Selection of habitats by wintering elk in a rapidly subdividing area of La Plata County, Colorado

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Abstract

La Plata County is currently undergoing rapid population growth. It is estimated that the county increased in population by 14% from 1990 to 1994, growing from 32,284 to 36,887 people. The projected population by the year 2000 is 44,556, a 38% increase from 1990. With this increased growth comes pressure to develop more land and natural resources throughout the county. New developments are geared toward single-family units on larger lots, which require larger parcels of land to house fewer people, versus multi-family units or small lot sizes which house a larger number of people per unit of land. As this development expands, it can adversely impact wildlife and wildlife habitats and can limit the ability of managers to manage wildlife. Part of La Plata County and particularly areas along a major U.S. highway or near public lands, have experienced proliferation of 1-4 ha lot subdivisions. This greatly increases human impacts in the forms of roads, fences, outdoor activity, dogs, structures, while at the same time removing land from agricultural use that provides forage and security cover.

While this area is receiving increased human use, it is also home to part of the third largest elk herd in Colorado, and winters approximately 6,000 elk. Elk winter range and severe winter range maps closely coincide with the area of "ranchette" proliferation. This area of overlap causes elk-human and elk-auto conflicts, degradation in the quality of elk winter range, and permanent loss of elk wintering areas.

A management study was initiated in the winter of 1996-97 within this heavily impacted area to identify areas of elk use in relation to subdivision presence, lot size, road development, habitat type, and surrounding land use. Elk appear tolerant of some subdivision attributes, but intolerant of others. In addition, elk navigate through some subdivisions, while other subdivisions are nearly totally avoided. If this elk herd is to be maintained, with severe development occurring on winter range and spring-fall transition ranges, the County staff and Division of Wildlife staff feel critical migration corridors and wintering areas must be maintained and protected through public and private methods.

Approximately 30 radio-collared elk have been monitored in a 600 square km area through each winter and spring-fall migration period. A Geographic Information System was used to create mapped layers of subdivision attributes, habitat type, and land use to relate to elk habitat use areas. This paper reports on elk winter use areas in relation to residential subdivisions.

Elk have shown a significant preference towards grass/forb rangelands, sagebrush (*Artemisia* spp.), and pinyon-juniper habitats, and an aversion towards ponderosa pine (*Pinus ponderosa*), pin oak (*Quercus palustris*), and mixed conifer habitats. Elk have also shown a significant aversion to parcels < 4 ha, and a preference toward parcels > 24 ha. No significant reaction was found toward mountain shrub habitats, or toward parcels 4-24 ha. Elk are generally considered "habitat generalists" and many studies have not been able to identify significant selection or aversion to habitats. This study has begun to identify the reaction of elk in human-dominated landscapes. Some preliminary land use planning recommendations are made.

This study will continue toward the goal of identifying the tolerance of elk toward various parcel sizes in each habitat type, to identify thresholds of human density and elk use.

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INTRODUCTION

The human population of the western United States is growing rapidly. This trend will continue and perhaps increase in the near future, as the baby boom generation enters retirement (Colorado Department of Health 1993), as the service sector of the nation's economy grows, and as expansion of the telecommunications network continues. These changes permit rapid exchange of information across long distances, allowing employees to work where they choose (Riley 1993). In such an economy, the aesthetic values of the environment become an economic asset (Randall 1986) that attracts individuals and businesses (further attracting people). This growth compromises the quality of life features that attracted people in the first place. In addition to population growth, this changing demography of the West is changing the impact people have on the environment. The historic land uses of the West, agriculture, logging, mining, and water development, cause habitat loss as a result of the removal of commodities from the landscape. These are relatively intensive changes to the environment that cause conversion from one habitat type to another. Population growth, however, may not cause type conversion, because residences can be built within various habitat types without converting those types, but impacts still occur, and may be extensive on a landscape level. Historical disturbances resulted in patches of habitat embedded in a matrix of disturbed land, whereas future disturbances may produce patches of disturbance within a matrix of habitats (Batty 1991, Hobbs and Miller 1994). As disturbances shift from primarily intensive and commodity driven to extensive settlement driven, a conservation opportunity exists because residential development, when properly managed, can be less intensive than commodity harvest (Stenberg and Shaw 1986, Hobbs and Miller 1994).

