Mule deer habitat use in the Bennett Hills, Idaho

by Clint Jason Gray

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University

Abstract:
The factors governing mule deer (Odocoileus hemionus) habitat use patterns in south-central Idaho are poorly understood. Therefore, 16 radio-collared does were tracked from the ground in 1993, and 9 of the same does were also tracked in 1994 to gather data on habitat use and to document the effects of the primary land use in the area, cattle grazing, on mule deer. The field season of 1993 was cooler and wetter than the 1994 season. Average home range size during the hot and dry field season was significantly smaller than the average home range size during the cool, wet season ($P<0.01$). Deer showed a strong preference for the Mountain Brush cover type for all activities, Aspen and Riparian cover types for bedding, and Sage/Bitterbrush for feeding. Cooler northeastern and eastern aspects were preferred by deer and southwestern and flat aspects were avoided. Overall, deer appeared to prefer steeper than average areas, but within Mountain Brush they chose flatter sites. Areas near water were preferred and stock ponds may have made bedding areas that would have been too far from water otherwise available for use. Deer preferred microsites that did not have fresh sign of cattle. Habitat use appeared to overlap more between deer and cattle during the dry year and the latter part of the summer/fall period. A more detailed analysis of the effects of cattle on mule deer was not possible due to the high density of different landowners in the area. Hunting season did not affect bed concealment or flushing distance of deer but may have caused movements out of established home ranges and premature migration to the winter range. Deer chose shaded areas for bedding and preferred clumps of Salix sp. shrubs within the Mountain Brush cover type. Microhistological fecal analysis documented the transition from forbs to shrubs in late summer. A model built with multiple logistic regression identified overhead cover as the most important factor for determining sites likely to be used by deer. This study documented the importance of the Mountain Brush cover type to mule deer in sage steppe environments. It also identified the potential of hunting pressure to trigger premature migrations.

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Clint Jason Gray

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

12 July 1995
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ABSTRACT

The factors governing mule deer (Odocoileus hemionus) habitat use patterns in south-central Idaho are poorly understood. Therefore, 16 radio-collared does were tracked from the ground in 1993, and 9 of the same does were also tracked in 1994 to gather data on habitat use and to document the effects of the primary land use in the area, cattle grazing, on mule deer. The field season of 1993 was cooler and wetter than the 1994 season. Average home range size during the hot and dry field season was significantly smaller than the average home range size during the cool, wet season ($P<0.01$). Deer showed a strong preference for the Mountain Brush cover type for all activities, Aspen and Riparian cover types for bedding, and Sage/Bitterbrush for feeding. Cooler northeastern and eastern aspects were preferred by deer and southwestern and flat aspects were avoided. Overall, deer appeared to prefer steeper than average areas, but within Mountain Brush they chose flatter sites. Areas near water were preferred and stock ponds may have made bedding areas that would have been too far from water otherwise available for use. Deer preferred microsites that did not have fresh sign of cattle. Habitat use appeared to overlap more between deer and cattle during the dry year and the latter part of the summer/fall period. A more detailed analysis of the effects of cattle on mule deer was not possible due to the high density of different landowners in the area. Hunting season did not affect bed concealment or flushing distance of deer but may have caused movements out of established home ranges and premature migration to the winter range. Deer chose shaded areas for bedding and preferred clumps of Salix sp. shrubs within the Mountain Brush cover type. Microhistological fecal analysis documented the transition from forbs to shrubs in late summer. A model built with multiple logistic regression identified overhead cover as the most important factor for determining sites likely to be used by deer. This study documented the importance of the Mountain Brush cover type to mule deer in sage steppe environments. It also identified the potential of hunting pressure to trigger premature migrations.

INTRODUCTION

Although mule deer (Odocoileus hemionus) are one of the most studied animals in North America, much remains to be learned in order to accomplish desired management goals. Much of the shortage of information can be attributed to the difficulty in measuring interactions between an animal and its environment. Add to this the broad spectrum of habitat use strategies utilized by mule deer to cope with conditions as varied as forested mountains with severe winters to hot, dry deserts in Mexico, and it becomes evident why many questions remain unanswered. This study was initiated as part of a long range program (Unsworth 1992) to answer questions about habitat factors which govern mule deer in the high elevation dry steppe of south-central Idaho and how these factors are related to livestock grazing, the primary land use of unirrigated lands in the steppe ecosystem.

