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Landscape Level Habitat Survey of Mule Deer Winter Range in Eastern Montana

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ABSTRACT

*In 2006 and 2007 Environmental Solutions Group, LLC (ESG) conducted landscape level surveys of mule deer (*Odocoileus hemionus*) winter range to test new field methods for assessing degree of browse utilization, browse species condition, and large animal distribution patterns. In 2007, a site was surveyed on Big Sheep Mountain in the Cherry Creek mule deer census area north of Terry in eastern Montana, covering approximately 6,400 ac (2,590 ha). Methodology followed Frisina and Knapp (2006). Data were collected along foot travel routes in a quarter mile pattern to cover the study area, totaling approximately 54 mi (86 km) of route at each site. Each data point represents a route segment up to 0.25 mi (0.4 km) long having a single type of vegetation. Data were collected for canopy cover and utilization level by individual browse species, canopy cover of other major individual plant species, amount of bare ground, and frequency of fecal pellet group observed for each ungulate species. Potential users of this methodology may now assess whether it offers useful and cost-effective application for their purposes.*

INTRODUCTION

Aerial surveys of large ungulate populations on important winter ranges in Montana has long provided the Montana Department of Fish, Wildlife and Parks (MT FWP) with information on population dynamics for management purposes, but these data would be more useful if they could easily and rapidly be related to detailed habitat conditions at a landscape scale. A new method for rapidly assessing conditions of browse vegetation across large tracts of mule deer (*Odocoileus hemionus*) winter range habitat was proposed by MT FWP scientists (Frisina and Knapp 2006). There was need for a cost-effective way to document important habitat conditions, to detect trends, and to develop an on-the-ground gauge of ungulate utilization of the browse resource. This method employs rapid assessment techniques to cover a large area quickly, and this report documents the results of a test of the methodology. Professional managers may now examine the methodology and these results to determine whether it can provide sufficient useful information on habitat conditions to enable management decisions based on resource realities in a cost-effective way.

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METHODOLOGY

This methodology was designed as a rapid way to assess browse species composition, distribution, utilization, condition, and the distribution patterns of wild ungulates, as indicated by fecal pellet densities. The purpose of this project was to apply the technique so that MT FWP could assess the effectiveness of the proposed methodology. As a rapid assessment tool, ocular estimation techniques are employed. These techniques require trained field observers and generally follow ocular estimation methods described by US Forest Service (1993).

Parameters evaluated were:

- •Canopy cover (abundance) of browse forage by species;
- •Canopy cover (abundance) of dominant non-browse forage by species;
- •Intensity of utilization of browse forage by species;
- •Wild ungulate fecal pellet group frequency by species;
- •Vegetation form (for example shrubland, grassland, forest, riparian, unvegetated)
- •Amount of other ground cover (for example rock, bare ground, litter, etc.); and
- •Landscape position (for example slope, benchland, broken topography, riparian bottom).

The result can be used to produce a series of maps of the study area showing:

- •Distribution and pattern of utilization intensity of each browse species;
- •Distribution of wild ungulate species usage of the site, based on fecal pellet group frequency; and
- •Any of the various other site characteristics listed above.

Following Frisina and Knapp (2006), sampling routes were laid out on a map of the study area in a pattern to cover the area with a grid of approximately 0.25 mi (0.6 km) separation. The goal was to sample along at least 45 mi (72 km) of route on the study area. During the sampling process, the routes were broken into "station" intervals wherever vegetation form changed, or when the maximum station length of 0.25 mi (0.4 km) was reached. As the observer progressed along the route, station data records were completed before proceeding to the next station. A station data record represents observation of conditions within a narrow, linear, band 6 ft (2 m) wide, centered along the route path. Location coordinates were recorded at each station end.

Browse forage species and major non-browse forage species were listed while walking the route. Note was taken of all the other parameters of interest, and photos are taken along the route path to document conditions on the station. Upon reaching the station end, canopy cover estimates were entered for each listed browse and non-browse species, as well as for bare ground, amount of litter, etc. The observed level of browsing intensity was entered for each browse species, and the observed category of fecal pellet group frequency was entered for each wild ungulate species known to use the study area. The station was also characterized by categories of landform position and major vegetation form, and narrative commentary was entered to describe other observations. Table 1 further defines the data collected.

