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# Populations of Phaeophyscia leana (Tuck.) Essl. within the Ohio River Basin

R. N. Gillespie
*Eastern Illinois University*

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# Populations of *Phaeophyscia leana* (Tuck.) Essl. within the Ohio River Basin

BY
R. N. Gillespie

**THESIS**

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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## ABSTRACT

*Phaeophyscia leana* (Tuck.) Essl., an endemic North American lichen species presently known to occur only within the Ohio River basin, is state-endangered in Illinois and a potential candidate for the Federal Endangered Species list. Since it utilizes periodically inundated corticolous substrates associated with river channels, oxbow lakes, and sloughs, this imperiled lichen is sensitive to landuse patterns within river floodplains. Surveys for *P. leana* were conducted to recensus previously documented populations, thereby assessing their stability, and to identify additional populations within the Ohio River Basin. Watercraft surveys were conducted on the Little Wabash River, from Carmi to New Haven, Illinois, and on the Wabash River from Darwin, Illinois, to the terminus at the Ohio River. Watercraft surveys resulted in the discovery of five new populations of *P. leana*, two in Illinois and three in Indiana, all of which were located south of Illinois State Route 141. Land-based surveys in Illinois identified new populations within the floodplain formed at the confluence of the Wabash and Ohio Rivers in Gallatin County and within the Black Bottom of Massac County. Nine large oxbow lake communities and backwater slough channels were found to support populations of *P. leana* within the Gallatin Bottoms which is the population center for *P. leana* in Illinois. Additions to the Illinois core site list include large populations at Fehrer Lake, Big Lake, and Saline Mines, all within the Gallatin Bottoms floodplain. Watercraft reconnaisance of the Wabash River and Ohio River floodplains (the Big Rivers Region) in Indiana led to the discovery of *P. leana* populations in Posey, Spencer, Perry, Crawford, and Switzerland County, Indiana, as well as a population in Trimble County, Kentucky. The population located at Vevay, Indiana, in Switzerland County is the closest documented population to the type locality near Cincinnati, Ohio. Land-based surveys conducted in the Hoosier National Forest and the Harrison-Crawford State Forest elucidated the only core site in Indiana, the Mano Point population, near Derby. A population was also discovered in Tennessee at the Hartsville boat launch on the Cumberland River (Old Hickory Lake). Core sites in Tennessee include the Hartsville population as well as populations discovered by Loy R. Phillippe on the Caney Fork River near Hell Bend (downstream from Carthage) and below the Center Hill Dam located on Wolf Island. A total of six core sites were located in this survey and eighty-five positions, where *P. leana* was observed growing, were recorded with UTM coordinates.

# INTRODUCTION

*Phaeophyscia leana* (Tuck.) Essl., an endemic North American lichenspecies presently known to occur only within the Ohio River Basin (Thomson 1963, Wilhelm and Masters 1994), is recognized as state-endangered in Illinois and a potential candidate for the Federal Endangered Species list (Herkert and Ebinger 2002, Wilhelm and Masters 1994). This imperiled lichen is especially sensitive to landuse patterns associated with riverine corridors and disturbed floodplains of midwestern rivers leave little suitable riparian habitat in which this unique lichen can subsist. *Phaeophyscia leana* was originally described by Thomas Lea from Riddley's Bog, near Cincinnati, Ohio (Thomson 1963, Wilhelm and Masters 1994). After the loss of this station through the expansion of the city of Cincinnati, it was believed that *Phaeophyscia leana* was globally extinct (Thomson 1963). However, *P. leana* was rediscovered by A. C. Skorepa in 1978 in southern Illinois along the Ohio River at Tower Rock Recreation Area (T12S, R8E, S19, 20), Hardin County, 400 kilometers from the type locality (Skorepa 1984).

Skorepa (1984) observed numerous thalli at Tower Rock Recreation Area within 50 m of the Ohio River shoreline but noted that as the flood zone gradually gave way to the upland topography of the Tower Rock overlook thalli of *P. leana* were no longer present. Skorepa also noted a difference in the elevation of thalli on trees as the distance from the river increased and that thalli were found exclusively below the high water mark. Although trees near the river supported thalli that were up to 2.5 m above the soil surface, thalli which were distant from the river were located primarily on the boles of substrate trees. As a result, Skorepa (1984) suggested that *P. leana* was limited to trees that are inundated by spring flood events, since trees which are not in the floodplain at Tower Rock do not support *P. leana*. Skorepa (1984) also commented on the lack of other lichen species in association with *P. leana* at the Tower Rock site, suggesting that other lichen species are not suited to the regimen of flooding disturbances to which *P. leana* is adapted.

Skorepa's rediscovery of *P. leana* prompted the Illinois Department of Natural Resources and the USDA Forest Service to commission Wilhelm and Masters to assess the status of *P. leana* in Illinois (1994). At the conclusion of their study, 25 populations of *P. leana* had been documented, eight of which were considered to be large populations or core sites (Wilhelm and Masters 1994, Wilhelm, Masters, and Shimp 2000). The present study was undertaken to re-examine previously documented populations, survey habitats which had not been surveyed, and to expand the known range of populations of *P. leana*.

## Demographic Analysis of the Tower Rock Study Site

In addition to surveillance of the lower Ohio River for populations of *P. leana*, Wilhelm and Masters (1994) analyzed the demographics of Skorepa's rediscovered population at Tower Rock. The population of *P. leana* is confined to a 1.2 ha area bordered to the west by a stream entering the Ohio River that separates the study site from the Tower Rock campground. The population is further confined by the rising Tower Rock escarpment to the north and east. Wilhelm and Masters (1994) and Wilhelm, Masters, and Shimp (2000) sampled 380 individual trees at Tower Rock within the limits of the lowest terrace in the study site. Eleven species of trees supported nearly all of the 1,540 lichen thalli

reported in their demographic analysis of the Tower Rock population. They determined that substrate area available for colonization below the mean flood crest was 452.6 $m^2$ and that thalli covered a total area of 1.6 $m^2$ or 0.35% of the total substrate area available for colonization. The southern aspects of substrate trees sampled were 41% colonized, while the more easterly aspects supported 35% of the thalli observed and the northern aspect was utilized by 8% of the thalli.. Thallus position on trees varied from ground level on the exposed roots of trees distant from the river to 3.7 m up the trunk on trees closer to the river channel.

Wilhelm and Masters (1994) and Wilhelm, Masters, and Shimp (2000) divided the trees supporting *P. leana* thalli into four cohorts based on diameter at breast height (DBH), elevation above the normal pool level, and distance from the river's edge. Cohort 1 featured large diameter trees (commonly 50 cm in DBH) located in close proximity to the river including *Populus deltoides* Marsh., *Acer saccharinum* L., and *Platanus occidentalis* L.. Forty eight percent of all *P. leana* thalli observed were located within this cohort and 46% of all trees measured fell into this category. Cohort 2 included a *Carya illinoensis* (Wang.) K. Koch-*Ulmus americana* L. grouping of slightly smaller individuals (diameters of 40-50 cm DBH) located further from the river. Thirty-one percent of the thalli observed at Tower Rock utilized the trees represented in this cohort as substrates. Cohort 3 was composed of *Acer negundo* L., *Diospyros virginiana* L., and *Liquidambar styraciflua* L.with DBH's near 30 cm. This cohort was situated even further from the river and higher up the elevation gradient towards the parking area, approximately 50 m from the river's edge. These trees constituted 14% of the substrates sampled and supported 19% of the thalli observed. Cohort 4 included a *Celtis occidentalis* L. , *Fraxinus pennsylvanica* var. *subintegerrima* (Vahl) Fern. group which were the highest on the terrace and most distant from the river. Only 3% of the thalli were found on these trees.

*Populus deltoides* supported the highest number of thalli at the Tower Rock site (42%) followed by *Carya illinoensis* (27%), and *Liquidambar styraciflua* (15%). Although Wilhelm, Masters, and Shimp observed preferences by *P. leana* for different tree species, preference analysis was confounded by tree size and frequency within the study area making elucidation of a discernible pattern of substrate selection difficult to quantify. Of the *Liquidambar styraciflua* substrates available, 63% supported thalli, while 70% of the *Populus deltoides* substrates supported thalli of *P. leana* (Wilhelm, Masters and Shimp 2000). Both substrate trees are readily colonized by *P. leana* and support healthy populations of the lichen when conditions are optimum.

## Populations Identified by Wilhelm, Masters, and Shimp

Wilhelm, Masters, and Shimp (2000) recorded 25 populations of *P. leana* in the lower Ohio River Valley and provided impetus and direction for further surveillance within the Ohio River Basin (Fig. 1). The study site identified by Wilhelm, Masters, and Shimp (2000) at Tower Rock was the largest population identified in Illinois. It was followed by large populations in Gallatin County associated with the oxbow lake communities within the Gallatin Bottoms including: the Round Pond / Long Pond oxbow lake complex, Hulda Lake, Hulda Woods, and Beaver Pond. Large stands of *P. leana* documented in Kentucky were located at Bell Island (Union Co.) near Old Shawneetown, Illinois, and at Bayou Swamp in

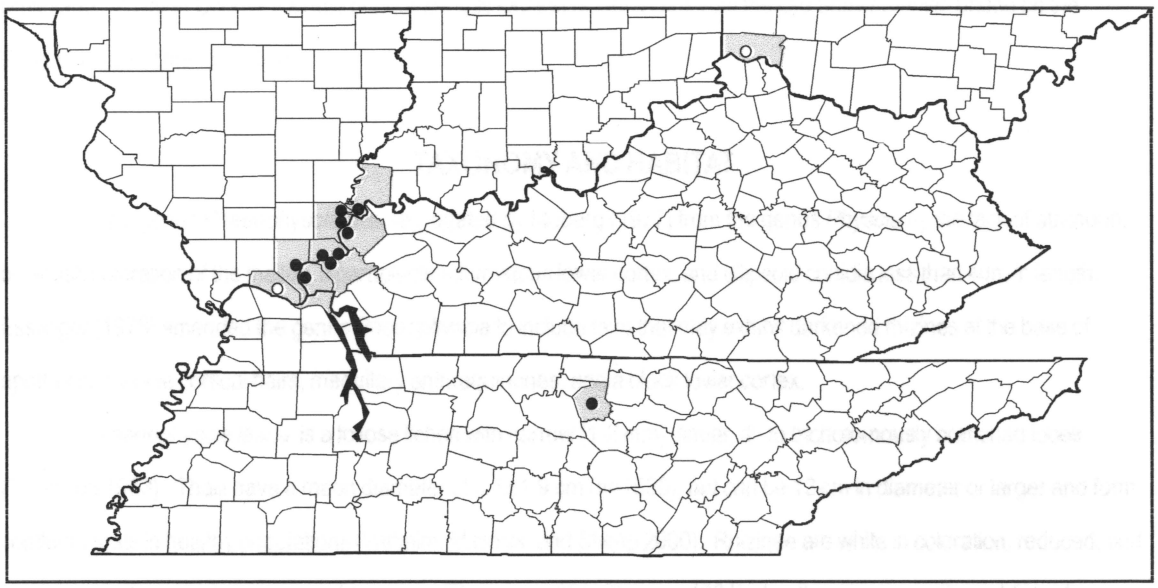

**Figure 1.** Distribution of *P. leana* populations as documented by Wilhelm, Masters, and Shimp (2000). Solid circles (●) represent extant populations, open circles (o) designate populations which were known to be extirpated at the conclusion of their study (n=2). Counties with documented stands of *P. leana* are shaded. Smaller populations may be grouped within single solid circles.

the vicinity of Birdsville (Livingston County). The single large Tennessee population, documented by Loy R. Phillippe, is located at Hell's Bend near Carthage (Smith Co.). Wilhelm, Masters, and Shimp (2000) also identified eleven smaller populations of *P. leana* in southern Illinois, a single population in Indiana, and five small populations in Kentucky (Wilhelm and Masters 1994).

Smaller populations in Illinois were located in Gallatin, Hardin, Pope, and Massac County. The Gallatin County populations included the New Haven IDOC boat landing, Clark Pond, Horseshoe Pond, Big Lake, and Cow Pond Slough. Populations in Hardin County were located near Finneyville, east of the Cave-in-Rock ferry landing, and near Elizabethtown. A population of *P. leana* discovered by Shimp near the confluence of Haney Creek and the Ohio River, in Hardin County, is considered extinct since the tree supporting the population was lost to bank erosion (Shimp pers. comm. 2002). In Pope County a small population is located south of Golconda at the southern end of a fishing village. Lastly, Massac County supported a population of *P. leana* at Fort Massac State Park in 1990 but further study of the Fort Massac lowlands in 1994 by Wilhelm and Masters led to the conclusion that thalli composing the population had been lost.

A single population was reported from Indiana in southeastern Posey County, adjacent to the Wabash River downstream from New Haven. Small populations were also discovered in Crittenden, Livingston, and Union County in Kentucky. In Crittenden County, populations were documented at the Ohio River boatlaunch near Tolu and at the southeast end of Hurricane Island. Livingston County populations were documented at the Givens Creek boat ramp, opposite Golconda, IL , and along the western shore of the Cumberland River, 2.5 miles upstream from the terminus near

Smithland. In Union County, a single population was located downstream from the Old Shawneetown bridge on the Kentucky-side of the Ohio River.

## TAXONOMY AND HABITAT

The genus *Phaeophyscia* was segregated by Moberg (1977) from the genus *Physcia* by the lack of atranorin, brownish coloration of the thallus, a paraplectenchymatous lower cortex, and ellipsoid conidia less than 4um in length. Esslinger (1978) amended the genus *Phaeophyscia* to include taxa that may exhibit darkened rhizines at the base of apothecia, hyaline cortical hairs, medullary anthraquinones, and a black lower cortex.

*Phaeophyscia leana* is a foliose lichen with narrow (1-2 mm), linear, di- to trichotomously branched lobes (Thomson 1963). Thalli have a mean diameter of 3.1±1.9 cm (n=1530), but can be 13 cm in diameter or larger and form confluent mats in healthy populations (Wilhelm, Masters, and Shimp 2000). Rhizinae are white in coloration, reduced, and rarely project beyond the margins of the lobes (Thomson 1963, Skorepa 1984). Apothecia are sessile, reddish when young but turn black with age, and bear 8-spored asci that produce 2-celled *Physcia*-type ascospores (Esslinger 1978, Thomson 1963). *Phaeophyscia leana* does not produce soredia, isidia or specialized diaspores (Thomson 1963, Esslinger 1978). Spot tests (K, C, KC) are negative and no lichen substances (secondary metabolites) are detected with thin layer chromatography (Thomson 1963, Esslinger 1978). Although members of the genus *Phaeophyscia* typically display a black lower cortex, *Phaeophyscia leana* exhibits a white lower cortex. *Phaeophyscia leana* is an epiphytic corticolous lichen which utilizes deciduous trees in floodplains and exhibits diagnostic characteristics that allow it to be unobtrusively and easily identified during survey operations. Moistened thalli, observed after spring rain events or morning dew falls, are a distinctive bright apple green readily discerned against dark, dampened tree bark. The distinctive linear, forked branching pattern of the lobes and presence of black apothecia facilitates identification in the field.

Suitable habitats are well-defined and limited to floodplain and riparian communities along major river systems. *Phaeophyscia leana* utilizes bark substrates and although it is often found on mature cottonwoods (*Populus deltoides*), *P. leana* displays minimal substrate preferences and will grow on a number of different tree species and woody vines such as *Toxicodendron radicans* L. Kuntze and *Aristolochia tomentosa* Sims. *Phaeophyscia leana* occupies an explicitly recognizable zone on the lower trunks of bottomland trees, requires seasonal inundation by floodwaters, and is limited to that portion of a tree's trunk below the high water mark. Flooding is essential for the exclusion of other lichen species which might displace *P. leana* from a substrate. This spatial adaptation limits competitive interactions with other lichen species that are adversely affected by periodic immersion and allows *P. leana* to occupy a niche available to few other lichen species (Barkman 1958). *Phaeophyscia leana* is further limited to habitats that are best described as park-like. Park-like habitats include sandy, wooded shorelines with little dense vegetation, open groves of bottomland trees, fencerows, woodland openings, woodland edges, fishing camps, and emergent stands of bald cypress (*Taxodium distichum* (L.) Rich.) in swamp communities. These habitats characteristically have high levels of incident light, although the portion of the trunk colonized by *P. leana* may be sun-dappled and receive fluctuating levels of radiation through the day.

## REPRODUCTION AND DISPERSAL

### Vegetative Diaspores

Foliose lichens often produce well-developed vegetative diaspores or propagules such as isidia and soredia dedicated to asexual reproduction (Hale 1974). Although *P. leana* does not produce specialized vegetative diaspores, fragmentation of the thallus as a result of natural disturbance events may lead to effective vegetative dispersal. Whole thalli or fragments of thalli may be stripped from trees by floodwaters, transported downstream with the flood surge, and lodge on tree bark in an environment conducive for growth to form new thalli.

Historically, habitats would have had more continuity along river corridors and backwaters and populations of *P. leana* would have formed more continuous bands. Historical populations of *P. leana* likely spread gradually, through dissemination along shoreline, floodplain habitats, and within regularly flooded areas of the basin. Swollen river systems would have pervaded floodplain communities depositing propagules and transporting newly displaced thalline fragments downriver. Dispersal over great distances would have been the result of numerous fragment displacement events. *Phaeophyscia leana* dispersal is dependent on population size since large populations would produce more fragments in a flood disturbance event and more effectively colonize new habitats. Smaller populations characteristic of contemporary conditions produce proportionately few propagules, are found in smaller, more restricted wetland habitats, and continue to decline with the loss of thalli.

### Sexual Reproduction

*Phaeophyscia leana* produces distinctive black apothecia which are sessile on the upper surface of the thallus. These ascomata contain asci in which meiosis occurs to form 8 ascospores per ascus (Thomson 1963). *Phaeophyscia leana* produces 2-celled ascospores that are fusiform or ellipsoid in shape with thickened apices and septa (Esslinger 1978). Ascospores produced by the fungal component of the lichen allow for sexual reproduction of the fungus (Purvis 2000). Once discharged into air currents from the asci, ascospores must encounter the proper substrate and habitat to germinate, and subsequently locate the proper photobiont in order for lichenization to occur. Ascospores that settle on suitable substrates may remain dormant until contact with a suitable alga. This pattern of establishment is considered the most common for lichens of temperate regions where growth rates are relatively slow (Hale 1974). Alternatively, ascospores may germinate on contact with a suitable substrate and form a hyphal system that functions as a saprotroph until it comes in contact with a suitable alga for lichenization (Hale 1974). Ascospores which germinate on a substrate and do not contact the proper photobiont most likely perish.

Encountering a symbiotic alga in nature is a fundamentally problematic step in the reproductive process of lichenized fungi. The genus *Phaeophyscia* belongs to the Order Lecanorales and the family Physciaceae (Brodo, Sharnoff, Sharnoff 2001). Members of the Physciaceae are currently known to only utilize the green alga *Trebouxia* as a photobiont (Ahmadjian 1988). The genus *Physcia*, which is closely related to *Phaeophyscia*, utilizes only two specific species of *Trebouxia*; *T. gelatinosa* and *T. impressa* (Ahmadjian 1988). Once an ascospore of *P. leana* is released,

settles on a suitable substrate, and germinates it must encounter a trebouxoid algal cell in order for a lichen thallus to form (i.e. lichenization). *Trebouxia* ssp. are exceedingly rare on corticolous substrates and it has been suggested that sources of *Trebouxia* available for lichenization are limited to free vegetative diaspores which come into contact with the prothallus of the mycobiont or ascospores (Hale 1974). It has also been suggested that during heavy rain events algal cells can be released by lichen thalli and become available for lichenization (Hale 1974). Although spring floods and rain showers or thalli damaged by spring flood events could be the source of free cells, the mechansim that occurs in nature is a matter of speculation. Many lichenologists believe that sexual reproduction in lichens is a vestigial event and that the diversity and success of asexual propagation is the derived condition (Nash 1996).

