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DEPARTMENT OF GEOGRAPHY

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TO: Sime/Rogers

November 23, 1973

The Director
National Parks Branch
Department of Indian Affairs &
Northern Development
Customs Building
Calgary

Attention: Mr. George Rogers

Enclosed is the report on the Small Mammals survey carried out by Gail Fitzmartin in the Banff-Kootenay National Parks this summer.

Yours sincerely,

Stuart A. Harris

S.A. Harris
Professor

SAH/rmy

THE UNIVERSITY OF CALGARY / CALGARY 44, ALBERTA, CANADA / AREA CODE 403, TELEPHONE 284-5584

REPORT ON THE SMALL MAMMALS

OF THE

VERMILION PASS BURN

Final Report

Gail Fitzmartyn

October 1973
University of Calgary,
Calgary, Alberta

CONTENTS

INTRODUCTION

This study was undertaken as a sequel to two previous years work on the small mammal population in the area of the Vermilion Pass burn (Shank, 1971, and Reid, 1972). The preliminary study was begun in the summer of 1971, three years after the fire occurred, leaving 6160 acres of burnt timber. The purpose of the study is to examine the development of the small mammal community after a major fire. The emphasis of the research was on the ecological succession and recolonization of such an area. Accordingly, five major areas were considered; successional forest, pristine forest, middle burn, burn edge, and unburnt pockets. The diversity of the burn habitat in comparison to the forest habitat was again demonstrated. Two species new to the study area were reported. A comparison of the grid and transect method of trapping was made in order to ascertain the best procedure for future use.

DESIGN OF DATA COLLECTION

The basic procedure followed in studying the mammals of the Vermilion Pass area was a capture, tag, release, and recapture method. The utilization of such a technique was believed to yield information on the movements and densities of the population present.

The areas were chosen for trapping by several criteria. Primary concern was placed on obtaining information which would be comparable to work done in previous years (Shank 1971 and Reid 1972). Proximity to previous trapping sites was therefore deemed essential. Secondly, five of the transects were to be located within the most typical vegetational communities of the burn (i.e. one middle burn transect was located in an area dominated by *Epilobium augustifolium*). The general location of these sites was determined by the vegetational maps of the burn prepared by Willard and Harris in 1972. The end and beginning of each transect was marked by surveyors pins if they did not correspond to the previously surveyed grid lines. Figure 1 gives the location of each of these trap lines. In most cases each designated area possessed a transect and a grid. The transect was composed of two parallel running lines of thirty traps placed at 15 meter intervals. A grid was attached to one end of these lines using 8 traps from the transect and 8 new ones. This set up yielded a 4 x 4 grid. The exception to this procedure occurred in the Vista lake area where a single line transect of 60 traps was used. Only Sherman traps were used. The bait provided was of the peanut butter-rolled oats-bacon fat type and all traps were left open all night and checked early in the morning and then closed for the rest of the morning. They were reopened in the afternoon and checked in the evening. It was hoped that this procedure would give a representative sample of nocturnal and diurnal communities without entrapping animals for excessive periods of time during the day. As the summer progressed, it was found that in order to decrease the number of deaths it was necessary to change the bedding whenever it got wet.

Each animal when captured was ear marked with a numbered fishing tag, weighed, and its length measured from the tip of the nose to the base of the tail. Reproductive conditions were also recorded.

Thirteen areas involving 788 traps were established and utilized throughout the summer. Code names for these areas were chosen arbitrarily. Each area was studied for a four to five day period each month. This interval was chosen as most of the animals in an area could be captured within this time without excessive "trap happiness" resulting.

AREA DESCRIPTIONS

B-1 -is a 4 x 4 grid and transect combination which begins on the crest of a hill 50 meters above SW12A and runs 150 meters beyond SW11A. Elevation at the start of the line is 5150'. The area is situated in the middle of the burn where debris is heavy but regeneration is quite good. The dominant herbs are Epilobium augustifolium and Arnica cordifolia. However Agropyron albicans, Fragaria glauca, and Linnaea borealis var americana are also abundant. Thalictrum occidentale and Ledum groenlandicum are the primary shrub species. Pinus contorta var latifolia seedlings are commonly seen throughout the area.

UB1 -is a 3 x 6 grid running along the NE side of Stanley Creek in a small unburnt pocket in the gorge below the hanging valley of the glacier. The grid is in close proximity to area H-1 of Shank (1971). The forest here is climax spruce-fir with heavy shrub cover of predominantly Menziesa glabella. The ground is blanketed with moss - primarily Hylocomium splendens. Grid reference for the area is 10DSE.

1-1 -is a 4 x 4 grid and transect combination starting 20 meters into the forest off the cutline on the west end of the burn by pin 17ASE. The transect runs approximately parallel to the fire guard toward pin 17BSE and 150 meters beyond. Fallen timber and underbrush is heavy in this climax spruce-fir forest and vegetation is similar to that of UB1.

2-1 -is in the same area as above however this portion is within the burn at approximately the same distance east of the outline. Debris is heavy and regeneration is generally poor. Agropyron albicans and Ledum groenlandicum are the dominant vegetation with some Arnica cordifolia and Epilobium alpinum. The grid at this location was placed at the top of the transect lines.

