CONNECTICUT BOTANICAL SOCIETY
newsletter

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Lichens and Air Pollution in Central Connecticut

BY STEVEN MESSIER

FOR THE PAST TWO YEARS I have been studying the lichen community of Winding Trails Recreation Area (WT), in Farmington, Connecticut. Reports from the early 1900s tell of rich lichen populations throughout the state, but large numbers of tree- and ground-dwelling lichen species have largely disappeared from our landscape over the past century. Many of the species that were listed as common in the early 1900s I have been unable to locate at WT. It is no secret that our environment has been dramatically altered during that time, including habitat loss, increased automobile use, and widespread industrial and agricultural pollution. But since the 1970s, several environmental bills have been passed, including the Clean Water and Clean Air Acts. Has the lichen community shown any response to these attempts over the last fifty years to clean up our environment? My survey of the lichen growth at Winding Trails attempts to shed some light on this question.

Lichens are divided into three main classes based on their growth form. Lichens that hug their substrate so tightly that you can't slip a knife under them are called *crustose*. The main body of these lichens (the *thallus*) often grows into the substrate. These lichens, frequently observed covering rocks, are very common in the most severe climates and are the most drought-tolerant. *Foliose*, or "leafy" lichens lie on the surface of their substrate, often growing a thallus several inches in diameter. Holding on with tiny root-like appendages called *rhizines*, foliose lichens are easily removed with a blade. Most of the conspicuous tree trunk (*corticolous*) lichens fall into this category. Lastly, *fruticose* lichens grow upright or hang from their substrate to several inches, frequently with cups or elaborate branching patterns. They are most common in very moist forests, like those in the Pacific Northwest or coastal Maine. Foliose and fruticose lichens are often lumped together and referred to as *macrolichens*, due to their relatively large thallus size and ease of identification without a microscope.

TOP: A crustose lichen on rock. BOTTOM: A foliose lichen on red maple. Photos: S. Messier

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Connecticut Botanical Society

Connecticut Botanical Society *Newsletter*
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We thank Janet Novak, Eleanor Saulys, Arieh Tal, and others for the excellent photos on the web site. CBS members are encouraged to submit web materials to: chris.wyse@cox.net

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Farewell to Nelson DeBarros

AT THE END OF JULY, we were sad to learn that Nelson DeBarros, Botanist/Plant Ecologist with the Natural Diversity Data Base of the Connecticut Department of Energy and Environmental Protection, was leaving Connecticut. Nelson served on the CBS Board for over four years. During that time, among other contributions, he led field trips, wrote for the *Newsletter,* developed materials for CBS information tables and coordinated volunteers. Before leaving for new opportunities in Washington, D.C., Nelson was kind enough to grant CBS Vice President Lauren Brown a brief interview. Excerpts follow:

Sand barren habitat was created at this site to mitigate for a loss of similar habitat across the street. State-listed plant species were successfully transplanted to this site along with other uncommon sandplain taxa such as *Ceanothus americanus* and *Tephrosia virginiana*. Photos: N. DeBarros

CBS: Tell us about your background before you came here.

ND: I received a B.S. in biology from Providence College and in 2010 a master's in ecology from Penn State, where I did my thesis on native bee selection of native plants. Then came an internship at New England Wildflower Society where I tended the rare plant garden. That's where I started learning sedges. I started at DEEP in January 2011, one week after Governor Malloy took office. In August, I received a pink slip, but my position was restored in September through union negotiations.

CBS: Did you know the whole Connecticut flora before you started?

ND: Heavens no, and I'm still learning.

CBS: What was your main responsibility on this job?

ND: My primary duty was to review projects authorized, funded, or performed by a State agency for potential impacts to plant species listed as endangered, threatened, or special concern under the Connecticut Endangered Species Act.

CBS: Were there situations where you were able to protect a listed species?

ND: Yes. One was a road realignment in Avon that was planned to go through a population of Davis' sedge (*Carex davisii*). In the end, the route wasn't changed but the plants will be transplanted to a preserved area nearby prior to the initiation of construction. Another situation involved planned improvements at Silver Sands State Park — enlarged parking lot, bathrooms, etc. — that would have affected a population of field beadgrass (*Paspalum laeve)*. Though the project hasn't been implemented, the parking lot was redesigned to protect the plant. Those particular projects were proposed by State agencies, but my group would also review private developments that required State authorizations. One was a housing project on a sandplain, which would have obliterated a population of low frostweed (*Crocanthemum propinquum)* and few-flowered nutsedge (*Scleria pauciflora* var. *caroliniana)*. For mitigation, a 20-acre site across the street was restored to sandplain vegetation. Though

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Lichens and Air Pollution

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A fruticose lichen on pine. Photo: S. Messier

