MOOSE AND DEER HABITAT USE AND DIET ON A RECLAIMED MINE IN WEST-CENTRAL ALBERTA

by

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Abstract. Moose(*Alces alces*) and deer (*Odocoileus* spp.) use of a reclaimed coal test mine site and adjacent habitat in west-central Alberta was monitored to determine habitat use, use of planted shrubs, and diets. In 1979, the site was seeded with grasses, alfalfa(*Medicago sativa*) and clover(*Trifolium* sp.), then planted with lodgepole pine(*Pinus contorta*) and white spruce(*Picea glauca*) seedlings, and willow (*Salix pedicularis*). Mean levels of use by moose and deer of the site were higher than in adjacent habitat, not significantly by moose ($p>0.05$), significantly by deer($0.05<p<0.10$). Use of the site was variable from year to year, with no clear trend; variability was less in adjacent habitats. Days-of-use/ha of the site by deer was twice that of moose, but the difference was not significant on a year-by-year basis. Moose diet was primarily willow(88%) and spruce(8%); deer diet was primarily *Cornus* (31%), legumes(23%), *Equisetum*(15%), and *Populus*(6%). Planted willow shrubs were heavily or moderately browsed between 1981 and 1985. Seeded grasses were sparingly grazed.

Additional Key Words: Western Canada; reclamation; willows; ungulates.

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Introduction

In the mountain and foothills biomes of Alberta, mining exploration and extraction have resulted in removal of forest cover and disturbance of a moderate amount of land(Thirgood and Ziemkiewicz 1978, Marshall 1983). Although the removal of forest cover can improve habitat for some wildlife species through the creation of ecotones, physical land disturbance may reduce the local availability and

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quality of wildlife habitat (Alberta Energy and Natural Resources 1984). We report on a monitoring study which quantified the use of reclaimed mine land by deer and moose in west-central Alberta, and docum- ented the efficacy of the new wild ungulate habitat provided.

Recent studies of wildlife habitat and mining in Alberta have been directed towards determining habitat requirements (Green et al. 1986, Green and Salter 1987) and documenting procedures to establish wildlife habitat on abandoned mining areas(Green et al. 1986). Published studies of wild ungulate use of reclaimed mines in western Canada either focus on elk (Cervus elaphus)(Kuhn and Martens 1980), or do not distinguish between ungulate species (Stanlake et al. 1978). The following study focuses on deer and moose, and is set at a more northerly latitude than other published Canadian studies.

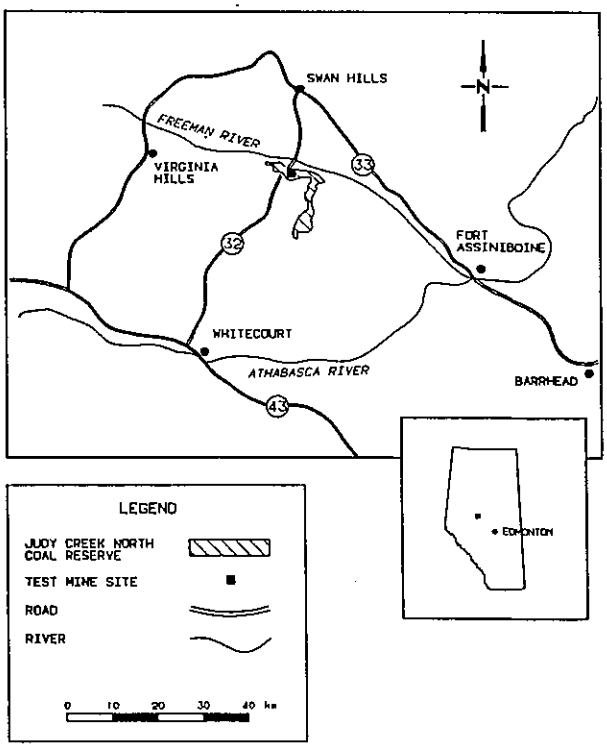
During January, 1979, Esso Resources Canada Limited excavated a coal test mine to obtain a bulk sample from the Judy Creek North reserve. A subsequent program to stabilize and reforest the test mine site, in conjunction with a vegetation and wildlife monitoring study, provided the opportunity to evaluate use of the habitat by moose and deer. Mule deer(Odocoileus hemionus), white-tailed deer(O. virginianus) and elk occur in the region; however, white-tailed deer appear to be much less abundant than mule deer, and elk have been recorded only occasionally. The specific objectives of the study were: (1) to determine moose and deer habitat utilization on the test mine site and surrounding habitats; (2) to evaluate the use of planted deciduous shrubs on the reclaimed area; and (3) to document moose and deer food habits.

