancement, or purchase
C. Review current and new habitat improvement projects on public land to ensure that they capitalize on opportunities to improve mule deer habitats
D. Integrate habitat improvement for mule deer into the management plans for our WMAs
E. Use the Department's ecological integrity monitoring to evaluate and monitor condition and trends of mule deer habitats
F. When mule deer resource selection function analyses are completed, we will work with land managers to identify areas of high potential use and develop management prescriptions for mule deer

Protection and enhancement

G. Promote use of native plants in restoration opportunities for mule deer

H. Encourage treatments to enhance summer range habitats where mule deer raise their fawns

I. Work with land management agencies, private timber companies, and private landowners to identify opportunities to improve mule deer habitats, including rehabilitation following wildfires

J. On Department Wildlife Areas in eastern Washington, where appropriate, use prescribed fire to improve and maintain fire-dependent mule deer habitat

K. Work with the Washington Prescribed Fire Council, and other entities advocating for less restrictive smoke regulations, to allow more prescribed burning to protect, restore, and enhance fire dependent mule deer habitat

L. On Department Wildlife Areas in eastern Washington, maintain or improve mule deer habitat to maximize potential, while keeping in mind the needs of other priority species

M. Provide assistance to landowners who wish to improve mule deer habitat on private lands

N. In the East Slope Cascades and in the East Columbia Gorge MDMZs, use landowner agreements, conservation easements, or fee purchase to protect and enhance important mule deer winter ranges and seasonal migration corridors

O. In the Columbia Plateau MDMZ, work with landowners to protect and enhance remaining shrub-steppe, channeled scablands, and other undeveloped areas

P. In the Blue Mountains MDMZ, protect and enhance riparian zones and wet meadows

Q. In the Columbia Plateau MDMZ, work with landowners to protect and enhance riparian zones and moist bottom lands

R. In the Columbia Plateau and Blue Mountains MDMZ, on CRP lands that benefit mule deer, encourage landowners to stay enrolled and to re-enroll. If existing cover could be improved encourage and work with landowners to do so

S. In the Blue Mountains MDMZ, protect and enhance remaining bunchgrass communities, shrub-steppe, and other undisturbed areas

T. In the East Slope Cascades and East Columbia Gorge MDMZs, work with county planners to condition developments on or near important mule deer use areas to minimize or eliminate potential impacts to deer habitat

U. In the East Slope Cascades MDMZ, particularly within the Methow and Entiat valleys, Swakane Canyon, and Navarre Coulee, encourage treatments such as prescribed burns, timber harvest, and shrub planting to enhance the quality of winter range habitats and increase available forage for mule deer

V. In the East Slope Cascades, Blue Mountains, and East Columbia Gorge MDMZs, work with the Okanogan, Wenatchee, and Umatilla national forests to implement forest health treatments that improve habitat quality and reduce unnaturally large forest fires

W. In the East Columbia Gorge MDMZ, encourage treatments such as prescribed burns, timber harvest, and shrub planting to enhance the quality of winter range habitats and increase available forage for mule deer

X. In the East Slope Cascades, Blue Mountains, and East Columbia Gorge MDMZs, work with the Okanogan, Wenatchee, and Umatilla national forests to develop "let it burn" policies and limit fire suppression efforts

Y. Continue the cooperative study with the Colville National Forest and Washington State University evaluating the effects of various timber harvest treatments on mule deer forage availability and body condition

Z. Where available, use information on physical condition, such as organs collected each fall from hunter-killed deer to inform the Department about habitat conditions

Habitat connectivity

AA. Coordinate with other land management agencies, the WSDOT, and NGOs to protect mule deer migration routes and travel corridors within and across the Northern Rocky Mountains, Okanogan Highlands, East Slope Cascades, Columbia Plateau, East Columbia Gorge, and Naches MDMZs

BB. In the Columbia Plateau MDMZ, use conservation easements and other means to limit development and maintain connectivity of known mule deer movement corridors

CC. In the Blue Mountains MDMZ, identify and protect movement corridors to maintain connectivity between the foothills and Snake River breaks

DD. To reduce deer mortality caused by canals in the Columbia Plateau and Naches MDMZs, encourage preventative measures such as canal crossing structures and escape mechanisms

Human disturbance

EE. In the Northern Rocky Mountains, Okanogan Highlands, Columbia Plateau ,and Naches MDMZs, work with county commissioners, private land owners, land management agencies and NGOs to manage use of snowmobiles and ATVs on mule deer range, particularly in winter use areas and in the remaining shrub steppe habitat

FF. In the East Slope Cascades, East Columbia Gorge, and Naches MDMZs, work with county commissioners, land management agencies, and NGOs to use seasonal closures to protect mule deer from disturbance during the winter season

GG. On Department lands in the East Columbia Gorge MDMZ, implement seasonal closures to protect mule deer from disturbance during the winter season

Range management

HH. Work with county weed boards, other agencies, and other landowners to prevent introduction and reduce the spread of invasive weeds

II. Promote livestock management practices that are favorable to mule deer habitats

JJ. Within all National Forests, Bureau of Land Management, Bureau of Reclamation, DNR, and Department lands in eastern Washington, promote approved livestock management practices on lands important to mule deer

Mule Deer Initiative

KK. Implement Washington Mule Deer Initiative

Human-wildlife conflict

The Department is legislatively mandated to mitigate damage of commercial crops caused by mule deer. Crop damage caused by mule deer includes browsing of orchard trees, bucks rubbing their antlers against fruit trees, and grazing on commercial hay and alfalfa fields or other

agricultural crops. Wherever mule deer occur within agricultural lands in eastern Washington, there is potential risk of deer -landowner conflict. Mule deer and white-tailed deer are often sympatric in agricultural areas and crop damage mitigation is often directed toward all deer and not specifically toward mule deer.

Recently, an increasing number of mule deer are residing in urban or suburban communities in eastern Washington including Airway Heights, Clarkston, Colfax, Curlew Lake Community, Medical Lake, Conconully, Pomeroy, Republic, Selah, west Spokane, Tum Tum, Yakima, Goldendale, and Winthrop. Deer populations living within the city limits have refuge from hunters and predators, so deer numbers have grown, causing problems for residential landowners and businesses.

Objective 5:

Maintain or reduce the number of damage prevention permits or kill permits issued to minimize commercial crop damage caused by deer in MDMZs over the period 2016 – 2021.

Strategies:

A. Throughout eastern Washington, when mule deer damage to commercial agricultural crops is reported, the wildlife conflict specialist will contact the landowner or reporting party within 72 hours
B. In keeping with Department policy, the wildlife conflict specialist will review the level of crop damage caused by deer and provide recommendations or implement actions
C. The Department will use non-lethal preventative measures as the preferred measures for resolving mule deer/human conflicts
D. Where appropriate, the Department will implement general, special permit, or damage prevention hunts that target local mule deer herds responsible for damage
E. Where appropriate the wildlife conflict specialist will pursue DPCAs with landowners experiencing mule deer caused damage to their crops
F. Seek support for capital funding for cost-share fencing to provide to private landowners. If funded, seek agreements with private landowners to install fencing to protect high-value crops.

Objective 6:

By 2020, have long-term solutions or plans in place for at least three local communities dealing with urban mule deer populations causing nuisance or damage issues.

Strategies:

A. Work with communities to develop deer committees or groups composed of local citizens that represent the diversity of opinions in the community
B. Work with local community or deer committee to develop solutions specific to the community, supplying biological and policy expertise, but allowing the group to solve their own problem. Encourage long-term solutions such as no feed ordnances, deer resistant landscaping, and fencing. Discourage non-effective solutions such as contraception and relocations
C. Supply communities and individual landowners with educational materials regarding deer resistant landscape

Public education

Public support is important to the acceptance and success of mule deer management outlined in this plan. Changes to the way the land is managed is a sensitive topic to many in eastern Washington, and without the approval of the local governments and the landowners, many of the protections recommended will be impossible to achieve. Similarly, changes in management direction, hunt dates, permit levels, or hunt types are met with resistance by hunters when the reasons for such modifications are not understood. It is important that information regarding mule deer management be provided through various forms of public education, outreach, and engagement.

Objective 7:

By 2018, increase the number of times mule deer are profiled in public outreach and engagement efforts to at least four per year.

Strategies:

A. Provide regular messages and articles via the Department's website and social media and statewide news media outlets about the needs of mule deer and their management and related research

B. Provide training to intra-agency personnel regarding mule deer management issues, policies, and techniques
C. Develop and deliver to targeted audiences (i.e., landowners, hunters, viewers, and shed-antler hunters) public information programs to emphasize the importance of not disturbing deer when climatic conditions may produce added stress
D. Develop and deliver to targeted audiences (i.e., landowners, hunters, and viewers) public information programs that emphasize the importance of summer range to maintaining mule deer productivity
E. With the help of our partners, use deer salvage programs to increase public awareness of the need to reduce deer/vehicle incidents and deer mortalities on state highways.
F. Incorporate public education, outreach and engagement strategies of the Washington Mule Deer Initiative

Objective 8:

Establish and promote public use of at least two mule deer viewing opportunity sites with informational kiosks by 2021.

Strategies:

A. Develop a viewing site on the Indian Dan Unit of the Wells Wildlife Area
B. Develop a viewing site on the Methow Wildlife Area
C. Add the new sites to a distribution list of mule deer viewing and photography opportunities
D. Promote appreciative and intrinsic values of mule deer, their ecology, and habitats
E. Promote Washington Mule Deer Initiative

Public safety

Over 1,200 mule deer are removed from Washington State highways each year after being hit by motor vehicles (Myers et al. 2008). Deer-vehicle collisions cause substantial costs to motorists, and in some cases lead to injury and even fatalities. In Washington the property damage and injury statistics are not specifically recorded, but nationally, such accidents result in approximately 200 people killed and insurance payments of nearly $2 billion each year.

In the East Slope Cascades MDMZ, high levels of mule deer-vehicle collisions have been documented at specific sites along SR 20 in Okanogan County and SR 97 in Okanogan and Chelan Counties. In the Okanogan Highlands MDMZ, high collision rates occur along SR 20 and SR 97 in eastern Okanogan County and US 395 in Stevens County. In the Blue Mountains MDMZ, high collision rates occur along SR 12 in Columbia, Garfield, and Walla Walla Counties. Using deer safe crossing structures at selected sites, reducing speed limits, and preventing deer from accessing highways, would reduce the number of deer-vehicle collisions, saving hundreds of thousands of dollars in property damage and saving lives.

Objective 9:

Raise public awareness about deer-vehicle collisions by hosting a town hall type meeting in each MDMZ by 2023, discussing the selected problem areas described above.

Strategies:

A. Coordinate with WSDOT, county highway departments, and NGOs to attend and describe their efforts to install wildlife crossings (under- or overpasses) at sites with high collision rates
B. Coordinate with WSDOT and county highway departments to attend and describe efforts to reduce speed limits in areas of high collision rates
C. Work with WSDOT to evaluate the effectiveness of the wildlife crossing structure on SR 97 and adjust or improve this feature as needed
D. Use multi-media displays to educate the public about the circumstances surrounding deer-vehicle collisions and ways to reduce collision rates

Poaching abatement

While not a population concern in most areas, the public perception is that poaching abatement is an important tool for preserving the hunted population. Certainly, in quality hunt areas, poaching of trophy mule deer bucks has been the cause of public outcry. It is important that the Department enforce the game regulations both to retain public support and to encourage all hunters to respect bag limits and other restrictions. Wildlife enforcement officers report that 9 out of 10 mule deer hunters that they contact are in compliance with all game regulations. This rate of compliance should be maintained.

Objective 10:

Achieve 90% compliance of regulations during mule deer hunting season by 2018.

Strategies:

A. Increase current level of wildlife enforcement effort on mule deer areas to full staffing levels
B. Promote citizen involvement including the use of volunteers and watch groups in enforcement issues
C. Develop public outreach and education to inform public on reporting illegal activities

Objective 11:

Prevent illegal take of mule deer outside of the hunting season and illegal commercialization of mule deer parts from increasing above the current level.

Strategies:

A. Increase current level of wildlife enforcement effort on mule deer areas to full staffing levels
B. Promote citizen involvement including the use of volunteers and watch groups in enforcement issues
C. Request a focus of enforcement patrols on winter use areas containing large-antlered mule deer

Research

Sound mule deer management begins with strong research programs. Studying mule deer distributions, populations, habitat use, and interactions with their environment provides knowledge that becomes the basis for sound management recommendations. However, the costs of funding research on mule deer continue to increase. It is important that the Department increase funding to conduct investigations to address and resolve issues that affect mule deer populations, habitat, and hunting opportunities.

Objective 12:

Increase funding for mule deer management and research by 10% by 2022.

Strategies:

A. Provide raffle and auction tag opportunities to fund mule deer surveys

B. Increase public and legislative recognition of value of mule deer, mule deer hunting, and mule deer viewing to Washington's economy in order to gain support for increases

The recolonization by wolves in Washington has led to a growing need to understand the dynamics of predation of all kinds, including how predation relates to mule deer population trends. The Department, in partnership with universities and other entities, is beginning to develop predator-prey studies, which will likely occur in one or more MDMZs. The intent is to understand the multiple interactions involving wolves, cougars, coyotes, and black bears as the affect the ungulate prey community. Planning and preparation for predator-prey work involving white-tailed deer, mule deer, elk, and moose has begun, but details are not yet available.

Objective 13

Integrate mule deer into the planned, multi-species predator-prey study by 2017.

Strategies

A. Conduct an initial assessment of ungulate populations, including mule deer, and ascertain any preliminary indications that any of these ungulate populations are being limited by predation.

B. Identify MDMZs that would be appropriate to include in the multi-species predator-prey study.

Spending Priorities

Mule deer management spending depends on available funds and increased future costs of goods and services. Department spending priorities for managing mule deer should focus on the following:

Population Estimation – High Priority

Conduct annual helicopter surveys to estimate mule deer densities on one-third of the fall-winter-spring ranges in each MDMZ where aerial surveys are appropriate.

Timeline: Annually

Cost: $150,000 to $175,000 divided between seven MDMZs

Habitat – High Priority

Because habitat is the key to maintaining mule deer populations, the Department will monitor and work to preserve and improve existing mule deer habitats across eastern Washington.

Fire, in the form of prescribed burning, is one means to preserve and improve the forest habitat by restoring an essential ecological process with which mule deer have evolved. Other funding sources will likely fund the implementation of prescribed fire; however, a critical component of this effort will be monitoring to determine that the effort is meeting objectives.

Timeline: Annually

Cost: $50,000

The goal of forest management on Department lands in the MDMZs is to restore the historic range of variability to the habitat that would include a larger proportion of mature trees in open stands with well-developed understory. This approach will benefit mule deer and other wildlife, reduce the risk of severe wildfires, and better facilitate the use of prescribed burning.

Timeline: Annually

Cost: $50,000

Weed control is another important aspect of habitat management on Department lands in the MDMZs. The Department has an active weed control program that maintains and improves habitat that a variety of wildlife species benefit from including mule deer.

Timeline: Annually

Cost: $500,000

Forage enhancement projects on Department lands in the MDMZs include planting both food plots and self-sustaining native vegetation. These plantings benefit both mule deer and a variety of other wildlife.

Timeline: Annually

Cost: $120,000

Habitat Subtotal: $720,000

Public Education – Medium Priority

Efforts to provide information regarding mule deer management through various forms of public education, outreach, and engagement should be elevated."

Timeline: Annually

Cost: $10,000

Research– High Priority

Mule deer will be one component of a much larger multi-species predator-prey study. The financial investment in mule deer work will be a proportion of a larger overall project budget.

Timeline: 6 years

Cost: Approximately $30,000 per year

Part 2: Mule Deer Management Zones

The eastern Washington mule deer habitat has been divided into seven Mule Deer Management Zones (MDMZ; Figure 1) using level III and IV ecoregions (Omernik 1987), local knowledge of mule deer biology and distribution, and Game Management Unit (GMU) boundaries. While GMU boundaries were designed to assist with management, deer population distribution does not always coincide with administrative boundaries. A new approach to harvest management delineations is being launched with this management plan. Each MDMZ is a grouping of GMUs based upon a combination of local knowledge, physiographic province and ecoregion (Franklin and Dyrness 1973, Omernik 1987). These GMUs share common mule deer populations, and vegetative (Table 5) and geographic characteristics. Using MDMZs as the largest mule deer management unit ensures that data collected are more representative of a population, and management is applied at the population level.

Table 5. Area (km^2) of major land cover types in eastern Washington (Fry et al. 2011) and total area by MDMZ (NRM = Northern Rocky Mountains, OH = Okanogan Highlands, BM = Blue Mountains, CP = Columbia Plateau, ESC = East Slope Cascades, NC = Naches, and ECG = East Columbia Gorge).

Land cover type	NRM	OH	BM	CP	ESC	NC	ECG
Agriculture	1,093	469	4,182	22,156	1,021	382	744
Barren/Sparsely Vegetated	7	72	23	448	619	39	15
Developed	65	30	176	1,152	229	114	52
Disturbed	8	40	205	599	666	323	183
Deciduous Forest	1	7	44	11	138	2	1
Conifer Forest	6,410	4,551	1,354	1,076	12,674	3,228	1,543
Open Water	121	92	116	756	287	26	82
Shrub-steppe	134	434	1,083	7,220	1,750	561	931
Shrubland	134	363	270	4,543	1,338	211	217
Upland Grass & Herbaceous	537	1,184	1,567	4,611	884	319	700
Wetlands & Riparian	521	257	123	215	386	79	80
TOTAL	9,032	7,499	9,143	42,788	19,992	5,285	4,547

Photo David Parker

Mule Deer Management Zone: Northern Rocky Mountains

Area Description

The Northern Rocky Mountains MDMZ MDMZ is located within the northeast corner of Washington and includes all of GMUs 105, 108, 111, and 117 in Stevens County, 113, 117, and 124 in Pend Oreille County, and 124 in Spokane County (Figure 6). It covers an estimated area of 9,033 km^2 (3,501 mi^2), making it the fourth largest management zone. Elevations range from approximately 393 m (1,289 ft) on the Columbia River at Lake Roosevelt to 2,227 m (7,309 ft) on Salmo Peak in the Selkirk Mountains. Precipitation varies within the zone, from less than 51 cm (20 in) per year in the southern valleys to over 203 cm (80 in) in the mountains to the north. Most precipitation occurs during the winter and spring months. Seasonal temperatures vary from a mean of 20°C (68°F) in July to -4°C (25°F) in December. Based upon the National Land Cover Dataset (Fry et al. 2011), there are an estimated 6,410 km^2 (2,475 mi^2) of forest, 1,093

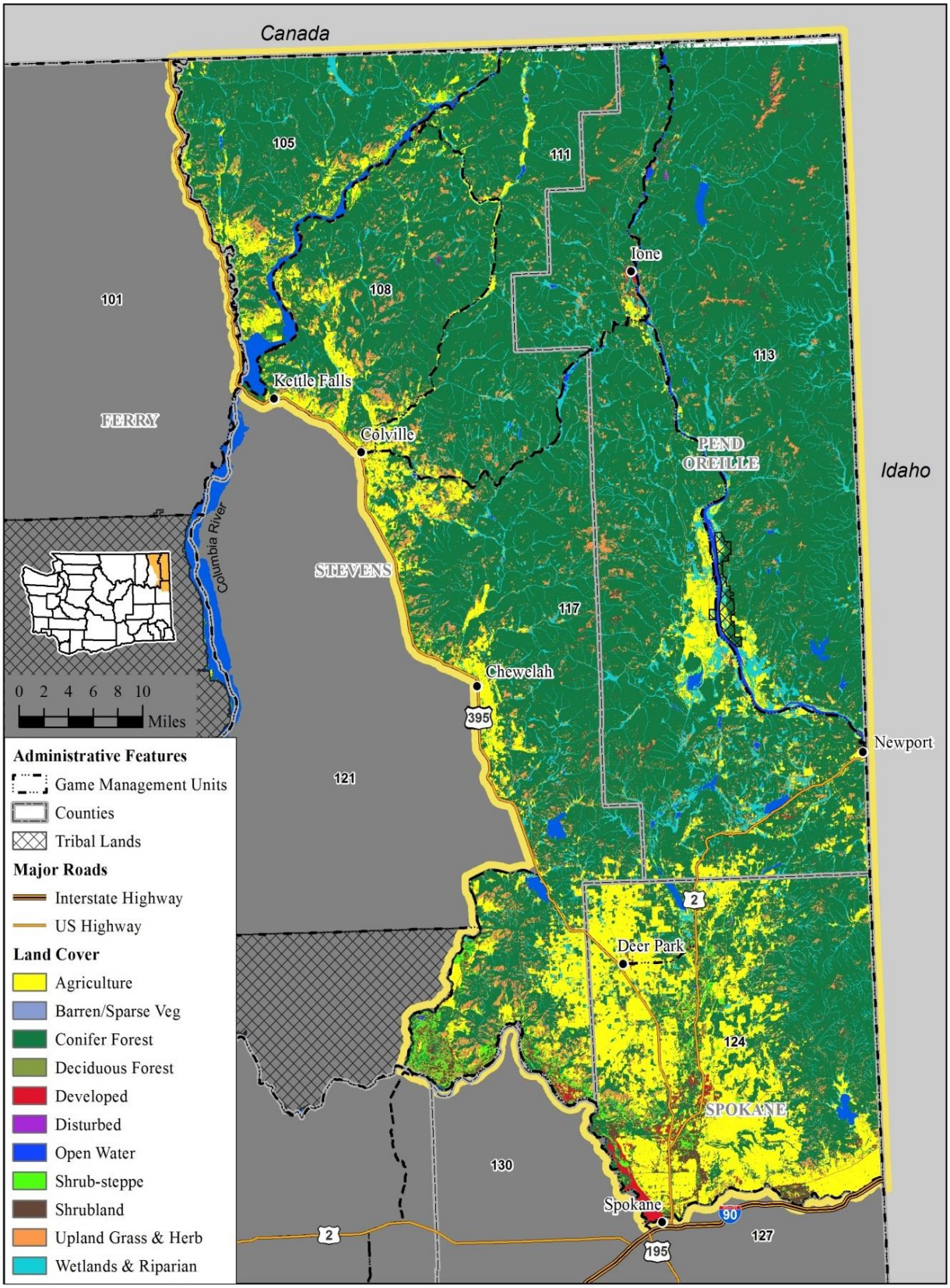

Figure 6. Location and vegetative cover of the Northern Rocky Mountains MDMZ.