Lichens as Pollution Indicators

A lichen receives all its nutrition from the atmosphere by absorption of gases, deposition, or water contact with its thallus. Its large surface area to biomass ratio facilitates the uptake of beneficial nutrients. However, because it lacks a cuticle to shield its thallus, the lichen may also pick up other chemical substances such as heavy metals, oxidants like nitrates and ozone, or radioactive elements. Since it grows very slowly and does not shed any parts, it slowly accumulates these noxious compounds. The tendency for the thallus to dehydrate considerably during dry periods concentrates some chemicals even further, potentially to toxic levels. The consequences of absorbing toxins have been recognized since 1790, when Erasmus Darwin noted the absence of lichens near the metal smelters in North Wales. In 1866, the Finnish botanist William Nylander considered lichens a very sensitive instrument for measuring the wholesomeness of the air.[1]

Lichens are valuable air quality monitors for a number of reasons. They are easy to locate and identify and are available for monitoring year-round. Lichens are especially vulnerable to airborne pollutants because they are active throughout the year and they grow on surfaces readily exposed to

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CORTICOLOUS MACROLICHENS of WINDING TRAILS (2017)

	NATIONAL PARKS[1]	NAT'L. CAPITAL REGION[2]	NORTHEAST[3]
ABUNDANT (> 500 OBSERVATIONS)			
Flavoparmelia caperata	I	N	NS
Punctelia rudecta	I	NT	NS
Parmelia squarrosa	S	S	S
VERY COMMON (100 TO 500 OBSERVATIONS)			
Phaeophyscia. rubropulchra			NT
Parmelia sulcata	I-T	NT	NT
Hypogymnia physodes	I		NS
Cladonia coniocraea	I		
Imshaugia aleurites			S
Punctelia caseana	I	NT	
Physcia millegrana		NT	NT
COMMON (20 TO 100 OBSERVATIONS)			
Usnocetraria oakesiana		S	
Myelochroa aurulenta			
Parmotrema hypotropum			S
Candelaria concolor	S-I	N	NT
UNCOMMON (5 TO 20 OBSERVATIONS)			
Physcia stellaris	I		N
Phaeophyscia pusilloides			NT
Hypotrachyna livida		S	
Evernia mesomorpha	I		S
Usnea hirta	S	S	S
Heterodermia speciosa			
Myelochroa galbina			S
RARE (FEWER THAN 5 OBSERVATIONS)			
Heterodermia neglecta			
Melanelixia subaurifera		S	
Bryoria furcellata	S		S
Platismatia tuckermanii			S
Physcia aipolia	I		N
Tuckermanopsis ciliaris	S-I	S	S
Physconia detersa	I-T		S
Leptogium cyanescens		S	S
Collema subflaccidum		S	

Macrolichens of Farmington's Winding Trails Recreation Area and associated air quality ratings from three U. S. pollution studies. Key: S (sensitive), I (intermediate), T (tolerant), N (nitrophile).

1 Wetmore 1983. (endnote 4).
2 Lawrey 2011. (endnote 5).
3 Will-Wolf et al. 2015. (endnote 8).

Lichens and Air Pollution

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airflow. They respond relatively quickly to deteriorating air quality and can also re-colonize within a couple of years after conditions improve.[2] They are long lived, so their thalli can be used to evaluate environmental change over many decades, and many lichen species grow over wide geographical ranges, facilitating pollution dispersal studies.

Winding Trails Lichens and Air Pollution

In order to identify the community of corticolous macrolichens in the Winding Trail woods, I examined 2466 trees in eleven plots spread over a variety of woodland types. Species presence and percent cover on each tree from knee to head level was recorded. From 4227 observations I identified a total of thirty different macrolichen species from the eleven plots. From these results I grouped the species in abundance categories and, for each species, listed the pollution sensitivity ratings from three published sources (see table).

Numerous studies over the past one hundred years have used lichens as air quality bio-indicators. In 1970, a ten-point scale was developed for estimating sulfur dioxide (SO_2) pollution using selected lichen species in England and Wales.[3] Pilot programs in the U. S. began in National Parks and Forests in the early 1980s, and now there are thousands of lichen study plots nationwide.

