

# Mule Deer and Elk Winter Diet as an Indicator of Habitat Competition

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**Abstract**—Mule deer (*Odocoileus hemionus*) populations have gradually declined in recent decades, while elk (*Cervus elaphus*) have often increased throughout their common ranges. The cause is uncertain and a source of debate. Increasing elk numbers on these ungulate winter ranges may be causing competition for resources. We contrast winter diets of mule deer and elk and relate them to population trends of both species on the Mount Haggin Wildlife Management Area in southwest Montana. Elk increased from an observed number of 172 in 1978 to 700 in 1996 and slightly declined in 1997. Likewise, mule deer increased from 202 in 1978 to 586 in 1989, but declined to 288 between 1990 and 1997. The same five browse species comprised 95 percent and 52 percent of the mule deer and elk winter diets, respectively. These data indicate there is a potential for forage competition between mule deer and elk sharing winter ranges. Because elk have a more varied diet (55 percent browse, 32 percent grass, 12 percent forbs) than mule deer (98 percent browse, 2 percent grass, 0.5 percent forbs) on this winter range, it is likely that mule deer will be the most negatively impacted.

## Introduction

During the past several decades elk (*Cervus elaphus*) populations have increased across the Western United States (O'Gara and Dundas 2002; Peek and others 1982). Concurrently, concern has been expressed that mule deer (*Odocoileus hemionus*) populations are on a gradual, but steady decline (Connolly 1981; Wallmo 1978). Much conjecture has been put forth regarding the causes of the mule deer decline; there are probably many factors involved. Our

objective was to determine mule deer and elk winter diets and consider the possibility that overlapping diets impact one or both ungulates.

## Study Area

The study area within the Mount Haggin Wildlife Management Area (MHWMA) is approximately 16 km southeast of Anaconda in southwest Montana and was described in detail by Guenther (1989). The MHWMA was purchased in 1976 by the Montana Department of Fish, Wildlife and Parks (MFWP) to conserve habitat for a variety of wildlife species including elk and mule deer. All 18 sampling locations studied were on ungulate winter range within the northern portion of the MHWMA (Guenther 1989).

The topography is characterized by mountainous slopes. Sampling locations are near the Continental Divide at elevations between 1,577 m and 1,943 m. Average annual precipitation is about 340 mm, with 47 percent falling from April through July. June and February are the wettest and driest months averaging 70 and 16 mm of precipitation, respectively.

Although vegetation on the study area is diverse, the bitterbrush (*Purshia tridentata*)-grass type predominates (Guenther 1989). Many of the sample locations show the impacts of historic intensive livestock grazing and air-borne pollutants from the nearby Anaconda smelter. Guenther (1989) identified 12 shrub, 25 graminoid, and 44 forb species that occur on the 18 sampling locations. Other common shrubs in the area include snowberry (*Symphoricarpos albus*) and Oregon grape (*Berberis repens*). The most common grasses are Kentucky bluegrass (*Poa pratensis*), basin wildrye (*Elymus cineris*), needleandthread (*Stipa comata*), green needlegrass (*S. viridula*), rough fescue (*Festuca scabrella*), Idaho Fescue (*F. idahoensis*), and bluebunch wheatgrass (*Agropyron spicatum*). Among the most abundant forbs are the exotic whitetop (*Cardaria draba*) and spotted knapweed (*Centaurea maculosa*), which have invaded nine of the study sites. Native long-leaved aster (*Aster chilensis*) is also common. Rocky Mountain Juniper (*Juniperus scopulorum*) and lodgepole pine (*Pinus contorta*) are present and Douglas-fir (*Pseudotsuga menziesii*) appears to be increasing on some sites (Guenther 1989). Small stands of aspen (*Populus tremuloides*) are scattered across the winter range.

The MHWMA provides year-long range for elk, mule deer, moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), and pronghorn (*Antilocapra americana*) (Frisina 1982, 1992). The portion of the MHWMA studied is an important winter range for elk, mule deer, and moose.

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## Methods

Mule deer feces were analyzed from 18 sampling locations during 1991 and elk feces were analyzed from 13 of the sampling locations. No elk feces were found at five of the 18 sampling locations. The samples were sent to the Composition Analyses Laboratory at Colorado State University for diet determination using microhistological techniques (Sparks and Malecheck 1968). Each sample was a composite from 10 pellet groups. From each composite sample, the mean composition of plants in the diet was determined from five slides of 20 fields each.

Mule deer and elk population trends were determined from aerial surveys flown during winter when clear skies, cold temperatures, and snow cover provided ideal conditions for observing animals. During the years of our study, 1978 through 1997, the entire winter range was flown each winter to obtain trend counts. The first author was the observer on all flights. Separate flights were made for deer and elk. A mule deer trend count was obtained every winter and an elk trend count was completed for 16 of the 20 winters. During four years, weather conditions were unusually mild and elk too widely scattered for a comparable survey to be accomplished. When weather conditions are unusually mild, not all elk migrate to the winter range. A fixed-wing aircraft was used for all elk counts. A small helicopter was used to conduct nine of the mule deer counts (1978 through 1984, and 1997) and a fixed wing aircraft for 11 of the counts (1986 through 1996). The open nature of the winter range (lack of dense forest) made deer similarly observable from both types of aircraft (fig. 1).

