

PHAEOPHYSCIA LEANA – A LICHEN SPECIES AT THE EDGE

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Abstract

Phaeophyscia leana. Lea's Bog Lichen, is the only state endangered lichen in Illinois and a potential candidate for the Federal Endangered Species list. This imperiled lichen is especially sensitive to landuse patterns associated with riverine corridors and the highly disturbed habitat along most Midwestern river systems leaves little suitable riparian area in which this unique lichen can subsist. *Phaeophyscia leana* utilizes the trunks of large cottonwoods (*Populus deltoides*) along a river's edge as well as trees associated with historical river channel oxbow lakes and backwater sloughs, which are often inundated by flood events. Corticolous substrates that are periodically inundated is not only unique for *P. leana* but provides a habitat free of competition from other lichens. Recent surveys have better documented known populations, assessed habitat destruction and identified several new populations of *P. leana* along both the Ohio and Wabash Rivers.

Introduction:

Phaeophyscia leana (Tuck.) Essl. was originally described from a bog near Cincinnati, Ohio. Expansion of the city of Cincinnati subsequently eliminated Riddley's bog and, after the loss of this station, *P. leana* was considered globally extinct (Thomson 1963). In fact, holotype material collected from 1834 to 1844, by Thomas Lea, was all that remained of the population. In 1978, *P. leana* was rediscovered by A. C. Skorepa approximately 400 km southwest of the type locality along the shores of the Ohio River at Tower Rock Recreation Area (T12S, R8E, Sections 19 and 20), Hardin Co., Illinois (Skorepa 1984; Esslinger 1978; Wilson and Methven 1997). Skorepa's surprising rediscovery of a large population of *P. leana* in southern Illinois led to a renewed interest in the species and, in 1994, the Illinois Department of Natural Resources commissioned Wilhelm, Masters, and Shimp to determine the status of *P. leana* in Illinois. An intensive regional survey revealed eight large populations and seventeen additional smaller localities in southern Illinois, Indiana, Kentucky, and Tennessee (Wilhelm and Masters 1994). Based on the number of populations discovered and an analysis of the Tower Rock locality, *P. leana* was given an Illinois endangered species classification.

Purpose:

This study is intended to further document the range of *P. leana* in the lower Ohio River valley. In addition to the discovery of new populations of *P. leana*, populations previously reported by Wilhelm, Masters, and Shimp have been revisited to analyze the extent of habitat disturbance, threats to the population's integrity and loss of *P. leana* populations (1994). Populations of *P. leana* were plotted using GPS/GIS technology to facilitate future studies, monitoring, and the development of management plans for populations of *P. leana*.

Materials and Methods:

Intensive surveys by automobile, watercraft, and on foot have been undertaken to ascertain the range of *P. leana* in southern Illinois. Watercraft surveys have been completed from the mouth of the Wabash River to Mink Island near New Harmony State Park, Indiana, (Wabash River Mile 40). Land surveys of the present range of *P. leana* have been facilitated by the analysis of aerial USGS digital orthoquad images, USDA Soil Survey aerials, and USGS topographic maps. Lichen population localities have been documented by the use of GPS technology and records of lichen populations and surveyed habitats have been marked with waypoints.

Habitat:

Phaeophyscia leana is a unique bottomland lichen that utilizes habitats often considered less than suitable for lichen colonization; the bark of trees along major rivers, oxbow lakes, and backwater sloughs that are frequently inundated by surges of river floodwaters. *Phaeophyscia leana* is found below the spring "high water mark" on a tree's trunk in association with a very limited lichen community that is not as well adapted to the periodic flood events. In addition to a pattern of flood events *P. leana* is found in habitats that are park-like in nature, have high levels of incident light, and have excellent air flow characteristics. Park-like habitats include sandy wooded shorelines with little brushy or herbaceous vegetation, open groves of bottomland trees within an encompassing agricultural matrix, fencerows, woodland openings, and fishing camps. *Phaeophyscia leana* also utilizes stands of Bald Cypress (*Taxodium distichum*) that are emergent in some oxbow lakes where the scattered cypress provide *P. leana* with an open, park-like habitat.