The Study Area

The Judy Creek test mine site is located at an elevation of 980 m above sea level, 53 km southwest of Swan Hills, Alberta(Figure 1). The mean annual temperature is 4°C. Mean annual precipitation is 42 cm, and most occurs during the growing season.

The test mine site is approximately 18 ha in area. The area adjacent to the test

Figure 1.
Location of the Test Mine Site



mine site supports primarily coniferous and mixedwood forest communities. Dominant forest cover types are: lodgepole pine-black spruce(*Picea mariana*)/ feathermoss; trembling aspen(*Populus tremuloides*)-white spruce/low bush cranberry(*Viburnum edule*); lodgepole pine/ bunchberry (*Cornus canadensis*)-bog cranberry (*Vaccinium vitis-idaea*); and trembling aspen-balsam poplar(*Populus balsamifera*)/wild sarsaparilla (*Aralia nudicaulis*).

Reclamation of the mined land was conducted in 1979 prior to the monitoring study. The seed mix contained Canadian bluegrass(*Poa compressa*), creeping bentgrass(*Agrostis palustris*), creeping red fescue(*Festuca rubra*), crested wheatgrass (*Agropyron cristatum*), slender wheatgrass (*A. trachycaulum*), smooth brome(*Bromus inermis*), and timothy(*Phleum pratense*). Legume species included alfalfa and alsike clover (*Trifolium hybridum*). The reestablished communities consisted largely of these species as well as invading grasses, forbs and shrubs (Kennedy 1986). The reclaimed mine area was planted in spring 1979 with lodgepole pine and white spruce seedlings at 1250 stems/ha.

Methods

Pellet Group Counts

Pellet group counts were used to determine moose and deer use of the study area. Moose and deer habitat utilization is expressed for both the test mine and surrounding habitat types by a "days-of-use" statistic, calculated according to the following formula:

$$\text{Days-of-Use} = \frac{\sum p^i \times 100}{\sum t^i \times 13} \quad (1)$$

where $\sum p^i$ equals the number of pellet groups in the i^{th} vegetation type, and $\sum t^i$ equals the number of plots in the i^{th} vegetation type. The plot size of 100 m^2 was standard in non-test-mine habitats; a smaller plot size (10 m^2) was used on the test mine site. A defecation rate of 13 pellet groups per day was assumed for both moose and deer following Usher(1978), Connolly(1981) and Creed *et al.*(1984).

On the test mine, 50 permanently marked 2 x 5 m square plots were established. To allow complete coverage, the plots were distributed in a systematic manner. In June of 1978, 1980, 1983 and 1984, all pellet groups from the previous winter were counted and then removed from the plots.

Forest habitats adjacent to the test mine were categorized as shrubland, deciduous dominant, coniferous dominant and mixedwood forest. Within each habitat type, 20 plots were randomly placed along each of 10 transects (total 200 plots). In June of 1979, 1980, 1983 and 1984, all pellet groups from the previous winter were counted and then removed from the plots.

Use of Planted Deciduous Shrubs

To determine whether

moose and deer would forage on planted browse, three shrub islands of willow were constructed in spring 1979 on the test mine site. Stem cuttings were taken from local populations of willow growing in the vicinity of the test mine. Cuttings were from 0.75 to 1.5 cm in diameter and approximately 30 cm long. All side branches were clipped back to the main stem and planted within one day of being collected. Willow plants(N = 175) were distributed equally among the 3 "islands" at approximately 1 m spacings.

During May-June of 1981 to 1985, the degree of browsing of planted willows was evaluated. The percentage of current annual twigs browsed was classified as follows: no use (0), very light (1-9), light (10-39), moderate (40-59), heavy (60-89) and very heavy(90-100).