This management study was located in eastern La Plata County, in the southwest corner of Colorado. La Plata County is currently undergoing rapid population growth, growing by an estimated 14% from 1990-1994 (32,284 residents to 36,887 residents). The population is projected to continue to grow to 44,556 by the year 2000, 56,087 in 2010, and 63,987 in 2020, nearly a 100% increase from 1990 (Colorado Demography Section, 1999). With this growth comes pressure to develop more land and natural resources throughout the county. New developments are geared toward single-family homes on larger lots which require larger parcels of land to house fewer people, versus multi-family units which require smaller parcels of land to house more people (Layden and Manfredo 1996). As this development expands, it can adversely impact wildlife and wildlife habitats (Bailey 1984) and can limit the ability of wildlife managers to manage wildlife.

Land use planning in Colorado is tiered by size of development parcels. Division of land into parcels more than 14 ha is allowed by State law, whereas any subdivision into parcels <14 ha falls under the jurisdiction of the county government. Divisions of land into parcels of land >14 ha are easy to accomplish because they generally require no governmental approval. Some Colorado counties (not La Plata) have begun reviewing these land divisions through a Health, Public Safety and Welfare clause of the State law. When subdivision into parcels <14 ha is requested, review is required to determine compatibility with the county land use plan for access, sewage, water, area compatibility, essential services, natural and environmental hazards, etc. Each of these issues receives greater scrutiny as the size of the subdivision increases and lot size decreases. In La Plata County, for example, subdivision into parcels <0.5 ha requires both a central water and sewer system, but parcels 0.5-1.2 ha need to have either a central water or a central sewer system, and parcels >1.2 ha only need individual water and septic systems. La Plata County has also recently recognized "abuses" occurring with larger subdivisions, where the original applicant created lot sizes of 6-14 ha (15-35 acres), and then subsequent owners have further subdivided into 1-6 ha parcels, changing the environmental quality of the area, because the original infrastructure was not built with further subdivision in mind. This tiering of review has caused a proliferation of parcels >14 ha scattered throughout the county, with some public planning process now in place to organize subdivision (parcels <14 ha) into designated areas with adequate water, sewer, transportation, and environmental conditions.

Rocky Mountain elk (*Cervus elaphus nelsoni*) are native residents of Colorado (Bryant and Maser 1982), including La Plata County. They were hunted to near extinction at the peak of the resource extraction period (McCabe 1982), and animals were reintroduced from Wyoming in 1912. The elk population has made significant recovery (>200,000 in Colorado, Colorado Division of Wildlife (CDOW) unpub. data) and in parts of the State including La Plata County exceed the desired population. The elk population in the study area (Figure 1), about 6,000, is approximately 40% of the San Juan Basin elk herd, the fourth largest elk herd in Colorado. The elk herd in the study has abundant summer range on public lands throughout the San Juan Mountains, and traditionally winters in the southeastern quarter of La Plata County, which is primarily private land (51%) and Southern Ute Indian Reservation (20%). The winter range is bisected by US Highway 160, a major arterial. This highway corridor is also a focus

of residential subdivisions in the last 15 years, resulting in fragmented land developments and fragmented habitats. In severe winters, the elk migrate farther south, and most cross Highway 160 and navigate through the subdivisions. In milder winters, the majority winter north of the highway and reside near and within other subdivisions (Figure 1). Despite this, the elk population has been stable even with heavy hunting pressure, but wildlife managers, concerned with long-term degradation in habitat and carrying capacity, are attempting to reduce the herd (San Juan Basin Elk Mgmt. Plan, CDOW, unpub.).

