Vegetation Map of the Vermilion Burn, 1972.

by Terry Willard and Stuart A. Harris

In past years, the vegetation part of the study has been based on the use of plots put in at convenient points on the burn. It was hoped that by this means, a reasonable idea of the recolonization of the burn would be obtained. What these studies could not tell us was the percentage of the area occupied by a given vegetation association or species.

This year, a map was made of the area and the surveyors also set out a 300 metre grid of pins. Terry Willard worked with the surveyors for most of June to help establish the first bench marks and then set about the task of describing and mapping the vegetation using two metre and five metre plots established at 141 of the 285 pins. The resultant maps (Figs. 1 - 3) give a relatively clear idea of the state of revegetation of the burn.

Past Work.

Dubé (1972) has shown that there is a post-fire area of lodgepole pine changing via a spruce-pine stage to an alpine fir-Engelmann spruce climax in the general area of Eisenhower Junction-Marble Canyon. The final product is a forest composed of three layers or strata. These are the trees, the shrub layer and the herbaceous

plants on the ground. Most previous studies have concentrated on the regeneration of the trees for obvious economic reasons, but in the present study the changes of all three strata will be studied.

Ogilvie (1969) places this type of climax forest in his sub-alpine forest zone. He also explains the selective regeneration of lodgepole pine as being due to its special adaptation. The cones are usually sealed shut by resin bonds. Temperatures in excess of 113° F are required for melting these bonds and are only attained in fires. The cone remains on the tree for up to fifty years so that after a fire there is a sudden release of seeds in large quantities at a time when the seeds previously on the ground may have been destroyed. The condition of the cones also changes with the age of the trees. In the first twenty years open cones are produced but are replaced by mainly closed cones thereafter.

Lodgepole pine is adapted to growth in open conditions with high light intensity and it is shade-intolerant, i.e. it cannot establish itself within stands. Together with its rapid germination and rate of seedling growth, these characteristics readily explain its position in the zone.

Methods Used.

The original condition of the burned area was determined in two ways. Aerial photographs show the distribution of avalanche slopes and burned areas immediately prior to the fire. Age and species composition could not readily be determined on dead trees

owing to their dryness and state of preservation, so attention was concentrated on the live stands around the burn. Tree corings at breast height were used and the age was arrived at by counting the rings.

Tree and shrub distribution was mapped on the basis of five metre radius plots around each pin on the 300 metre grid. These have an area of 15.7 square metres. The herbaceous plots were only two metres in radius around the same pins. For each plot records were kept of the relevant species present and their number. Alternate transect lines were used for the mapping which proved satisfactory for the main area. However, application of this technique to the avalanche areas proved of doubtful value. The variability from plot to plot for the shrubs on the slope within the avalanche areas was immense and suggests that more than one plot per 300 metres will be necessary to sort out the distribution patterns. For this reason only part of this area was completed. In interpreting the maps, it needs to be remembered that small inclusions of other dominant species may occur between the sites on which the mapping of the dominant plants is based.

Results:

1. Condition prior to the fire. Fig. 4 shows the probable condition prior to the 1968 fire. A number of small avalanche areas were already present as well as a small area which had burned at an earlier

date.

A list of the tree corings is given in Table 1. On the Kootenay side of the Pass the climax forest included spruce trees between 250 and 307 years old, with lodgepole pine trees greater than 210 years old. However, in Banff National Park the trees were younger, the spruce having 120-200 rings while firs were 10 to 75 years old.

2. Vegetation regrowth. For convenience of discussion this will be split into the three strata, viz., trees, shrubs and herbs.

(a) Trees. Figure 1 and Table 2 give the results for the distribution of tree species in the five metre plots. It will be readily apparent that lodgepole pine occurs over most of the area, although some small areas of the north-west facing slopes and around the Altrude Lakes have yet to experience tree regeneration. Spruce and fir occur in the counts only close to the margins of the burn or along the road beside unburned trees. It looks as though most of the pre-existing seeds were destroyed in the fire and recolonization is dependent on the dispersal of fresh supplies of seed.