## ORIGINS

*Phaeophyscia leana* is an Appalachian endemic species presently known to occupy floodplain habitats along the Ohio and Cumberland River systems (Thomson 1963). The position of populations discovered to date suggests an Appalachian origin and subsequent dispersal along the Cumberland and Ohio River drainages. At the closing of the PreCambrian eon (600 MYBP) and the beginning of the Paleozoic era, portions of proto-North America were inundated periodically by shallow equatorial seas. The continental margin of proto-North America that was involved in the eventual formation of the Appalachian Mountain range became an active plate boundary as the Iapetus Plate (oceanic) began to subduct beneath the North American craton. This region of subduction created a number of volcanic island arcs which accreted to the North American plate boundary (Skinner and Porter 1992). By the middle Devonian, the proto-Atlantic or Iapetus Ocean closed as two continental plate boundaries began to converge (Skinner and Porter 1992). The Taconic Orogeny, a middle Ordovician occurrence (440-480 MYBP), is recognized as the initial mountain building event of the Paleozoic era. It was followed by a second accretional event known as the Acadian Orogeny (350-450 MYBP) that was followed by the Alleghenian Orogeny (250-300 MYBP). Two hundred and fifty million years of volcanic events, accretion of terrane (micro-plates and island arcs), and uplift of the early Appalachians during the subduction of the Iapetus Plate, pale in comparison to the Alleghenian Orogeny, the final collisional event of the Pennsylvanian period when the African continental plate (Gondwanaland) collided with the North American craton to form the supercontinent amalgamation Pangea.

This collision zone is recognized today as the ancient eroded belt of fold and thrust mountains consisting of the Ozark-Ouachita region, the Marathon Mountains of Texas, and the Appalachian Highlands (Rodgers 1970). In the late Triassic period (220 MYBP) Pangea began to rift and a new passive tectonic margin formed as North America began todiverge from the African continent toward a more northerly global position. The tectonic coincidences which had formed the Appalachian range subsided and the mountains succumbed to the erosional processes of time. As Pangea fractured, the Atlantic Ocean began to form as did the Caribbean Ocean and the Gulf of Mexico. Crustal down-warping during the mid-Cretaceous (100 MYBP) resulted in the inundation of a portion of central North America known as the Mississippi Embayment which extended as far north as the present day city of Cairo, Illinois (Rodgers 1970). During the Cenozoic

era minor uplift events further altered the Appalachian Highlands causing the rapid downcutting of mountain stream systems particularly evident in the Kanawha and New Rivers, that are tributaries of the Ohio River (Schultz and Compton-Gooding 1991).

The geologic processes which created the Appalacian Highlands created ecological conditions conducive to speciation of organisms within the Appalachian Mountains. The resulting compartmentalization of habitats, particularly evident in the ridge and valley system of Appalachia, induced local ecological contrasts in climate and vegetational patterns, created barriers to gene flow, and supported the speciation of Appalachian endemic taxa (Thomson 1963). The genus *Physcia* includes several taxa that are North American endemics with origins in the Appalachian Mountains. *Physcia subtilis* Degel., *P. millegrana* Degel., and *P. frostii* Degel., as well as a host of subspecific variants, are believed to have arisen in the Appalachian center of endemism (Thomson 1963). The indigenous nature of *Physcia* to Appalachia, and the resultant variability brought about by evolutionary processes, suggest a great antiquity not only of *Physcia* and *Phaeophyscia* but lichen species which have dispersed from this geographical area (Thomson 1963).

The ability to utilize habitat areas which are disturbed by flood events is a unique characteristic of *P. leana* and provides clues to the environmental environmental conditions it may have been exposed during its inception. Scenarios proposed to account for the evolution of *P. leana* are as follows:

- Streams that flood frequently during rain events (typical of present Appalachian physiography) occupied valley floors and contributed a disturbance that an ancestral lichen species had to overcome in order to utilize available yet problematic habitats associated with the basement of the valley. Individuals which could withstand flood events would have been selected and a new species could have emerged to utilize substrates prone to flooding.
- The Appalachian coal basins associated with the western margin of the Appalachian orogenic belt are an indication of the presence of wetland communities during Paleozoic times. These coal swamps could have provided a habitat for the origin of a progenitor of *P. leana*.
- Glacial advancement into North America altered flow patterns of stream systems draining northward to the St. Lawrence River across Indiana, Illinois, and Ohio. At the toe of advancing glaciers, meltwater streams formed and drainage systems were diverted along the ice floe face. For example, it is believed that the ancient Kanawha-New River was dammed by glacial ice that disrupted its northward flow, diverted the river's drainage, and formed the precursors of the present Ohio River drainage system (Lindsey 1966). Fluctuations in the seasonal release of meltwater into drainage systems carrying effluent away from continental glaciers could have led to the adaptation of an ancestral lichen species to frequent flooding disruptions. Habitation of the Ohio River basin by *P. leana* would then be a direct result of the glaciation of continental North America. The formation of the Ohio River drainage could also have provided *P. leana* with a dispersal route from Appalachia (Thomson 1963, Lindsey 1966).

## THE OHIO RIVER WATERWAY

The Ohio River flows 1,578 kilometers (981 river miles) from its origin at the confluence of the Allegheny and Monongahela rivers in Pittsburgh, Pennsylvania, before it empties into the Mississippi River at Cairo, Illinois (USACE 2002). Political jurisdictions within the basin include New York, Pennsylvania, Ohio, Virginia, West Virginia, North Carolina, Maryland, Tennessee, Kentucky, Indiana, and Illinois. The Ohio River Basin drains approximately 203,940 square miles (528,204.6 $km^2$) and major tributaries from its origin to terminus include the Muskingum, Kanawha-New, Guyandotte, Big Sandy, Scioto, Licking, Great Miami, Kentucky, Green, and Wabash Rivers (ORSANCO 2002). The Ohio River Valley Ecosystem Team of the U. S. Fish and Wildlife Service (1999) divides the Ohio River basin into three physiographic provinces, the Appalachian Plateau, the Central Lowlands, and the Interior Low Plateau. The Appalachian Plateau, in the eastern third of the drainage, has the rugged topography inherent to the Appalachian Highlands. This province is characterized by ridge and valley systems with steep gradient streams that commonly flood during seasonal rain events, extensive mixed mesophytic forests, and minimal agriculture due to poor soils. The Central Lowlands province occupies the northwestern third of the basin and has been greatly modified by Pleistocene glaciation. Soils of this province are relatively level owing to glacial advances and deposition, and due to high soil fertility, supports a rigorous agricultural industry. The Interior Low Plateau province located in the southwestern third of the Ohio River drainage is characterized by limestone formations and rolling terrain of the Lexington Plains and Bluegrass regions of Kentucky and the Shawnee Hills of southern Illinois. The floodplain areas in this province are dominated by agriculture while the rugged hills and bluff-lines are forested.

The historic river bed dropped a half foot per mile resulting in a fast, shallow flowing stream with pools, riffles, and falls. By 1820, 102 obstructions to navigation were identified between Pittsburgh, Pennsylvania and Louisville, Kentucky that made navigation of the waterway a treacherous undertaking (Ohio River Fisheries Management Team 1995). Improvements to navigation began in 1825 and the first lock and dam was completed below Pittsburgh in 1885 (ORFMT 1995). Channelization of the river was completed in 1929 with 50 low lock and dam structures in operation (ORFMT 1995). These were later modernized with 20 higher navigation dams that support a 2.7m minimum depth for commercial navigation (ORFMT 1995). The locks and dams on the Ohio River and its major tributaries have decreased the velocity of the river and the advent of modern high-lift facilities have created a deeper (average depth of 7.3 m), more languid river system than existed before anthropogenic modification (ORSANCO 2002). The Ohio River is the busiest inland waterway system in the United States and sustains the transport of twice the barge tonnage of the Great Lakes system. The average annual commercial cargo shipped on the Ohio River averages 230 million tons, and includes coal, crude oil, and petroleum goods as well as major commodities such as aggregates, iron, steel, chemicals, and grain (ORFMT 1995, ORSANCO 2002).

## DESCRIPTION OF PRINCIPAL STUDY AREAS

Surveys were conducted in all counties bordering the Wabash and Ohio Rivers in Illinois as well as selected areas along the Mississippi River. The physiography of southern Illinois, as well as landuse patterns present in floodplains or riparian corridors, dictate which areas are most conducive for populations of *P. leana* and where survey work should be concentrated. In Illinois, the Gallatin Bottoms in Gallatin County, the Black Bottom in Massac County, and the White County floodplain of the Wabash River were most important in this study (Fig. 2). These three counties have large floodplains, limited industrial buildup along the rivers, and large wetland features located within the floodplains. Due to their position within the dissected uplands of the Shawnee Hills Division, Pope and Hardin Counties have bluff lines along the Ohio River and do not have large areas of floodplain habitat. The river shorelines of Pulaski and Alexander County are heavily industrialized due to their proximity to the confluence of the Ohio and Mississippi Rivers. Facilities for the loading of commodities to be transported by barge and tow on the inland waterway system and electrical power generating stations are prevalent and have negated potential shoreline habitats for *P. leana*.

Gallatin, Hardin, Massac, Pope, and White counties have continental climates with an annual temperature range of 100 degrees, with maximum temperatures reaching 38° C two-thirds of the summers with the hottest months being July and August (Martin 1996, Parks 1975, Wallace and Fehrenbacher 1969). Winter minimums of -18° C or less are reached half of the winter season with January and February being the coldest months (Parks 1975). Annual precipitation averages 112-116 cm (Parks 1975, Martin 1996, Wallace and Fehrenbacher 1969). The first six months of the year (January through June) receive the highest average precipitation annually, averaging nearly 10 cm or more precipitation per month, and September and October are the driest months (Wallace 1969). The growing season averages 200 days at Paducah, Kentucky (McCracken Co.), which correlates closely with the Black Bottom of Massac County, and 187 days at New Burnside, Illinois (Johnson Co.), which corresponds to the Burden Falls Wilderness in northern Pope County (Parks 1975) . December, January, and February are characterized by annual seasonal snowfalls of up to 15.8 inches in White County (Martin 1996).

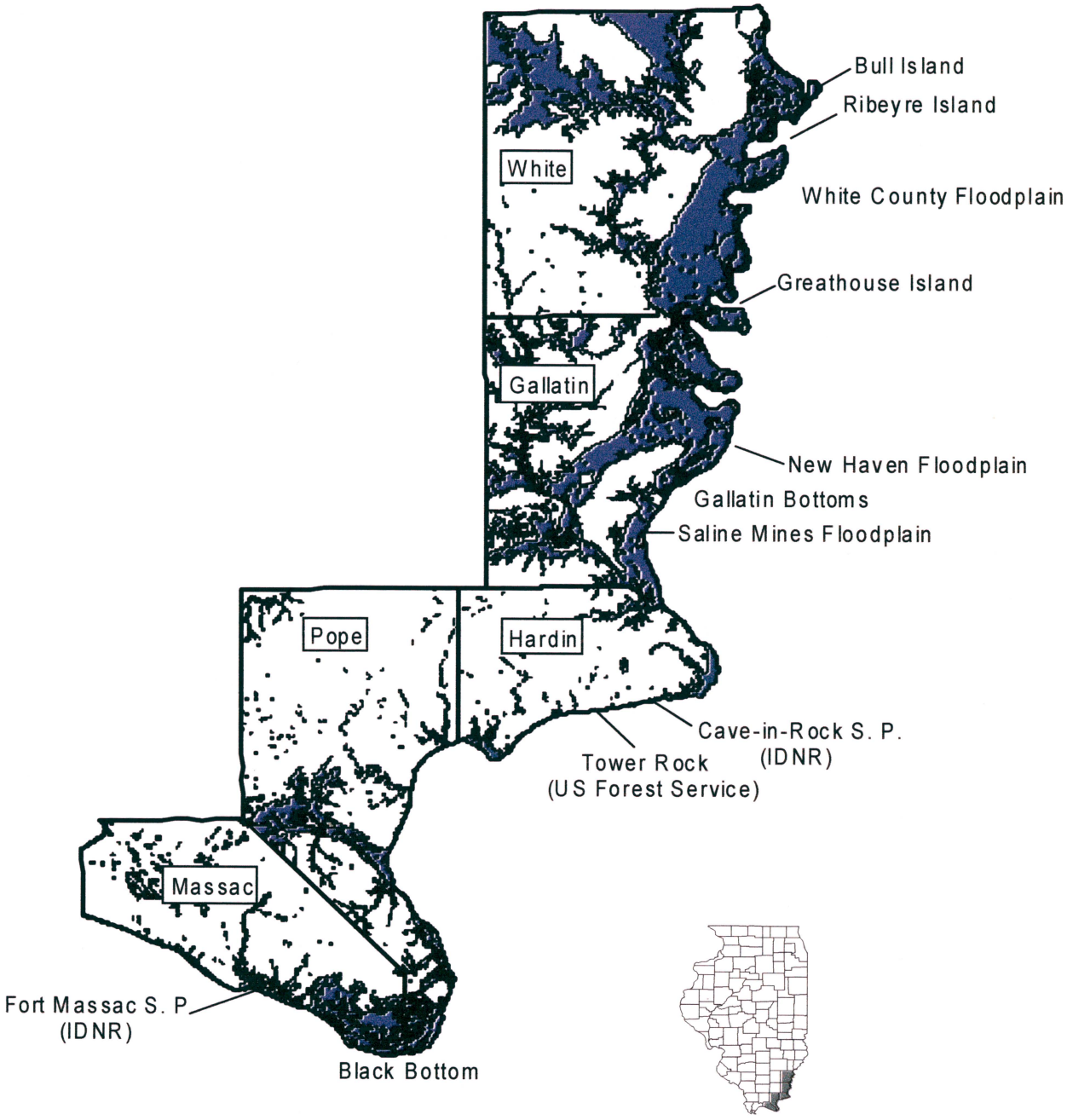


**Figure 2.** Principle floodplain study areas in Illinois

## The Black Bottom, Massac County, Illinois

### Physiographic Characteristics

Located east of Brookport and south of the village of Unionville, the Black Bottom makes up the southeastern toe of Massac County. The Black Bottom is a crescent shaped meander loop floodplain approximately 55 square kilometers (21.5 mi.$^2$) in area (Butler 1977). The bottom is 5 kilometers wide from the Ohio River towards Unionville and 16 kilometers long from east to west. The bottom is characterized by long, narrow, natural lakes interconnected by sloughs and cutoffs. Loon Lake, Brushy Lake, and Allard Lake, located within sections 20 and 29, are situated within the western bottom. Kinneman Lake, which spans the center of the study area, traverses sections 28, 34, and 35 and terminates at the boundary of section 36. Several smaller, channel-like lakes, the largest of which is Beaver Dam Lake, lie south of Kinneman Lake and the Redbird Ridge area. Avery Lake, Sugar Camp Lake, and Clear Lake lie to the northeast of Kinneman Lake. The floodplain surface has a washboard topography of long, low, flat, crested ridges, paralleling each other and the curvature of the Ohio River, that are separated by shallow depressional areas or swales. Ridgetop elevations vary from 102 meters above sea level in the eastern bottoms in the vicinity of New Liberty to 97 meters in the western bottom (Butler 1977).

### Floral Characteristics

Analysis of the General Land Office survey records for Massac County, compiled by Augustus Stone, Sr. and B. F. Stone in 1806, led Butler (1977) to identify three primary floral zones within the Black Bottom. The Hardwood Bottom, Swamp (divided into deep and shallow swamp communities), and Cane Bottom (divided further into the cane bottom proper and the river-lakeshore subzones)were specified by Butler as the primary communities composing the Black Bottom prior to European settlement. The Hardwood Bottom zone is the most elevated but receives overflow from the Ohio River and remains ponded during the winter and early spring flood seasons. This zone occupies ridgelines and areas distant from the Ohio River and supports a higher number of *Quercus* and *Carya* species than swale areas. The Swamp grouping correlates with Mohlenbrock's Deep Swamp community or the *Taxodium, Nyssa aquatica / Rosa palustris* Marsh. community (Voigt & Mohlenbrock 1964). Dominants of Deep Swamp communities are *Taxodium distichum, Nyssa aquatica, Populus heterophylla* L., *Carya aquatica* (Michx. f.) Nutt., *Fraxinus profunda* (Bush) Britt., *Gleditisia aquatica* Marsh., and *Acer drummondii* Hooker & Arnott (Voigt & Mohlenbrock 1964). Buttonbush (*Cephalanthus occidentalis* L.) is a ubiquitous understory component that often forms "thickets" in shallow water areas present along the peripheries of oxbow lakes. Deep Swamps of the Black Bottom are undergoing transitional changes as a result of local agricultural practices. Drainage and land clearing have significantly reduced deep swamp areas within the Black Bottom. Sedimentary filling of these wetlands is responsible for the conversion of deeper water communities to more disturbed shallow water wetlands.

Black Bottom shallow swamp communities, as well as shallow swamp communities in Gallatin County, such as the Goose Pond INAI site and Goose Pond Scatters, are disturbed by high sediment loads and have shrub layers dominated by *Cephalanthus occidentalis*. After the subsidence of overflow events, the shrub layer and tree trunks exposed to flood waters are heavily coated with deposited silt. Voigt and Mohlenbrock (1964) recognize Shallow Swamps, areas of less than one foot of standing water, as the *Taxodium, Fraxinus tomentosa* Michx. f. / *Itea virginica* L. community. In Shallow Swamps, *Nyssa aquatica* is replaced *by Fraxinus tomentosa* and its associates, *Liquidambar styraciflua, Ulmus rubra* Muhl., and *Acer rubrum* L..

The Cane Bottom, as described by Butler (1977), is the area of bottom land composed of fertile soils of the Armiesburg series associated with the Ohio River and encompassing the channel lakes. Descriptive elements of the General Land Office survey notes for this area include "thick cane brakes," "good bottom," "thick cane," and "thick cane bottom." Tree species present within the cane bottom include *Carya* spp., *Carya ovata* (Mill.) K. Koch, *Carya illinoensis, Ulmus* spp., *Fraxinus* spp., *Juglans nigra* L., *Quercus bicolor* Willd., *Acer saccharum, Quercus macrocarpa* Michx., *Liriodendron tulipifera* L., *Morus rubra* L., and *Gleditsia triacanthos* L. (Butler 1977). Within swale areas *Quercus palustris* Muench., *Liquidambar styraciflua*, and *Fraxinus* ssp. are common. Areas along the lakeshores or along the river, within the cane bottom, have slightly different floral assemblages. Dominants include *Salix nigra* Marsh., *Populus deltoides, Platanus occidentalis, Acer rubrum, Gleditsia triacanthos, Acer saccharinum, Acer negundo, Ulmus rubra,* and *Ulmus americana* (Butler 1977). The riverbank subzone of the Black Bottom was at one time dominated by *Populus deltoides*. According to Butler (1977), the survey record refers to the area near the Ohio River along the section line between Sections 33 and 34 (T16S R6E), roughly from Pearcy Camp along the north shore of Kinneman Lake perpendicular to the Ohio River channel, as a "cottonwood bottom." Whether or not *P. leana* occupied this cottonwood bottom historically is a matter of speculation, but it is likely that it did due to the importance of *Populus deltoides* as a substrate and the presence of the lichen within the floodplain at present time. *Taxodium distichum* and *Nyssa aquatica* are emergent along the shorelines of the channel lakes and the survey notes document dense stands of cane encompassing the channel lakes as well. Although remnants of the cane bottoms can still be observed along lakes, and within areas which are still forested, the preponderance of the cane bottom has long since been converted to rowcrop agriculture.

## Soils of the Black Bottom

Seven percent or 4381.7 hectares of Massac County remain in wetland habitats, 5.4% or 3387.4 hectares remain in bottomland forest, and an additional 1335.7 hectares are open water areas (IL Land-Use Clearinghouse 2002). Soils of the Black Bottom chiefly belong to the Armiesburg-Emma association, a moderately permeable soil formed in alluvial deposition inherent to river floodplains (Parks 1975). The soils are nearly level to moderately sloping and well drained to moderately well drained. Particular soils of importance within the Black Bottom include Armiesburg silty clay loam and Huntington silt loam that surround the large natural channel lakes situated within the Bottom. The Armiesburg

series is a group of soils which are created from water-deposited sediments and consist of deep, nearly level to gently undulating, well-drained soils of bottom lands and areas surrounding the channel lakes and drainageways of the Black Bottom. The Huntington series consists of deep, nearly level, well-drained soils adjacent to the Ohio River, formed in silty water-borne sediments more than 50 inches thick (Parks 1975). Huntington silt loam is located 1.5 to 6 meters lower than the main floodplain and is often situated between broad plains of Armiesburg soils (Parks 1975). Slopes are generally gradual but may be steeper when associated with wetland features or the natural channel lakes of the Black Bottom. The rich alluvial soils of the Black Bottom supported a diverse forest and wetland flora which was well suited for *P. leana* before European anthropogenic disruption. Owing to the natural productivity of these soils, the Black Bottom is now utilized for row crop agriculture rather than to support floral communities and substrates utilizable by *P. leana*.