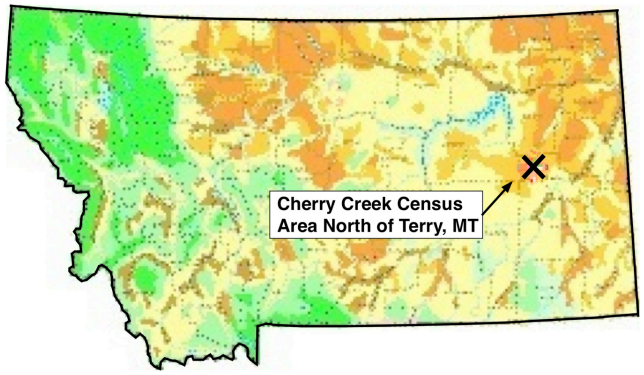

Figure 1—The Cherry Creek Mule Deer Census study area general location in Montana.

THE STUDY AREA

This study area in eastern Montana (figure 1) was chosen by MT FWP for trial of this methodology. The study area covers 10 sections (6,400 ac, or 2,591 ha) of prime mule deer winter range habitat. This paper describes the process and results applied to and produced on the study area surveyed in July 2007 on Big Sheep Mountain in the Cherry Creek Mule Deer Census Area north of Terry in eastern Montana (figure 2).

The study area is located in a highly varied terrain that includes wide ephemeral riparian bottoms, wooded draws with steep sides holding dense thickets of deciduous trees and shrubs, areas of erosional "badland" topography, and flat to moderately steep grassland steppe with scattered low shrubs. Elevation ranges from about 3,600 ft (1,312 m) at the west end down to about 3,100 ft (1,130 m) on the northern edge. The wooded draws and riparian bottoms support extensive stands of the Green Ash/Common Chokecherry (*Fraxinus pennsylvanica/Prunus virginiana*) habitat type (Hansen and others 1995). Vegetation in these communities is potentially very diverse, but historic and on-going livestock use has severely altered most of the stands. Stands that have escaped being trampled and altered are physically protected by either steep terrain or a BLM livestock exclosure plot fence.

This site is in valuable winter range habitat for which MT FWP maintains mule deer (*Odocoileus hemionus*) population data. Pronghorn antelope (*Antilocapra americana*) and white-tailed deer (*Odocoileus virginianus*) also inhabit the area. Sharp-tailed grouse (*Tympanuchus phasianellus*) and sage grouse (*Centrocercus urophasianus*) use the shrub-grassland range, as well. Figure 3 shows the route layout as sampled at Big Sheep Mountain.

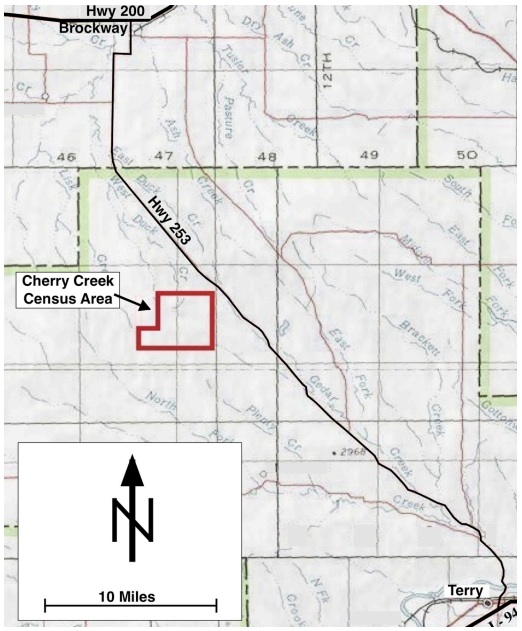

Figure 2—The vicinity of the Cherry Creek Mule Deer Census study area north of Terry in eastern Montana.

RESULTS

Browse Species Occurrence And Distribution

Of prime importance in this habitat survey is to obtain detailed knowledge of what species of browse are present on the study area, their abundance, condition, patterns of distribution, and the level to which they are being browsed. At each station, each browse species was recorded with estimated canopy cover on the station and with level of browsing intensity (Keigley and Frisina 1998). A list of browse species and data on their abundance in the study area is provided in table 2.

By weighting the species canopy cover station values by length of station, one may compile the abundance of each species over the study area at a spatial resolution determined by the density of routes and length of stations. This browse species information can be mapped by using the station location coordinates to give managers detailed tools by which to evaluate range conditions. Figure 4 shows the distribution of occurrence of fragrant sumac (*Rhus aromatica*) in the study area, as well as the distribution of browse intensity on the species.

Table 1—Variables sampled on each station polygon.

