Biology ID 17744
Janice Gray

PROGRESS REPORT

on the research project entitled
(final version)

LONG TERM POST-FIRE VEGETATION MONITORING OF THE RECENT McGINTY'S COVE BURN IN ISLE ROYALE NATIONAL PARK

by

Robert A. Janke

Michigan Technological University

March 1998

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 1975 on a steep slope of a ridge near McGinty's Cove on the northwest shore and at the southwest end of Isle Royale. The approximate area of the burn was 2 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. The vegetation in the plots has been monitored in the summers of 1977, 1978, 1979, 1980, 1982, 1990, and 1997.

The most recent monitoring was performed by myself with the assistance of National Park Service employees Pat Valencia, Mallory Tackett, 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 and moose browsing was noted. 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 (2x2m) 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. A 1 m. by 1 m. square wooden quadrat frame was used in this sampling process. 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). During the early 6 years after the burn, white birch (Betula papyrifera) and quaking aspen (Populus tremuloides) have had the highest seedling densities. 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). Our post-fire monitoring of the recent burn at Card Point, revealed that birch and aspen behaved similarly there (Janke, 1997). For all species combined, the seedling density increased during the first 5 years after the fire. Since then it has declined. Similar trends also have occurred at Card Point.

From the data from the 3 meter circular plots, sapling densities were calculated for each species for each year of sampling (Table 2). The results indicate a general increase in sapling densities with time for all species combined, followed by a decline in more recent years. Among the canopy tree species, quaking aspen and mountain ash (Sorbus decora) densities have declined the most dramatically since 1982. This was also true at Card Point. Northern white cedar (Thuja occidentalis), on the other hand, has dramatically increased in density.

Identical types of calculations were made for the 6 meter radius plots (table 3) dealing with the post-sapling stage. 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 fire. Many of these had been badly damaged by fire, especially in the roots or near the base of their boles so that they subsequently either were blown over by strong winds or died standing upright. This accounts for the initial decline in post-sapling density.

Our most recent sampling of the post-sapling stratum indicates that it is now dominated by white spruce, (Picea glauca). Normally it would be dominated by white birch and/or quaking aspen and in most stands these species would remain dominant for approximately 90 years after a fire (Janke and Lowther, 1981). This unusual dominance of white spruce also exists at Card Point where the age of the post-fire stand is similar to that of McGinty's cove.

Our results suggest that moose have strongly affected the composition of canopy tree species. The intensive decline in the sapling densities of quaking aspen and mountain ash, both highly palatable to moose, was probably caused by moose. Also moose have probably promoted the dominance of the post-sapling stage of tree species by the very unpalatable white spruce, rather than by the palatable species – birch and aspen. Palatable species make up about 72% of the stems in the seedling stage, but only 47% of stems in later stages of development. Palatable tree species, then, have invaded the area in abundance, but many are apparently not surviving beyond the seedling stage. Our browse observations of saplings, the stage most available to moose, indicate that 96% of palatable species were browsed by moose.

Another important relationship between moose and recently burned areas is the effect of fire on the food supply of moose. A great portion of this food supply consists of woody plants in the sapling stage. We have estimated this by totaling the densities of all species in the sapling stage considered to be palatable to moose. These densities are given below along with the corresponding number of years since the burn occurred:

Years since burn	Palatable sapling density (stems/ha.)
2	0
3	113
4	562
5	934
7	5,959
15	4,543
22	2,007

In some of our previous studies of 100 year old boreal forest stands, the density of palatable saplings averaged about 2700 stems/hectare (Janke, 1983). Immediately after the fire this density was considerably less than that of 100 year old stands but after about 7 years it began to exceed the latter considerably. Now, approximately 23 years after the fire, it is not too different from that of 100 year old stands. The fire, then, seems to have resulted in a period of about 16 years in which the woody food supply for moose exceeds that of older stands. A similar trend occurred within the Card Point burn.

Using the ground cover data from the square quadrats, the average % cover of each ground cover species was calculated for each year of sampling. The results indicate that the total % cover of all species combined increased during the first 8 years after the fire, but in more recent years it has declined (Table 4). The number of species, however, has generally increased throughout the period of sampling. This may be due to the late persistence of the early invaders, though generally reduced in % cover, and the continual invasion of new species which, for one reason or another, are slower invaders.