### Presettlement Conditions

Earthen mounds constructed by ancient Mississippian peoples have drawn the interest of the archeological community and much is known about the historical conditions of areas supporting major Mississippian centers. Fortuitously, the Black Bottom of Massac County shows evidence of a particularly large Mississippian settlement known as the Kincaid Site (Butler 1977). The Kincaid Site is located along the northern shore of Avery Lake, a kilometer from the present Ohio River channel, situated along the Massac-Pope county border 5.7 kilometers from the village of New Liberty. Avery Lake is a long, narrow, permanent channel-like lake similar to Allard, Kinneman, and Loon Lakes. A Mississippian population established agricultural encampments throughout the lower Black Bottom and significantly affected the floral composition of the Cane Bottom zone (Butler 1977). All settlements located within the Black Bottom were situated within or in close proximity to the cane bottom. Stands of *Arundinaria gigantea* (Walt.) Chapm. indicate the presence of fertile well drained soils located on higher stations of the floodplain which are affected by inundation less regularly than areas of lower elevation(Butler 1977). Canebrakes are easily cleared with fire and cane is a fast burning, light fuel, similar to tallgrass species of prairie ecosystems. The combination of highly fertile soils positioned in less-flood-prone areas and the ease by which this land could be cleared for cultivation provided sufficient inducement for the selection of field sites in canebrake areas (Butler 1977).

The ignition of canebrakes within the Black Bottom by Mississippian peoples would have had certain ramifications for the understory of surrounding bottomland forest communities. Ground fires originating from the canebrakes would have traveled into adjacent forested areas where the understories of riverbank-lakeshore subzones and associated forested bottomland areas would have been drastically altered. Understories would have been more open as a result of shrub layer die-back and more fire tolerant tree species would have been selected. The clearing effect of these fires presumably would have provided more park-like habitats well suited for the growth of *P. leana*. River slack-water periods would have allowed fires to move from upland areas onto floodplains where fires would burn up to permanent, deep water, wetland communities. Floodplain fires would have promoted open understories and park-like habitats within areas which seasonally flood and provide a particularly conducive combination of factors for the support of larger historical populations of *P. leana*.

## The White County Floodplain

### Physiographic Characteristics

In White County, 74% of the available acreage is dedicated to rowcrop agriculture, 6% remains forested, and 895 hectares of natural wetland features remain (IL Land-Use Clearinghouse 2002). The primary floodplains are located in southeastern White County where the Wabash and Little Wabash River drainages coincide. Alluvial sediments have been deposited due to flooding of the Wabash River systems and old river channels and slack water sloughs present within the floodplain. Ribeyre Island and Greathouse Island are two large abandoned river channels of the Wabash River present within the White County floodplain. Sandy Slough, Goose Pond Swamp, The Bayou, and Brushy Slough represent slackwater sloughs of both the Wabash and Little Wabash Rivers.

### Soils of White County Floodplains

Soil associations in White County include the Armiesburg-Petrolia-Nolin and the Skelton-Ruark-Crawleyville associations (Martin 1996). The Armiesburg association is present along the Wabash River on rises and ridges. Poorly drained Petrolia type soils are located within sloughs. Although native vegetation was principally bottomland forest, wetland flora or wet prairie communities, the land is utilized principally for cultivation even though overflow hazards are prevalent. The Skelton-Ruark-Crawleyville association was formed in outwash deposits on terraces and lake plains and is characterized by gradual, broad, low flats with some ridges, side slopes, and sand dunes. Skelton soils are permeable, internally draining sandy loams, Ruark soils are nearly level, poorly drained and common on broad lowland flats and drainageways, and Crawleyville soils are nearly level soils on broad rises and terraces (Martin 1996).

### Landuse

The floodplain of southern White County, as well as the bottomland areas of northeastern Gallatin County, are intensively cultivated and center pivot irrigation is utilized on the most productive farmland. An aquifer, influenced by the proximity of the Wabash River, allows for the alteration of soil surface moisture levels during the growing season and further increases the potential of floodplain agriculture in Gallatin and White counties. As a result, forested communities are highly residual within river floodplains. Rowcrop agriculture, logging, and drainage have resulted in the demise of expanses of forested bottomlands along the Lower Wabash River as well as the bottomland forests of the Ohio and Cumberland Rivers. Cultivation of river floodplains involves an element of risk due to flooding hazards, however levee construction has alleviated some crop losses within significant floodplain areas. Short-season soybeans are commonly seeded in order to maximize the available growing season. Fields often stay wet long into the spring planting period due to the characteristic overflow of flood zones in late winter and early spring. Flood events characteristically deposit swaths of debris across the floodplain, including piles of uprooted trees and associated woody flotsam. Compared to upland sites, spring dryout and planting comes later. Lower terraces, containing swales on particularly wet years, will have ponded areas that will be left for "patch-planting" at a later time when these plots dry sufficiently for access and proper seeding.

During the summer, the low water level of rivers provides a period of safety from flooding for growing crops but the agricultural season is often terminated by fall rain events which raise river stages and produce floods.

## The Gallatin Bottoms

### Physiographic Characteristics

The Gallatin Bottoms lies within the bottomlands section of the southern extent of the Wabash Border Division. Here, the Little Wabash River joins the Wabash River near New Haven, upstream of the terminus of the Wabash River. The Wabash River then converges with the Ohio River, just north of Wabash Island, Kentucky (Ohio River Mile 848) within sight of the John T. Myers Locks and Dam (US ACE 2000). The union of these three rivers has produced an expansive floodplain which retains wetland communities including deep flowing slough channels, large oxbow lakes, and cypress swamps that support populations of *P. leana* in relative abundance.

Within the Gallatin Bottoms, 8.8 $km^2$ consist of wetland areas larger than 16 hectares in size or more than 0.2 kilometers in width (Wallace and Fehrenbacher 1969). Original land survey records refer to "low drownded bottoms," "flat drownded land," "overflowed land," or simply "all swampy." Survey records also include descriptive phrases concerning the wetland features present within the Gallatin Bottoms such as "1st 3850 swamp the rest pond impassable," "pond too deep to wade," "mile continues in willow pond all the length," "all swamp impassable," and, in reference to present day Hulda Lake, "open lake deep as Ohio." Approximately 8.6% of Gallatin County is composed of wetland ecosystems including 1747.6 hectares of lakes, rivers, and streams (IL Land-Use Clearinghouse 2002). In addition to wetland communities, 7.3% (6231 hectares) of the county remains in bottomland forest (IL Land-Use Clearinghouse 2002). The Gallatin Bottoms can be subdivided into primary floodplains, the New Haven floodplain and the Saline Mines floodplain. The New Haven floodplain lies between New Haven and Old Shawneetown and includes the New Haven Ponds (Clark, Horseshoe, and Beaver Pond), the Gallatin Sloughs (Yellowbank, Cattail, Running Slough, and others), and the Old Shawneetown Lakes, (Hulda, Round Pond, Long Pond, Fehrer, Black, Big, and Fish Lakes). The Saline Mines floodplain is formed at the confluence of the Saline and Ohio Rivers and now supports a single oxbow lake community, Mud Lake. Although large wetland communities still persist, the remainder of Gallatin County is classified as built-up land, woodland areas, or land converted to agricultural use.

### Floral Characteristics

Voigt and Mohlenbrock (1964) studied the composition of bottomland forests along the Lower Wabash River in Gallatin and White counties. Forest composition based on basal area was interpreted in several areas in the vicinity of New Haven. Of particular relevance to this study is ecological / floristic data obtained by Mohlenbrock at Cattail Slough (Sect. 31, T7S, R10E). Trees of greatest ecological importance within this wetland feature (with composition percentage values) and available for colonization by *P. leana* included *Quercus palustris* (0.4), *Fraxinus pennsylvanica* var.

*subintegerrima* (5.6), *Quercus bicolor* (0.8), *Ulmus americana* (6.5), *Liquidambar styraciflua* (2.6), *Acer saccharinum* (27.4), *Platanus occidentalis* (16.6), *Juglans nigra* (0.5), *Ulmus rubra* (1.3), *Nyssa sylvatica* Marsh. (0.4), and *Quercus macrocarpa* (5.5). East of Inman, in the vicinity of Willow Pond or Joes Slough, (Sect. 12, T8S, R9E), Mohlenbrock reported a different set of major compositional species, including *Quercus alba* L. (10.1), *Carya ovata* (17.5), *Quercus lyrata* Walt. (1.4), *Quercus velutina* Lam. (13.4), *Quercus palustris* (1.1), *Fraxinus pennsylvanica* var. *subintegerrima* (1.4), *Quercus bicolor* (1.8), *Ulmus americana* (9.0), *Carya illinoensis* (1.1), *Liquidambar styraciflua* (8.8), *Ulmus rubra* (3.9), *Nyssa sylvatica* (6.4), *Quercus macrocarpa* (5.9), and *Celtis occidentalis* (1.6). Voigt and Mohlenbrock also ranked the most abundant components of the herbaceous understory including *Toxicodendron radicans* (100% constance); *Campsis radicans* (L.) Seem (77% constance); and *Parthenocissus quinquefolia* (L.) Planch. (44% constance); and, *Arundinaria gigantea*; (44% constance).

### Soils of the Gallatin Bottoms

The soils of the Karnak-Allison-Wakeland association prevalent within the Gallatin Bottoms are deep, slowly permeable, nearly level, silty and clayey soils that were formed from the deposition of alluvial river sediments and are generally productive, fertile agricultural soils (Wallace and Fehrenbacher1969).

### Landuse

Wetland communities in Gallatin County have been adversely affected by oil exploration and agricultural practices that are the economic mainstay of the area. Pollution from oil field enterprises that dot the Gallatin floodplain impinge on the health of wetland and riverine systems. Land clearing, drainage programs, and levee protection of bottomlands intended to produce more productive farmland have significantly altered floodplain ecosystems and environmental processes of the Gallatin Bottoms. Agricultural pesticides and siltation from field erosion have transfigured wetland habitats that remain. The destruction of wetland communities within the Gallatin Bottoms, whether as obvious as the drainage of a backwater slough or insidious as the slow siltation of an oxbow lake, threaten to change the specialized habitats required by *P. leana* and raise concern as to the continued survival of *P. leana* in Gallatin County.

## THE CUMBERLAND RIVER BASIN

The headwaters of the Cumberland River originate on the Cumberland Plateau at the conflux of the Poor and Clover Forks Rivers in Harlan County, Kentucky, between the Pine Mountain and Cumberland Mountain ridgelines. The Cumberland River traverses approximately 1115 km (693 river miles) before converging with the Ohio River (Ohio River Mile 920.4) at Smithland, Kentucky. The total basin area covers 46412.8 $km^2$ (ORSANCO 2002). A commercially navigable channel is maintained from the terminus to the head of navigation on the river at Celina, Tennessee, 381 river miles (613 km) from Smithland (USACE 2002). Primary tributaries entering the Cumberland River of importance to this study include the Obey and Caney Fork Rivers.

Cordell Hull Lock and Dam is located 5 river miles upstream from Carthage, Tennessee. At full pool, 504.0 ft

above MSL, Cordell Hull Reservoir has 11,900 surface acres (ORSANCO 2002, USACE 2002). Below Carthage the mainstem storage impoundment, Old Hickory Lake, is maintained by the Old Hickory Dam and powerstation at river mile 216.2 in Sumner and Davidson counties, 25 river miles upstream from Nashville, Tennessee (ORSANCO 2002, USACE 2002). At full pool, 455 ft above MSL, the surface acreage of Old Hickory Lake is 22,500 acres (ORSANCO 2002, USACE 2002). Important large impoundments on tributaries of the Cumberland include the Dale Hollow Lake Reservoir on the Obey River and a large impoundment located on the Caney Fork River, the Center Hill Lake Reservoir. The Center Hill Dam on the Caney Fork River is approximately 20 km southeast of Carthage, Tennessee.

Impoundments constructed on the Cumberland and Caney Fork Rivers are intended to control damaging flood events, create a commercially navigable waterway, generate hydroelectric power, and provide recreational opportunities and tourist trade to local economies in Kentucky and Tennessee (ORSANCO 2002). While these activities have been generally successful,the river systems and associated floodplains have been significantly altered. Stream continuity has been disrupted and natural flood disturbances have been dampened. Mainstem reservoirs such as Old Hickory and Cordell Hull Lake, among others, inundate vast portions of the river corridor. The Cumberland River is impounded along much of its length in order to produce reliable hydropower and fluctuations in water levels are monitored throughout the Cumberland drainage to optimize power output.

Cumberland River impoundments are uninhabitable by *P. leana* along the majority of the drainage basin due to the lack of adequate water level fluctuations. The flooding processes required by *P. leana* are rarely evident as proximity to the impounding structures increases although "backwater" areas of the lakes have water level fluctuations that most closely resemble conditions within the drainage prior to dam emplacement. Populations of *P. leana* located in Tennessee utilize backwaters of Old Hickory Lake or are situated in areas where river systems are less influenced by impoundment. The Center Hill Dam population is located immediately below the hydroelectric dam of the Center Hill Reservoir and although the Hell Bend population is further down the drainage it still lies within areas in which river stages are allowed to fluctuate. Impoundments on the Cumberland River destroyed available substrates and inundated populations of *P. leana* when filling. Farther from dam facilities, the riverine zone was not permanently inundated, and whereas some substrate trees were lost, populations of *P. leana* were able to persist. Segments of the Cumberland River between the lakes act as refugia for *P. leana* bounded by "dead zones" of large impoundments. The reservoirs also limit the dispersal of propagules into suitable habitats downstream. Propagules which are carried into the lake systems will not be supported by flooding disturbance events needed for persistence and are doomed as transport through the reservoirs is unlikely.

## METHODS

Reconnaisance of *P. leana* populations began in winter 2001 and continued through summer 2002. Watercraft, automobile, and foot surveys were implemented during searches for populations of *P. leana*. Previously reported populations were visited initially to ascertain whether known populations had been lost and to develop a search image for habitats required by the lichen. Accurate documentation of known and new populations discovered during surveys was accomplished with global positioning technology in order to facilitate relocation of populations. UTM position data was recorded with a 12 parallel-channel-processing GPS instrument, (Garmin II+ unit), calibrated to map datum WGS 84. All UTM positions recorded were averaged for a 60 second time interval prior to final tabulation. UTM coordinates were then entered into MapTech mapping software for accurate positioning of waypoints onto topographic maps and digital orthoquadrangle images.

Watercraft surveys were conducted on the Wabash River from the mouth of the Wabash to the Illinois/Indiana border above Darwin Ferry at Darwin, Illinois (Wabash River Mile 200). Surveys on the Wabash began in January of 2002 and were completed after the fall of the spring flood crest in July of 2002. In addition to reconnaissance of the Wabash River, the Little Wabash River from Carmi, Illinois to its confluence with the Wabash River was also surveyed. During watercraft surveys, all populations of *P. leana* located were recorded as waypoints as were major disembarkment locations for surveys on foot along the shoreline corridor.

Land surveys were guided by analysis of aerial USGS digital orthoquadrangle images, USDA Soil Survey aerials, USGS topographic maps, and US ACE Ohio River Navigation Charts (2000). Surveys on foot were conducted in the sloughs of Gallatin, Massac, and White counties in Illinois, where suitable habitats are most abundant and access by any other means is impractical, as well as within large floodplain habitats of Posey County, Indiana. Vehicular surveys were initiated along the Ohio, Wabash, and portions of the Mississippi River floodplains in Illinois; the Ohio and Wabash River floodplains in Indiana; portions of the Ohio and Cumberland Rivers in Kentucky; and segments of the Cumberland and Caney Fork Rivers in Tennessee. Attention was directed to riverside and floodplain roadways as well as river access points during vehicular surveys.

Large populations which appear secure and likely to persist are labeled as core sites. Smaller populations which recieve higher levels of disturbance are labeled as vulnerable sites and have made up the majority of populations discovered. The smallest populations located, consisting of few individuals often on single substrates, are labeled as point populations and are most susceptible to extirpation.

In this study populations of *P. leana* have been designated by geographical boundaries. Areas of inhabitance are characteristically limited by the continuity of habitats present. Park-like habitat areas are often bordered by land which will not sustain populations of *P. leana*, such as agricultural fields, eroded river bends, shoreline development, etc. Individual substrates with a number of *P. leana* thalli are populations, but during this study and in previous studies (Wilhelm and Master 1994, Wilhelm, Masters, and Shimp 2000) the term population has been utilized to identify groups of substrates colonized by *P. leana*. This study has labeled these groups of thalli from geograpically seperated habitats as populations of *P. leana* for ease of discussion.

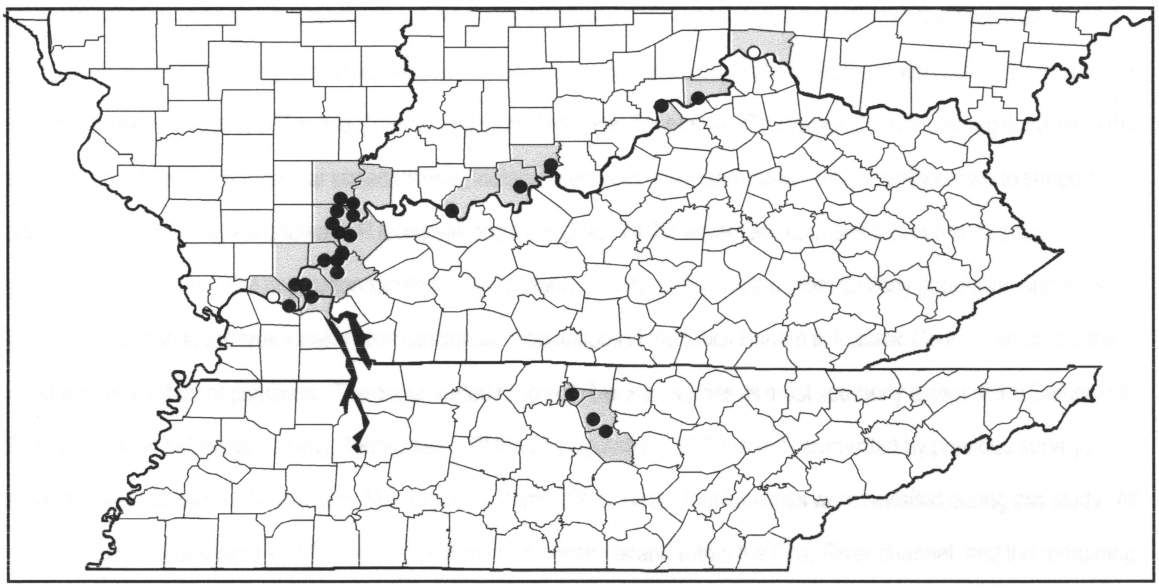

**Figure 3.** General distribution of extant and historical populations of *P. leana*. Solid circles denote (●) principle populations (n=23); open circles (○) represent the type locality and the Fort Massac population which are no longer extant (n=2). Smaller populations present within major population centers are combined within single circles. Counties inhabited by *P. leana* are shaded in grey.

## RESULTS

Eighty-five waypoints were recorded to document populations of *P. leana* during surveys conducted within the Ohio River basin. Of these, 78 waypoints were recorded within floodplain communities of southern Illinois, particularly within the Gallatin Bottoms of eastern Gallatin County and the Black Bottom of Massac County. Wilhelm, Masters, and Shimp (2000) suggested that further surveys of Gallatin County sloughs would yield additional populations of *P. leana*. This study demonstrated that additional sloughs and oxbow lake communities in Gallatin County were indeed colonized by *P. leana*. After observing the density of lichen stands associated with Gallatin County oxbow lakes, natural lake communities were recognized as important wetland habitats for *P. leana* and areas in which survey work should be concentrated. Populations of *P. leana* located in association with the oxbow lake communities of the Black Bottom are not as dense or abundant as observed in Gallatin County. In addition, bottomland woodlands in the Black Bottom were less inhabited than woodlands present within the Gallatin Bottoms. This suggests that natural lakes, bottomland forests, and other wetland habitats in the Black Bottom are not as well suited to support *P. leana* populations because of higher levels of disturbance. Natural lake communities or deep swamps are more likely to retain ecological requirements essential to support populations of *P. leana* and display more resistance to conversion to less suitable habitats than sloughs or shallow water wetland features.