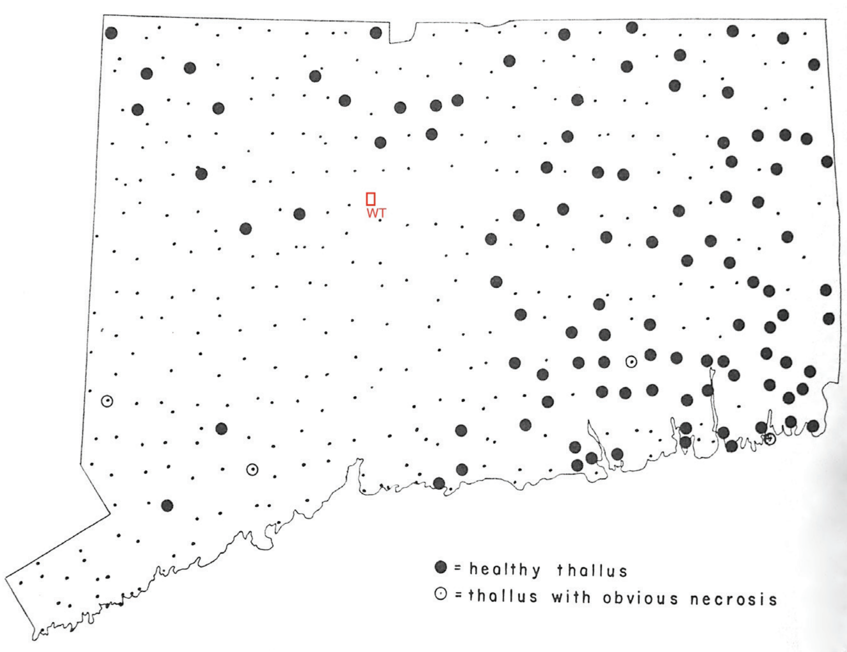
Especially sensitive or tolerant lichen species make the best indicator species for rating air quality. While authors disagree on sensitivity scales for many lichens, there is agreement for several species on a number of lists. Three studies were particularly useful in relating the WT species to air pollution levels. The first was a 1983 study that used corticolous lichens to assess atmospheric SO_2 levels in 43 National Parks nationwide. Lichen species were rated as (S) sensitive, (I) intermediate, or (T) tolerant, depending on their ability to survive in progressively greater concentrations of SO_2.[4]

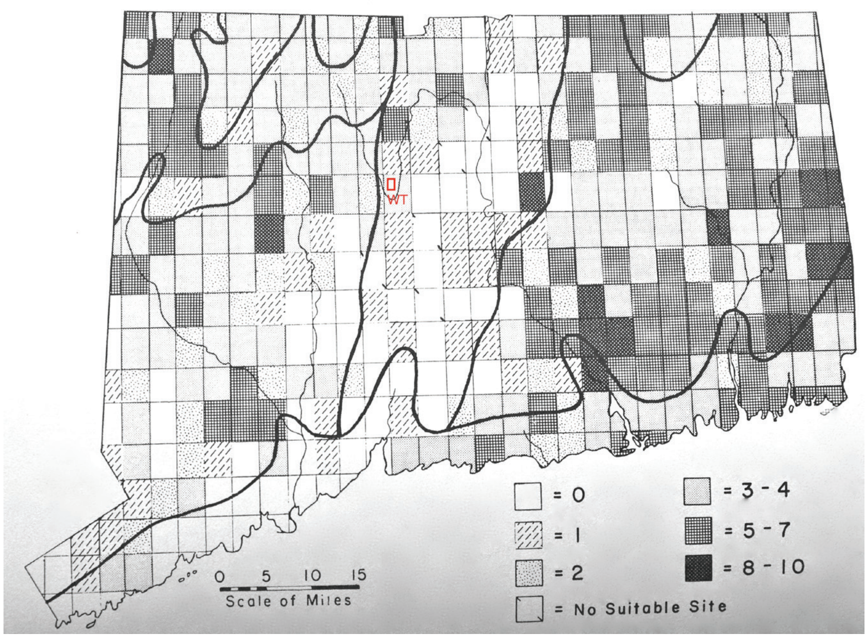
The second study, from the National Capital Region (NCR), uses a rating system devised by the USDA Forest Service that rates macrolichens as pollution sensitive if they generally respond negatively to a wide range of pollutants.[5] Six of the species considered pollution sensitive occur in the forests of Winding Trails: *Usnea hirta, Usnocetraria oakesiana, Hypotrachyna livida, Leptogium cyanescens, Tuckermanopsis ciliaris, and Parmelia squarrosa*. The first five species occur occasionally, and *Parmelia squarrosa* is abundant in the Winding Trails woods, suggesting that acidic air pollution levels must be quite low in the Farmington area.

The NCR list also includes lichens designated as nitrophiles: species that thrive in nutrient-enriched areas caused by nitrogen emitted from power plants, automobiles, industry, or agricultural fertilizers. While the emission of SO_2 in eastern North America has decreased substantially over the last few decades, the deposition of nitrogen has hardly changed.[6] Nitrogen deposition has been recognized as a threat to biodiversity worldwide.[7] Some of the most common Winding Trails lichens fall into the nitrophile category, namely, *Flavoparmelia caperata, Punctelia rudecta, Punctelia caseana, Parmelia sulcata,* and *Physcia millegrana*. The NCR study also considers the last four species to be pollution tolerant. Of course, the presence of these lichens does not mean that the air quality is poor. If it were, the six sensitive species listed above would have been absent. But the nitrophiles' presence suggests elevated atmospheric nitrogen levels, possibly from traffic on the busy Route 4 just outside the park, agricultural fields in the vicinity, or some more distant sources.

The third study, a 2015 study in the northeastern U. S.,[8] includes several more WT species on its list, including seven lichens rated pollution-sensitive, so that, of the thirty macrolichens

TOP: *Flavoparmelia caperata,* a nitrophile.
BOTTOM: *Parmelia squarrosa,* a pollution-sensitive species. Photos: S. Messier





TOP: Distribution of *Parmelia squarrosa* in 1980.

