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PROGRESS REPORT
on the research project entitled
LONG TERM POST-FIRE
VEGETATION MONITORING
OF THE RECENT
CARD POINT BURN
IN ISLE ROYALE NATIONAL PARK
(final version)

by

Robert A. Janke

Michigan Technological University

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INTRODUCTION

This report deals with the most recent monitoring (Summer, 1997) of the vegetation on a small recently burned area on Isle Royale National Park. The burn occurred in 1976 at Card Point, a small peninsula on the southwest end of Isle Royale in Lake Superior. The approximate area of the burn was 10 acres. It was a natural lightning-caused fire which the National Park Service allowed to continue burning to a natural extinction.

During the summer of 1977, we established permanent vegetation plots on the burn site so that successional changes could be monitored. These were randomly located along a series of equally-spaced parallel lines. In the Card Point Burn, the organic layer of the soil was burned down to mineral soil in some areas, while in other areas within the burn it was completely unburned. Vegetation plots were established in both types of soil condition so that the effects of the presence or absence of the upper soil organic layer on post-fire vegetation establishment could be compared. The vegetation in the plots had previously been monitored in the summers of 1977, 1978, 1979, 1980, 1982, and 1990.

The most recent monitoring was performed by myself with the assistance of National Park Service employees Pat Valencia, Meghan Wendt, and Mark Romanski. Most of the transportation and housing were provided by the National Park Service. My efforts on the project were volunteered.

METHODS

The methods used in sampling the vegetation were similar to those used in previous monitoring of this burn. The above mentioned plots had been established by using a single stake in the ground as a reference point. Tree and tall shrub species with stems one meter or more in height and less than 5 cm. d.b.h. (saplings) were sampled in a circular plot of 3 meters radius centered about the stake. Stem counts were made and, for each stem the height was measured. Stems 5 cm. d.b.h. or greater (post-sapling stage) were sampled in a 6 meter circular plot concentric with the sapling plot. Stem counts and d.b.h. measurements were made.

Low ground cover vegetation and seedlings (stems less than 1 meter high) of tree and tall shrub species were sampled in square quadrats oriented so that one side of the square aligned with the line connecting the plot stakes and so that the stake was at the center of this side. Four square meter (2 X 2 m.) quadrats were used for the burned soil plots. However, since the vegetation in the unburned soil plots was originally quite dense, one square meter quadrats were used for these. A 1 m. by 1 m. square wooden quadrat frame was used in this sampling process. In the case of the 4m² quadrats, the frame was laid down 4 times. For ground cover species, % cover was estimated for each species. For seedlings, both % cover estimates and stem counts were made.

RESULTS AND CONCLUSIONS

From the square quadrat data, tree/tall shrub seedling densities were calculated for each species for each year of sampling (table 1 for burned soil, table 2 for unburned soil). During the first 6 years after the burn, white birch (Betula papyrifera) and quaking aspen (Populus tremuloides) have had the highest seedling densities among canopy tree species. This may be attributed to the fact that (a) both species have very small seeds easily carried long distances by wind, and (b) seed-bearing trees of both species are abundant throughout Isle Royale. Also when destroyed by fire these species will often produce sprouts from either the stump, as in the case of birch, or from the roots, as in the case of aspen. They are by far the most frequent post-fire invaders on Isle Royale (Janke and Lowther, 1981).

Comparing seedling densities on burned soil with that on unburned soil reveals some striking differences. White birch, quaking aspen, big-tooth aspen (Populus grandidentata) and white spruce (Picea alba) all have considerably greater seedling densities on burned soil than on unburned soil. This may be explained by the fact that seed germination for those species is best when the depth of the soil litter layer is least (Janke, 1978). The total seedling

density of all species combined has also been considerably greater on burned soils than on unburned soils throughout our entire monitoring period.

From the data from the 3 meter circular plots, sapling densities were calculated for each species for each year of sampling (table 3). The results indicate a general increase in sapling densities with time for all species combined, followed by a decline in more recent years. Identical types of calculations were made for the 6 meter radius plots (table 4) dealing with the post-sapling stage. The results indicate that overall post-sapling density (stems 5 cm d.b.h. or greater) is still very low. Species richness is also very low. White spruce is the dominant tree species. During the first few years after the burn, there was actually a decline in the total number of stems after which they tended to increase up to the present time. The trees sampled during the year 1977 were all survivors of the fires. Many of these had been badly damaged by fire, especially in the roots or near the base of their boles. Most of these subsequently either were blown over by strong winds or died standing upright. This accounts for the initial decline in post-sapling density.