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km^2 (422 mi^2) of agricultural land, 537 km^2 (207 mi^2) of upland cover (grass and meadow), 134 km^2 (52 mi^2) of shrub-steppe, and 134 km2 (52 mi^2) of shrubland in addition to other cover types within this zone (Figure 6; Table 5). Dry forests comprised of Ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*) and grasslands are common at elevations below 1,000 m (3,200 ft). Western red cedar (*Thuja plicata*), western hemlock (*Tsuga herophylla*), grand fir (*Abies grandis*), western larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta*), and western white pine (*Pinus monticola*) occur on more mesic sites at any elevation, dependent upon aspect. Subalpine fir (*A. lasiocarpa*), western larch, Engelmann spruce (*Picea engelmannii*), whitebark pine (*P. albicaulis*), and lodgepole pine are common in high elevation forests above 1,600 m (5,250 ft).

Forty-three percent of the land within the zone is owned by public agencies (Table 6). The Colville and Kaniksu National Forests, the Little Pend Oreille National Wildlife Refuge, and the Department's West Branch Little Spokane River and LeClerc Creek Wildlife Areas are the major public land holdings. Private timber companies also own a substantial portion of forested areas within this zone. Most of the other lands held in private ownership are found along the valley bottomlands, which are productive agricultural croplands.

Table 6. Landownership area (km^2) and percentage of each in the Northern Rocky Mountains MDMZ, 2015.

Landowner/ Manager	Area	Percent
Federal	3,312	36.5
Tribal	22	0.3
State	635	7.0
City/ County	6	0.1
Total Public	3,953	43.6
Private	5,093	56.2
TOTAL	9,068	100.0

Populations and Monitoring

While no estimates of mule deer abundance are available for populations within this zone, local managers believe densities are low when compared to other mule deer populations in eastern Washington. Mule deer are not evenly distributed across the Northern Rocky Mountains

MDMZ, but rather are found in small, scattered groups. Some of these groups are seasonally migratory, others are resident, and others may exhibit a combination of movement patterns. Productivity rates are unknown but thought to be low, based upon limited observation by local managers. Survival rates and cause specific mortality rates are likewise unknown. However, in addition to the more common sources of mortality, these deer are subject to predation by wolves, due to their proximity to multiple wolf packs.

Current population monitoring consists primarily of late summer and early spring surveys to estimate age and sex ratios. These surveys are vehicle-driving routes along fixed transects. No changes in survey methods will be made until after new survey techniques for mule deer occupying these dense forested landscapes are available (see Objective 1 in Part 1 of this plan).

Group of mule deer in Pend Oreille County. *Photo Tommy Petrie*

Harvest Management

Harvests of mule deer bucks in the Northern Rocky Mountains MDMZ are lowest of any Washington mule deer management zone (Table 3), which is likely a function of the low deer density, but they are stable (Figure 7). Success rates, likewise, are very low but local mule deer managers believe most mule deer buck harvest is incidental, taken by hunters pursuing white-tailed deer, and that hunting effort for mule deer in this zone is low.

Habitat Management

Within the last 10 years there have been no habitat improvement projects specifically designed to enhance mule deer habitats within the Northern Rocky Mountains MDMZ. Some projects intended to improve elk habitats have likely benefitted mule deer. These projects primarily consisted of prescribed burning. Within the forested habitats of Northern Rocky Mountains MDMZ, treatments that reduce the forest canopy and create openings that promote the growth of forbs, grasses and deciduous species will increase forage for mule deer. Habitat projects should focus on improving fawn survival by enhancing ranges used by lactating does between July and October. Hayden et al. (2008) provide a detailed discussion of management options for improving mule deer habitats in the northern forests of the western U.S. and Canada. These discussions include the benefits of closing and retiring forest roads, prescribed burning, creating habitat structure through logging, and managing invasive plant species. Treatments applied to public lands within Northern Rocky Mountains MDMZ should include prescribed burning to stimulate growth of forage species and closing roads through important seasonal mule deer ranges to limit disturbance. The Department will review timber plans, and recommend silviculture practices that benefit mule deer. When reviewing proposed timber harvest plans for private timber lands, companies should be encouraged to avoid timber harvest treatments that

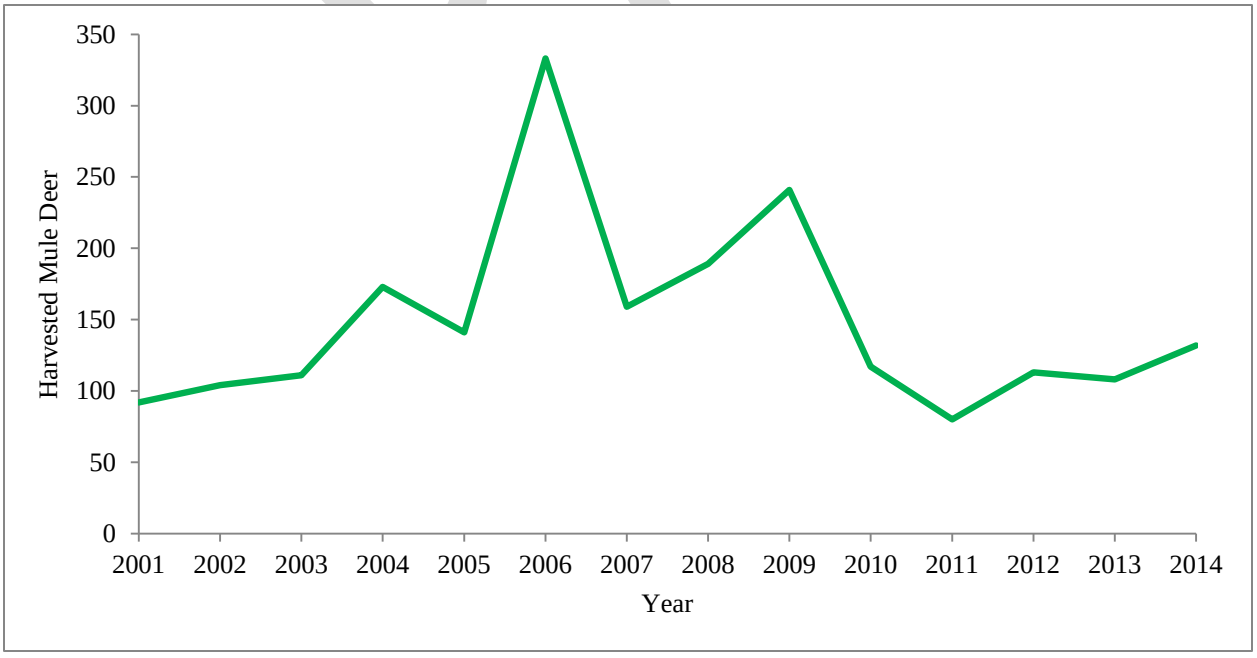

Figure 7. Estimates of annual harvest for mule deer (antlered and antlerless) during the general season in the Northern Rocky Mountains MDMZ.

create openings larger than 40 acres, leave islands of standing timber within harvest areas for cover, and reduce the use of herbicides post-harvest to allow for development of seral plant communities.

Mule deer summer range in the Northern Rocky Mountains MDMZ. Photo *Doug Kuehn*

Special Considerations

1. Tribal harvest occurs in Northern Rocky Mountain MDMZ as the Colville Confederated Tribe (CCT) retains off-reservation hunting rights in GMU 105. Qualitative harvest information is shared by the CCT. The Department coordinates with the CCT when the need arises.
2. The deer in the Northern Rocky Mountain MDMZ are subject to predation by wolves, due to their proximity to multiple wolf packs.
3. The Colville National Forest will soon complete the revision of its forest plan. The Department should work closely with them to help interpret this plan and find common ground for improved habitat management for mule deer on the forest.
4. Major restoration of mule deer habitats burned by the Kaniksu Complex Fires of 2015 is required.

The Okanogan Highlands west of the Columbia River. *Photo James Kujala*

Mule Deer Management Zone: Okanogan Highlands

Area Description

The Okanogan Highlands MDMZ is located in north-central Washington and includes all of GMUs 101 in Ferry and Okanogan County, 121 in Stevens County, and 204 in Okanogan County (Figure 8). The Okanogan Highlands MDMZ is bounded by the border with British Columbia to the north, the Okanogan River to the west, the Columbia Plateau to the south, and the Northern Rocky Mountains MDMZ to the east. It excludes the Colville and Spokane Indian Reservations, which are contained within the described boundary (Figure 1). The zone covers an area of 7,499 km^2 (2,895 mi^2; Table 5). Broad, north-south orientated valleys, moderate slopes, and rounded peaks and ridges characterize the Okanogan Highlands MDMZ (Franklin and Dyrness 1973). Elevations range from approximately 237 m (777 ft) at the confluence of the Columbia and Okanogan Rivers to 2,176 m (7,140 ft) on Copper Butte, the highest peak in the Kettle Range. This region is characterized by hot, dry summers and cool winters with most precipitation falling during the winter in the form of snow. Snowfall varies within the zone, ranging from 102 - 203 cm (40 - 80 in) per year in the valleys to over 1,829 cm (720 in) in the mountains.

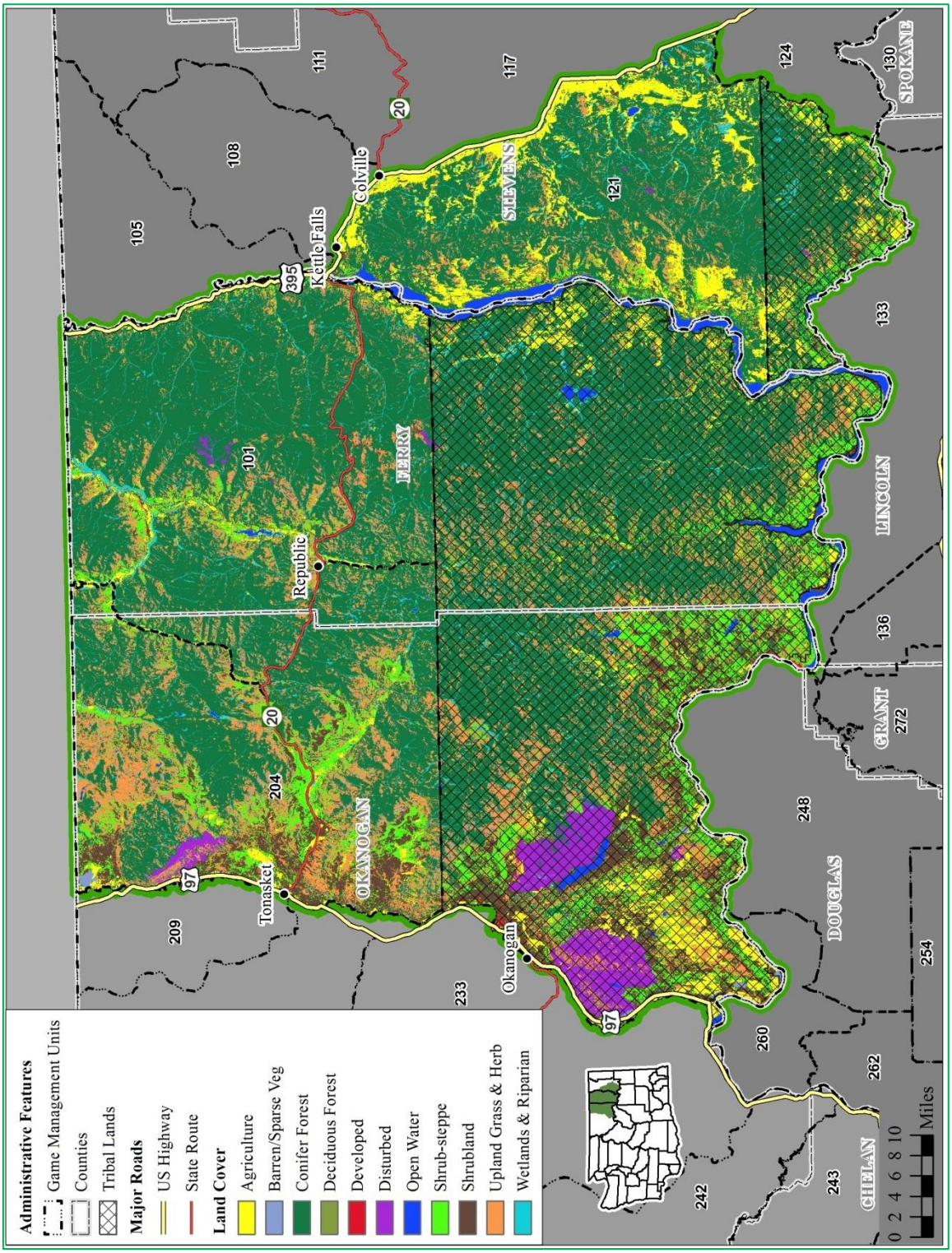

Figure 8. Location and vegetative cover of the Okanogan Highlands MDMZ.

Average January temperatures range from -4°C to 2°C (25°F to 35°F) with minimum temperatures ranging from -18°C to -26°C (0°F to -15°F); July mean temperatures are 21°C to 27°C (70°F to 80°F) with minimum temperatures ranging from 7°C to 10°C (45°F to 50°F).

Within this zone, there is an estimated 4,551 km2 (1,760 mi2) of conifer forest, 469 km2 (181 mi2) of agricultural lands, 1,184 km2 (457 mi2) of upland grasslands, 434 km2 (168 mi2) of shrub-steppe, 363 km2 (140 mi2) of shrubland, and other vegetative cover types (Table 5). Along the extreme southern and southwestern boundaries of the Okanogan Highlands MDMZ, the shrub-steppe vegetation including Idaho fescue (Festuca idahoensis) and bitterbrush (Purshia tridentata) are common. Moving east and north, forested communities dominate the landscape. The valleys of the northern and northwestern portions of this zone contain a mixture of bunchgrass and sagebrush where conditions are favorable. Forested plant associations change as elevation increases, with Ponderosa pine at lower elevations changing to Douglas fir, grand fir, and lodgepole pine (P. contorta) at mid-elevation, and subalpine fir at the highest elevations. Almost half of the zone is owned by public agencies (Table 7). The Colville and Okanogan

Spring mule deer range in eastern Okanogan County near Chesaw. *Photo Doug Kuehn*

National Forests, Washington State Department of Natural Resources lands, and the Department's Chesaw Wildlife Area are the major land holdings. Private timber companies also own a substantial portion of forested areas within this zone. Most other lands held in private ownership are found along the valley bottomlands.

Table 7. Landownership area (km^2) and percentage of each in the Okanogan Highlands MDMZ, 2015.

Landowner/ Manager	Area	Percent
Federal	3,266	23.7
Tribal	6,121	44.3
State	651	4.7
City/ County	0	0.0
Total Public	3,916	28.4
Private	3,766	27.3
TOTAL	13,803	100.0

Populations and Monitoring

While no estimates of mule deer abundance are available for populations within this zone, local Department managers believe densities vary from low to moderate in numbers based upon limited survey data and incidental observations. Mule deer are present throughout the Okanogan Highlands MDMZ but densities increase when moving from east to west and south to north across the zone because of habitat changes. Based upon telemetry studies of radio marked adult female mule deer in the Okanogan Highlands MDMZ, mule deer within this zone were observed to exhibit different movement patterns including seasonally migratory, resident, or a combination of both within the same population. Radio marked deer captured on Vulcan Mountain, within the Bonaparte drainage, and east of Tonasket all showed these same movement patterns. Some of the radio marked mule deer living on the isolated mountains in the extreme western portion of the Okanogan Highlands MDMZ (e.g., Tunk Mountain and Cayuse Mountain) showed unique adaptions during the winter season. These deer spent the winter months in dense, closed canopy forests at high elevation and did not move to lower elevations.

Recently observed pregnancy and fetal rates in Okanogan Highlands MDMZ were 0.93 and 1.44 (Table 1), respectively. Mean annual survival rates observed during recent field studies of adult female mule deer were 0.89 within the Okanogan Highlands MDMZ (Figure 4). Investigations of deaths of radio-marked adult female mule deer showed cougars to be a common source of mortality along with deer-vehicle collisions, although the high survival rates suggest these mortality sources are not limiting the adult female segment of the population. Other potential sources of mule deer mortality include legal hunting harvest and poaching, although neither source was documented during field studies of marked deer. However, in addition to the more common sources of mortality, these deer are subject to predation by wolves, due to their proximity to multiple wolf packs, and golden eagles.

Another potential influence to mule deer numbers in the Okanogan Highlands MDMZ documented elsewhere is interference competition with elk (Stewart et al. 2002). Recent changes in harvest management strategies for elk within this zone are likely to result in increased elk numbers and distribution. Similar responses by mule deer have been observed when cattle are present on seasonal mule deer ranges (Stewart et al. 2002), but the range of effects of cattle grazing within Okanogan Highlands MDMZ mule deer are unknown. California bighorn sheep (*Ovis canadensis*) also share the range with mule deer in the Okanogan Highlands MDMZ, but their distribution is restricted to Mount Hull near Tonasket and Vulcan Mountain near Curlew, so any competition between deer and sheep would be limited as well.

A group of mule deer in Ferry County. *Photo Annemarie Prince*

Current population monitoring consists of late fall and early spring surveys to estimate age and sex ratios. Surveys conducted during November and December are flown by helicopter

Bachelor group of mule deer bucks in Ferry County. *Photo Annemarie Prince*

to count and classify deer in randomly selected survey units. Spring ground-based surveys have been conducted during March and April to estimate adult: fawn ratios and over-winter survival (Table 2).

Harvest Management

Harvest of mule deer bucks in the Okanogan Highlands MDMZ is moderate when compared to other MDMZs (Table 3), and appears to be stable (Figure 9). This zone has mule deer and white-tailed deer present together. The Department manages the Okanogan Highlands MDMZ as a mixed deer management zone, where both the mule deer and white-tailed deer populations each receive consideration.

Habitat Management

Some habitat improvement projects specifically designed to enhance mule deer habitats are ongoing within the Okanogan Highlands MDMZ. These projects have involved prescribed burning, road closures, and providing safe wildlife crossings along state highways. Specifically, USFS Tonasket and Three Rivers Ranger Districts conduct prescribed burning actions throughout the lands they manage in Okanogan Highlands MDMZ and total hectares burned vary by project and year. The Department has conducted timber harvest and is currently planning

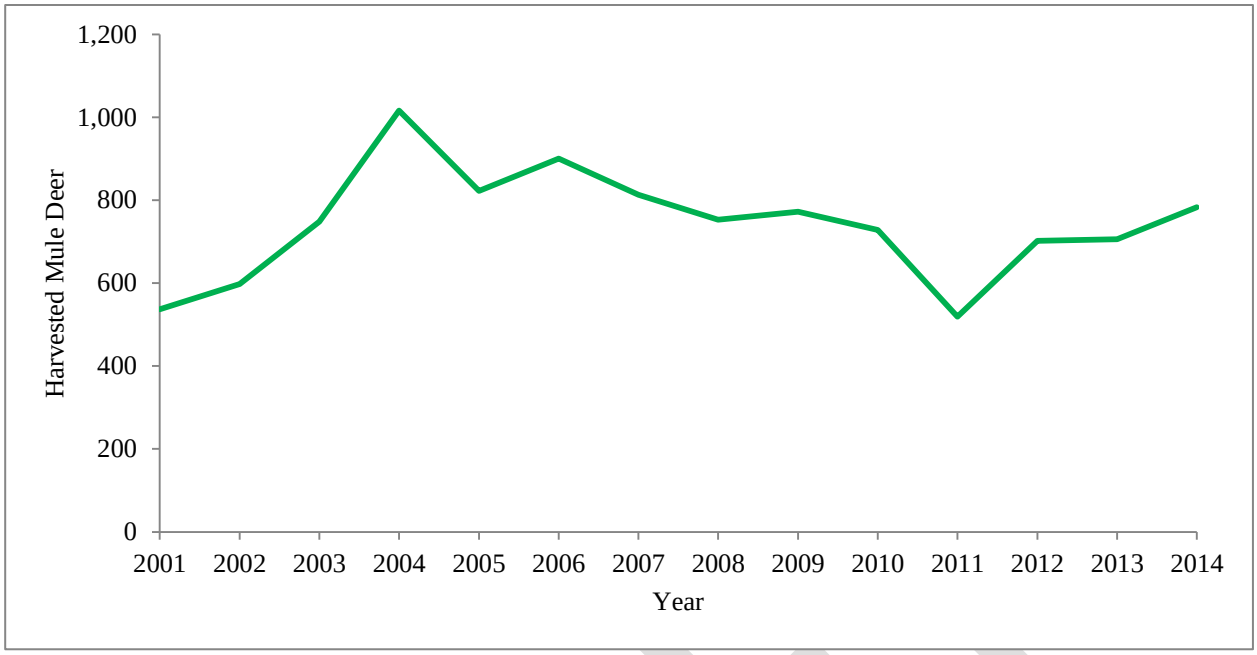

Figure 9. Estimates of annual harvest for mule deer (antlered and antlerless) during the general season in the Okanogan Highlands MDMZ.

prescribed burn actions on the Chesaw Wildlife Area to regenerate decadent Aspen stands. The USFS Tonasket Ranger District has recently decommissioned 4.0 miles of road in the Crawfish Lake and Bailey Mountain area. The Washington State Department of Transportation in partnership with NGOs and other agencies are working to install wildlife crossing structures on SR 97 between the towns of Riverside and Tonasket. While designed to reduce incidence of vehicle collisions, they also may open habitat that would otherwise be unavailable.