Threats:

The availability and quality of the habitat utilized by *P. leana*, is affected by factors that influence riparian zones and floodplain communities including changes to the Midwestern landscape and its riverine systems. River systems that have been "tamed" with locks and dams to allow for navigation and the transport of commodities have had their hydrologic features irreparably damaged. Seasonal floods that were once more gradual fluctuations are now torrents that scour the land and erode river shorelines. Land clearing, drainage projects, levee construction, and the resultant sediment load produced by the erosion of exposed agricultural fields have also disrupted Illinois rivers and bottomland wetlands. Oxbow lakes and sloughs that have not been completely expunged by drainage regimes are influenced by fertilizer and pesticide runoff, and heavy silt loads coat wetland plants and associated tree species that provide habitats for *P. leana*.

Results:

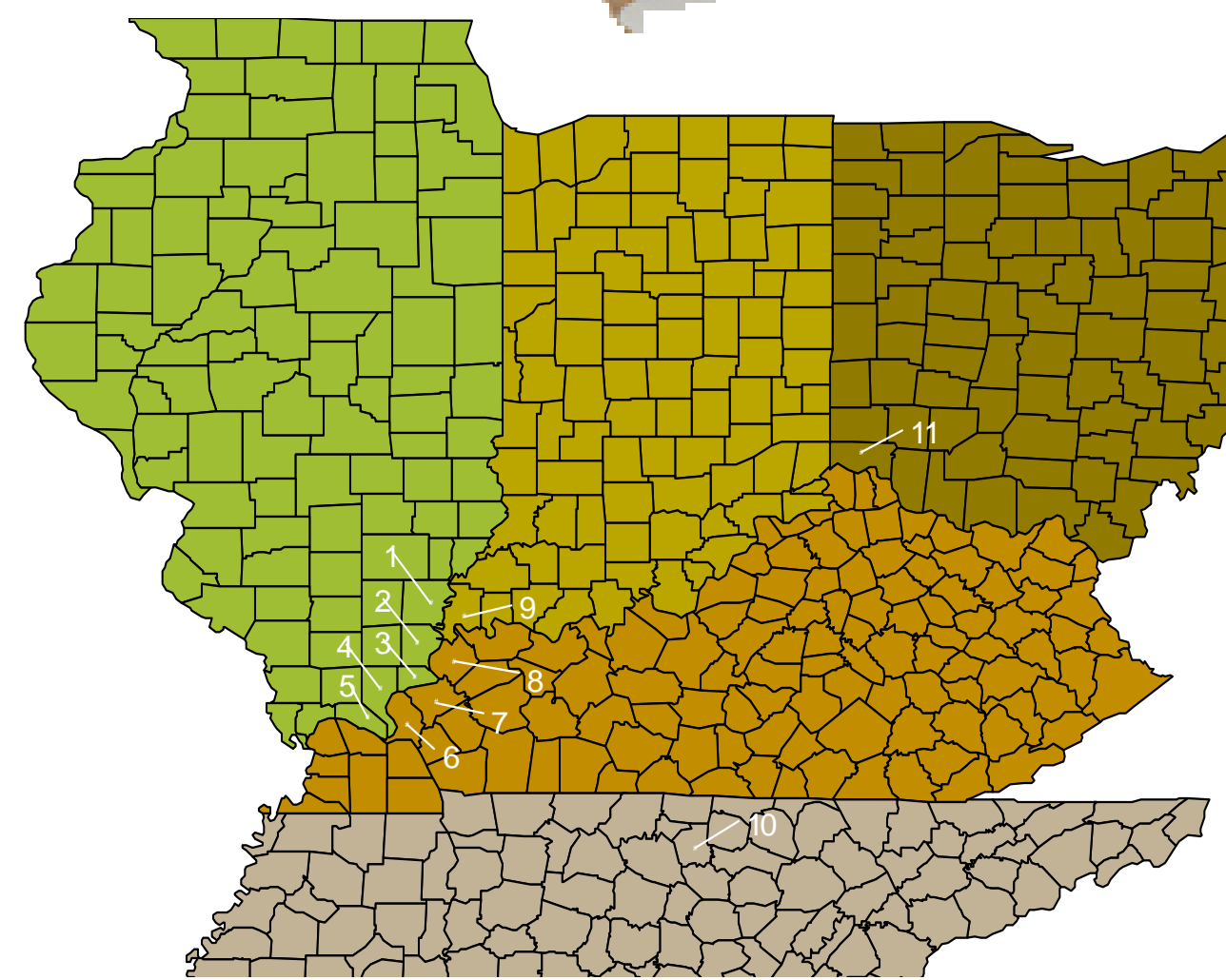
To date over 78 waypoints have been logged to identify *P. leana* populations. These locations have been recorded to aid in the delineation of the populations themselves and provide an accurate method of relocation for further research. A list of some of the most important localities to date have been provided as well as the county of origin, a general size qualifying note, and the substrate utilized. Previously identified populations by Wilhelm, Masters, and Shimp have been revisited and their status has been documented (2000). Populations lost since the conclusion of their surveys are as follows:

Recently extirpated populations

- 1.) One location near Elizabethtown, Hardin Co., IL, immediately west of Big Creek is now a quarry.
- 2.) A population at Fort Massac State Park, Massac Co., IL, is no longer present as the cottonwoods have sloughed off into the river.
- 3.) Two thalli at the New Haven (IDOC) boat ramp, Gallatin Co., IL, on green ash are no longer extant.
- 4.) A locality near the confluence of Caney Creek and the Ohio River (near River Mile 873 below Sturgeon Island) is defunct due to bank erosion.

Previously Identified Populations and Current Status

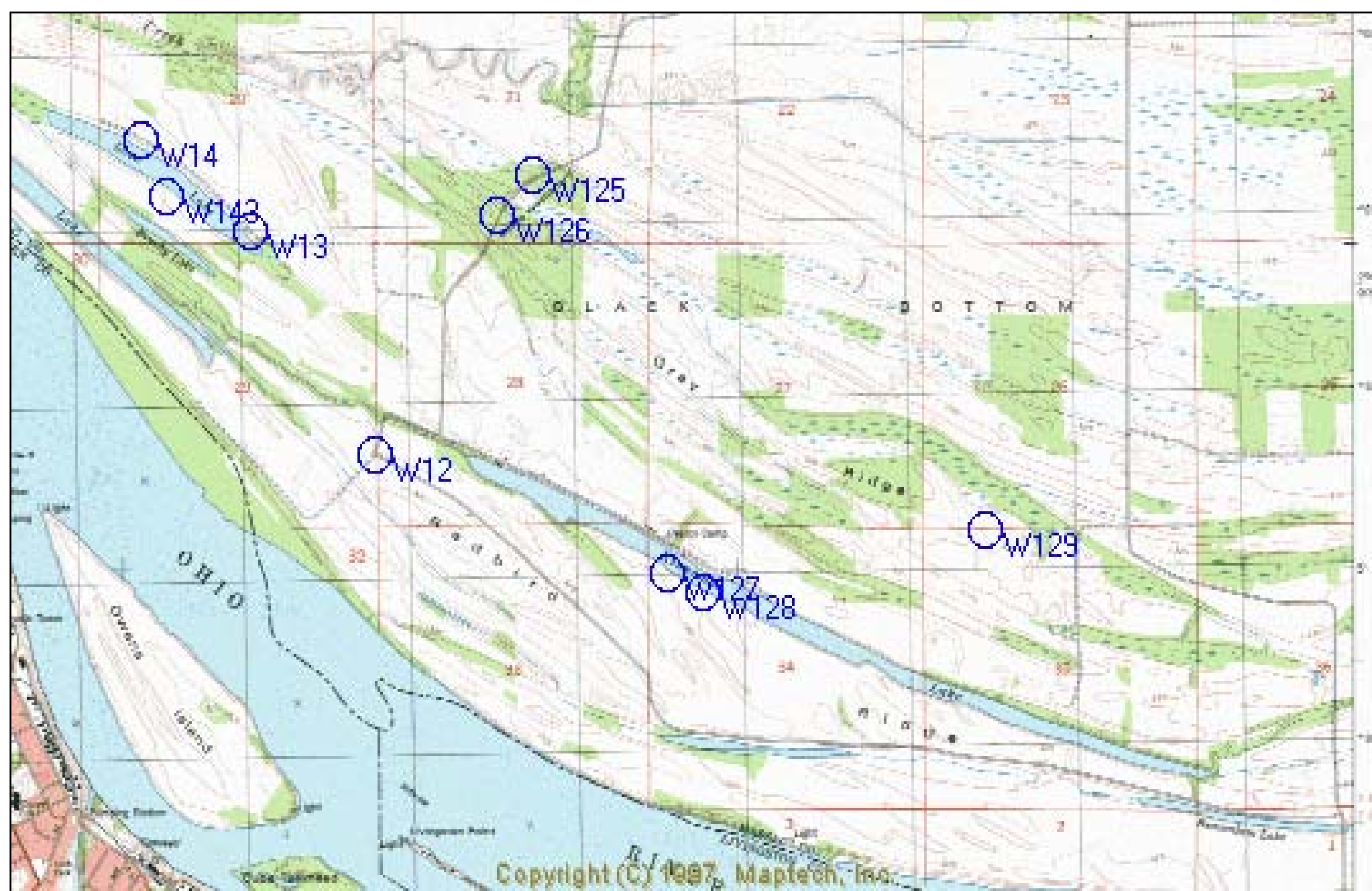
Designation:	County:	Size:	Status:
Hurricane Island	Crittenden, KY	Small	Extant
Tolu	Crittenden, KY	Small	Extant
Bell Island	Union, KY	Large	Extant
Big Lake	Gallatin	Large	Extant (Fishing village)
Round Pond	Gallatin	Large	Extant (Fishing village)
Clark Pond	Gallatin	Large	Extant (Substrate trees near roadway)
Horseshoe Pond	Gallatin	Large	Extant (Substrate trees near roadway)
Beaver Pond	Gallatin	Large	Extant (Substrate trees near roadway)
Hulda Lake vic.	Gallatin	Large	Extant (Thalli on trees of old homesite)
Cow Pond	Gallatin	Small	Extant (Scattered thalli)
Cave in Rock	Hardin	Small	Extant (Soil disturbance)
Finneyville	Hardin	Small	Extant (Limited disturbance)
Tower Rock	Hardin	Large	Extant (Limited disturbance, riverbank erosion)
