

PROGRESS REPORT

on the Research Project Entitled

POST-FIRE VEGETATION
MONITORING OF TWO
RECENT BURNS ON
ISLE ROYALE
NATIONAL PARK
(final edition)

by
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INTRODUCTION

This report deals with the most recent monitoring (Summer, 1990) of the vegetation on two small recently burned areas on Isle Royale National Park. One of these burns occurred in 1976 at Card Point, a small peninsula on the southwest end of Isle Royale in Lake Superior. The other occurred in 1974 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 covered by the Card Point Burn was 10 acres; that near McGinty's Cove, 2 acres. Both were natural lightning-caused fires which the National Park Service allowed to continue burning to a natural extinction.

During the summer of 1977, we established permanent vegetation plots at both burn sites 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 was monitored in the summers of 1977, 1978, 1979, 1980, and 1982 for the Card Point and the McGinty's Cove burns.

The most recent vegetation monitoring effort was carried out by myself with the assistance of 2 undergraduate college students, James Albee and David Anderson. Funding (\$2000) was provided by the Conservation and Research Foundation, Inc. Most of the transportation and housing was provided by the National Park Service. The effort involved in processing the data and preparing this report was my own contribution to the project.

METHODS

The methods used in sampling the vegetation were similar to those used in previous monitoring of those burns. The plots had in previous years been laid out along a series of parallel straight lines and their locations can be determined by metal stakes inserted into the ground. 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 presence or absence of browsing (by moose or hares) was noted. Stems 5 cm d.b.h. or greater (trees) 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 at McGinty's Cove and for the burned soil plots at Card Point. However, since the vegetation in the unburned soil plots at Card Point 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 for Card Point (table 1 for burned soil, table 2 for unburned soil) and McGinty's Cove (table 3). For both burns white birch (Betula papyrifera) and quaking aspen (Populus tremuloides) have 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).

At McGinty's Cove, balsam fir (Abies balsamea) and white spruce (Picea glauca) also invaded the burn soon after the fire (table 3). However their seedling densities are considerably less than that of the birch or aspen. This is probably due to the larger, less mobile seeds of these species. For Card Point these species invaded in considerably smaller numbers. This may be due to the fact that the Card Point burn is surrounded mostly either by the shore of Lake Superior or by swamp and therefore the only nearby seed sources were the few trees within the burn that survived the fire. In the case of McGinty's Cove, on the other hand, the burn was completely surrounded by a mature forest containing seed-bearing spruce and fir. For both species, but especially for fir, the proximity of the seed source is a very important factor in seedling establishment (Janke, 1978).

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 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). Balsam fir, however, has

greater seedling densities on the unburned soil. This species is not known to show a preference for low litter depths and so may be responding to the lesser competition with birch and aspen seedlings on unburned soil.

From the data from the 3 meter circular plots, sapling densities were calculated for each species for each year of sampling for both burns (tables 4 and 5). The results indicate a general increase in sapling densities with time for all species combined except for more recent years at McGinty's Cove. Identical types of calculations were made for the 6 meter radius plots (tables 6 and 7) dealing with the tree stratum. The results indicate that overall tree density (stems 5 cm d.b.h. or greater) is still very sparse in both burns but considerably more so at Card Point. Species richness is also very low in both burns. White spruce is the dominant tree species. During the first few years after each 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 tree stratum densities.

The relatively low densities of some major tree species in the tree stratum may be due to browsing by moose. Among these species, mountain ash (Sorbus decora) and quaking aspen are the most favored browse for moose. Both species had zero density in 1990 for both burns. For aspen the density was zero throughout the study. In contrast, white spruce, which has the lowest palatability to moose, ranks highest in density for the two burns combined, even though it is slower growing than mountain ash and aspen. This all suggests that moose have played a very important role in changing the species composition in the tree stratum by preventing some species from growing into the tree stratum. To support this theory, the browse data from the sapling stratum shows that in 1982 the percent of stems browsed was 66% and 64% at Card Point and McGinty's Cove, respectively; and in 1990, the corresponding percentages were 97% and 93%.