The recent decline in sapling densities, and the slow rate of increase in post-sapling densities is probably the result of intensive moose browsing. This is especially true of canopy tree species. All of the canopy species that are palatable to moose have recently declined in sapling density. The two most palatable species, quaking aspen and mountain ash (*Sorbus decora*), have declined the most. The unpalatable white spruce (*Picea glauca*), however, has increased. Furthermore, even though white spruce has been relatively low in seedling and sapling density, it now exceeds all other canopy tree species in post-sapling density.

The effects of moose on tree/tall shrub species is evident in the height distribution of saplings. For non-palatable species, most of the saplings are more or less equally distributed in a height range from 1 to 4.5 meters. For palatable species, however, 76% of the saplings are less than 2 meters high. Moose, then, have definitely been an important factor in determining what species will become a part of the forest canopy. In the earlier years following the fire, it appeared that quaking aspen, mountain ash, and white birch would eventually dominate the canopy. Now it appears as if white spruce will be the dominant canopy tree. This strong effect of moose on the succession of tree species is undoubtedly related to their high population size in recent years.

Using the ground cover data from the square quadrats, the average % cover of each ground cover species for each year that sampling occurred was calculated (tables 5 and 6). For plots on both burned and unburned soil at Card Point, the total ground cover increased with time to 1980 and then declined to the present time. This decline in ground cover is probably due to increased competition with the tree and tall shrub species. On unburned soil, the total cover is considerably higher immediately after the fire than on burned soil. This is because root systems, if not the whole plants, survived the fire on these plots. The total cover remained higher in the unburned soil plots but the difference has gradually become less. The species diversity, though greater at first, is presently less than that on burned soil. Species diversity has increased for both soil types during our period of monitoring.

The early plant invaders on burned soil were mostly herbs such as *Epilobium angustifolium*, *Epilobium glandulosum*, and *Impatiens biflora*. One woody plant, *Rubus parviflorus* was also prominent. On unburned soil, on the other hand, most of the cover following the fire was made up of the woody shrubs *Rubus parviflorus* and *Rubus idaeus*. Also abundant were the grass *Calamagrostis canadensis* and *Cornus canadensis*, an abundant plant in Isle Royale's mature forests. Most of these plants probably sprouted up from roots from plants that were present before the fire and were not disturbed by the fire.

At present the most abundant ground cover plants on burned soil are *Fragaria virginiana*, *Cornus canadensis*, and *Rubus parviflora*. On unburned soil, they are *Diervilla lonicera*, *Cornus canadensis* and *Deschampsia flexuosa*.

Our results definitely indicate, then, that the post-fire succession that occurs on burned soil is very different from that on unburned soil. Post-fire succession, therefore, is very dependent on the conditions under which the fire takes place. These results also indicate that succession following clear-cutting or violent wind storms would be quite different than that following fire.

RECOMMENDATIONS

After studying approximately 20 years of change, we find that the vegetation in the Card Point burn is still changing relatively rapidly. I recommend, therefore, a continuation of the monitoring of this burn at time intervals of about 5 years. Although we already have made a thorough study of post-fire succession on Isle Royale in the past, most of this work has been in later stages of succession (beyond 40 years). Continued monitoring of more recent burns will yield much-needed information on earlier post-fire successional stages.

REFERENCES CITED

Janke, Robert A. and John L. Lowther. 1981. Post-fire succession in the boreal forest type of Isle Royale National Park. Proc. 2nd Conference of Research in the National Parks. San Francisco. 11:99-135.

Janke, Robert A. 1978. The ecology of the boreal forest-type of Isle Royale National Park. An annual research report to the National Park Service.

Table 1
Density (stems/hectare) of tree/tall shrub species
Seedlings on burned soil.

Species	Number of Years Since Burn (year)						
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1900)	20 (1996)
White Birch*	36,500	72,700	239,000	262,570	220,700	33,700	29,200
Quaking aspen*	0	35,300	33,000	37,570	37,860	10,760	3,125
White spruce*	0	0	166	429	1,570	2,650	2,656
Balsam fir*	0	0	0	0	0	1,250	469
Mountain ash*	0	0	1,000	1,860	2,570	5,460	3,125
Big tooth aspen*	0	0	0	2,710	1,860	780	156
Pin cherry	0	166	0	0	1,000	156	781
Northern white cedar*	0	0	0	0	0	312	312
Willow	0	0	0	0	0	4,370	3,281
Mountain alder	0	0	0	0	7,710	2,964	4,688
Tag alder	0	0	0	0	0	0	313
Ninebark	0	0	0	0	0	624	781
Mountain maple	0	0	0	0	0	0	0
Red elderberry	0	0	0	0	0	0	0
Sugar plum	0	0	0	0	0	0	156
TOTAL	36,500	108,166	273,166	305,139	273,770	62,885	49,062