Within the forested habitats of eastern portions of the Okanogan Highlands MDMZ, logging and burning are recommended to reduce the forest canopy and create openings that promote the growth of forbs, grasses, and deciduous species. This will increase forage for mule deer. To stimulate increased productivity in local mule deer populations, habitat improvement should focus on increasing summer forage in areas used by lactating does between July and October. Hayden et al. (2008) provide a detailed discussion of management options for improving mule deer habitats in the northern forests of the western U.S. and Canada. These discussions include the benefits of forest road management and prescribed burning, creating habitat structure through logging, managing invasive plant species, the effects of human encroachment, and impacts resulting from energy and mineral development. Treatments applied to public lands within Okanogan Highlands MDMZ should include periodic burning to stimulate

The Kettle Mountains in Ferry County. *Photo Annemarie Prince*

growth of forage species, conditioning of timber harvests that benefit mule deer, and closing roads through important seasonal mule deer ranges to limit disturbance. When reviewing proposed timber harvest plans for private timber lands, companies should be encouraged to avoid timber harvest treatments that create openings larger than 40 acres, leave islands of standing timber within harvest areas for cover, and reduce the use of herbicides post-harvest to allow for development of seral plant communities.

Public Safety

Reducing the number of deer-vehicle collisions is important to the Department. High-levels of mule deer-vehicle collisions have been documented at specific sites along SR 20 and SR 97 in eastern Okanogan County (see Objective 9).

Human-Mule Deer conflict

Wherever mule deer occur within agricultural lands in eastern Washington, deer /landowner conflict can occur. The Department has the primary role in mitigating agricultural damage caused by mule deer, and the creation of DPCAs is one approach showing great promise. The

The Kettle Mountains in Ferry County. *Photo Annemarie Prince*

agency has also taken measures to reduce agriculture damage within the Okanogan Highlands MDMZ by creating two deer areas where hunters play a role in reducing damage. A number of second deer permits are issued each year through the special permit drawing process based on the amount of damage within each deer area. Hunters are restricted to harvesting an antlerless deer on private lands. Recently, an increasing number of mule deer are residing in urban or suburban communities in eastern Washington. While not agricultural damage in many cases, the Department takes the issues created by these deer seriously, and attempts to assist landowners with remedies. Municipalities currently supporting mule deer numbers beyond the tolerance of many local landowners and are creating potential public safety issues include Conconully, Tum Tum, Twisp, and Winthrop.

Special Considerations

1. Tribal harvest occurs in Okanogan Highlands MDMZ as the Colville Confederated Tribe (CCT) retains off-reservation hunting rights in GMUs 101, 105, and 204. Qualitative harvest

information is shared by the CCT. The Department coordinates with the CCT when the need arises.

2. Major restoration is required to improve mule deer habitats burned by the Tunk Block of the Okanogan Complex, North Star, Kettle Complex, Marble Valley, and Carpenter Road Fires of 2015.

Mule deer doe in typical shrub-steppe habitat near Coffee Pot Lake in Lincoln County. *Photo James Kujala*

Mule Deer Management Zone: Columbia Plateau

Area Description

The Columbia Plateau MDMZ, located in east central Washington (Figure 1), is the largest of the mule deer zones, covering an estimated 42,788 km^2 (16,520 mi^2) (Table 5). The Columbia Plateau MDMZ is bounded by Idaho to the east, a portion of the Columbia and Spokane Rivers to the north, and the Snake River and Oregon border to the south (Figure 10). The Columbia Plateau MDMZ includes GMUs 127 in Spokane, and Whitman Counties, 130 in Spokane, Lincoln, and Whitman Counties, 133 in Lincoln County, 136 in Lincoln and Adams Counties, 139 and 142 in Whitman County, 248, 254, 260, 262, and 266 in Douglas County, 269 in Douglas and Grant Counties, 272 in Douglas, Grant and Lincoln Counties, 278 in Grant and Adams Counties, 284 in Adams, Grant, and Whitman Counties, 290 in Grant County, 371 in Kittitas and Yakima Counties, 372 in Benton and Yakima Counties, 379 in Franklin and Grant Counties, and 381 in Franklin County. Within this zone, there are an estimated 22,156 km^2

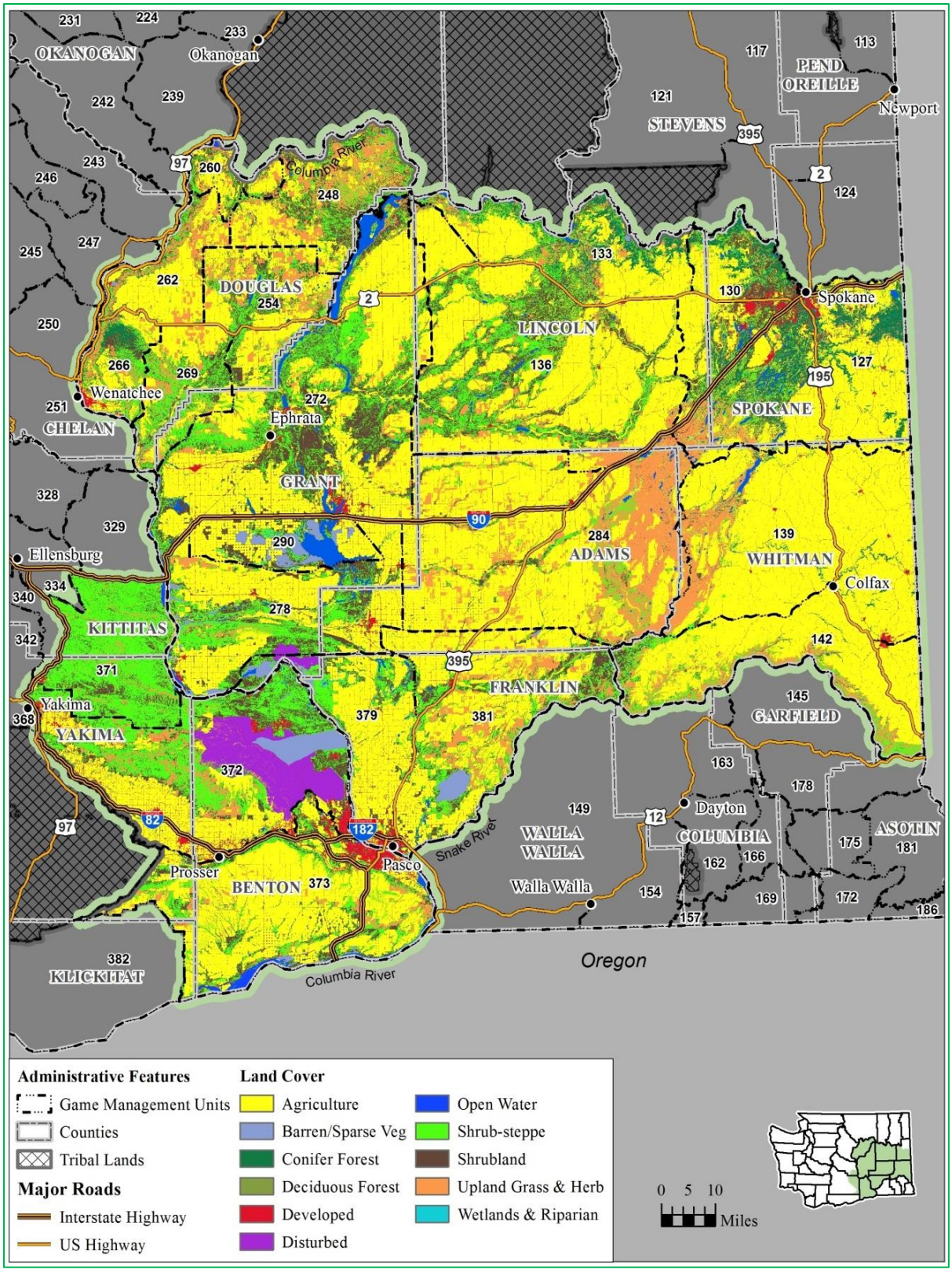

Figure 10. Location and vegetative cover of the Columbia Plateau MDMZ.

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(8,555 mi^2) of agricultural land, 7,220 km^2 (4,542 mi^2) of shrub-steppe, 4, 611 km^2 (1,780 mi^2) of upland grassland, 4,543 km^2 (1,754 mi^2) of shrubland, 1,087 km^2 (420 mi^2) of forested land, 756 km^2 (292 mi^2) of open water, and 215 km^2 (83 mi^2) of riparian habitat, among other cover classes (Table 5).

The Columbia Plateau MDMZ contains much of the remaining shrub-steppe and undisturbed channeled scablands of the Columbia Basin in eastern Washington. Undeveloped areas that contain native vegetation will have three-tipped sage (*Artemsia tripartita*)-Idaho fescue, big sage-bluebunch wheatgrass (*Pseudoroegneria spicata*) and big sage-Idaho fescue plant community associations (Daubenmire 1970). Ponderosa pine and Douglas fir forests are generally limited to portions of the north-facing breaks along the Columbia and Palouse Rivers, along segments of upper Crab Creek, Wilson Creek, Rock Creek, Pine Creek, and Hangman Creek drainages, on some of the steptoes found in the far eastern Columbia Plateau MDMZ, and the area around Badger Mountain in western Douglas County. Irrigated crop production, dry-land farming, and cattle grazing are the most common agricultural pursuits. Deep soil areas and loess islands adjacent to native plant communities are most often farmed for winter wheat (*Triticum* sp.), lentils (*Lens* sp.), canola (*Brassica rapa*), and alfalfa (*Medicago* sp.). Alfalfa, corn, potatoes, carrots, and grapes are examples of the crops grown on irrigated farmland. The elevation ranges from 350 – 600 m (1,150 – 1,970 ft). The climate is arid to semi-arid with between 23 – 40 cm (9 – 16 in) of precipitation per year, which mostly falls during the winter and spring seasons. A precipitation gradient declines going from east to west and north to south across the Columbia Plateau MDMZ. As an example, Spokane receives 42.0 cm (16.5 in) of precipitation per year, while Yakima receives an average of 20.9 cm (8.2 in), and Richland in the south receives 18.1 cm (7.1in).

The Columbia Basin Irrigation Project (CBIP) is located in the central portion of the Columbia Plateau MDMZ. This large irrigation project, created by the U.S. Bureau of Reclamation beginning in the 1950s, takes water from the Columbia River to irrigate thousands of acres of farmland via a series of canals, laterals, and drains in Adams, Grant, and Franklin counties. The irrigated portions within the CBIP of the Columbia Plateau MDMZ receive significantly less use by mule deer than the dryland agricultural areas.

Most (82.3%) of the zone is privately owned (Table 8). Federal lands within the Columbia Plateau MDMZ are managed by the Bureau of Reclamation, Bureau of Land Management, the USFWS, the National Park Service, the Department of Energy, and the Department of Defense. State lands within the Columbia Plateau MDMZ include the Department, Washington State Department of Natural Resources, Washington State Parks, and Washington State Department of Transportation.

Table 8. Landownership area (km^2) and percentage of each in the Columbia Plateau MDMZ, 2015.

Landowner/ Manager	Area	Percent
Federal	5,327	12.4
Tribal	0	0.0
State	2,340	5.5
City/ County	44	0.1
Total Public	7,711	18.0
Private	35,082	82.0
TOTAL	42,793	100.0

Populations and Monitoring

While no estimates of mule deer abundance exist for the entire zone, estimates are available for portions of the Columbia Plateau MDMZ. Population estimates from 2012 to 2014 for mule deer wintering in Crab Creek and along Lake Roosevelt in the Columbia Plateau MDMZ ranged from 11,142 ± 1,386 to 13,597 ± 1,532 (90% CI) based upon surveys using the Aerial Survey sightability model (Samuel et al. 1987, Unsworth et al. 1990, Unsworth et al. 1999b). Current population monitoring consists of late fall surveys to estimate age and sex ratios. Aerial surveys are conducted in a portion of the Columbia Plateau MDMZ every year, and ground surveys typically conducted in those areas not surveyed by helicopter. Resultant estimates are for total deer as well as ratio estimates for bucks and fawns.

Mule deer are present throughout most of the Columbia Plateau MDMZ at varying densities depending upon locality and habitat quality, with the exception of the largest irrigated parcels within the CBIP. Telemetry studies of radio marked adult female mule deer in the eastern portions of Columbia Plateau MDMZ indicate that mule deer within this zone exhibit a

mixture of movement patterns including seasonally migratory, resident, or a combination of both.

Recently observed pregnancy and fetal rates in the eastern Columbia Plateau MDMZ were 0.96 and 1.44, respectively (Table 1). Mean annual survival rates observed during recent field studies of adult female mule deer were 0.92 within this MDMZ (Figure 4). Juvenile survival over the summer season was 0.52 (Johnstone-Yellin 2009) while over-winter survival rates into the yearling age class were 0.90 (WDFW, unpublished data). Investigations of 28 deaths of radio-marked juvenile mule deer (30 marked as neonates, 35 marked at 6 months of age) showed legal hunting and coyotes to be a common source of mortality, although the high survival rates would suggest that these mortality sources are not limiting the adult female segment of the population. Field studies showed that every yearling buck radio tagged as a six month old fawn that grew 3 antler points on at least one side, was legally harvested during the general rifle season (n =10) (WDFW, unpublished data). While not observed during recent field studies of marked deer, other likely sources of mule deer mortality include predation by other

Mule deer buck bedded in shrub steppe in Grant County. *Photo WDFW*

predators (in addition to coyotes mentioned above), collisions with vehicles, drowning in irrigation canals, and poaching. Predator species living within this zone include cougars, bobcats, black bears, gray wolves, coyotes, golden eagles, and domestic dogs.

Harvest Management

Mule deer harvest in the Columbia Plateau MDMZ is the highest of all mule deer management zones (Table 3) and has remained stable since 2001 (Figure 11). In the Columbia Plateau MDMZ, general season buck harvests have been under a 3-point minimum APR for 18 years at the time of this writing. Post hunt survey results show that most adult bucks are being harvested under the APR and that the post-season buck population is comprised largely of yearling males. As stated above every radio tagged yearling buck with three antler points on one side (10 3-pt yearlings out of 35 total yearlings marked) during the fall hunting season were harvested that year. Harvest vulnerability for bucks is high in the Columbia Plateau MDMZ because of the open country with long sighting distances and much of the terrain can be traversed easily on foot or by vehicle. One mitigating factor is that much of the Columbia Plateau MDMZ is privately owned. Because private land access is sometimes difficult to obtain, private lands can act as refugia for bucks during the hunting season. The hunt units that show the greatest adult buck

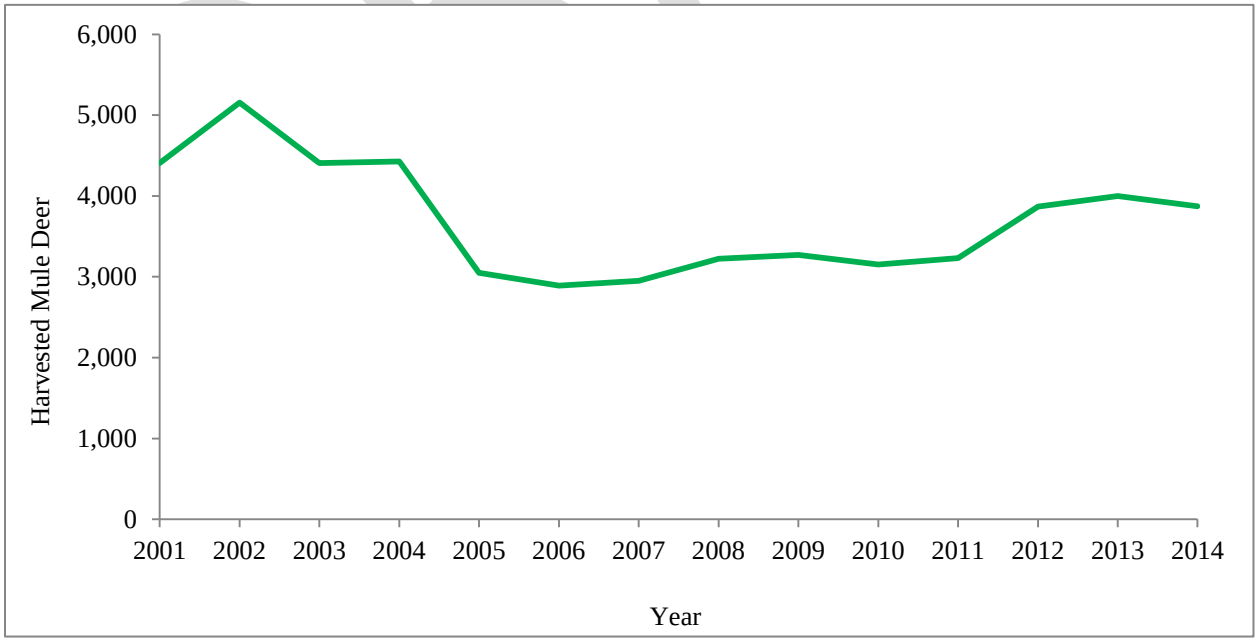


Figure 11. Estimates of annual harvest for mule deer (antlered and antlerless) during the general season in the Columbia Plateau MDMZ.

escapement in the Columbia Plateau MDMZ have been managed by limited entry permit only hunts.

Habitat Management

Recent telemetry studies of mule deer in the Columbia Plateau MDMZ showed that mule deer habitat use is associated with shrub-steppe, channeled scablands, and other undisturbed areas including the bunchgrass covered breaks along the Snake and Columbia Rivers (WDFW, unpublished data). These areas provide both year-round and seasonal mule deer habitat for fawning and fawn rearing, migration corridors, and escape cover. The juxtaposition of these remaining natural habitats with wheat or hay farmland across parts of the Columbia Plateau MDMZ provide a matrix of edge, cover, and forage areas beneficial to mule deer. The Department considers retention, protection, and enhancement of these limited natural areas to be a high priority.

Other key habitats that are very limited across the Columbia Plateau MDMZ are riparian zones and high moisture bottom-lands. These areas are particularly important to lactating does raising fawns. During the hot, dry sum-mers, these habitats provide lactating does the highest quality forage available, unless they have access to irrigated hay or alfalfa. The riparian zones and high moisture bottomlands tend to shrink in size as the summer growing season progresses, limiting availability of these habitats even further. The Department encourages other public agencies and private landowners to protect and enhance these important habitats.

Spring mule deer range in the Columbia Plateau Management Zone. *Photo Howard Ferguson*

Most of the habitat improvement projects in the Columbia Plateau MDMZ beneficial to mule deer have been developed on Department Wildlife Areas or National Wildlife Refuges, usually associated with protection of other species. However, the largest on-going improvement project is funded by the Department of Ecology Office of Columbia River (DOEOCR), and is located in GMU 272 in Grant County, where the riparian corridor along Crab Creek between Stratford and Moses Lake is being hydrated due to increasing water flows associated with the Bureau of Reclamation's Supplemental Feed Route Project. The DOEOCR is providing funds for the Department to plant trees and shrubs that provide forage for mule deer and control Russian olive (*Elaeagnus angustifolia*) and the invasive common reed (*Phragmites australis*), which will likely improve habitat for mule deer. As mentioned earlier, mule deer populations within the Columbia Plateau MDMZ appear to be summer range limited. Consequently, habitat improvement projects that improve summer forage conditions, providing lush vegetation for lactating does, would increase fawn survival and facilitate herd growth.

Since the mid-1990s, large tracts of marginally productive farmland across the Columbia Plateau MDMZ have been enrolled into the Conservation Reserve Program (CRP). In Washington, about 600,000 ha of converted farmland were planted to perennial grasses, forbs, and shrubs; this makes up roughly 10% of the state's total agricultural lands. Most of these were planted with perennial grass cover to stabilize the soil, but occasionally native plants were included in the planting. The State Acres For wildlife Enhancement (SAFE) program is a voluntary effort that aims to provide wildlife habitat for high value, at-risk species on private land. It is part of the Farm Service Agency's Conservation Reserve Program (CRP) and was implemented in 2010 in cooperation with the Washington Department of Fish and Wildlife. Similar to CRP, private landowners are paid rental payments, on 10-15 year contracts, to convert cropland or restore CRP fields into habitat using native grasses, shrubs, and forbs. There are five different SAFE projects, totaling nearly 100,000 acres, all within the Columbia Plateau MDMZ.

CRP and SAFE lands provide mule deer with refugia but usually offer little forage. Forage quality of CRP lands is improved when alfalfa and other forbs are present in seed mixtures or supplemental plantings. Cost often precludes the addition of forbs into a planting.

However, when forbs are provided at no cost, or if the landowner is compensated, they frequently add forbs into the planting.