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 8, 9, and 10). 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 species

richness, though greater at first, is ultimately less than that on burned soil.

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 woody shrubs such as Rubus parviflorus, Rubus idaeus, and Sambucus pubens. Also abundant were the grass Calamagrostis canadensis and Cornus canadensis, an abundant plant in Isle Royale's mature forests. Most of these plants were probably present before the fire.

At present the most abundant ground cover plants on burned soil are Rubus parviflorus, Cornus canadensis, and Linnaea borealis (also a plant of mature forests). On unburned soils, the dominant plants, presently, are Diervilla lonicera, Cornus canadensis, Rubus parviflorus, and Calamagrostis canadensis.

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 15 years of change, we find that the vegetation in the Card Point and McGinty's Cove burns is still changing relatively rapidly. I recommend, therefore, a continuation of the monitoring of these burns 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 these recent burns will yield much-needed information on earlier post-fire successional stages.

It would also be desirable to have more than 2 recent burns to study in order to increase the statistical validity of the results. I therefore recommend that, when more fires occur in the future, more permanent study plots be set up within them.

REFERENCES CITED

- 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.

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.

Table 1
CARD POINT
(burned soil)
seedling densities (stems/hectare)

Species	Number of Years Since Burn (Year)					
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)
White birch	36,500	72,700	239,000	262,570	220,700	33,700
Quaking aspen	0	35,300	33,000	37,570	37,860	10,760
White spruce	0	0	166	429	1,570	2,650
Balsam fir	0	0	0	0	0	1,250
Mountain ash	0	0	1,000	1,860	2,570	5,460
Big tooth aspen	0	0	0	2,710	1,860	780
Pin cherry	0	166	0	0	1,000	156
Northern white cedar	0	0	0	0	0	312
Willow	0	0	0	0	0	4,370
Mountain alder	0	0	0	0	7,710	2,964
Tag alder	0	0	0	0	0	0
Ninebark	0	0	0	0	0	624
Mountain maple	0	0	0	0	0	0
Red elderberry	0	0	0	0	0	0
TOTAL	36,500	108,166	273,166	305,139	273,770	62,885

Table 2
CARD POINT
(unburned soil)
seedling densities (stems/hectare)

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

Table 3
McGINTY'S COVE
seedling densities (stems/hectare)

Species	Number of Years Since Burn (Year)					
	3 (1977)	4 (1978)	5 (1979)	6 (1980)	8 (1982)	16 (1990)
White birch	33,500	58,750	80,095	56,900	45,160	20,180
Quaking aspen	9,000	9,821	6,792	7,790	6,967	4,820
White spruce	1,000	2,143	1,410	1,765	1,471	1,960
Balsam fir	2,500	5,357	5,129	4,120	6,178	7,680
Mountain ash	0	893	882	882	1,471	540
Northern white cedar	0	893	602	1,765	6,914	7,320
Balsam poplar	0	0	0	0	1,471	0
Mountain maple	500	1,429	1,283	1,180	2,207	357
Willow	0	0	0	0	2,501	1,430
TOTAL	46,500	79,286	96,193	74,402	74,340	44,287

Table 4
CARD POINT
sapling densities (stems/hectare)

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

Table 5
McGINTY'S COVE
sapling densities (stems/hectare)

Species	Number of Years Since Burn (Year)					
	3 (1977)	4 (1978)	5 (1979)	6 (1980)	8 (1982)	16 (1990)
White birch	0	44	155	236	2,812	2,347
Quaking aspen	0	6	217	324	1,435	454
White spruce	0	13	35	34	47	732
Balsam fir	0	0	0	0	52	480
Mountain ash	0	63	190	261	822	631
Northern white cedar	0	0	4	10	0	581
Balsam poplar	0	0	0	0	5	0
Mountain maple	0	0	0	88	276	202
Willow	0	0	0	25	557	429
Red elderberry	0	0	0	0	1,814	0
TOTAL	0	126	601	978	7,820	5,856