*Species capable of occupying the forest canopy

Table 2
Density (stems/hectare) of tree/tall shrub species
Seedlings on unburned soil

<u>Species</u>	Number of Years Since Burn (Year)						
	<u>1</u> <u>(1977)</u>	<u>2</u> <u>(1978)</u>	<u>3</u> <u>(1979)</u>	<u>4</u> <u>(1980)</u>	<u>6</u> <u>(1982)</u>	<u>14</u> <u>(1990)</u>	<u>20</u> <u>(1996)</u>
White birch*	0	26,600	20,000	12,900	20,000	15,560	7,000
Quaking aspen*	0	910	1,430	714	0	1,110	3,000
White spruce*	0	0	0	0	0	0	2,000
Balsam fir*	0	909	2,860	3,570	2,860	0	0
Mountain ash*	0	0	12,860	6,430	12,140	14,440	14,000
Big tooth aspen*	0	0	0	0	0	0	0
Pin cherry	0	0	0	1,428	572	1,110	0
Northern white cedar*	0	0	0	0	0	0	0
Willow	0	0	0	0	714	0	2,000
Mountain alder	0	0	0	0	2,857	0	0
Tag alder	0	0	0	0	0	0	2,000
Ninebark	0	0	0	0	0	1,110	0
Mountain maple	0	0	0	0	0	4,440	0
Red elderberry	0	0	0	0	0	1,110	3,000
TOTAL	0	28,419	37,150	25,042	39,053	38,880	33,000

***Species capable of occupying the forest canopy**

Table 3
Density (stems/hectare) of tree/tall shrub species
Saplings

<u>Species</u>	Number of Years Since Burn (Year)						
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)	20 (1996)
White birch*	0	0	77	192	584	4,107	2,570
Quaking aspen*	0	4	581	1,047	2,226	929	231
White spruce*	0	0	0	0	205	327	517
Balsam fir*	7	12	27	41	56	353	313
Mountain ash*	0	4	304	174	1,450	1,479	27
Big tooth aspen*	0	0	35	35	61	118	27
Pin cherry	0	0	0	6	37	183	82
Balsam poplar*	0	0	0	0	6	131	41
Mountain alder	0	0	0	27	6	746	2,366
Willow	0	0	0	27	580	1,584	993
Tag alder	0	0	0	3	12	92	572
Service berry	0	0	0	0	5	39	0
Mountain maple	0	0	0	0	73	0	0
Choke cherry	0	0	0	0	18	0	0
Red elderberry	0	0	0	0	500	10	68
Ninebark	0	0	0	0	0	0	95
TOTAL	7	20	1,024	1,552	5,854	10,098	7,902

*Species capable of occupying the forest canopy

Table 4
Density (stems/hectare) of tree/tall shrub species
Post-sapling Stage

<u>Species</u>	Number of Years Since Burn						
	(Year)	(Year)	(Year)	(Year)	(Year)	(Year)	(Year)
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)	20 (1996)
White burn*	52	0	3	0	0	3	27
Quaking aspen*	0	0	0	0	0	0	17
White spruce*	39	0	6	9	10	13	99
Balsam fir*	13	0	3	0	0	0	3
Mountain ash*	16	8	3	3	10	0	0
Red elderberry	0	0	0	0	3	0	0
Tag alder	0	0	0	0	0	13	218
Willow	0	0	0	0	0	0	3
TOTAL	120	8	15	12	23	29	367

*Species capable of occupying the forest canopy

Table 5
% cover of low ground cover species*
(burned soil)

(not listed
for 2.00
probably
E. alatum)