Human-Mule Deer Conflict

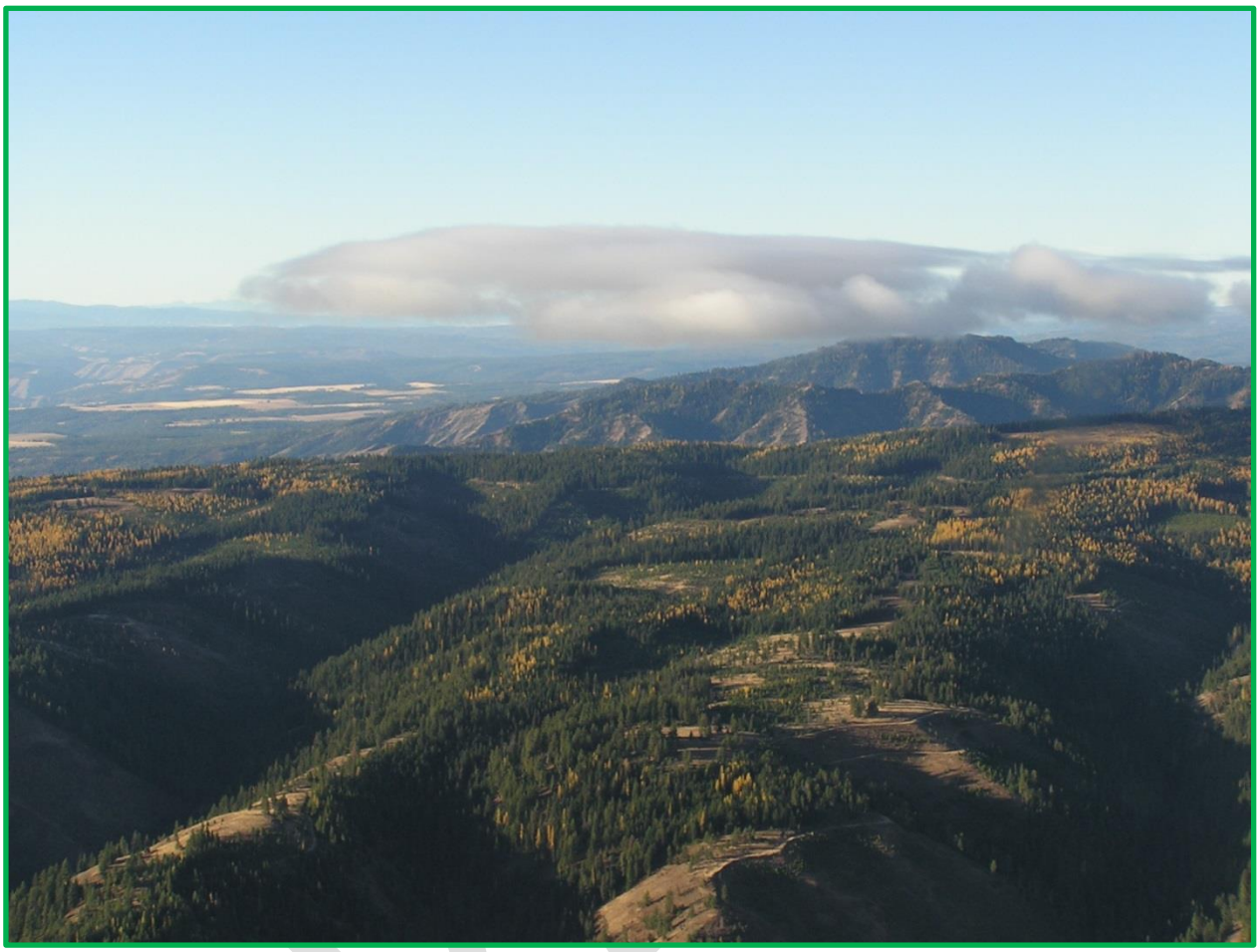
Wherever mule deer occur within agricultural lands in eastern Washington, deer/landowner conflict can occur. The Department has the primary role in mitigating agricultural damage caused by mule deer, and the creation of DPCAs is one approach showing great promise. Recently, an increasing number of mule deer are residing in urban or suburban communities in eastern Washington. While not agricultural damage in many cases, the Department attempts to assist landowners with remedies. Yakima and Selah currently have mule deer numbers beyond the tolerance of many local landowners and create potential public safety issues.

Mule deer range on Swanson Lakes Wildlife Area in Lincoln County. *Photo Howard Ferguson*

Special Considerations

1. Habitat loss, particularly shrub-steppe, is the most important issue facing wildlife managers in the Columbia Plateau MDMZ. The particularly harsh, dry conditions that develop during the summer growing season limit summer forage, which in turn limits the mule deer population growth in the Columbia Plateau MDMZ. Wild fire can have devastating impacts to shrub-steppe habitats; sagebrush removal by fire can take decades or more to recover.

2. The Yakama Nation and the Nez Perce tribe have ceded areas within the Columbia Plateau MDMZ, although the vast majority of the land is private with indicia of ownership, and therefore there are few "open and unclaimed" lands. However tribal harvest of mule deer may occur where "open and unclaimed" lands exist. Neither tribe shares harvest information with the Department.



Fall in the Blue Mountains. *Photo Paul Wik*

Mule Deer Management Zone: Blue Mountains

Area Description

The Blue Mountains MDMZ, located in southeast Washington, is the third largest of the mule deer zones, covering an estimated 9,143 km^2 (3,530 mi^2) in size (Table 5). The Blue Mountains MDMZ is comprised of the portion of the Blue Mountains that extend into Washington from Oregon, the foothills surrounding the Blue Mountains, and the breaks along the south and west side of the Snake River. The zone is bounded by the Snake River on the north, the Snake River and Idaho border to the east, a portion of the Columbia and Snake Rivers to the west, and Oregon border to the south (Figure 12). This zone includes GMUs 145 in Garfield County, 149 in Walla Walla, Columbia, and Garfield Counties, 154 and 157 in Walla Walla and Columbia Counties, 162 in Columbia County, 163 and 166 in Columbia and Garfield Counties, 169 in Columbia, Garfield, and Asotin Counties, 172, 175, and 178 in Garfield and Asotin Counties, and 181 and

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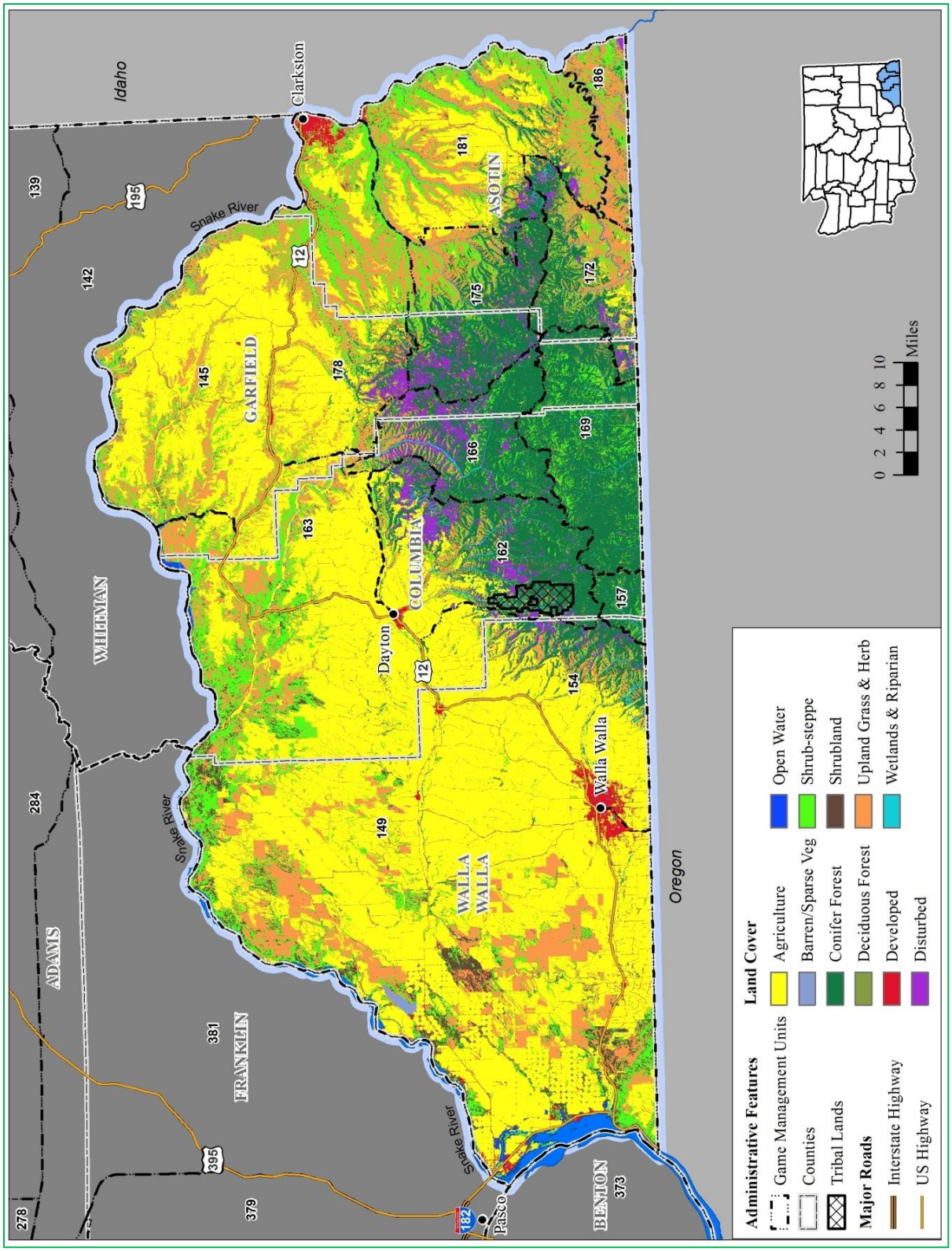

Figure 12. Location and vegetative communities of the Blue Mountains MDMZ

186 in Asotin County. The Blue Mountains are part of the Blue Mountains physiographic province that extends deep into Oregon while the foothills and breaks along the Snake River are part of the Columbia Plateau (Franklin and Dyrness 1973). The Blue Mountains were formed by uplifts occurring during the late Pliocene, followed by millions of years of erosion that created the major drainages and deep, rugged canyon complexes that characterize the area. The climate in the Blue Mountains is primarily influenced by easterly marine airflows from the Pacific Ocean. Summers are usually hot and dry with winters that often dip below freezing. The annual average temperature is 10°C (50°F) with temperatures averaging 14°C (57°F) between April and November and 2°C (36°F) from December through March. Precipitation averages 41 cm (16 in) annually, with most precipitation falling as rain or snow between December and March. There is a moisture gradient across the Blue Mountains MDMZ that influences both winter snow depth and spring-summer precipitation across the mountains from west (wetter) to east (dryer). The Snake River breaks create a moderating influence on moisture patterns.

Within this zone, there are an estimated 4,182 km^2 (1,615 mi^2) of agricultural land, 1,567 km^2 (605 mi^2) of upland grassland, 1,398 km^2 (540 mi^2) of forested land, 1,083 km^2 (418 mi^2) of shrub-steppe, 270 km^2 (104 mi^2) of shrubland, 123 km^2 (47 mi^2) of riparian land, and 116 km^2 (45 mi^2) of open water among other cover types (Table 5). The vegetative communities of the Blue Mountains are a mixture of forest and bunchgrass communities. Higher elevations are characterized by dense conifer forests on the north slopes and in the canyons, whereas south slopes are open with scattered conifers and patches of brush. As elevation decreases below 1,370 m (4,500 ft), open grass meadows and slopes become more prominent; as south slopes become more open, bunchgrass and low shrubs dominate the vegetative communities.

Riparian zones are dominated by deciduous trees and shrubs. The following forest types are representative of the Blue Mountains: Engelmann spruce -fir forest, ponderosa pine forest, and grand fir-Douglas fir forest (Kuchler 1964). Agricultural crops and rangeland composed of native shrub-steppe, bunchgrasses and non-native cheatgrass dominate the foothills and Snake River breaks at lower elevations (Figure 12).

Much (78.8%) of the zone is privately owned (Table 9). Larger tracts of publicly owned land within the Blue Mountains MDMZ are managed by the Umatilla National Forest, the Army

Corp of Engineers, the Department, Washington State Department of Natural Resources, Washington State Parks, and the Confederated Tribes of the Umatilla Indian Reservation.

Table 9. Landownership (km^2) area and percentage of each in the Blue Mountains MDMZ, 2015.

Landowner/ Manager	Area	Percent
Federal	1,477	16.2
Tribal	42	0.5
State	453	5.0
City/County	6	0.1
Total Public	1,936	21.2
Private	7,166	78.4
TOTAL	9,144	100.0

Populations and Monitoring

No complete estimates of mule deer abundance exist for the entire zone, but estimates are available for portions of the Blue Mountains MDMZ. Recent estimates of mule deer wintering along portions of the breaks and foothills along the Snake River totaled 19,000 based upon surveys using the Aerial Survey sightability model (Samuel et al. 1987, Unsworth et al. 1990, Unsworth et al. 1999b). Mule deer are present throughout much of the Blue Mountains MDMZ at varying densities depending upon locality and habitat quality. The highest densities are along the breaks of the Snake River while the high elevation mountains contain the lowest densities (WDFW, unpublished data).

No estimates of pregnancy, fetal, or survival rates are available for mule deer herds in the Blue Mountains MDMZ. Hunter harvests only give the estimated minimum number of bucks killed annually. In addition to legal hunter harvest, other potential sources of mule deer mortality include predators such as coyotes, collisions with vehicles, and poaching. Predator species living within this zone include cougar, bobcat, black bear, gray wolf, coyote, golden eagles, and domestic dogs. While these mortality sources influence population size, habitat condition and availability have the greatest impact to mule deer populations, particularly here in the Blue Mountains MDMZ where most of the population is likely to be summer range limited.

Current population monitoring consists of a mix of aerial and ground surveys during late summer and fall to estimate total number, age ratios and sex ratios for the sampled units. Summer surveys are ground counts. November and December surveys are flown by helicopter to count, classify, and then statistically estimate deer in randomly selected survey units.

Harvest Management

Total harvest of mule deer in the Blue Mountains MDMZ is the third greatest of all zones (Table 3), and has shown a slightly increasing trend over recent years (Figure 13).

Access is limited over much of the private land in the Blue Mountains MDMZ and reduces hunter harvest but provides refugia and likely provides for some increased buck survival. Following a notable decline after implementation of the Department's GoHunt website in 2013, there have been recent increases in lands enrolled in different access options (e.g., Feel Free to Hunt, Hunt by Written Permission, and Register to Hunt) across the Blue Mountains MDMZ. Nevertheless, hunter expectations for access outpace our ability to provide opportunity, but hunter expectations for access outpace our ability to provide opportunity.

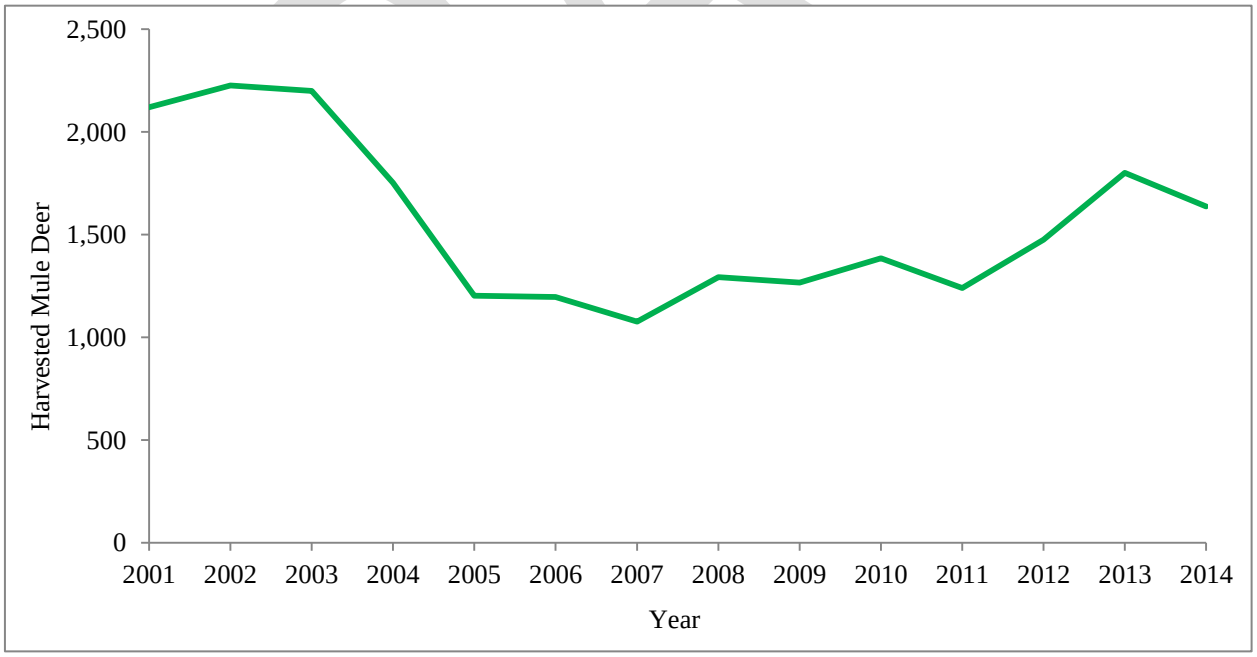

Figure 13. Estimates of annual harvest for mule deer (antlered and antlerless) during the general season in the Blue Mountains MDMZ

The lack of hunter access to private land also increases hunting pressure on the available public land. Current season structure and the lack of places to hunt make it difficult for the Department to reduce the hunting pressure on public lands. Intense hunting pressure and associated disturbance probably reduces the habitat effectiveness of these lands to mule deer during the fall.

Habitat Management

Habitat is the key factor influencing mule deer populations, and limited habitat is the major impediment to increasing deer numbers and hunting opportunity within the Blue Mountains MDMZ. The Blue Mountains MDMZ has been altered by landscape changes including conversion to croplands, grazing by domestic livestock, wildfire suppression, highway or road construction, invasion of noxious weeds, extensive wind power development, and urban/suburban development. These alterations have been detrimental to mule deer habitat.

Mule deer in the Blue Mountains MDMZ depend upon the shrublands, forested ridges, and steep canyons in the mountains and the shrub-steppe and bunchgrass covered Snake River breaks. These areas are very important in maintaining mule deer numbers because they provide habitats for fawning and fawn rearing, migration corridors, and escape cover. Retention, protection, and enhancement of these limited natural areas are a high priority. Riparian zones and high moisture meadows are also very limited across the Blue Mountains MDMZ. These areas are particularly important to lactating does raising fawns. During the hot, dry summers, these habitats provide lactating does the highest quality forage available unless they have access to irrigated hay or alfalfa. The riparian zones tend to shrink in size as the summer growing season progresses, particularly in the foothills and breaks, limiting availability of these habitats even further. Summer range, in particular, has the greatest influence on mule deer recruitment, likely resulting in mule deer being summer range limited in the Blue Mountains MDMZ. During the growing season of summer, lactating mule deer does require 17 to 32% greater nutritional levels compared to a non-lactating doe (Robbins 1993). A highly productive summer range is required to meet these nutritional needs.

Areas containing noxious weeds in the grasslands of the foothills and canyons of the mountains and Snake River breaks country are increasing over time (P. Wik, WDFW, personal

Mule deer bucks in the foothills of the Blue Mountains MDMZ. *Photo Paul Wik*

communication). Infestations of noxious weeds reduce the habitat quality for mule deer use and should be given high priority to maintain habitat effectiveness.

Forest management on National Forest lands is benefiting mule deer in some areas and decreasing productivity in other areas. The Department works with the Umatilla National Forest to ensure that benefits to mule deer are considered in future timber harvest and road management. Use of controlled burns and allowing natural fires to burn helps rejuvenate vegetation growth and improve forage for mule deer.

Since the mid-1990s, large tracts of marginally productive farmland across the Blue Mountains MDMZ have been enrolled into the Conservation Reserve Program (CRP). In Washington, about 600,000 ha of converted farmland were planted to perennial grasses, forbs, and shrubs; this makes up roughly 10% of the state's total agricultural lands. Most of these were planted with perennial grass cover to stabilize the soil, but occasionally native plants were included in the planting. Lands converted to CRP provide mule deer with refugia but usually offer little forage. Forage quality of CRP lands for mule deer are improved when alfalfa and other forbs are present in seed mixtures or supplemental plantings. Cost often precludes the

addition of forbs into a planting. However, when forbs are provided at no cost, or if the landowner is compensated, they frequently add forbs into the planting.

The most recent potential impact to mule deer in the Blue Mountains MDMZ is alternative energy development. Electricity generated by wind power currently is one of the fastest growing alternative energy sources in the region with large, numerous wind power sites already in operation between Walla Walla and Dayton, and Dayton and Pomeroy, and new development sites being planned near the Snake River breaks. Although wind power is generally considered a "green energy" source, there may well be associated impacts to mule deer and the habitat upon which they depend (Sawyer et al. 2002). Direct impacts can occur in the form of habitat loss and increased mortality because of road construction and operation. While the direct impacts to mule deer resulting from wind farm development are unknown, it is important that mule deer numbers and potential impacts be monitored (Hebblewhite 2011).

The Department also manages the Blue Mountains MDMZ for elk, and many of the habitat enhancement projects designed to benefit elk will improve habitat for mule deer, however the presence of elk can create interference competition with mule deer. Mule deer also share the Blue Mountains MDMZ with white-tailed deer, although the level of competition between these two species is unknown. Mule and white-tailed deer are managed in concert in the Blue Mountains MDMZ. Harvest opportunities for both antlered and antlerless white-tailed deer often exists in the foothills surrounding the mountains and in the Snake River breaks.