Density of tree growth varies enormously, the highest count being 56 trees in 15.7 square metres at 12B-NW. Reasons for this variability are unknown, although one area includes the previous burn while others may represent a lack of fire in the vegetation, e.g. on old avalanche slopes, or else zones of very hot fires. Most of the burn has between two and ten trees per 15.7 square

metres, but in all probability, the density will increase for a few years as seeds germinate.

(b) Shrubs. Table 2 and Figure 2 show the data for the distribution of shrubs in the area. It would appear that Menziesia glabella is the dominant shrub, and field evidence appears consistent with the regrowth of the shrub from pre-existing root systems that survived the fire. Most plants show well developed mature root systems with about three years' growth on top. This also is true of most of the other species present.

The north-west facing slope shows an almost complete dominance (75% of the plants) of Menziesia. Shrubs are absent at the highest altitudes on rocky surfaces, and again in one small zone on the valley side.

The pattern on the south-east facing slope is far more complicated, with other species such as Spiraea lucida, Shepherdia canadensis, Lonicera sp. and Rosa acicularis becoming dominant in some localities. The pattern appears to be too complicated to be mapped with the present grid in the main area of the avalanche slopes. It may be a product of competition of the species following fire, or it may represent added interference from avalanche activity. It would appear as though the pattern of shrub dominance on south-east facing slopes is much more complicated than on north-west facing slopes.

(c) Herbs. Table 3 and Figure 3 give the results of the study of the herbaceous plants present in the two-metre plots. The largest

single area is covered by an association dominated by Epilobium angustifolium (fireweed). Arnica cordifolia is also a major dominant in many areas but may be losing ground to the Epilobium. Grasses occur locally near former avalanche slopes and on flood plains, while both Habernaria dilatata and Erigeran glabellus are locally dominant in Banff National Park on south-east facing slopes. Tremendous variety is present and the dominant species will probably change as regeneration of the forest takes place. At high altitudes on the rocky north-west facing slopes , no herbaceous plants have become re-established yet. This may also change in the next few years.

Conclusions and suggestions for further work.

The state of recovery of the vegetation over the bulk of the area has been mapped. It will, however, need re-mapping at regular intervals, while it may also be desirable to establish plots in any plant associations which have not been examined so far. Both Pauline Olthof and Dennis Dube are being asked to locate their plots on a copy of the new base map. In this way this can be checked out. It will also be necessary to complete the study of the vegetation of the avalanche slopes with a more detailed study so as to determine the present situation there. This will need regular re-examination until the plant associations have stabilized.

References

Dube, D. 1972. Vermilion Pass Fire Project, Preliminary Report A. Manuscript Report to Parks Branch, Dept. of Indian Affairs and Northern Development.

Ogilvie, R.T. 1969. The Mountain Forest and Alpine Zones of Alberta. in "Vegetation, Soils and Wildlife." J.G. Nelson and M.J. Chambers, Eds., Methuen Publications, Toronto, pp. 25-44.

Table 1. Results of tree coring studies of the trees surrounding the burned area.

Location	Tree Species	Age (years)
SE 17-A	Spruce	285
SE 17-B	Spruce	257
SE 17-A	Lodgepole pine (rare)	210 (approx)
SE 17-A	Alpine fir	25
SE 17-A	Alpine fir	159
SE 6-D	Spruce	307
SW 0-A	Alpine fir	87
SW 0-A	Spruce	195
NE 3-A	Spruce	125
NE 4-A	Spruce	195
NE 3-A	Alpine fir	80
NE 4-A	Alpine fir	10
NE 4-A	Alpine fir	75
NE 3-A	Lodgepole pine (rare)	175
SW 17-A	Spruce	187
SW 17-A	Spruce	237
SW 20	Spruce	253
SW 17-A	Alpine fir	88

Table 2. Results of the study of the trees in the five metre plots in the Vermilion Pass Burn Area, 1972..