In 1995, a survey of La Plata County residents was undertaken (Layden and Manfredo 1996) by the Colorado Division of Wildlife (CDOW), Colorado State University, and the La Plata Board of County Commissioners. This survey documented strong support for wildlife, wildlife habitat protection, and land-use planning among county residents and residents of the city of Durango. In addition, elk hunters have an estimated total economic benefit to the county of $2.8 million (Hunting and Fishing Industries Economic Impact Model, CDOW, 1995, unpub.). Because of strong public support for maintaining quality of life values, wildlife habitat protection, and consideration of wildlife in land-use planning, and because of a seasonal economic dependence on wildlife-related recreation, La Plata County Planning Department staff has requested more specific data on elk distribution and habitat use patterns from the CDOW.

This study was initiated to identify areas of current conflict between elk and human settlement, areas of future or potential conflict, and to identify areas and habitat characteristics necessary to protect and preserve the elk population that residents of La Plata County and the CDOW desire.

The specific null hypotheses tested in this study were: 1) elk use vegetation/habitat coverage in proportion to its availability, 2) elk use parcel sizes in proportion to their availability, and 3) all vegetation/habitat coverages will be used by elk regardless of subdivision parcel size in proportion to their availability. We were also interested in the degree of variation shown by individual elk versus the population as a whole.

METHODS

This study involves the area between Durango, Colorado on the west and the La Plata/Archuleta County line on the east, an e-w distance of approximately 30 km. The north and south study area boundaries were subjectively identified as the extent of the wintering areas for elk in this area (22 km). Six primary elk wintering areas were identified near subdivisions that contained a large proportion of the elk in the area. Elk were caught in December 1996, with the aerial net-gunning crew instructed to select mature cow elk from each herd segment within the general wintering areas. Subsequently, elk were caught to replace mortalities in these same wintering areas using Clover traps (Clover 1956). Elk were fitted with radio transmitter collars and released on the spot. Radio-marked elk were then monitored with aerial telemetry at monthly intervals; their location was visually verified from the air when possible and marked using the aircraft's LORAN Global Positioning System. In addition, intensive ground radio telemetry monitoring was used March-May of each year, and again animal location was verified with visual location when possible or by triangulation at close distances. The spring period of more intensive monitoring was used to collect both winter range information (March-mid April), and spring transition (migration) range (mid-April-May), without the confounding factor of hunting seasons.

Vegetation coverage was determined using Basinwide Vegetation Classification (CDOW, Bureau of Land Management, United States Forest Service Cooperative Project, unpub. data) derived from 25m LANDSAT thematic imagery. The number of vegetation types was reduced from 24 to 8 on the basis of limited representation or subjective similarity of cover and forage value. This vegetation cover map was used in ARC/INFO (ESRI) to relate to parcel size and elk use.

Parcel size information was obtained from the La Plata County Planning Department in a digital file for use in ARC/INFO. Subjective groups of parcel size are analyzed in this paper. Those parcel sizes were identified as 0-1 ha (0-3 acres), 1-4 ha (3-10 ac), 4-14 ha (10-35 ac), 14-24 ha (36-60 ac), and 24+ ha (60+ ac) on the basis of subdivision patterns in this area: a few areas developed with very small parcels, a recent (10 year) proliferation of 1.1, 2, and 3 ha subdivisions, widespread subdivision into 6-10 ha parcels and 15 ha parcels. The largest parcel-size group (>24 ha) was used to represent primarily agricultural-based areas versus primarily residential-based areas. Individual parcel lines were dissolved within similar size parcel polygons to reflect overall land-use patterns.

Chi square goodness of fit tests were used to compare actual elk use with expected use by vegetation/habitat cover and parcel size. Components which were used significantly more or less than expected were further analyzed with the Bonferroni Z test (Neu et al. 1974) to determine which specific vegetation type or parcel sizes were used more or less than expected. Significance levels of $p<0.1$ were used to determine selection or aversion to a habitat characteristic.

