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Lichen Studies on Allison Savanna

CLIFFORD WETMORE*

ABSTRACT — Soil and tree lichens were studied on the Helen Allison Savanna in Anoka County, Minnesota. Sample plots established in parts of the savanna have had fires at various time frequencies, and one section has had no recent fires. Fire has not eliminated any lichen species on the trees but has reduced their frequency in the lower trunk plots. Most soil species of lichens are eliminated by even infrequent fires. Fifty two species were found on trees and 13 species on the soil.

The Helen Allison Savanna Natural Area (owned by The Nature Conservancy) is located south of the Cedar Creek Natural History Area, east of Bethel in Anoka County, Minnesota. The land is gently rolling. Some low areas have wet marshes, and some of the dry knolls have sand blowouts. Scattered oaks and brush dominate most of the higher ground. The Allison Savanna, a rectangular plot 550 meters in the east-west direction and 410 meters in the north-south direction, has been divided into five north-south strips for experimental burning. Strips are called burn units in this report.

The easternmost burn unit (burn unit 1) has been burned almost every year since 1962 (when burning began) and extends from the east fence to about 95 meters westward. The second burn unit is from 95 to 126 meters and has been burned about three out of four years. Burn unit three is from 126 to 160 meters and has been burned two out of every four years. Burn unit four extends from 160 to 180 meters and has been burned one year out of four. Burn unit five includes all of the area west of 180 meters to the eastern edge of the open field and probably has not been burned for at least 50 years.

This lichen survey is being done prior to scheduled initiation of burning in burn unit five to study the effects of burning on the lichens.

Methods of sampling for lichens

During the summer of 1980 work was begun by studying the lichens present in the whole savanna except for the eastern open field. One hundred sample points were located at random in the forested area. At each sample point 25 cm x 25 cm soil plots were established. The nearest tree within 15 meters and over 10cm DBH was sampled. In the trees, plots were located at the base, at 0.75m, and at 1.5m up on the trunk. In each tree plot a line was traced around the sampled tree and the coverage of each lichen species along the line was recorded as well as the compass directions of each segment of the line. Lichens on branches within two meters of the ground were recorded in abundance classes. A general survey also was made to detect other species of lichen not found in the plots.

The lichens in the soil plots were tabulated by percent cover and burn unit. The lichens in the tree trunk plots

Table 1. Average number of lichen species in each burn unit in the top, mid and base plots.

	Top	Mid	Base	Total Species
Burn unit 1	4.4	2.5	1.1	15
Burn unit 2	3.0	0.7	0.2	10
Burn unit 3	4.1	3.3	1.0	13
Burn unit 4	4.3	3.7	2.3	10
Burn unit 5	3.1	3.3	2.8	18

were analyzed by computer according to burn unit, tree species, compass direction and band (top, mid, or base plot).

Table 2 lists all tree lichens by burn unit with the number of occurrences in the trunk plots and on the branches or outside of the plots. The columns labeled "T" indicate the number of trunk plots with that Lichen species. The columns labeled "B" indicate the number of trees with that lichen present either on branches or outside of the trunk plots. Total trees and total species in each burn unit are at the bottom.

Table 3 lists the lichens found in the soil plots by burn units and the number of plots in which each species present within each burn unit.

The lichen names used here follow Hale and Culberson (1975) and the identifications generally follow Hale (1979) for macrolichens and Harris (1977) for crustose lichens.

Analysis of lichen distributions

Fifty two species were found on the trees and 13 on the soil. When lichens in the tree plots were analyzed for trends with regard to compass direction, *Phaeophyscia orbicularis* was found more often on the southwest side of the tree, *Physconia detersa* was found most often on the northwest, *Parmelia bolliana* and *Parmelia flaventior* occurred most often on the northeast side. Those that showed significant absence on certain compass directions are: *Arthonia caesia* (SW), *Parmelia bolliana* (SW), *Physciopsis adglutinata* (NE), *Physcia stellaris* (NE), *Physcia americana* (SW).

There was no significant correlation between lichen species and tree diameter. Some species were found significantly more often on certain species of trees: *Arthonia caesia* and *Physcia stellaris* on *Quercus ellipsoidalis* E.J. Hill, *Physcia aipolia* on *Fraxinus pennsylvanica* March.

When comparing the tree plots on trunks in different burn units there is a strong reduction in the number of

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TABLE 2. Allison Savanna lichens - Trees