Special Considerations

1. Summer range limitations resulting in potential impacts to mule deer population growth are amplified in the Blue Mountains MDMZ because of the particularly dry conditions that develop during the summer growing season, particularly on the east side of the Blue Mountains. These conditions have the potential to be exacerbated by climate change.
2. The DPCA program in the Blue Mountains MDMZ has some of the highest numbers of damage tags in the state issued to farmers to control mule deer damage.

Clarkston has a special season to reduce urban deer, and Pomeroy has recently been the focus of additional harvest to relieve urban deer-human conflict.

3. Fire suppression in the Wenaha-Tucannon Wilderness and upper Mill Creek Watershed (GMU 157) have resulted in growth of climax vegetation communities and decreased productive habitat for mule deer.

4. Loss of CRP due to reductions in Federal funding has resulted in a decrease in available habitat.

5. Extensive wind power development has occurred in portions of the Blue Mountains MDMZ, but potential impacts to mule deer associated with wind power farms are unknown. The Department will monitor current and future research results from studies investigating potential influences to mule deer habitats and populations related to construction and operation of wind power farms.

6. Major restoration of mule deer habitats burned by the Grizzly Bear Complex and Tucannon Fires of 2015 is required.

7. The CTUIR and Nez Perce Tribe have ceded areas within the Blue Mountains MDMZ and the National Forest provides large areas of "open and unclaimed" land, where tribal harvest of mule deer may occur. The CTUIR contributes to our shared knowledge of mule deer harvest in the Blue Mountains MDMZ with qualitative information. The Nez Perce Tribe does not share harvest data with the Department.

The Cascade Mountains in western Okanogan County. *Photo Tom McCoy*

Mule Deer Management Zone: East Slope Cascades

Area Description

The East Slope Cascades MDMZ is located in north-central Washington and is bounded to the north by the border with British Columbia, the crest of the Cascade Mountains to the west, the Columbia and Okanogan Rivers to the east, and I-90 to the south (Figure 14). This zone covers an estimated 19,992 km^2 (7,719 mi^2; Table 5), and lies within the east central portion of the Northern Cascades physiographic province (Franklin and Dyrness 1973) along the mountains and foothills of the east slope of the Cascade Mountains, adjacent to the Columbia River in north central Washington.

Elevations range from 300 m (1,000 ft) along the Columbia River to nearly 3,300 m (10,000 ft) at the highest peaks along the Cascade Crest. The major soil types found in this

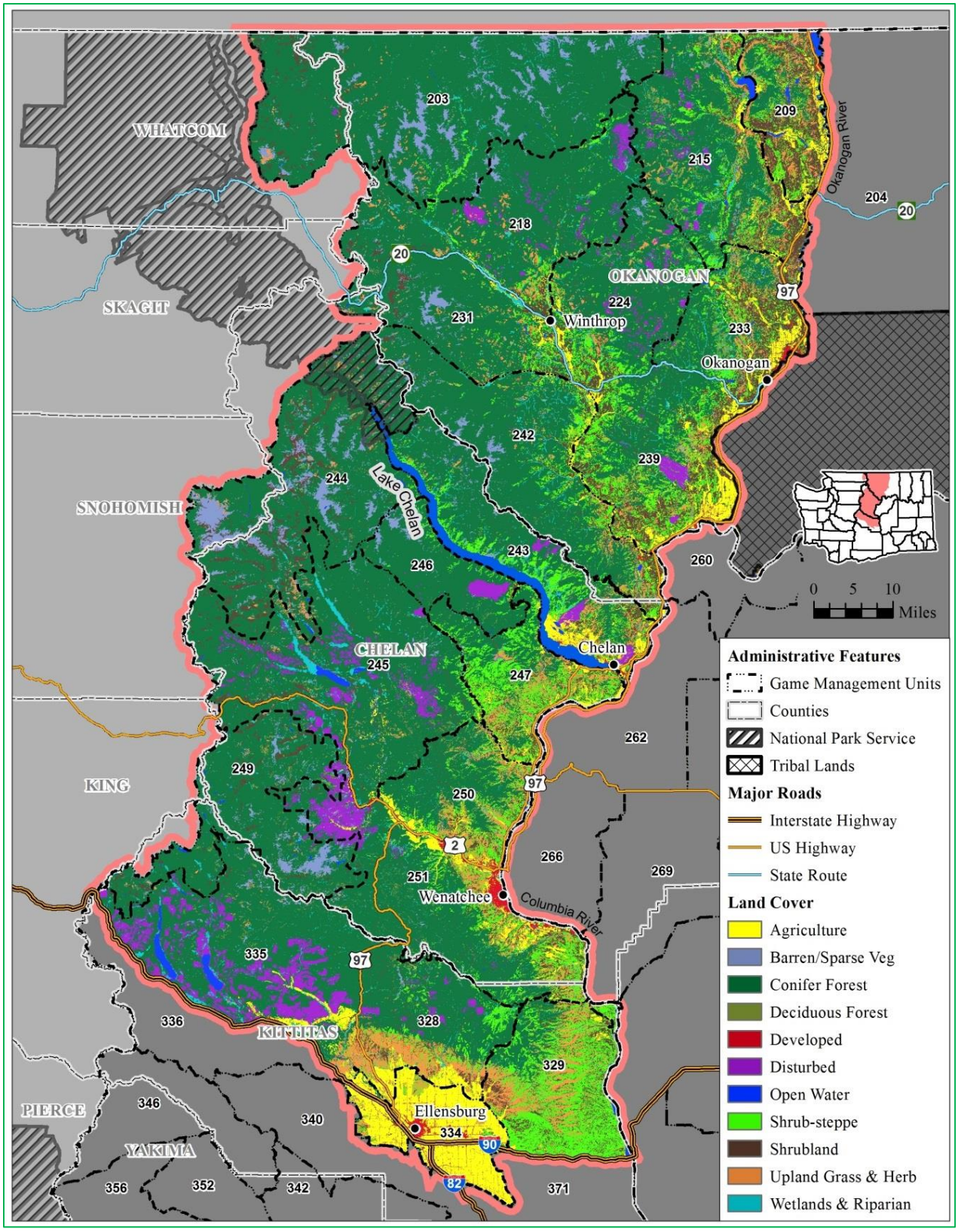

Figure 14. Location and vegetative cover of the East Slope Cascades MDMZ.

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portion of the east Cascades are haploxerolls, xerochrepts, and haploxeralfs (Franklin and Dyrness 1973). Climate of the region is characterized by hot, dry summers and cool winters. Most precipitation falls during winter in the form of snow.

Within the East Slope Cascades MDMZ zone, there are an estimated 12,812 km2 (4,947 mi2) of forested land, 1,750 km2 (676 mi2) of shrub-steppe, 1,338 km2 (517 mi2) of shrubland, 1,021 km2 (394 mi2) of agricultural land, 884 km2 (341 mi2) of upland grassland, and 386 km2 (149 mi2) of wetland and riparian habitat among other cover classes (Table 5). Vegetation found within the East Slope Cascades MDMZ area varies depending upon altitude and aspect and includes shrub-steppe vegetation, shrub communities, forest communities with dense over-story cover, and alpine meadows. Shrub-steppe communities are found at lower and intermediate elevations and on the exposed, south-facing slopes. Common associations include big sage-bluebunch wheatgrass and three-tipped sage-Idaho fescue. Ponderosa pine dominates forested areas at lower to intermediate elevations (Lillybridge et al. 1995). Quaking aspen (Populas sp.) occur near moist areas at mid elevations. At higher elevations, the grand fir-Douglas fir forest type is present along with lodgepole pine. Ponderosa pine, Douglas fir, and grand fir are found in both open and dense stands at both intermediate and higher elevations above 1,067 m (3,500 ft). White fir (A. concolor), grand fir, Pacific silver fir (A. amabilis), subalpine fir, Engelman spruce, and lodgepole pine are common on cool, moist sites at higher elevations. Alpine meadows and barren rocky areas are found at the highest elevations.

Mule deer in the Methow Valley of the East Slope Cascades Management Zone. *Photo Scott Fitkin*

Much of the zone is owned by public agencies (Table 10), with the Wenatchee and Okanogan National Forests, North Cascades National Park, Washington State Department of Natural Resources Trust lands, Washington State Parks, and the Department's Sinlahekin, Methow, Chelan, Wells, and Colockum Wildlife Areas the major public land holdings. Private timber companies also own large portions of forested areas within this zone. Most other lands held in private ownership are found along the valley bottomlands.

Table 10. Landownership area (km^2) and percentage of each in the East Slope Cascades MDMZ, 2015.

Landowner/ Manager	Area	Percent
Federal	13,012	65.1
Tribal	0	0.0
State	2,661	13.3
City/ County	0	0.0
Total Public	15,673	78.4
Private	4,323	21.6
TOTAL	19,996	100.0

Populations and Monitoring

The East Slope Cascades MDMZ is home to Washington's major migratory mule deer populations, with the largest wintering concentrations in Okanogan County's Methow Valley (Zeigler 1973). Zeigler (1973) and Myers et al. (1989) have shown that the majority of mule deer comprising these herds (80 - 90%) spend the summer raising fawns in the alpine meadows and subalpine basins along the Cascade Crest, moving to lower elevations below 1,370 m (4,500 ft) during the late fall where they spend the winter season. Mule deer in Chelan County showed similar movement patterns (WDFW, unpublished data).

Recent aerial survey and modeling results provided an estimated 47,000 mule deer within the East Slope Cascades MDMZ (WDFW 2013). While the largest herd, it is the second largest zone by area. Mule deer are present throughout the East Slope Cascades MDMZ with the highest densities observed during January through March on the low elevation traditional winter ranges. Based upon telemetry studies of radio marked adult female mule deer in the East Slope Cascades MDMZ (Myers et al. 1989, WDFW, unpublished data), mule deer were either resident,

or exhibited movement patterns that were seasonally migratory. Migratory deer moved up to 65 km (40 mi) straight-line distance between summer and winter seasonal use areas (Figure 2).

Recently observed pregnancy and fetal rates in East Slope Cascades MDMZ were 0.95 and 1.66 (Table 1), respectively. Mean annual survival rates observed during recent field studies of adult female mule deer from 2000 - 2007 (n = 50) were 0.92 within East Slope Cascades MDMZ (Figure 4). Investigations of deaths of radio marked adult female mule deer showed cougars, poaching, deer-vehicle collisions, and unidentified predators to be common sources of mortality, although the high survival rates would suggest these mortality sources are not limiting the adult female segment of the population.

Mule deer foraging in agricultural fields. *Photo Scott Fitkin*

Another potential influence to mule deer numbers in the East Slope Cascades MDMZ is interference competition with elk (Stewart et al. 2002). If harvest management strategies for elk within this zone become more restrictive, there is the likelihood that elk numbers and distribution will increase. Similarly, interference competition has also been documented between mule deer and cattle when present on seasonal mule deer ranges (Stewart et al. 2002), but the effects on mule deer of cattle grazing within the East Slope Cascades MDMZ are unknown. California bighorn sheep also share the range with mule deer in the East Slope Cascades MDMZ. Bighorn

sheep from the Quilomene, Swakane, Chelan Butte and Manson herds occupy mule deer winter range along the Columbia River from Vantage to Okanogan County and along the north shore of Lake Chelan. Current estimates of herd size for any of these individual bighorn populations is between 100 and 200 sheep, and competition between deer and sheep is limited.

Mule deer on winter range in western Okanogan County. *Photo Scott Fitkin*

Current population monitoring consists of late fall and early spring surveys to estimate age and sex ratios. Surveys conducted during November and December are flown by helicopter to count, classify, and estimate total deer in random sampling units. At the south end of the East Slope Cascades MDMZ, in Yakima and Kittitas counties, December ground surveys are done to estimate fawn:buck:doe ratios. Spring ground based surveys are conducted during March and April to estimate adult: fawn ratios and over-winter survival. In Yakima and Kittitas counties, aerial spring green-up surveys are also flown to estimate population.

Harvest Management

Mule deer harvest (Figure 15) in portions of the East Slope Cascades MDMZ is greatly influenced by weather conditions during the hunting season. Weather conditions during fall and early winter for the past 6 years have been average to below average in severity. Conservative harvest of antlerless mule deer is generally designed to maintain population stability or provide recreational opportunity. It is also used at times to limit herd growth, or reduce deer numbers in damage areas, or for responses to dramatic changes in carrying capacity such as those associated with the Carlton Complex fire.

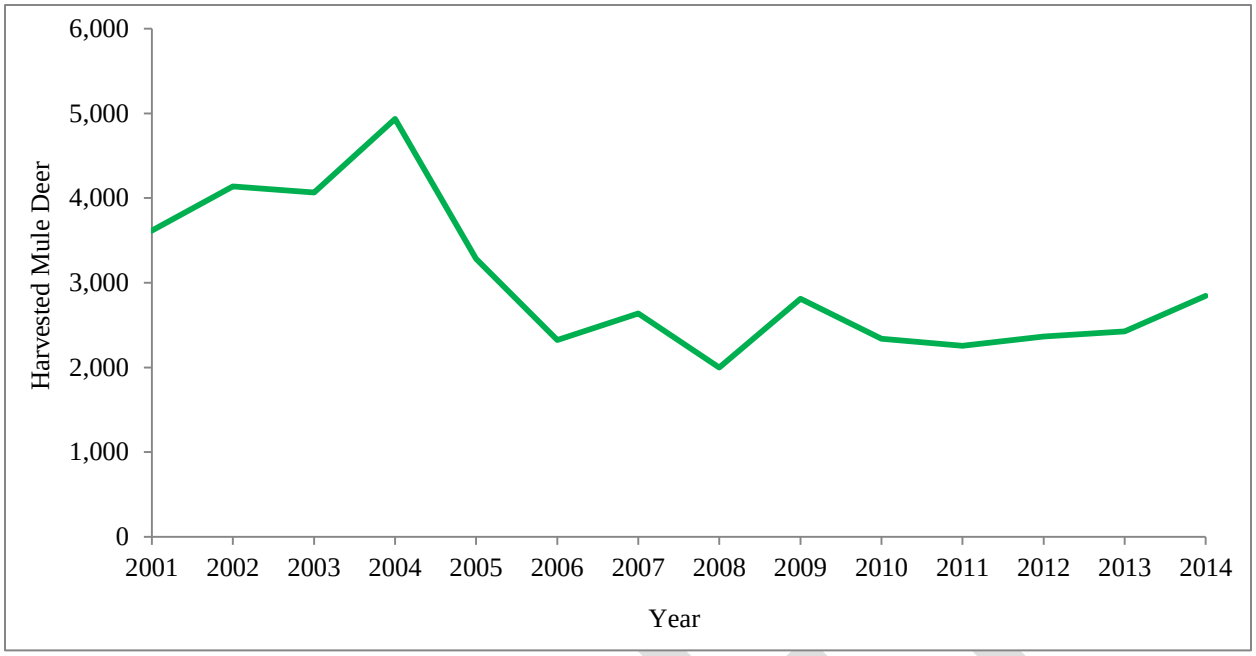

Figure 15. Estimates of annual harvest for mule deer (antlered and antlerless) during the general season in the East Slope Cascades MDMZ.

Habitat Management

Habitat quality has a great effect on potential mule deer abundance and recruitment. Mule deer habitat within the East Slope Cascades MDMZ can be divided into areas based upon seasonal use. Most (80 - 90%) of the mule deer within the East Slope Cascades MDMZ spend the summer season in lush, high mountain meadows and subalpine basins (Zeigler 1973, Myers et al. 1989). These productive, high mountain habitats make the East Slope Cascades MDMZ extremely important to mule deer. These optimal habitat conditions provide nutritious forage for lactating does and contribute to high fawn survival and recruitment. These high elevation summer ranges are vast (Figure 2) and managed by the Okanogan-Wenatchee National Forest and the Washington State Department of Natural Resources; therefore, summer habitat improvement in the East Slope Cascades MDMZ is lower in priority than elsewhere. These habitats are not limited, face little threat of alteration, and are at present self-sustaining. Spring and fall ranges are very important because they contain the corridors used by migrating mule deer moving between summer and winter ranges (Figure 2). Also, spring ranges offer the first opportunity for mule deer to reverse the energy deficit they have been experiencing all winter. Fall ranges have added importance because they provide forage needed by does to improve body condition after a summer of lactation and fawn rearing before entering the breeding season and stress of the winter. On winter ranges, mule deer move to a small portion of their annual range

Mule deer doe and fawns in the Methow Valley. *Photo Scott Fitkin*

to find forage and thermal cover. During times of nutritional stress, they are vulnerable to disturbance. Sawyer et al. (2006) found that because mule deer are geographically restricted during the winter season, the quality of the winter range can affect deer survival and recruitment. For these reasons within the East Slope Cascades MDMZ, the greatest gains will come by focusing habitat improvement and acquisition projects on spring, fall, and winter use areas, and reducing disturbance to wintering mule deer.

Many of the habitat improvement projects specifically designed to enhance mule deer habitats have been ongoing within the East Slope Cascades MDMZ. Projects on Department lands have involved prescribed burning, forest thinning, noxious weed control, and planting of native shrubs to improve winter ranges. Habitat improvement projects conducted on national forest lands include forest thinning and other timber harvest, prescribed burning, planting bitterbrush and other native shrubs, and fence removal. Much of the mid-elevation forests used by mule deer during the spring and fall are comprised of closed-canopy, over-stocked stands of mixed conifer species with little understory vegetation. Timber management treatments such as thinning or burning would open the canopy, promote serial stage vegetation communities, and improve these timber stands for mule deer.

The WSDOT, in partnership with NGOs and other agencies, are working to install wildlife crossing structures in this zone. The sites with the highest priority are SR 20 at the base of the Loop Highway near Beaver Creek, and the segment between Winthrop and Mazama, and SR 97 north of Omak to reduce the level of deer-vehicle collisions; these areas have been the site of thousands of deer-vehicle collisions over the last 25 years. To provide adequate public safety, it is imperative that these activities continue and expand in the future. In addition, this will help to ensure the well-being of these important mule deer herds.

Human-Mule Deer Conflict

Wherever mule deer occur within agricultural lands in eastern Washington, deer -landowner conflict can occur. The Department has the primary role in mitigating agricultural damage caused by mule deer, and the creation of DPCAs is one approach showing great promise. The Department has also taken measures to reduce agriculture damage within the East Slope MDMZ by creating four deer areas where hunters play a role in reducing damage. A number of second

The Methow Wildlife Area, an important winter range, near Winthrop. *Photo Tom McCoy*

deer permits are issued each year through the Special Deer Permit drawing process based on the amount of damage within each deer area. Hunters are restricted to harvesting an antlerless deer on private lands. Recently, an increasing number of mule deer are residing in urban or suburban communities in eastern Washington. While not agricultural damage in many cases, the Department takes the issues created by these deer seriously, and attempts to assist landowners with remedies. Municipalities currently supporting mule deer numbers beyond the tolerance of many local landowners and creating potential public safety issues include Conconully, Okanogan, Twisp, and Winthrop.

Mule deer buck in the Sinlahekin Valley. *Photo Justin Haug*

Poaching Abatement

It appears that illegal harvest of adult female mule deer is low. Since interest in mule deer bucks is high, many hunters have expressed concerns about the level of illegal harvests of adult male mule deer. Large mule deer antlers are highly valued, and dealers pay large sums of money to obtain sets of trophy quality antlers. Unfortunately, commercialization of limited resources like large-antlered mule deer bucks leads to an increase in illegal harvests to satisfy those markets, and can affect populations. While poaching has less of an effect on mule deer than habitat loss, the Department still gives enforcement of regulations a high priority.

Special Considerations

1. Loss of the integrity of continuous migration corridors
2. Major restoration of mule deer habitats burned by the Carlton Complex Fire in 2014 is required, along with the Chelan Complex, Okanogan Complex, and Wolverine Fires of 2015.
3. Continued development and fragmentation of low-elevation habitats
4. Increasing use and distribution of off-road vehicles along with increasing disturbance on winter ranges while mule deer are concentrated
5. Increasing prevalence of invasive weeds on traditional winter ranges, in combination with increasing fire return intervals, are resulting in a reduction of shrub vegetation communities
6. Aging forests that provide little forage habitat for mule deer
7. The Yakama Nation and the Muckleshoot Indian Tribe assert traditional hunting on GMUs east of the Cascade crest including part of the East Slope Cascades MDMZ. The National Forest provides large areas of "open and unclaimed" land, where tribal harvest of mule deer may occur. Neither tribe shares harvest information for this MDMZ with the Department.

Summer mule deer range in the Paysaten Wilderness. *Photo Scott Fitkin*

The Naches River Valley. *Photo Northwest Sportsmen Magazine*

Mule Deer Management Zone: Naches

Area Description

The Naches MDMZ is sixth among mule deer management zones in size and covers an estimated area of 5,285 km^2 (2041 mi^2; Table 5). The Naches MDMZ is located in central Washington and is bounded on the north by I-90, the crest of the Cascade Mountains to the west, I-82 and the U.S. Army's Yakima Training Center to the east, and the Yakama Reservation to the south (Figure 16). In Kittitas County, it includes all of GMU 336. In Yakima County, it includes all of GMUs 352, 356, 360, 364, and 368. GMUs 340, 342, and 346 are shared between the two counties. The zone lies within the northern portion of the Southern Washington Cascades physiographic province and also includes the extreme western edge of the Columbia Basin physiographic province (Franklin and Dyrness 1973). Elevations range from 320m (1,050 ft) along the Yakima River to nearly 3,300 m (10,000 ft) at the highest peaks along the Cascade Crest. Climate of the region is characterized by hot, dry summers and cool winters. Most precipitation falls during winter, in the form of snow at higher elevations with little snow accumulating at lower elevations.