Studies of mule deer habitat use (Mackie 1970, Uresk and Uresk 1982, Fielder and Mckay 1984, Austin and Urness 1985, Carson and Peek 1987, Kufeld et al. 1988) indicate that the habitat features critical to mule deer vary among sites. Factors influencing habitat use included water, topographical features, horizontal configuration, aspect, slope, elevation, roads, human activities (mainly hunting), cover types, forage, and livestock. Many of these factors are inter-related, making it difficult to identify individual effects.

Rautenstrauch and Krausman (1989) indicated that availability of water was the primary factor affecting mule deer habitat selection in southwest Arizona. Mackie

(1970) found decreased use of areas greater than 3/4 mile from water during summer and fall in central Montana. He also showed that deer preferred steeper, more rugged terrain than randomly available. Roads have been found to influence habitat use by mule deer (Rost and Bailey 1979). Brown and McDonald (1988) reported decreased diurnal activity and a shift to more secure habitats during hunting seasons in southeast Idaho. Austin and Urness (1985) discussed the importance of forage availability in an area with limited summer habitat. Succession may also play a large role in mule deer habitat selection (Bodurtha et al. 1989).

Ragotzkie and Bailey (1991) and Loft et al. (1991) found that livestock grazing had significant impacts on mule deer habitat use. In years of average and above average precipitation, mule deer and cattle diets have little overlap in many regions (Mackie 1970, Currie et al. 1977). This overlap probably increases during years of drought (Short 1977) or when overgrazing limits forage. In spite of this, mule deer have been shown to prefer ungrazed pastures even in years of adequate forage production (Loft et al. 1991, Ragotzkie and Bailey 1991).

Moderate grazing by cattle on mule deer summer range in the Sierra Nevadas was shown to decrease the availability of hiding cover for deer in meadow-riparian and aspen habitats (Loft et al. 1991), to reduce use of preferred habitats by deer (Loft et al. 1991), to increase home range size of deer (Loft 1988), and to increase the time deer spent feeding compared to areas with no grazing (Kie et al. 1991). These factors could adversely affect mule deer through increased exposure to predators and increased costs of foraging.

Although negative effects are abundant in the literature, cattle grazing may be an effective tool for enhancing forage availability for mule deer. Willms et al. (1979) found increased spring mule deer use of a pasture grazed the previous fall. On 2 adjacent ungrazed pastures in central Arizona, Wallace and Krausman (1987) reported higher deer densities in the pasture that was grazed the previous year. A rest-rotation grazing system is used on several elk winter ranges managed by the Montana Department of Fish, Wildlife and Parks to enhance forage (Frisina pers. comm. 1992). Livestock grazing may also promote diversity in habitat (Mackie 1978).

Despite the potential detrimental effects of cattle grazing on mule deer, cattle grazing will likely continue to be a dominant aspect of public land use in the West, and mule deer will likely continue to justify their presence on public land. Mule deer are Idaho's most important big game animal, providing over 1,000,000 days of recreation in 1991 (Unsworth 1992). In a bioeconomic analysis Loomis et al. (1991) found that the incremental benefits of deer hunting gained under a 2-years-off 1-year-on grazing system are greater than the lost net economic value of the forage to the rancher. Managers need to develop methods for management of both deer and cattle on the same lands.

The deer studied were part of a large migratory herd that moved from 20 km to 65 km between their summer range in the Bennett Hills and Sawtooth mountains and their winter range near King Hill, Idaho. The primary objective of this study was to describe summer/fall habitat use patterns of female mule deer in the Bennett Hills by quantifying variables discussed in the literature as possible factors influencing habitat use. Ancillary objectives included documenting the effects of livestock, hunting, and seasonal and annual variation in temperature and precipitation on female mule deer in the study area.

STUDY AREA

The study area was located in the Bennett Hills of south-central Idaho, in Big Game Management Unit 45 of Idaho Department of Fish and Game (IDFG) Region 4. It included portions of Elmore, Camas, and Gooding counties. The Bennett Hills are bounded on the north by Camas Prairie and on the south by the Snake River floodplain. Most of the study animals summered on the northern front of the Bennett Hills. Elevations in this geological formation range from 1,500 m in the south portion to 2,100 m on Bennett Mountain.