Diets of Moose and Deer

Fecal samples for moose and deer were collected during June, 1982, at each pellet group plot on the test mine. Composite samples were used for plant species identification (Holechek et al. 1982; Holechek and Gross 1982). Material from each composite sample was mounted on 10 microscope slides; 200 locations on each slide were examined to identify the presence of plant species in the diet.

Results

Habitat Use

Mean levels of days-of-use/ha by moose of the test mine site were higher than in adjacent forest and shrubland habitat over the study period, (Table 1)but not significantly so(Mann-Whitney Test, T=20, p>0.05). No evidence was found

TABLE 1. Moose(M) and deer(D) habitat utilization (days-of-use/ha) on Judy Creek test mine site and in adjacent habitats, as determined from pellet group counts 1978-85.

Habitat Type		YEAR OF SURVEY						
		1978	1980	1981	1982	1983	1984	1985	Mean
Test Pit Site	M		0.0	3.1	7.4	4.3	1.8	5.7	3.7
	D		5.4	14.8	5.1	21.3	6.3	1.4	9.0
Adjacent Habitats									
Shrubland	M	5.9	2.2			5.7	7.5		5.3
	D	1.4	0.3			5.7	1.4		2.2
Deciduous Forest	M	3.9	-			3.8	5.0		4.2
	D	1.5	-			4.8	8.7		5.0
Mixedwood Forest	M	5.1	3.5			4.3	2.4		3.8
	D	3.0	4.0			2.4	3.4		3.2
Coniferous Forest	M	1.2	0.4			2.5	0.8		1.2
	D	1.5	2.7			4.1	1.2		2.4

of moose using the test mine site in 1980, the year after test excavation. However, moose used the site in each of the subsequent years, with intensity varying from 1.8 (1984) to 7.4(1982) days-of-use/ha, and a mean of 3.7 days-of-use/ha(Table 1). No trend in use is apparent from the data. In relation to adjacent habitats, mean use by moose of the test mine site was greater than use of coniferous forest, equivalent to use of mixedwood forest, and less than use of deciduous forest and shrubland. Again, no year-to-year trend in days-of-use by moose was apparent from the data from adjacent habitats.

Use of the test mine site by deer was highly variable, with a 15-fold difference in calculated use levels among years(Table 1). Levels of use measured in adjacent habitats were also variable, but much less so than the test mine site. No evidence of deer using the test mine site was found in 1980, the year after excavation. Days-of-use/ha varied from 1.4(1985) to 21.3 (1983), with a mean of 9.0 (Table 1). In years when data are available for comparison, deer used the test mine site more frequently than all other habitat types in all years except 1984, when deciduous forest data show greater use. Mean days-of-use/ha was greater for deciduous forest than other adjacent habitats (Table 1).

Mean levels of use by deer of the test mine site have been higher than in adjacent forest and shrubland habitats over the total study period(Mann-Whitney Test, $T=20$, $0.05<p<0.10$). Overall, deer days-of-use/ha of both the test mine site and adjacent habitats fluctuated, with no trend apparent.

Deer used the test mine site twice as much as moose (total 54.3 vs. 22.3 days-of-use/ha during 1980-85), but the difference in use, when considered on a year-by-year basis, was not significant (Wilcoxon's Signed Rank Test, $T=3$, $p>0.05$).

Use of Planted Shrubs

Browsing of willows planted in 1979 was observed in 1980 and continued consistently from 1981 to 1985(Table 2). Of the 1,204 shrubs evaluated for browse use for all years, 318(26%) showed no use. For the most part, the remainder were browsed heavily(26%), moderately (20%) or lightly (16%). In the final year of evaluation (1985), more than half of the plants were browsed heavily. In other years, the proportions in each browse evaluation class remained relatively constant.

Diets of Moose and Deer

Five plant groups or genera were identifiable in fecal fragments of moose. Over 88% of the moose fecal fragments analysed consisted of willow(Table 3). One other genus(*Picea*) accounted for 8.1 % of the fragments, while the remaining identifiable groups or genera were minimally represented. Fecal fragments from deer were dominated by *Cornus* (31.2%), unidentified legumes (23.2%), and *Equisetum*(15.2%). Ten other groups or genera were also identifiable,

TABLE 2. Browsing of willow plantings on the test mine site. Numbers in parenthesis are percentages of total shrubs evaluated.