Within the Naches MDMZ, there are an estimated 3,230 km^2 (1,247 mi^2) of forested habitats, 561 km^2 (217 mi^2) of shrub-steppe, 382 km^2 (148 mi^2) of agricultural lands, 319 km^2

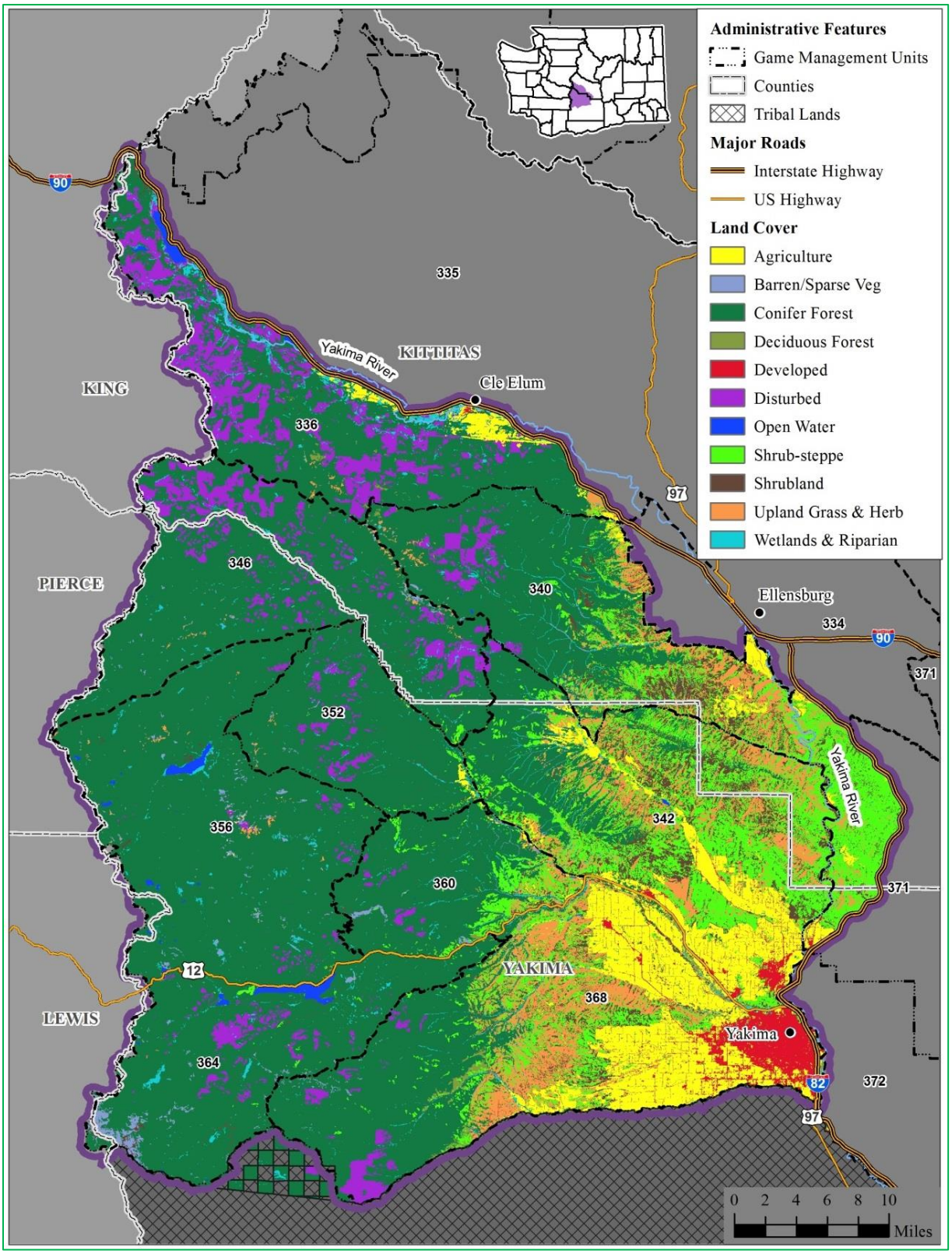

Figure 16. Location and vegetative cover of the Naches MDMZ.

2236

(123 mi^2) of upland grasslands, 211 km^2 (81 mi^2) of shrubland, and 79 km^2 (31 mi^2) of wetlands and riparian among other cover classes (Table 5). Vegetation found within the Naches MDMZ area varies with altitude and aspect, and includes shrub-steppe vegetation, shrub communities, forest communities with dense over-story cover, and alpine meadows. Shrub-steppe communities are found at lower and intermediate elevations and on the exposed, south-facing slopes. Common associations include big sage-bluebunch wheatgrass. Ponderosa pine dominates forested areas at lower to intermediate elevations (Lillybridge et al. 1995). At higher elevations, the grand fir-Douglas fir forest type is present along with lodge pole pine. Grand fir, Pacific silver fir, subalpine fir, and lodge pole pine are common on cool, moist sites at higher elevations, about 1,067 m (3,500 ft). Alpine meadows and barren rocky areas are found at the highest elevations.

Much (72.5%) of the zone is owned by public agencies (Table 11) with the Wenatchee and Okanogan National Forests, Washington State Department of Natural Resources Trust lands, Washington State Parks lands, and the Department's Oak Creek, Wenas, and L. T. Murray Wildlife Areas the major land holdings. Most other lands held in private ownership are found along the foothills and valley bottomlands.

Table 11. Landownership area (km^2) and percentage of each in the Naches MDMZ, 2015.

Landowner/ Manager	Area	Percent
Federal	2,554	48.3
Tribal	0	0.0
State	1,402	26.5
City/ County	2.0	0.0
Total Public	3,959	74.9
Private	1,327	25.1
TOTAL	5,286	100.0

Populations and Monitoring

Mule deer in the Naches MDMZ represent a mix of migratory and resident populations. Migratory mule deer spend the summer raising fawns in the alpine meadows and subalpine

basins along the Cascade Crest and higher elevations, moving to lower elevations during the late fall to spend the winter season.

Since 2011, aerial survey and modeling results provided a spring population estimate of 5,400 mule deer within the Naches MDMZ (WDFW 2013). Mule deer abundance in this zone is one of the lowest, although it is also one of the smaller zones. Mule deer are present throughout the Naches MDMZ with the highest densities observed during January through March and April on the low elevation traditional winter ranges.

On-going telemetry studies are ongoing to provide managers with survival and movement information; annual survival rates of 77% for adult female mule deer have been observed after two years of field study (D. Vales, unpublished data). Predation by cougars is the most common cause of death of radio marked deer. Since 2004, deer in this zone have been increasingly stricken with deer hair-loss syndrome, a condition caused by an exotic louse. The mule deer population declined as a result (Bernatowicz et al. 2011), but has started to rebound. The common predator species within this MDMZ include cougar, coyotes, black bear, and bobcat.

Mule deer in the Naches MDMZ may also be influenced by interference competition with elk (Stewart et al. 2002). When elk and mule deer ranges over-lap, mule deer tend to leave the

Mule deer in the Naches MDMZ. *Photo Jeff Bernatowicz*

area (Johnson et al. 2000), with a potential net decrease in available mule deer range the result. Similar responses by mule deer have been observed when cattle are present on seasonal mule deer ranges (Stewart et al. 2002), but the range of effects of cattle grazing within the Naches MDMZ on mule deer are unknown. Bighorn sheep also share the range with mule deer in the Naches MDMZ, but their distribution is restricted, and any potential influences of competition between deer and sheep are likely limited as well.

Current population monitoring consists of late fall and early spring surveys to estimate abundance and age and sex ratios. Ground surveys are conducted during November and December to estimate age and sex ratios. Spring surveys are flown to count and classify deer in randomly selected survey units during March and April, and estimate over-winter survival.

Harvest Management

Mule deer harvests of bucks in the Naches MDMZ have shown decreasing trends in recent years (Figure 17) while hunter success rates have remained relatively constant (See Appendix A).

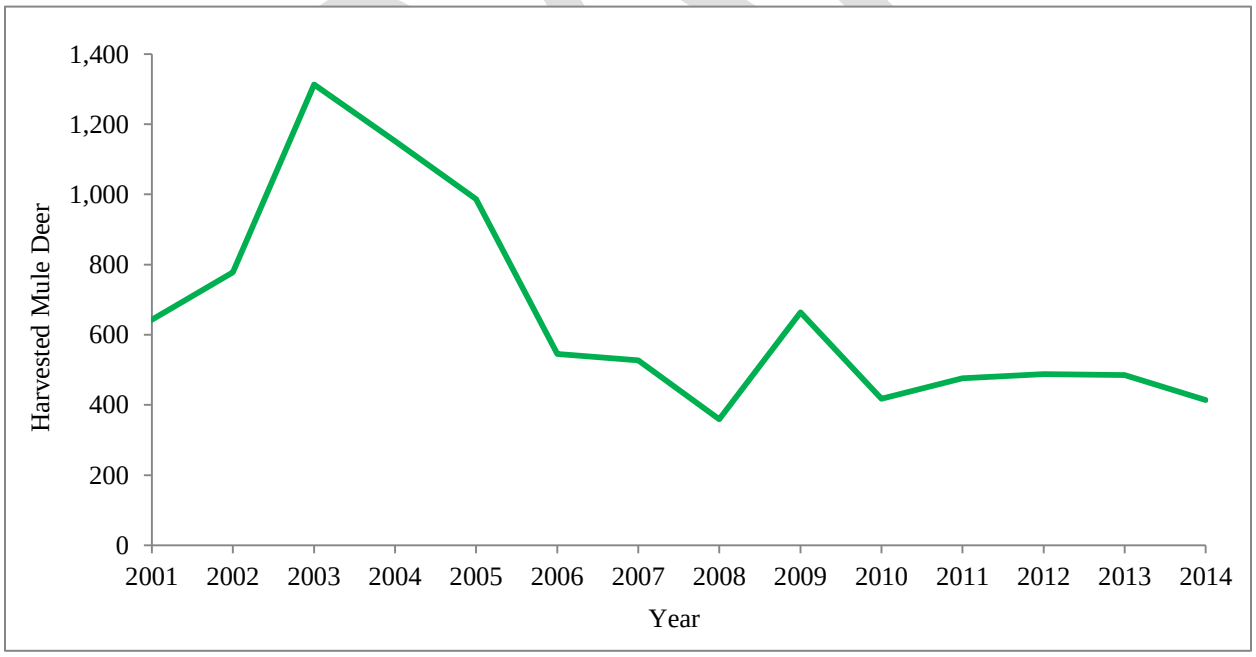

Figure 17. Estimates of annual harvest for mule deer (antlered and antlerless) during the general season in the Naches MDMZ.

Habitat Management

Habitat quality has the greatest effect on potential mule deer abundance and recruitment. Mule deer habitat within the Naches MDMZ can be divided into major ranges based upon seasonal use. A portion of the mule deer population within the Naches MDMZ spends the summer season in lush, high mountain meadows and subalpine basins. These high mountain habitats are highly productive due to the nutritious forage available for lactating does that contribute to high fawn survival and recruitment. These high elevation summer ranges are relatively abundant and in public ownership. Summer habitat improvement in the Naches MDMZ should be lower in priority since these habitats are not limited, but these ranges could provide improved habitat for deer through regular treatments of thinning and burning. Spring and fall ranges are very important because these ranges contain the corridors used by migrating mule deer moving between summer and winter ranges. Spring ranges offer the first opportunity for mule deer to reverse the energy deficit the deer have been experiencing all winter. Fall ranges are of added importance. These ranges can provide forage needed by adult female mule deer to improve body condition following a long period of lactation and fawn rearing, before going into the breeding season and scarcity of the winter season. Winter ranges provide mule deer with forage and thermal cover during a time of nutritional stress when deer are limited to a relatively small portion of their annual range. Because mule deer are forced onto a restricted geographic area during the winter season, the quality of the winter range has the potential to affect deer survival and recruitment (Sawyer et al. 2006). For these reasons, habitat improvement and acquisition projects within the Naches MDMZ should focus on improving and preserving spring, fall, and winter use areas. Browse planting and regeneration should be encouraged on winter use areas. Strictly regulating access to Department lands and other important use areas, even during hunting season, would improve habitat quality, deer use, and reduce disturbance associated with human activities.

A number of habitat improvement projects specifically designed to enhance mule deer habitats have been ongoing within the Naches MDMZ. Projects on Department lands have involved prescribed burning, forest thinning, noxious weed control, and planting of native shrubs to improve winter ranges. Habitat improvement projects conducted on national forest lands include forest thinning and other timber harvest, and prescribed burning.

Human-Mule Deer Conflict

Wherever mule deer occur within agricultural lands in eastern Washington, deer-landowner conflict can occur. The Department has the primary role in mitigating agricultural damage caused by mule deer, and the creation of DPCAs is one approach showing great promise.

High elevation summer range in the Naches Management Zone. *Photo WDFW*

Recently, an increasing number of mule deer are residing in urban or suburban communities in eastern Washington. While not agricultural damage in many cases, the Department takes the issues created by these deer seriously, and attempts to assist landowners with remedies. Mule deer numbers are beyond the tolerance of some local landowners and are creating potential public safety issues in the river bottom area west and north of Ellensburg.

Poaching Abatement

It appears that the illegal harvest of adult female mule deer is very low, although good information is lacking. Since interest in mule deer bucks is high, many hunters have expressed concerns about the level of illegal harvests of adult male mule deer. While poaching has less of an effect on mule deer than habitat loss, the Department still expects compliance with regulations and focuses enforcement to toward violators

Special Considerations

1. Landscape level changes in vegetative cover and the potential effects to mule deer
2. Continued development and fragmentation of low-elevation habitats
3. Increasing use and distribution of off-road vehicles
4. Old age forest in winter/spring ranges
5. The Yakama Nation and the Muckleshoot Indian Tribe assert traditional hunting on GMUs east of the Cascade crest including part of the Naches MDMZ. The National Forest provides large areas of "open and unclaimed" land, where tribal harvest of mule deer may occur. Neither tribe shares harvest information with the Department for this MDMZ.

The Klickitat River Canyon on the Klickitat Wildlife Area. *Photo Sue Van Leuven*

Mule Deer Management Zone: East Columbia Gorge

Area Description

The East Columbia Gorge MDMZ is smallest of the seven mule deer management zones in size, covering an estimated 4,547 km^2 (1,756 mi^2;Table 5). The East Columbia Gorge MDMZ is located in south-central Washington and is bounded to the north by the northern border of the Yakama Indian Reservation, the Klickitat River to the west, GMU 373 to the east, and the Columbia River to the south (Figure 18). The East Columbia Gorge MDMZ includes GMUs 382 in Klickitat and Yakima Counties and 388 in Klickitat County. The zone lies within the northern portion of the Southern Washington Cascades physiographic province and also includes the extreme western edge of the Columbia Basin physiographic province (Franklin and Dyrness 1973). Elevations range from 190 m (623 ft) along the Columbia River to nearly 1,782 m (5,845

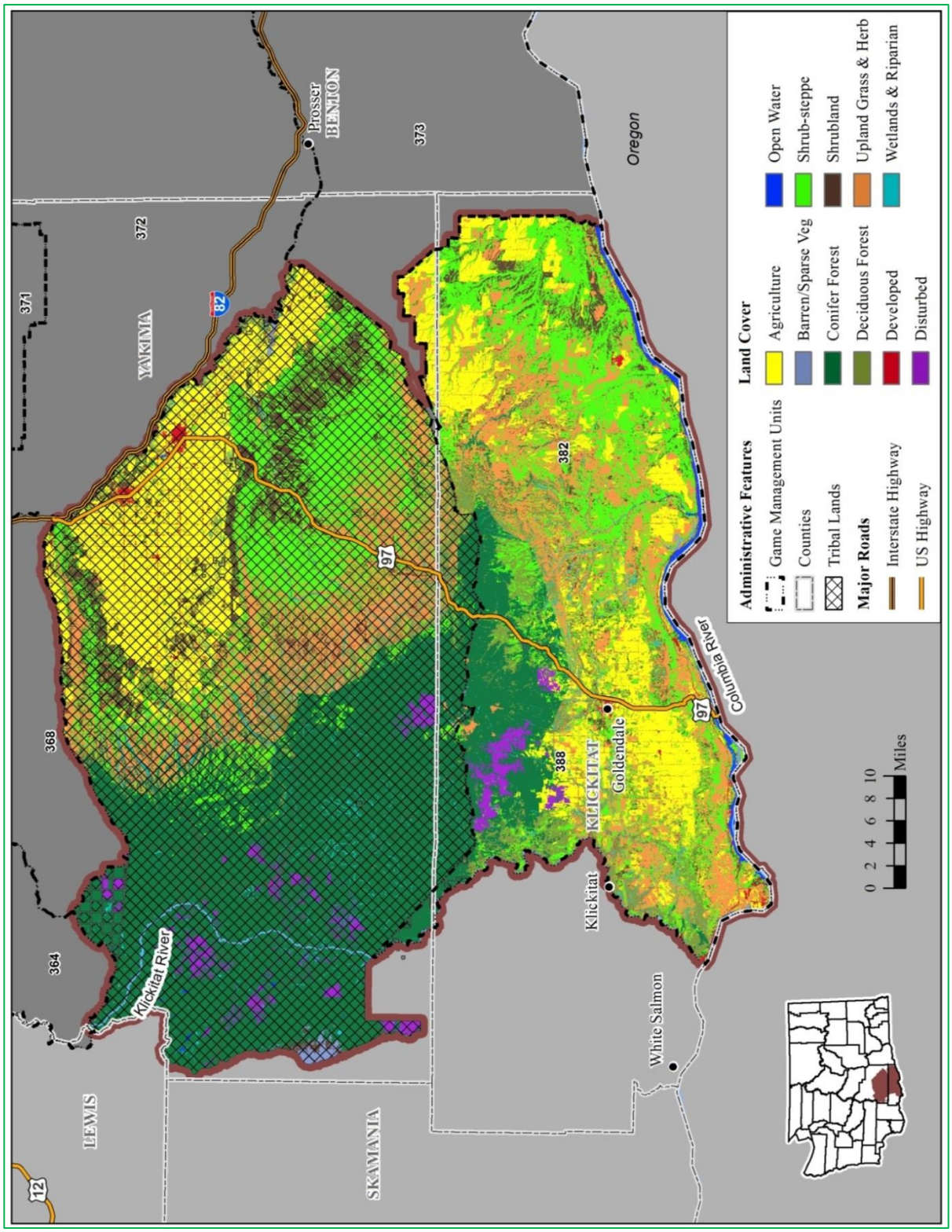

Figure 18. Location and vegetative cover classes of the East Columbia Gorge MDMZ.

2349

ft). Climate of the region is characterized by hot, dry summers and cool winters. Most precipitation falls during winter in the form of both rain and snow.

Within the East Columbia Gorge MDMZ, there are an estimated 1,544 km^2 (596 mi^2) of forested land, 931 km^2 (359 mi^2) of shrub-steppe, 744 km^2 (287 mi^2) of agricultural land, 700 km^2 (270 mi^2) of upland grassland, 200 km^2 (77 mi^2) of shrubland, and 80 km^2 (31 mi^2) of riparian wetland among other cover classes (Table 5). Vegetation found within the East Columbia Gorge MDMZ varies depending upon altitude and aspect, and includes shrub-steppe vegetation, shrub communities, forest communities with dense over-story cover, and alpine meadows. Shrub-steppe communities are found at lower and intermediate elevations and on the exposed, south-facing slopes. A unique feature of the region is the presence of the largest remaining oak (*Quercus* sp.) forests in Washington. Ponderosa pine dominates the forested areas at lower to intermediate elevations (Lillybridge et al. 1995). Higher in elevation, the grand fir-Douglas fir forest type is present along with lodge pole pine 1,067 m (3,500 ft). Grand fir, Pacific silver fir, subalpine fir, and lodge pole pine are common on cool, moist sites at higher elevations.

Much of the zone is privately owned (Table 12). Public lands in the East Columbia Gorge MDMZ include the USFS- Columbia River Gorge National Scenic Area, Washington State Department of Natural Resources Trust lands, the Department's Klickitat Wildlife Area and BLM. Private timber companies also own portions of forested areas within this zone.

Table 12. Landownership area (km^2) and percentage of each in the East Columbia Gorge MDMZ, 2015.

Landowner/ Manager	Area	Percent
Federal	105	1.2
Tribal	5,104	60.0
State	247	2.9
City/ County	0	0.0
Total Public	352	4.1
Private	3,053	35.9
TOTAL	8,509	100.0

Populations and Monitoring

Mule deer in East Columbia Gorge MDMZ represent a mix of migratory and resident populations. Migratory mule deer spend the summer raising fawns in the alpine meadows and subalpine basins along the Cascade Crest and higher elevations of the Simcoe Mountains, moving to lower elevations during the late fall to spend the winter season (McCorquodale 1996). Mule deer are present throughout the East Columbia Gorge MDMZ with the highest densities observed during January through March and April on the low elevation winter ranges. McCorquodale (1996) observed densities 30 – 78 deer/ km^2 wintering in the Klickitat Basin.