Variable Name	Variable Type	Unit of Measure	Note
Station Length	Numeric	Percent	Linear Measure
Browse Species Canopy Cover	Numeric Category[a]	Percent	Canopy Cover (Daubenmire 1959)[b]
Other Plant Species and Ground Cover	Numeric Category	Category	Canopy Cover (Daubenmire 1959)
Browse Species Level of Utilization	Attribute	Category	Intense, Light-to-moderate[c]
Vegetation Form	Attribute	Category	Shrubland, Grassland, Riparian[d] Forest
Landscape Position	Attribute	Category	Slope, Benchland, Broken Topography, Wooded Draw, Riparian[e]
Slope Steepness	Attribute	Category	Flat, Gentle, Moderate, Steep[f]
Ungulate Fecal Pellet Group Frequency	Attribute	Category	High, Moderate, Low, Limited[g]

[a]These categories represent a range of value, for which the range midpoint is used in calculations.
[b]Canopy cover is the gross outline of an individual plant's foliage. Cover of each species is estimated as a fraction of the sampled area. The sum of all species cover may exceed 100 percent due to layering.
[c]Level of browse utilization on each species is in one of these two categories (Keigley and Frisina 1998)
[d]Vegetation form is based on the dominant tallest plant life form characterizing the station as: ***Forest*** = A station with at least 10 trees per acre; ***Shrubland*** = A station with at least 15 percent total canopy cover of shrub browse species; ***Grassland*** = A station with less than 15 percent total canopy cover of shrub browse species; and ***Riparian Forest*** = A station located along a stream floodplain that is dominated by riparian/wetland tree species;
[e]Landscape position is described in one of four broad categories that best characterizes the station. These broad groupings of landform type are reflected in vegetation potential and in animal habitat value. The terminology used in this study is defined as follows: ***Slope*** = A sloping or rolling terrain characterizes the overall length of the station, often with a complex combination of variable aspect and steepness. Slope is further described by categories of steepness and aspect; ***Benchland*** = Nearly level to gently sloping uplands, including low terraces that lack riparian vegetation, that are largely independent of aspect; ***Riparian*** = Low bottomland associated with a drainage-way that supports vegetation requiring a wetter moisture regime than is provided by surrounding uplands. The riparian landscape position is assumed to be independent of slope steepness and aspect; and ***Broken topography*** = Highly eroded and dissected landforms with large amounts of naturally occurring bare ground, such as is typically found in clay parent materials—also known as "badland topography."
[f]Slope steepness categories represent a simplified characterization of an often complex landform of a station, where: ***Flat*** = 0 to 5 percent slope; ***Gentle*** = 5 to 20 percent slope; ***Moderate*** = 20 to 50 percent slope; and ***Steep*** = Greater than 50 percent slope.
[g]Observed fecal pellet frequency is recorded for each ungulate species by estimating the frequency of occurrence through each station, as: ***High*** = Pellet groups occurring along the station at intervals closer than 50 ft (15 m); ***Moderate*** = Pellet groups occurring along the station at intervals 50–100 ft (15–30 m); ***Low*** = Pellet groups occurring along the station at intervals greater than 100 ft (30 m); and ***Limited*** = No pellet groups observed.

In the study area, browse forage was not utilized evenly. Less palatable species were hardly browsed (for example western snowberry [*Symphoricarpos occidentalis*], creeping juniper [*Juniperus horizontalis*], and Plains silver sagebrush [*Artemisia cana* subsp. *cana*]), while almost every plant of the most preferred species was intensely browsed (for example chokecherry [*Prunus virginiana*], thorny buffaloberry [*Shepherdia argentea*], and western serviceberry [*Amelanchier alnifolia*]).

Figure 5 shows the occurrence distribution of thorny buffaloberry (*Shepherdia argentea*), a highly desired browse species. Thorny buffaloberry, even though armed with a thorny aspect, is intensely browsed throughout the study area. In all cases it was hedged down into the "arrested" growth form (Keigley and Frisina 1998), far shorter than the normal stature of the species. Seedlings or saplings of the species were not observed. These are indications that the population of this important species is in decline in the study area.

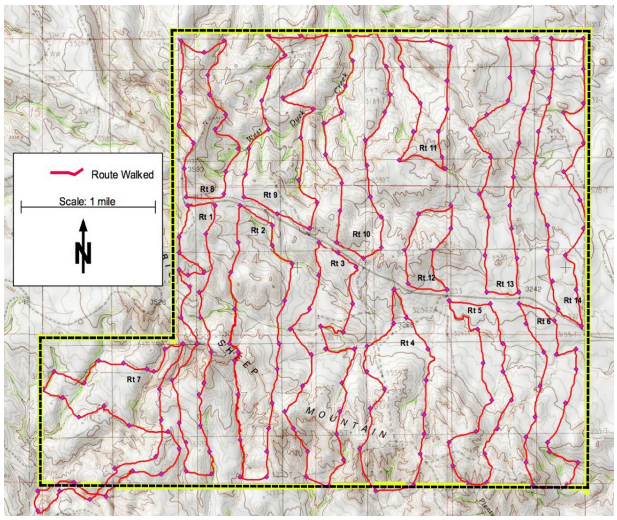

Figure 3—Map of the study area showing the layout of routes sampled.

