SURVEYS for SENSITIVE VERTEBRATES and RIPARIAN HABITATS on the MEDICINE BOW and ROUTT NATIONAL FORESTS

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INTRODUCTION

This report discusses results from an inventory of sensitive species and their associated riparian habitats in the Medicine Bow and Routt National Forests. The purpose of the project is to provide a baseline dataset of small mammal and amphibian abundance and characterize habitat at select riparian locations in southeastern Wyoming and Northern Colorado. Surveys for potential sites were conducted during the winter of 2006-2007 to control for the possible influences of snow compaction from winter recreation activities. Vegetation sampling, small mammal trapping, and amphibian surveys were conducted the following summer in 2007.

METHODS

Study Area

Study sites are located in two general areas of the Medicine Bow and Routt National Forests (MBRNF). The first group of sites is about 5km east of Medicine Bow Peak in southeastern Wyoming. The second group is in the vicinity of Rabbit Ears Pass, near Highway 40 in northern Colorado. Figure 1 shows a map of the study area and the locations of sites. Sites were defined as mesic meadows dominated by grasses, sedges, and willows. Meadows ranged in size from approximately 1 to 6.3 ha and ranged in elevation from 2862 m (9390 ft) to 3178 m (10427 ft). Because recreational snowmobiling and skiing are common activities in the MBRNF, sites were selected to account for possible influences of snow compaction on vegetation and animals. Table 1 outlines the locations of the study sites and shows the level of recreational use. It is worth noting that although skiing and snowboarding activities occur in select parts of the Forests, snowmobiling plays a much larger role in potential snow compaction than non-motorized activities (Keinath and McCumber, 2007).

Snow Pack Surveys

Prior to this project, WYNDD conducted aerial surveys of the extent of snow compaction across the MBRNF during the winter of 2005-2006. The results of that project are available in a report delivered to the MBNF in January of 2007 (Keinath and McCumber 2007). One of the major products of that project was a Forest-wide map delineating areas that receive heavy and light snowmobile use. We used that map to select 'paired' riparian meadows of 'high-' and 'low-impact' for amphibian and mammal surveys. Paired sites were always less than 10 radial kilometers from each other and within 75 meters in elevation of each other.

During the winter of 2006-2007, snow pack measurements were taken at paired sites within two days of each other (to control for differences in recent snowfall). The purpose of those measurements was to quantify the effects of repeated winter recreation on snow density and subnivean space. A reduction or elimination of subnivean space has potentially negative implications for small mammals and hibernating amphibians (Saneki et al., 2006; Wanek, 1973; Jarvinen and Schmid, 1971). Small mammals depend on it to

travel and forage throughout the winter, and amphibians require it for oxygen exchange to subterranean hibernacula. In addition, compacted snow is potentially less insulating for small animals, allowing temperatures at the ground-snow interface to drop well below freezing when they would otherwise remain near 32°F under normal conditions (Wanek, 1973).

One snow pit was dug per site per visit. Pairs B and D (Figure 1) were visited twice at different times during the winter (B_1, B_2, and D_1, D_2) to increase the sample size because pair A was too remote to sample. During each visit, we recorded visual estimates of the extent of snowmobile and ski tracks and dug snow pits to evaluate the density of the snow pack. In selecting sites to dig pits, we chose locations that were representative of the intensity of use in the target meadow while avoiding areas with woody cover, wind scour, or abnormal snow deposition. Snow weight at the surface and at 10cm intervals throughout the snow profile was measured with a standard scoop of known volume ($175.05cm^3$). Snow depth, air and ground temperatures, and a qualitative estimate of subnivean space were also recorded at each snow pit. Later, snow density and water equivalent were derived from the above measurements.

Vegetation Sampling

Vegetation measurements were designed to capture general cover and structural characteristics across sample meadows. Broad vegetation categories were used (i.e. rush, willow, grass, etc.) in order to capture course-scale differences between 'high' and 'low' impact sites. Sampling began by randomly placing a 180m x 180m grid over the study site. Vegetation sample points were spaced every 15 m in parallel rows within the grid. We attempted to sample 50 points per site and space them regularly throughout the grid. Sample points were skipped if they were within 5 m of a tree that was greater than 5 cm diameter at breast height (DBH) or if the point fell on open water.

The first measurement taken at the point was a visual estimate of percent cover considering a 7.5 m radius around the point. Cover was classified with 25% increments as either predominantly non-woody vegetation ("grass") or predominantly willow. This classification was used to stratify sampling points into those two major habitat types. At each sample point, we rated the soil condition as '0' (dry, rocky, hard soil), '1' (dry, firm soil), '2' (moist, firm soil), or '3' (moist, spongy soil).

The second set of more detailed measurements was taken at the point using a Daubenmire square (Daubenmire 1959). We recorded visual estimates of the percent cover of grasses, sedges, rushes (and rush-like plants), forbs, willows (and other woody plants), bare ground, lichens, mosses, litter, and Canada thistle (*Cirsium arvense)*. Cover of dominant vegetation was estimated in 10% increments, and cover types representing less than 10% of the plot were estimated as either 1% or 5%. For grasses, sedges, rushes and rush-like plants, and forbs, we estimated the number of individual flowering plants in the square as 0, 1, few (approximately 2-7), or many (more than approximately 7). For willow and other woody plants, we selected the two stems nearest the southwestern corner of the

square and counted the number of live and dead terminal buds on stems that were ≥1 cm long. We also measured the depth of litter at each corner of the square.

Finally, above-ground biomass was measured by placing a 110 cm Robel pole (Robel 1969) on the northeast corner of the Daubenmire square, standing 3 m to the south, and positioning our eyes 1 m above the ground. We estimated the highest point on the pole (in meters) that was at least 50% obstructed from view by plant matter.

Small Mammal Trapping

At each study site, we set and checked approximately 100 small Sherman traps (H. B. Sherman Traps, Inc., Tallahassee, Florida) for three nights. Traps were spaced 15 m apart along parallel lines within the vegetation grid. We did not set a trap if the sample point was within 5 m of a tree (≥5 cm DBH), or if it fell on surface water. Traps were baited with three-way horse feed and polyester bedding. We left the traps closed during the day, opened them at approximately 7PM, and checked them by 11AM the following morning. Unless traps were protected by thick vegetation, they were covered with foam insulation to protect captured animals from extreme cold and heat. We identified captured animals to species when possible. The small mammals were weighed, aged, sexed, and released. Each animal was given a unique mark using colored pens so that recaptured individuals could be identified. Morphological measurements were occasionally taken to aid identification, and trap mortalities were collected and preserved.

Amphibian Surveys

At each study site, we pre-selected 1-3 sample points, spaced at least 200 m apart, which provided a good vantage for hearing amphibians. After sunset, we listened at each point for 10 minutes and recorded the intensity of calling for species heard. We ranked intensity on the following scale: '1' (individual, non-overlapping calls), '2' (individual, overlapping calls), or '3' (a constant chorus of calls). We also ranked background noise (wind, cars, etc) to determine our ability to hear calls further away: '0' (no noise), '1' (very little noise), '2' (medium noise; whispers not audible), or '3' (high background noise).

Visual searches for amphibians were also conducted during midday hours for about 60 minutes per site. We began surveying in areas within the meadow that had the most surface water and moved progressively to areas of less water. Surface water was scanned systematically by two people by walking on each side of the water's edge.

RESULTS

Snow Pack Surveys

Visual estimates of the extent of tracking by snowmobiles and skis corresponded well with how meadows were mapped by Keinath and McCumber (2007). 'High' impact sites

were found to be 35-90% tracked when visited in person, whereas 'low' impact sites were only 2-10% tracked. Table 2 displays the data from snow pits collected in the winter of 2006- 2007. In all cases, snow depth was less in 'high' impact sites due to compaction by snowmobiles (and to a lesser extent skis) on those sites (Figure 2). Overall, snow depth at tracked sites was about half that of untracked sites. This difference was significant at the $\alpha = 0.05$ level (p_5=0.031). The trend is greatly exaggerated at B_2 where snow depth at the high impact site is only 10% of its low impact counterpart.