Seven waypoints document newly discovered populations in Indiana, Kentucky, and Tennessee. The new Indiana populations were located during watercraft surveys of the Wabash River and automobile surveys of Ohio River floodplains in southern Indiana. Watercraft surveys documented populations in Posey County, including the River Mile 18

Island Population, the Mackeys Island Population, and the Hovey Lake WMA Population. Populations were also discovered in Spencer, Perry, Crawford, and Switzerland County. Single populations were located across from Madison, Indiana at Milton, Kentucky (Trimble County) and near Hartsville, Tennessee (Trousdale County), during surveys of the Cumberland River. Although four states (Illinois, Indiana, Kentucky, and Tennessee) are currently known to support populations of *P. leana,* it is unclear if *P. leana* still occurs in Ohio. Of the seventeen counties that currently support populations of *P. leana,* the population located in Switzerland County, Indiana is the most easterly population and is the closest population to the type locality near Cincinnati. Populations in the Black Bottom in Massac County, Illinois are the most westerly extant populations. The documented range of *P. leana* reaches its most southerly extent at the Center Hill Dam population in DeKalb County, Tennessee . Of the 25 populations of *P. leana* documented by previous surveys (Wilhelm and Masters 1994, Wilhelm, Masters, and Shimp 2000), all but four localities were revisited during this study. All unvisited populations were small; one was located on Hurricane Island within the Ohio River channel, and the remaining three were unmapped and difficult to locate and reverify.

Four populations identified by Wilhelm and Masters (1994) and Wilhelm, Masters, and Shimp (2000) are no longer extant. The Fort Massac population along the banks of Massac Creek and the Ohio River within Fort Massac State Park was lost prior to the submission of the report to the Illinois Department of Conservation by Wilhelm and Masters in 1994. Surveys of the Fort Massac bottomlands by Wilhelm, Masters, and Shimp in 1994 failed to relocate this population and it was reported that the single *Populus deltoides* substrate supporting the population was lost to bank erosion. Surveys of areas along Massac Creek and the adjacent Ohio River shoreline during this study also failed to locate thalli of *P. leana.* A second population was lost at the New Haven boat launch on the Little Wabash River. The two thalli which were growing on *Fraxinus pennsylvanica* var *subinterrigma* at this locality, no longer exist on the substrate. The Elizabethtown population located west of Big Creek along the Ohio River shoreline has been converted to a quarry and loading facility. The final site, a population near the terminus of Haney Creek, was reported by Shimp (pers. comm. 2002) to have been lost as a result of shoreline erosion. These four populations, plus the type locality population, are the only sites where *P. leana* has been extirpated.

## Status of Populations of *P. leana* discovered by Wilhelm, Masters, and Shimp

The present status of populations of *P. leana* discovered by Wilhelm, Masters, and Shimp are arranged in geographical descent, with the first population addressed being the most northerly locality and the last population being the most westerly and southerly population surveyed in Illinois. The status of *P. leana* populations in Indiana, Kentucky, and Tennessee reported by Wilhelm, Masters, and Shimp are presented following the Illinois populations.

## Illinois Populations (Figs. 4, 5, 6, 7)

| Population | Voucher Data | Status |
|---|---|---|
| **Gallatin Co.** | | |
| 1. New Haven Boat Launch | Wilhelm and Masters 22346 | Defunct |
| The New Haven access site to the Little Wabash River at one time supported two thalli located at the base of *Fraxinus pennsylvanica var. subintegerrina* near the boatramp. These thalli could not be relocated and the population has been lost. | | |
| 2. Clark Pond | Shimp 5274 | Extant |
| The population is located adjacent to Big Barn Road, the primary roadway accessing the Gallatin Bottoms. Thalli are scattered on trees along the roadway. | | |
| 3. Horseshoe Pond | Shimp 5273 | Extant |
| Thalli were noted on trees near the bottomland roadway. The population is still extant although some vegetation in the right-of-way has been negatively affected by herbicide application. | | |
| 4. Beaver Pond | Wilhelm & Masters 22343-22345 | Extant |
| The population is located northeast of the bridge crossing the Beaver Pond channel in an area frequented by fishing parties. The population benefits from the alteration of the surrounding vegetation by visitors to the wetland. | | |
| 5. Cow Pond Slough | Shimp 5271 | Extant |
| The population is located near the roadway running through Cow Pond Slough. | | |
| 6. Hulda Woods | Wilhelm & Masters 22339, 22341, 22342 | Extant |
| Thalli are located predominantly on trees along the southern edge of the forest tract. | | |
| 7. Hulda Lake | W. & Masters 22336-22338, Shimp 5272 | Extant |
| The population is located at the southern extent of the Hulda Lake oxbow on trees associated with a former homesite. The population is stable at present, although the trees are located in very close proximity to the roadway and could be damaged or destroyed by road maintenance. | | |
| 8. Long Pond (Long Pond / Round Pond Complex) | Shimp 5270 | Extant |
| Although Shimp's collection was obtained on the western side of Long Pond, the majority of the population in this area is located along the bottomland roadway south of Round Pond within the Round Pond / Long Pond oxbow lake complex. Thalli are readily apparent on *Quercus palustris* and *Quercus pagodaefolia* Ell. in a park-like setting adjacent to the roadway east of Long Pond. The population extends to the southern shore of Round Pond, within the fishing village on the western shore of Round Pond, and along the eastern shoreline to lesser extents. This locality is considered a core site for Gallatin County. | | |

9. Big Lake — Shimp 5269 — Extant

Considered a core site for *P. leana* in Gallatin County, Big Lake supports a large component of the total *P. leana* population in Illinois. The numbers of thalli observed within the fishing camp along the western shore of the lake are equivalent to larger populations observed elsewhere. Relatively undisturbed habitats surrounding the lake and the large assemblages of *Taxodium distichum* associated with the wetland support a large population of *P. leana*. Shimp's collection was obtained at the southern end of Big Lake. This population does not appear to be threatened at this time although timber harvest within the surrounding bottomland forest would certainly be detrimental.

10. Bell Island, KY — Wilhelm & Shimp 22332 — Extant

Discovered during watercraft surveillance, this population is considered a continuation of the Big Lake-Fish Lake oxbow lake area. The site actually lies within the state of Kentucky although it is a component of the Illinois shoreline adjacent to the Ohio River.

**Hardin Co.**

11. Finneyville — Shimp & Basinger 5386, 5387 — Extant

Shimp and Basinger surveyed this population from the Finneyville Road south to Ohio River Mile 870 near Sturgeon Island. Reconnaisance during this study identified additional thalli (approximately 20 individuals) extending from the Finneyville road to "Finney Rock" near Ohio River Mile 869. Thus the Finneyville population (T. 11S R. 10E S.21) extends from "Finney Rock" (near the southern section line of Section 16) to the Illinois shoreline adjacent to Sturgeon Island. This section of the Ohio River is fairly industrialized along the Kentucky shoreline in the vicinity of the Mulfordtown and Caseyville fleeting and loading areas. Commercial barge traffic tending the Kentucky facilities produces erosive wakes which are undermining shoreline substrates supporting the Finneyville population.

12. Cave-in-Rock — Wilhelm & Masters 18802 — Extant

The Cave-in-Rock population is located east of Illinois State Route 1 and the landing location of the Cave-in-Rock ferry. Analysis of this site identified eleven*Populus deltoides* utilized by *P. leana* east of the ferry landing. Approximately 160 thalli exist at the Cave-in-Rock site but many of the substrate trees are declining and disturbance of the substrates is drastic in some cases. Examples include the mooring of the ferry to colonized trees, disturbance of soil and root systems, the utilization of substrate trees for the support of electrical fixtures, and the compaction of soils within the supporting habitat by heavy equipment.

13. Tower Rock Recreation Area — Skorepa 11975 — Extant

Wilhelm & Masters17802, 17807, 17812

Tower Rock Recreation Area, although still inhabited by *P. leana*, is diminishing in the number of thalli supported within the site. Wilhelm has expressed concern as to the future of the Tower Rock population (pers. comm.).

14. Elizabethtown Quarry — Wilhelm & Masters 18769, 18770 — Defunct

The Elizabethtown site located west of Big Creek is now a quarry. A single thallus was located to the east of the Big Creek terminus, near the Elizabethtown Ohio River access site, on *Populus deltoides*.

15. Haney Creek Population — Shimp (pers. comm. 2002) — Defunct

Shimp reported a population of *P. leana* at the confluence of Haney Creek and the Ohio River. Shimp subsequently reported that the population was lost after the substrate tree was dislodged from the riverbank due to shoreline erosion.

**Pope Co.**

16. Golconda Fishcamp — Wilhelm & Shimp 22332 — Extant

The population is located within a fishing village and camping area near Golconda.

**Massac Co.**

17. Fort Massac State Park — Wilhelm & Masters 18772 — Defunct

Extant in December, 1990, the population located west of Massac Creek is no longer present.

## Indiana Populations

**Posey Co.**

18. New Haven vic. Site — Shimp & Shimp 5391 — Unknown

This population has not been revisited but is reported to be located 8.8km southeast of New Haven, Illinois along the Wabash River. This population is unmapped and could not be relocated.

## Kentucky Populations

**Crittenden Co.**

19. Tolu River Access — Wilhelm & Masters 18801 — Extant

The population is located west of the village of Tolu near the Ohio River access site.

20. Hurricane Island Pop. — Wilhelm & Shimp 22331 — Unknown

This population was not revisited during this study due to the position of the population on an island within the Ohio River channel.

**Livingston Co.**

21. Givens Creek River Access — Wilhelm & Masters 18800 — Extant

A small population is located across from Golconda, Illinois that contains approximately ten thalli on *Populus deltoides* in the immediate vicinity of the Givens Creek terminus with the Ohio River. The population is located adjacent to Rondeau Island at the end of KY State Route 133.

22. Bayou Swamp — Wilhelm & Masters 18797, 18796, 18799 — Extant

Wilhelm & Shimp 22334

A large population projected at thousands of individuals is supported on *Taxodium distichum*, *Acer negundo*, and *Carya laciniosa* (Michx.f.) Loud. along the margins of the lake.

23. Cumberland River — Wilhelm & Shimp 22333 — Unknown

Three thalli were noted along the west shoreline of the Cumberland River, approximately 2.5 river miles (4km) above the terminus of the river at Smithland, KY. This small population could not be relocated and was therefore not revisited

**Union Co.**

24. Old Shawneetown — Wilhelm & Shimp 22329 — Unknown

Approximately 1.5 river miles (2.4 km) downstream on the Ohio River from the Old Shawneetown bridge (IL State Route 13 / KY State Route 56). This population was not revisited due to access limitations.

## Tennessee Populations

**Smith Co.**

25. Carthage Population — Phillippe L4046 — Extant

Thousands of thalli were observed near the Bluff Creek confluence with the Caney Fork River at Hell's Bend south of Carthage.

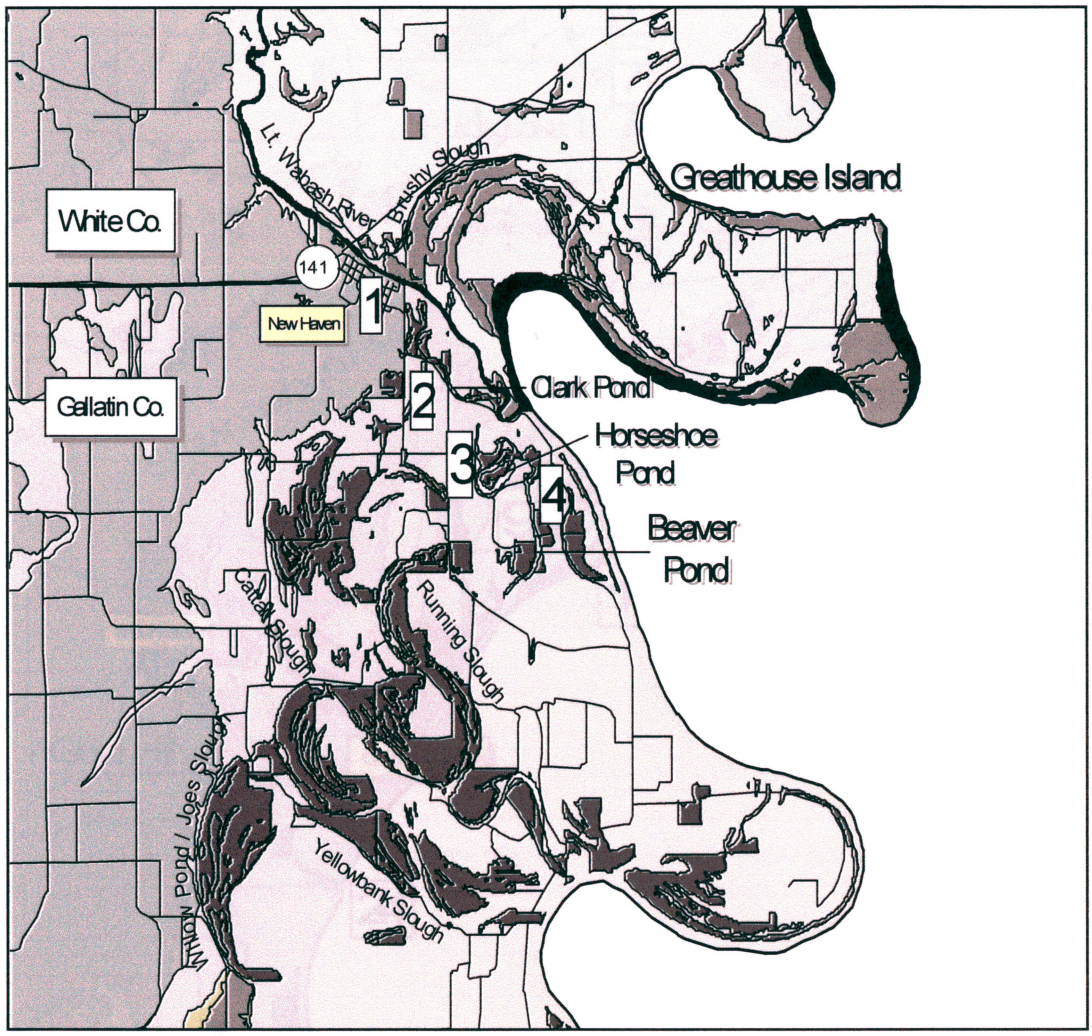


**Figure 4.** Populations of *P. leana* identified by Wilhelm and Masters in the vicinity of the New Haven ponds area of the Gallatin Bottoms: 1.) New Haven IDOC boat launch 2.) Clark Pond 3.) Horseshoe Pond 4.) Beaver Pond

- Wabash River floodzone areas in Gallatin and White County
- Slough / Wetland Communities
- Oxbow lakes / Large Slough Channels

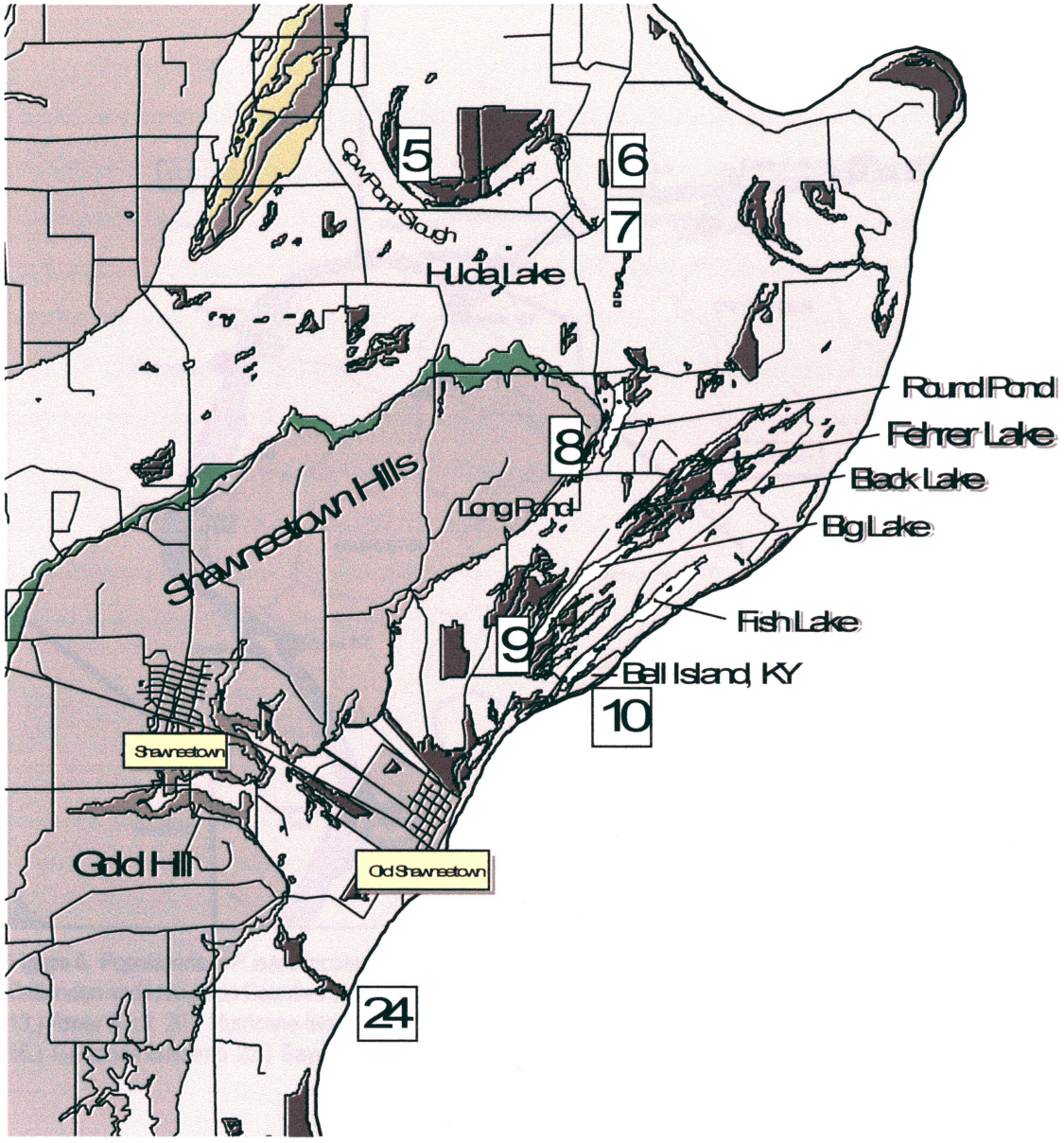


**Figure 5.** Populations of *P. leana* identified by Wilhelm, Masters, and Shimp associated Shawneetown oxbow lake communities: 5.) Cow Pond Slough 6.) Hulda Woods 7.) Hulda Lake 8.) Long Pond 9.) Big Lake 10.) Bell Island (Union County, Kentucky) 24.) Old Shawneetown (Union County, Kentucky)

- Wabash and Ohio River floodzone areas in Gallatin County
- Slough / Wetland Communities
- Oxbow lakes / Large Slough Channels