Species	Number of Years Since Burn (Year)						
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)	20 (1996)
Epilobium angustifolium	1.2	4.7	12.3	10.1	4.8	1.1	0.5
Impatiens biflora	0.0	2.5	6.8	2.8	1.2	p	p
Rubus parviflorus	0.3	2.6	4.8	4.6	3.7	8.2	2.0
Epilobium glandulosum 2380	0.2	3.5	4.3	1.6	p	0.0	0.0
Poa palustris 100	0.1	0.2	3.3	7.8	5.3	0.1	0.0
Rubus idaeus	0.0	0.8	2.4	4.6	2.6	1.1	1.7
Calamagrostis canadensis 161	0.2	0.8	2.3	4.5	2.1	0.5	1.2
Cornus canadensis	0.1	1.0	1.5	2.4	3.2	3.9	2.7
Anaphalis margaritacea	0.0	0.0	1.4	1.8	2.2	0.9	1.1
Diervilla lonicera	0.2	1.0	1.2	1.4	0.7	1.1	1.2
Achillea millifolium	0.2	1.1	0.1	1.7	0.7	0.4	0.4
Stellaria calycantha ② 127	0.1	0.8	0.8	0.5	p	0.0	p
Glyceria striata 57	0.0	0.6	0.6	0.7	0.0	0.0	0.0
Milium effusum 181	0.0	0.2	0.6	1.1	0.4	0.0	0.9
Rosa acicularis	0.0	0.2	0.5	1.3	0.5	0.2	0.4
Carex aenea 302	0.0	0.3	0.5	0.1	p	p	p
Taraxacum officinale	0.0	0.2	0.4	1.6	2.0	1.3	1.7
Agropyron trachycaulum 17	0.0	0.0	0.3	0.1	p	0.0	0.0
Carex brunnescens 315	0.0	0.1	0.3	1.0	p	p	0.0
Solidago altissima ② 127	0.0	0.0	0.2	0.8	0.1	0.0	0.4
Veronica americana ③ 236	0.0	0.0	0.2	0.0	p	0.0	0.0
Ranunculus abortivus 200	0.0	0.1	0.2	0.2	0.1	0.0	p
Polygonum cilinode ② 55	0.0	0.0	0.2	0.1	0.1	0.0	0.0
Cirsium vulgare	0.0	0.0	0.2	0.1	0.1	0.0	0.0
Galium triflorum ③ 785	0.0	0.2	0.2	0.2	0.4	0.3	0.3
Lactuca biennis ③ 537	0.0	0.1	0.2	0.4	0.3	p	p
Aralia nudicaulis	0.0	0.1	0.1	0.2	0.1	p	0.4
Galeopsis tetrahit ③ 158	0.1	0.9	0.0	0.1	p	0.0	0.0
Lonicera canadensis	0.0	0.0	0.0	0.1	p	0.2	p
Maianthemum canadensis	0.0	0.0	0.0	0.1	0.1	0.3	0.4
Clintonia borealis	0.0	0.0	0.0	0.2	0.1	0.2	p
Carex deweyana 310	0.0	0.0	0.0	0.2	0.1	0.0	p
Physocarpus opulifolius	0.0	0.0	0.0	0.1	0.2	p	0.0
Aster macrophyllus ③ 445	0.0	0.0	0.0	0.2	0.7	0.4	0.9
Linnaea borealis	0.0	0.0	0.0	0.2	0.7	2.6	1.1
Melampyrum lineare	0.0	0.0	0.0	0.2	2.2	0.3	0.4