As was the case with snow depth, ground temperature was significantly lower at all high impact sites (p_5=0.013) (Figure 3). The average ground temperature at high impact sites was 28.5°F and 32.0°F at low impact sites. Although likely partially the result of other factors (see below), ground temperature was much lower at site B_2 (24°F) as a result of the lack of insulating snow.

Not surprisingly, snow density was higher at almost all high impact sites (Figure 4). This does not, however, result in a significant difference in snow water content between high and low impact sites (p_5=0.115; Figure 5), because the same amount of frozen water was simply compressed into a smaller area.

Subnivean space was not quantitatively ranked, so a statistical comparison is not possible, but there was no clear impact of snowmobile compaction on subnivean space. In fact, our small sample size suggests that the low impact sites in this study might have had less subnivean space! It bears mentioning that paired snow pit sites for B_2 were probably not chosen well and should be removed from the analyses. When removed, nevertheless, all of the aforementioned parameters remain significant at the α =0.01 level.

Vegetation Sampling

Percent cover in sampled riparian meadows was dominated by graminoids, willows, forbs, and litter. The complete vegetation dataset is available in Appendix A and in the attached shapefile; '***2007_WYNDD_Ripar_Veget.shp***'. A summary of completed surveys is presented in Table 3 showing that 440 cover points were collected in all with a minimum of 39 collected at each site. From the beginning of summer data collection, we observed that there was a great amount of natural variability between sites that could not be explained by any one variable. For example, at some sites, willows dominated and were 1.5 m high where others had few willows and were dominated by grass cover. When sites were grouped by level of winter recreation, vegetation parameters were not noticeably different except in two cases. One was forb cover. We found that the percent cover of forbs was significantly lower (p_9=0.042) in meadows that receive winter motorized recreation ($\bar{x}$ = 34%) than in those that did not ($\bar{x}$ = 41%). Percent willow cover at sites dominated by willow was also different between 'high' and 'low' impact sites (p_4=0.047). Average willow cover at low impact sites was 52% and 47% at high impact sites. However, these results should be interpreted with caution as we explain in the Discussion section below.

Small Mammals and Amphibians

A total of 19 auditory and 5 visual surveys were conducted for amphibians. At least one auditory survey was completed at each site, but because detections were consistently low, some sites were not visually searched (see Table 3 for details). There were 5 total detections of amphibians; all of the boreal chorus frog (*Pseudacris maculata*). Two larval groups were observed at site E (high impact) near FS 315 and Highway 40. One adult was seen at site B (low impact) near Green Rock Picnic Area, and two groups were heard calling at B (high impact) near Hourglass Lake. Amphibian detections were so low that no meaningful trends about habitat preferences or impacts from snow compaction can be concluded.

A total of 119 small mammals were live trapped (92 unique individuals) at the 10 riparian sites, representing 7 genera and approximately 9 species. A list of all species captured is presented in Table 4. The complete capture and detection dataset is shown in Appendix B and in the attached shapefile; '***2007_WYNDD_Ripar_Vert_Capt.shp***'. A total of 2851 trap nights were conducted with a minimum of 229 completed at each site for a total capture rate of 4.2 captures/100 trap nights. None of the species captured are listed as Species of Concern by WYNDD. Some individuals of *Microtus* and *Sorex* could not be identified to species because it would have required killing the animal (to look at their teeth). Shrews (*Sorex spp.*), however, often suffer high levels of trap mortality and in this study, 15 of 25 (60%) died in traps and were identified to species in the laboratory.

Capture data were combined with vegetation and winter recreation parameters in an attempt to explain the abundance and diversity of taxa among sites. Specifically, dominant cover type and level of winter recreation were analyzed in relation to the number of captures, presence or absence of species, average weight by species, age, and sex ratio. No clear relationships emerged from the data, revealing that, at least with the small sample size we had, there was not a significant difference between small mammals caught and the habitat type or level of winter recreation.

CONCLUSIONS and DISCUSSION

This study was not an exhaustive inventory of all species of small mammals and amphibians occurring in the riparian meadows of MBRNF. Rather, it was pilot project designed to generally characterize snow pack, vegetation, and associated species of small mammals and amphibians in selected high-elevation, wet meadows that receive different levels of compaction from winter recreation activities. Our conclusion is that winter recreation (primarily snowmobiling) has a pronounced influence on snow pack depth and density. These changes lead to lower ground temperatures but not necessarily a reduction in subnivean space. Results suggest that those changes in snow pack did not have a noticeable impact on the presence of small mammals, or that impacts were not detectable with the small sample size and techniques used in this study. In contrast, previous research has found that snow compaction reduces the presence of small mammals in the subnivean space by 80 to 100% (Jarvinen and Schmid, 1971; Sanecki et al., 2006). It is possible, that snow compaction in our study area does have subtle influences on small

mammal populations that were imperceptible in this study due to low capture rates and a limited number of sites. Unfortunately, detections of amphibians were so low that no meaningful conclusions can be drawn.

Our vegetation results hint at the possible influence of winter recreation on forb and willow cover. Those two cover types were significantly lower in meadows receiving extensive snowmobile activity. There are two things to consider in interpreting those results, however. First, our sample size was very small, and second, there are other influences besides winter recreation that could have influenced vegetation composition and structure. We noticed that levels of summer ATV use, domestic grazing, surface water, soil moisture, and organic matter varied greatly across sites. The current vegetation structure at each site is the product of complex differences in site conditions and the legacy of human management. Without controlling for all of those differences, it is hard to pinpoint the effects of any one factor.

It seems intuitive that snowmobiling over willows would at least have the effect of reducing willow height by clipping off the top branches. However, in reality, riders may be reticent to cross willows until the snow is deep enough to prevent from sinking into air pockets beneath the branches. Thus, the willow portions of our study sites may not have been compacted until the snow was deep enough to cover willows, and therefore deep enough to protect the subnivean space from activity at the surface. This may also explain why small mammal populations seemed unaffected by compaction.

Because this is the first project of its kind to be conducted on the MBRNF, many lessons were learned from the study. First, amphibians occur at very low densities on the landscape and require extensive searching to be located. Second, low small mammal capture rates indicate a more extensive trapping effort was needed than was possible for this study. Third, if the impacts of winter recreation are to be distinguished from impacts of other factors, meadows must be paired VERY carefully. Alternatively, manipulative experiments could be performed in which snow compaction on sample meadows is directly regulated for multiple years. Further, given the sometimes high variability in the data, sample size was a clear hindrance to making statistically valid conclusions, so we recommend that subsequent studies incorporate at least twice as many sites as were studied in this project. Finally, if snow compaction were indeed to have an influence on small mammal and amphibian abundance, the probable mechanism would be compressed subnivean space and reduced ground temperatures. Thus, future studies should focus on collecting many more samples of these variables in a standardized and quantitative way.

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FIGURES

Figure 1. Location of paired study sites with level of compaction (H=high, L=Low) in the Medicine Bow and Routt National Forests.

Figure 2. Snow depth at sites receiving extensive and little winter recreation in the MBRNF. (B1, B2 and D1, D2 are temporal replicates of the B and D sites).