BOTTOM: Number of macrolichen species in 1980. (Heavy curved lines indicate boundaries of Connecticut ecoregions.)

found in my Winding Trails study, about half can be considered sensitive to acidic pollution. Lichen species rated as either S or I from the three published studies account for 61% of all observations at WT. Even without the variably rated *Flavoparmelia caperata*, 35% of the observations are species considered pollution-sensitive. The northeastern study also includes a few additional lichens that are both pollution-tolerant and nitrophilic, including *Candelaria concolor, Phaeophyscia pusilloides* and *P. rubropulchra,* bringing the WT nitrophile total to eleven. The last species is especially common at Winding Trails, again pointing to enhanced forest nitrogen levels.

Metzler's 1980 Connecticut Lichen Study — 37 years later

In 1980, Ken Metzler published *Lichens and Air Pollution: A Study in Connecticut.*[9] He looked at macrolichen species on the trunks of five red and black oak trees at each of 411 stations evenly distributed across the state, four sites for each U. S. Geological Survey quadrangle. Metzler found that, in general, lichen species on these trees decreased in a southwesterly direction across the state. The fewest numbers of species were found along coastal southwestern Connecticut and in the central lowlands. In fact, he called large parts of these areas "lichen deserts"– areas with no foliose lichens and fewer than three crustose species (see map). And, with one exception, he found fruticose lichens present only in the eastern part of the state.

Winding Trails borders the west edge of Metzler's central lowlands "lichen desert." At the closest station to Winding Trails he found only 3 to 4 foliose lichens on the oak tree trunks, with an average lichen cover of 1 percent. In contrast, stations in the eastern portions of Connecticut had 5 to 10 species each, with a cover of 20 to 50 percent. The only macrolichens he recorded for the Farmington area were *Parmelia sulcata, Punctelia rudecta, and Flavoparmelia caperata*. At present, these relatively pollution-tolerant, nitrophilic lichens are common to abundant in the Winding Trails woods.

Two lichens noticeably missing in Farmington at the time of Metzler's study were *Parmelia squarrosa* and *Phaeophyscia rubropulchra*. *Parmelia squarrosa* has already been noted as a clean air indicator. In 1980, it was found in only about a quarter of Metzler's stations, and was almost exclusively restricted to the northern and eastern portions of the state (see map); it is now abundant in the WT forest. *Phaeophyscia rubropulchra* is also very common today and presently occurs on about a third of the red oaks in Winding Trails. Considered as pollution tolerant in the 2015 study of the Northeast, its absence in 1980 seems strange. But it has clearly spread significantly over the last 37

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Lichens and Air Pollution

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years. A similar pattern of regrowth for this lichen was noted in the upper Ohio River Valley[10]. There, following the shutdown of a nearby power plant, *P. rubropulchra* showed a 5-fold increase over the 23-year period from 1973 to 1996.[10]

Another species noted in the Ohio River study that Metzler considers pollution sensitive, is *Myelochroa aurulenta*. In the Ohio River Valley it increased 13-fold over 23 years, while in our area it was missing in 1980 and is now present on about 1 in 9 red oak trees. As an interesting note, *Phaeophyscia rubropulchra* and *Myelochroa aurulenta* showed almost identical distributions across Connecticut in 1980. Both were missing from the entire central valley and mostly confined to the northwest and southeast parts of the state, located in only about 40 stations. The return of these two lichens along with *Parmelia squarrosa* to the Winding Trails forests indicates a significant air quality improvement in Metzler's central lowlands "lichen desert," thanks to stricter air-pollution legislation.

Care must be taken not to overstate the progress made since Metzler's study. Fruticose lichens growing on trees, as a whole, are considered to be the most pollution-sensitive group because of their 3-dimensional structure. Metzler found no fruticose species in the central valley on red or black oaks, but did mention that other trees may host some of these species. In my study, out of 38 observations of corticolous fruticose lichens, only one occurs on a red oak. Thus, there may have been more present on other trees at the time of Metzler's study as well. But 38 out of 4227 lichen observations is still very few. In addition, most of the fruticose lichen individuals I saw had small thalli, less than an inch long. So, while not entirely absent from the Winding Trails forests, it appears that this very sensitive group of lichens has yet to make a significant recovery there.

The macrolichen cover on Winding Trail's red oaks does not come close to the 20 to 50 percent that Metzler found in the eastern part of the state. It now stands at 3 to 4 percent, which is slightly better than the 1 percent recorded in the area 37 years ago. Clearly, lichen populations here have a long way to go to approach the large coverage Metzler observed in the eastern part of the state.

Metzler's study provides an invaluable portrait of the lichen populations in Connecticut's forests in 1980. A comparison of my 2017 data to his results suggests many lichen species have made a good recovery from the

Myelochroa aurulenta **Photo: S. Messier**

effects of the sulfur dioxide pollution of the middle of the last century, while others are slowly regrouping. However, judging from earlier reports and herbarium records, it is very clear that large numbers of lichens that were common in Connecticut in the early 1900s are still missing. Despite environmental protection efforts, lichen communities in our woods may never return to their preindustrial status. Recent studies indicate that re-establishing lichen communities differ from those destroyed earlier by pollution.[11] Global air quality changes promoting environmental eutrophication point toward the emergence of new lichen assemblages in the future,[12] and the abundance of nitrophiles observed at Winding Trails seems to support this prediction.