UB2 -is a 4 x 4 grid and transect combination in an area which escaped the fire on a SW facing slope. The transect begins at 6ESE and moves along the edge of the pocket within 75 meters of the burn. Traps 1, 60, 61, and 62 are situated along the creek while the remainder are uphill from this site. Elevation at this point is approximately 6100'. The forest is climax spruce-fir with some white bark pine (Pinus albicaulis). The forest floor is covered with several species of moss (notably Hylocomium splendens) and the dominant shrub species is Menziesa glabella. The surrounding burnt area has moderate to poor regeneration with Epilobium augustifolium and Arnica cordifolia as the main herbs.

UB3 -is a 30 trap transect located in an area which was apparently only lightly burnt, since although the trucks are charred near the base, the trees remain alive. Vaccinium sp. and moss comprise the greatest heraceous cover. The dominant shrub is Menziesa glabella. The line begins 15 meters below and 15 meters across from 4ESE and moves downhill from this point.

D-1 -is a transect only, and was set in this area of the burn approximately 50 meters east of the B.C.-Alberta cutline. The region is a conglomerate of habitats. The line runs from 5560' to 5742'. The lower parts tend to be grassy with few shrubs evident. Epilobium augustifolium, Arnica cordifolia and Linnaea borealis var americana are also common as are the Lodgepole pine (Pinus contorta) seedlings. As elevation increases there is a similar increase in the number of shrubs found with Ledum groenlandicum and Menziesa glabella predominating. Localized patches of Cornus canadensis and Aquilegia flavesens were also present.

M-1 - This grid-transect combination starts in a small area between the Great Divide streams approximately 100 meters above and 50 meters SW of OBW at an elevation of 5420'. The line moves NE across a stream and continues on across another smaller stream after about 40 meters. It then extends through a small tongue of burnt forest almost to its termination in unburnt forest. The first 120 meters of this area is mainly grass covered with an occasional appearance of an individual of Menziesa glabella or Salix sp. Beyond this, the area tends to be dominated by Arnica cordifolia with Epilobium augustifolium also being common. Debris in this area is heavy. Other herbs frequently occurring include Fragaria glauca, Cornus canadensis, and Vaccinium sp. The surrounding forest is of the climax type with typical spruce-fir association.

A-1 -is a successional Lodgepole pine plot on relatively level ground one mile east of Storm Mountain Lodge. It begins 50 meters west of the benchmark on the southeast side of the highway. Most of the transect is within the forest where little ground cover other than Vaccinium sp. occurs. Some Shepherdia canadensis and Menziesa glabella are present throughout as well. However, the area is interspersed with clearings which have only low growing herbs such as Fragaria glauca with small patches of the above mentioned shrubs. At the far end of the transect there is a marshy shrub area which is primarily Shepherdia canadensis and Salix sp. The primary ground cover in the wet region is moss.

B-2 -is a grid and transect combination in a flat area of burnt forest running parallel to the Vermilion River. It begins 20 meters past the weather station in the vicinity of 6ASE and runs toward 5ASE. At its distal end the line runs adjacent to a small unburnt pocket of climax spruce-fir forest. The undergrowth in the area is heavy with *Salix* sp., *Lornicera involucrata* and *Betula glandulosa* dominating. The burnt portion is largely *Epilobium augustifolium* with a variety of grasses being interspersed along the river. *Vaccinium* sp. and *Cornus canadensis* are also commonly found. The elevation at this point is 5270'.

Y-3 -is the climax spruce fir forest plot. The line begins in a small tongue of the forest along the stream running past the Marble Canyon Warden Station. The forest here is interspersed with small open areas and road cuts. The portion near the stream is grassy with a well developed shrub layer of *Shepherdia canadensis*, *Salix* sp., *Betula glandulosa*, *Potentilla fruticosa*, and *Lornicera involucrata*. The trees in this portion are well separated. As the line moves upstream, the open areas decrease and *Hylocomium splendens* replaces the grasses as the dominant ground cover. At this point the area becomes similar to the forest of 1-1. Elevation is 4800'.

K-3 - runs down the gorge cut by Stanley Creek. The region is burnt with generally poor regeneration. The action of the stream has resulted in erosion of the soil leaving the ground unstable above a labyrinth of underground streams. In many places it has simply given way. *Marchantia* sp. is abundant along these north facing slopes. Along the creek grasses tend to dominate but the emphasis shifts to *Epilobium augustifolium* with some *Arnica cordifolia* as the distance from the stream increases. In the areas closer to the stream shrubs such as

Salix sp., *Shepherdia canadensis*, *Menziesa glabella* and *Ledum groenlandicum* are common but not abundant. The slope is steep ranging from 5567' at 10CSE to 5310' at the termination of the transect.

RESULTS

A complete synopsis of the data collected over the summer appears in Table I. A total of 20,210 traps were checked over this period with over 75% of the trap half days occuring during July and August. The 475 captures yielded 246 individuals giving an average of 1.93 captures per individual.

The percentage of trap success dropped dramatically from 6.1% in May to .73% in June. In July and August, success was slightly higher with values of 2.25% and 2.34% respectively. This is a significant decrease over the results from previous years - the overall success for 1971 being 5.92% and 5.53% for 1972. This decrease in captures was also noted in the decrease of recaptures - the figure being 2.28 for 1971 and 2.35 for 1972.