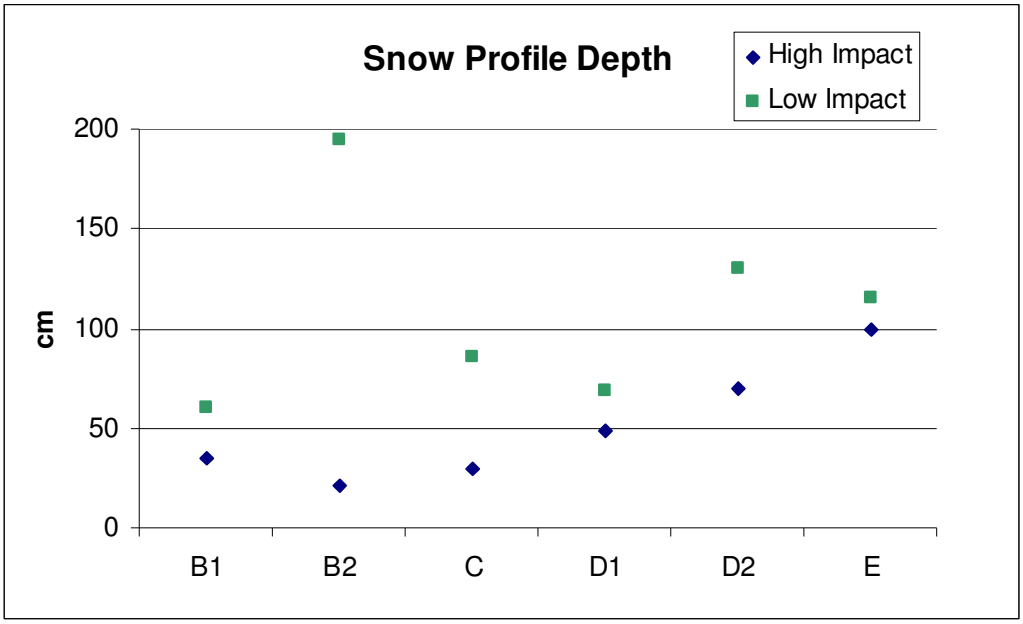


Figure 3. Subnivean ground temperature at sites receiving extensive and little winter recreation in the MBRNF.

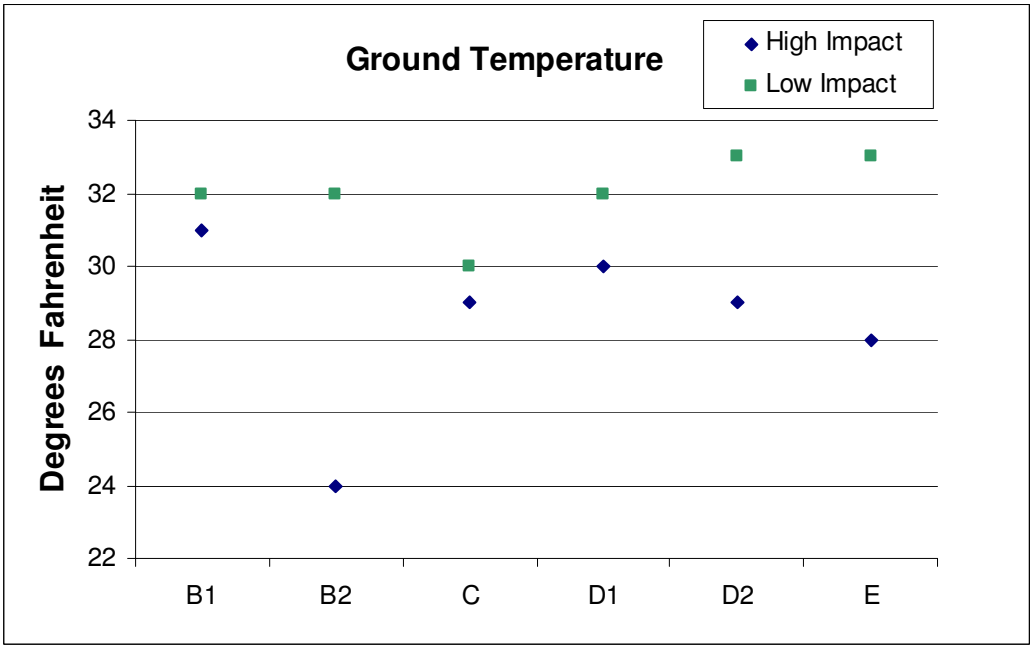


Figure 4. Average density of snow at sites receiving extensive and little winter recreation in the MBRNF.

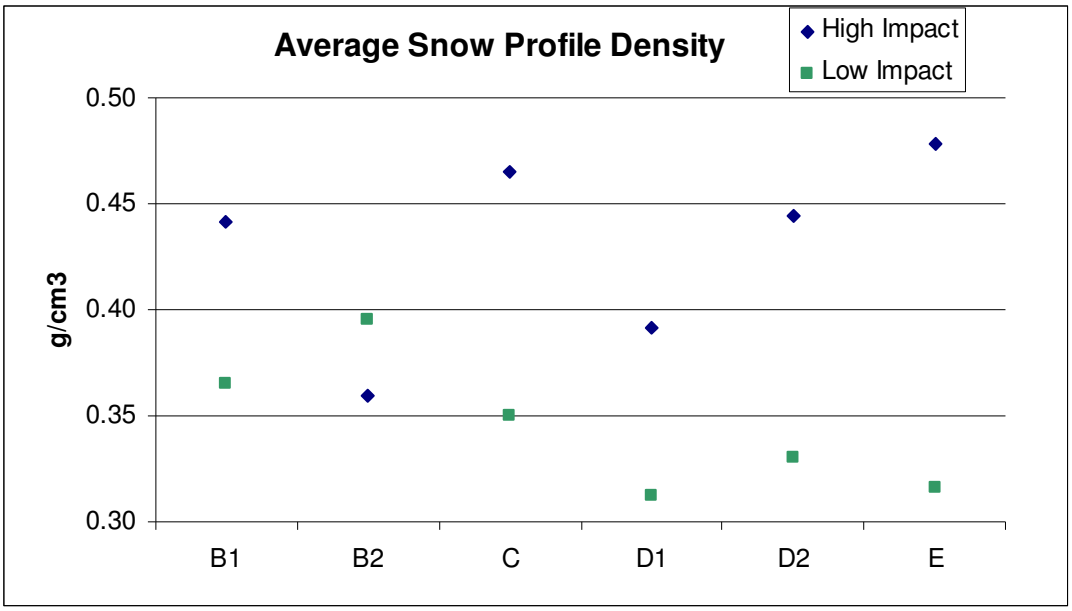
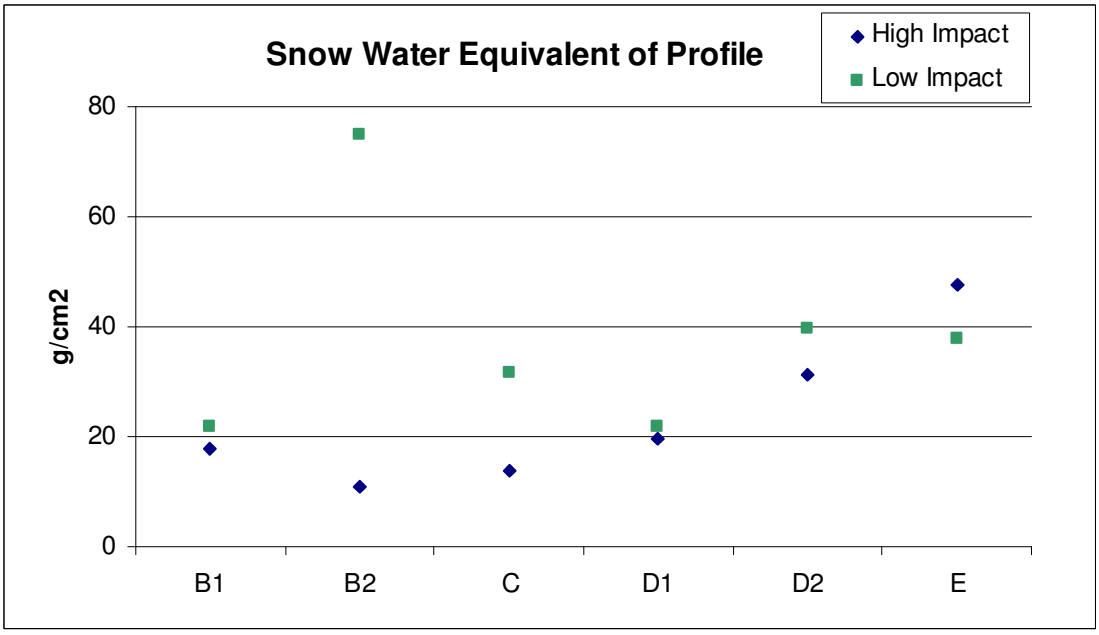


Figure 5. Amount of water (grams) stored in a vertical column (cm^2) of snow at sites receiving extensive and little winter recreation in the MBRNF.