Phaeophyscia rubropulchra **Photo: S. Messier**

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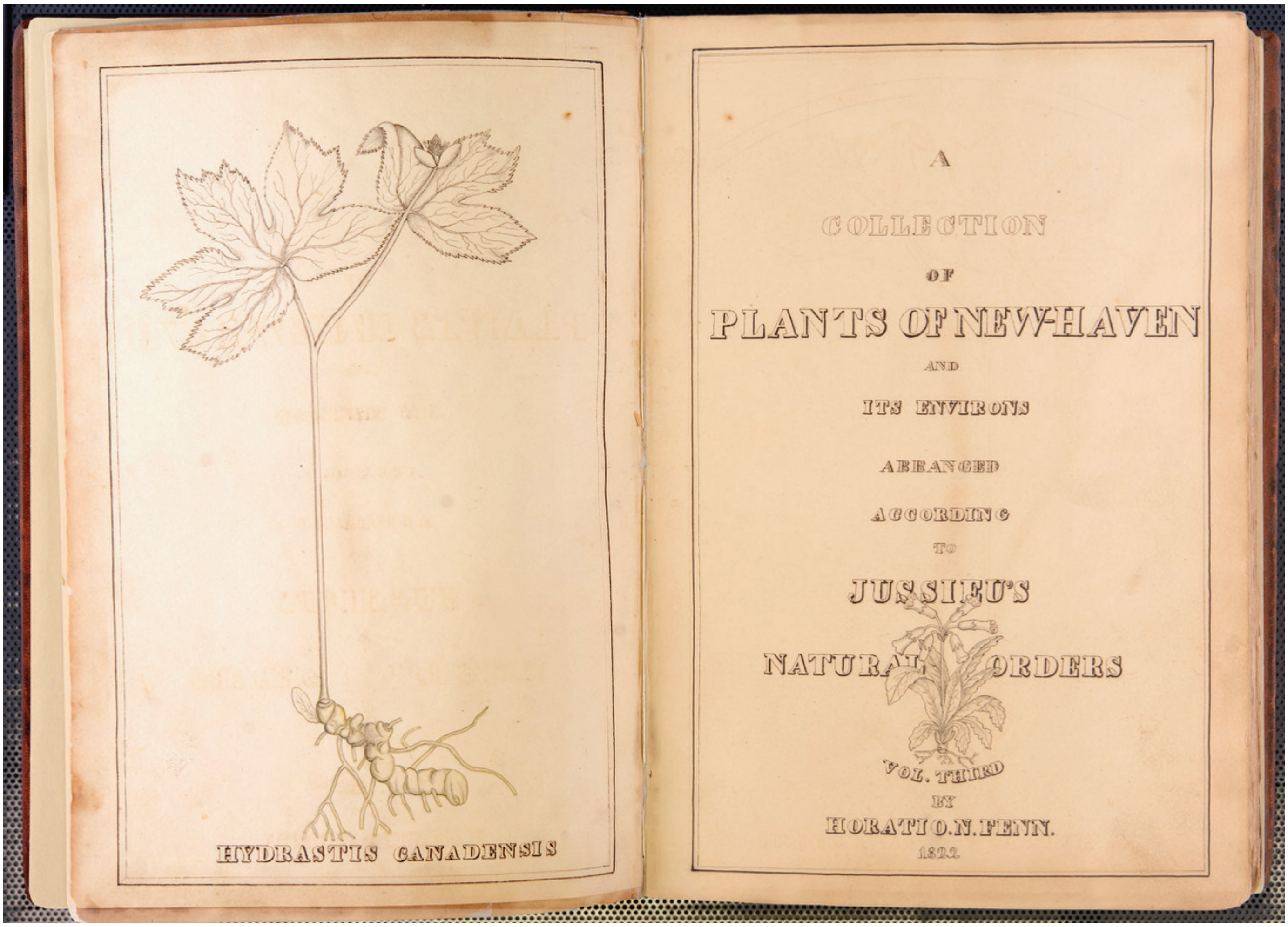


Title page and frontispiece of Volume 3 of the Fenn Collection. Hydrastis canadensis is now endangered in Connecticut. All photos courtesy of the Peabody Museum of Natural History, Division of Botany, Yale University; peabody.yale.edu