The deaths per 100 captures show a decrease over the figures for previous years. The overall loss figure being 4.83% with the hgihest fatality counts being registered in June and early July. The overall figure for 1972 was 17.45% while 1971 recorded 7.09%. There appeared to be a correlation between the deaths and the weather. In fact the number of deaths continually increased with the incidence of days of prolonged rain. This relationship is probably due to the insulative quality of wet bedding which fails to provide the animals with the warmth they require to withstand the cold traps overnight. *Cleithrionomys* sp. and *Microtus* sp. seem to be particularly susceptable to death under such conditions as they frequently had to be warmed to bring them out of their cold stupor after even a slight cold snap. Future studies should take steps to ensure protection of the animals from death under these circumstances.

The following species were found within the study area.

1. Clethrionomys gapperi - red back vole
2. Peromyscus maniculatus - white footed mouse
3. Microtus pennsylvanicus - the meadow vole
4. Microtus longicaudis - long-tailed mountain vole
5. Zapus princeps - western jumping mouse
6. Spermophilis lateralis - golden mantled ground squirrel
7. Tamiasciurus hudsonicus - red squirrel
8. Sorex cinereus - cinereus shrew
9. Microsorex hoyi hoyi - american pigmy shrew
10. Eutamias amoenus - rufous tailed chipmunk
11. Eutamias minimus - the least chipmunk

Two of these species are new to the list of species captured in previous years. Individuals of Microtus longicaudis were trapped in area M-1 and area Y-3. In both cases the animals were captured in a grassy habitat in close proximity to a stream. One individual of Microsorex hoyi hoyi was captured in an unburnt edge habitat of 1-1. As a number of cinereus shrews were also captured in this area, verification of the species identification was accomplished by preparation of it's skull. The shrews will not be treated further in this analyses as their size tends to bias their capture.

Unlike 1972, Tamiascuirus hudsonicus was again captured in 1973. The species is represented by only two individuals captured in area Y-3 although the animal was seen frequently throughout the burnt and unburnt regions. For this reason, it is believed that its size lent considerable bias to its capture which would explains its absence in the 1971 data.

Spermophilis lateralis was captured with considerably more frequency in 1973 than in either of the two previous years. By far the greatest number occurred in the climax forest plot (Y-3)of the Marble Canyon area where their numbers equalled that of any other species captured. They were present however throughout the burn as well with at least one individual captured in each of the middle burn areas (D-1, M-1, B-1, and K-3).

An increase in the number of Zapus princeps individuals was also noted in 1973. Thirteen animals were recorded in area Y-3, seven in area M-1, one in area B-2 and one in area B-1. No significant difference was noted in the number of captures in July and August - a problem noted in previous years. None of these individuals showed evidence of capture in 1971. With the exception of one juvenile, all the captures of this species occurred within close proximity to a stream. Examination of such areas in previous years could elicit more information on their recolonization as well as that of other species such as Microtus longicaudis. Confirmation of all species identification was made possible by prepared skins and skulls obtained from trap deaths. The only exception to this was in the species of chipmunks. The only trap death which occurred for this species was an individual of Eutamias amoenus. Most captures appeared to be of this species. The only individual in doubt was captured in the Vista lake area and appeared to be Eutamias minimus. Field identification of the two species is mainly by color and size. It is therefore important that the skin and skull be retained if there is any doubt. As this was not the case, positive identification cannot be given.

A bleeding procedure was initiated in an effort to ascertain whether two species of chipmunk existed without having to kill specimens. This procedure was eventually abandoned when difficulty resulted in obtaining a blood sample from the animals. The method involved inserting a capillary tube into the sinus behind the eye. I was unable to penetrate the thick membrane protecting the cavity and therefore could not obtain sufficient samples to analyze electrophoretically.

Table II gives an indication of the species breakdown in each area. Upon initial examination the results appear to be somewhat unrelated. However the reason for the deviation is seen more clearly if the habitat is taken into consideration. A distribution map was drawn up for each species in an area and this was compared to the vegetational map for the area. These maps indicate a species bias for certain habitat types. For example, the climax forest plot could be divided into two types - one portion of the area was adjacent to a stream and supported a good growth of grass, while the other portion of the same line was away from the influence of the stream and supported the vegetation more typical of a dense climax forest. The population of the latter consisted almost exclusively of Clethrionomys gapperi. The more open areas supported larger populations of Zapus princeps and Spermophilis lateralis with a few Clethrionomys sp. present. A similar bias was found along lines where streams predominated. In area M-1, streams transected the lines in two places. Areas adjacent to this tended to be grass dominated. In this case, populations of Zapus princeps and Microtus longicaudis tended to be found. Microtus pennsylvanicus and Peromyscus maniculatus were generally captured further from the water source. Another deviation was seen in area K-3 where although a stream was present, the dominance of grass was not as obvious. The unstable nature of the area due to the erosion by the underground water system was perhaps a factor in this. K-3 therefore demonstrated the abundance of Peromyscus sp. seen in the poorer vegetated areas of the burn. Thus in the middle burn areas where grasses were not the dominant vegetational type, Peromyscus maniculatus was the dominant species.

