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PROGRESS REPORT

on the research project entitled

LONG TERM POST-FIRE
VEGETATION MONITORING
OF THE RECENT
STANLEY RIDGE BURN
IN ISLE ROYALE NATIONAL PARK

by

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INTRODUCTION

This report describes the progress made on a research project dealing with the monitoring of vegetation within a recently burned area in Isle Royale National Park. The primary objective is to determine what vegetation invades the area following a fire and how this vegetation changes with time after the fire.

The fire was lightning-caused and occurred during the summer of 1988 on Stanley Ridge on the northeast end of Isle Royale. Before it was extinguished by natural causes, the area burned spread over approximately 75 acres. It was the largest fire on Isle Royale since 1948. Part of this was on the ridge top which had been occupied by a forest of jack pine (*Pinus banksiana*). The remainder was on the rocky open south slope of the ridge.

The initial vegetation sampling of this burn occurred during the summer of 1991. The area was again sampled during the summers of 1992 and 1993. This report will discuss the results of the 1993 sampling and will compare these with the results of sampling in 1991 and 1992.

Sampling during the summer of 1993 was performed by myself with the assistance of three National Park Service employees Pat Valencia, Cory Counard, and Erica VanWie. Funding (\$1400) was provided by the National Park Service.

METHODS

Following the ridge top, 10 plot reference points separated by random distances had been established with the assistance of National Park Service personnel during the summer of 1990 in the jack pine forested portion of the burn. These had been marked by permanent metal reference stakes. During the summer of 1991 we established 10 more plot reference points within the open rocky meadow on the south-east facing slope of the ridge. Each of these points were established at a random distance down-slope of the ridge (in a direction of 160 °) from one of the original 10 reference points and marked with a permanent metal stake. Thus 10 vegetation plots were established in each of 2 distinctly different ecosystems.

Stems of tree and tall shrub species equal to or greater than 1 meter in height (saplings) were counted in circular plots of 6 meters radius centered about each reference point. All stems were checked for moose browsing. Low ground cover plants and seedlings (stems less than 1 meter in height) of tree and tall shrub species were sampled in 2x2 meter square plots oriented so that one side of the square aligned with the line connecting one of the upper plot reference points with the corresponding lower one and so that the reference point was at the center of this side. For ground cover plants, % cover was estimated for each species. For seedlings, both % cover estimates and stem counts were made. Also browsing was noted. To facilitate this sampling, a 1x1 meter wooden quadrat frame was used and laid down on the ground 4 times to cover the 2x2 meter quadrat.

RESULTS

No woody plants in the tree stage of development (d.b.h. > 5 cm.) were found in the sampling areas. This is not surprising since our sampling in 1991 indicated that no trees survived the fire and the five years since the fire is hardly sufficient time for seedlings to become trees. None exceeded 3.8 meters in height. Our 1991 sampling of dead trees indicated that, before the fire, the ridge top was a forest dominated by jack pine (*Pinus banksiana*). The south slope of the ridge however, was relatively open with widely scattered trees.

The density of woody plants in the sapling stage has increased considerably since the summer of 1992 (Table 1). Jack pine, in particular, has shown a dramatic increase in density in the ridge top ecosystem. Its density was zero in both 1991 and 1992 but in 1993 it exceeded that of all other species. Quaking aspen (*Populus tremuloides*), on the other hand, has shown a steady density increase since the original sampling in 1991. This can be explained by the more rapid growth rate of aspen compared to jack pine allowing seedlings to convert to saplings much sooner.

Woody plants in the seedling stage have also increased considerably each year between 1991 and 1993 (Table 2). Total seedling density is still considerably greater on the ridge top than on the south slope ecosystem. On the ridge top the seedling layer is dominated by quaking aspen, jack pine, white birch (*Betula papyrifera*) and sugar plum (*Amelanchier spp*). The density of the aspen seedlings greatly exceeds that of the pine or birch, yet the forest preceding the burn was dominated by jack pine. This might suggest that the jack pine forest will be replaced by an aspen forest as a result of the burn. However, the nature of the future forest also depends on how well these seedlings survive to become trees. Our previous studies have indicated that of these 3 species, jack pine fares best on dry rocky habitats. Aspen, however, fares better on more moist and less rocky soil. The ridge top in this burn may be considered a dry rocky habitat. It is therefore possible that jack pine will eventually prevail here. This is supported by the fact that between 1992 and 1993, aspen seedlings have declined, while jack pine seedlings have increased in density. Also, as stated above, jack pine saplings now exceed those of aspen.

On the open south, most of the seedlings are tall shrub species. Of these, sugar plum seedlings constitute more than 2/3 of the total. Among seedlings of tree species, only jack pine is present. Its density is very low. This aligns with the fact that very few trees were present on this rocky open slope prior to the fire.