TABLES

Table 1. Descriptions and locations of the paired sites used in the study.

(Coordinates are in NAD 83, UTM Zone 13N)

Site Description	Pair	Snowmobile/Ski Use	Easting	Northing
Medicine Bow Mtns Near FS 338 and Jim Creek.	**A**	high	0397128	4571863
Medicine Bow Mtns Near FS 307A and Cliff Mine.	**A**	low	0400773	4569737
Medicine Bow Mtns Near Hwy 130 and Hourglass Lake.	**B**	high	0395002	4578239
Medicine Bow Mtns Near Hwy 130 and Green Rock Picnic Area.	**B**	low	0397896	4578111
Medicine Bow Mtns Near FS 317, north of Hwy 130	**C**	high	0395821	4579307
Medicine Bow Mtns On southern border of Snowy Range Scientific Natural Research Area, near Sally Cr.	**C**	low	0396192	4577196
Rabbit Ears Pass Along Muddy Cr. Just south of Dumont Lake.	**D**	high	0362140	4473510
Rabbit Ears Pass Near Hwy 40, 9km west of Dumont Lake.	**D**	low	0352634	4471175
Rabbit Ears Pass Near junction of FS 315 and Hwy 40.	**E**	high	0358915	4472162
Rabbit Ears Pass 1 km east of FS 296 on Walton Cr.	**E**	low	0354430	4472454

Table 2. Snow profile information collected at 4 of the 5 paired sites

	Impact	B_1	B_2	C	D_1	D_2	E	mean	t-test p-value
snow depth (cm)	**High**	35	21	30	49	70	100	50.8	**0.031**
	Low	60	195	86	69	130	115	109.2	
ground temp (°F)	**High**	31	24	29	30	29	28	28.5	**0.013**
	Low	32	32	30	32	33	33	32.0	
surface density (g/cm^3)	**High**	0.38	0.46	0.20	0.33	0.26	0.54	0.36	0.072
	Low	0.18	0.27	0.13	0.45	0.11	0.50	0.28	
average snow density (g/cm^3)	**High**	0.44	0.36	0.46	0.39	0.44	0.48	0.43	**0.013**
	Low	0.36	0.40	0.35	0.31	0.33	0.32	0.34	
total water equivalent (g/cm^2)	**High**	17.7	10.8	13.9	19.6	31.1	47.8	23.5	0.115
	Low	21.9	75.1	31.5	21.9	39.6	37.9	38.0	
subnivean space	**High**	some	some	some	n/a	much	some		
	Low	none	much	some	none	none	none		

Table 3. Completed surveys for vegetation, small mammals, and amphibians during summer, 2007.

Pair	Snowmobile/Ski Use	Vegetation samples	Small mammal trap nights	Amphibian surveys call / visual
A	high	42	229	1 / 1
A	low	39	299	1 / 1
B	high	44	234	2 / 1
B	low	49	267	3 / 1
C	high	44	280	3 / 0
C	low	46	312	2 / 0
D	high	48	368	2 / 0
D	low	44	322	2 / 0
E	high	42	318	2 / 0
E	low	42	229	1 / 1

Table 4. Summary of target species live-trapped, seen, and heard during 2007 surveys.

Small Mammals

Common Name	Scientific Name	Occurrence: Med Bow / Routt	Number of ind. captured	Impact: High / Low
Southern red-backed vole	Clethrionomys gapperi	Med Bow / Routt	3	High / Low
Long-tailed vole	Microtus longicaudus	Med Bow	1 (positive id)	Low
Montane vole	Microtus montanus	Routt	1 (positive id)	High / Low
Unidentified vole	Microtus spp.	Med Bow / Routt	18	High / Low
Deer mouse	Peromyscus maniculatus	Med Bow / Routt	11	High / Low
Masked shrew	Sorex cinereus	Med Bow	6 (positive id)	High / Low
Dusky shrew	Sorex monticolus	Med Bow / Routt	7 (positive id)	High / Low
Unidentified shrew	Sorex spp	Med Bow / Routt	12	High / Low
Golden-mantled gr. squirrel	Spermophilus lateralis	Med Bow	1	High
Northern pocket gopher	Thomomys talpoides	Med Bow	1	Low
Western jumping mouse	Zapus princeps	Med Bow / Routt	31	High / Low

Amphibians

Common Name	Scientific Name	Occurrence: Med Bow / Routt	Number of ind. seen/heard	Impact: High / Low
Boreal chorus frog	Pseudacris maculata	Med Bow / Routt	5	High / Low

Appendix A: Vegetation data collected in riparian meadows in the Medicine Bow and Routt National Forests, summer, 2007

Pair A: Vegetation
MedBow Mtns

M3H1 (Jim Creek)
M3L1 (Cliff Mine)

Table 1. Mean (95% CI) vegetation percent cover for grass sites; bootstrapped, 1000 repetitions.

		Cliff Mine (low impact)	Jim Creek (high impact)	Notes
Grass sites		12	13	Cliff: 2/12 sites 1 mo later. Jim: 5/13 sites 1 mo late.
Site descriptions	Percent grass	89 (79,98)	81 (69,90)	
	Percent willow	11 (2,19)	19 (10,31)	
	Ground	1	1.8 (1.4,2.3)	Cliff: only 3 samples, all "1"
	Robel	1.2 (0.8,1.6)	3.1 (1.4,5.2)	Jim: 1/13 site was "11+"
	% grass	43 (32,55)	3 (1,5)	
	% sedge	1 (0,3)	48 (34,62)	
	% rush	2 (0,4)	2 (0,6)	
	% forb	47 (35,58)	28 (16,42)	
	% willow	0 (0,0)	4 (0,9)	
	% bare ground	37 (23,49)	9 (3,15)	
	% lichen	0 (0,0)	0 (0,0)	
	% moss	0 (0,0)	10 (1,24)	
	% litter	34 (23,46)	35 (23,50)	
	Grass flowering	Many: 0	Many: 0	
		Few: 5	Few: 0	
		1: 1	1: 1	
		0: 6	0: 3	
	Sedge flowering	Many: 0	Many: 1	
		Few: 0	Few: 1	
		1: 0	1: 0	
		0: 2	0: 9	
	Rush flowering	Many: 0	Many: 1	
		Few: 0	Few: 1	
		1: 0	1: 0	
		0: 2	0: 1	
	Forb flowering	Many: 1	Many: 1	
		Few: 3	Few: 1	
		1: 2	1: 2	

	0: 6	0: 6	
Litter depth (cm)	1.0 (0.7,1.3)	2.2 (1.2,3.4)	Bootstrap of means from each Daubenmire
L/D total	N/A	15/3 15/(15+3)= 83%	

Table 2. Mean (95% CI) vegetation percent cover for willow sites; bootstrapped, 1000 repetitions.

