Distribution and occurrence of lichen species across Virginia

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~ Introduction ~

Temporal and spatial dynamics in lichen populations may correlate with climate and air quality and serve as early warning indicators of potential forest health degradation. The USDA Forest Service, Forest Inventory and Analysis (FIA) Program is monitoring for changes in lichen populations across the United States. This survey is the first to systematically survey lichen species at select sample locations across large regions, providing valuable information on species distributions and occurrences.

~ Methods ~

Lichens were collected by FIA on 53 forest health plots across Virginia in 1994, 1995, 1998 and 1999.

Within each FIA plot field crew members search for macrolichens on woody plants within a maximum time limit of 2 hours (fig. 1). Each lichen believed to be a distinct species is collected and sent to a specialist for identification. While lichens on fallen branches and other litter may be included, tree and shrub bases below 0.5m are excluded from sampling. Field crew members need not accurately assign species names to the lichens, but must be able to distinguish morphological differences among species (USDA 2004).

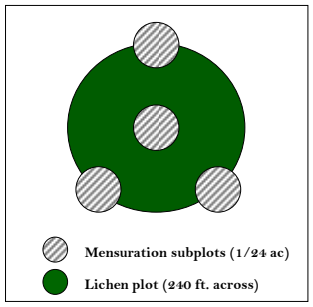

Figure 1. FIA plot layout.

~ Results ~

Between 1994 and 1999, 115 unique lichen species were recorded on 53 plots across Virginia.

Table 1. Lichen species encountered on plots across VA.

Species	N_{plots}	Species	N_{plots}
Anaptychia palmulata	5	*Parmelinopsis minarum*	19
Anzia colpodes	1	*Parmeliopsis ambigua*	1
Bulbothrix confoederata ‡	1	*Parmotrema arnoldii* ‡	2
Candelaria concolor	14	*Parmotrema austrosinense* ‡	1
Candelaria fibrosa	1	*Parmotrema chinense* ‡	9
Canoparmelia caroliniana	9	*Parmotrema crinitum*	5
Canoparmelia crozalsiana	3	*Parmotrema dilatatum* ‡	3
Cetraria americana	3	*Parmotrema eurysacum* ‡	9
Cetraria ciliaris	10	*Parmotrema gardneri*	8
Cetraria fendleri	3	*Parmotrema hypoleucinum* ‡	1
Cetraria oakesiana	9	*Parmotrema hypotropum* §	42
Cetraria orbata	1	*Parmotrema margaritatum*	11
Cetrelia cetrarioides	1	*Parmotrema michauxianum*	10
Cetrelia chicitae	1	*Parmotrema perforatum*	4
Cetrelia olivetorum	2	*Parmotrema rigidum* ‡	3
Cladonia bacillaris	4	*Parmotrema subtinctorium*	2
Cladonia chlorophaea	5	*Parmotrema tinctorum*	2
Cladonia coniocraea	7	*Parmotrema ultralucens*	1
Cladonia cristatella	3	*Parmotrema xanthinum*	3
Cladonia cylindrica	2	*Phaeophyscia adiastola*	5
Cladonia furcata	1	*Phaeophyscia ciliata*	2
Cladonia macilenta	1	*Phaeophyscia insignis*	1
Cladonia ochrochlora	1	*Phaeophyscia pusilloides*	17
Cladonia parasitica	3	*Phaeophyscia rubropulchra*	30
Cladonia pyxidata	4	*Physcia aipolia*	14
Cladonia ramulosa	4	*Physcia americana*	17
Cladonia rei	2	*Physcia millegrana*	30
Cladonia squamosa	2	*Physcia neogaea* ‡	8
Everniastrum catawbiense	1	*Physcia stellaris*	14
Flavoparmelia baltimorensis	1	*Physciella chloantha*	2
Flavoparmelia caperata §	52	*Physconia detersa*	3
Flavopunctelia flaventior	1	*Platismatia tuckermanii*	4
Flavopunctelia soredica	1	*Pseudevernia consocians*	8
Heterodermia granulifera	4	*Punctelia bolliana* ‡	2
Heterodermia hypoleuca	2	*Punctelia borreri* ‡	1
Heterodermia obscurata	25	*Punctelia perreticulata*	1
Heterodermia speciosa	7	*Punctelia punctilla* ‡	7
Heterodermia squamulosa	1	*Punctelia reddenda* ‡	2
Hyperphyscia adglutinata	1	*Punctelia rudecta* §	51
Hyperphyscia syncolla	1	*Punctelia semansiana*	4
Hypogymnia physodes	4	*Punctelia subrudecta* ‡	14
Hypotrachyna imbricatula	1	*Pyxine caesiopruinosa*	6
Hypotrachyna livida	17	*Pyxine sorediata*	21
Hypotrachyna osseoalba	2	*Pyxine subcinerea*	3
Hypotrachyna revoluta	1	*Ramalina americana*	10
Imshaugia aleurites	6	*Rimelia cetrata*	6
Imshaugia placorodia	3	*Rimelia diffractaica*	1
Leptogium cyanescens	3	*Rimelia reticulata*	24
Lobaria pulmonaria	3	*Rimelia subisidiosa*	2
Lobaria quercizans	1	*Usnea ceratina*	4
Melanelia subaurifera	1	*Usnea hirta* ‡	2
Myelochroa aurulenta	26	*Usnea miriabilis*	4
Myelochroa galbina	9	*Usnea mutabilis*	10
Normandina pulchella	2	*Usnea rubicunda*	7
Parmelia squarrosa	9	*Usnea strigosa*	27
Parmelia sulcata	8	*Usnea subfloridana*	1
Parmeliella triptophylla	1	*Xanthoria candelaria* ‡	1
Parmelinopsis horrescens	5		