Givens Creek Mouth	Livingston, KY	Small	Extant (~10 thalli on single substrate tree)
Birdsville, Rte. 137	Livingston, KY	Large	Extant (Limited disturbance)
Golconda vic.	Pope	Small	Extant (Fishing village)
Carthage, Caney Fork	Smith, TN	Large	Extant
O. Shawneetown vic.	Union, KY	Small	Extant



Range of Phaeophyscia leana (Tuck.) Essl.

Range	Status
Illinois: (1-White, 2-Gallatin, 3-Hardin, 4-Pope, and 5-Massac Co.)	Extant
Indiana: (9-Posey Co.)	Extant
Kentucky: (6-Livingston, 7-Crittenden, 8-Union Co.)	Extant
Tennessee: (10-Smith Co.)	Extant
Ohio: (11-Hamilton Co.)	Defunct

Much to the delight of the authors several small localities of *P. leana* were discovered during surveys of the oxbow lakes east of Brookport, Illinois, in Massac county. This discovery reestablished a population of *P. leana* in Massac county after the loss of the most westerly known population of *P. leana* at Fort Massac State Park (Wilhelm & Masters 18772, 17 DEC 1990). The Black Bottoms are traversed by oxbow lakes similar to the lake complexes in Gallatin county and it was hypothesized that the lichen could still remain within this habitat. It was indeed, but not to the magnitude of the Gallatin county *P. leana* populations. Using Maptech mapping software GPS waypoints can easily be entered and plotted on topographic maps.