		Cliff Mine (low)	Jim Creek (high)	Notes
Willow sites		27	30	Cliff: 14/27 sites 1 mo later. Jim: 16/30 1 mo later.
Site descriptions	Percent grass	16 (10,21)	20 (16,25)	
	Percent willow	84 (78,90)	80 (75,85)	
	Ground	1.4 (1.1,1.7)	2.0 (1.9,2.2)	Cliff: only 22 samples. Jim: only 27 samples.
	Robel	7.6 (6.3,8.9)	6.8 (5.7,8.0)	Cliff: 9/27 were “11+.” Jim: 6/29 were “11+”
	% grass	7 (4,12)	6 (3,10)	
	% sedge	10 (4,16)	25 (17,33)	
	% rush	0 (0,0)	0 (0,1)	
	% forb	58 (49,66)	36 (29,44)	
	% willow	61 (50,72)	52 (44,61)	
	% bare ground	5 (0,13)	4 (1,7)	
	% lichen	0 (0,0)	0 (0,1)	
	% moss	5 (1,11)	14 (7,22)	
	% litter	30 (23,37)	26 (22,30)	
	Grass flowering	Many: 1 Few: 0 1: 3 0: 16	Many: 1 Few: 1 1: 1 0: 8	
	Sedge flowering	Many: 0 Few: 0 1: 1 0: 12	Many: 1 Few: 2 1: 0 0: 23	
	Rush flowering	Many: Few: 1: 0:	Many: 0 Few: 1 1: 0 0: 1	
	Forb flowering	Many: 0 Few: 6 1: 4 0: 17	Many: 0 Few: 8 1: 0 0: 19	
	Litter depth (cm)	2.1 (1.5,3.0)	6.1 (3.8,8.7)	Bootstrap of means from each Daubenmire
	L/D total	545/363 545/(545+363) 60%	734/515 734/(734+515)= 59%	

Pair B: Vegetation
MedBow Mtns

M1H5 (Hourglass)
M1L1 (Green Rock)

Table 1. Mean (95% CI) vegetation percent cover for grass sites; bootstrapped, 1000 repetitions.

		Green Rock (low impact)	Hourglass (high impact)	Notes
Grass sites		29	22	
Site descriptions	Percent grass	84 (79,88)	72 (65,77)	
	Percent willow	17 (12,21)	29 (22,34)	
	Ground	1.5 (1.3,1.7)	2.1 (1.7,2.4)	
	Robel	2.8 (2.1,3.6)	1.3 (0.9,1.7)	Grn: 1/29 was "11+"
	% grass	7 (3,11)	6 (2,12)	
	% sedge	53 (45,62)	24 (18,30)	
	% rush	0 (0,0)	7 (2,13)	
	% forb	11 (6,17)	17 (11,24)	
	% willow	2 (0,7)	11 (6,18)	
	% bare ground	3 (0,7)	7 (1,16)	
	% lichen	0 (0,0)	0 (0,0)	
	% moss	1 (0,1)	23 (14,32)	
	% litter	65 (55,74)	53 (44,61)	
	Grass flowering	Many: 1	Many: 1	
		Few: 1	Few: 5	
		1: 1	1: 0	
		0: 7	0: 2	
	Sedge flowering	Many: 2	Many: 3	
		Few: 5	Few: 10	
		1: 2	1: 0	
		0: 19	0: 7	
	Rush flowering	Many:	Many: 1	
		Few:	Few: 2	
		1:	1: 1	
		0:	0: 3	
	Forb flowering	Many: 2	Many: 2	
		Few: 1	Few: 2	
		1: 2	1: 2	
		0: 12	0: 10	
	Litter depth (cm)	6.8 (5.7,7.9)	3.7 (2.6,4.8)	Bootstrap of means from each Daubenmire
	L/D total	93/29	103/24	
		93/(93+29)	103/(103+24)	
		76%	81%	

Table 2. Mean (95% CI) vegetation percent cover for willow sites; bootstrapped, 1000 repetitions.

		Green Rock (low)	Hourglass (high)	Notes
Willow sites		20	21	
Site descriptions	Percent grass	24 (18,30)	26 (19,33)	
	Percent willow	76 (70,83)	74 (67,81)	
	Ground	1.4 (1.2,1.7)	2.4 (2.1,2.7)	
	Robel	8.8 (7.5,9.9)	3.7 (2.8,4.7)	Grn: 9/20 were "11+"
	% grass	7 (2,14)	2 (0,4)	
	% sedge	21 (15,28)	24 (19,31)	
	% rush	0 (0,0)	1 (0,3)	
	% forb	31 (19,43)	25 (16,34)	
	% willow	54 (41,66)	45 (35,55)	
	% bare ground	3 (1,6)	1 (0,1)	
	% lichen	0 (0,0)	0 (0,0)	
	% moss	3 (1,7)	15 (8,23)	
	% litter	45 (35,56)	54 (43,64)	
	Grass flowering	Many: 0	Many: 0	
		Few: 0	Few: 1	
		1: 0	1: 0	
		0: 6	0: 1	
	Sedge flowering	Many: 0	Many: 1	
		Few: 2	Few: 3	
		1: 1	1: 5	
		0: 15	0: 12	
	Rush flowering	Many:	Many: 1	
		Few:	Few: 0	
		1:	1: 0	
		0:	0: 1	
	Forb flowering	Many: 1	Many: 0	
		Few: 4	Few: 5	
		1: 1	1: 3	
		0: 8	0: 9	
	Litter depth (cm)	4.5 (2.9,6.3)	6.7 (4.8,9.1)	Bootstrap of means from each Daubenmire
	L/D total	510/142	391/156	
		510(510+142)	391/(391+156)	
		78%	72%	

Pair C: Vegetation
MedBow Mtns

M1H3 (Brooklyn)
M1L3 (Backcountry)

Table 1. Mean (95% CI) vegetation percent cover for grass sites; bootstrapped, 1000 repetitions.

		Backcountry (low impact)	Brooklyn (high impact)	Notes
Grass sites		28	14	
Site descriptions	Percent grass	82 (78,87)	70 (59,80)	
	Percent willow	18 (13,22)	30 (21,39)	
	Ground	1.6 (1.3,1.9)	1.4 (0.8,1.9)	
	Robel	1.5 (1.1,1.9)	1.6 (1.0,2.3)	
	% grass	20 (14,26)	13 (5,22)	
	% sedge	25 (15,35)	27 (13,44)	
	% rush	0 (0,1)	3 (0,8)	
	% forb	38 (30,44)	23 (14,33)	
	% willow	8 (2,14)	6 (1,11)	
	% bare ground	9 (4,15)	15 (4,30)	
	% lichen	0 (0,1)	5 (0,13)	
	% moss	8 (3,14)	10 (2,21)	
	% litter	37 (28,46)	40 (29,52)	
	Grass flowering	Many: 1	Many: 1	
		Few: 8	Few: 3	
		1: 6	1: 0	
		0: 7	0: 4	
	Sedge flowering	Many: 1	Many: 1	
		Few: 6	Few: 2	
		1: 4	1: 2	
		0: 10	0: 5	
	Rush flowering	Many: 0	Many: 1	
		Few: 0	Few: 0	
		1: 0	1: 0	
		0: 4	0: 2	
	Forb flowering	Many: 8	Many: 6	
		Few: 13	Few: 0	
		1: 1	1: 1	
		0: 3	0: 5	
	Litter depth (cm)	2.7 (1.8,3.9)	3.0 (1.8,4.2)	Bootstrap of means from each Daubenmire
	L/D total	49/15	17/10	
		49/(49+15)	17/(17+10)=	
		77%	63%	

Table 2. Mean (95% CI) vegetation percent cover for willow sites; bootstrapped, 1000 repetitions.