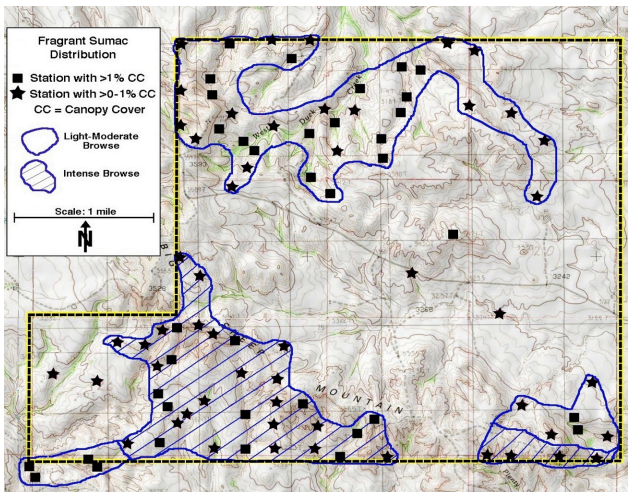

Figure 4—Approximate distribution of fragrant sumac (*Rhus aromatica*) occurrence on the study area, showing locations with different levels of browse intensity.

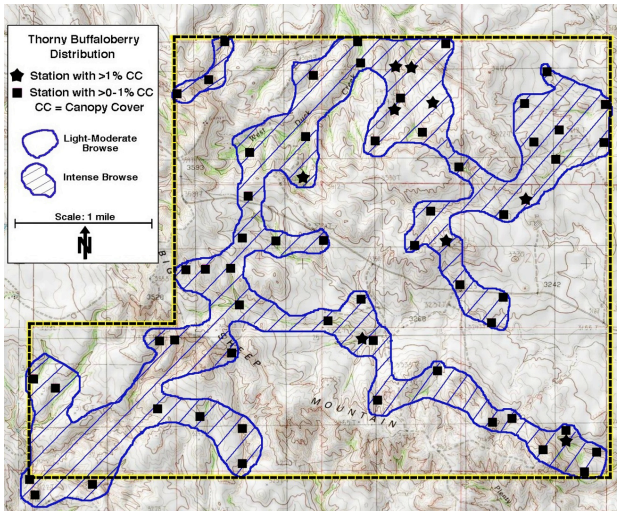

Figure 5—Approximate distribution of thorny buffaloberry (*Shepherdia agrentea*) occurrence on the study area, showing locations with different levels of browse intensity.

Large Wild Ungulate Distribution (Pellet Group Frequency)

Estimation of the frequency of ungulate species fecal pellet groups was made by ocular observation for each station along the browse assessment routes walked, although white-tailed deer (*Odocoileus virginianus*) pellets were not distinguished from those of mule deer (*Odocoileus hemionus*). For wild ungulates known to use the site, pellet group frequency on each station polygon was categorized as:

High—Pellet groups observed at a spacing closer than one per 50 ft (15 m) of route distance;
Moderate—Pellet groups observed at a spacing of 50 to 100 ft (15 to 30 m) of route distance;
Low—Pellet groups observed at spacing greater than 100 ft (30 m) of route distance; or
Limited—No pellet groups observed on the station.

The distributions of pellet group frequencies recorded is tabulated in table 3. Although both mule deer (*Odocoileus hemionus*) and white-tailed deer (*Odocoileus virginianus*) are present, fecal pellets were not distinguished between the two deer species. Pronghorn antelope (*Antilocapra americana*) are present on the study area, but their fecal pellets were not observed along the routes sampled.

CONCLUSIONS

Who Did What?

This study was not designed to differentiate the impacts of the different ungulate species that utilize the range; nor was it designed to distinguish livestock impacts from those of wildlife. Questions about which animals are eating which plants may need to be answered before management decisions intended to bring habitat improvement can be made with much confidence. While both wildlife and livestock utilize all accessible portions of the range, very few deer pellets were found on some of the routes where severely browsed shrubs were observed. Relatively lush herbaceous growth in many parts of the study area may have obscured observation of fecal pellets.

Bang for the Buck

This effort was largely a test to find out how much area could be sampled by an observer in a given length of time, or for a certain dollar amount, and to what resolution the data could be interpreted. The study area encompassed 10 sections (6,400 ac [2,590 ha]) of fairly rugged terrain containing a diverse vegetation. Approximately 54 mi (86 km) of route were surveyed with 250 stations sampled, giving a linear resolution of approximately 0.18 mi (0.29 km) to the data.