Table 6
CARD POINT
tree densities (stems/hectare)

Species	Number of Years Since Burn (Year)					
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)
White birch	52	0	3	0	0	3
Quaking aspen	0	0	0	0	0	0
White spruce	39	0	6	9	10	13
Balsam fir	13	0	3	0	0	0
Mountain ash	16	8	3	3	10	0
Red elderberry	0	0	0	0	3	0
Tag alder	0	0	0	0	0	13
TOTAL	120	8	15	12	23	29

Table 7
McGINTY'S COVE
tree densities (stems/hectare)

Species	Number of Years Since Burn (Year)					
	3 (1977)	4 (1978)	5 (1979)	6 (1980)	8 (1982)	16 (1990)
White birch	0	6	5	5	16	32
Quaking aspen	0	0	0	0	0	0
White spruce	18	13	9	15	31	44
Balsam fir	0	0	0	0	0	0
Mountain ash	0	0	0	0	0	0
Northern white cedar	71	38	40	49	26	38
TOTAL	89	57	54	69	73	114

Table 8
CARD POINT
(burned soil)
% cover of low ground cover plants*

Species	Number of Years Since Burn (Year)					
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)
Epilobium angustifolium	1.2	4.7	12.3	10.1	4.8	1.1
Impatiens biflora	0.0	2.5	6.8	2.8	1.2	p
Rubus parviflorus	0.3	2.6	4.8	4.6	3.7	8.2
Epilobium glandulosum	0.2	3.5	4.3	1.6	p	0.0
Poa palustris	0.1	0.2	3.3	7.8	5.3	0.1
Rubus idaeus	0.0	0.8	2.4	4.6	2.6	1.1
Calamagrostis canadensis	0.2	0.8	2.3	4.5	2.1	0.5
Cornus canadensis	0.1	1.0	1.5	2.4	3.2	3.9
Anaphalis margaritacea	0.0	0.0	1.4	1.8	2.2	0.9
Diervilla lonicera	0.2	1.0	1.2	1.4	0.7	1.1
Achillea millifolium	0.2	1.1	0.1	1.7	0.7	0.4
Stellaria calycantha	0.1	0.8	0.8	0.5	p	0.0
Glyceria striata	0.0	0.6	0.6	0.7	0.0	0.0
Milium effusum	0.0	0.2	0.6	1.1	0.4	0.0
Rosa acicularis	0.0	0.2	0.5	1.3	0.5	0.2
Sambucus pubens	0.0	1.0	0.5	0.1	p	0.0
Carex aenea	0.0	0.3	0.5	0.1	p	p
Taraxacum officinale	0.0	0.2	0.4	1.6	2.0	1.3
Salix spp.	0.0	0.0	0.4	0.6	2.4	0.5
Agropyron trachycaulum	0.0	0.0	0.3	0.1	p	0.0
Carex brunnescens	0.0	0.1	0.3	1.0	p	p
Solidago altissima	0.0	0.0	0.2	0.8	0.1	0.0
Veronica americana	0.0	0.0	0.2	0.0	p	0.0
Ranunculus abortivus	0.0	0.1	0.2	0.2	0.1	0.0
Polygonum cilinode	0.0	0.0	0.2	0.1	0.1	0.0
Cirsium vulgare	0.0	0.0	0.2	0.1	0.1	0.0
Galium triflorum	0.0	0.2	0.2	0.2	0.4	0.3
Lactuca biennis	0.0	0.1	0.2	0.4	0.3	p
Aralis nudicaulis	0.0	0.1	0.1	0.2	0.1	p
Galeopsis tetrahit	0.1	0.9	0.0	0.1	p	0.0
Lonicera canadensis	0.0	0.0	0.0	0.1	p	0.2
Maianthemum canadensis	0.0	0.0	0.0	0.1	0.1	0.3
Clintonia borealis	0.0	0.0	0.0	0.2	0.1	0.2
Carex deweyana	0.0	0.0	0.0	0.2	0.1	0.0
Physocarpus opulifolius	0.0	0.0	0.0	0.1	0.2	p
Aster macrophyllus	0.0	0.0	0.0	0.2	0.7	0.4
Linnaea borealis	0.0	0.0	0.0	0.2	0.7	2.6
Melampyrum lineare	0.0	0.0	0.0	0.2	2.2	0.3
Ranunculus acris	0.0	0.0	0.0	0.1	0.1	0.5
Carex houghtoniana	0.0	0.0	0.0	1.0	0.1	0.0
Equisetum arvense	0.0	0.0	0.0	0.0	0.9	0.5
Lathyrus japonicus	0.0	0.0	0.0	0.0	0.5	0.8
Rubus pubescens	0.0	0.0	0.0	0.0	0.1	0.3
Solidago canadensis	0.0	0.0	0.0	0.0	0.0	0.7
Lycopodium annotinum	0.0	0.0	0.0	0.0	0.0	0.3
Streptopus roseus	0.0	0.0	0.0	0.0	0.0	0.2
TOTAL	2.7	23.0	46.8	54.9	39.3	27.0