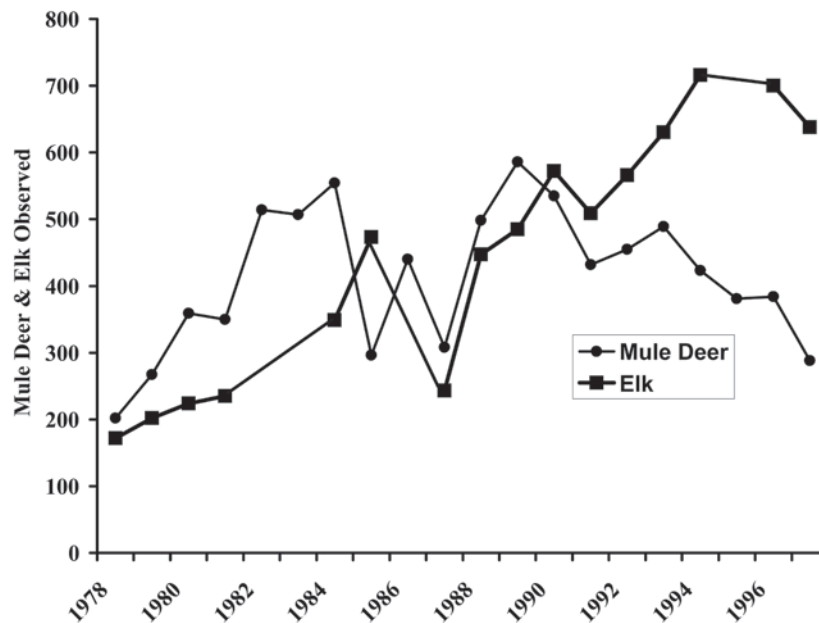
## Results

### Mule Deer Diet

Twenty-five taxa or plant groups were identified in the winter diet of mule deer (table 1). These consisted of 14, 5, and 6 browse, grass, and forb taxa, respectively. Browse was the most important component with five species comprising 95 percent of the diet: antelope bitterbrush, Oregon grape, Rocky Mountain juniper, Douglas-fir, and lodgepole pine. Antelope bitterbrush provided over half of the mule deer winter diet (table 1). Antelope bitterbrush is often very important to the nutrition of mule deer (Young and Clements 2002). In a synthesis of mule deer food habits studies for the Western United States and Canada, Kufeld and others (1973) rated antelope bitterbrush as a preferred browse during winter. Kufeld and others (1973) considered Rocky Mountain juniper, Oregon grape, and Douglas-fir to be of moderate value, and lodgepole pine of low preference. Grasses and forbs combined contributed only about 2.5 percent to the winter diet of mule deer (table 1). Idaho fescue and rough fescue combined were the only herbs  $\geq 1$  percent of the winter diet. Idaho fescue was considered moderately preferred in the winter by mule deer and rough fescue of low preference by Kufeld and others (1973).

### Elk Diet

Twenty-four plant species were identified in the winter diet of elk (table 1). These consisted of 9, 10, and 5 browse, grass, and forb taxa, respectively. Browse was the most



**Figure 1**—Population trend for mule deer and elk wintering on the Mount Haggin WMA, 1978 to 1997.

**Table 1**—Mean percent plant content in feces found within the 18 and 13 sampling sites for mule deer and elk, respectively, on the Mount Haggin Wildlife Management Area, 1991 (T = species cover <0.1 percent).