The monospecific inhabitation index demonstrates the increasing diversity of species in the area. While the pristine forest plot on the west edge of the burn (1-1) showed a similar pattern to that of last year, a new plot situated in a valley above the middle burn showed significant numbers of Peromyscus maniculatus. The unburnt pockets showed the most obvious drop in individuals present. The population of Clethrionomys gapperi now is competing with almost equal numbers of individuals of other species, notably Eutamias sp. and Peromyscus sp. Such small numbers of animals captured cannot however indicate any trend and a close look at the situation in the future could provide further insight. The increase in diversity in the middle burn is primarily due to the habitat bias already discussed. However since vegetational succession will also occur in the area, such differences will prove to be an integral part of recolonization and as such may warrant closer examination in the future.

Comparison of transect and plot data

Before density analyses can be made, a discussion of the two methods of trapping is essential. In general, in order to obtain accurate population analyses, large area trapping for extended periods of time is required. However, in some cases, as in this study, initiation of such a procedure is impossible. Therefore a method must be devised which will make the best possible use of the alloted time and manpower.

Grid and transect live trapping were both used in an effort to discover the most effective means for future research in the area. Density therefore was calculated using results from both methods. Table 3 gives the comparative results for grids and transects for the density of resident and transient mice per hectare. The area for the grids and transects was computed by adding to the actual area of the grid or transect the area of a border of the width of the distance between two successive traps. Thus the boundaries were increased by 7.5 meters on each side. This increase is required to at least partially account for the animals which are found in the area surrounding the traps but which do not reside within the boundaries of them. "If samples of animals captured by a line trapping method are to be related to samples captured on a grid of traps, it must be first demonstrated that both trap placements are sampling the same trappable population. This can be assumed if parameters determined from the index lines are in close agreement with those found on the grid as a whole" (Brant, 1962). Tables 3 and 4 give comparative data for grids and transects for transient and resident densities of mice and chipmunk densities respectively. Table 3 was computed using the designation of Shank (1971) which classified individuals according to their probability of recapture into five groups. From these groups, high and low figures were estimated. The figures obtained show a reasonable similarity between results from the grids and transects. Table 4 shows a similar pattern where results were obtained from both methods. It should be noted however that more chipmunks were captured on the transects and therefore their density is better represented in these results. This is probably due to the fact that their numbers were scarace and generally the species were represented by only one or two animals in a localized area. Thus unless the grid was placed near such an area, no animals were captured. This demonstrates one drawback of using small grids. The home range of animals differ; for instance in general a Peromyscus sp. will have a much larger home range than an individual of Microtus pennsylvanicus. When using a small grid, small localized populations may be overlooked. This is particularly obvious when vegetational or habitat differences occur over the area to be studied.

On the other hand, the major drawback to the transect has always been an inability to estimate accurately the size of the area over which the animals have been taken. Without this information no population density figures can be calculated. The addition of a "boundary area" seems to alleviate this problem to some degree. Without it, population figures from the two methods varied by factors of 1.4 to 4.3. The only thing which would account for the differences obtained by the two methods is in the amount of edge present. Without the boundary area, the transect has twice the edge per unit area than the grid (.138 to .067). With the correction, the two are much closer (.071 to 0.54). The effect of edge can be seen in Table 6 where traps were classified according to the amount of edge they possessed and trap success calculated for each category. Traps with two edges were the most efficient. Traps with no edges show fluctuations. This is most likely due to the fact that they are influenced by the success of the traps around them and because of their limited placement in this study by the specific habitat which they cover. For example in almost every case where the grid was placed near a stream, the trap success of those with no edges improved. (Only traps in the middle of the grid will have no edges as they are completely surrounded by other traps). Such evidence however can only be looked on as a generalization based on a limited amount of information. Comparison of grids and transects is therefore difficult. However it is my opinion that transects would prove to be of great value in an area as diversified as a burn as the area covered as opposed to the amount of time involved is much less than that of a grid. A number of small grids would do well if the area was more uniform as is the case in a heavily wooded climax forest. It might be useful however to employ the use of some grids in combination with the transects in order to ensure that such lines are indicators of the number of animals present in a specific area.

RECOMMENDATIONS FOR FUTURE STUDY

I would recommend that the small mammal study be repeated at least two year intervals for several years. I believe this is necessary in order to monitor changes as they occur within the burn. The finding of two new species in the area demonstrates the need for continued research. If the study is repeated then I would suggest a few changes in the general procedure.

While it is important to test different habitats within the burn, it is equally important not to overextend your activities. An assistant enabled me to present the continuous data presented here. Without this help, it would have been impossible to prepare a comparison on the scale which I did.

I would also suggest that quantitative descriptions of the areas be given. Biases caused by habitat differences can make a tremendous difference in calculations and analyses. This is particularly important when repeating the study on grids and transects used in previous years. Correlation between vegetation and animal changes are then possible - that is, causal analyses can be made.

If trapping is to be continued in May and June then additional steps must be taken to protect entrapped animals. I have already made some suggestions in the report that may help. A change to bedding other than cotton batting may prove useful if one can be found with adequate insulative qualities.

The tagging of the larger small mammals could also be revised. Color-coded discs rather than fishing tags would be useful. If this was initiated it would then be possible to record their movements visually rather than relying on re-captures. Such animals do not readily re-enter a trap as small as the Sherman. Finally I would suggest that long range plans for research in the area be considered. In this way definite trends could be recorded.