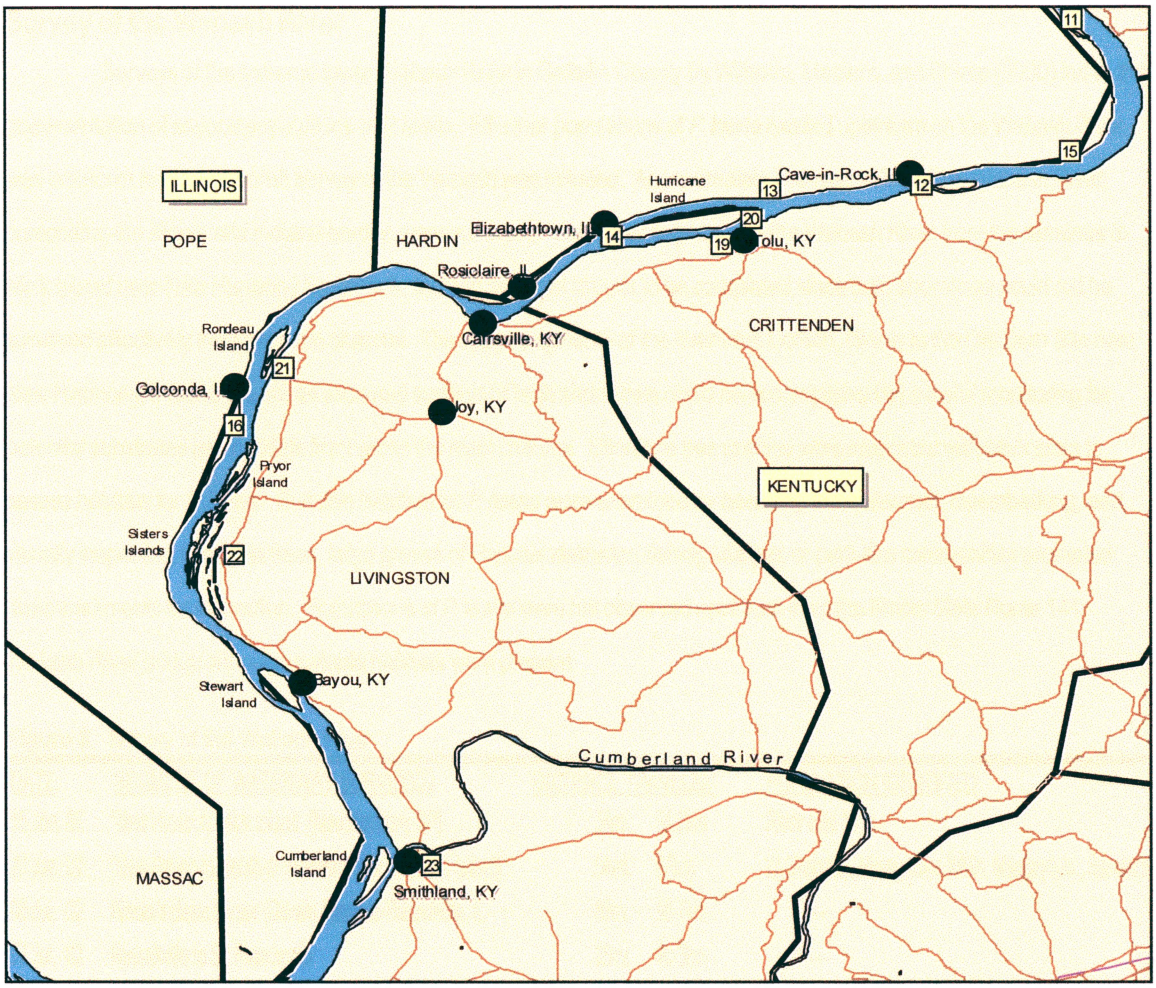


**Figure 6.** Populations of *P. leana* located by Wilhelm, Masters, and Shimp in Pope and Hardin Counties in Illinois and Crittenden and Livingston Counties in Kentucky: 11.) Finneyville 15.) Haney Creek 12.) Cave-in-Rock 13.) Tower Rock 20.) Hurricane Island 19.) Tolu 14.) Elizabethtown 21.) Givens Creek boatlaunch 16.) Golconda fishcamp 22.) Bayou Swamp 23.) Cumberland River

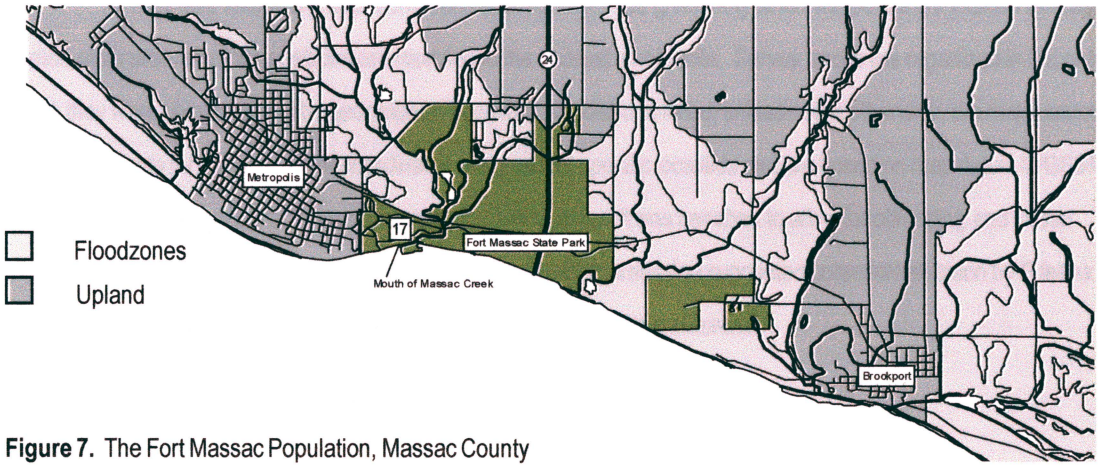


**Figure 7.** The Fort Massac Population, Massac County

## Survey of the Wabash River

Surveys of the extreme lower Wabash River in Gallatin County by Wilhelm, Masters, and Shimp (2000) led to the documentation of several populations of *P. leana*. Whether populations of *P. leana* existed upstream on the Wabash River was unknown and a watercraft survey of the Wabash was initiated. Approximately 200 river miles of the Wabash River, composing the Illinois and Indiana border, were surveyed. The lower segments of the Wabash River from the terminus to Mink Island near New Harmony State Park, Indiana required circuits to be completed since both shorelines could not be surveyed effectively from the main channel. The upper segments of the river from Darwin, Illinois to the Old Dam Site near New Harmony, Indiana are not as wide and surveys of both shorelines could be accomplished by careful monitoring for potential substrates and habitats from within the main channel. Shoreline tree species were inspected with binoculars to assess habitats for *P. leana*. Suitable habitats for *P. leana* were examined by beaching the watercraft, disembarking, and visually inspecting substrate trees, large groves of *Populus deltoides*, fishing villages, or park-like communities prompted disembarkments for inspection. Populations of *P. leana* were not observed upstream from the Illinois State Route 141 Wabash River bridge although suitable habitats were present.

**Figure 8.** Survey of the Wabash River

| DATE | SEGMENT OF WATERWAY SURVEYED | DISTANCE TRAVELED | POPULATION IDENTIFIED |
|---|---|---|---|
| 15 Jan. 02 | *New Haven to Mink Island (New Harmony SP) | 34mi. 54.8km | River Mile 18 Is. |
| 27 Jan. 02 | *New Haven to Mouth of Wabash River (Wabash Island) | 54mi. 87km | Lt. Wabash , Hovey Lake WMA, Mackey's Is., Sander's |
| 06 Jul. 02 | Illinois/Indiana border (Darwin Ferry) to Russellville, IL | 60mi. 96.7km | — |
| 07 Jul. 02 | Russellville to St. Francisville | 25mi. 40.3km | — |
| 11 Jul. 02 | 1.) Mt. Carmel to New Harmony (Old Dam Site) | 57mi. 91.9km | — |
| | 2.) St. Francisville to Little Rock Farms (above Mt. Carmel) | 10mi. 16km | — |

Segments of the river which required upstrem and downstream survey circuits for effective surveillance of both shorelines are indicated by astericks.

All river mile values are approximations and half miles are given only when waypoints are located directly on center, otherwise river mile positions are rounded to the nearest whole mile. Survey tracks are organized in the order in which they were completed not by geographical location. All positions listed, unless noted otherwise, are major watercraft disembarkments for surveys. UTM coordinates are given for specific localities and are based on map datum WGS84 along with local references for the areas surveyed. The watercraft was beached to allow for offloading and further investigation of potential substrate trees and surrounding habitat areas that suggested potential habitation by *P. leana*. Geographical position data was recorded following the beaching of the watercraft.

## Survey Track 1 (Fig. 9)

**NEW HAVEN, IL – MINK ISLAND, IN – NEW HAVEN, IL (15 January 2002)**

Crew: R. N. Gillespie, J. C. Gillespie

Upstream Circuit Disembarkments (West Shoreline of River)

**EMMA QUADRANGLE**

| | | |
|---|---|---|
| W028 16S 406735 4194404 | River Mile 18 Population | River Mile 18 |
| W029 16S 406622 4194439 | River Mile 18 Population | River Mile 18 |
| Greathouse Island | Survey Point | River Mile 22-24 |
| W034 16S 409915 4198093 | Vic. Greathouse Island | River Mile 23 |
| Wabash Memorial Bridge (IL 141 / IN 62) | Survey Point | River Mile 24.5 |
| Rising Sun (Dogtown) | Survey Point | River Mile 29 |

**MAUNIE QUADRANGLE**

| | | |
|---|---|---|
| W036 16S 410744 4208785 | "The Chute," Grand Chain Rapids | River Mile31 |
| Maunie | Survey Point | River Mile 34 |
| W037 16S 411303 4212116 | Vic. Browns Pond near Maunie | River Mile 36 |

**SOLITUDE QUADRANGLE**

| | | |
|---|---|---|
| Harmonie State Park, IN | Survey Point | River Mile 38-39 |
| W038 16S 415484 4214144 | Mink Island | River Mile 40 |

Downstream Circuit Disembarkments (East Shoreline of River)

**SOLITUDE QUADRANGLE**

| | | |
|---|---|---|
| Harmonie State Park, IN | Survey Point | River Mile 38-39 |

**MAUNIE QUADRANGLE**

| | | |
|---|---|---|
| W039 16S 409995 4211959 | Vic. Maunie (IN- shoreline) | River Mile 36 |
| W040 16S 409993 4211960 | In close proximity to W039 | River Mile 36 |
| W041 16S 409525 4211919 | Vic. Aldrich Mound near Maunie | River Mile 35.5 |
| W042 16S 408575 4211067 | Vic. Maunie at point of Aldrich Bend | River Mile 34.5 |
| Maunie | Survey Point | River Mile 34 |
| W044 16S 410133 4207059 | Above Rising Sun (Dogtown) | River Mile 29.5 |
| Rising Sun (Dogtown) | Survey Point | River Mile 29 |

**EMMA QUADRANGLE**

| | | |
|---|---|---|
| W045 16S 410587 4205238 | Big Creek channel opp. Dogtown Hills | River Mile 28.5 |
| Wabash Memorial Bridge (IL 141 / IN 62) | Survey Point | River Mile 24.5 |
| W049 16S 410583 4197645 | Flatwoods Landing Site | River Mile 23 |
| W054 16S 406175 4194489 | Vic. River Mile 18 Island Population | River Mile 18 |
| W055 16S 406063 4194540 | Vic. River Mile 18 Is. Population | River Mile 18 |
| W056 16S 403700 4195151 | Above Lt. Wabash coincidence | River Mile 15.5 |

## SURVEY TRACK 2 (Fig. 9)

**NEW HAVEN, IL - WABASH ISLAND, KY - NEW HAVEN, IL (27 January 2002)**

Crew: R. N. Gillespie, J. C. Gillespie, D. Schnepper

Note: Points marked with asterisks are not placed on Reach maps.

Downstream Circuit Disembarkments (West Shoreline of the River)

**EMMA QUADRANGLE**

| | | |
|---|---|---|
| W062 16S 404913 4193073 | Vic. Beaver Pond, Fishing Camp | River Mile 14 |

**WABASH ISLAND QUADRANGLE**

| | | |
|---|---|---|
| W063 16S 405581 4191319 | Vic. landmark island W087 | River Mile 13 |
| W064 16S 405779 4190825 | Vic. landmark island W087 | River Mile 13 |
| W065 16S 405789 4190675 | Vic. landmark island W087 | River Mile 13 |
| W066 16S 406234 4189970 | Vic. landmark island W087 | River Mile 12.5 |
| W068 16S 407777 4186450 | Mackeys Island Landing Site | River Mile 08 |
| W071 16S 404185 4185635 | Open grove near mouth of Wabash | River Mile 04 |
| W072 16S 404626 4185164 | Sanders Population | River Mile 04 |
| W073 16S 404549 4185121 | Sanders Population | River Mile 04 |
| W075 16S 405646 4184275 | Vic. Wabash mouth | River Mile 03 |
| Wabash Island, KY | Survey Point | - |

Upstream Circuit Disembarkments (East Shoreline of the River)

| | | |
|---|---|---|
| W076 16S 409796 4184649 | Mouth of Wabash River * | River Mile 00 |
| W078 16S 404391 4185775 | Vic. Wabash mouth (IN-Side) | River Mile 04.5 |
| W080 16S 406601 4186549 | Mackeys Island Population | River Mile 08 |
| W081 16S 406840 4186466 | Mackeys Island Population | River Mile 08 |
| W084 16S 408409 4189111 | Above Oak Grove, IN | River Mile10.5 |
| W085 16S 406756 4189819 | Hovey Lake WMA Population | River Mile 12 |
| W086 16S 406818 4189763 | Hovey Lake WMA Population | River Mile 12 |
| W087 16S 406094 4190817 | Landmark Is. * | River Mile 13 |

**EMMA QUADRANGLE**

| | | |
|---|---|---|
| W088 16S 403531 4194436 | Little Wabash Locality* | - |
| W089 16S 402481 4195688 | Brushy Slough Disembarkment | - |

## SURVEY TRACK 3 (Fig. 11)

**DARWIN, IL – RUSSELLVILLE, IL (6 July 2002)**

Crew: R. N. Gillespie, P. Gillespie, S. Gillespie, W. Gillespie

**HUTTON QUADRANGLE**

| | | |
|---|---|---|
| WP171 16S 447650 4350883 | Aurora Bend above Darwin Ferry | River Mile 192 |
| Darwin (River Access) at Ferry Landing | Survey Pt. (Boat Launch)[Last ramp before IN] | River Mile 190 |
| WP172 16S 449481 4345059 | Below Darwin at Round Pond | River Mile 186 |

**FAIRBANKS QUADRANGLE**

| | | |
|---|---|---|
| Riverview village | Survey Point | River Mile 181.5 |

**WEST UNION QUADRANGLE**

| | | |
|---|---|---|
| WP173 16S 444191 4334031 | Below York Cutoff near York Village | River Mile 176 |

**HUTSONVILLE QUADRANGLE**

| | | |
|---|---|---|
| WP174 16S 444288 4330408 | Above Hutsonville at Hutsonville Cutoff | River Mile 173 |
| Hutsonville (River Access) | Survey and Logistical Point | River Mile 173 |

**MEROM QUADRANGLE**

| | | |
|---|---|---|
| Hutsonville vic. Fishing Village | Survey Point | River Mile 168 |
| Merom | Survey Point | River Mile 165 |
| WP175 16S 449936 4321057 | Below Merom near Eagle Island | River Mile 163 |
| Riverton | Survey Point | River Mile 162 |

**HEATHSVILLE QUADRANGLE**

| | | |
|---|---|---|
| WP176 16S 449962 4316726 | Vic. Palestine, IL at Gill Township Levee | River Mile 160.5 |
| Bristol Hills / Shawn Hills | Survey Point | River Mile 158 |
| WP177 16S 455474 4311999 | Vic. Long Pond near Richwoods, IL | River Mile 154 |
| WP178 16S 455078 4308725 | Below Old Busseron Creek coincidence | River Mile 151 |

**RUSSELLVILLE QUADRANGLE**

| | | |
|---|---|---|
| WP179 16S 454727 4298043 | Above Russellville along Niblack Levee | River Mile 141 |
| Russellville (River Access- unimproved) | Survey Pt. (Boat Launch and Pull-out) | River Mile 140.5 |

## SURVEY TRACK 4 (Fig. 10)

**RUSSELLVILLE, IL – ST. FRANCISVILLE, IL (7 July 2002)**

Crew: R. N. Gillespie, P. Gillespie, S. E. Gillespie, W. Gillespie

**RUSSELLVILLE QUADRANGLE**

| | | |
|---|---|---|
| Russellville (River Access- unimproved) | Survey Pt. (Boat Launch and Pull-out) | River Mile 140.5 |
| WP180 16S 456468 4293629 | Below Russellville east of Miller Pond | River Mile 138 |

**VINCENNES QUADRANGLE**

| | | |
|---|---|---|
| Robeson Hills (Robeson Rapids) | Shoreline Survey Point | River Mile 130 |
| City of Vincennes, IN (River Access) | Survey Point (Kimmell Park) | River Mile 129 |
| WP181 16S 454165 4282388 | Above Lincoln Memorial Bridge | River Mile 128 |
| Lincoln Memorial Bridge | Survey and Logistical Point | River Mile 128 |
| George Rogers Clark N. H. P. | Survey and Logistical Point | River Mile 127.5 |
| WP182 16S 451010 4280981 | Above Allison Ditch No. 3 coincidence | River Mile 126 |
| WP 183 16S 448265 4280047 | Vic. Allison Ditch No. 3 | River Mile 124.5 |
| Embarras River (Sandbar and Debris Field) | Confluence of Embarras with Wabash | River Mile 122 |

**ST. FRANCISVILLE QUADRANGLE**

| | | |
|---|---|---|
| St. Francisville (River Access and Park) | Survey Pt. (Boat Pull-out) | River Mile 115 |

## SURVEY TRACK 5 (Fig. 10)

**MT. CARMEL, IL – GRAYVILLE, IL (11 July 2002)**

Crew: R. N. Gillespie, J. C. Gillespie

**EAST MT. CARMEL QUADRANGLE**

| | | |
|---|---|---|
| Grand Chain Rapids | Survey Point | River Mile 97 |
| Mt. Carmel Fishing Villages and Dam | Survey Point | River Mile 97-96 |

**MT. CARMEL QUADRANGLE**

| | | |
|---|---|---|
| Mt. Carmel (River Access) | Survey Pt. (Boat Launch) | River Mile 94.5 |
| WP184 16S 432751 4248270 | Vic. Mt. Carmel at Patoka Island | River Mile 93 |

**KEENSBURG QUADRANGLE**

| | | |
|---|---|---|
| Beall Woods S. P. (Beall Woods Rapids) | Survey Point and Logistical Point | River Mile 89 |

**GRAYVILLE QUADRANGLE**

| | | |
|---|---|---|
| WP185 16S 423342 4240378 | Vic. of McCleary Bluffs (Below Beall Woods) | River Mile 80 |
| WP186 16S 422577 4237924 | Above Schuh Bend at R.M.78 Island | River Mile 78 |
| Grayville (River Access- Cutoff) | Survey Pt. (Boat Launch and Pull-out) | River Mile 65.5 |

## SURVEY TRACK 6 (Fig. 9)

**GRAYVILLE, IL – NEW HARMONY, IN (11 July 2002)**

Crew: R. N. Gillespie, S. E. Gillespie, P. Gillespie

**GRAYVILLE QUADRANGLE**

| | | |
|---|---|---|
| Grayville (River Access- Cutoff) | Survey Pt. (Boat Launch and Pull-out) | River Mile 65.5 |

**NEW HARMONY QUADRANGLE**

| | | |
|---|---|---|
| Grayville Memorial Park | Survey Site | River Mile 65 |
| WP187 16S 417027 4226245 | Above Bull Island, near Lt. Fox Island | River Mile 59 |
| Bull Island vic. | Survey Site | River Mile 57-53 |
| New Harmony (River Access) | Survey (Boat Pull-out) | River Mile 51.5 |

**MAUNIE QUADRANGLE**

| | | |
|---|---|---|
| Ribeyre Island vic. | Survey Point | River Mile 51-41 |

**SOLITUDE QUADRANGLE**

| | | |
|---|---|---|
| New Harmony Old Dam Site | Survey Point | River Mile 41.5 |

## SURVEY TRACK 7 (Fig. 10)

**ST. FRANCISVILLE, IL – LITTLE ROCK FARMS, IL (11 July 2002)**

Crew: R. N. Gillespie, J. C. Gillespie, P. Gillespie, S. E. Gillespie

**ST. FRANCISVILLE QUADRANGLE**

| | | |
|---|---|---|
| St. Francisville (River Access and Park) | Survey Point (Boat Launch ) | River Mile 115 |
| St. Francisville vic. Fishing Village | Survey Point | River Mile 111 |
| WP188 16S 443211 4263491 | Above Catfish Bend and Lt. Rock Farms | River Mile 109 |
| WP189 16S 441073 4261992 | Lt. Rock Farms Escarpment | River Mile 106 |