RESULTS

Thirty adult female elk were captured on 17-18 December 1996. One was classified as 1.5 years old, the rest were adults ranging to approximately 15 years old. Elk from all 6 wintering areas were captured, 3 in 1 and 4-6 in the other 5. All elk were released at the site of capture, and all survived >1 month. One mortality occurred approximately 2 months post capture, apparently related to a severe winter storm of >1 m of snow on even the lowest elevation winter range. Two elk were subsequently harvested the following hunting seasons. Each of these 3 recovered collars were placed on elk in January 1998. Data for 3 elk were not used in the following analyses because of insufficient sample size, resulting in data for 27 elk with sufficient data (20-77 individual relocations) for 2 winter periods, 1996-97 and 1997-98. Data for 1998-99 have not been analyzed and are not included in this report. Weather is not a variable being evaluated in this study except in how it influences elk distribution and habitat use. Both winters could be considered "normal" in temperature and precipitation, except precipitation occurred in different patterns, the first winter having one significant snowfall that remained on the ground into April, the second winter having "normal" snowfall spread throughout the winter.

Individual elk showed significant preference or aversion to vegetation cover (Table 1). Fifteen elk had sufficient sample size to allow individual chi square analyses. Overall, 5 elk used sagebrush (*Artemesia tridentata*)/grasslands more than expected, 4 used grass/forb range more, and 3 used pinyon/juniper (*Pinus edulis/Juniperus* spp.) significantly more than expected. One elk selected mountain shrub more than expected, but 4 individuals used mountain shrub less than expected. Habitats selected less often than expected were: agricultural, primarily irrigated hay, (8 elk); mixed conifer (8); ponderosa pine (*Pinus ponderosa*)(6); and ponderosa pine/gambel oak (*Quercus gambelii*) (6). The remaining 12 elk were assigned to 4 groups of similar habitat use patterns for analysis. The groups of elk analyzed preferred sagebrush (1 group), mountain shrub (1), pinyon/juniper (1), and pine/oak (1 group), but avoided pine/oak (2), grass/forb range (1), agricultural areas (2), and mixed conifer (3). All elk combined preferred grass/forb range, sagebrush, and pinyon-juniper, and avoided agriculture, ponderosa pine, ponderosa pine/oakbrush, and mixed conifer types.

No individual elk had a sufficient sample size to allow analysis of parcel size selection or avoidance, because of the low occurrence of 0-1 ha parcel sizes (3.4% of total area). All elk were randomly placed into 7 groups for Chi Square analysis (Table 2). One group exhibited use of all parcel sizes in proportion to their availability, but each of the other 6 displayed avoidance of 0-1 ha and 1-4 ha parcels, and 4 groups showed a preference for 24+ ha parcels. All elk combined showed significant preference toward 24+ ha parcels and avoided parcels 0-4 ha.

The analysis of the interaction of parcel size and vegetation type could not be completed because of the strong preference shown for 24+ ha parcels and the avoidance of 0-1 ha parcels, consistent among all cover types, and the avoidance of agriculture, the pine types, and mixed conifer. In all vegetation types, elk prefer the larger parcel size strongly, and avoid the smallest parcel sizes. Table 3 displays the skewed nature of the data and the lack of data in small classes.

Another way of looking at differential elk use of vegetation types across parcel sizes, and also selection of vegetation types with elk "hiding" or security cover as well as aversion to small parcel sizes is in Figure 2. In this case, ordination of the data across the 2 axes in a scatterplot displays a grouping of 29 elk analyzed in the upper half, and most in the upper right quadrant. The upper half of this plot represents selection of larger parcel sizes, with the axis ranging from 0-24 ha on the bottom (-1) and 24+ ha on the top (+1). The horizontal axis is based on security cover, the left side (-1) composed of agricultural, grass/forb range, and sagebrush which are too short to conceal an elk, and the right side is all other taller vegetation combined (+1). Again, this illustration supports the earlier finding that elk substantially use larger parcel sizes at a higher frequency than smaller parcels, and that hiding cover is an important habitat component in subdivided winter ranges but there is some tolerance for open habitats.

The average size of each polygon that elk were using was calculated (Table 4). The Basinwide Vegetation Map contains many fragments (<0.5 ha) of each vegetation type that skews the mean patch size available (approaching 1 ha average). This artifact made comparison of patch size used to patch size available impossible at this time. All patch sizes used, however, were > the smallest parcel size analyzed (24 ha). This suggests the importance of minimizing the human-induced fragmentation that occurs with subdivision of land in a landscape that is already quite diverse in vegetation coverage.