There are no current data on annual survival rates of mule deer in East Columbia Gorge MDMZ, however McCorquodale (1996) reported results from telemetry studies here during the early 1990s with estimated survival rates for adult females and males at 0.82 and 0.50, respectively. Hunting mortality and poaching were major causes of death in marked deer using the Klickitat Basin (McCorquodale 1996). In addition to legal hunting, common mortality sources include disease, predation, and deer-vehicle collisions. The mule deer population in the East Columbia Gorge MDMZ has declined in recent years, which is reflected in the declining harvest trends (WDFW 2013). Lice infestations and hair loss syndrome has been documented in mule deer (Bernatowicz et al. 2011) and likely contribute to the decline in mule deer numbers. Common

A mule deer buck on summer range in the East Columbia Gorge MDMZ. *Photo Scott McCorquodale*

predator species include cougar, bobcat, black bear, and coyote. Current population monitoring consists of summer, late fall, and early spring surveys to estimate age and sex ratios. Ground surveys are conducted during August and March to estimate pre hunt buck-doe and doe-fawn ratios and adult-fawn ratios, respectively. Late fall surveys are flown by helicopter to count and classify deer in appropriate habitat within GMUs 388 and 382 during December.

Harvest Management

Harvests of mule deer bucks in the East Columbia Gorge MDMZ has shown decreasing trends in recent years (Figure 19) while hunter success rates have remained relatively constant (See Appendix A). Mule deer buck harvests during the general season within most GMUs in this zone have been managed for a minimum post-season ratio of >15 buck: 100 does.

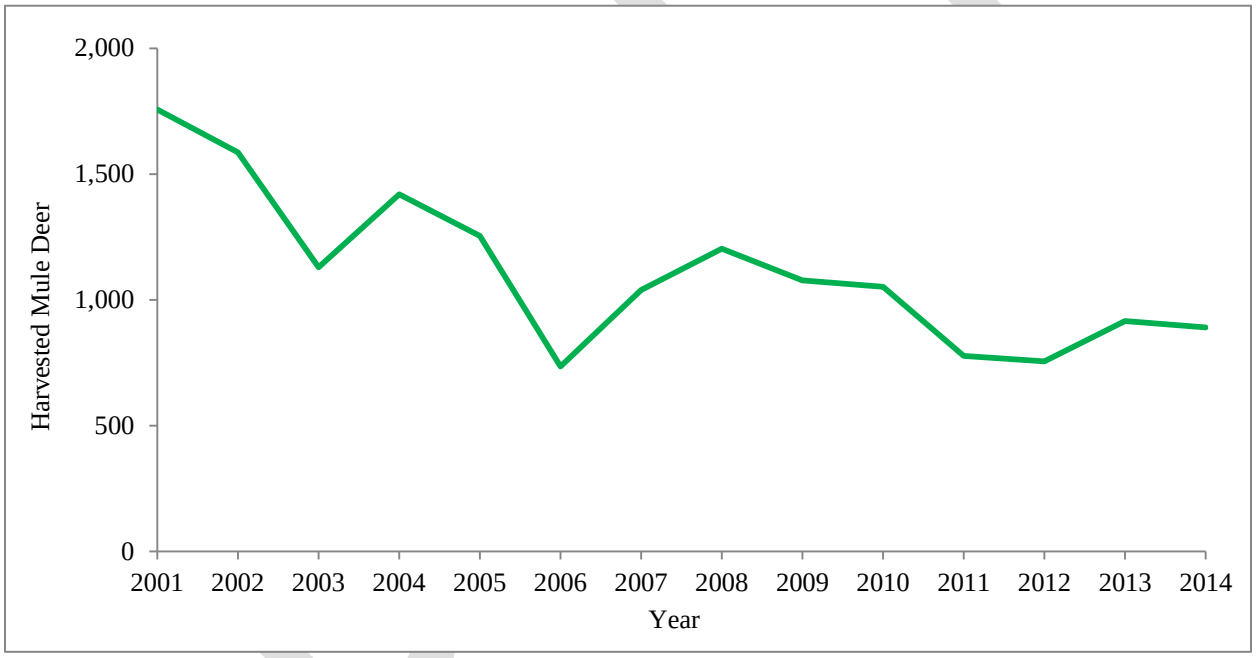

Figure 19. Estimates of annual harvest for mule deer (antlered and antlerless) during the general season in the East Columbia Gorge MDMZ.

Habitat Management

Habitat quality has the greatest effect on mule deer abundance and recruitment. Mule deer habitat within the East Columbia Gorge MDMZ can be divided into major ranges based upon seasonal use. Summer habitat improvement in the East Columbia Gorge MDMZ should be lower in priority since these habitats are not limited, but these ranges could provide improved habitat for deer through regular treatments of thinning and burning. Spring and fall ranges are

Lupine covered meadow on the Klickitat Wildlife Area. *Photo David Anderson*

very important because these ranges contain the corridors used by migrating mule deer moving between summer and winter ranges. Spring ranges offer the first opportunity for mule deer to reverse the energy deficit the deer have been experiencing all winter. Fall ranges are of added importance. These ranges can provide forage needed by adult female mule deer to improve body condition following a long period of lactation and fawn rearing, before going into the breeding season and scarcity of the winter season. Winter ranges provide mule deer with forage and thermal cover during a time of nutritional stress when deer are limited to a relatively small portion of their annual range. Because mule deer are forced onto a restricted geographic area during the winter season, the quality of the winter range has the potential to affect deer survival and recruitment (Sawyer et al. 2006). For these reasons, habitat improvement and acquisition projects within the East Columbia Gorge MDMZ should focus on improving and/or preserving spring, fall, and winter use areas. Browse planting and regeneration should be encouraged on winter use areas. Strictly regulating access to Department lands during critical times would improve habitat quality, deer use, and reduce disturbance associated with human activities.

A number of habitat improvement projects specifically designed to enhance mule deer habitats have been ongoing within the East Columbia Gorge MDMZ. Projects on Department lands have involved prescribed burning, forest thinning, noxious weed control, and planting of native shrubs to improve winter ranges. Habitat improvement projects conducted on national forest lands include forest thinning and other timber harvest, and prescribed burning.

Future acquisition or conservation easements to protect important mule deer range include winter use areas in the Rock Creek drainage in eastern Klickitat County as well as forestlands in the Simcoe Mountains. The Department often enters into cooperative habitat management with landowners to facilitate improved habitat conditions and maintain and/or increase hunting access. There are opportunities to enhance deer habitat through management agreements with Washington State Department of Natural Resources on the Dalles Mountain Natural Area Preserve, Washington State Parks on the Columbia Hills State Park, and Bureau of Land Management lands in the Rock Creek drainage.

Human-Mule Deer Conflict

Wherever mule deer occur within agricultural lands in eastern Washington, deer /landowner conflict can occur. The Department has the primary role in mitigating agricultural damage caused by mule deer, and the creation of DPCAs is one approach showing great promise. Recently, an increasing number of mule deer are residing in urban or suburban communities in eastern Washington. While not agricultural damage in many cases, the Department takes the issues created by these deer seriously, and attempts to assist landowners with remedies. Goldendale is the only municipality currently supporting mule deer numbers beyond the tolerance of local landowners and are creating potential public safety issues.

The East Columbia Gorge MDMZ has experienced extensive alternative energy development in recent years. Electricity generated by wind power currently is one of the fastest growing alternative energy sources in the region with large wind power sites already in operation along the Columbia River breaks. Although wind power is generally considered a "green energy" source, there may well be associated impacts to mule deer and the habitat upon which they depend (Sawyer et al 2002). Direct impacts can occur in the form of habitat loss and increased mortality because of road construction and operation. While the direct impacts to mule deer resulting from wind farm development are unknown, it is important that mule deer numbers and potential impacts be monitored (Hebblewhite 2011).

The Klickitat Wildlife Area. *Photo Sue Van Lueven*

Special Considerations

1. Approximately 2% of the deer observed during the March 2014 Klickitat deer survey had noticeable signs of the hair-loss syndrome.

2. Vineyard development in mule deer winter range in Klickitat County has been increasing. The Department and the Columbia River Gorge National Scenic Area are currently working on a plan to address land conversion for vineyard development and its accumulative impacts on mule deer. Included in this is consideration of the impacts of exclusionary fencing on mule deer movement patterns.

3. Extensive wind power development has occurred in portions of the East Columbia Gorge MDMZ, but potential impacts to mule deer associated with wind power farms are unknown. The Department will monitor current and future research results from studies investigating potential influences to mule deer habitats and populations related to construction and operation of wind power farms.

4. Feral horses inhabit the northern portion of the East Columbia Gorge MDMZ on the Yakama Reservation; as the population of feral horses has increased over time, dispersing horses have expanded their range to the south, off reservation. Increasing densities of feral horses could

potentially result in competition with mule deer for forage and space, but the level of competition is unknown. The Department will monitor for any deleterious effects to mule deer associated with the presence of feral horses on mule deer ranges.

5. The Yakama Nation asserts traditional hunting on GMUs east of the Cascade crest including part of the East Columbia Gorge MDMZ. A small proportion of "open and unclaimed" public lands exist in the MDMZ where tribal harvest of mule deer may occur. The Yakama Nation does not share harvest information with the Department.

Literature Cited

Anderson, C.C. and R.J. Scherzinger. 1975. Improving quality of winter forage for elk by cattle grazing. Journal of Range Management 28:120-125.

Ashton, I. W. 2010. Observed and projected ecological response to climate change in the Rocky Mountains and Upper Columbia Basin: A synthesis of current scientific literature. Natural Resource Report NPS/ROMN/ NRR—2010/220. National Park Service, Fort Collins, Colorado. 98 pp. Available online at: http://www.greateryellowstonescience.org/download_product/958/0

Austin, D. D. and P. J. Urness. 1986. Effect of cattle grazing on mule deer diet and area selection. Journal of Range Management 39: 18-21.

Baker, D. L. and N. T. Hobbs. 1985. Emergency feeding of mule deer during winter: tests of a supplemental ration. Journal of Wildlife Management 49:934-942.

Ballard, W. B., D. Lutz, T. W. Keegan, L. H. Carpenter, and J. C. deVos, Jr. 2001. Deer-predator relationships: a review of recent North American studies with emphasis on mule and black-tailed deer. Wildlife Society Bulletin 29:99-115.

Ballard, W. B., D. Lutz, T. W. Keegan, L. H. Carpenter, and J. C. deVos, Jr. 2003. Deer-predator relationships: a review of recent North American studies with emphasis on mule and black-tailed deer. In: deVos, J.C., M. R. Conover, and N.E. Headrick. Mule deer conservation: Issues and management strategies. Jack H. Berryman Institute Press, Utah State University, Logan, UT, USA.

Bartmann, R. M., G. C. White, and L. H. Carpenter. 1992. Compensatory mortality in a Colorado mule deer population. Wildlife Monographs 121.

Bernatowicz, J. A., K. Mansfield, J. W. Mertins, and W. Moore. 2011. Hair-loss syndrome in deer in south central Washington. IN McCorquodale, S.M., Ed. 2011. Proceedings of the 8th Western States and Provinces Deer and Elk Workshop – 2009. Washington Department of Fish and Wildlife, Olympia.

Bienz, C. S. 1991. Using mule deer antler beam diameters as a possible index of habitat quality. Applied Animal Behaviour Science 29: 509.

Bleich, V. C. and T. J. Taylor. 1998. Survivorship and cause-specific mortality in five populations of mule deer. Great Basin Naturalist 58:265-272.

2501 Bowyer, T. R., 1986. Antler characteristics as related to social status of male southern
2502 mule deer. The Southwest Naturalist 31:289-298.
2503 Brooks, M. L., 2008. Chapter 3: Plant invasions and fire regimes. In: Wildland fire in
2504 ecosystems: fire and nonnative invasive plants. Gen. Tech. Rep. RMRS-GTR-42-
2505 vol. 6. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky
2506 Mountain Research Station. 355 p.
2507 Caughley, G. 1977. Analysis of vertebrate populations. John Wiley and Sons. New York,
2508 NY. 234 p.
2509 Coe, P. K., B. K. Johnson, K. M. Stewart, and J. G. Kie. 2005. Spatial and Temporal
2510 Interactions of Elk, Mule Deer, and Cattle. Pages 150-158 in Wisdom, M. J.,
2511 technical editor, The Starkey Project: a synthesis of long-term studies of elk and
2512 mule deer.
2513 Cook, R. A., T.A. Stephenson, W. L. Myers, J. G. Cook, and L. A. Shipley. 2007.
2514 Validating predictive models of nutritional condition for mule deer. Journal of
2515 Wildlife Management 71:1934-1943.
2516 Cook, R. A., J. G. Cook, T. R. Stephenson, W. L. Myers, S. M. McCorquodale, D. J.
2517 Vales, L. L. Irwin, P. B. Hall, R. D. Spencer, S. L. Murphie, K. A. Schoenecker,
2518 and P. J. Miller. 2010. Revisions of rump fat and body scoring indices for deer,
2519 elk, and moose. Journal of Wildlife Management 74:880-896.
2520 DeCesare, N. J., M. Hebblewhite, M. Bradley, K. G. Smith, D. Hervieux, and L. Neufeld.
2521 2012. Estimating ungulate recruitment and growth rates using age ratios. Journal
2522 of Wildlife Management 76:144-153.
2523 DeVos, J. C., M. R. Conover, N. E. Headrick, editors. 2013. Mule deer conservation:
2524 Issues and management strategies. Berryman Institute Press, Utah State
2525 University, Logan, Utah. 240p.
2526 Duda, M.D., M. Jones, T. Beppler, S. Butzen, S.J. Bissell, A. Crisione, P. Doherty, G. L.
2527 Hughes, and A. Lanier. 2014. Washington hunter's participation in hunting various
2528 species and their opinions on and attitudes toward various hunting regulations. Report to
2529 Washington Department of Fish and Wildlife. Responsive Management, Harrisonburg,
2530 VA, USA. 247 p.

Dusek, G. L. 1975. Range relations of mule deer and cattle in prairie habitat. Journal of Range Management 39:605-616.

Franklin, J. F. and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. Oregon State Univ. Press, Corvallis, OR. 452p.

Feeney, D., G. Beauvais, R. Coupal, S. Lanning, S. Liesken, N. Nibbelink, and K. Nordyke. 2004. Big game migration corridors in Wyoming. University of Wyoming Cooperative Extension Service Bulletin B-1155, Laramie, WY.

Freddy, D. J., W. M. Bronaugh, and M. C. Fowler. 1986. Response of mule deer to disturbance by persons afoot and snowmobiles. Wildlife Society Bulletin 14:63-68.

Frisina, M. R. and F. G. Morin. 1991. Grazing private and public land to improve the Fleecer elk winter range. Rangelands 13:291-294.

Fry, J. A., G. Xian, S. Jin, J. A. Dewitz, C. G. Homer, Y. Limin, C. A. Barnes, N. D. Herold, and J. D. Wickham. 2011. Completion of the 2006 National Land Cover Database for the conterminous United States. Photogrammetric Engineering and Remote Sensing 77:858-864.

Gaillard, J. M., A. J. Sempere, J. M. Boutin, G. V. Laere, and B. Boisaubert. 1992. Effect of age and body weight on the proportion of females breeding in a population of roe deer (*Capreolus capreolus*). Canadian Journal of Zoology 70:1541-1545.

Goss, R. J. 1983. Deer antlers: regeneration, function and evolution. Academic Press, Inc., New York, NY. 316pp.

Gruell, George E. 1986. Post-1900 mule deer irruptions in the Intermountain West: Principal cause and influences. Gen. Tech. Rep. INT-GTR-206. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 37 p.

Hamlin, K. L., S. J. Riley, D. Pyrah, A. R.W. Dood, and R.J. Mackie. 1984. Relationships among mule deer fawn mortality, coyotes, and alternative prey species. Journal of Wildlife Management 48:189-499.

Haugen, A. O. 1975. Reproduction performance of white-tailed deer in Iowa. Journal of Mammalogy 56:151-159.

Hayden, J., G. Ardt, M. Fleming, T. W. Keegan, J. Peek, T. O. Smith, and A. Wood. 2008. Habitat guidelines for mule deer: Northern forest ecoregion. Mule Deer Working Group, Western Association of Fish and Wildlife Agencies. USA.

Hebblewhite, M. 2011. Effects of energy development on ungulates. In: Naugle, D. E. Energy development and wildlife conservation in western North America. Island Press, Washington, D.C., USA.

Hoenes, B., H. Ferguson, R. Finger, M. Livingston, and S. McCorquodale. 2013. Development of a standardized survey protocol for mule deer herds that winter in the Columbia Plateau Ecoregion: Phase 1 Project Summary 2009-2011. Completion Report, Washington Department of Fish and Wildlife, Olympia, WA USA. 38p.

Hurley, M. A., J. W. Unsworth, P. Zager, M. Hebblewhite, E. O. Garton, D.M. Montgomery, J. R. Skalski, and C. L. Maycock. 2011. Demographic response of mule deer to experimental reduction of coyotes and mountain lions in southeastern Idaho. Wildlife Monographs 178. 33 p.

Innes, R. J. 2013. *Odocoileus hemionus*. In: Fire effects information system. U.S. Forest Service, Rocky Mountain Research Station, Fire Science Laboratory. <http://fs.fed.us/database/feis> Accessed June 30, 2015.

Johnson, B. K., J. W. Kern, M.J. Wisdom, S. L. Findholt, and J. G. Kie. 2000. Resource selection and spatial separation of elk and mule deer in spring. Journal of Wildlife Management 64:685-697.

Johnstone-Yellin, T. L., L. A. Shipley, W. L. Myers, and H. S. Robinson. 2009. To twin or not to twin? Trade-offs in litter size and fawn survival in mule deer. Journal of Mammalogy 90:453-460.

Julander, O. and J. B. Low. 1976. A historical account and present status of the mule deer in the West. IN: Workman, G.W. and J.B. Low, eds. 1976. Mule deer in the West: A Symposium. College of Natural Resources, Utah State University, Logan, Utah. USA. 134 p.

Keegen, T. A., B. B. Ackerman, A. N. Aoude, L. C. Bender, T. Boudreau, L. H. Carpenter, B. B. Compton, M. Elmer, J. R. Heffelfinger, D. W. Lutz, B. D. Trindle, B. F. Wakeling, and B. E. Watkins. 2011. Methods for monitoring mule deer populations. Mule Deer Working Group, Western Association of Fish and Wildlife Agencies, USA. 118 p.

Kie, J. G., T. Bowyer, M. C. Nicholson, B. B. Boroski, and E. R. Loft. 2002. Landscape heterogeneity at differing scales: Effects on spatial distribution of mule deer. Ecology 83:530-544.

Knowles, C. J. and R. B. Campbell. 1982. Distribution of elk and cattle in a rest-rotation grazing system. In: Proceedings of wildlife-livestock relationships symposium. Forestry, Wildlife, and Range Experimental Station, University of Idaho, Moscow, ID, USA.

Kuchler, A.W. 1964. Potential natural vegetation of the conterminous United States. American Geographic Society Special Publication No. 36. New York, NY 152 p.

Kufeld, R. C., O. C. Wallmo, and C. Freddema. 1973. Foods of the Rocky Mountain mule deer. U.S.D.A. Forest Service Research Paper RM-111. 31 p.

Lancia, R. A., W. L. Kendall, K. H. Pollock, and J. D. Nichols. 2005. Estimating the number of animals in wildlife populations. Pages 106-153 IN: C. E. Braun, ed. Techniques for wildlife investigation and management. The Wildlife Society, Bethesda, MD.

Lendrum P. E., C. R. Anderson Jr, K. L. Monteith K. L., J. A. Jenks, and R.T. Bowyer. 2013. Migrating mule deer: Effects of anthropogenically altered landscapes. PLoS ONE 8: e64548. doi:10.1371/journal.pone.0064548

Lillybridge, T. R., B. L Kovalchik, C. K. Williams and B. G. Smith. 1995. Field guide for forested plant associations of the Wenatchee National Forest. Gen. Tech. Rep. PNW-GTR-359. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 335p.

Lindzey, F. G., W. G. Hepworth, T. A. Mattson, and A. F. Reeve. 1997. Potential for competitive interactions between mule deer and elk in the Western United States and Canada. Wyoming Cooperative Fish and Wildlife Research Unit Report, Laramie, WY.

Loft, E. R., J. W. Menke, and J. G. Kie. 1991. Habitat shifts by mule deer: influence of cattle grazing. Journal of Wildlife Management 55:16-26.

Mackie, R. J. 1970. Range ecology and relations of mule deer, elk, and cattle in the Missouri River Breaks, Montana. Wildlife Monograph 20:1-79.

Mackie, R. J., K. L. Hamlin, and D. F. Pac. 1982. Mule deer (*Odocoileus hemionus*). Pages 862-877 IN: Chapman, J. A. and G. A. Feldhammer, eds. 1982.Wildlife mammals of North America: Biology, Management, and Economics. The John Hopkins University Press, Baltimore. 1147 p.

McCorquodale, S. M. 1996. Ecology and comanagement of black-tailed deer in the Klickitat Basin of Washington. Yakama Nation Wildlife Program Report. Yakima, WA. 118p.

Mertins, J. W., J. A. Mortenson, J. A. Bernatowicz, and P. B. Hall. 2011. *Bovicola tibialis* (Phthiraptera: Trichodectida): Occurrence of an exotic chewing louse on cervids in North America. Journal of Medical Entomology 48:1-12.

Monteith, K. L., V. C. Bleich, T. R. Stephenson, B. M. Pierce, M. M. Conner, R. W. Klaver, and R. T. Bowyer 2011. Timing of seasonal migration in mule deer: effects of climate, plant phenology, and life-history characteristics. Ecosphere 2:47.