SUMMARY

The purpose of the study was to re-examine the small mammal population of the Vermilion Pass burn area. *Clethrionomys gapperi* was found to dominate in the dense climax forest. *Peromyscus maniculatus* still abounds within the burn. However streams and other permanent sources of water result in the appearance of other species, notably *Zapus princeps* which showed a definite increase in its numbers over those present in previous years. Two new species, *Microsorex hoyi hoyi* and *Microtus longicaudis*, were captured. Density analyses were carried out and particular attention was paid to the effect of different habitats within the burn on the population which they supported. Two types of live trapping, grid placement and transect placement were compared and their relative advantages in a study of this kind was examined. Recommendations for future study were included.

ACKNOWLEDGEMENTS

I would like to acknowledge the assistance of Banff and Kootenay National Parks who allowed me to trap in the summer of 1973.

I would also like to acknowledge the help of Robert Guy who assisted in the trapping proceedings.

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OTHER MAMMALS OF THE BURN

Although no formal investigation of the larger mammals of the Vermilion Pass burn was made, sitings of all wildlife were recorded in an attempt to become familiar with the situation as it now stands. Such references should not be taken as an analyses of the large mammal population but only as an indication of what species may be found in the area. A systematic account of these sightings is given below.

Two members of the lagomorph order were seen within the burn. Two pikas were seen on numerous occasions within the rock pile on the northern bank of Vista lake. The first sighting was recorded early in May. B.C. varying hares were seen in the successional forest as well as in the burn. One or possibly more individuals were seen regularly in the forest in the vicinity of Eisenhower Junction and one in area B-1 and one in area B-2. The one in area B-2 was seen most frequently in the unburnt pocket which bordered the area.

Many members of the rodent family were captured within the traps however some managed to elude capture. The red squirrel was one such species which although often seen, it was seldom trapped. Such sightings were far more common in the climax forest while chipmunks were found to be more commonly observed in the successional forest. One flying squirrel was also seen within the successional forest. Other members of this family were simply too large to be captured. Porcupines were observed commonly in the area. Although each sighting was made within the burn, all were seen in close proximity to an unburnt pocket or patch of forest. At least 3 and possibly 4 individuals are believed to be present; one in the vicinity of Vista lake, one near the Continental Divide and one at the fireguard at the west end of the burn. Finally, a muskrat was observed in the Vermilion river near the Stanley Glacier car park. The fact that food avilability for the animal in the area is minimal and that it was seen only once leads me to the belief that the animal was a transient, only travelling through the area.

Carnivores were also apparent throughout the burn. Eleven sightings of at least 5 individual coyotes were made over the summer. Three of these animals were commonly seen in the successional forest between A-1 and Boom creek while one was seen at each of the following locations - SE15 of the burn, 12BNW in the burn. Only two wolf sightings were made. It is probable that the same individual was responsible for both recordings as it was seen at 5ASW one day and in the successional forest 1.5 miles NE the next. Bears were seen only infrequently within the study area. Only one black bear and two grizzly bears were recorded in the area between Marble Canyon and Eisenhower Junction. The black bear was seen in the forest just beyond Marble Canyon while the grizzlies were seen at Vista lake and on the avalanche slope north of the Stanley Glacier parking lot. The grizzlies were seen in the area several times and one is believed to be responsible for the mutilation of many of my traps. Mink were observed at Vista lake and Boom creek just NE of the road, while marten were sighted at Vista lake, 10DSE and 11SWB. The two latter sightings were both within the burn.

Ungulates were the most commonly seen large animal in the region. Mule deer tended to favor the successional forest at the east end of the burn. Regular sightings indicate that at least 6 bucks, 5 does, and 2 fawns inhabit the region between Boom creek and Eisenhower Junction. The burn yielded only two individuals which were regularly sighted. One was seen at the Stanley Glacier car park and one at the far west end of the burn. Both these animals were does. Only one white tail deer was seen during the summer and this was a buck reported in the climax forest behind the Marble Canyon Warden station.

Elk proved to be one of the most ubiquitous animals of the region. In all over 40 sightings of individuals or groups of individuals were made. In most cases the animals were reported when grazing on the grass by the side of the road, or on one of the avalanche slopes. No attempt will be made to estimate the total number of animals present. However it is possible to cite the largest groups seen in each area. The area between the west fireguard and the avalanche slope NE of Stanley car park harbored the greatest percentage of wapiti seen. Sightings suggest that at least 9 mature cows, 4 yearling cows, and 2 calves exist in the area. The area between here and Boom creek held at least 3 mature cows and a calf while the successional forest from there to Eisenhower Junction reported the only males seen with 5 mature bulls, one yearling bull and 5 cows.

The only other animal reported in the area was moose. As was noted by Shank, moose are often associated with burns. My observations indicate that a minimum of 7 individuals exist in the area. A male and a female were reported in the forest behind Marble Canyon and a similar pair exists in the successional forest of the east end of the burn. A cow was often seen in the area of the fireguard at the west end and another in the hanging valley of Stanley Glacier. The north-facing slope of the Continental Divide supports a cow and a calf. This final pair was seen quite regularly in the area and around Altrude lakes.

The number of animals which can be seen by even casual observations demonstrates the abundance of mammals within the burn. A closer look at the stages of recolonization could prove to be useful in future management within the burn.