DISCUSSION

Elk habitat preferences have been studied for many years (Boyce and Hayden-Wing 1979, Lyon and Ward 1982, Skovlin 1982). Many of these studies have evaluated elk use in human- altered landscapes by looking at the effects of logging, roads, fire, and livestock, among others. The study of elk in human-dominated landscapes, such as rural residential

subdivisions, is either new or relatively unpublished. The discipline of wildlife management strives to understand the ecological, genetic, and demographic processes that determine the status of wildlife populations and sustain biodiversity. Field studies are primarily based in areas where human settlement and associated impacts are insignificant landscape features, and many study areas are selected specifically because of the lack of human impacts. This has led to a gap between our understanding of ecological processes and the reality of much of wildlife management in human-dominated landscapes.

Management of elk, habitats, and land uses has been primarily based on documented avoidance or stress responses by elk (Lyon 1979, Morgantini and Hudson 1979, Edge and Marcum 1985). Habituation of elk to human disturbances may occur if that disturbance is predictable and harmless (Lyon and Ward 1982). When responses are observed that appear to contradict documented avoidance responses, habituation may be occurring in elk inhabiting urban fringe areas (Thompson and Henderson 1998). Habituation may be occurring in La Plata County, as elk are often tolerant of roads, fences, and close proximity to houses during the winter. This trend may continue, which could achieve a goal of maintaining a high elk population with current development trends, but at the expense of current population management techniques.

Elk in this study exhibit preferences for grass/forb rangeland, sagebrush, and pinyon/juniper, and individual elk preference toward mountain shrub. This is consistent with the findings of many other studies (Skovlin 1982) and has led to the description of elk as an ecotone species. Each of these habitats satisfies a unique requirement. Grass/forb rangelands and sagebrush provide good foraging areas but little security cover, while pinyon/juniper and mountain shrub habitats provide good security cover. In addition, Reynolds (1964) found that elk use was considerably higher where shrubs were intermixed with pinyon/juniper. Winn (1976) found higher plant species diversity and higher plant biomass at the edge of two habitat types (an ecotone) than at the interior of either.

In contrast, many studies (Julander and Jeffrey 1964, McConnell and Smith 1970, Marcum 1975, Winn 1976 Lonner 1977,) were not able to establish any preference of habitat types. One group of 3 elk in this study also follows this pattern of no significant selection. All remaining elk, analyzed as individuals and in groups, and the population as a whole, did prefer specific habitats at significant levels. Therefore, the preferences identified in this study must be considered significant and potentially critical to the maintenance of this elk herd.

The avoidance by elk of agricultural types in this study is somewhat surprising. Elk are commonly seen in agricultural fields and those fields certainly provide adequate forage. Because agriculture fields in this area are typically hay meadows, they are frequently covered by snow and therefore the vegetation is covered. Foraging may be easier in native grass/forb ranges and sagebrush after snowfall. Agricultural fields almost certainly could be shown to be a preferred vegetation type during the short period in the autumn before they are snow covered, and again in the spring during green-up. In addition, agricultural areas are primarily foraging areas for elk, and the bulk of feeding occurs during early morning and late evening (Waldrip and Shaw 1979). These periods are under represented in our study; therefore our data may be reflecting bedding and resting sites.

Our results appear to support unregulated development in most of the coniferous forests (Ponderosa pine, pine/oak, and mixed conifer) and possibly the mountain shrub community because of elk avoidance to these habitat types. These habitat types are typically the upper elevation limit of winter range, and the avoidance of these types is probably due to snow depth (Sweeney and Steinhoff 1976). However, the areas are important for elk migration (Skovlin 1982). Elk in this area extensively use the mountain shrub, ponderosa pine, and mixed conifer forests for spring and fall migration and when these habitats are available in the winter (this study, unpubl. data).

Six of 7 groups of elk analyzed, and all elk combined, significantly avoided all subdivided parcels below 4 ha. No groups had significant preference or avoidance of 4-24 ha parcels. All elk combined and 4 groups significantly preferred 24+ ha parcels. Black et al. (1976) have recommended 24 ha stands of security cover be left for elk, but Irwin and Peek (1979) suggested that 24 ha may not be enough based upon their work in Idaho. These 2 studies tend to support findings in this study, and would reinforce the need for a minimum of 24 ha areas of hiding cover (mountain shrub, pinyon-juniper, and higher elevation conifer types).