* The letter p signifies % cover less than 0.1 %

Table 5
(Continued)
Number of Years Since Burn

Species	(Year)						
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)	20 (1996)
Ranunculus acris 2074	0.0	0.0	0.0	0.1	0.1	0.5	0.4
Carex houghtoniana 349	0.0	0.0	0.0	1.0	0.1	0.0	0.0
Equisetum arvense 15	0.0	0.0	0.0	0.0	0.9	0.5	0.5
? - Lathyrus japonicus ^{moniliformis} 2001-1900	0.0	0.0	0.0	0.0	0.5	0.8	p
Rubus pubescens 3X315	0.0	0.0	0.0	0.0	0.1	0.3	0.5
Solidago canadensis (3) 433	0.0	0.0	0.0	0.0	0.0	0.7	0.2
Lycopodium annotinum	0.0	0.0	0.0	0.0	0.0	0.3	1.2
Streptopus roseus	0.0	0.0	0.0	0.0	0.0	0.2	0.3
Ribes glandulosa 2070	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Mitella nuda	0.0	0.0	0.0	0.0	0.1	p	0.1
Thalictrum dasycarpum	0.0	0.0	0.0	0.0	p	0.0	p
Coptis trifolia	0.0	0.0	0.0	0.0	p	p	0.0
Fragaria vesca 2000	0.0	0.0	0.0	0.0	p	0.0	0.3
Geocaulon lividum	0.0	0.0	0.0	0.0	p	p	p
Phleum pratense 171	0.0	0.0	0.0	0.0	p	0.0	0.0
? - Dryopteris intermedia ?	0.0	0.0	0.0	0.0	p	p	0.0
Eupatorium maculatum	0.0	0.0	0.0	0.0	p	0.0	p
Fragaria virginiana 2075-1900	0.0	0.0	0.0	0.0	p	p	4.4
Aster simplex ^{lateriflorus} 3422	0.0	0.0	0.0	0.0	p	0.0	0.0
Carex arctata 343	0.0	0.0	0.0	0.0	p	p	p
Lycopodium obscurum	0.0	0.0	0.0	0.0	p	p	p
Hieracium pilloselloides 3(5030)	0.0	0.0	0.0	0.0	0.0	p	0.5
Actea rubra 2070-1900	0.0	0.0	0.0	0.0	0.0	p	0.0
Gymnocarpium dryopteris	0.0	0.0	0.0	0.0	0.0	p	0.0
Cerastium vulgatum 2072	0.0	0.0	0.0	0.0	0.0	p	p
Carex canescence 344	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Dryopteris intermedia ?	0.0	0.0	0.0	0.0	0.0	p	0.0
Viburnum edula	0.0	0.0	0.0	0.0	0.0	p	0.0
Hieracium aurantiacum	0.0	0.0	0.0	0.0	0.0	p	0.3
Trientalis borealis	0.0	0.0	0.0	0.0	0.0	p	p
Cornus stolonifera	0.0	0.0	0.0	0.0	0.0	p	p
Campanula rotundifolia (3) 315	0.0	0.0	0.0	0.0	0.0	0.0	p
Agrostis hyemalis 167	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Taxus canadensis	0.0	0.0	0.0	0.0	0.0	0.0	p
Osmorhiza clatoni	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Anemone spp. 2070-1900	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Thelypteris phegopteris ^{boscii} 300	0.0	0.0	0.0	0.0	0.0	0.0	p
Heracleum lanatum	0.0	0.0	0.0	0.0	0.0	0.0	0.4

Table 5
(Continued)

Species	Number of years since burn						
	(Year)						
	1	2	3	4	6	14	20
	(1977)	(1978)	(1979)	(1980)	(1982)	(1990)	(1996)
2 — Castilleja							
septentrionali	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Aster puniceus	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Pyrola asarifolia	0.0	0.0	0.0	0.0	0.0	0.0	p
Caltha palustris	0.0	0.0	0.0	0.0	0.0	0.0	p
Lactuca canadensis	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Vaccinium spp.	0.0	0.0	0.0	0.0	0.0	0.0	p
Species Number	10	22	27	37	55	47	59
TOTAL % COVER	2.7	22.0	45.9	54.2	37.7	27.3	29.9

Table 6
% cover of low ground cover species*
(unburned soil)

SPECIES	Number of Years Since Burn (Year)						
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)	20 (1996)
Rubus parviflorus	37.8	36.0	27.9	27.3	18.4	9.4	0.2
Rubus idaeus	13.3	19.3	27.4	30.5	16.7	0.6	0.6
Cornus canadensis	8.7	4.1	21.9	23.8	22.8	14.6	3.6
Calamagrostis canadensis	14.3	12.9	13.5	13.9	13.6	7.8	1.6
Clintonia borealis	0.1	0.0	10.7	7.6	2.8	1.5	1.7
Milium effusum	1.1	0.6	5.4	16.8	5.8	0.0	0.3
Galium triflorum ³⁷⁸⁵	0.1	1.1	8.2	5.1	1.7	p	0.4
Heracleum ^{lanatum} maximum	0.0	0.0	6.4	7.0	0.0	0.8	1.5
Diervilla lonicera	0.0	0.0	5.5	8.0	6.6	19.3	7.0
Aralia nudicaulis	1.1	0.9	5.2	2.3	0.6	0.4	0.3
Linnaea borealis	0.0	0.0	4.0	3.7	3.7	0.2	0.3
Equisetum arvense	0.0	0.0	2.7	0.5	0.2	p	p
Lycopodium annotinum	0.0	0.0	2.3	1.0	1.8	p	0.3
^{common} ^{1000 50110} Oxalis ^{acetosella} montana	0.0	0.0	2.2	1.8	2.3	0.0	p
Epilobium angustifolium	0.1	2.6	2.2	3.1	1.9	0.6	1.1
Stellaria calycantha	0.0	0.0	2.0	0.2	0.1	0.0	0.2
Maianthemum canadensis	0.6	0.9	1.5	2.0	0.9	2.4	0.8
Poa palustris	1.6	2.9	1.4	5.1	3.8	0.2	1.5
Ranunculus abortivus	0.0	0.1	1.4	2.4	0.9	0.0	0.5
Osmorhiza claytoni	0.6	0.3	1.1	1.4	0.1	p	0.4
[?] Dryopteris spinulosa ⁵³	0.0	0.0	1.1	0.5	0.6	0.0	0.2
Rubus pubescens	0.0	0.0	1.1	0.8	0.0	p	0.2
Lactuca biennis	0.0	0.0	0.9	0.6	1.0	0.4	0.3
Streptopus roseus	0.0	0.0	0.7	0.7	0.0	0.3	0.2
Lycopodium obscurum	0.0	0.0	0.6	0.3	0.1	0.1	0.1
Impatiens ^{sp. 15} biflora	1.4	0.5	0.3	0.3	0.1	0.0	0.3
Geocaulon livida	0.0	0.0	0.3	0.2	0.1	0.0	p
Viola renifolia ⁰⁵⁶¹	0.0	0.0	0.3	0.2	0.1	0.0	p
Carex aenea	0.6	0.7	0.1	0.2	0.0	0.0	0.2
Taraxacum officinale	0.4	0.1	0.0	0.3	1.7	2.1	0.5
Polygonum cilinode ⁰¹⁸⁵	0.7	0.3	0.0	0.1	0.1	0.0	0.1