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Discussion:

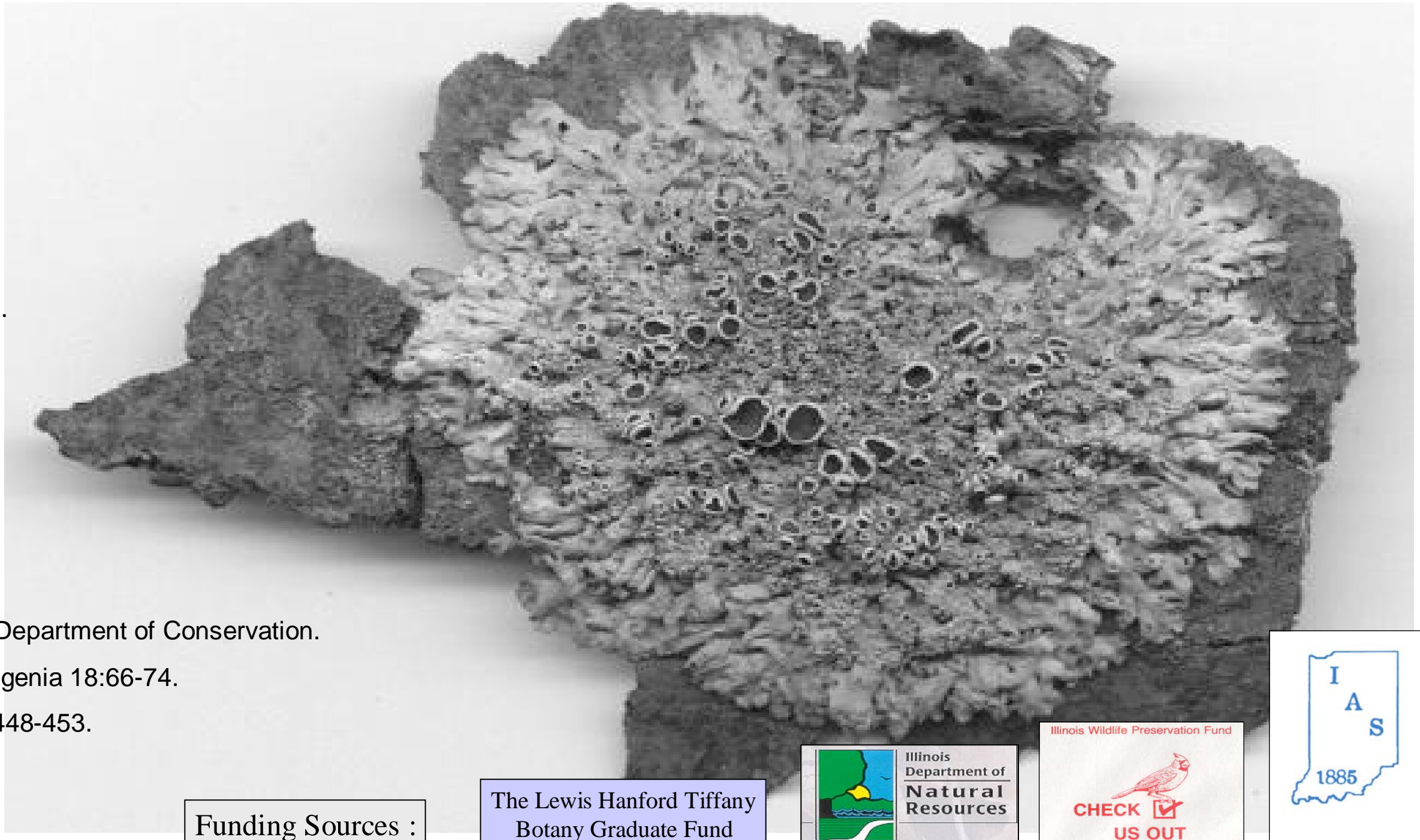
Although *P. leana* is exceedingly endangered throughout its range and populations are generally small, scattered, and subject to stochastic events; surveys have uncovered a unique trend in that Gallatin county, at the present, seems to be a population center for the lichen in Illinois. Reconnaissance has produced a battery of locality waypoints within the Gallatin county floodplain. Lichen populations have been discovered from the town of New Haven, the most northerly landmark within the Gallatin Bottoms, to the confluence of the Saline and Ohio Rivers, to the south. Wilhelm and Masters identified sixteen notable populations in southern Illinois and of those, ten were located in the Gallatin Bottoms and four were considered large and not vulnerable to a foreseeable threat (1994). Currently, this project has identified three large populations, within the remainder of the Gallatin floodplain that had not been surveyed by past efforts, which could be considered large or of similar magnitude to populations found by Wilhelm, Masters, and Shimp (2000). Route 13 and the village of Old Shawneetown splits the Gallatin Bottoms into two portions: the Saline Mines floodplain and the New Haven floodplain. Within the Saline Mines floodplain are two recently discovered populations designated as the Mud Lake locality and the Saline Mines North locality. Mud Lake is an oxbow of the Ohio River and still supports a population of *P. leana* although landuse in the area is intensively agricultural. Saline Mines North is a wooded drainage that was logged a few years prior to the lichen population's discovery. Above Old Shawneetown, lies the expansive bottoms produced at the confluence of the Wabash and Ohio Rivers. Nine large oxbow lakes support populations of *P. leana* and a host of river slough channels still remain. During periods of flooding the river reclaims the historic channels and river water surges throughout these waterways as it has for years. Yellowbank Slough is perhaps the largest and best known of these channels and along its high banks habitat exists which supports *P. leana*. Other sloughs have populations of *P. leana* as well but as a whole reconnaissance has not identified large populations similar to the oxbow lake communities. Gallatin county sloughs have yielded a consistent pattern of scattered-sporadic thalli.