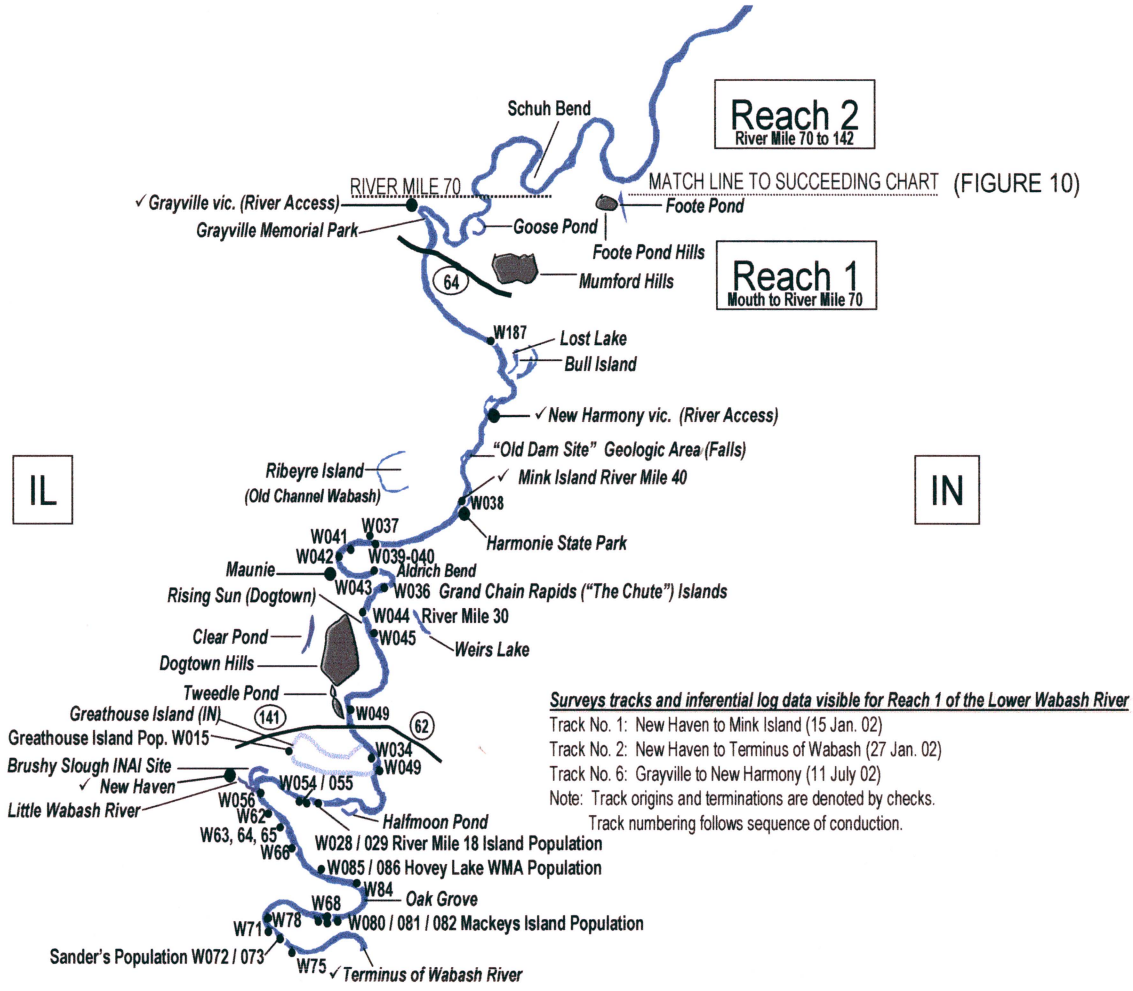


**Figure 9.** Reach 1 of the Wabash River from the terminus near Wabash Island, KY to River Mile 70.

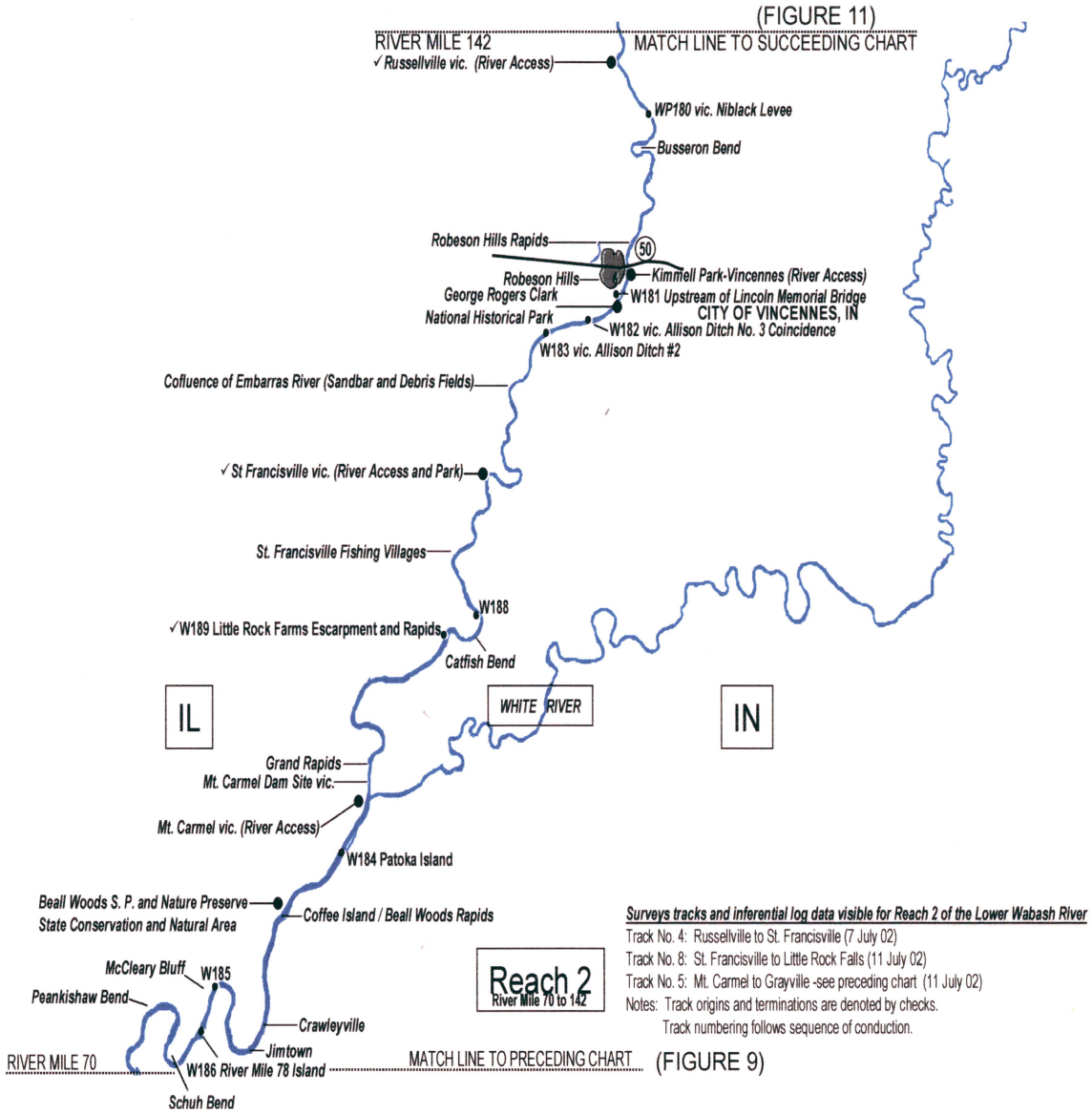


**Figure 10.** Reach 2 of the Wabash River

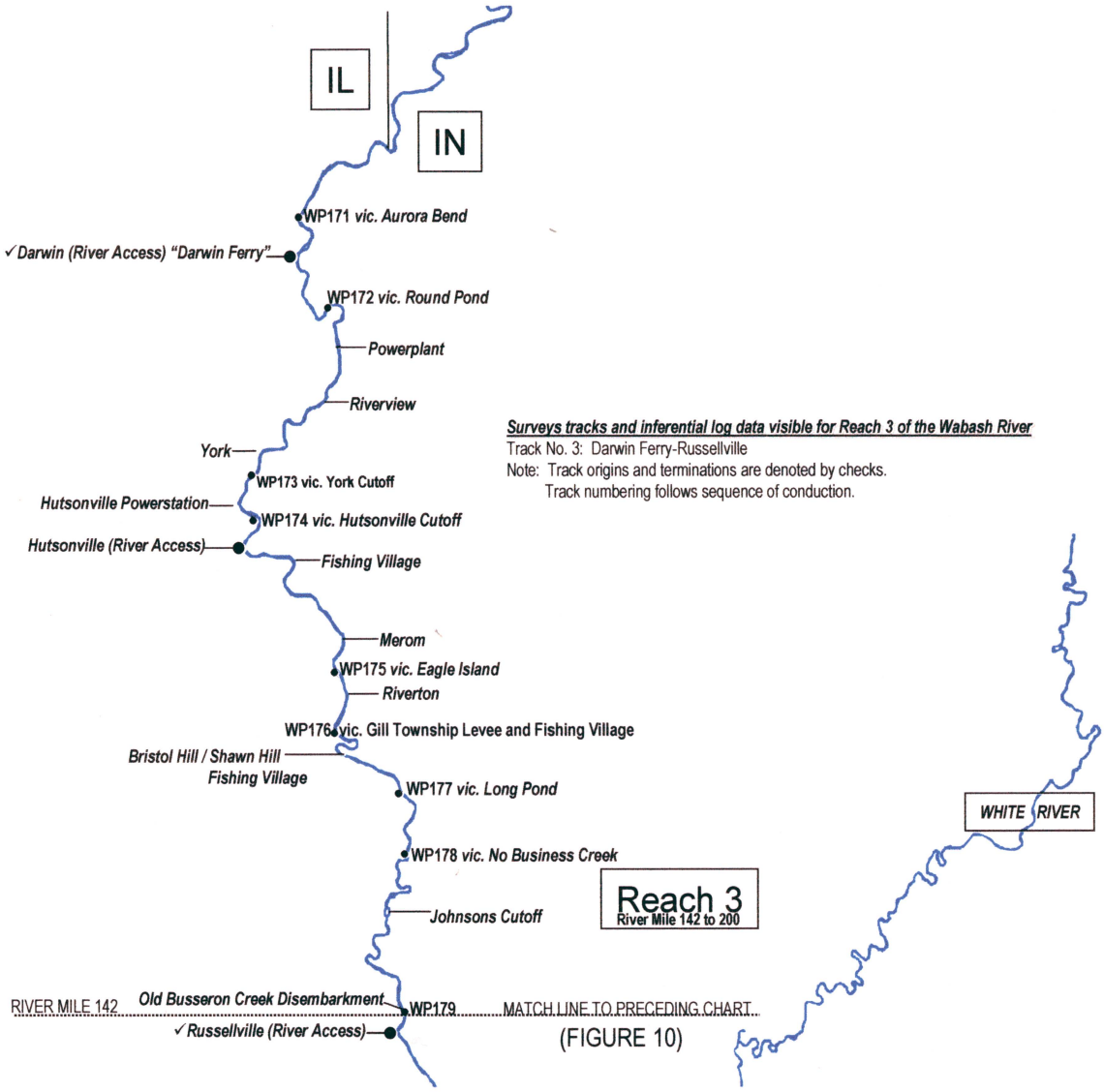


**Figure 11.** Reach 3 of the Wabash River

## Survey of the Wabash River

Surveys of the lower Wabash River were productive, especially near the mouth of the river system in Gallatin County, although the number of populations quickly diminished as survey efforts shifted northward up the Wabash River. Two small populations were located in White County: the first near the junction of Illinois State Route 141 and the Epworth Road (1450E), and the second within a fishing village accessed by 1700E Road at the most westerly reach of the abandoned Greathouse Island river channel. These two populations represent the most northern range of *P. leana* in Illinois. Except for the discovery of these two populations, surveys of the White County, Wabash River floodplain revealed no new populations, although it was assumed that surveys of the oxbow lakes (Clear Pond, Fish Pond Swamp, the Granny Tweedle Ponds, and Brown's Pond) near the Dogtown Hills of White County would reveal populations of *P. leana*. Although Clear Pond had wooded corridors surrounding the wetland, suitable trees were not colonized by *P. leana* but supported a lichen flora characteristic of southern Illinois. Fish Pond Swamp had little remaining habitat available for colonization as agricultural land uses had extended to the edge of the wetland along the majority of its' margins. Surveys in the vicinity of Granny Tweedle and Brown's Pond failed to reveal populations of *P. leana* as agricultural landuse again limited potential habitats. Results compiled during watercraft surveys of the area also revealed limited utilization of the White County Wabash River floodplain by *P. leana*. In fact, the Wabash River corridor upstream from Illinois Route 141 proved to be uninhabited by *P. leana*. Wilhelm, Masters, and Shimp (2000) had suggested that populations of *P. leana* might be present near Maunie, Illinois (near Grand Chain Rapids) but reconnaissance of this area produced nothing. Potential habitats were present, particularly along the Indiana-side of the river, that supported stands of *Populus deltoides* (shrouded by a curtain of *Salix nigra* along the river's most recent shoreline) from near river mile 33 (WP 43) through the Maunie bend to river mile 35 (near disembark W42).

Reconnaisance of the Drew Pond area above the village of Maunie (1 km west of Ribeyre Island, IN) did not reveal populations of *P. leana* although suitable park-like habitats were located. In addition, optimum habitats were present and suitable substrates were readily available for colonization along Road 2000E for 2 kilometers along the Illinois shoreline of the Ribeyre Island old channel but *P. leana* did not exist at this site. The Grayville Wabash River cutoff was examined during watercraft surveys and areas within Wabash County in the vicinity of Bonpas Creek from the Grayville Wabash River access to Cowling were surveyed by vehicle. The lowlands of Beall Woods Nature Preserve, near Keensburg, Illinois, were found to be uncolonized as Wilhelm had reported. The corridor of fishing villages from the Mt. Carmel Wabash River access north to Grand Chain was surveyed but no populations were located although suitable substrates were located there. In Lawrence County, the riverside park at St. Francisville was visited, and although several *Populus deltoides* were available in suitable situations, *P. leana* was not present. Kimmell Park (Vincennes, IN), along the Wabash River, supports a significant stand of *Populus deltoides* which mirrors the Cave-in-Rock site but does not support *P. leana*. Foote Pond, north of Griffin, Gibson County, Indiana, was surveyed as were areas near Goose

Pond and the village of Jimtown. Potential substrate trees were present at Foote Pond but the lichen flora present extended to the soil surface indicating a lack of adequate flooding disturbances.

The Bull Island-Lost Lake old Wabash River channel, south of Griffin in Posey County, was also surveyed. Although suitable habitats were located, *P. leana* was not observed. Floodplain areas within Harmonie State Park, adjacent to the Wabash River, were also examined. Although potential substrates were available north of the park's Wabash River access ramp to the mouth of Rush Creek, no populations of *P. leana* could be found. Below Harmonie State Park, Weirs Lake, across the Wabash River from Rising Sun, Illinois, was surveyed and found not to support *P. leana*. The eastern end of Weirs Lake has been developed for oil production with pump-jack and storage tanks present. In southern Posey County, Halfmoon Pond, Twin Swamps Nature Preserve, Hovey Lake WMA, Cypress Slough, and areas in the immediate vicinity of Oak Grove were surveyed. Thalli were not observed. Future surveys will be needed as populations may exist within the larger wetland areas of southern Posey County, Indiana.

## Survey of the Little Wabash River from Carmi to New Haven

During the course of this study it was suggested to the author, by the district 21/22 natural heritage biologist, that a survey of the Little Wabash River might reveal additional populations of *P. leana* in White County. Reconnaisance of the area by vehicle led to the examination of many areas beyond the corridor of the river channel. Areas in association with Brown's Pond proved to be predominantly agricultural and unsuitable for *P. leana*. Accessible areas of the river corridor near the village of Emma, particularly along 700N Rd. and south from Emma along 1375E Rd., did not reveal stands of *P. leana* or particularly suitable habitats. Several *Populus deltoides* were searched to no avail south of Emma. The river bridge on 600N Rd. was also visited and the surrounding habitat surveyed. Although suitable substrates were available in park-like habitats, *P. leana* was not present. An abandoned river cutoff north of New Haven designated as "The Bayou" along 375N Rd. did not support *P. leana*. The elevation of the channel's upper rim, and the trees thereon, are of such height above the channel that flooding events would be unlikely except in extreme cases. On the north side of Illinois State Route 141 Little Wabash River bridge, a fishing village associated with New Haven had areas of park-like habitat which were visually inspected with field glasses but were not found to be inhabited by *P. leana*. To the south of route 141, road 375 N continues along the periphery of Brushy Slough. Trees adjacent to the roadway were expected to support a few individuals due to the position of the site relative to the Epworth Road population (located north across route 141) and the presence of larger trees exposed to edge conditions. However, trees surrounding the borrow pits and woodland edges associated with Brushy Slough were not colonized and the survey track route through Brushy Slough did not reveal populations or individual thalli of *P. leana*.

The Little Wabash River was surveyed via canoe from Carmi at a private ramp operated near the Carmi River bridge to the Little Wabash public access site at New Haven. Although the presence of log jams and unseen hazards within the channel had the potential to hamper the survey, higher river stages at the time facilitated the survey effort.

Water in the river was notably turbid. Suitable substrate trees were exceedingly sparse as the shoreline corridors were dominated almost completely by *Acer saccharinum* and *Acer saccharum* and large bank subsidence areas or slumps were woefully common. Larger, established populations of *Populus deltoides* in potentially suitable habitats were exceedingly rare components of the river corridor. When single individuals of *P. deltoides* were located, disembarkment for foot-borne inspections were undertaken. Stands of *P. deltoides*, which were plentiful along areas of the Wabash and Ohio Rivers, were rare along the Little Wabash River. In all, twenty-nine river miles (46.6km) of the Little Wabash River were surveyed for populations of *P. leana* without success.

## Areas Surveyed near the Terminus of the Ohio River and in Western Illinois

Surveys from the Black Bottoms westward along the Ohio River towards Cairo, Illinois, to the terminus of the Ohio River near the Ft. Defiance city park were not productive and suitable habitats were found to be uninhabited by *P. leana*. Mermet Lake Conservation Area, the Heron Pond-Little Black Slough Nature Preserve, and areas associated with the Cache River State Natural Area were not inhabited by *P. leana*. Grand Lake, Horseshoe Lake Conservation Area, and Ft. Defiance City Park were surveyed but populations of *P. leana* were not present. Surveys of the Mississippi floodplain northward from Cairo, did not reveal populations of *P. leana*. Excellent habitats were discovered at the villages of Thebes (Alexander County) and Grand Tower (Jackson County), but trees were found to be uncolonized. Visually these two sites appear very similar to areas that are colonized by *P. leana* along the lower Ohio River. The Grand Tower site, a riverside park, is similar to the habitat of the Cave-in-Rock population and has an excellent stand of *Populus deltoides*. The understory is completely open and the underlaying soil is composed almost entirely of sand. The Thebes boat access to the Mississippi River has a stand of massive *Populus deltoides* that has been available for colonization for a significant duration of time. Areas near East Cape Girardeau (Picayune Island) in Alexander County, as well as Wolf Lake, La Rue Pine Hills Nature Preserve, and the confluence of the Big Muddy River with the Mississippi River (all within Jackson County) were surveyed to no avail. Surveys continued to the Chester river access ramp but this area was not suitable for *P. leana*. Areas surveyed along the lower Illinois River included river access sites and riverfront areas within and downstream from the village of Kampsville, Calhoun County, Illinois. The Godar-Diamond Waterfowl Jackson Management Area, the Hamilton Lake vicinity, the village of Hardin, the Twelve Mile Island Illinois River access, Pere Marquette State Park, and the Mississippi riverfront areas associated with the village of Grafton were all surveyed but populations of *P. leana* were not located.

## New Populations of *P. leana* discovered in Illinois and southwestern Indiana

Population reports are arranged geographically including northerly populations in White County, the populations of Gallatin County, populations of Posey County, Indina, and the populations of the Black Bottom (Massac County). Maps of the sites, UTM coordinates, and other relevant information for future visitation of these localities are included.