Plot No.	Pinus contorta latifolia	Abies lasiocarpa	Picea engelmannii	Salix sp.	Betula glandulosa	Dead Trees large/small	logs/stumps
NE 1	1	6		1			
NE 2		2					
NE 3		3		1			
NE 4		1					
NE 5							
NE 6							
NE 7		Dense					
NE 8		8					
NE 9		5					
NE 10		14					
NE 11		5					
NE 12				1			
NE 13							
NE 14					15		
NE 15							
000							
SE 1						1 / 1	6 / 0
SE 1 (i)			1				
SE 2	5					1 / 1	3 / 0
SE 3						0 / 1	5 / 0
SE 4						1 / 2	3 / 0
SE 5		2		1			
SE 6					2		
SE 7					1		100's / 0
SE 8						0 / 2	4 / 0
SE 9				1	1		
SE 10	1					0 / 145	2 / 0
SE 11	Parking Lot						
SE 12	1	18					

able 2. (continued)

Plot No.	Pinus contorta latifolia	Abies lasiocarpa	Picea engelmannii	Salix sp.	Betula glandulosa	Dead Trees large/small	logs/stumps
SE 13	100% gravel						
SE 14							
SE 15			2				
SE 16							
SE 17			Climax				
SE 4B	9					4 / 2	7 / 2
SE 4C				18		7 / 0	0 / 3
SE 4C(i) (5660)	Seedlings		Seedlings				
SE 4D	3					9 / 12	13 / 3
SE 4D(i) (6060)		Seedlings					
SE 4E	4						
SE 11B						4 / 6	12 / 1
SE 11C	33					6 / 11	4 / 0
SE 11 D	12					4 / 6	8 / 2
SE 11E	11(old)	11 (unburned)		12	24		
SE 11E(i)			Dense				
SE 11F	5					11 / 48	21 / 6
SE 11G	3					10 / 20	4 / 0
TI SEA				3	1	5 / 14	15 / 6
TI SEB	4					6 / 12	15 / 2
TI SEC	7					5 / 20	18 / 3
TI SED	7					7 / 45	11 / 6
TI SEE	20					3 / 16	12 / 1
TI SEF (5975)							
TI SEG						7 / 16	12 / 1
TI SEH						10 / 5	10 / 0
T2 SWA	7					1 / 28	12 / 10
T2 SWB(i) (565)	3						
T2 SWB(ii)		(unburned fir stand)					
T2 SWC						0 / 30	
T2 SWD						2 / 14	

Table 2. (continued)

Plot No.	Pinus contorta latifolia	Abies lasiocarpa	Picea engelmannii	Salix sp.	Betula glandulosa	Dead Trees large/small	logs/stumps
T2 SWE							
TE SW					3		
T2 SWF							
T3 SEA	1		2			4 / 4	7 / 0
T3 SEB	1		2			3 / 45	23 / 5
T3 SEC						4 / 2	10 / 0
T3 SED	6					3 / 25	14 / 2
T3 SEE	4					17 / 5	
T3 SEF	3					5 / 21	5 / 0
T3 SEG						6 / 12	7 / 0
T3 SEH	4		3			4 / 14	8 / 3
T4 DEA (5900)						3 / 18	7 / 4
T4 DEA(i) (5527)			1				
T4 DEB	7					7 / 15	8 / 1
T4 DEC	4					4 / 2	7 / 2
T4 DED	9					6 / 10	7 / 1
T4 DEE							
T4 DEF						5 / 4	6 / 2
T4 DE (6200)						7 / 10	7 / 3
T4 DEG							
T5 SWA	13			3		2 / 15	3 / 1
T5 SWB	15			3		2 / 23	7 / 1
T5 SWC	12					2 / 9	

Table 3. Result of the study of the shrubs in the five metre plots in the Vermilion Pass Burn Area, 1972.