TABLE 3:

Density of Resident and Transient Mice per Sectare as a Function of Area and Date of Sampling. Upper figure Represents Residents While the Lower Parenthetical Figure Refers to Transients.

		May	June	July	August
Pristine Forest					
1-1	Grid (a)	--	--	5.43-7.24	1.81-3.62
		(--)	--	(3.62-10.86)	0
	Transect (b)	--	0-2.867	6.45-15.05	1.43-9.32
		--	(1.43)	(2.87-5.73)	(2.15)
UB2	(a)	--	0	1.81-9.05	0-10.86
		--	0	(3.62)	(0-1.81)
	(b)	--	.716	2.87-3.58	.716-6.45
			(.716)	(.716)	(3.58-4.30)
Forest Pocket					
UB1	(a)	0-1.59	--	0	0.-1.59
		(1.59)	--	(1.59)	0
	(b)	--	--	--	--
		--	--	--	--
UB3	(a)	--	--	1.39	0.4.17
		--	--	(1.39)	0
	(b)	--	--	--	--
		--	--	--	--
Successional Forest					
A-1	(a)	--	--	--	0
		--	--	--	(0)
	(b)	--	--	--	.716-2.15
		--	--	--	(1.43)
Y-3	(a)	--	--	3.619	7.24-10.85
		--	--	(5.43)	(0-3.62)
	(b)	--	--	7.17	6.45-18.63
		--	--	(5.73-7.16)	(5.02-6.45)

continued...

Table 3 continued

		May	June	July	August
Edge of Burn					
2-1	(a)	--	--	1.80	0
		--	--	(1.80)	0
	(b)	--	0-1.43	.716-1.43	.716-2.15
		--	(.716)	(1.43)	(.716)
B-2	(a)		0-1.81-	1.81-3.62	0-5.43
		---	0	0	0
	(b)	--	0-1.43	2.15	.716-4.30
		--	0	(0-.716)	0
Middle of Burn					
M-1	(a)	--	0	0-1.81	3.62-5.43
		--	0	0	(1.81-5.43)
	(b)	--	0-2.15	3.58-5.734	2.15-5.018
		--	(1.43-2.15)	(4.3-6.45)	(1.43)
D-1	(a)	--	--	--	--
		--	--	--	--
	(b)	--	.716	.716-2.15	.716-2.867
		--	(0-.716)	(1.43)	(2.15)
B-1	(a)	3.62	1.81-3.62	1.81-3.62	5.43-7.24
		(7.23)	0	(1.81)	(5.43-7.24)
	(b)	4.30-5.73	2.15-4.30	1.43-5.02	5.73-12.90
		(2.15)	0	(1.43)	(5.73-7.88)
K-3	(a)	--	--	0-1.81	1.81-3.62
		--	--	0	(1.81-5.43)
	(b)	--	--	.716-1.43	2.15-5.73
		--	--	(.716-1.43)	(1.43-2.87)

TABLE 4:

Density of Mice and Chipmunks. Expressed as number per Sectare. Calculated from Grid and Transect Data. Number in Parenthesis is Chipmunk Density.

	June		July		August	
	Grid	Transect	Grid	Transect	Grid	Transect
Pristine Forest						
1-1	0(0)	4.3(0)	12.67(0)	22.22(0)	7.24(0)	5.73(0)
UB-2	0(0)	1.43(0)	14.48(0)	18.64(0)	10.86(0)	8.60(0)
Unburnt Pockets						
UB-1	0(0)	--	7.69(0)	--	7.69(0)	--
UB-3	1.38(0)	--	1.38(0)	--	0(2.78)	--
Successional Forest						
A-1	--	--	0(0)	0(0)	0(0)	1.43(2.15)
Y-3	--	--	0(0)	8.6(.716)	7.24(0)	13.26(0)
Edge of Burn						
2-2	0(0)	.716(1.43)	--	2.87(0)	0(0)	2.87(.716)
B-2	3.62(0)	2.86(0)	3.62(0)	2.87(0)	0(0)	3.58(0)
Middle of Burn						
M-1	--	4.3(0)	3.62(0)	11.46(0)	5.43(0)	2.86(.716)
D-1	--	.716(0)	--	2.86(0)	--	2.15(0)
B-1	3.62(0)	2.86(0)	3.62(0)	3.58(0)	12.67(0)	15.77(.716)
K-3	--	--	1.81(0)	2.87(0)	7.24(0)	6.45(0)

TABLE 5:

Numerical Ratio and Percentage of Juveniles in Total Capture and in the Transient Populations. Each Transient Value is the Average of the High and Low Estimates of the Individual Transients Passing through the Area.