In one of our previous studies in which we sampled seedlings and saplings in 100 year old jack pine stands (mostly on rocky ridge tops), the densities of both seedlings and saplings of jack pine were zero. After the fire on Stanley Ridge, however, seedling and sapling densities were relatively high. This may be related to the nature of jack pine cones which normally are reluctant to open unless exposed to high temperatures as during a fire. Just after a fire, then, jack pine seeds are profuse but not long after the fire they are no longer available.

The percentages of woody stems browsed by moose were calculated only for saplings since a large share of seedlings are covered by snow in the winter. Calculations were made only for those species for which a sufficient number of stems were sampled to yield accurate values of browse percentages (Table 3). It is apparent that jack pine is not palatable to moose. On the other hand aspen and sugar plum appear to be highly palatable.

Of the total of 1035 sapling stems per hectare of all species combined in the forested ridge top for the year 1993, 592 stems per hectare may be considered palatable to moose (Table 1). One of our previous studies dealing with 100 year-old jack pine stands indicated a density of palatable sampling stems of only 289 stems/hectare. This difference may become even greater in the near future since most of the palatable species (aspen, birch, sugar plum, and willow) in the burn have been increasing markedly in the past 2 years. One of the important effects of this fire, then, has been to increase the food supply for moose beginning approximately 5 years after the fire occurrence.

For the ridge top, most species of ground cover plants experienced an increase in percent cover between 1991 and 1992 (Table 4). However, between 1992 and 1993 a significant number of these species have declined in percent cover. This is probably due to competition from other more aggressive plants. As a result of this the total percent cover of all vascular ground cover plants has increased very little compared to the previous year. In the future we expect a drastic decline in percent ground cover since our past studies of 100 year old jack pine stands (Janke, 1983) show that ground cover averages 22.1% compared to the 46.5% value from this burned area. The total number of species has shown no increase (Table 6).

The blueberry plant (*Vaccinium angustifolium*) has declined considerably between 1992 and 1993. However, it is still, by far, the most dominant ground cover species. It remains the most dominant plant in 100 year old jack pine stands (Janke, 1983) even though its percent cover averages only 4.7%.

For the open south slope, most species of ground cover have increased in percent cover and the total cover of all species combined has increased from 11% in 1991 to 23.1% in 1993 (Table 5). The total number of species has increased from 37 in 1991 to 46 in 1993 (Table 6). The most dominant species here are *Amelanchier* spp., *Convolvulus spithameus*, *Fragaria virginiana*, and *Agropyron trachycaulum*.

RECOMMENDATIONS

Since one of the primary objectives of this project is to determine how vegetation changes following a burn, we recommend that similar sampling procedures be repeated in future years. Since the vegetation is still changing quite rapidly, we proposed that these plots be sampled again during the summer of 1994. We also recommend that sampling be done in similar habitats on Stanley Ridge in areas that were not burned so that we can compare the vegetation of the burn with what was present before the burn. This needs to be done only once so that permanent plots need not be established.

The recommended schedule for sampling the burn after 1994 will depend upon how rapidly the various parameters change between 1993 and 1994.

BIBLIOGRAPHY

Janke, R.A. 1983. The flora and vegetation ecology of Isle Royale National Park. A final report for a research project submitted to the U.S. National Park Service. pp. 24-35.

TABLE 1. Sapling densities (stems/hectare) of tree and tall shrub species for 1991, 1992, and 1993.

FORESTED RIDGE TOP

<u>species</u>	<u>density</u>		
	<u>1991</u>	<u>1992</u>	<u>1993</u>
quaking aspen	8.8	141.5	353.6
white birch	0.0	61.9	141.5
sugar plum (serviceberry)	0.0	26.5	61.8
pin cherry	0.0	17.7	0.0
jack pine	0.0	0.0	433.8
willow	0.0	0.0	35.4
mountain alder	<u>0.0</u>	<u>0.0</u>	<u>8.8</u>
total all species	8.8	247.6	1034.9

OPEN SOUTH SLOPE

<u>species</u>	<u>density</u>		
	<u>1991</u>	<u>1992</u>	<u>1993</u>
sugar plum (serviceberry)	0.0	35.4	168.0
jack pine	0.0	26.5	114.9
willow	8.8	8.8	53.1
quaking aspen	17.7	0.0	123.8
choke-cherry	<u>0.0</u>	<u>0.0</u>	<u>8.8</u>
total all species	26.5	70.7	468.6

TABLE 2. Seedling densities (stems/hectare) of tree and tall shrub species for 1991, 1992, and 1993.