Expenses to accomplish the field sampling and subsequent analysis and reporting were held within a $10,000 budget for this study area. However, to cover the study area to the resolution specified, required approximately 50 percent more field time than was budgeted. Future applications of this methodology should figure the field time at 2.5 hours per mile of route. (This is to walk the routes and collect the data at a data intensity of five to six stations per mile.) Considering travel distance to remote sites, inclement weather delays, and the time to adequately make the observations, this initial work was budgeted approximately 25 percent too low.

Suggestions

Managers of wildlife populations and habitats may now evaluate this new tool for its potential to serve their needs and to integrate with their traditional methods. This method is intended for rapid, survey application, where spatially detailed information is needed across large areas. The test data collected is available for scrutiny, criticism, suggestion for improvement, and creative application to management needs. The mapped variable examples presented in this paper are from the full set included in the report to MT FWP (Thompson and Hansen 2007).

Table 2—Browse species recorded with canopy cover of each, the number of stations and percent of stations having the species recorded (constancy of occurrence) (total number of stations = 250).

Browse Species	Project wide avg. canopy cover[a] (%)	Range of canopy cover (%)	#Stations w/ species recorded	% Constancy of occurrence[b]
Western snowberry (*Symphoricarpos occidentalis*)	6.1	0-60	202	80.8
Green ash (*Fraxinus pennsylvanica*)	5.4	0-3	74	29.6
Common chokecherry (*Prunus virginiana*)	4.1	0-10	88	35.2
Creeping juniper (*Juniperus horizontalis*)	2.6	0-10	169	67.6
Silver sagebrush (*Artemisia cana*)	2.0	0-40	213	85.2
Fragrant sumac (*Rhus aromatica*)	0.8	0-10	90	36.0
Common juniper (*Juniperus communis*)	0.5	0-10	74	29.6
Woods rose (*Rosa woodsii*)	0.5	0-3	61	24.4
Arkansas rose (*Rosa arkansana*)	0.4	0-3	122	48.8
Thorny buffaloberry (*Shepherdia argentea*)	0.2	0-3	66	26.4
Western serviceberry (*Amelanchier alnifolia*)	0.2	0-3	43	17.2
Kinnikinnick (*Arctostaphylos uva-ursi*)	0.2	0-0.5	10	4.0
Common rabbitbrush (*Chrysothamnus nauseosus*)	0.1	0-10	35	14.0
Golden currant (*Ribes aureum*)	0.1	0-3	31	12.4
Missouri gooseberry (*Ribes setosum*)	0.1	0-0.5	26	10.4
Red-osier dogwood (*Cornus stolonifera*)	0.1	0-0.5	19	7.6
Succulent hawthorn (*Crataegus succulenta*)	0.1	0-3	17	6.8
Bebb willow (*Salix bebbiana*)	0.1	0-10	16	6.4
Great Plains cottonwood (*Populus deltoides*)	0.1	0-20	10	4.0
Water birch (*Betula occidentalis*)	0.1	0-10	6	2.4
Rocky Mountain juniper (*Juniperus scopulorum*)	<0.1	0-10	10	4.0
Yellow willow (*Salix lutea*)	<0.1	0-10	5	2.0
Silverberry (*Elaeagnus commutata*)	<0.1	0-3	3	1.2
Black currant (*Ribes americanum*)	<0.1	0-0.5	3	1.2
American plum (*Prunus americana*)	<0.1	0-3	2	0.8
Common hop (*Humulus lupulus*)	<0.1	0-3	2	0.8
Peachleaf willow (*Salix amygdaloides*)	<0.1	0-10	1	0.4
Black cottonwood (*Populus trichocarpa*)	<0.1	0-20	1	0.4
Wyoming big sagebrush (*Artemisia tridentata* subsp. *wyomingensis*)	<0.1	0-3	1	0.4

[a]Average canopy cover = sum of (station polygon canopy cover of species X station length) / sum of all stations lengths)
[b]Constancy of occurrence = number of stations where a species was recorded / total number of stations on the project (250)

Table 3—Ungulate pellet group frequency recorded for the 250 stations in Study Area 2.

Pellet Group Frequency	Number of Stations by Ungulate Species	
	Deer	Pronghorn Antelope
High (<50 ft [15 m] apart)	1	0
Moderate (50–100 ft [15–30 m] apart)	10	0
Low (>100 ft [30 m] apart)	38	0
Limited (none observed)	201	250

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