Winn (1976) and Marcum (1975) both found higher elk use on the edge of larger openings (>300 m wide) than in the interior portions of large openings. This suggests that in open habitats (agriculture, grass/forb range, and sagebrush in this study) openings > 9 ha may be of diminishing value to elk. This could explain low observed use in agricultural fields (which are typically >24 ha in this area), and higher observed elk use in grass/forb ranges which are more frequently natural openings of <24 ha. Sagebrush may be providing both security cover and forage in larger openings, and therefore this cover

receives relatively high use in large openings.

This study analyzed potential conflicts between subdivision of land and elk habitat management in part of the winter range in La Plata County. This area has high potential for conflict because of the intensity of human development, but also because winter range conditions impose significant constraints on herd size and productivity. Thomas et al. (1976:461) stated: "These ranges, because of their scarcity and intensity of use, are more sensitive to alteration of the vegetation." Klemmendson (1967:268) stated that big game winter range had been declining in size and productivity for more than 30 years, and concluded that, while " . . . something must be done to counteract the trend of dwindling winter habitat . . . it seems unlikely that existing priorities will greatly change."

The documented human population increase in La Plata County and the forecasts for the future put intense pressure on landowners to divide or subdivide. This has caused land prices to rise, which can create disparity between local costs of living and local incomes. One remedy for this is to create smaller lot sizes or build multi-family homes. But these alternatives are contradictory to the current trend of larger lot sizes with single family homes. This situation could be mitigated by clustering homes in 1 corner of a much larger parcel, maintaining the open spaces residents want while reducing the per-unit cost. This may be a better alternative for reducing the negative impacts on elk by leaving large areas intact while still permitting development.

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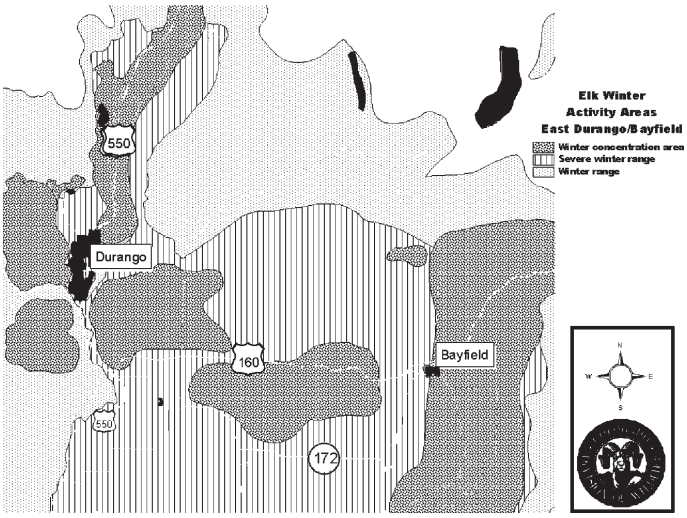

Figure 1. Elk winter range areas in a developing portion of eastern La Plata County, Colorado