Early Botanical Collections of the Yale University Herbarium

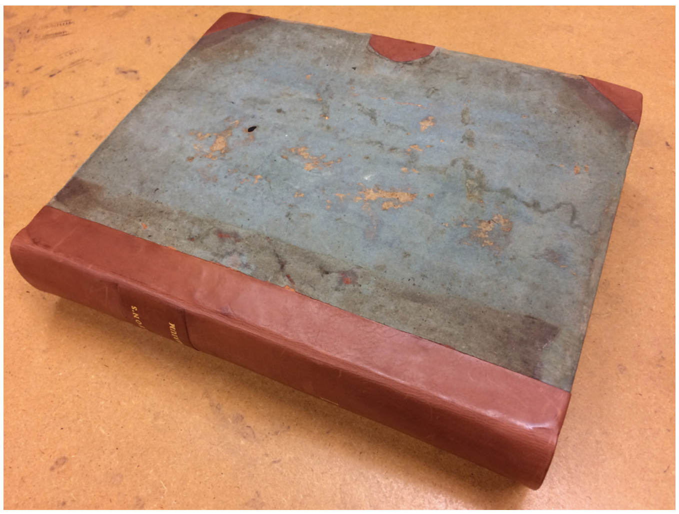
BY PATRICK SWEENY

THE YALE PEABODY MUSEUM of Natural History's Division of Botany houses both the Yale University Herbarium and the Connecticut Botanical Society Herbarium. The Division holds over 350,000 specimens of vascular plants, mosses, algae, lichens and fungi from around the globe that have been collected during the last 200 years.[1] These specimens, along with those in other herbaria around the world, form the basis of our understanding of plant diversity and are useful for scientific research, conservation, commerce, and education.[2] Among the earliest specimens at the Yale University Herbarium are two notable collections of plants from the early 19th century. These collections contain some of the oldest botanical specimens collected in New England and are of immense scientific value and historical interest. What follows is a description of these two collections, a brief discussion of their importance, and some details about the individuals who created the collections and their possible motivations.

The Fenn Collection

Horatio Nelson Fenn (1798 - 1871) assembled his collection while a student in the Medical Institution of Yale College, an early incarnation of the Yale School of Medicine. Prior to his time at Yale, Fenn worked as a clerk in a drugstore in Rochester, New York, and he eventually returned there to practice medicine and dentistry. While at Yale, Fenn lived in the home of Eli Ives, a professor of Materia Medica and Botany in the Medical Institution and one of Fenn's mentors. Fenn's collection is a set of almost 700 vascular plants collected in the New Haven area around 1822. The collection is among the earliest collected plant material from Connecticut and is one of the largest and

Fenn's specimens of *Lobelia inflata and L. siphilitica.*



Volume 1 of Amos Eaton's First Herbarium

most complete collections of plants from a specific region within the state. The plants span the breadth of vascular plant diversity, with gymnosperms, ferns and fern allies, and flowering plants represented. The species in the Fenn collection grow in a wide range of habitats including marshes, forests, and sand dunes. Native and non-native plants are present.

The collection consists of four leather-bound books (or volumes) of cotton rag paper to which the individual specimens are affixed. Each volume measures about 17 cm by 25 cm and is about 5 cm thick. There are usually one or two plants on each page, and each plant is labeled with a Latinized binomial and sometimes a common name. The plants are arranged according to an early "natural" classification for plants devised by the 18th-century French botanist Antoine Laurent de Jussieu. Parts of Jussieu's system are still in use today. Each volume has a title page and frontispiece, the latter presumably drawn by Fenn.

Amos Eaton's First Herbarium

Amos Eaton (1776 - 1842) was an important 19th-century scientist and educator. He studied at Yale under Benjamin Silliman and later taught at Williams College in Williamstown, Massachusetts. Among his notable accomplishments was the creation of the *Manual of Botany for the Northern and Middle States,* first published in 1817. Eaton's *Manual* was the first popular guide to the plants of North America and it was an important predecessor to Asa Gray's *Manual of Botany*. Before his time at Yale, Eaton lived in Catskill, New York and practiced law. During this time, he was accused of forgery and as a result spent five years in jail. There he spent his time studying natural history and also tutored John Torrey. Amos Eaton's grandson, Daniel Cady Eaton, became the first professor of botany at Yale (1864–95) and the first curator of the Yale University Herbarium.

Amos Eaton's First Herbarium is a set of over 1,200 specimens of vascular plants, algae, mosses, fungi, and lichens collected by Eaton in Connecticut, Massachusetts and New York. The earliest specimens in Eaton's First Herbarium likely are from before 1817. This collection, like Fenn's, consists of pressed and dried specimens mounted to cotton rag paper, labeled with Latin binomials, and arranged in four volumes. Each volume has about 90 sheets and measures about 23 cm by 28 cm and is about 5 cm thick. Many of the specimens are only small fragments. The specimens are arranged according to the classification system of Carl Linnaeus, an 18th-century scientist who is considered to be the father of biological nomenclature. A second set of about 225 plants collected by Eaton, his Second Herbarium, is also housed at Yale. The oldest specimen in this collection dates from 1834. A detailed account of both of Eaton's herbaria is provided by Merrill.[3]

Scientific Value

Both the Fenn and Eaton collections have immense scientific value. They document a flora at a particular time and place, and are among the earliest specimens from northeastern North America. As such, they provide early snapshots of plant diversity in North America and provide data useful for studying long-term ecological changes in the region. For example, Fenn's collection contains a specimen of *Arethusa bulbosa* (dragon's-mouth orchid). This species is considered extirpated in Connecticut, suggesting that habitats where this orchid can exist are now absent, or at least quite rare, in the New Haven area. Fenn's collection also contains what may be the earliest specimen of *Lythrum salicaria* (purple loosestrife) collected in North America. This species is native to Eurasia and is a widespread, invasive plant of wetlands across the northern United States and elsewhere. Was New Haven ground zero for the purple loosestrife invasion?