FORESTED RIDGE TOP

<u>species</u>	<u>density</u>		
	<u>1991</u>	<u>1992</u>	<u>1993</u>
quaking aspen	26,500	51,750	47,250
jack pine	23,000	25,000	30,250
white birch	9,750	20,750	24,000
sugar plum (serviceberry)	18,250	18,250	27,000
white spruce	500	1,000	750
pin cherry	750	750	1,750
staghorn sumac	250	500	750
red elderberry	250	250	0
choke-cherry	500	0	0
balsam fir	<u>0</u>	<u>0</u>	<u>500</u>
total all species	79,750	118,250	132,250

OPEN SOUTH SLOPE

<u>species</u>	<u>density</u>		
	<u>1991</u>	<u>1992</u>	<u>1993</u>
sugar plum (serviceberry)	22,000	27,250	32,750
choke-cherry	1,750	9,750	12,500
staghorn sumac	500	1,500	2,250
jack pine	1,000	0	250
pin cherry	<u>1,000</u>	<u>0</u>	<u>0</u>
total all species	26,250	38,500	47,750

TABLE 3. Percent of stems browsed for saplings of tree and tall shrub species. The symbol * indicates that insufficient stems were sampled to yield an accurate % browsed.

FORESTED RIDGE TOP		
<u>species</u>	<u>% browsed</u>	
	<u>1992</u>	<u>1993</u>
jack pine	*	0
quaking aspen	56	65
white birch	*	63
all species combined	45	38

OPEN SOUTH SLOPE		
<u>species</u>	<u>% browsed</u>	
	<u>1992</u>	<u>1993</u>
sugar plum (serviceberry)	*	95
quaking aspen	*	100
jack pine	*	0
all species combined	33	74

TABLE 4. Percent cover of vascular ground cover species for forested ridge top. "P" indicates cover less than 0.1%.

Species	<u>1991</u>	<u>1992</u>	<u>1993</u>
<i>Vaccinium angustifolium</i>	14.3	14.5	10.9
<i>Epilobium angustifolium</i>	1.7	3.6	3.4
<i>Betula papyrifera</i>	1.6	2.7	3.4
<i>Amelanchier</i> spp.	2.1	2.5	3.4
<i>Populus tremuloides</i>	1.9	2.5	2.7
<i>Deschampsia flexuosa</i>	0.1	2.0	2.3
<i>Maianthemum canadense</i>	0.5	1.9	1.8
<i>Pinus banksiana</i>	1.0	1.8	2.8
<i>Potentilla tridentata</i>	1.3	1.3	3.1
<i>Potentilla arguta</i>	P	1.0	0.2
<i>Carex aenea</i>	2.9	1.0	0.5
<i>Hieracium florentinum</i>	0.1	1.0	0.8
<i>Diervilla lonicera</i>	1.0	0.9	1.4
<i>Rubus strigosus</i>	0.5	0.9	1.9
<i>Vaccinium myrtilloides</i>	0.6	0.8	1.0
<i>Solidago nemoralis</i>	P	0.8	0.8
<i>Arctostaphylos uva-ursi</i>	0.4	0.7	0.9
<i>Lonicera dioica</i>	0.4	0.5	0.6
<i>Danthonia spicata</i>	0	0.5	0.4
<i>Linnaea borealis</i>	0.2	0.4	0.5
<i>Carex houghtoniana</i>	0.2	0.4	0.2
<i>Symphoricarpos alba</i>	0.1	0.2	0.1
<i>Argrostis hyemalis</i>	0.3	0.2	0.9
<i>Calamagrostis canadensis</i>	0.3	0.2	0.4
<i>Aster macrophyllus</i>	0	0.2	0.4
<i>Oryzopsis pungens</i>	P	0.1	0.2
<i>Fragaria virginiana</i>	0.1	0.1	0.2
<i>Arabis divaricarpa</i>	P	0.1	0.2
<i>Prunus pensylvanica</i>	P	0.1	0.3
<i>Anaphalis margaritacea</i>	P	0.1	0.1
<i>Erigeron canadensis</i>	0	0.1	P
<i>Poa glauca</i>	0	P	0.1
<i>Geranium bicknellii</i>	P	P	P
<i>Corydalis sempervirens</i>	0.1	P	0
<i>Polygonum douglasii</i>	P	P	P
<i>Convolvulus spithameus</i>	P	P	P
<i>Picea glauca</i>	0	P	P
<i>Rubus parviflorus</i>	P	P	P
<i>Campanula rotundifolia</i>	P	P	P
<i>Sambucus pubens</i>	0.1	P	P
<i>Agropyron trachycaulon</i>	0.3	P	0
<i>Prunus virginiana</i>	P	P	0
<i>Polygonum cilinode</i>	P	P	0
<i>Antennaria plataginifolia</i>	0	P	P
<i>Silene antirrhina</i>	P	P	0
<i>Dracocephalum parviflorum</i>	0	P	0
<i>Viburnum edula</i>	0	P	0
<i>Taraxacum officinale</i>	0	P	P
<i>Rhus typhina</i>	0.1	P	P