Located on the southern edge of the Idaho Batholith, much of the soil in the Bennett Hills is derived from granite. Snake River Basalt is also common. Most of the basalt has a mantle composed of loess and/or alluvium, but in some areas the mantle is absent. Andesite and rhyolite are also common components of some soils in the Bennetts (Case 1981, Noe 1991).

Mean annual precipitation at the Fairfield Ranger Station, near the study area, is 40.5 cm. Approximately 70% of the annual precipitation falls from November through April in the form of snow. Mean annual daily minimum temperature is 3° Celsius and maximum temperature is 14° C (National Climatic Data Center 1993).

The Bennett Hills are primarily rolling sagebrush rangeland with scattered stands of aspen and brush. Conifers were very rare on the study area. Riparian zones, consisting primarily of 3-4 m tall willow (Salix sp.), bordered the perennial streams, Camas Creek, Sheep Creek, King Hill Creek, and Dempsey Creek, on the study area. Meadows were common in level, low-lying areas.

The primary land use in the Bennett Hills is livestock grazing. Domestic sheep pass through the area in late spring and cattle are present all summer and fall. Ownership on the study area was predominantly private (71%), but there were also significant amounts of land managed by the Bureau of Land Management (9%), and Idaho Department of State Lands (17%). There was also a small portion of United States Department of Agriculture Forest Service land (3%).