Among the early ground cover invaders, that became relatively abundant at some time during the first 6 years, were Rubus idaeus, Aralia nudicaulis, Milium effusum, Rubus parviflorus, Epilobium ciliatum, Galium triflorum, and Epilobium angustifolium. Of these, Rubus idaeus, Rubus parviflorus, and Epilobium angustifolium were also among the more abundant early invaders at the Card Point burn.

RECOMMENDATIONS

After studying approximately 23 years of change, we find that the vegetation in the McGinty's Cove 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. 1997. Long term monitoring of the recent Card Point burn in Isle Royale National Park. Progress report to National Park Service.

Janke, Robert A. 1983. The Flora and Vegetational Ecology of Isle Royale National Parks. Progress report to National Park Service.

Table 1
Seedling densities (stems/hectare)
of
tree/tall shrub species

Species	Number of Years Since Burn (Year)						
	2 (1977)	3 (1978)	4 (1979)	5 (1980)	7 (1982)	15 (1990)	22 (1997)
White Birch*	33,500	58,750	80,095	56,900	45,160	20,180	18,000
Quaking Aspen*	9,000	9,821	6,792	7,790	6,967	4,820	3,000
White Spruce*	1,000	2,143	1,410	1,765	1,471	1,960	2,500
Balsam Fir*	2,500	5,357	5,129	4,120	6,178	7,680	7,330
Mountain Ash*	0	893	882	882	1,471	540	834
Northern White Cedar*	0	893	602	1,765	6,914	7,320	10,200
Balsam poplar*	0	0	0	0	1,471	0	0
Mountain Maple	500	1,429	1,283	1,180	2,207	357	2,330
Willow	0	0	0	0	2,501	1,430	3,670
Red elderberry	0	0	0	0	0	0	167
TOTAL	**46,500**	**79,286**	**96,193**	**74,402**	**74,340**	**44,287**	**48,031**

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

Table 2
Sapling densities (stems/hectare)
of
tree/tall shrub species

Species	Number of Years Since Burn (Year)						
	2 (1977)	3 (1978)	4 (1979)	5 (1980)	7 (1982)	15 (1990)	22 (1997)
White Birch*	0	44	155	236	2,812	2,347	1,322
Quaking Aspen*	0	6	217	324	1,435	454	24
White spruce*	0	13	35	34	47	732	543
Balsam fir*	0	0	0	0	52	480	354
Mountain ash*	0	63	190	261	822	631	118
Northern white Cedar*	0	0	4	10	0	581	1,156
Balsam poplar*	0	0	0	0	5	0	0
Mountain maple	0	0	0	88	276	202	47
Willow	0	0	0	25	557	429	142
Red elderberry	0	0	0	0	1,814	0	94
TOTAL	**0**	**126**	**601**	**978**	**7,820**	**5,856**	**3,800**

* Species capable of occupying the forest canopy

Table 3
Post-sapling densities (stems/hectare)
of
Tree/tall shrub species

Species	Number of Years Since Burn (Year)						
	2 (1977)	3 (1978)	4 (1979)	5 (1980)	7 (1982)	15 (1990)	22 (1997)
White Birch*	0	6	5	5	16	32	100
White Spruce*	18	13	9	15	31	44	395
Northern white cedar*	71	38	40	49	26	38	35
TOTAL	**89**	**57**	**54**	**69**	**73**	**114**	**530**