### Epworth Road Population (Fig. 12; WP16)

**Location:** The Epworth Road population is located immediately northwest of the junction of Illinois State Route 141 and Epworth Road (1450E. Rd.). Access to the area is made by a steep-grade pull-off on the west side of Epworth Road.

**Description:** The population is located within a woodlot positioned on the south side of a borrow pond (utilized to "build-up" Epworth Road to alleviate flooding). Scattering of open grown trees with open understory

**Ownership:** Downen Enterprises

**Located / Date Last Observed:** 1 January 2002 / 21 August 2002

**County**: White Co., IL

**Extent of Population**: 3 substrate trees colonized

**Population Size**: 25 thalli

**Topographic Map(s)**: Emma quadrangle 7.5

**Legal Description**: T7S R10E S9

**UTM Coordinates**: Waypoint(s) 16 16S 402555 4197921

**Substrate**: *Populus deltoides*

**Observer (s):** R. N. Gillespie, (Dr. Andrew Methven, Dr. Scott Meiners, and Mylinh Urfer)

**Notes:** Three substrate trees supporting thalli have been discovered at this site, but the remainder of the trees in the woodlot are uncolonized. All of the substrate trees utilized are *Populus deltoides.* The first two substrate trees are located in close proximity to each other adjacent to the termination of the pull-off and along the borrow pond shoreline. The third *Populus* is located further west along a drive through the woodlot. Together these trees support approximately 25 thalli. Thalli are located on the E and NE aspect of the first two trees while the third tree supports thalli on the SE to E aspects. Thalli are principally located lower than 3 meters up the trunk from the soil surface. This population of *P. leana* is small and long term stability of this population is not forseen. Thalli are fragmenting, pulling away from the substrate bark surface, and exhibiting areas of necrosis.

### Greathouse Island Population (Fig. 12; WP15)

**Location:** The Greathouse Island population is located along 1700E Rd. at the farthest western extent of Greathouse Island (old Wabash River channel).

**Description:** Park-like area provided by fishing village located along a gravel road adjacent to the old river channel.

**Ownership:** Barbara N. Schneider

**Located / Date Last Observed:** 1 January 2002 / 1 January 2002

**County**: White Co., IL

**Extent of Population**: 3 substrate trees colonized

**Population Size**: 10 thalli

**Topographic Map(s)**: Emma quadrangle 7.5

**Legal Description**: T7S R10E S11

**UTM Coordinates**: Waypoint(s) 15 16S 405967 4198193

**Substrate**: Primarily *Quercus palustris* but *Fraxinus* and *Celtis* were also present.

**Notes**: The population of *P. leana* is located on the west bank of the old channel within a fishing village on *Quercus palustris* on the E to SE aspects of the trees. Less than ten total thalli observed on trunks less than 1 meter from the soil surface. Few thalli were located at the site but Greathouse Island, IN provides extensive habitats which were difficult to access during the period of survey and could potentially support additional populations of the lichen.

**Observer (s)**: R. N. Gillespie

## Little Wabash Population (Fig. 12; WP88)

**Location:** Upstream from the confluence of the Little Wabash River and the Wabash River a single thallus was found on *Populus deltoides* at the point of an abrupt northerly bend in the river. This station is located at the second bend of the Little Wabash from the mouth of the river in the vicinity of Clark Pond (to the west). Access can also be afforded by oil-field access lanes.

**Description:** Wooded shoreline corridor bounded by agricultural fields, fishing camps, and the Little Wabash River channel.

**Ownership:** Martin Duffy (Duffy Farms)

**Located / Date Last Observed:** 27 January 2002 / 27 January 2002

**County**: Gallatin Co., IL

**Extent of Population**: Single substrate tree colonized

**Population Size**: Single thallus

**Topographic Map(s)**: Emma quadrangle 7.5

**Legal Description**: T7S R10E S27

**UTM Coordinates**: Waypoint(s) 88 16S 403531 4194436

**Substrate:** *Populus deltoides* with *Acer, Fraxinus, Carya, Celtis,* and *Gleditisia* present.

**Notes**: A single thallus was located on *Populus deltoides* just to the east of a small fishing campsite at a point of a bend in the river. The thallus was oriented to the E and was within 1 meter of the soil surface. Substrate and thallus were muddy. The single, small, fragmented, and silt-covered thallus (4 cm) will likely not persist for long.

**Observer (s)**: R. N. Gillespie, J. C. Gillespie, Danny Schnepper

## River Mile 18 Island Population (Figs. 12; WP28, 29)

**Location:** First island located within the Wabash River upstream from the confluence of the Little Wabash River and Wabash River at River Mile 18 from the mouth of the Wabash River.

**Description:** Wooded river island characterized by sand deposition and removal of understory and soil surface debris by flooding.

**Ownership:** Unknown

**Located / Date Last Observed:** 15 January 2002 / 15 January 2002

**County**: Posey Co., IN

**Extent of Population**: Three substrate trees colonized

**Population Size**: 15 thalli

**Topographic Map(s)**: Emma quadrangle 7.5

**Legal Description**: T7S R10E S24

**UTM Coordinates**: Waypoint(s) 28 16S 406735 4194404

29 16S 406622 4194439

**Substrate**: *Populus deltoides* with associated *Acer* spp. dominants

**Notes**: The River Mile 18 Island supports a small population of *P. leana*. Thalli are found on three *Populus deltoides* positioned at the eastern end of the island with predominantly easterly aspects. The thalli occupy a zone from the soil surface to approximately 2 meters above. The river island has sand deposits in many areas along its length from flood events and the understory has been washed out, covered with silt, or piled by floodwaters. The population is located at the east end and southern edge of the island

**Observer (s)**: Robert N. Gillespie, James C. Gillespie

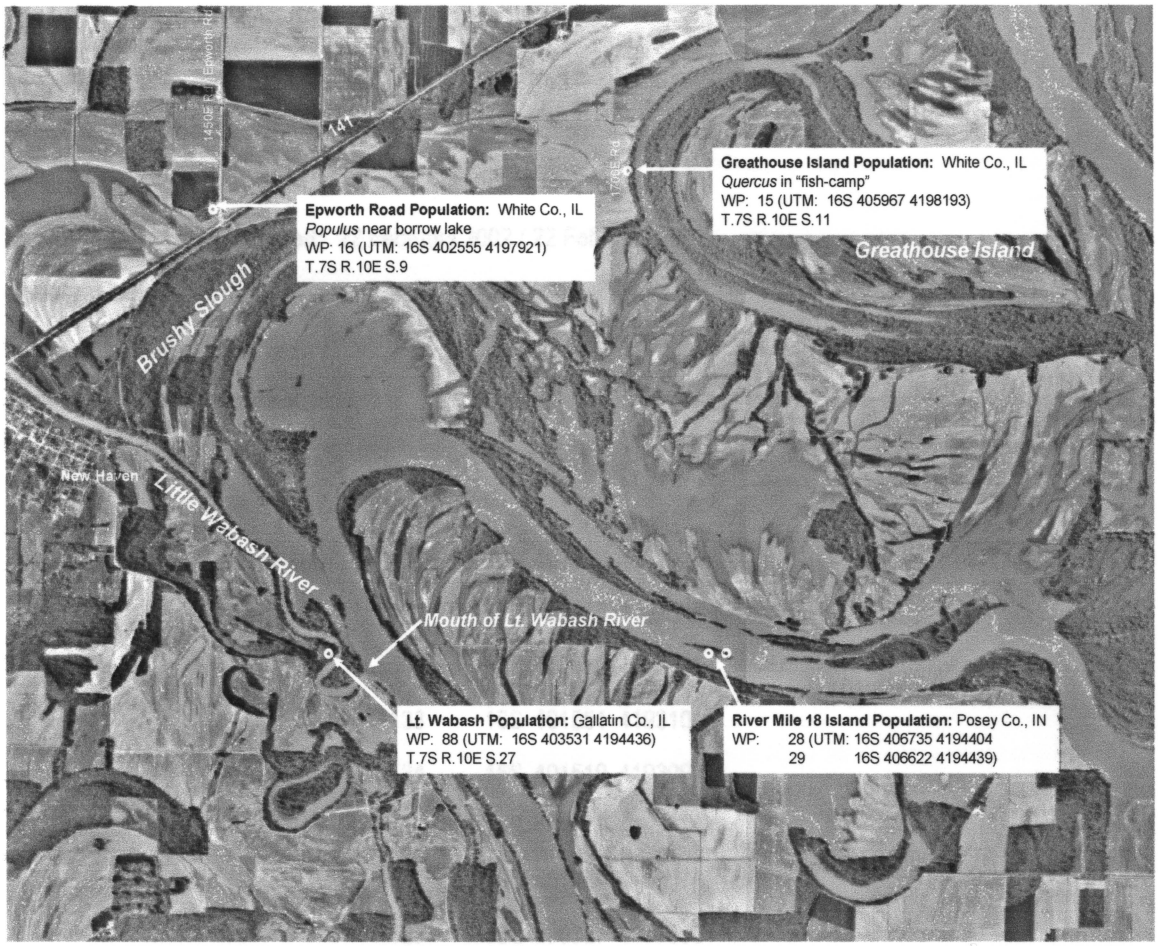


**Figure 12.** Digital orthoquadrangle aerial of the Wabash River in the vicinity of New Haven, Illinois.

## Gravel Pit Populations (Fig. 13; WP130-139)

**Location:** Approximately 4 kilometers south of New haven in the vicinity of an abandoned gravel quarry.

**Description:** Wooded slough channels surrounded by bottomland agricultural fields

**Ownership:** Medlin, Bickett Farms

**Located / Date Last Observed:** 22 February 2002 / 22 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: Thalli scattered along forested borders of slough channels and field edges.

**Population Size**: Approximately 200 thalli

**Topographic Map(s)**: Emma & Wabash Island quadrangle 7.5

**Legal Description**: T7S R10E S32, 33

**UTM Coordinates**: Waypoint (s)

| | | |
|---|---|---|
| 130 | 16S 402539 | 4191924 |
| 131 | 16S 402445 | 4192343 |
| 132 | 16S 402186 | 4192717 |
| 133 | 16S 401551 | 4193104 |
| 134 | 16S 401510 | 4193097 |
| 135 | 16S 401375 | 4193098 |
| 136 | 16S 401339 | 4193076 |
| 137 | 16S 400327 | 4192596 |
| 138 | 16S 401014 | 4192090 |
| 139 | 16S 401442 | 4192193 |

**Substrates:** *Quercus, Carya, Celtis, Fraxinus, Populus*

**Notes:** The Gravel Pit Populations refer to a battery of surveys that originated from an abandoned gravel quarry located 4km south of New Haven. Surveys focused on the Cattail and Running Slough wetlands. The northeastern extent of Cattail Slough is designated as the Gravel Pit Slough due to the close proximity of this wetland to the landmark (within 450m). Survey tracks through the wooded corridor along the southern border of Gravel Pit Slough led to several populations of *P. leana* (WP133-136). The wooded corridor of Gravel Pit Slough was composed of *Carya illinoensis, Carya laciniosa, Fraxinus pennsylvanica* var. *subintegerrima, Populus deltoides, Quercus palustris, Quercus macrocarpa, Liquidambar styraciflua,* and *Acer saccharinum. Arundinaria gigantea* was a prevalent member of the understory along Gravel Pit Slough and within the bottomlands of Cattail Slough as a whole. Approximately 50 thalli were observed occupying a range of aspects (S, SE, E, W, NW, N).

Survey work proceeded into the bottomland forests west of the gravel pit and into the sloughs of the northeast quarter of Section 31 near the Greenhouse Road. Thalli were detected within the more forested areas of Cattail Slough

(WP137) but were much less abundant than edge areas of Gravel Pit Slough. The population at WP137 was located adjacent to a ponded area associated with Cattail Slough on *Fraxinus pennsylvanica* var. *subintegerrima*. Less than 5 thalli were observed. Waypoint 138 was located within a fencerow that is the remainder of a post-1970 land clearing of a bottomland forest tract which had once extended to the bend of Gravel Pit Slough. Substrates utilized were principally *Carya laciniosa* and *Carya ovata*.

Bottomland forests associated with Cattail Slough within Section 31 were described by Mohlenbrock as an *Acer saccharinum-Populus deltoides /Aster* community. *Acer saccharinum* was a dominant species throughout the forested lowlands of Cattail Slough. *Populus deltoides* and *Fraxinus pennsylvanica* var. *subintegerrima* were common associates followed closely by *Liquidambar styraciflua* and *Ulmus* spp. *Betula nigra* L. appeared commonly along the edges of ponded areas.

Included with the Gravel Pit coordinates are locations along Running Slough and Grinnel Slough. Waypoints 130 and 131 are associated with Grinnel Slough and document the positions of thalli located there. *Populus deltoides* is the principal substrate at these locations. Waypoint 132 is located on the border of the abandoned gravel quarry and thalli observed at this position were present on *Populus deltoides* and *Carya illinoensis*. Waypoint 139 is found along the roadway bordering Running Slough. Thalli were observed on *Fraxinus pensylvanica* var. *subintegerrima* and *Celtis occidentalis*.

**Observer:** R. N. Gillespie

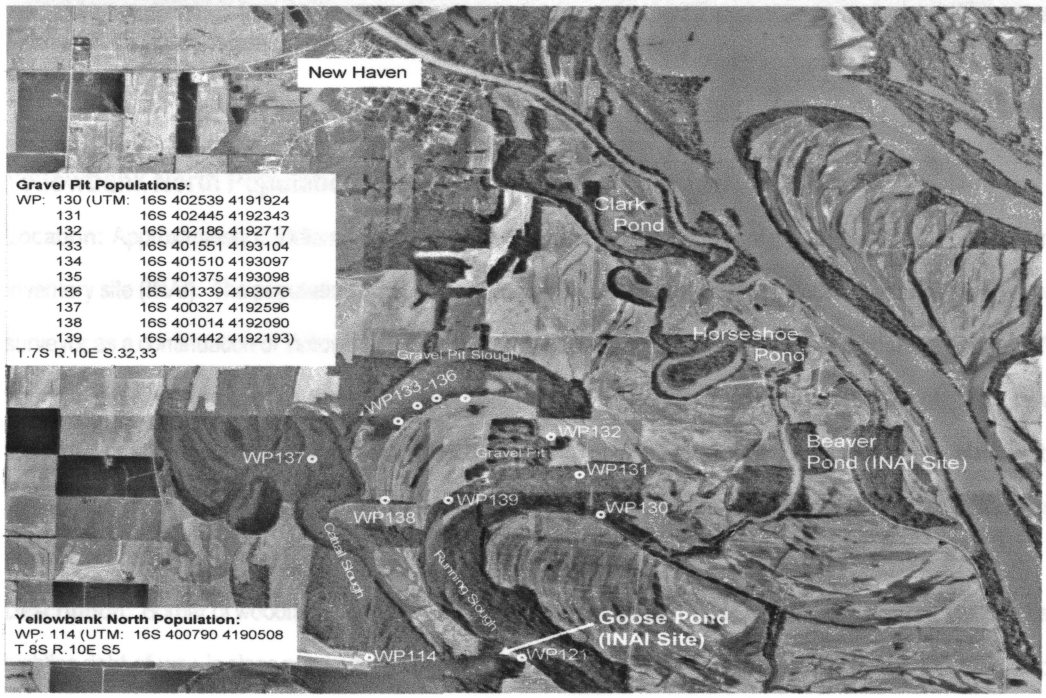


**Figure 13:** Digital orthoquadrangle map of the New Haven ponds area of northern Gallatin County centered on the abandoned gravel quarry and immediate surrounding populations of *P. leana*.

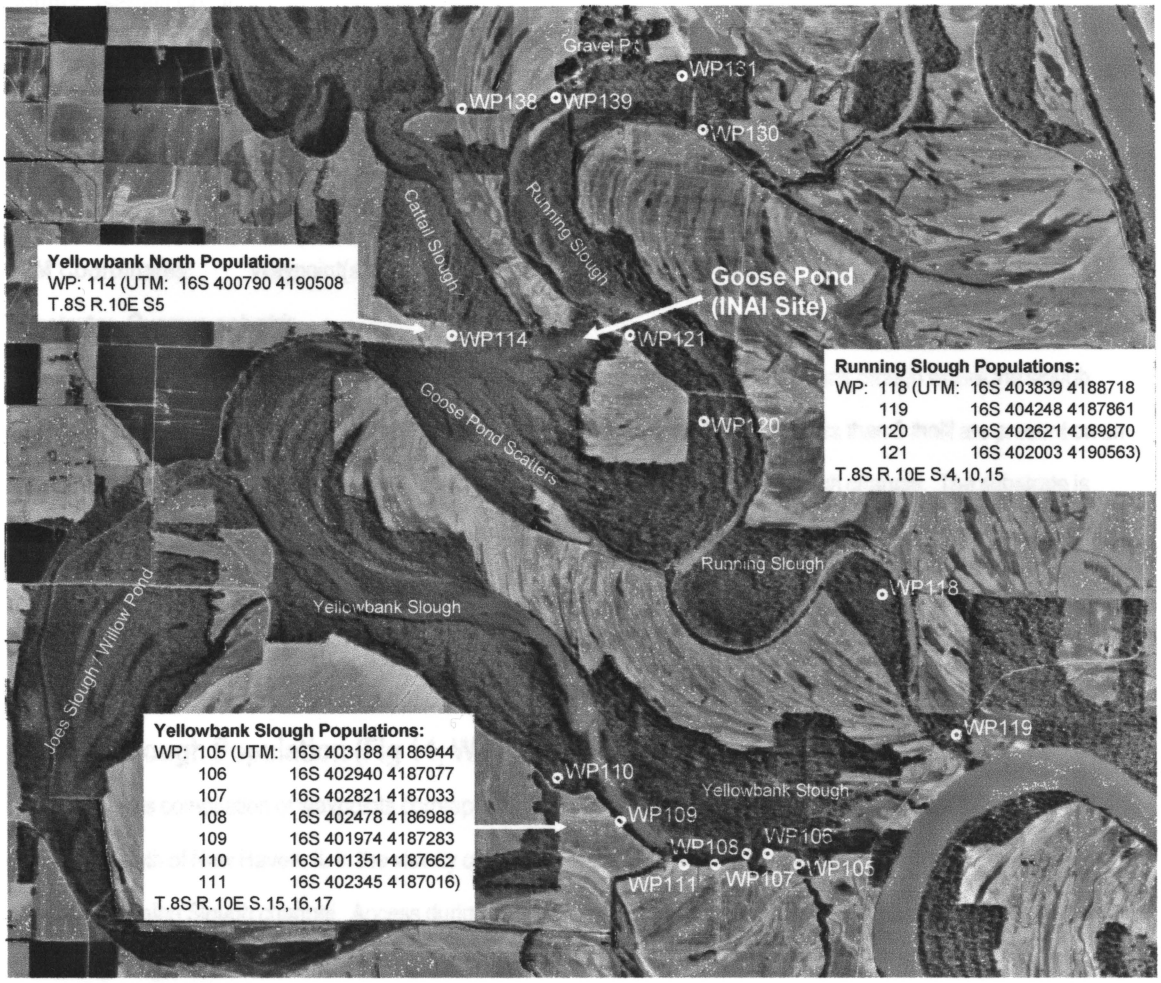


**Figure 14.** Digital orthoquadrangle of Gallatin County slough channels

## Yellowbank North Population (Figs. 13-14; WP114)

**Location:** Approximately 6.5 kilometers south of New Haven, IL in the vicinity of the Goose Pond Illinois Natural Areas Inventory site (INAI). The population is positioned along the northern boundary of Goose Pond Scatters regarded by the surveyor as a continuation of Yellowbank Slough. Access during the survey was obtained from the "Gravel Pit" roadway from the north and a foot survey was undertaken from the Gravel Pit area. The population could potentially be visited from the west along a field access road to Yellowbank Slough. The population is located on the north side of a forest road and immediately north of a highline right-of-way (providing power to an active pump-jack located north of Goose Pond) as it enters the woodland.

**Description:** Border of woodland north of Yellowbank Slough / Goose Pond Scatters, corner of agricultural field and highline right-of-way, in close proximity to where the highline enters the woodland headed towards Goose Pond.