YEAR	Browse Use[1]						
	None	Slight	Light	Moderate	Heavy	Severe	Total
1981	42	15	25	25	35	11	154
1982	95	23	53	30	30	2	232
1983	43	16	48	75	77	8	267
1984	113	30	48	60	45	3	299
1985	25	4	15	52	131	25	252
Totals	318(26)	88(7)	189(16)	242(20)	319(26)	49(4)	1,204

[1] Browse use expressed as the number of plants browsed in each class. Classes are based on percentage of current annual twigs browsed, as follows: None(0), Slight (1-9), Light (10-39), Moderate (40-59), Heavy (60-89), Very Heavy (90-100).

TABLE 3. Moose and deer food habits as determined by fecal fragment analysis.

Plant Group (Genera)	% Composition Moose	Deer
Graminoids		
Festuca	0.2	1.6
Poa	0.0	3.8
Forbs		
Legume (type)	3.0	23.2
Equisetum	0.0	15.2
Cornus	0.0	31.2
Woody Browse		
Picea(spruce)	8.1	4.0
Pinus	0.0	2.0
Populus	0.0	6.5
Rubus	0.0	4.2
Salix(willows)	88.1	1.6
Viburnum	0.7	1.6
Vaccinium	0.0	0.4
Lichen		
Letraria(type)	0.0	1.6

principal among which were Populus, Rubus, Picea and Poa.

Discussion

Both deer and moose used the reclaimed test mine site to a level equivalent to use of adjacent habitats. Other studies have documented white-tailed deer(Beregovoy and Brucker 1983), mule deer (Medcraft and Clark 1986), and elk(Kuhn and Martens 1980) use of reclaimed mine sites. We are unaware of any studies documenting use of reclaimed mine sites by moose.

Our study did not attempt to determine seasonal differences in use or diets of deer and moose. In a study of mule deer and pronghorns(Antilocapra americana), Medcraft and Clark(1986) found that, year-round, mule deer used unmined land less than mined land reclaimed and seeded with alfalfa; however, pronghorns used unmined land more than the

mined land owing to a greater dependence, particularly in winter, on native forages. In the Judy Creek region, there may be seasonal differences in the willingness of moose and deer to use the test mine site.

The results of our analysis of moose and deer diets indicate that moose in the study area are heavily dependent on willows for forage, while deer diet is more varied. Analyzed feces were collected from the test mine site only; however, we assume that the diets indicated represent foraging both on and off the mine site.

Our records of browsing on willows coupled with the dietary dependence of moose on willows suggests that the plantings are encouraging use of the test mine site by moose. Only a small proportion of deer feces fragments consisted of willow. The second most prominent genus in the diet of moose was Picea, suggesting that planted spruce were also being used. Fragments of the other planted tree species, Pinus contorta, were not found in moose feces.

The relationship of deer diets to the plant species used in revegetation is less clear. Both Festuca and Poa were found in deer feces fragments, and both were seeded on the test mine site. Legumes, perhaps including alfalfa, were prominent in deer feces fragments; however, the technique for analyzing fragments was incapable of determining legume genera or species. Alfalfa is known to attract deer to use other reclaimed mine sites, and to dominate their diet in spring and fall(Medcraft and Clark 1986). Willows, Picea, and Pinus fragments were present in deer feces. At Judy Creek, assuming that all legume fragments are from seeded forbs, and that graminoids and woody browse genera fragments are from seeded or planted sources, the majority of deer fecal fragments were from species or genera that were not used in revegetation. This suggests that deer spend more time feeding in (cf. moving across) areas other than the test mine site.

Conclusions

Our monitoring study documented that deer and moose used a reclaimed mine site in west-central Alberta within 1 year of revegetation. To our knowledge, the response by moose has not been previously recorded in published literature. No trends in the amount of use by deer or moose are apparent from our data. Planted willows were consistently browsed from year to year, and fecal fragment analysis suggests that moose will be attracted to revegetation with willows. Graminoid genera used in revegetation also occurred in deer fecal fragments, but much less often than forbs and woody browse. Our data and other studies suggest that revegetation using seed mixes with a greater proportion of legumes will attract deer.

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