*Species capable of occupying the forest canopy

Table 4
% Cover Of Low Ground Cover Species
Number of Years Since Burn

Species	(Year)						
	2 (1977)	3 (1978)	4 (1979)	5 (1980)	7 (1982)	15 (1990)	22 (1997)
Rubus idaeus	23.0	21.3	23.4	28.1	26.4	1.11	0.1
Aralia nudicaulis	8.4	12.3	15.9	16.2	14.6	7.34	10.5
Milium effusum	10.1	4.8	1.7	2.4	0.6	P	P
Epilobium angustifolium	1.7	3.9	4.8	4.6	1.5	0.2	0.5
Rubus parviflorus	1.0	2.5	6.2	5.7	7.7	23.4	12.0
Galium triflorum	4.6	1.0	1.5	3.0	1.2	0.6	0.3
Epilobium ciliatum	7.9	0.9	0.4	0.3	0.8	0.0	0.1
Clintonia borealis	0.3	0.8	0.0	1.6	2.9	2.1	2.1
Taraxicum officinalis	0.2	0.6	0.4	1.2	1.4	0.7	0.8
Impatiens biflora	0.2	0.4	1.1	1.0	0.1	p	p
Lactuca biennis	0.3	0.4	1.6	1.0	0.4	0.0	0.0
Trientalis borealis	0.0	0.4	1.1	0.3	2.8	0.4	p
Calamagrostis canadensis	0.0	0.3	0.0	0.0	1.2	p	0.0
Maianthemum canadensis	0.0	0.2	0.6	0.8	0.9	1.8	2.5
Osmorhiza clatoni	0.0	0.2	0.3	1.0	0.6	0.1	p
Poa palustris	2.4	0.2	0.0	2.0	3.5	p	0.0
Ranunculus abortivus	0.0	0.1	0.6	1.2	0.1	0.0	0.0
Anaphalis margaritaceae	0.0	0.1	0.3	0.0	2.1	1.6	1.7
Carex houghtoniana	0.0	0.0	0.7	2.1	0.1	0.0	0.0
Lonicera canadensis	0.0	0.0	0.6	0.1	0.2	0.1	1.0
Taxus candensis	0.0	0.0	0.3	0.6	0.1	0.0	0.5
Carex aenea	0.0	0.0	0.1	0.0	p	0.0	p
Stellaria calycantha	0.0	0.0	0.1	0.1	0.1	0.0	0.0
Viola spp.	0.0	0.0	0.1	0.4	0.3	0.0	0.0
Streptopus roseus	0.0	0.0	0.0	0.3	0.2	0.3	0.8
Dryopteris disjuncta	0.0	0.0	0.0	1.1	3.7	p	p
Dryopteris spinulosa	0.0	0.0	0.0	0.6	1.9	0.1	p
Actea rubra	0.0	0.0	0.0	0.1	0.3	0.5	0.5
Aster macrophylla	0.0	0.0	0.0	0.1	0.7	0.7	0.9
Linnaea borealis	0.0	0.0	0.0	0.1	0.5	0.5	0.7
Mitella nuda	0.0	0.0	0.0	0.1	0.2	0.0	0.3
Pyrola secunda	0.0	0.0	0.0	0.1	0.1	0.0	0.0

Table 4
(Continued)
Number of Years Since Burn

Species	2 (1977)	3 (1978)	4 (1979)	5 (1980)	7 (1982)	15 (1990)	22 (1997)
	(Year)						
Circaea alpina	0.0	0.0	0.0	0.1	p	0.0	0.0
Lycopodium lucidulum	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Fragaria vesca	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Viola renifolia	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Aster simplex	0.0	0.0	0.0	0.0	p	0.0	0.0
Hieracium aurantiacum	0.0	0.0	0.0	0.0	p	0.2	0.1
Rubus pubescens	0.0	0.0	0.0	0.0	p	0.3	P
Pyrola asarifolia	0.0	0.0	0.0	0.0	0.0	0.2	P
Solidago nemoralis	0.0	0.0	0.0	0.0	0.0	0.2	0.3
Melampyran lineare	0.0	0.0	0.0	0.0	0.0	0.2	P
Prenanthes alba	0.0	0.0	0.0	0.0	0.0	p	0.0
Cornus canadensis	0.0	0.0	0.0	0.0	0.0	p	0.2
Diervilla Lonicera	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Petasites palmatus	0.0	0.0	0.0	0.0	0.0	p	0.0
Aquilegia canadensis	0.0	0.0	0.0	0.0	0.0	0.0	P
Agrostis hyemales	0.0	0.0	0.0	0.0	0.0	0.0	P
Arctostaphylos uva-ursi	0.0	0.0	0.0	0.0	0.0	0.0	P
Carex arctata	0.0	0.0	0.0	0.0	0.0	0.0	P
Deschampsia flexuosa	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Chimaphila umbellata	0.0	0.0	0.0	0.0	0.0	0.0	P
Hieracium pilloselloides	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Campanula rotundifolia	0.0	0.0	0.0	0.0	0.0	0.0	P
Lycopodium obscurum	0.0	0.0	0.0	0.0	0.0	0.0	P
Poa compressa	0.0	0.0	0.0	0.0	0.0	0.0	P
Ranunculus acris	0.0	0.0	0.0	0.0	0.0	0.0	P
TOTAL % COVER	60.1	50.4	61.8	77.7	78.3	43.3	37.3
SPECIES NUMBER	12	18	21	30	39	32	42