	Ratio of Juveniles to total capt. May	Ratio of Juveniles to total June 1-31	Ratio of Juveniles to total July 1-31	Ratio of Juveniles to total Aug. 1-31	Ratio of Juv. transients to total trans. May	Ratio of Juv. transients to total transients June 1-31	Ratio of Juv. transients to total transients July 1 - 31	Ratio of Juv. transients to total transients Aug. 1-31
Pristine Forest								
1-1	--	0/6	14/37	5/9	--	0/2	6/7.5	2/3
UB-2	--	0/2	5/23	7/14	--	0/1	1/3	3/5.5
Mean	--	0	29.79%	52.5%	--	0	56.67%	54.54%
Pockets								
UB-1	--	--	1/1	1/1	1/1.5	--	0/1	0/0
UB-3	--	0/1	1/1	0/2	--	0/1	0/0	0/0
Mean	--	0	100%	50%	33.34%	0	0	0
Edge of Burn								
2-2	--	0/1	1/4	1/2	--	0/1	1/2	1/1
B-2	--	--	5/5	3/7	--	0/0	.5/.5	0/0
Mean	--	0	62.5%	46.43%	--	0	75%	50%
Middle Burn								
M-1	--	0/2	2/5	0/2	--	0/2	3/8	0/3
D-1	--	0/2	0/5	3/4	--	--	0/2	3/3
B-1	1/13	0/3	0/4	12/21	0/5	0/0	0/2	6.5/8.5
K-3	--	--	2/4	4/11	--	--	.5/1.5	1.5/3
Mean	7.69%	0	22.5%	42.13%	0	0	17.7%	56.62%
Successional Forest								
A-1	--	--	--	--	--	--	--	0/2
Y-3	--	--	1/12	2/19	--	--	1/5	0/5.5
Mean	--	--	8.33%	10.53%	--	--	10.0%	0
Total Mean	7.69%	0	44.62%	40.32%	16.67%	0	31.87%	32.25%

TABLE 6:

Trap success as a function of the amount of edge present per trap

	0 edges	1 edge	2 edges
B-1	1.613	2.59	2.68
UB-1	0.0	.833	2.08
1-1	3.33	3.80	3.33
2-1	.66	0.0	9.33
B-2	1.81	1.41	0.0
UB-2	5.0	1.97	4.28
UB-3	no traps	.591	.96
M-1	2.5	2.2	2.5
D-1	no traps	.88	0.0
Y-3	.909	6.66	7.27
K-3	3.00	1.98	3.00
A-1	0.0	.49	2.857
U-L	--	--	11.083

Area	trap ½ days before May 31	trap ½ days May 31-June 30	trap ½ days June 30-July 31	trap ½ days July 31-Aug.31	Total trap ½ days	# individuals captured	# captured before May 31	# captured May 31-June 30	# captured June 30-July 31	# captured July 31-Aug. 31	Total # captured	Captures/100 ½ days before May 31	Captures/100 ½ days May 31-June 30	Captures/100 ½ days June 30-July 31	Captures/100 ½ days July 31-Aug. 31	Total captures/ 100 ½ days	# deaths before May 31	# deaths May 31-June 30	# deaths June 30-July 31	# deaths July 31-Aug. 31	Total # deaths	deaths/100 capt. before May 31	deaths/100 capt. May 31-June 30	deaths/100 capt. June 30-July 31	deaths/100 capt. July 31-Aug. 31	Total deaths/100 capt.
V.L.	420	---	---		420	24	47	--	--		47	11.19	--	--	--	11.19	1	--	--	--	1	2.13	--	--	--	2.13
B-1	420	612	680	816	2528	40	24	4	7	39	64	5.71	.65	1.03	4.8	39.25	--	--	--	1	1	--	--	--	1.5	1.56
UB-1	72	--	180	180	432	4	2	--	1	1	4	2.8	--	.55	.55	1.3	--	--	1	--	1	--	--	--	--	25
1-1	--	544	816	680	2040	46	--	6	57	13	76	---	1.1	6.9	1.91	3.3	--	3	2	--	5	--	--	25	--	6.56
2-1	--	544	816	680	2040	10	--	3	7	5	15	---	.55	.86	.74	.74	--	--	--	1	1	--	--	--	6.6	6.6
B-2	--	270	680	544	1494	12	--	2	9	9	20	---	.74	1.33	1.66	1.21	--	--	--	2	2	--	--	--	22	10.0
UB-2	--	680	680	544	1904	26	--	2	24	19	45	---	.3	1.76	3.5	1.86	--	--	1	2	3	--	--	4.4	10.5	6.6
UB-3	--	240	300	240	780	4	--	1	2	2	5	---	.4	.66	.83	.63	--	--	0	--	--	--	--	--	--	0.0
M-1	--	408	816	884	2180	30	--	7	26	16	49	---	1.7	3.2	1.81	2.24	--	1	5	--	6	--	14.3	240	--	12.0
D-1	--	408	816	884	2180	11	--	3	9	6	18	---	.74	1.1	.68	.84	--	--	--	--	0	--	--	--	--	0.0
Y-3	--	--	816	680	1496	46	--	--	42	51	94	---	---	5.15	7.5	6.28	--	--	--	2	2	--	--	--	2.34	2.34
K-3	--	--	680	680	1360	15	--	--	8	21	29	---	---	.89	3.1	2.62	--	--	--	1	1	--	--	--	3.44	3.44
A-1	--	--	544	680	1428	5	--	--	--	9	9	---	---	--	1.02	.63	--	--	--	--	0	--	--	--	--	0.0
Totals					20,210	246					475					2.83	1				23					4.83

TABLE 1 - Results for 1973, organized according to area of trap days, individuals captured, number of captures, percentage trap success, trap death and percentage trap death.