		Backcountry (low)	Brooklyn (high)	Notes
Willow sites		18	30	
Site descriptions	Percent grass	31 (24,38)	24 (19,29)	
	Percent willow	69 (63,76)	76 (70,81)	
	Ground	2.4 (2.2,2.7)	1.8 (1.5,2.0)	
	Robel	5.2 (3.9,6.6)	6.6 (5.2,8.0)	
	% grass	3 (0,9)	7 (4,12)	
	% sedge	37 (27,48)	24 (17,31)	
	% rush	2 (0,5)	1 (0,2)	
	% forb	46 (33,58)	29 (20,40)	
	% willow	52 (37,66)	49 (38,60)	
	% bare ground	5 (1,14)	2 (0,4)	
	% lichen	0 (0,0)	0 (0,0)	
	% moss	6 (1,11)	11 (4,19)	
	% litter	34 (24,42)	42 (33,51)	
	Grass flowering	Many: 0	Many: 1	
		Few: 0	Few: 0	
		1: 2	1: 1	
		0: 1	0: 0	
	Sedge flowering	Many: 1	Many: 0	
		Few: 2	Few: 2	
		1: 2	1: 2	
		0: 10	0: 21	
	Rush flowering	Many: 0	Many: 0	
		Few: 1	Few: 0	
		1: 0	1: 0	
		0: 0	0: 2	
	Forb flowering	Many: 0	Many: 1	
		Few: 4	Few: 2	
		1: 2	1: 2	
		0: 10	0: 20	
	Litter depth (cm)	6.0 (3.8,8.4)	6.2 (4.5,7.8)	Bootstrap of means from each Daubenmire
	L/D total	509/189	673/223	
		509/(509+189)	673/(673+223)	
		73%	75%	

Pair D: Vegetation
Rabbit Ears Pass

R1L1 (Far)
R3H1 (Camp)

Table 1. Mean (95% CI) vegetation percent cover for grass sites; bootstrapped, 1000 repetitions.

		Far (low impact)	Camp (high impact)	Notes
Grass sites		29	36	
Site descriptions	Percent grass	83 (76,90)	88 (83,92)	
	Percent willow	17 (11,24)	13 (8,17)	
	Ground	0.6 (0.3,0.9)	0.1 (0,0.2)	
	Robel	1.6 (1.0,2.3)	1.3 (1.1,1.4)	
	% grass	16 (9,25)	16 (12,20)	
	% sedge	10 (3,19)	3 (2,6)	
	% rush	0 (0,0)	0 (0,0)	
	% forb	45 (35,54)	48 (40,57)	
	% willow	4 (1,9)	0 (0,0)	
	% bare ground	27 (16,38)	30 (21,38)	
	% lichen	2 (0,7)	0 (0,1)	
	% moss	4 (0,10)	0 (0,0)	
	% litter	16 (11,23)	19 (15,23)	
	Grass flowering	Many: 5	Many: 6	
		Few: 4	Few: 4	
		1: 2	1: 5	
		0: 5	0: 19	
	Sedge flowering	Many: 1	Many: 0	
		Few: 4	Few: 6	
		1: 1	1: 0	
		0: 2	0: 4	
	Rush flowering	Many:	Many:	
		Few:	Few:	
		1:	1:	
		0:	0:	
	Forb flowering	Many: 8	Many: 16	
		Few: 9	Few: 7	
		1: 3	1: 4	
		0: 8	0: 9	
	Litter depth (cm)	1.6 (0.6,3.0)	1.0 (0.8,1.2)	Bootstrap of means from each Daubenmire
	L/D total	37/89	N/A	
		37/(37+89) = 29%		

Table 2. Mean (95% CI) vegetation percent cover for willow sites; bootstrapped, 1000 repetitions.

		Far (low)	Camp (high)	Notes
Willow sites		16	12	
Site descriptions	Percent grass	28 (22,34)	27 (21,33)	
	Percent willow	72 (66,78)	73 (67,79)	
	Ground	1.1 (0.7,1.6)	1.1 (0.8,1.3)	
	Robel	5.7 (3.8,7.7)	7.9 (6,9.5)	Far: 3/16 were "11+" Camp: 1/12 were "11+"
	% grass	14 (5,24)	10 (5,16)	
	% sedge	7 (2,16)	1 (0,3)	
	% rush	0 (0,0)	0 (0,0)	
	% forb	48 (36,60)	57 (42,73)	
	% willow	48 (34,63)	51 (32,70)	
	% bare ground	3 (0,8)	3 (0,9)	
	% lichen	0 (0,0)	3 (0,8)	
	% moss	6 (0,11)	0 (0,0)	
	% litter	28 (19,38)	21 (11,34)	
	Grass flowering	Many: 1	Many: 0	
		Few: 0	Few: 2	
		1: 2	1: 1	
		0: 7	0: 4	
	Sedge flowering	Many: 0	Many: 0	
		Few: 0	Few: 0	
		1: 0	1: 0	
		0: 5	0: 2	
	Rush flowering	Many:	Many:	
		Few:	Few:	
		1:	1:	
		0:	0:	
	Forb flowering	Many: 2	Many: 3	
		Few: 4	Few: 2	
		1: 2	1: 0	
		0: 7	0: 7	
	Litter depth (cm)	1.7 (1.0,2.6)	3.1 (1.2,6.3)	Bootstrap of means from each Daubenmire
	L/D total	336/165	329/114	
		336/(336+165)	329/(329+114)	
		67%	74%	

Pair E: Vegetation
Rabbit Ears Pass

R1L2 (Dam)
R4H1 (Forty)

Table 1. Mean (95% CI) vegetation percent cover for grass sites; bootstrapped, 1000 repetitions.

		Dam (low impact)	Forty (high impact)	Notes
Grass sites		20	9	
Site descriptions	Percent grass	83 (78,90)	61 (53,69)	
	Percent willow	16 (10,23)	39 (31,47)	
	Ground	0.1 (0,0.15)	0.9 (0.4,1.3)	
	Robel	1.7 (1.1,2.5)	2.5 (1.9,3.2)	
	% grass	5 (2,9)	21 (9,33)	
	% sedge	3 (0,11)	24 (3,51)	
	% rush	0 (0,0)	0 (0,0)	
	% forb	48 (38,58)	35 (23,44)	
	% willow	2 (0,5)	23 (4,42)	
	% bare ground	38 (27,50)	11 (2,22)	
	% lichen	0 (0,0)	0 (0,0)	
	% moss	0 (0,0)	1 (0,2)	
	% litter	21 (15,26)	41 (24,58)	
	Grass flowering	Many: 1	Many: 1	
		Few: 3	Few: 2	
		1: 0	1: 1	
		0: 6	0: 4	
	Sedge flowering	Many: 0	Many: 0	
		Few: 1	Few: 0	
		1: 0	1: 1	
		0: 0	0: 3	
	Rush flowering	Many:	Many:	
		Few:	Few:	
		1:	1:	
		0:	0:	
	Forb flowering	Many: 3	Many: 0	
		Few:12	Few: 4	
		1: 1	1: 1	
		0: 3	0: 3	
	Litter depth (cm)	0.9 (0.7,1.1)	3.2 (1.7,4.8)	Bootstrap of means from each Daubenmire
	L/D total	6/0	75/44	
		6/(6+0) = 100%	75/(75+44) 63%	

Table 2. Mean (95% CI) vegetation percent cover for willow sites; bootstrapped, 1000 repetitions.