Amos Eaton's collection contains plants that were important to the naming of new species. In his various editions of the *Manual of Botany for the Northern and*

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Early Botanical Collections

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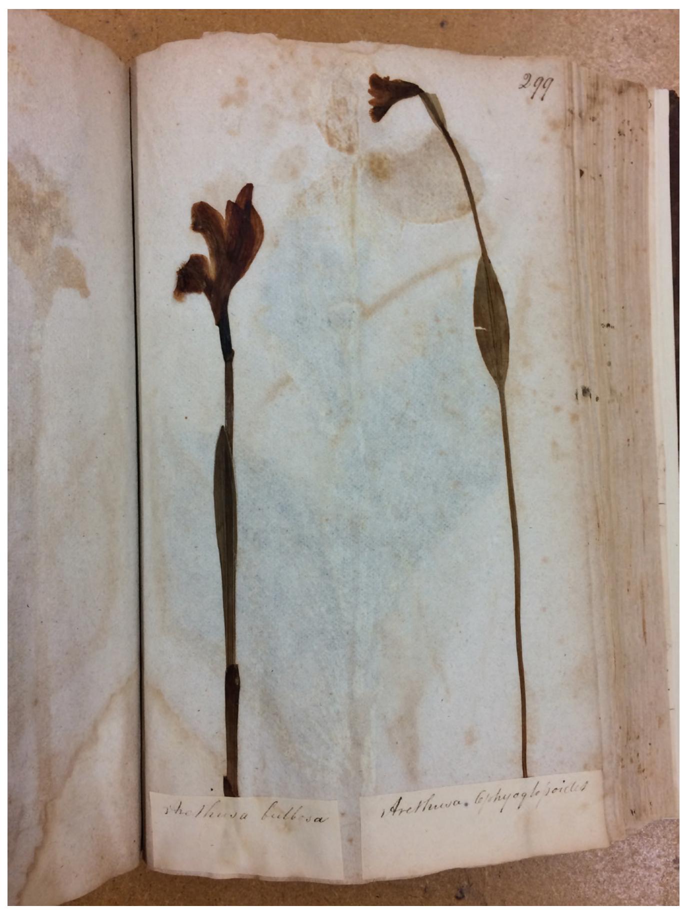
Middle States, Eaton named about forty species new to science. His first herbarium has type specimens of some of these species. Type specimens are central to the practice of taxonomy. All named species have type specimens associated with them, and these specimens anchor species concepts to something tangible — without them the concept of a species might drift from the author's original intent.

Historical importance

From a historical perspective, both of these collections form a bridge between the old and the new. The Fenn and Eaton collections share many similarities with some of the earliest known herbaria created in the first half of the 16th century in Europe to aid in the study and identification of medicinal plants. These herbaria had sheets bound into leather- or vellum-bound books. They belonged to individuals, often the collector, and had little information provided for each plant, beyond an identification. Specimens in some early 16th century herbaria were arranged according to their medicinal properties, unlike the Fenn and Eaton collections, which, like many modern herbaria, were arranged according to some classification devised for identification purposes or as a "natural" arrangement.

Fenn's and Eaton's motivations for creating their collections seem to be aligned, in part, with that of modern collectors. They were interested in documenting the flora of the region. Eaton's collection certainly aided him in the creation of his *Manual.* Fenn's motivation seems to have been both scientific and medical. Botany played a large role in medicine at the time Fenn was studying at Yale. The archives of the Yale School of Medicine contain original versions of notes from Eli Ives' lectures on medicinal plants, and many of the species in Fenn's collection are featured in these notes. However, there are also non-medicinal plants in Fenn's collection, and the arrangement of plants is not based on medicinal use, but rather follows Jussieu's natural classification. Thus, the Fenn and Eaton collections form a direct historical link between past and present.

While these early botanical collections are particularly interesting, all specimens within herbaria and other kinds



ABOVE LEFT: *Lonicera* specimens from Volume 1 of Eaton's First Herbarium. The arrow points at a type specimen of *Lonicera hirsuta* (hairy honeysuckle), a plant named and described by Eaton in 1818 in the second edition of his *Manual.*

ABOVE RIGHT: On the left is Fenn's specimen of dragon's-mouth orchid (*Arethusa bulbosa*), now extirpated from Connecticut.