Plot No.	Menziesia glabella	Spiraea lucidia	Shepherdia canadensis	Rosa acicularia	Other Species
NE 12(i)	5				
NW 12B		15	6	4	
NE 12C	6	5	4	3	
NE 12C(i)					5 Ledum
NE 12D	5				3 Ledum 1 Sambucus
SE 8B	10				3 Pedicularis 2 Rubus
SE 8D	7				2 Sambucus
NE 4(i)	(unburned pocket)				
NE 4A	Solid Rock				
NE 4B	18				2 Sambucus
NE 4C	14				2 Sambucus 1 Pedicularis
NE 4D	13			1	
SE 16B	25				6 Ledum
SE 16B(i)	(unburned pocket)				
SE 16C	15				
SW 8A	5		1		
SW 8A(i)	1			1	
SW 8B	1	3		7	
SW 8C			5		1 Rubus 2 Juniper 3 Amelanchier
SW 8D			2		2 Juniper
SW 5A					1 Lonicera 1 Potenticla
SW 5B	11				2 Vaccinium
SW 5C	8				1 Vaccinium
NE 14C		2	2		
SW 16A	3				1 Lonicera
SW 16B	4	1		5	2 Lonicera

Table 3. (continued)

Plot No.	Menziesia glabella	Spiraea lucidia	Shepherdia canadensis	Rosa acicularia	Other Species
SW 16C		3			
SW 16D					
SW 16E					
NE 8A					2 Ledum
NE 8B	5	5	4	2	1 Potentilla
NE 8C	4	5		3	
NE 8D	10			10	
SW 12A	2	3			1 Ledum
SW 12B				4	1 Lonicera
SW 12C	1				
SW 12D					1 Amelanchier 1 Potentilla
SW 12E	(unburned spruce climax)				
NE 10A	5				2
NE 10B	1				
NE 10C	2	1			
NE 10D	5			14	
NE 6A		5			
NE 6B	2	2			2 Ledum 1 Lonicera
NE 6C					
NE 6D	1				
OE B	6				
OE C	17				1 Ledum
OE D	8				5 Sambucus
OE E	2				
OE F	1				
OE G					
OE H					
SE 6B	1				3 Ledum
SE 6C	5				1 Ledum
SE 6D	13				
SW 2A	1	3			
SW 2B	2				
SW 2C	5				

Table 3. (continued)

Plot No.	Menziesia glabella	Spiraea lucidia	Shepherdia canadensis	Rosa acicularia	Other Species
SW 2D	2				
SE 13B	4				2 Ledum 1 Lonicera
SE 13C	12				2 Lonicera
SE 13D	5	4			2 Ledum
SW 10A	2			3	
SW 10B	4	2			
SW 10C					
SW 10D	3				2 Ledum 1 Rubus 1 Amelanchier
SW 10E					2 Amelanchier

Table 4. Results of the study of the herbaceous vegetation in the two meter plots in the Vermilion Pass Burn Area, 1972.

Plot No.	*Epilobium angustifolium* (no. of stems)	*Arnica alpina* (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
NE 1	Roadside (Waste)		5		Lots of Yarrow (80-100) 5 Columbine 200 Strawberries 3 Raspberry Lots of Paintbrush nearby
NE 2	Wasteland				
NE 3	Wasteland (gravel)				Large Salix taking up 50% of plot Raspberries Strawberries
NE 4	Wasteland				5-10% *Linnaea borealis*
NE 5	15				Tall Grasses Strawberries
NE 5(i)					5 *Orchis rotundifolia* 2 *Angelica argula* 3 *Pinguicula oulgans*
NE 6	37		10		
NE 7		22	5		
NE 8		37			
NE 9	10	35			
NE 10			60		
NE 11	35	12	35		
NE 12	15		15		Lots of strawberries
NE 13			30		60% Strawberries (*Arnica* and *Epilobium* in woods nearby)
NE 14					Strawberry 6 Paintbrush 50 Dodecatheon
NE 15	100% Gravel and Dirt				
000	Great Divide, Parking Lot				

Table 4. (continued)