		Dam (low)	Forty (high)	Notes
Willow sites		28	33	
Site descriptions	Percent grass	22 (16,27)	24 (19,30)	
	Percent willow	79 (73,85)	76 (71,80)	
	Ground	1.1 (0.8,1.3)	1.6 (1.3,1.9)	
	Robel	8.4 (7.1,9.5)	5.4 (4.4,6.5)	Dam: 10/28 samples were "11+"
	% grass	5 (2,8)	11 (6,17)	
	% sedge	13 (6,21)	24 (16,33)	
	% rush	1 (0,3)	0 (0,1)	
	% forb	39 (30,49)	42 (34,50)	
	% willow	44 (34,54)	37 (28,47)	
	% bare ground	5 (2,9)	3 (1,6)	
	% lichen	0 (0,0)	0 (0,0)	
	% moss	3 (1,7)	4 (1,7)	
	% litter	36 (26,45)	37 (31,44)	
	Grass flowering	Many: 0	Many: 1	
		Few: 2	Few: 5	
		1: 1	1: 2	
		0: 9	0: 10	
	Sedge flowering	Many: 0	Many: 1	
		Few: 1	Few: 1	
		1: 2	1: 1	
		0: 10	0: 18	
	Rush flowering	Many: 2	Many: 0	
		Few: 1	Few: 0	
		1: 0	1: 0	
		0: 0	0: 1	
	Forb flowering	Many: 2	Many: 0	
		Few: 8	Few: 7	
		1: 2	1: 4	
		0: 11	0: 21	
	Litter depth (cm)	2.2 (1.5,3.2)	4.6 (3.1,6.3)	Bootstrap of means from each Daubenmire
	L/D total	564/323	475/303	
		564/(564+323)	475/(475+303)	
		64%	61%	

Appendix B: Animal Observations

Pair	Impact	Site	Com_name	Sci_name	Date	Age	Weight (g)	Sex	Body (mm)	Tail (mm)	Hind Foot (mm)	Recap?	Mortality?	X	Y
C	High	BROOKLYN	Southern red-backed vole	Clethrionomys gapperi	July_2007	SA/A	21, 14	M	92	32	-	Y	N	395821	4579307
C	High	BROOKLYN	Southern red-backed vole	Clethrionomys gapperi	July_2007	J/SA	17, 16 14	M	79, 85, 91	36, 33	-	Y	N	395821	4579307
C	High	BROOKLYN	Southern red-backed vole	Clethrionomys gapperi	July_2007	J/SA	18	M	91	32	-	N	N	395821	4579307
C	High	BROOKLYN	Southern red-backed vole	Clethrionomys gapperi	July_2007	J/SA	14	F	90	31	-	N	N	395821	4579307
D	Low	FAR	Southern red-backed vole	Clethrionomys gapperi	July_2007	J/SA	16	M	-	34	-	N	N	352634	4471175
A	Low	CLIFF MINE	Long-tailed vole	Microtus longicaudus	July_2007	J/SA	35	M	-	61	-	N	N	400773	4569737
D	High	CAMP	Montane vole	Microtus montanus	July_2007	A	57	M	-	-	-	N	N	362140	4473510
A	Low	CLIFF MINE	Vole species	Microtus spp.	July_2007	J/SA	19	F	90	31	-	N	N	400773	4569737
A	Low	CLIFF MINE	Vole species	Microtus spp.	July_2007	J	19	F	-	30	-	N	N	400773	4569737
B	Low	GREEN ROCK	Vole species	Microtus spp.	July_2007	J/SA	33	F	100	39	-	N	N	397896	4578111
B	Low	GREEN ROCK	Vole species	Microtus spp.	July_2007	SA/A	41	M	105	35	-	N	N	397896	4578111
B	Low	GREEN ROCK	Vole species	Microtus spp.	July_2007	J/SA	15	M	80	26	-	N	N	397896	4578111
B	Low	GREEN ROCK	Vole species	Microtus spp.	July_2007	J/SA	18	M	83	32	-	N	N	397896	4578111
B	Low	GREEN ROCK	Vole species	Microtus spp.	July_2007	J/SA	19	F	79	37	-	N	N	397896	4578111
B	Low	GREEN ROCK	Vole species	Microtus spp.	July_2007	J/SA	20	M	91	33	-	N	N	397896	4578111
C	High	BROOKLYN	Vole species	Microtus spp.	July_2007	J/SA	14	F	90	26	-	N	N	395821	4579307
D	High	CAMP	Vole species	Microtus spp.	July_2007	SA/A	39	M	-	-	-	N	N	362140	4473510
D	High	CAMP	Vole species	Microtus spp.	July_2007	SA/A	31, 29	F	-	37	-	Y	N	362140	4473510
D	High	CAMP	Vole species	Microtus spp.	July_2007	J/SA	17	F	-	-	-	N	N	362140	4473510
D	High	CAMP	Vole species	Microtus spp.	July_2007	J/SA	17	M	-	-	-	N	N	362140	4473510
D	High	CAMP	Vole species	Microtus spp.	July_2007	SA/A	33	M	116	33	-	N	N	362140	4473510
D	Low	FAR	Vole species	Microtus spp.	July_2007	J/SA	17	M	95	32	-	N	N	352634	4471175
E	High	FORTY	Vole species	Microtus spp.	July_2007	J	13	M	-	30	-	Y	N	358915	4472162
E	High	FORTY	Vole species	Microtus spp.	July_2007	A/SA	27	M	-	32	18	Y	N	358915	4472162
E	High	FORTY	Vole species	Microtus spp.	July_2007	-	-	-	-	-	-	U	N	358915	4472162
E	High	FORTY	Vole species	Microtus spp.	July_2007	J/SA	14	M	66	30	-	N	N	358915	4472162
E	High	FORTY	Vole species	Microtus spp.	July_2007	J/SA	22	M	-	33	-	N	N	358915	4472162

Pair	Impact	Site	Com_name	Sci_name	Date	Age	Weight (g)	Sex	Body (mm)	Tail (mm)	Hind Foot (mm)	Recap?	Mortality?	X	Y
E	Low	DAM	Vole species	Microtus spp.	July_2007	J	28	M	-	25	-	N	N	354430	4472454
A	High	JIM CREEK	Deer mouse	Peromyscus maniculatus	July_2007	A	19, 18	M	74	75, 69	19	Y	N	352634	4471175
A	High	JIM CREEK	Deer mouse	Peromyscus maniculatus	July_2007	SA	15	M	-	65	19	N	N	352634	4471175
A	High	JIM CREEK	Deer mouse	Peromyscus maniculatus	July_2007	A	23	M	75	66	-	N	N	352634	4471175
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	A	20, 18	F	-	-	18	Y	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	SA/A	32, 20	F	-	60	-	Y	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	A	24	F	70, 97	62	19	Y	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	A	21, 18	F	75	-	18	Y	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	SA/A	20	M	-	-	19	N	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	A	27, 24	F	-	-	16	Y	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	A	21	F	79	-	21	Y	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	A	30	F	78	-	19	N	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	SA/A	17	M	-	67	19	N	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	SA/A	20	F	-	64	19	N	N	362140	4473510
D	High	CAMP	Deer mouse	Peromyscus maniculatus	July_2007	A	22	F	-	-	-	N	N	362140	4473510
D	Low	FAR	Deer mouse	Peromyscus maniculatus	July_2007	A	28	F	-	-	18	N	N	352634	4471175
D	Low	FAR	Deer mouse	Peromyscus maniculatus	July_2007	A	25	F	-	-	19	N	N	352634	4471175
E	Low	DAM	Deer mouse	Peromyscus maniculatus	July_2007	J	11	-	-	-	-	N	N	354430	4472454
E	Low	DAM	Deer mouse	Peromyscus maniculatus	July_2007	A	14	M	-	61	27	N	N	354430	4472454
B	High	HOURGLASS	Boreal chorus frog	Pseudacris maculata	July_2007	A	-	M	-	-	-	-	N	395002	4578239
B	High	HOURGLASS	Boreal chorus frog	Pseudacris maculata	July_2007	A	-	M	-	-	-	-	N	395002	4578239
B	Low	GREEN ROCK	Boreal chorus frog	Pseudacris maculata	July_2007	A		U	-	-	-	-	N	397896	4578111
E	High	FORTY	Boreal chorus frog	Pseudacris maculata	July_2007	-	-	-	-	-	-	N	N	358915	4472162
E	High	FORTY	Boreal chorus frog	Pseudacris maculata	July_2007	LARVA		U	-	-	-	-	N	358915	4472162
E	High	FORTY	Boreal chorus frog	Pseudacris maculata	July_2007	LARVA		U	-	-	-	-	N	358915	4472162
C	Low	BACKCOUNTRY	Masked shrew	Sorex cinereus	July_2007		2.8			38	11	N	Y	395002	4578239
C	High	BROOKLYN	Masked shrew	Sorex cinereus	July_2007		3.1			35	10	N	Y	395821	4579307
C	High	BROOKLYN	Masked shrew	Sorex cinereus	July_2007		2.7			35	10	N	Y	395821	4579307
A	Low	CLIFF MINE	Masked shrew	Sorex cinereus	July_2007		3.1			39	11	N	Y	400773	4569737
A	High	JIM CREEK	Masked shrew	Sorex cinereus	July_2007		3.1			42	11	N	Y	352634	4471175
A	High	JIM CREEK	Masked shrew	Sorex cinereus	July_2007		3.4			38	11	N	Y	352634	4471175
E	High	FORTY	Dusky shrew	Sorex monticolus	July_2007		4.4		106	42	12	N	Y	358915	4472162
C	Low	BACKCOUNTRY	Dusky shrew	Sorex monticolus	July_2007		3.6			42	11	N	Y	395002	4578239