*The letter p signifies % cover less than 0.1%

Table 6
(Continued)
Number of Years Since Burn

Species	(Year)						
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)	20 (1996)
<i>Galeopsis tetrahit</i> ^{cherry not 10}	5.0	1.0	0.0	0.2	p	0.0	0.6
<i>Carex arctata</i>	0.0	0.0	0.0	5.9	3.6	p	1.0
<i>Epilobium glandulosum</i>	0.0	0.0	0.0	0.2	p	0.0	p
<i>Anaphalis margaritacea</i>	0.0	0.0	0.0	0.3	0.2	2.6	0.3
<i>Solidago canadensis</i>	0.0	0.0	0.0	0.0	0.0	1.0	0.1
<i>Trientalis borealis</i>	0.0	0.0	0.0	p	p	0.0	p
<i>Cirsium arvense</i> ^{(3) 511}	0.0	0.0	0.0	0.0	p	0.0	0.0
<i>Carex brunescens</i>	0.0	0.0	0.0	0.0	p	p	0.0
<i>Circaea alpina</i> ^{enchanted (2) 199}	0.0	0.0	0.0	0.0	p	0.0	0.0
<i>Carex canescens</i>	0.0	0.0	0.0	0.0	p	0.0	0.0
<i>Achillea millefolium</i>	0.0	0.0	0.0	0.0	p	0.0	0.0
<i>Cerastium vulgatum</i>	0.0	0.0	0.0	0.0	0.0	p	0.0
<i>Physocarpus opulifolius</i>	0.0	0.0	0.0	0.0	0.0	p	0.0
<i>Carex houghtoniana</i>	0.0	0.0	0.0	0.0	0.0	0.0	p
<i>Melampyrum lineare</i>	0.0	0.0	0.0	0.0	0.0	p	0.2
<i>Cornus stolonifera</i>	0.0	0.0	0.0	0.0	0.0	p	p
<i>Deschampsia flexuosa</i> ¹⁵⁵	0.0	0.0	0.0	0.0	0.0	0.0	2.6
<i>Frageria virginiana</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.3
<i>Agrostis hyemalis</i>	0.0	0.0	0.0	0.0	0.0	0.0	2.8
<i>Mitella nuda</i>	0.0	0.0	0.0	0.0	0.0	0.0	p
<i>Hieracium pilloselloides</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.3
<i>Thelypteris phegopteris</i> ^{beach fern}	0.0	0.0	0.0	0.0	0.0	0.0	0.2
<i>Aster macrophyllus</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.4
<i>Hieracium aurantiacum</i>	0.0	0.0	0.0	0.0	0.0	0.0	p
<i>Cirsium vulgare</i>	0.0	0.0	0.0	0.0	0.0	0.0	p
<i>Ranunculus acris</i>	0.0	0.0	0.0	0.0	0.0	0.0	p
<i>Solidago altissima</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Species Number	17	17	29	36	37	29	51
TOTAL % COVER	93.2	84.3	158.3	174.3	112.9	68.2	33.5