Characteristically slough channels are farmed right up to their sloping banks. Large bottomland trees that border the channel's sides have been the source of many discovered thalli. These trees provide a parklike habitat, which is desirable for *P. leana*, but they are subject to high levels of disturbance due simply to the nature of their placement at the edge of large bottomland ag fields or along oil field access roads. The third recently discovered large population is located at Fehrer Lake in close proximity to Round Pond, Big Lake, and Bell Island, KY, all of which were identified by previous research as *P. leana* population localities (Wilhelm, Masters, and Shimp 2000). Fehrer Lake is only a portion of a larger population. Bottomland woodlands surrounding these oxbow lakes are heavily colonized and cypress trees (*Taxodium distichum*) emergent from the lakes themselves have high numbers of *P. leana* thalli. Populations discovered to date have been assigned sizes but these are arbitrary figures at best. In all actuality it is difficult to assign boundaries to a population since oxbow lakes and sloughs tend to flow together and a spattering of thalli between populations is often characteristic. Floodplains such as the Gallatin Bottoms have habitats remaining that are well suited for *P. leana*, other bottomlands have received higher levels of disturbance and *P. leana* is not as common, if not absent. It is also difficult to define what ecological factors, besides presence or absence of habitat, define the optimum conditions for this organism (Barkman 1958). We are already aware that its habitat constraints are tenuous and in some cases potential habitats which would seem to be perfect for the support of a *P. leana* population are not colonized, undoubtedly other factors that we do not know of are at play.

Populations of *Phaeophyscia leana* will likely be slowly eroded away with only a limited number of people concerned about the loss of the organism unless the protection of the lichen can be included in larger management programs that protect bottomland wetlands or forest communities as a unit. *Phaeophyscia leana* is not a charismatic megafauna that will excite droves of people to come to its aid, but it is an interesting component of an ecosystem that has received only abuse. It is unfortunate that it is endangered because it provides us with a glimpse of how degraded this particular segment of the Illinois landscape has become and it sheds light on the amount of misguided effort that has gone in to destroying its habitat.