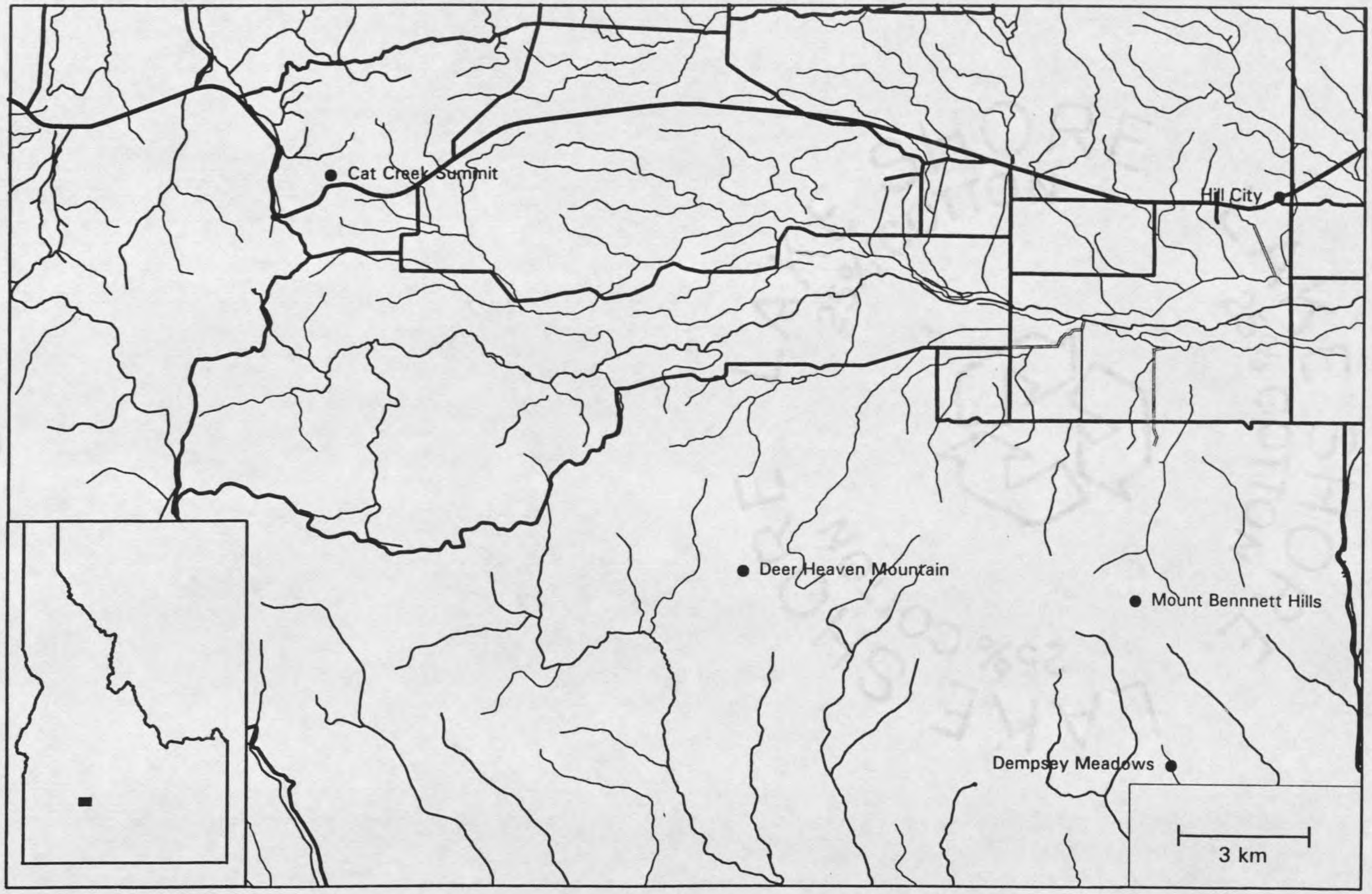

Figure 1. Map of the Bennett Hills Study Area. Heavy lines represent roads. Lighter lines depict drainages.

METHODS

Capturing and Radio-collaring Mule Deer

Forty-three mule deer were captured with a net gun from a helicopter and radio-collared during the winter of 1992. Each deer was fitted with a transmitter that had a time-delay, mortality-sensing device. Age was determined at capture from tooth replacement and wear (Robinette et al. 1957). Of the 22 radio-collared mule deer that survived the winter, only 5 (3 does, 2 bucks) remained in the Bennett study area. The remainder moved further north into the Sawtooth mountains. One of the bucks could not be tracked from the ground due to an uncooperative landowner. Thirteen additional does were captured and collared on July 11, 1993 to provide an adequate sample. Additional bucks could not be collared in the summer due to their antler growth. Since 1 buck is not an adequate sample from which to infer habitat use, only the 16 does were intensively tracked in 1993.

Thirty-four more deer were captured and radio-collared during the winter of 1993. Of the 31 radio-collared deer that survived the winter, only 3, (1 doe, 2 bucks), remained in the Bennett study area. These could not be tracked from the ground due to an uncooperative landowner so the 9 does remaining from the collaring efforts in 1993 were again tracked in 1994.

Deer Relocations

Radio-collared mule deer were relocated from a fixed wing aircraft (Maule M5-235) bi-monthly during the non-hunting season and weekly during September, October and November when weather conditions and pilot schedules allowed. The coordinates of each relocation were recorded by an onboard computer using a geographical positioning system. Information recorded included cloud cover, ambient temperature, relative wind speed, habitat, aspect, date and time. When a mortality signal was received, the radio-collared deer was located from the ground and cause of death determined. Aerial locations were used only for calculating home ranges.

Error of aerial locations can vary from less than 100 m to 1 km (Patric et al. 1988) so intensive ground tracking was employed to attain precise locations for use in micro level habitat analysis. A 2-element, H antenna and scanner/receiver were used to locate deer. All tracking was done during daylight hours. I attempted to obtain visual observations whenever possible. Locations were recorded as 1) visual, 2) auditory, or 3) triangulation. Auditory locations were common in dense brush when the deer would flush at close range but remained unseen due to screening vegetation. Triangulation locations were estimated from 3 bearings taken from as close as practical and with the greatest possible separation of angles to reduce the size of the error polygon (Heezen and Tester 1967, Springer 1979). These were not used for habitat analysis. Each relocation was plotted on topographic maps and recorded in latitude and longitude to 0.01 minute using a Garmin Global Positioning Device. Locations were later converted to Universal

Transverse Mercator (UTM) coordinates for home range analysis. Activity, group size, number of fawns, and number of deer seen within 1 km of the radio-collared animal were recorded. Activity was classified as feeding, bedding, traveling, escape, or unknown. At each location where a bed was found, concealment, percent of the bed shaded, what the bed was shaded by, and the distance I was from the deer when it flushed were recorded. Concealment was represented by an estimation of the percent of the deer not visible at 50 feet (17 m). A concealment rating scale from 1 to 10 was constructed by dividing the percent of the deer not visible by 10.