Plot No.	Epilobium angustifolium (no. of stems)	Arnica alpina (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
SE 1	174	18			3% Linnaea borealis 2% Mosses
SE 2	148	83	20	50	2% Linnaea borealis 2% Mosses
SE 3	172	71	5	75	8 Cornus canadensis 5% Linnaea borealis 3% Mosses
SE 4	15		50		5% Linnaea borealis
SE 5			75		Gravel
SE 6	Roadside (gravel)		5		Arnica, Epilobium in nearby woods
SE 7	37		5		2% Mosses
SE 8	10		80		
SE 9			50		
SE 10	78	3	5		2% Linnaea borealis 5% Mosses
SE 11	Parking Lot for Glacier				
SE 12	10	10	35	80	Many strawberries and much grass
SE 13	100% Gravel, 45° Angle Road Side				
SE 14	3	8	5	25	10 Cornus canadensis
SE 15	30	80		35	5% Linnaea borealis
SE 16	45	57	1	25	5 Cornus canadensis 2% Linnaea borealis 2% Mosses
SE 17	Unburned Area				
SE 4A			50	100	Thalictuim (meadow rue) didn't plot
SE 4B (5380)	107			10	1% Mosses
SE 4C (5575)	91	22		5-10	59 Cornus canadensis 1% Mosses

Table 4. (continued)

Plot No.	Epilobium angustifolium (no. of stems)	Arnica alpina (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
SE 4D (6200)	78	21		80	15% Linnaea borealis 75% Mosses
SE 4E (5366)	39	47	70	85	7 Dandelions
SE 11B (5660)	10	16	<0.5%	75	67 Cornus canadensis 0.5% Linnaea borealis
SE 11C (5660)	8	27	1	30	42 Cornus canadensis 5% Linnaea borealis
SE 11C (i) (5666)					Lots of Arnica and Columbine
SE 11D (5800)	87	122		90	(ION of plot) 10 Cornus canadensis
SE 11D (i) (5800)					Arnica dominant
SE 11E (5900)			100	100	
SE 11F		87	5		
SE 11G	27	31	2		2% Linnaea borealis
SE 11H					
SE 11I					
T_1SE A (5400)	140		5	35	1% Mosses
T_1SE B (5500)	33	68	1	25	20 Cornus canadensis 1% Linnaea borealis
T_1SE C (5600)	31	110		35	43 Cornus canadensis 2% Linnaea borealis
T_1SE D (5700)	10	57	1	20	1 Cornus canadensis 2% Linnaea borealis
T_1SE E (5800)		125		55	5% Linnaea borealis
T_1SE E(i) (5850)	.Fireweed take over dominance				

Table 4. (continued)

Plot No.	*Epilobium angustifolium* (no. of stems)	*Arnica alpina* (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
T_1SE F (5975)	47	51		35	Lots of fireweed in area
T_1SE G	5	84		25	1% Mosses
T_1SE H	6	4		5	*Arnica* only around trees Fireweed in open patch
T_2SW A (5400)	15			100	2 Dandelions Some *Arnica* in area
T_2SW B (5650)		90% D		65	*Thalictium* near unburned area
T_2SW B(ii) (5680)				45	15 *Thalictium*
T_2SW C (5700)		100		5	
T_2SW C(i) (5720)	Avalanche area, wasteland: no growth			0	
T_2SW D (5800)	34		2	5	23 Yarrow
T_2SW E (6000)	10		10	75	5% *Linnaea borealis* Lots of strawberry and several unidentified plants Avalanche area
T_2SW F (6200)	5		5	85	Larkspur Strawberry Yarrow *Thalictium*
T_2SW	Dogwood first sighted at 5650				
T_3SE A (5200)	29	30	5	35	18 *Cornus canadensis* 3% *Linnaea borealis* 0.5% Mosses

Table 4 (continued)