Waypoint #	Stand Designation:	County:	Substrate:	Status:
72	IN-Side	Gallatin	Populus deltoides	Scattered thalli
88	Links Wabash Loc.	Gallatin	Populus deltoides	Single thallus
90	Rnd Pt Bottoms LLC	Gallatin	Quercus rubra	Several thalli (woodland edge)
92	Bicketts Ditch	Gallatin	Quercus, Carya, Celtis	Several thalli along wooded roadway
94	Fehrer Lake Recon	Gallatin	Taxodium, Populus, Fraxinus	Large population (confluent mats)
101	Oshawneetown Levee	Gallatin	Celtis occidentalis	Scattered thalli
102	Oshawneetown Col	Gallatin	Quercus palustris	Scattered thalli
103	Shawneetown Woods	Gallatin	Carya, Celtis, Fraxinus	Several thalli along woodland edges
104	Nhulda road Pins	Gallatin	Quercus palustris	Several thalli
105	Yellowbank Recon	Gallatin	Quercus, Carya, Celtis, Fraxinus	Numerous thalli along slough edge
118	Running Slough	Gallatin	Fraxinus pennsylvanica	Numerous thalli along slough edge
121	Goose Pond vic.	Gallatin	Quercus, Carya	Several substrate trees with confluent mats
122	Hulda Corner Locale	Gallatin	Celtis	Single thallus
123	Big Lake Rd.	Gallatin	Quercus, Carya	Scattered large thalli
130	Gravel Pit Levee	Gallatin	Populus, Carya	Scattered single thalli
132	Gravel Pit	Gallatin	Populus, Carya	Several thalli
133	Gravel Pit Slough	Gallatin	Carya, Celtis, Quercus, Fraxinus	Numerous thalli along slough edge
137	Cattail Slough	Gallatin	Fraxinus pennsylvanica	Numerous thalli along slough edge
138	Cattail S (Fencerow)	Gallatin	Carya	Single thallus
139	Running Slough	Gallatin	Fraxinus, Celtis	Scattered thalli along slough edge
140	Oshawneetown North	Gallatin	Quercus, Carya	Scattered thalli along roadway
141	Oshawneetown South	Gallatin	Quercus, Carya, Celtis	Scattered thalli along roadway
151	Saline Mines vicinity	Gallatin	Quercus, Quercus, Carya, Celtis	Several thalli in bottomland woods
154	Mud Lake	Gallatin	Sax. Taxodium	Large population
169	Big Lake/Fish Lake	Gallatin	Taxodium, Fraxinus, Populus	Large population (confluent mats)
Desktop	Mud Lake North	Gallatin	Gleditsia, Quercus, Carya, Celtis	Large population (confluent mats)
12	Kinneman Lake	Messac	Carya illinoensis	Few thalli
13	Loon Lake Cypress	Messac	Taxodium distichum	Large thalli and confluent mats
125	Kinneman Lake Rd	Messac	Quercus, Carya	Scattered thalli along roadway
127	Kinneman S Bank	Messac	Fraxinus pennsylvanica	Scattered thalli
129	Gray Ridge Fencerow	Messac	-	Single thallus
143	Loon Lake S Bank	Messac	Populus deltoides	Scattered thalli
28	IN-Side (Island)	Posey	Populus deltoides	Few thalli
80	IN-Side Mackeys Is	Posey	Populus deltoides	Scattered thalli
65	IN-Side Hovey Lake	Posey	Populus deltoides	Few scattered thalli
15	Greathouse Island	White	Quercus palustris	Few thalli
16	Epworth Rd.	White	Populus deltoides	Few thalli

Phaeophyscia leana (Tuck.) Esslinger is a foliose lichen with narrow (1-2mm), linear, di- to trichotomously branched lobes (Thomson 1963). Thalli have a mean diameter of 3.1 +/- 1.9cm (n=1530), but can be up to 13cm in diameter (Wilhelm, Masters, Shimp 2000). Apothecia are reddish-black, sessile, and bear 8-spored asci that produce 2-celled ascospores (Thomson 1963). Spot tests are negative: K-, C-, KC- (Thomson 1963, Esslinger 1978). Atranorin is absent and no lichen substances are detected with thin layer chromatography (Esslinger 1978).



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