	Clethrionomys individuals	Clethrionomys captures	Clethrionomys average weight	Clethrionomys average length	Peromyscus				Microtus pennsylvanicus				Microtus longicaudis				Eutamias				Spermaphilis				Others		monospecific inhabitation index	
1-1	44	75			--	--	--	--	1	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	95.24	
UB-2	16	31	22.3	84.8	9	13	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	61.54	78.39
UB-1	2	2	26.25	87.50	1	1	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50.0	
UB-3	2	3			--	--	--	--	--	--	--	--	--	--	--	--	2	2	--	--	--	--	--	--	--	--	67.0	58.5
A-1	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	7									60.0%	
Y-3	10	19			4	6			--	--	--	--	1	1	--	--	1	8	--	--	15	26			14	33	32.56	46.28
2-2	--	--	--	--	4	7			3	3			--	--	--	--	3	5	--	--							40.0	
B-2	8	16			--	--	--	--	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4	4	67.0	53.5
M-1	--	--	--	--	4	8	23.0	78.33	6	12	31.33	90.33	10	13	31.00	92.83	1	2	--	--	1	1	--	--	8	13	34.5	
D-1	--	--	--	--	6	11	26.66	77.66	2	3	--	--	--	--	--	--	--	--	--	--	3	4	--	--	--	--	54.55	
B-1	8	14	24.0	89.75	27	53	21.11	74.33	1	1	--	--	--	--	--	--	2	3	--	--	1	1	--	--	1	1	64.84	58.49
K-3	1	1	--	--	12	24	20.50	77.00	--	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--	1	1	80.0	
V.L.	4	6			6	12			1	1	--	--	--	--	--	--	13	28			--	--	--	--	--	--		

TABLE 2: Average weight and length of each species in each sampling area, together with the number of individuals captured and number of captures made.

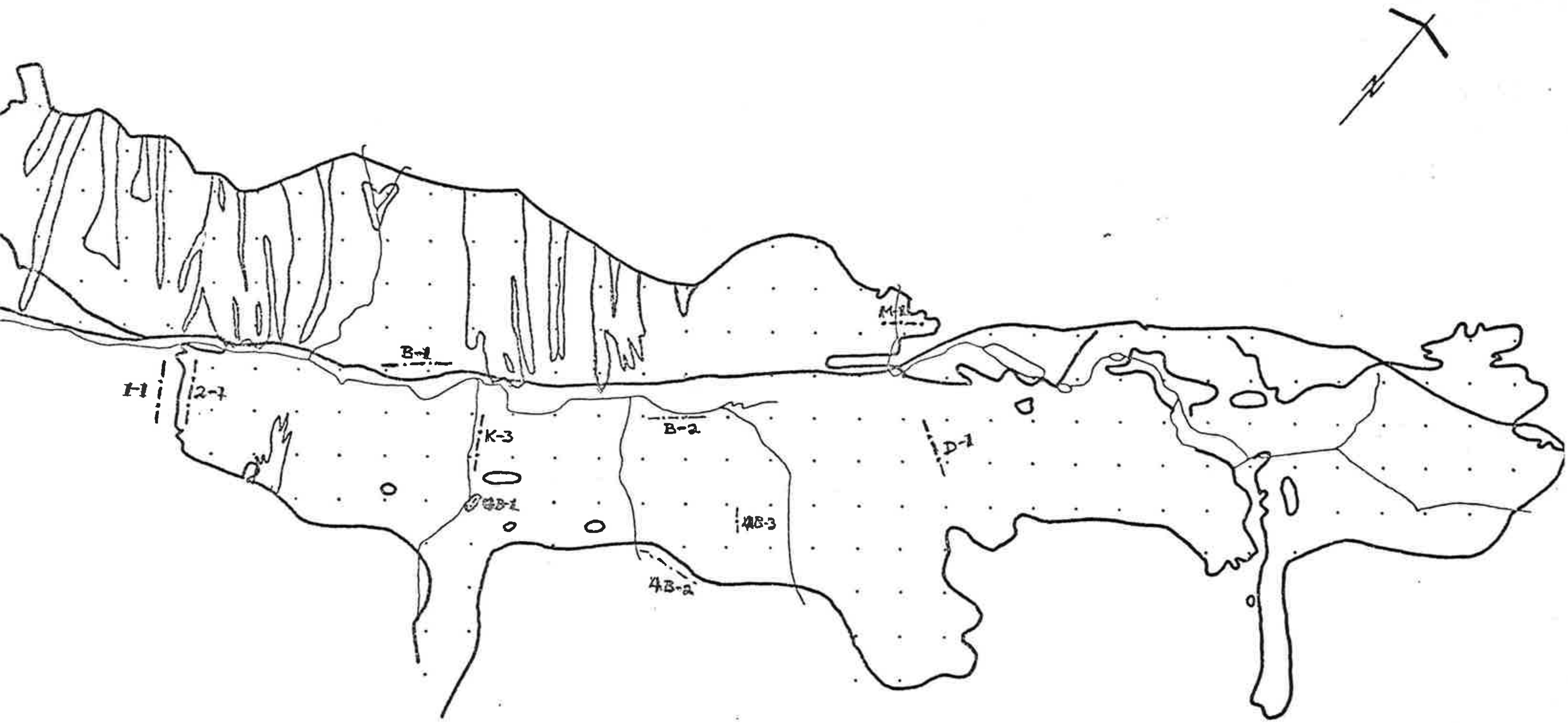

Figure 1. Sites of traps, small mammal survey, 1973.

0 — 1600
METRES