continued

TABLE 4. continued

Species	<u>1991</u>	<u>1992</u>	<u>1993</u>
<i>Viola conspersa</i>	P	P	P
<i>Ribes glandulosum</i>	P	0	P
<i>Oryzopsis asperifolia</i>	0	0	0.1
<i>Melampyron lineare</i>	0	0	P
<i>Abies balsamea</i>	0	0	P
<i>Actea rubra</i>	0	0	P
<i>Aralia hispida</i>	0	0	P
<i>Shepherdia canadensis</i>	0	0	P
total of all species	33.0	44.1	46.5

TABLE 5. Percent cover of vascular ground cover species for open south slope.
"P" indicates cover less than 0.1%.

Species	1991	1992	1993
<i>Amelanchier</i> spp.	1.9	2.5	2.1
<i>Polygonum douglassii</i>	0.3	1.2	0.4
<i>Convolvulus spithameus</i>	1.6	1.2	1.9
<i>Geranium bicknellii</i>	0.1	1.0	1.4
<i>Saxifraga virginiana</i>	0.2	0.9	0.4
<i>Solidago nemoralis</i>	0.4	0.8	0.9
<i>Danthonia spicata</i>	1.3	0.8	0.8
<i>Argrostis hyemalis</i>	0.4	0.8	1.4
<i>Symphoricarpos albus</i>	0.3	0.8	0.8
<i>Potentilla arguta</i>	0.5	0.7	0.9
<i>Prunus virginiana</i>	0.3	0.6	0.7
<i>Fragaria virginiana</i>	0.5	0.5	1.6
<i>Argopyron trachycaulum</i>	0.3	0.5	1.6
<i>Deschampsia flexuosa</i>	0.1	0.4	0.8
<i>Hieracium florentinum</i>	0.1	0.4	0.6
<i>Antennaria plantaginifolia</i>	0.1	0.4	0.1
<i>Diervilla lonicera</i>	0.5	0.4	0.4
<i>Arabis divaricarpa</i>	0.2	0.3	0.7
<i>Vaccinium angustifolium</i>	0.3	0.3	0.2
<i>Carex houghtoniana</i>	0	0.3	0.4
<i>Woodsia ilvensis</i>	0.2	0.2	0.2
<i>Satureja vulgaris</i>	P	0.2	0.5
<i>Artemisia canadensis</i>	0.1	0.2	0.6
<i>Rhus typhina</i>	0.2	0.2	0.4
<i>Sorbus decora</i>	0.2	0.1	0.6
<i>Aquilegia canadensis</i>	0	0.1	0.2
<i>Arctostaphylos uva-ursi</i>	0.1	0.1	0.2
<i>Rubus strigosus</i>	0.1	0.1	0.2
<i>Viola conspersa</i>	P	0.1	0.1
<i>Prunus pensylvanica</i>	0.1	0.1	P
<i>Mianthemum canadense</i>	P	P	0
<i>Pinus banksiana</i>	P	P	0.1
<i>Carex aenea</i>	P	P	0
<i>Lilium philadelphicum</i>	0	P	P
<i>Dracocephalum parviflorum</i>	P	P	P
<i>Campanula rotundifolia</i>	P	P	0.1
<i>Oryzopsis pungens</i>	P	P	0.1
<i>Corydalis sempervirens</i>	0.1	P	0
<i>Polygonum cilinode</i>	P	P	0
<i>Erigeron canadensis</i>	0	P	0.4
<i>Taraxacum officinalis</i>	0	P	0.1
<i>Carex umbellata</i>	0	0	0.5
<i>Ranunculus rhomoibeus</i>	0	0	0.3
<i>Poa compressa</i>	P	0	0.2
<i>Poa glauca</i>	0	0	P
<i>Epilobium angustifolium</i>	0	0	P
<i>Silene antirrhina</i>	0	0	P
<i>Melampyrum lineare</i>	0	0	P
<i>Collinsia parviflora</i>	0	0	P
<i>Lonicera canadensis</i>	0	0	P
total of all species	11.0	16.8	23.1

TABLE 6. Number of vascular ground cover plant species.

	<u>1991</u>	<u>1992</u>	<u>1993</u>
Forested ridge top	42	50	50
Open south slope	37	41	46