Plot No.	Epilobium angustifolium (no. of stems)	Arnica alpina (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
T_3SE B (5400)		6	40	60	18 Cornus canadensis 1% Linnaea borealis
T_3SE C (5500)	1	27		75	73 Cornus canadensis 10% Linnaea borealis 1% Mosses
T_3SE D (5600)		3	10	45	200 Cornus canadensis 2% Linnaea borealis
T_3SE F (5700)	10	57		25	20 Cornus canadensis 2% Linnaea borealis 1% Mosses Columbine nearby (80:40/A:f)
T_3SE G (5800)	5	35		55	27 Cornus canadensis 1% Linnaea borealis (60:40/A:f)
T_3SE H (6000)		157	2	60	25 Cornus canadensis 5% Linnaea borealis 7 Balsamorhiza
T_3SE I (6100)	37	25		10	Some columbine nearby
T_4DE A (5400)	120			15	2% Mosses
T_4DE B (5500)	20			< 1	Arnica and columbine nearby
T_4DE C (5600)	9		0.5	5	21 Cornus canadensis
T_4DE D (5700)	24		1	5	Some dandelion
T_4DE E (6000)		198		75	

Table 4. (continued)

Plot No.	*Epilobium angustifolium* (no. of stems)	*Arnica alpina* (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
T_4DE F (6100)		20			15 *Thalictium* 20 Columbine 15 *Cornus canadensis*
T_4DE G (6200)	30	15	15	25	20 Columbine
T_5SW A (5500)	57		5	75	40 *Cornus canadensis* 10% *Linnaea borealis* 2% Mosses
T_5SW B (5600)	129		5	25	21 *Cornus canadensis* 10% Mosses
T_5SW C (5750)	*Arnica* start to appear				
T_5SW D (5775)	*Arnica* take over: 80% dominance				
T_5SW C (5750)	45	27	5	15	27 *Cornus canadensis* 1% Mosses
T_5SW D (5775)	17	143	2	75	24 *Cornus canadensis* 2% *Linnaea borealis* 1% Mosses
T_5SW E (5900)	44	49	5	15	21 *Cornus canadensis*

Table 4. (continued)

Plot No.	Epilobium angustifolium (no. of stems)	Arnica alpina (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
NE 12(i)	5	3	75	95	15% Mosses Bog Orchids
NE 12B	43		25	40	15 Erigeron glabellus
NE 12C	5			15	5 Cornus canadensis 3 Erigeron glabellus
NE 12C(i)	Organic Bog			100	
NE 12D	2	1	2	10	3 Cornus canadensis 5% Mosses
SE 8B	69	15		70	3 Erigeron glabellus 10 Senecio (cymbalariosclis) 27 Cornus canadensis
SE 8B(i)	Arnica take over dominance			10	
SE 8C	31			5	20 Cornus canadensis
SE 8D	3			5	2 Carex sp. 3 Cornus canadensis
NE 4A	Solid Rock			1-2	Lichens 1% Mosses
NE 4B	17			5	8 Cornus canadensis 1% Mosses
NE 4C	19			2	1% Mosses
NE 4D	13	25		10	6 Cornus canadensis 2% Linnaea borealis 1% Mosses
SE 16B		3		2	9 Senecio sp. 2 Solidago multiradiata 25 Cornus canadensis 2% Linnaea borealis 1% Mosses
SE 16B(i)	Unburned Pocket				

Table 4. (continued)

Plot No.	Epilobium angustifolium (no. of stems)	Arnica alpina (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
SE 16C		175		85	75 Cornus canadensis 1% Linnaea borealis 1% Mosses
SW 8A	130	75	5	85	4% Linnaea borealis 1% Mosses
SW 8A(i)	Arnica take over dominance				
SW 8A(ii)					Cover is almost completely Erigeron glabellus and grass
SW 8B	1		65	70	1 Senecio sp. 2 Mertensia ciliata
SW 8C	44		35	100	3 Thalictium occidentale 25 Achillae millefolium 54 Allium cernuum
SW 8D	3		30	95	5 Achillea millefolium 15 Allium cernuum 5 Mertensia ciliata 5% Fragaria glauca 7 Gaillardia aristata 2 Heracleum lanatum
SW 5A	105	2	5	35	57 Cornus canadensis 5% Mosses 8 Erigeron glabellus
SW 5B	40		10	30	75 Cornus canadensis 5% Linnaea borealis
SW 5C	4	57	10	25	51 Cornus canadensis 3% Linnaea borealis
NE 14C	2		5		2 Senecio sp. 44 Erigeron glabellus