§ Indicates most commonly found species
‡ Indicates species that are potential new records for Virginia, or possible range extensions within the State.

Parmotrema chinense – a species with a possible range extension

The most common species sampled were *Flavoparmelia caperata* (L.) Hale, *Parmotrema hypotropum* (Nyl.) Hale, and *Punctelia rudecta* (Ach.) Krog. Of the 115 species tallied, 27% were found on only one plot (table 1).

Flavoparmelia caperata – the most commonly collected species

Species richness averaged 15.4 plot^{-1} (min=3, max=35). Over one-half of plots had between 11 and 20 lichen species (fig. 2).

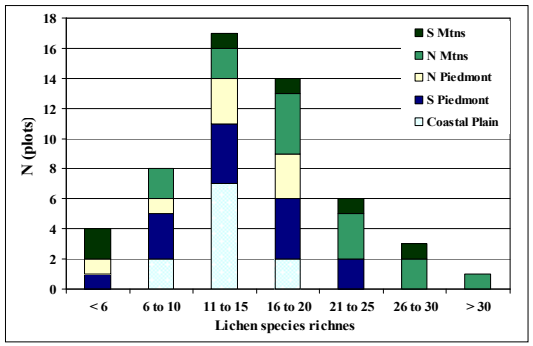

Figure 2. Lichen species richness by physiographic province, VA.

Several potential new records for Virginia were encountered, including *Bulbothrix confoederata* (Culb.) Hale and *Usnea hirta* (L.) Wigg (table 1). Within the genus *Parmotrema* there were 5 potential new records for Virginia (fig. 3). For several species, range extensions may be warranted. For instance, *Parmotrema arnoldii* (DR.) Hale, previously known only from the mountains in Virginia (Brodo et al. 2001), was recorded on the Coastal Plain and the Piedmont.

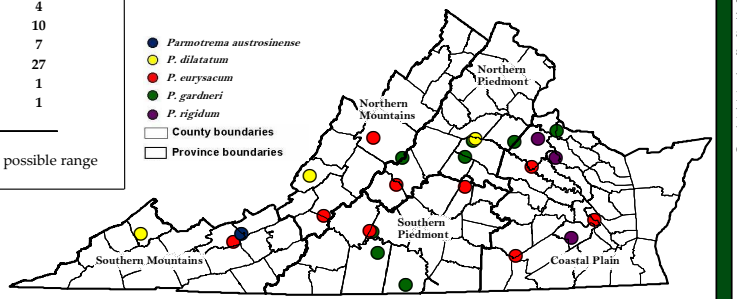

Figure 3. County-level occurrences of *Parmotrema spp.* previously unknown from VA.

~ Conclusions ~

Factors known to affect lichens include climate and air quality. In each major physiographic province, between 25% and 67% of plots contained species that are considered sensitive to pollution (SO_2 in particular).

Additional factors that can influence lichen occurrence are: tree species, stand age, site history, % of plot forested (35% of plots were <100% forested) and the amount of dead wood present (Humphrey et al. 2002; Schmull et al. 2002). Lichens were not collected on the subplots, or by condition (USDA 2004), thereby precluding rigorous analyses of these issues.

Lichens can be useful in detecting changes in ecosystem health, whether due to changes in air quality or climate. Lichens are also components of biodiversity, and as such can reflect changes in forest biodiversity and may be an early indicator of more serious developing conditions. In order to detect changes in lichen communities, however, information on their occurrence and distribution, from studies such as this, are necessary. Additionally, a better understanding of the correlations between changes in lichen communities, species trends, and changes in forest function are needed.

~ Literature Cited ~

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~ ACKNOWLEDGEMENTS ~

The author gratefully acknowledges the cooperation and assistance provided by the VA Dept of Forestry, other agencies, and the individuals who collected this data.

Lichen photos courtesy: http://www.lichen.com

~ CITATION ~

Rose, Anita K. 2006. *Distribution and occurrence of lichen species across Virginia.* [Poster & Published Abstract]. IN: Proceedings of the American Botanical Society annual meeting (Botany 2006) Chico, CA Aug, 2006. ONLINE AT: http://www.2006.botanyconference.org/