Fenn's specimen of purple loosestrife (*Lythrum salicaria*) may be the first ever collected in North America.

of natural history collections have their own stories to tell. Collectively these specimens are the primary record of contemporary biodiversity on our planet and are invaluable for scientific research, conservation, and education. It is paramount that we ensure their long-term preservation and accessibility for future generations. Eaton and Fenn would be amazed by the modern uses and current relevance of their collections. We can only hope that their specimens and all of those at the Peabody and beyond remain properly cared for and available for use into the future.

Patrick Sweeney, Ph.D., is Senior Collections Manager, Division of Botany, at the Yale University Herbarium, Peabody Museum of Natural History. *He thanks Barbara Narendra, Archivist of the Yale Peabody Museum Archives, for generously sharing her knowledge about the lives of Fenn and Eaton.*

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1 Many of the specimens housed within the Division of Botany, may be viewed at the Peabody Museum's portal: http://collections.peabody.yale.edu/search/.

2 Funk, V. 2003. 100 uses for an herbarium (well at least 72). *American Society of Plant Taxonomists Newsletter, 17, 17-19.*

3 Merrill, E. D. 1946. The Amos Eaton Herbarium. *Rhodora*, 48, 201-205; and Merrill, E. D. & Reeder, J. R. 1946. New Plant Names Published by Amos Eaton Between the Years of 1817 and 1840. *Bartonia*, 24, 26-79.

Nelson DeBarros

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the mitigation area had grown to hardwoods, I could see that it had the soils and site characteristics of a sandplain. The trees were cut down and the topsoil and organic matter removed. We translocated a few discrete "blocks" of vegetation from the project area to the mitigation site, blocks which included high densities of the low frostweed, and we transplanted all individuals of the *Scleria pauciflora* along with some New Jersey tea (*Ceanothus americanus)* which is an important host plant for invertebrates in this area. Otherwise, all of the vegetation currently within the created sandplain presumably dispersed onto the site or grew from the soil seedbank. The site is gorgeous now.

ND: Among my other responsibilities, I helped in documenting populations of listed species, I provided technical assistance for habitat management, and I monitored some of the most sensitive populations of listed species. One of these – a population of *Agalinis acuta* – went especially well, with good cooperation from the landowner for habitat management. In addition, I assisted in the required five-year updating of the list. In 2015, about an equal number of species got listed and delisted. A number of species were delisted because we dropped hybrids and dropped several tree species that could have been planted.

CBS: What's the state of preservation of rare species in Connecticut?

ND: More can always be done. Since rare plants generally don't move and may require some pretty specific environmental conditions, the best long-term strategy is often land conservation.

CBS: Do you have any final thoughts on the job?

ND: I never in a million years thought I'd have an opportunity like this. I learned so much, not only about the Connecticut flora but about how the world works. I hope to be able to apply this knowledge in my next job. I hope someday to return to the Northeast.

CBS: And we certainly hope you will!

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Notices and News

■ **APRIL BIOBLITZ AT UNIVERSITY OF SAINT JOSEPH**

The first ever University of Saint Joseph (USJ) BioBlitz will be held in West Hartford on April 20-21, 2018. The BioBlitz will be centered on the main USJ campus, but will also include Auer Farm in Bloomfield, CT. There will be a variety of programs and performances on Saturday for the general public. A "pop-up" museum and an environmental fair will also be a highlight of the event. For more information and to register as a participant, please contact USJ BioBlitz organizers Dr. Kirsten Martin (kirstenmartin@usj.edu) or Dr. Michelle Kraczkowski (mkraczkowski@usj.edu).

■ **CBS IS NOW ON INSTAGRAM**

Instagram is a popular way of sharing images and information, and many organizations use it to build community. Following CBS on our new Instagram account is simple to do. Sign up for a free account on your device at Instagram.com, search for ctbotanicalsociety, and then just click on "follow" to start seeing CBS Instagram posts. We will also be needing many photos to keep the account actively evolving through the fall and winter, so if you have especially striking plant photos that you would like to contribute, please send them to Charles Strasser at crstrasser@gmail.com. Include the town where the photo was taken, and indicate whether you would like a photographer credit.

■ **CBS 2017 ANNUAL MEETING: BOTANICAL EXPLOSIONS!**

The 2017 Annual Meeting will take place on Saturday, December 2nd at the Connecticut Forest & Park Association headquarters, at 16 Meriden Rd. (Route 66), Rockfall, CT. The natural history used-book silent auction will be begin at 9:30 a.m. Our guest lecturer will be Dr. Joan Edwards, chair of the Biology Department of Williams College. Dr. Edwards' topic will be "Botanical Explosions: The Evolutionary Impact of Ultra-fast Plants." Ultra-fast plant movements have evolved in a diverse range of plants from liverworts and mosses to flowering plants. This lecture first explores these ultra-fast actions by using high-speed video to slow down the movements and define the biomechanics of adaptations like the trebuchet catapults of bunchberry dogwood, the vortex rings of Sphagnum moss, and the splash cups of liverworts. Then, by examining the plants in their native habitat, we'll explore how these fast movements are evolutionarily adaptive.