Pair	Impact	Site	Com_name	Sci_name	Date	Age	Weight (g)	Sex	Body (mm)	Tail (mm)	Hind Foot (mm)	Recap?	Mortality?	X	Y
C	Low	BACKCOUNTRY	Dusky shrew	Sorex monticolus	July_2007		6.1			40	12	N	Y	395002	4578239
C	High	BROOKLYN	Dusky shrew	Sorex monticolus	July_2007		3.5			40	11	N	Y	395821	4579307
C	High	BROOKLYN	Dusky shrew	Sorex monticolus	July_2007		6.1			42	12	N	Y	395821	4579307
B	High	HOURGLASS	Dusky shrew	Sorex monticolus	July_2007		3.9			43	12	N	Y	395002	4578239
A	High	JIM CREEK	Dusky shrew	Sorex monticolus	July_2007		5.8			44	12	N	Y	352634	4471175
C	High	BROOKLYN	shrew species	Sorex spp	July_2007	A	7	F?		-		N	N	395821	4579307
C	High	BROOKLYN	shrew species	Sorex spp	July_2007	-	5	F?		-		N	N	395821	4579307
C	High	BROOKLYN	shrew species	Sorex spp	July_2007	-	5	F		-		N	N	395821	4579307
E	Low	DAM	shrew species	Sorex spp	July_2007	-	5	-		-		N	N	354430	4472454
D	Low	FAR	shrew species	Sorex spp	July_2007	-	3	F?		-		N	N	352634	4471175
E	High	FORTY	shrew species	Sorex spp	July_2007							N	N	358915	4472162
B	Low	GREEN ROCK	shrew species	Sorex spp	July_2007	A	5	-		-		N	N	397896	4578111
A	High	JIM CREEK	shrew species	Sorex spp	July_2007	-	3	-		-		N	N	352634	4471175
E	High	FORTY	shrew species	Sorex spp	July_2007	-	5	-		-		N	Y	358915	4472162
C	High	BROOKLYN	shrew species	Sorex spp	July_2007		4					N	Y	395821	4579307
A	High	JIM CREEK	shrew species	Sorex spp	July_2007		4			42	10	N	Y	352634	4471175
A	High	JIM CREEK	shrew species	Sorex spp	July_2007		5.6			40	11	N	Y	352634	4471175
A	High	JIM CREEK	Golden-mantled gr. squirrel	Spermophilus lateralis	July_2007	-	-	-	-	-	-	N	N	352634	4471175
A	Low	CLIFF MINE	Northern pocket gopher	Thomomys talpoides	July_2007	J	42	F	-	42	-	N	N	400773	4569737
A	High	JIM CREEK	Western jumping mouse	Zapus princeps	July_2007	SA/A	26	M	-	-	31	Y	N	352634	4471175
A	High	JIM CREEK	Western jumping mouse	Zapus princeps	July_2007	SA/A	23	F	-	-	-	N	N	352634	4471175
A	Low	CLIFF MINE	Western jumping mouse	Zapus princeps	July_2007	SA/A	26	M	-	-	-	Y	N	400773	4569737
A	Low	CLIFF MINE	Western jumping mouse	Zapus princeps	July_2007	A	32, 29	M	-	-	-	Y	N	400773	4569737
A	Low	CLIFF MINE	Western jumping mouse	Zapus princeps	July_2007	SA/A	30	F	-	-	-	Y	N	400773	4569737
A	Low	CLIFF MINE	Western jumping mouse	Zapus princeps	July_2007	SA	21	F	-	-	-	N	N	400773	4569737
A	Low	CLIFF MINE	Western jumping mouse	Zapus princeps	July_2007	SA/A	29	F	-	-	-	N	N	400773	4569737
A	Low	CLIFF MINE	Western jumping mouse	Zapus princeps	July_2007	A	35	M	-	-	-	N	N	400773	4569737
B	High	HOURGLASS	Western jumping mouse	Zapus princeps	July_2007	SA/A	23	F	-	-	-	N	N	395002	4578239
B	Low	GREEN ROCK	Western jumping mouse	Zapus princeps	July_2007	SA/A	26	M	-	-	-	N	N	397896	4578111
B	Low	GREEN ROCK	Western jumping mouse	Zapus princeps	July_2007	SA/A	26	F	-	-	-	N	N	397896	4578111
B	Low	GREEN ROCK	Western jumping mouse	Zapus princeps	July_2007	A	36	M	-	-	-	Y	N	397896	4578111
B	Low	GREEN ROCK	Western jumping mouse	Zapus princeps	July_2007	SA/A	31, 28	M	-	-	-	N	N	397896	4578111
C	Low	BACKCOUNTRY	Western jumping mouse	Zapus princeps	July_2007	J	15	F	-	-	-	N	N	395002	4578239

Pair	Impact	Site	Com_name	Sci_name	Date	Age	Weight (g)	Sex	Body (mm)	Tail (mm)	Hind Foot (mm)	Recap?	Mortality?	X	Y
D	High	CAMP	Western jumping mouse	Zapus princeps	July_2007	A	28	M	-	-	-	N	N	362140	4473510
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	32, 28	F	-	-	-	Y	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	29, 32	M	-	-	-	Y	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	32	M	-	-	-	N	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	30	F	-	-	-	N	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	33	M	-	-	-	N	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	30	F	-	-	-	N	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	25	F	-	-	-	N	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	35	F	-	-	-	N	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	33	F	-	-	-	N	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	43	M	-	-	-	N	N	352634	4471175
D	Low	FAR	Western jumping mouse	Zapus princeps	July_2007	A	29	F	-	-	-	N	N	352634	4471175
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	SA/A	27	M	-	137	-	Y	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	A	29	M	-	129	-	Y	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	A	38	F	-	145	-	N	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	SA/A	24	M	-	-	-	N	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	J/SA	20	M	-	133	-	N	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	SA/A	25	M	-	-	-	N	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	SA/A	25	M	-	-	-	N	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	A	30	F	-	-	-	N	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	A	-	-	-	-	-	N	N	358915	4472162
E	High	FORTY	Western jumping mouse	Zapus princeps	July_2007	A	37	F	-	-	-	N	N	358915	4472162
E	Low	DAM	Western jumping mouse	Zapus princeps	July_2007	J/SA	24	M	-	130	-	N	N	354430	4472454
E	Low	DAM	Western jumping mouse	Zapus princeps	July_2007	SA/A	34	M	-	126	-	N	N	354430	4472454
E	Low	DAM	Western jumping mouse	Zapus princeps	July_2007	A	35	F	-	-	-	N	N	354430	4472454
E	Low	DAM	Western jumping mouse	Zapus princeps	July_2007	SA/A	27	F	-	-	-	N	N	354430	4472454