Morrison, P. H., H. M. Smith, and G. Wooten. 2007. Rare plant and vegetation survey of the Bowen Mountain Section of the Methow Wildlife Area. Pacific Biodiversity Institute, Winthrop, Washington. 75p.

Mysterud, A., T. Coulson, and N. C. Stenseth. 2002. The role of males in the dynamics of ungulate populations. Journal of Animal Ecology 71:907-915.

Myers, W. L., R. H. Naney, and K. R. Dixon. 1989. Seasonal movements and home ranges of female mule deer in western Okanogan County, Washington. Washington Department of Wildlife P-R Completion Report W-95-R. 34p.

Myers, W. L., ed. 2003. Observations of mule deer habitat use, movements, and survival in Chelan County, Washington: A completion report to Chelan County Public Utility District. Washington Department of Fish and Wildlife, Olympia, WA.

Myers, W. L., W. Y. Chang, S. S. Germaine, W. M. Vander Haegen, and T. E. Owens. 2008. An analysis of deer and elk-vehicle collision sites along state highways in Washington State. Completion Report, Washington Department of Fish and Wildlife. Olympia, WA. 40p.

Myers, W. L., B. Cosentino, B. Hall, D. Kavanagh, B. McRae, and A. Shirk. 2012. Habitat connectivity for Rocky Mountain mule deer (*Odocoileus hemionus hemionus*) in the Columbia Plateau Ecoregion. IN: Washington Wildlife Habitat Connectivity Working Group. 2012. Washington Landscapes Project: Analysis of the Columbia Plateau Ecoregion. Washington Department of Fish and Wildlife, and Department of Transportation, Olympia, WA.

Myers, W. L., W. E. Foreyt, P. A. Talcott, J. E. Evermann, and W. Y. Chang. 2015. Serologic, trace element, and fecal parasite survey of free-ranging mule deer in eastern Washington. Journal of Wildlife Diseases 51:125-136.

Nelson, J. R. 1982. Relationships of elk and other large herbivores. In: Thomas, J. W. and D. E. Toweill, ed. Elk of North America: Ecology and management, Stackpole Books, Harrisburg, PA, USA.

Nowak, R. M. 1991. Walker's mammals of the world. Volume 11. The John Hopkins University Press, Baltimore, MY. 1629 p.

Omernik, J. M. 1987. Ecoregions of the conterminous United States. Annals of the association of American geographers 77:118-125.

Peek, J. M. and P. R. Krausman. 1996. Grazing and mule deer. Pages 183-192. In: Krausman, P. R., ed. Rangeland wildlife. Society of Range Management. Denver, CO, USA.

Pojar, T. M. and D. C. Bowden. 2004. Neonatal mule deer fawn survival in west-central Colorado. Journal of Wildlife Management 68:550-560.

Raedeke, K. J., L. Melampy, J. Bottelli, and N. K. Elston. 1997. Ecology of mule deer on the Yakima Training Center. Document No. 9000-051-700 Raedeke Associates, Inc., Seattle, WA. 142p.

Relyea, R. A. and S. Demarais. 1994. Activity of desert mule deer during the breeding season. Journal of Mammalogy 75:940-949.

Ritters, K. H. and J. D. Wickham. 2003. How far to the nearest road? Frontiers in Ecology 1:125-129.

Robinette, W. L., C. H. Baer, R. E. Fillmore, and C. E. Knittle. 1973. Effects of nutritional change on captive mule deer. Journal of Wildlife Management 37:312-326.

Robbins, C. T. 1993. Wildlife Feeding and Nutrition. Second Edition. Academic Press, San Diego, CA.

Robinson, H. S., R. B. Wielgus, and J. C. Gwilliam. 2002. Cougar predation and population growth of sympatric mule deer and white-tailed deer.Canadian Journal of Zoology 80:556-568.

Samuel, M. D., G. O. Garton, M. W. Schlegel, and R. G. Carson. 1987. Visibility bias during aerial surveys of elk in northcentral Idaho. Journal of Wildlife Management 51:622-630.

Sauve, T. 1977. Pre-flood status of Vegetation: Rock Island Hydroelectric Project. Applied Research Section Report, Environmental Management Division, Washington Department of Game, Olympia, WA. 45p.

Sawyer, H., F. Lindzey, D. McWhirter, and K. Andrews. 2002. Potential effects of oil and gas development on mule deer and pronghorn populations in western Wyoming. Transactions of the 67th North American Wildlife and Natural Resources Conference 67:350-365.

Sawyer, H., R. H. Nielson, F. Lindzey, L. L. McDonald. 2006. Winter habitat selection of mule deer before and during development of a natural gas field. Journal of Wildlife Management 70:396-403.

Schroeder, M. A., J. Gorrell, M. Vander Haegen, J.Anthony, A. Duff, J. Foisy, C. Gibilisco, and B. Cosen- tino. 2013. Ecological Integrity Monitoring of Wildlife Areas in Washington State: Pilot Study for the 2011-2013 Biennium. Lands Division, Wildlife Program. Washington Department of Fish and Wildlife, Olympia. 33 pp.

Skalski, J. R., K. E. Ryding, and J. J. Millspaugh. 2005. Analysis of harvest records: Resampling for nonresponse. Pages 238-244 *in* Wildlife demography: analysis of sex, age, and count data. Elsevier Academic Press, San Diego, CA.

Short, H. L. 1981. Nutrition and metabolism. IN: Wallmo, O.C., ed. 1981. Mule and black-tailed deer of North America. University of Nebraska Press, Lincoln, NE. 605.

Shukla, S., A. C. Steinemann, and D. P. Lettenmaier. 2011. Drought monitoring for Washington State: Indicators and applications. Journal of Hydrometeorology 12:66-83.

Skovlin, J. M., P. J. Edgerton, and R. W. Harris. 1968. The influence of cattle management on deer and elk. Transactions of the North American Wildlife and Natural Resources Conference 33:169-181.

Sleeman, J. M., J. E. Howell, W. M. Knox, and P. J. Stenger. 2009. Incidence of hemorrhagic disease in white-tailed deer is associated with winter and summer climatic conditions. Ecohealth 6:11-15.

Smith, J. L., W. A. Michaelis, K. Sloan, J. Musser, and D. J. Pierce. 1994. An analysis of elk poaching losses and other mortality sources in Washington using biotelemetry. Washington Department of Fish and Wildlife Report, Olympia, WA. 79 p.

Smith, R. H., and A. LeCount. 1979. Some factors affecting survival of desert mule deer fawns. Journal of Wildlife Management 43:657-665.

Southwood, T. R. E. 1985. Interactions of plants and animals: patterns and processes. Oikos 44:5-11.

Stahler, D. R., D. W. Smith, and D. S. Guernsey. 2006. Foraging and Feeding Ecology of the Gray Wolf (Canis lupus): Lessons from Yellowstone National Park, Wyoming, USA. Journal of Nutrition. July 2006 vol. 136 no. 7 1923S-1926S.

Stankey, G. H., R. N. Clark, and B. T. Borman. 2005. Adaptive management of natural resources: theory, concepts, and management institutions. USDA Forest Service, Pacific Northwest Research Station General Technical Report PNW-GTR-654. 84p.

Stewart, K. M., R. T. Bowyer, J. G. Kie, N. J. Cimon, and B. K. Johnson. 2002. Temporospatial distributions of elk, mule deer, and cattle: resource partitioning and competitive displacement. Journal of Mammalogy 83:229-244.

Strickland, B. K. and S. Demarais. 2008. Influence of Landscape composition and structure on antler size of white-tailed deer. Journal of Wildlife Management 72:1101-1108.

Swenson, J. E. 1982. Effects of hunting on habitat use by mule deer on mixed-grass prairie in Montana. Wildlife Society Bulleting 10:115-120.

Teer, J. G., D. L. Draw, T. L. Blankenship, W. F. Andelt, R. S. Cook, J. G. Kie, F. F. Knowlton, and M. White. 1991. Deer and coyotes: the Welder experiments. Transactions of the North American Wildlife and Natural Resources Conference 56:550-560.

Tollefson, T. N., L. A. Shipley, W. L. Myers, D. H. Keisler, and N. Dasgupta. 2010. Influence of summer and autumn nutrition on body condition and reproduction in lactating mule deer. Journal of Wildlife Management 74:974-986.

Tollefson, T. N., L. A. Shipley, W. L. Myers, and N. Dasgupta. 2011. Forage quality's influence on mule deer fawns. Journal of Wildlife Management 75:919-928.

Unsworth, J. W., D. F. Pac, G. C. White, and R. M. Bartmann. 1999a. Mule deer survival in Colorado, Idaho, and Montana. Journal of Wildlife Management 63:315-326.

Unsworth, J. W., F. L. Leban, E. Garton, D. J. Leptich, and P. Zager. 1999b. Aerial survey: user's manual with practical tips for designing and conducting aerial big game surveys. Electronic edition. Idaho Department of Fish and Game, Boise, Idaho, USA.

Unsworth, J. W., L. Kuck, and E. O. Garton. 1990. Elk sightability model validation at the National Bison Range, Montana. Wildlife Society Bulletin 18:113-115.

U.S. Department of Agriculture. 2013. Summary Report: 2010 National Resources Inventory. Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. 163 p.

U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation-Washington. 82 p.

Wallace, M. C. and P. R. Krausman. 1987. Elk, mule deer, and cattle habitats in central Arizona. Journal of Range Management 40:80-83.

Wallmo, O. C. 1981. Mule and black-tailed deer distribution and habitats. Pages 1-25 *in* O. C. Wallmo, ed. Mule and black-tailed deer of North America. University of Nebraska, Lincoln, NE. 605 p.

Washington Department of Fish and Wildlife. 1999. 1999 Game status and trend report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA.

Washington Department of Fish and Wildlife. 2008. Game Management Plan: July 2009-June 2014. Wildlife Program. Washington Department of Fish and Wildlife, Olympia, Washington, USA.

Washington Department of Fish and Wildlife. 2012. Washington's 2012 big game hunting seasons and regulations: Effective April 1, 2012 – March 31, 2013. Wildlife Program. Washington Department of Fish and Wildlife, Olympia, Washington, USA. 123 p.

Washington Department of Fish and Wildlife. 2013. 2013 Game status and trend report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA.

Washington Department of Fish and Wildlife. 2014a. Game Management Plan: July 2015-June 2021. Wildlife Program. Washington Department of Fish and Wildlife, Olympia, Washington, USA. 159 p

Washington Department of Fish and Wildlife. 2014b. Washington's 2014 big game hunting seasons and regulations: Effective April 1, 2014 – March 31, 2015. Wildlife Program. Washington Department of Fish and Wildlife, Olympia, Washington, USA. 119 p.

Washington Department of Fish and Wildlife. 2014c. 2014 Game status and trend report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA 312 p

Washington Department of Fish and Wildlife, and the National Wildlife Federation. 2011. Summary of climate change effects on major habitat types in Washington State: Shrub-steppe and grassland habitats. Washington Department of Fish and Wildlife, Olympia, Washington, 64pp

Washington State Department of Transportation. 2005. Annual state highway collision data summary. Washington State Department of Transportation Annual Report. Olympia, WA. 93p.

Western Association of Fish and Wildlife Agencies [WAFWA]. 2004. WAFWA Mule Deer Working Group. Mule Deer Mapping Project. <http://www.gis.usu.edu/current_proj/muledeer.html>. Accessed 19 Apr 2013.

White, G. 1996. Noremark: population estimation from mark-resighting surveys. Journal of Wildlife Management 24:50-52.

White, G. C., and R. M. Bartmann. 1998. Mule deer management – what should be monitored? Pages 104-118 in J. C. deVos, Jr., editor. Proceedings of the 1997 Deer/Elk Workshop, Rio Rico, Arizona. Arizona Game and Fish Department. Phoenix, AZ.

Wickerstrom, M. L., C. T. Robbins, T. A. Hanley, D. E. Spalinger, and S. M. Parish. 1984. Food intake and foraging energetics of elk and mule deer. Journal of Wildlife Management 48:1285-1301.

Wiles, G. J., H. L. Allen, and G. E. Hayes. 2011. Wolf conservation and management plan for Washington. Washington Department of Fish and Wildlife, Olympia, WA 297pp.

Wisdom, M. J. 1998. Assessing life-stage importance and resource selection for conservation of selected vertebrates. PhD dissertation, University of Idaho, Moscow, ID, USA.

Wisdom, M. J. and J. W. Thomas. 1996. Elk. In: Krausman, P.R. Rangeland Wildlife. Society for Range Management, Denver, CO, USA.

Wong, B. and K. L. Parker. 1988. Estrus in black-tailed deer. Journal of Mammalogy 69:168-171.

Wood, A. K., R. J. Mackie, and K. L. Hamlin. 1989. Ecology of sympatric populations of mule deer and white-tailed deer in a prairie environment. Montana Department of Fish, Wildlife, & Parks, Helena, MT, USA.

Zeigler, D. L. 1978. The Okanogan mule deer. Biological Bulletin No.15. Washington Department of Game, Olympia, WA, USA. 106 p.

Appendix A: Hunter Success Rates

The following are hunter success rates by GMU for mule deer (antlered and antlerless) during the general season for modern firearms. GMUs listed are those in which the majority of reported deer harvest was mule deer.

Table 1. Hunter success rates by GMU for mule deer harvested during the general modern firearm season in the Blue Mountains Mule Deer Management Zone from 2001 – 2014.

GMU	2001	2002	2003	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
169	0.11	0.16	0.16	0.20	0.20	0.12	0.14	0.14	0.09	0.08	0.16	0.16	0.15
186	0.31	0.36	0.31	0.36	0.31	0.36	0.33	0.30	0.38	0.22	0.31	0.35	0.30

Table 2. Hunter success rates for mule deer harvested during the general modern firearm season in the Columbia Plateau Mule Deer Management Zone from 2001 – 2014.

GMU	2001	2002	2003	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
248	0.35	0.34	0.21	0.26	0.26	0.23	0.27	0.19	0.24	0.26	0.32	0.32	0.34
254	0.24	0.29	0.22	0.24	0.23	0.16	0.23	0.22	0.20	0.18	0.26	0.26	0.31
260	0.30	0.30	0.16	0.17	0.17	0.16	0.14	0.19	0.21	0.24	0.24	0.20	0.28
262	0.20	0.19	0.19	0.17	0.17	0.16	0.17	0.20	0.26	0.25	0.30	0.30	0.30
266	0.15	0.23	0.14	0.14	0.16	0.17	0.16	0.19	0.22	0.19	0.21	0.24	0.23
269	0.32	0.34	0.18	0.21	0.20	0.22	0.21	0.29	0.27	0.20	0.30	0.27	0.22
272	0.18	0.22	0.24	0.21	0.28	0.29	0.23	0.22	0.27	0.20	0.26	0.24	0.24
278	0.19	0.21	0.13	0.09	0.28	0.17	0.12	0.12	0.24	0.21	0.20	0.21	0.23
284	0.41	0.42	0.38	0.38	0.40	0.30	0.29	0.35	0.35	0.33	0.46	0.40	0.43
372	0.25	0.44	0.21	0.28	0.20	0.18	0.20	0.30	0.21	0.28	0.26	0.35	0.15
373	NA	NA	NA	NA	0.23	0.29	0.29	0.44	0.27	0.31	0.32	0.27	0.23
379	NA	NA	NA	NA	0.53	0.23	0.27	0.25	0.14	0.14	0.23	0.21	0.20
381	0.41	0.45	0.31	0.34	0.27	0.27	0.33	0.50	0.37	0.37	0.42	0.45	0.36

Table 3. Hunter success rates for mule deer harvested during the general modern firearm season in the East Columbia Gorge Mule Deer Management Zone from 2001 – 2014.

GMU	2001	2002	2003	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
382	0.30	0.36	0.25	0.32	0.30	0.32	0.36	0.33	0.35	0.28	0.26	0.29	0.29
388	0.21	0.18	0.25	0.07	0.14	0.17	0.20	0.22	0.15	0.20	0.27	0.20	NA

Table 4. Hunter success rates for mule deer harvested during the general modern firearm season in the East Slope Cascades Mule Deer Management Zone from 2001 – 2014.

GMU	2001	2002	2003	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
203	0.14	0.20	0.17	0.15	0.11	0.12	0.12	0.13	0.21	0.23	0.19	0.16	0.25
218	0.21	0.18	0.19	0.12	0.09	0.13	0.07	0.14	0.13	0.13	0.16	0.17	0.20
224	0.21	0.17	0.18	0.15	0.10	0.12	0.08	0.15	0.10	0.11	0.09	0.13	0.15
233	0.21	0.22	0.16	0.21	0.13	0.14	0.13	0.19	0.16	0.14	0.17	0.15	0.18
239	0.20	0.19	0.15	0.21	0.09	0.13	0.10	0.19	0.12	0.15	0.15	0.15	0.19
242	0.17	0.15	0.15	0.15	0.13	0.12	0.10	0.19	0.10	0.12	0.13	0.11	0.15
243	0.15	0.20	0.19	0.18	0.13	0.18	0.13	0.17	0.17	0.13	0.19	0.17	0.22
244	0.10	0.11	0.16	0.27	0.30	0.14	0.15	0.18	0.20	0.21	0.18	0.21	0.26
245	0.13	0.11	0.18	0.16	0.09	0.13	0.07	0.14	0.09	0.10	0.10	0.11	0.12
246	0.11	0.16	0.16	0.19	0.13	0.11	0.12	0.17	0.17	0.12	0.18	0.17	0.14
247	0.10	0.14	0.14	0.13	0.09	0.11	0.09	0.12	0.13	0.09	0.14	0.11	0.14
249	0.10	0.15	0.24	0.18	0.21	0.15	0.14	0.23	0.20	0.15	0.18	0.21	0.14
250	0.13	0.15	0.15	0.18	0.15	0.12	0.14	0.22	0.14	0.11	0.17	0.18	0.19
251	0.14	0.12	0.13	0.15	0.09	0.08	0.10	0.15	0.11	0.09	0.11	0.13	0.13
328	0.11	0.11	0.09	0.07	0.04	0.06	0.05	0.09	0.07	0.08	0.08	0.08	0.07
330	0.23	0.14	0.26	0.26	0.13	0.04	0.04	0.21	0.14	0.14	NA	0.10	NA
334	0.06	0.14	0.13	0.09	0.05	0.09	0.05	0.10	0.08	0.03	0.15	0.09	0.09
335	0.15	0.14	0.15	0.14	0.10	0.13	0.08	0.18	0.11	0.11	0.10	0.11	0.10

Table 5. Hunter success rates for mule deer harvested during the general modern firearm season in the Naches Mule Deer Management Zone from 2001 – 2014.

GMU	2001	2002	2003	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
336	0.10	0.12	0.08	0.07	0.05	0.05	0.03	0.08	0.05	0.07	0.04	0.03	0.06
340	0.07	0.10	0.07	0.06	0.03	0.06	0.03	0.08	0.07	0.05	0.07	0.09	0.06
342	NA	NA	0.11	0.09	0.05	0.10	0.06	0.15	0.08	0.11	0.11	0.13	0.07
346	0.07	0.05	0.08	0.06	0.04	0.05	0.03	0.05	0.04	0.03	0.03	0.04	0.03
352	0.05	0.04	0.08	0.06	0.03	0.07	0.04	0.07	0.04	0.03	0.05	0.04	0.03
356	0.05	0.03	0.06	0.05	0.01	0.04	0.02	0.06	0.02	0.02	0.05	0.03	0.07
360	0.06	0.06	0.07	0.08	0.02	0.05	0.03	0.07	0.03	0.03	0.03	0.04	0.03
364	0.03	0.06	0.05	0.06	0.03	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.03
368	0.07	0.13	0.08	0.11	0.04	0.07	0.08	0.14	0.06	0.07	0.10	0.11	0.07

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Appendix B: Department Wildlife Feeding Policy

Policy – 5302: Feeding wildlife in the winter provides the following criteria and guidelines for conducting winter feeding operations:

1. The Department may provide supplemental or emergency feeding for wildlife under the following conditions:

A. To prevent and/or reduce deer or elk damage to private property (agricultural or horticultural crops).

B. To support a Department management plan.

C. To respond to an emergency as determined by the Director or the Director's designee.

D. To allow for the regeneration of winter habitat that has been severely damaged or destroyed by disaster, such as fire or drought.

E. For Department approved wildlife research or wildlife capture.

F. In areas or times where hunting seasons have closed.

2. The Director or Director’s Designee declares an emergency

Implementation of emergency feeding operations will begin after an emergency has been declared in a specific location of the state.

3. The Department will use the following factors to determine whether an emergency exists in a specific location of the state:

A. Conditions and forecast: Includes conditions such as abnormally cold temperatures, extreme wind chill, snow depth, icing, or crusting over a prolonged period of time. Evaluation may also include the forecasted weather to reflect early arrival and projected duration of severe winter weather.

B. Concentration and distribution of wildlife: Includes assessment of wildlife patterns such as animals concentrated in unusually high numbers in a specific area or located in areas where they are generally not found.

C. Access to natural forage: Assessment of availability of natural forage, including factors that may limit access (such as snow depth, icing, or crusting)

D. Disaster: Includes description of disaster (such as fire or drought) and its impact on wildlife, such as winter range that has been severely damaged or destroyed. Feeding may be an option to provide adequate time for recovery of wildlife habitat and subsequently reduce wildlife mortality.

E. Physical condition of wildlife: Evaluation to determine the physiological condition of animals, including experienced judgment by Department personnel based on knowledge of local wildlife. Evaluation may include bone marrow and kidney fat analysis to evaluate body fat reserves necessary for winter survival.