Species		Mule Deer	Elk
<b>Grasses</b>		<b>2.0</b>	<b>31.9</b>
Wheatgrasses	<i>Agropyron</i> spp.	0.1	0.2
Bentgrasses	<i>Agrostis</i> spp.	–	0.2
Brome grasses	<i>Bromus</i> spp.	0.1	0.3
Sedges	<i>Carex</i> spp.	0.1	4.0
Fescue grasses	<i>Festuca</i> spp.	1.1	17.4
Rushes	<i>Juncus</i> spp.	–	0.3
Bluegrasses	<i>Poa</i> spp.	0.6	3.3
Needlegrasses	<i>Stipa</i> spp.	–	5.7
Prairie junegrass	<i>Koeleria macrantha</i>	–	0.4
Unknown grasses		–	0.1
<b>Forbs</b>		<b>0.5</b>	<b>12.0</b>
Pussytoes	<i>Antennaria rosea</i>	T	–
Sunflower family	<i>Asteraceae</i> spp.	0.1	0.2
Milkvetch & Locoweeds	<i>Astragalus–Oxytropis</i> spp.	–	0.5
Arrowleaf balsamroot	<i>Balsamorhiza sagittata</i>	0.1	–
Common horsetail	<i>Equisetum arvense</i>	–	2.0
Wyeth lupine	<i>Lupinus wyethii</i>	0.3	9.3
Phloxes	<i>Phlox</i> spp.	T	T
Flannelleaf mullein	<i>Verbascum thapsus</i>	T	–
<b>Shrubs/Trees</b>		<b>97.4</b>	<b>55.3</b>
Kinnikinnick	<i>Arctostaphylos uva-ursi</i>	T	–
Serviceberry	<i>Amelanchier alnifolia</i>	0.1	–
Fringed sagewort	<i>Artemisia frigida</i>	0.1	–
Oregon grape	<i>Berberis repens</i>	22.4	10.9
Winterfat	<i>Ceratoides lanata</i>	–	T
Rubber rabbitbrush	<i>Chrysothamnus nauseosus</i>	1.6	0.1
Green rabbitbrush	<i>Chrysothamnus viscidifloris</i>	0.1	–
Rocky Mountain juniper	<i>Juniperus scopulorum</i>	12.0	0.1
Douglas-fir	<i>Pseudotsuga menziesii</i>	5.0	7.6
Antelope bitterbrush	<i>Purshia tridentata</i>	52.8	34.4
Lodgepole pine	<i>Pinus contorta</i>	3.0	2.0
Quaking aspen	<i>Populus tremuloides</i>	–	0.1
Raspberry	<i>Rubus</i> spp.	T	–
Russet buffaloberry	<i>Shepherdia canadensis</i>	0.2	0.1
Common snowberry	<i>Symphoricarpus albus</i>	0.1	–
Gray horsebrush	<i>Tetradymia canescens</i>	0.2	–

significant portion at 55 percent of the diet. Only three browse species, antelope bitterbrush, Oregon grape, and Douglas-fir comprised 53 percent of the diet. Kufeld (1973) and Cook (2002) considered antelope bitterbrush a highly preferred winter forage plant, Oregon grape a valuable plant, and Douglas-fir to be of low preference to wintering elk. Grasses and forbs combined comprised about 44 percent of elk winter diets. Grasses contributed 32 percent with fescues the most important at 17 percent. Previous studies found both rough fescue and Idaho fescue to be preferred winter forage for elk (Kufeld 1973; Cook 2002). Forbs were least eaten by elk during winter at 12 percent of the diet,

but lupine did comprise 9 percent of the diet. The only documented species of lupine at the study sites was Wyeth lupine (*Lupinus wyethii*). Kufeld (1973) considered lupines of moderate preference to wintering elk.

## Conclusions and Management Implications

The winter diets of mule deer and elk were similar with the same five browse plants (antelope bitterbrush, Oregon grape, Rocky Mountain juniper, Douglas-fir, and

lodgepole pine) comprising 95 percent of the deer diet and 55 percent of the elk diet (table 1). However, the elk diet was more diverse than deer with grasses and forbs contributing 32 percent and 12 percent of the diet, respectively. The deer diet was 98 percent browse while this forage class contributed 56 percent to that of elk.

Population trend data indicate elk increased from an observed number of 172 in 1978 to 700 in 1996 and began to decline in 1997 (fig. 1). Likewise, mule deer increased from 202 in 1978 to 586 in 1989, but declined to 288 between 1990 and 1997 (fig. 1).

Guenther and others (1993) found utilization on MHWMA bitterbrush ranged from 57 percent to 96 percent, averaging 80 percent at the 18 sampling locations during the winter of 1988 to 1989. They noted that the majority of bitterbrush plants appeared heavily hedged due to historical browsing. Fraas (1992) found lower browsing rates at the same sites during the winter of 1990 to 1991 (0 to 60 percent). Fraas (1992) attributed the difference in browsing rate to differences in sampling methods. While Guenther (1989) chose twigs on the outermost portion of each plant, Fraas (1992) randomly chose branches, some deep within the canopy and thus not as susceptible to browsing. The diet similarity between elk and mule deer indicates there is potential for competition between these species. The trend in declining mule deer between 1990 and 1996 with a concomitant upward trend of elk through 1996 also indicates competition may be occurring. Elk diets at MHWMA are more varied providing them a survival advantage over mule deer when difficult winter conditions occur. Douglas-fir and lodgepole pine are both considered a low value browse for elk and deer (Kufeld 1973; Kufeld and others 1973), yet contributed 8 percent and 3 percent, respectively, to the diet. This relatively high contribution of these low value browse species to the winter diets is a further indication that the combined populations of mule deer and elk may be exceeding habitat carrying capacity. Guenther and others (1993) found browsing to be intense enough to suggest a management strategy directed toward reducing the number of wintering deer. Our data indicate it maybe more important to control the size of the wintering elk population.

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