Table 4. (continued)

Plot No.	Epilobium angustifolium (no. of stems)	Arnica alpina (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
NE 14B	1		2	10	15 Cornus canadensis 3% Mosses
SW 16A	47	15	10	75	10 Erigeron glabellus 5% Mosses
SW 16B	36	14	3	85	8 Erigeron glabellus 10% Mosses
SW 16C	1		1	5	10 Cornus canadensis 1% Linnaea borealis
SW 16D	7		1	10	4% Linnaea borealis
SW 16E	Didn't find.				
NE 8A				100	35 Cornus canadensis
NE 8B	10		10	15	12 Erigeron glabellus 3 Cornus canadensis 2% Linnaea borealis
NE 8C	10		15	25	3 Cornus canadensis 1% Linnaea borealis 1% Mosses
NE 8D	4		10	20	2% Linnaea borealis 1% Mosses 12 Erigeron glabellus
SW 12A	5	3	30	80	10% Mosses 3 Erigeron glabellus 10 Senecio sp.
SW 12B	14	5	15	35	3 Cornus canadensis 5% Mosses
SW 12C	3	27	10	20	
SW 12D	1	3	25	75	5 Gaillardia aristata 10% Fragaria glauca 15 Allium cernuum

Table 4. (continued)

Plot No.	Epilobium angustifolium (no. of stems)	Arnica alpina (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
SW 12E	2		35	85	5% Mosses 6 Senecio sp. 8 Solidago multiradiata 5 Erigeron glabellus 15 Achillea millefolium 5 Thalictrum occidentale
NE 10A			5	100	95% Mosses 10 Castilleja miniata
NE 10B	5	10	45	60	6 Erigeron glabellus
NE 10C	4	2		5	3 Cornus canadensis
NE 10D	73	35	10	55	14 Cornus canadensis
NE 6A	13	47	15	45	12 Cornus canadensis 5% Mosses 5 Senecio sp.
NE 6B	49	12	10	30	3 Cornus canadensis 3 Erigeron glabellus
NE 6C			5	10	3 Cornus canadensis 2% Mosses
NE 6D	14	3	2	15	5% Linnaea borealis 2% Mosses
OE B	19			1	2 Cornus canadensis
OE C	9		1	5	15 Cornus canadensis
OE D	20		2	5	
OE E	15	27	5	20	2 Cornus canadensis
OE F		150	1	60	
SE 6B	120		5	30	
SE 6C	8	127		40	39 Cornus canadensis 5% Linnaea borealis
SE 6D	51	62		35	

Table .. (continued)

Plot No.	Epolibium Angustifolium (no. of stems)	Arnica alpina (no. of stems)	Grasses (percentage)	Percentage of Plot Covered	Other Species
SW 2A	3	27		20	6 Senecio
SW 2B	68	14	10	50	5 Cornus canadensis
SW 2C	15	92	15	65	8 Cornus canadensis 5 Erigeron glabellus
SW 2D	10	15	5	15	15 Cornus canadensis
SE 13B	52	14		25	3 Cornus canadensis 5% Linnaea borealis 12 Senecio 5 Erigeron glabellus
SE 13C	1	59		10	5 Cornus canadensis 3% Linnaea borealis
SE 13D	59	4		15	5% Linnaea borealis
SW 10A		72	25	75	10% Mosses 10 Senecio 28 Erigeron glabellus
SW 10B		89	30	55	5 Cornus canadensis 5% Fragaria 3 Gaillardia
SW 10C	5	94	10	45	10 Campanula rotundifolia 6 Castilleja miniata
SW 10D	47	3	15	35	2 Castilleja
SW 10E	12		5	10	43 Cornus canadensis