* The letter p signified % cover less than 0.1%

Table 9
CARD POINT
(unburned soil)
% cover of low ground cover plants

Species	Number of Years Since Burn (Year)					
	1 (1977)	2 (1978)	3 (1979)	4 (1980)	6 (1982)	14 (1990)
Rubus parviflorus	37.8	36.0	27.9	27.3	18.4	9.4
Rubus idaeus	13.3	19.3	27.4	30.5	16.7	.6
Cornus canadensis	8.7	4.1	21.9	23.8	22.8	14.6
Calamagrostis canadensis	14.3	12.9	13.5	13.9	13.6	7.8
Sambucus pubens	4.0	14.3	11.4	9.6	6.0	.1
Clintonia borealis	0.1	0.0	10.7	7.6	2.8	1.5
Milium effusum	1.1	0.6	5.4	16.8	5.8	0.0
Galium triflorum	0.1	1.1	8.2	5.1	1.7	p
Heracleum maximum	0.0	0.0	6.4	7.0	0.0	0.8
Diervilla lonicera	0.0	0.0	5.5	8.0	6.6	19.3
Aralia nudicaulis	1.1	0.9	5.2	2.3	0.6	0.4
Linnaea borealis	0.0	0.0	4.0	3.7	3.7	0.2
Equisetum arvense	0.0	0.0	2.7	0.5	0.2	p
Lycopodium annotinum	0.0	0.0	2.3	1.0	1.8	p
Oxalis montana	0.0	0.0	2.2	1.8	2.3	0.0
Epilobium angustifolium	0.1	2.6	2.2	3.1	1.9	0.6
Stellaria calycantha	0.0	0.0	2.0	0.2	0.1	0.0
Maianthemum canadensis	0.6	0.9	1.5	2.0	0.9	2.4
Poa palustris	1.6	2.9	1.4	5.1	3.8	0.2
Ranunculus abortivus	0.0	0.1	1.4	2.4	0.9	0.0
Osmorhiza claytoni	0.6	0.3	1.1	1.4	0.1	p
Dryopteris spinulosa	0.0	0.0	1.1	0.5	0.6	0.0
Rubus pubescens	0.0	0.0	1.1	0.8	0.0	p
Lactuca biennis	0.0	0.0	0.9	0.6	1.0	0.4
Streptopus roseus	0.0	0.0	0.7	0.7	0.0	0.3
Lycopodium obscurum	0.0	0.0	0.6	0.3	0.1	0.1
Impatiens biflora	1.4	0.5	0.3	0.3	0.1	0.0
Geocaulon livida	0.0	0.0	0.3	0.2	0.1	0.0
Viola renifolia	0.0	0.0	0.3	0.2	0.1	0.0
Carex aenea	0.6	0.7	0.1	0.2	0.0	0.0
Taraxacum officinale	0.4	0.1	0.0	0.3	1.7	2.1
Polygonum cilinode	0.7	0.3	0.0	0.1	0.1	0.0
Galeopsis tetrahit	5.0	1.0	0.0	0.2	p	0.0
Carex arctata	0.0	0.0	0.0	5.9	3.6	p
Epilobium glandulosum	0.0	0.0	0.0	0.2	p	0.0
Anaphalis margaritacea	0.0	0.0	0.0	0.3	0.2	2.6
Solidago canadensis	0.0	0.0	0.0	0.0	0.0	1.0
TOTAL	91.5	98.6	169.7	183.9	118.5	67.9