Species	BU 1		BU 2		BU 3		BU 4		BU 5	
	T	B	T	B	T	B	T	B	T	B
<i>Arthonia caesia</i>	1	2	1	1					12	17
<i>Arthopyrenia finkii</i>									1	1
<i>Arthopyrenia submuriformis</i>									1	2
<i>Bacidia bacillifera</i>		1								
<i>Bacidia chlorococca</i>									4	
<i>Bacidia populorum</i>									X	
<i>Buellia polyspora</i>			2							
<i>Buellia punctata</i>									3	
<i>Caloplaca cerina</i>									5	
<i>Caloplaca chrysophthalma</i>	1				3				12	
<i>Caloplaca flavorubescens</i>			1						12	
<i>Caloplaca holocarpa</i>									3	
<i>Caloplaca microphyllina</i>			1							
<i>Caloplaca pollinii</i>									2	
<i>Candelaria concolor</i>	24	9	4	4	5	4	3	2	47	33
<i>Candelariella vitellina</i>									1	1
<i>Candelariella xanthostigma</i>	6	15	3	5	1	3	1	2	19	18
<i>Cladonia coniocraea</i>		1							3	
<i>Cyphellium tigillare</i>					(X)					
<i>Lecanora impudens</i>									4	
<i>Lecanora piniperda</i>	1								2	
<i>Lecanora strobilina</i>									2	
<i>Lecanora symmictera</i>	1								4	
<i>Leptorhaphis epidermidis</i>									1	
<i>Opegrapha pulicaris</i>									1	
<i>Parmelia bohliana</i>	2	9		3	2	4	3	2	32	22
<i>Parmelia caperata</i>	1	2		2				1	10	7
<i>Parmelia flaventior</i>	7	13	1	5	5	5	2	3	38	38
<i>Parmelia rufecta</i>		4		1				1	12	7
<i>Parmelia soledica</i>		4	1		1	1	2	2	6	21
<i>Parmelia subaurifera</i>									1	
<i>Parmelia sulcata</i>									4	
<i>Phaeophyscia cernohorskyi</i>	3				1	1	3		1	
<i>Phaeophyscia chloantha</i>									2	
<i>Phaeophyscia ciliata</i>									2	
<i>Phaeophyscia orbicularis</i>	7		1	2	3	1			16	2
<i>Phaeophyscia pusilloides</i>		1							1	
<i>Phaeophyscia rubropulchra</i>	3	2							16	6
<i>Physcia adscendens</i>									2	
<i>Physcia alpina</i>		2			2			1	19	18
<i>Physcia americana</i>					1				6	4
<i>Physcia millegrana</i>	37	12	13	4	18	4	7	2	139	36
<i>Physcia stellaris</i>	1	7	1	3		1		1	12	25
<i>Physciopsis syncolla</i>									3	
<i>Physconia detera</i>	1	3					1		8	2
<i>Rinodina dakotensis</i>		1		1						
<i>Rinodina exigua</i>									1	
<i>Rinodina millieria</i>									1	
<i>Rinodina papillata</i>	26	6	9	2	13	2	6	2	82	12
<i>Xanthoria fallax</i>	3	3		1	1	2	3		21	14
<i>Xanthoria polycarpa</i>									3	
Total lichen species	15	22	10	17	13	15	10	11	18	47
Total trees	16		6		6		3		56	

X = not on sample tree;

(X) = outside study area; 3 = no. plots recorded;

T = trunk plots; B = branches and outside of trunk plots

trees with lichens at the base and a reduction in numbers of species in the base and middle plots in the burned areas, but the total numbers of lichen species on tree trunks remains about the same in all burn units (Table 1).

It is obvious that even infrequent burning (as in BU 4) greatly reduces lichens at the base and frequent burning (BU 1 and BU 2) also reduces the lichens up to the mid plot at 0.75m from the ground. There also seems to be a significant reduction in the number of species on the lower branches in burned areas, as shown in Table 2.

Most of the soil plots did not have lichens, but burning significantly reduces the number of species found and the numbers of plots with lichens. In the unburned area (BU 5) the lichens probably cannot compete with the vascular plants. Any fire destroys most species, and the lichens do not have enough time to recover before the subsequent fire.

TABLE 3. Allison Savanna lichens - Soil

Species	BU 1	BU 2	BU 3	BU 4	BU 5
	<i>Cladonia cariosa</i>				
<i>Cladonia chlorophaea</i>					8
<i>Cladonia crispata</i>					X
<i>Cladonia cristatella</i>					27
<i>Cladonia merochlorophaea</i>					X
<i>Cladonia polycarpoides</i>					1
<i>Cladonia pyxidata</i>					4
<i>Cladonia rei</i>					28
<i>Cladonia verticillata</i>					4
<i>Cladonia (sterile squamules)</i>	6	1	6	2	32
<i>Lecidea oligotropa</i>					1
<i>Lecidea uliginosa</i>			1		4
<i>Peltigera canina var. rufescens</i>					(X)
<i>Peltigera canina var. spuria</i>					4
Total plots with lichens	6	1	7	2	42
Total species	1	1	2	1	11
Total plots	34	16	16	6	126

X = not in plot; (X) = outside study area; 4 = number of times recorded

The number of lichen species on tree trunks above about 1 meter is not significantly reduced by burning, regardless of frequency. The numbers of lichen species on tree trunks below 1 meter and on tree branches below 2 meters is significantly reduced by burning, even infrequent burning. Any fires decrease the frequency of lichens at the bases, but infrequent fires have less effect in the 0.75m plots. Most soil lichens are largely eliminated by any fires and only sterile *Cladonia* squamules are present in burned areas.

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