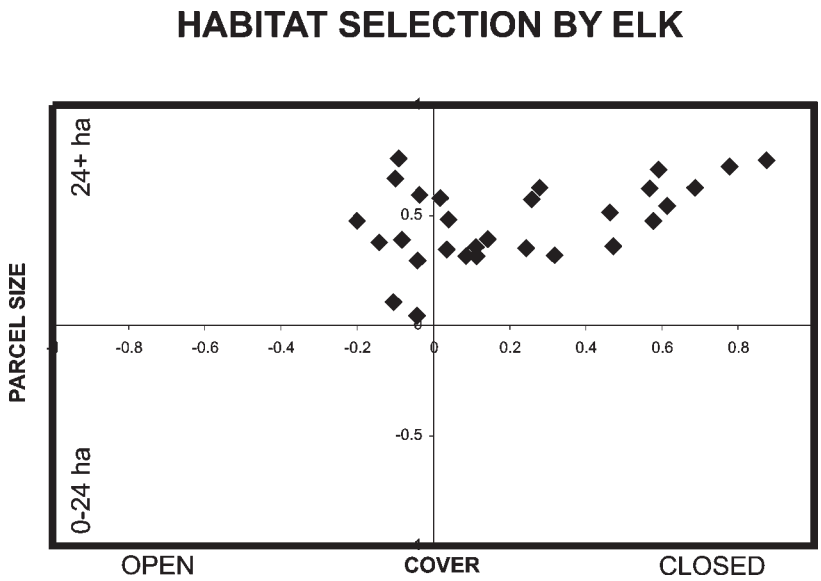

Figure 2. Ordination of La Plata County elk winter use areas in 1996-1998. Open cover types are agricultural, grass/forb rangelands, and sagebrush habitat types, closed cover types are mountain shrub and all coniferous covers. Parcel size is split into 0-24 ha and 24+ ha groups.

Table 1. Selection (+++) or avoidance (—) of vegetation cover by individual and groups of elk during winter, La Plata County, Colorado.

			HABITAT TYPE							
Elk ID	Sample	Chi Square	Agriculture	Grass/Forb Range	Sagebrush	Pinyon/ Juniper	Mountain Shrub	Ponderosa Pine/Oak	Ponderosa Pine	Mixed Conifer
471	70	16.49		+++						---
620	71	25.96		+++				---	---	
761	77	37.06					---		---	
991	50	24.78	---						---	
500	54	23.16	---				+++	---	---	
521	58	19.49			+++					
542	53	22.01	---			+++		---		
561	57	19.95	---							
600	47	14.19						---		
720	54	23.92		+++			---			
739	57	47.65	---		+++	+++	---	---		---
759	60	31.04			+++			---	---	---
801	56	36.35	---		+++	+++		---		---
841	72	65.15	---		+++		---	---	---	---
390	75	25.51	---	+++						---
Group 1	99	11.98 (NS p=.11)								
Group 2	189	66.78	---	---			+++	+++		
Group 3	71	26.65						---		---
Group 4	100	46.67	---		+++	+++		---		---
ALL ELK	1358	235.7	---	+++	+++	+++		---	---	---

Table 2. Selection (+++) or avoidance (—) of various parcel sizes by groups of elk during winter, La Plata County, Colorado.

GROUP	SAMPLE	CHI SQUARE	PARCEL SIZE (ha)				
			0-1	1-4	4-14	14-24	24+
1	159	13.04	---	---			
2	202	16.55	---	---			+++
3	178	11.78	---	---			+++
4	177	14.26	---	---			
5	144	13.95	---	---			+++
6	181	13.96	---	---			+++
7	148	5.81 (NS)					
ALL ELK	1360	81.05	---	---			+++

Table 3. Proportion of elk use (%) in various parcel sizes within vegetation types in La Plata County, Colorado.

	Habitat Types								
	Agriculture	Grass/Forb Range	Sagebrush	Pinyon/ Juniper	Mountain Shrub	Ponderosa Pine/ Oakbrush	Ponderosa Pine	Mixed Conifer	TOTAL POINTS
>24 ha	6.5	9.9	12.7	16.2	11.3	6.6	7.0	3.1	997
14-24 ha	1	1.6	2.4	3.7	2.0	1.0	0.8	0.07	171
4-14 ha	1.5	1.3	2.1	2.4	1.5	0.9	0.3	0.2	138
1-4 ha	0.6	0.7	0.3	1.5	0.2	0.07	0.3	0	49
<1 ha	0	0	0.07	0	0	0.2	0.07	0	4
TOTAL POINTS	130	183	240	324	203	119	115	45	1359

Table 4. The average size of each polygon that elk were using in winter in eastern La Plata County, Colorado.

Vegetation Type	Patch Size of Used Sites (ha)
Agriculture	53.4
Grass/Forb Range	27.6
Sagebrush	58.7
Pinyon/Juniper	85.1
Mountain Shrub	187.9
Ponderosa Pine	24.2
Pine/Oak	17.8