At each location where a radio-collared deer was seen or sign was found following an auditory location, the following site characteristics were recorded: elevation, aspect, slope, topography, horizontal configuration, and distance to the nearest water, stock, and primary and secondary roads. Elevation was taken from topographic maps (scale=1:24,000). Slope was measured with a clinometer. Topography was recorded as ridge top, upper slope, mid slope, lower slope, stream bed/bottom, or bench/flat. Horizontal configuration was classified as convex, straight, concave, or undulating. The nearest water was categorized as natural or artificial (i.e. stock ponds). I also noted if the pastures were stocked and if fresh sign of livestock were found within the plot. Maintained gravel roads were categorized as primary while tracks or unmaintained gravel roads were categorized as secondary. Distances to roads and water were measured from topographic maps (scale=1:24,000).

Cover type was also recorded at each location. Seven major cover types were identified by vegetation composition and structure. They were: Meadow, Low

Sage (<1 m), High Sage (>1 m), Sage/Bitterbrush, Mountain Brush, Riparian, and Aspen.

The Meadow type was found in low-lying areas which remained wet into late spring. It was composed of a grass/forb community and accounted for relatively little of the total area.

Big sagebrush (Artemisia tridentata) habitats dominated most of the area. Bitterbrush (Purshia tridentata), snowberry (Symphoricarpos sp.), currant (Ribes spp.), rabbitbrush (Chrysothamnus nauseosus and C. viscidiflorus), and serviceberry (Amelanchier alnifolia) were important shrub components of sagebrush habitats. Common forbs and grasses included balsamroot (Balsamorhiza spp.), buckwheat (Eriogonum spp.), lupine (Lupinus spp.), Idaho fescue (Festuca idahoensis), needlegrass (Stipa spp.), and oniongrass (Melica spp.).

Thick stands of bitter cherry (Prunus emarginata) and chokecherry (P. virginiana) were scattered throughout the area. Shrub components found in association with the cherries included Oregon grape (Berberis repens), ceanothus (Ceanothus sp.), willow (Salix spp.), stunted quaking aspen (Populus tremuloides), snowberry, and serviceberry. There was generally little grass or forb growth in the Mountain Brush habitats.

The Riparian type was found along streams and consisted primarily of very dense stands of willow shrubs. Mint (Mentha spp.) and sedge (Carex spp.) were commonly associated with these wet areas. In some areas cattle had reduced or eliminated the willow cover.

Homogeneous stands of aspen were scattered throughout the area. Stands heavily utilized by cattle tended to have very little understory, whereas those more remote from cattle had understories of variable density consisting of chokecherry, currant, serviceberry and snowberry. Forbs and grasses tended to be relatively sparse but horsemint (Agastache sp.) was commonly encountered.

At deer locations, all vegetation present within a 375 m^2 circular plot was noted. The percent cover for each species was estimated and assigned to a cover class (1=0-1%, 2=>1-5%, 3=>5-25%, 4=>25-50%, 5=>50-75%, 6=>75-95%, 7=>95%). In addition, the phenologic stages (West and Wein 1971) of shrubs, forbs, and grasses were recorded (Table 1). Utilization of each species was estimated and assigned to a utilization class (1=0-5%, 2=>5-20%, 3=>20-40%, 4=>40-60%, 5=>60-80%, 6=>80%). Every 2 to 3 days during the 1993 field season, fresh deer droppings were picked up, labeled, and put in paper bags. These were later analyzed microhistologically by the Composition Analysis Laboratory in Fort Collins, Colorado.

Table 1. Phenological stages and codes used for vegetation at Bennett Mountain.

Phenology Code	Shrubs	Grasses and Forbs
1	Flower	Vegetative growth
2	Fruit set	Flower buds
3	Fruit swelling	Flower
4	Fruit turning color	Fruit set
5	Fruit ripe	Fruit swelling
6	Fruit dry/dropping	Plant curing

Random Locations

Habitat availability was determined by going to 299 random points on the study area and measuring all habitat characteristics recorded at deer locations. This was accomplished by creating random locations in latitude and longitude to 0.01 minute