Table 10
McGINTY'S COVE
% cover of low ground cover plants

Species	Number of Years Since Burn (Year)					
	3 (1977)	4 (1978)	5 (1979)	6 (1980)	8 (1982)	16 (1990)
Rubus ideaeus	23.0	21.3	23.4	28.1	26.4	1.1
Aralia nudicaulis	8.4	12.3	15.9	16.2	14.6	7.3
Sambucus pubens	14.8	7.2	5.6	3.9	1.8	0.2
Milium effusum	10.1	4.8	1.7	2.4	0.6	p
Epilobium angustifolium	1.7	3.9	4.8	4.6	1.5	0.2
Rubus parviflorus	1.0	2.5	6.2	5.7	7.7	23.4
Galium triflorum	4.6	1.0	1.5	3.0	1.2	0.6
Epilobium adenocaulon	7.9	0.9	0.4	0.3	0.8	0.0
Clintonia borealis	0.3	0.8	0.0	1.6	2.9	2.1
Taraxicum officinalis	0.2	0.6	0.4	1.2	1.4	0.7
Impatiens biflora	0.2	0.4	1.1	1.0	0.1	p
Lactuca biennis	0.3	0.4	1.6	1.0	0.4	0.0
Trientalis borealis	0.0	0.4	1.1	0.3	2.8	0.4
Calamagrostis canadensis	0.0	0.3	0.0	0.0	1.2	p
Maianthemum canadensis	0.0	0.2	0.6	0.8	0.9	1.8
Osmorhiza clatoni	0.0	0.2	0.3	1.0	0.6	0.1
Poa palustris	2.4	0.2	0.0	2.0	3.5	p
Salix spp.	0.4	0.4	0.5	0.4	0.7	0.4
Ranunculus abortivus	0.0	0.1	0.6	1.2	0.1	0.0
Anaphalis margaritaceae	0.0	0.1	0.3	0.0	2.1	1.6
Carex houghtoniana	0.0	0.0	0.7	2.1	0.1	0.0
Lonicera canadensis	0.0	0.0	0.6	0.1	0.2	0.1
Taxus canadensis	0.0	0.0	0.3	0.6	0.1	0.0
Viola spp.	0.0	0.0	0.1	0.4	0.3	0.0
Streptopus roseus	0.0	0.0	0.0	0.3	0.2	0.3
Dryopteris disjuncta	0.0	0.0	0.0	1.1	3.7	p
Dryopteris spinulosa	0.0	0.0	0.0	0.6	1.9	0.1
Actea rubra	0.0	0.0	0.0	0.1	0.3	0.5
Aster macrophylla	0.0	0.0	0.0	0.1	0.7	0.7
Linnaea borealis	0.0	0.0	0.0	0.1	0.5	0.5
Mitella nuda	0.0	0.0	0.0	0.1	0.2	0.0
Lycopodium lucidulum	0.0	0.0	0.0	0.0	0.5	0.0
Rubus pubescens	0.0	0.0	0.0	0.0	0.0	0.3
TOTAL	75.3	58.0	67.7	80.3	80.0	42.6