**Ownership:** Robert Sutton

**Located / Date Last Observed:** 15 February 2002 / 15 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: Single substrate tree

**Population Size**: Less than five thalli

**Topographic Map(s)**: New Haven SW quadrangle 7.5

**Legal Description**: T8S R10E S5

**UTM Coordinates**: Waypoint(s) 114 16S 400790 4190508

**Substrate**: *Quercus palustris*

**Notes**: The Yellowbank North Population is positioned at the northeast end of Yellowbank Slough where the slough enters Goose Pond Scatters. The Goose Pond INAI site is located 1km to the east. Less than 5 thalli are present on an individual *Quercus palustris* in the vicinity of the north shoreline of the Yellowbank Slough channel. The substrate is adjacent to a forest road originating from the Cattail Slough lowlands. Thalli are present on the southerly aspects of the substrate.

**Observer**: R. N. Gillespie

## Running Slough Population (Fig 14; WP118-121)

**Location:** This compilation of waypoints corresponds to the lower drainage of Running Slough approximately 6.5 kilometers south of New Haven, IL in the vicinity of the Goose Pond INAI site. Localities are south of the gravel quarry along the Running Slough channel. Access during surveys was obtained by the "Gravel Pit" roadway from the north and foot surveys originated from the Gravel Pit area.

**Description:** Thalli scattered along slough channel wooded corridors and surrounding forested habitats. Slough channel is surrounded by agricultural fields and bounded by a levee along portions of its length.

**Ownership:** Bickettt, Scates, and Downen Farms

**Located / Date Last Observed:** 15 February 2002 / 21 July 2002

**County**: Gallatin Co., IL

**Extent of Population**: Sporadic thalli discovered along slough boundaries

**Population Size**: Single thalli to populations of up to 50 individuals

**Topographic Map(s)**: Wabash Island quadrangle 7.5

**Legal Description**: T8S R10E S4, 10, 15

**UTM Coordinates**: Waypoint (s) 118 16S 403839 4188718

119 16S 404248 4187861

120 16S 402621 4189870

121 16S 402003 4190563

**Substrate**: *Fraxinus, Quercus palustris, Quercus macrocarpa, Carya*

**Notes**: The largest population discovered (W121) during surveys of the Running Slough drainage is located in close proximity to Goose Pond within a park-like area composed principally of *Quercus palustris* near a small clearing along the Running Slough channel, which is occupied by abandoned oil field equipment (pump-jack, supporting flood platform, and storage tanks). The population of *P. leana* is on the order of 50 individuals and thalli are oriented to the southeast occupying a zone from ground level to approximately 1 meter in height.

Waypoint 120 documents a population of less than ten thalli located on a single *Fraxinus pennsylvanica* var. *subintegerrima*. The population is located on the edge of the Running Slough channel within the remaining wooded corridor. Waypoint 118 identifies the position of a single thallus within a bottomland forest adjacent to Running Slough on *Fraxinus pennsylvanica* var *subintegerrima*. This individual is 3m in height from the soil surface belying the low elevation of the substrate tree. Waypoint 119 is adjacent to the roadway at the terminus of Running Slough. Thalli occupy substrates including, *Fraxinus pennsylvanica* var. *subintegerrima* and *Gleditsia triacanthos*.

**Observer**: R. N. Gillespie, J. C. Gillespie

## Yellowbank Slough Populations (Fig. 14; WP105-111)

**Location:** Approximately 5.5 kilometers north of Hulda Lake on 14500E (Big Barn Road). Yellowbank Slough empties into the Wabash River at this location and access can be gained from this point. The balance of survey work conducted at Yellowbank focused on the southern border of the slough channel.

**Description:** High-banked slough channel with fluctuating water levels and wood banks bordered by agricultural fields and oilfield access roads.

**Ownership:** Edmund and James Bickett, Wabash Farms Inc.

**Located / Date Last Observed:** 1 February 2002 / 1 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: Sporadic thalli discovered along slough channel and wooded field edges.

**Population Size**: Approximately 150 thalli

**Topographic Map(s)**: Wabash Island quadrangle 7.5

**Legal Description**: T8S R10E S15, 16, 17

**UTM Coordinates**:

| | | |
|---|---|---|
| Waypoint(s) | 105 | 16S 403188 4186944 |
| | 106 | 16S 402940 4187077 |
| | 107 | 16S 402821 4187033 |
| | 108 | 16S 402478 4186988 |
| | 109 | 16S 401974 4187283 |
| | 110 | 16S 401351 4187662 |
| | 111 | 16S 402345 4187016 |

**Substrate**: *Quercus, Carya, Celtis, Fraxinus*

**Notes**: The survey was concentrated along the south bank of Yellowbank Slough beginning in Section 15 along the Wabash River to the section-line between sections 8 and 17, a distance of 3.2 kilometers. Additional surveys were undertaken on the northern border of the slough (within sections 8 and 9) as well as portions of the upper slough in section 6. Yellowbank Slough is a substantial wetland feature of the Gallatin Bottoms spanning an 8 km sweep from the Wabash River (River Mile 5.5) to its connection with Cattail Slough amidst Goose Pond Scatters. Yellowbank is a high-banked slough channel with corridors of timber remaining along the slough banks and upland terrace. Intensive agricultural landuse is characteristic beyond this thin border. The slough's wooded periphery abutting the field edges provides a linear, park-like environment which accommodates populations of *P. leana*. A number of stands of *P. leana* were sighted during surveys of the southern bank of the slough, and although particularly large populations were not discovered, thalli were consistently scattered along the edge of the slough. Approximately 150 individual thalli were observed in the 3 km survey of the southern slough bank. Aspects were variable and the heights of thalli observed above the soil surface were generally less than 2 meters but varied due to the position of the trees on the grade of the slough channel. Substrates utilized included *Celtis occidentalis, Quercus palustris, Quercus macrocarpa, Fraxinus pennsylvanica* var. *subintegerrima,* and *Carya* spp. Populations of *Arundinaria gigantea* were also prevalent along the wooded borders of Yellowbank Slough with larger populations located in sections 8 and 9.

**Observer**: R. N. Gillespie

## Hovey Lake Population (Fig. 15; WP85-86)

**Location:** Between river miles 12 and 13 from the mouth of the Wabash River, near Goose Pond, IN. The population is located on the Indiana-side of the Wabash River along the river's shoreline immediately downstream from a small island located approximately two river miles from the confluence of the Little Wabash and Wabash Rivers

**Description:** A stand of river-side *Populus*

**Ownership:** State of Indiana (Hovey Lake WMA).

**Located / Date Last Observed:** 27 January 2002 / 27 January 2002

**County**: Posey Co., IN

**Extent of Population**: Scattered thalli in grove of *Populus* deltoides

**Population Size**: Approximately 30 thalli

**Topographic Map(s)**: Wabash Island quadrangle 7.5

**Legal Description**: T8S R15W S2

| | | | |
|---|---|---|---|
| **UTM Coordinates**: | Waypoint(s) | 85 | 16S 406756 4189819 |
| | | 86 | 16S 406818 4189763 |

**Substrate**: *Populus deltoides*

**Notes**: Island landmark UTM Coordinates: W87 16S 406094 4190812. Thalli scattered on *Populus deltoides* associated with the river shoreline; most substrate trees with only one major thallus. Most thalli were within a meter of the soil surface and aspects were variable. This stand of *P. leana* is located within the Hovey Lake Wildlife Management Area.

**Observer**: R. N. Gillespie, J. C. Gillespie, Danny Schnepper

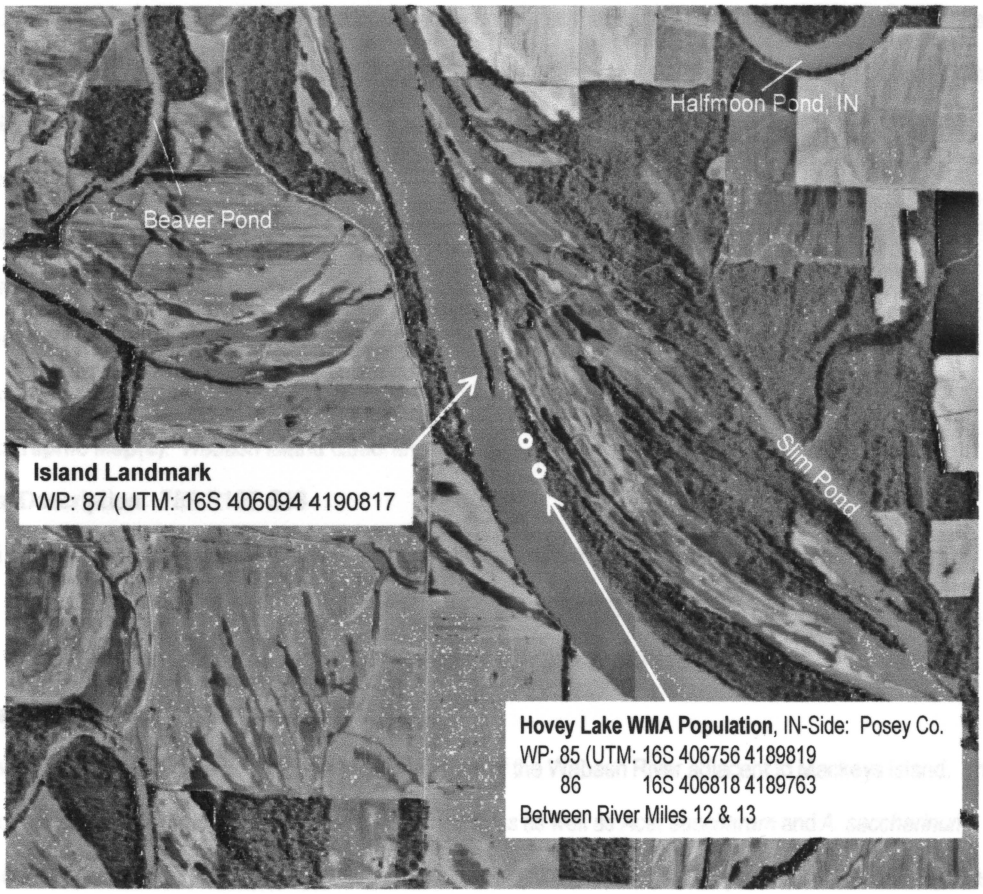


**Figure 15.** Digital orthoquadrangle of the Wabash River in close proximity to Beaver Pond, Gallatin Co., Illinois and Halfmoon Pond, Indiana.

## Mackeys Island Population (Fig. 16; WP80-82)

**Location:** South of Mackeys Island (Wabash River Island) at River Mile 8 from the mouth of the Wabash River. The population is not located on the island proper but found on the Indiana river bank directly across from the island. The population is located at the termination of an eroded bend in the river, 2 river miles southwest of the riverside town of Oak Grove, IN (Posey Co.) and the population may be accessible from field lanes on the Indiana-side originating from Oak Grove.

**Description:** Wooded shoreline corridor bounded by agricultural fields and the Wabash River channel. Several large scattered *Populus* deltoides (~10 well over 200cm DBH) with a consistent stand of *P. leana* varying from single to multiple individuals per substrate tree.

**Ownership:** Unknown

**Located / Date Last Observed:** 27 January 2002 / 27 January 2002

**County**: Posey Co., IN

**Extent of Population**: 15 substrate trees

**Population Size**: 50 thalli

**Topographic Map(s)**: Wabash Island Quadrangle 7.5

**Legal Description**: T8S R10E S13

**UTM Coordinates**: Waypoint (s)

| | |
|---|---|
| 80 | 16S 406601 4186549 |
| 81 | 16S 406840 4186466 |
| 82 | 16S 407443 4186295 |

**Substrates:** *Populus* deltoides and *Acer ssp.*

**Notes**: The population is located on the south shoreline of the Wabash River adjacent to Mackeys Island. The shoreline corridor is dominated by large, scattered *Populus deltoides* as well as *Acer saccharum* and *A. saccharinum*. *Populus* is consistently populated by one to several large thalli. The population is bounded by eroded shorelines to the east and west. Some large thalli were observed (10 cm diameter) and the population appears healthy although some separation from substrates was noted. The population was located during watercraft surveys. Disembarkation was also undertaken at Mackeys Island from the southwest, on the return trip along Indiana-side of the survey circuit from the mouth of the Wabash River. No lichen thalli were observed on *Populus deltoides* present on the island.

**Observer**: Robert N. Gillespie, James C. Gillespie, Danny Schnepper


**Figure 16.** Digital orthoquadrangle of the Mackey's Island population

## Sander's Population (Fig. 17; WP72)

**Location:** The Sander's Population is located along the Illinois shoreline of the Wabash River at River Mile 4 and was inspected during the watercraft survey of the lower Wabash River from New Haven to the terminus of the river. North of Hulda Lake, from the junction of 15400E (Big Barn Road) and 16000N (Calico Lane), the population can be located by following Calico Lane east until it turns south to follow the river bank. The population is located along the riverbank corridor north of the southerly turn of Calico Lane.

**Description:** Wooded river corridor between agricultural fields to the west and the Wabash River channel. *Populus* grove located in a "stillwater" zone somewhat removed from the main flow of the river channel. Several small ephemeral slough-like areas are present throughout extent of corridor. Thalli scattered on *Populus deltoides*.

**Ownership:** Ruth Sanders

**Located / Date Last Observed:** 27 January 2002 / 27 January 2002

**County**: Gallatin Co., IL

**Extent of Population**: 300m of corridor surveyed

**Population Size**: ~ 50 thalli

**Topographic Map(s)**: Wabash Island quadrangle 7.5

**Legal Description**: T8S R10E S22

**UTM Coordinates**: Waypoint(s) 72 16S 404626 4185164

**Substrate:** *Populus deltoides* and *Acer* spp.

**Notes**: This population supports some large thalli and was located initially with field glasses from the watercraft. The population may extend further to the north since riparian habitat continues. This population is bounded to the south by a fishing encampment and eroded river shoreline to the mouth of the Wabash River.

**Observer**: R. N. Gillespie, J. C. Gillespie, Danny Schnepper

## North Hulda Road Pins Population (Fig. 17; WP104)

**Location:** Stand of *P. leana* located on *Quercus palustris* adjacent to Big Barn Road (15400E Rd.) north of Hulda Lake.

De**scription:** Substrate tree along roadside.

**Ownership:** Elizabeth Kuhl

**Located / Date Last Observed:** 01 February 2002 / 01 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: Few thalli noted on roadside *Quercus palustris*.

**Population Size**: Approximately 10 thalli

**Topographic Map(s)**: Wabash Island quadrangle 7.5

**Legal Description**: T8S R10E S27

**UTM Coordinates**: Waypoint(s) 104 16S 403392 4184563

**Substrate**: *Quercus palustris*

**Notes**: Thalli influenced by roadway dust (limestone).

**Observer**: R. N. Gillespie

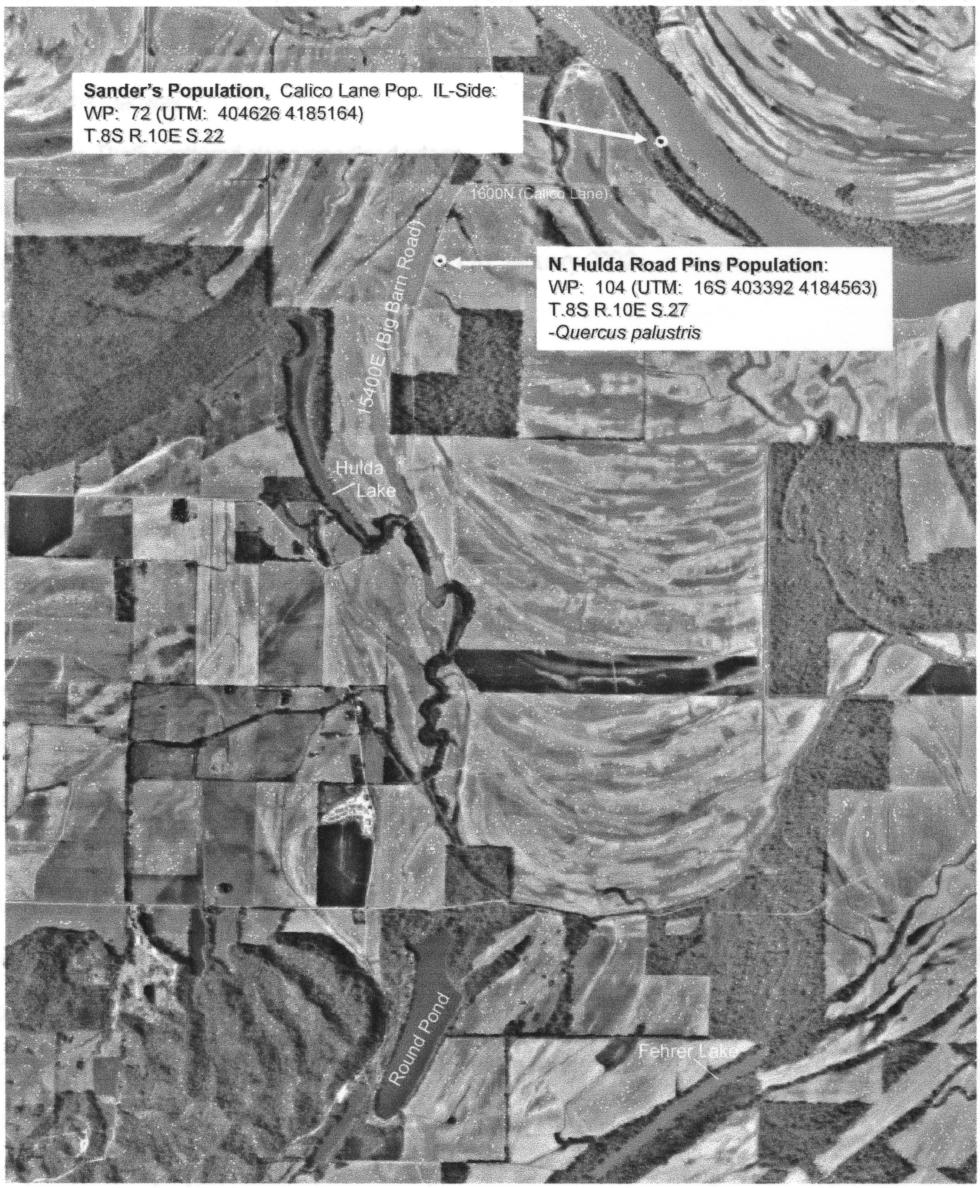


**Figure 17.** Digital orthoquadrangle of the Hulda Lake area with the Sander's and North Hulda Road Pins populations indicated.

## Round Pond Bottoms L. L. C. Population (Fig. 18; WP90-91)

**Location:** East following Bickett's Ditch Lane (Running Slough) from the northern end of Round Pond to the termination of the roadway at a major highline right-of-way. The population is located on the periphery of a bottomland forest tract adjacent to the roadway.

**Description:** Thalli scattered along woodland edges.

**Ownership:** Allen Gray est. (The Bottoms Limited Liability Corporation)

**Located / Date Last Observed:** 31 January 2002 / 31 January 2002

**County**: Gallatin Co., IL

**Extent of Population**: Sporadic thalli discovered along woodland edge

**Population Size**: Approximately 50 thalli

**Topographic Map(s)**: Wabash Island quadrangle 7.5

**Legal Description**: T9S R10E S2

| | | | |
|---|---|---|---|
| **UTM Coordinates**: | Waypoint(s) | 90 | 16S 406206 4180844 |
| | | 91 | 16S 406213 4181117 |

**Substrate**: *Quercus imbricaria* and *Quercus palustris*

**Notes**: Interior of woodland not surveyed at this time.

**Observer**: R. N. Gillespie

## Fehrer Lake Population (Fig. 18; WP92-100)

**Location:** The Fehrer Lake Population was discovered during a survey of the western shore of Fehrer Lake and the bottomland forests east of the Round Pond / Long Pond oxbow lake complex. Fehrer Lake is a member of the oxbow lake communities near Bell Island, KY approximately 3 kilometers northeast of Old Shawneetown. Access can be gained from the roadway immediately south of the Long Pond/Round Pond complex.

**Description:** A Deep Cypress Swamp community, oxbow lake, and surrounding bottomland woodlands.

**Ownership:** Logsdon Farms

**Located / Date Last Observed:** 31 January 2002 / 31 January 2002

**County**: Gallatin Co., IL

**Extent of Population**: Thalli discovered along slough channel and wooded field edges.

**Population Size**: Core Site (Extensive Population)

**Topographic Map(s)**: Grove Center & Wabash Island quadrangle 7.5

**Legal Description**: T9S R10E S10, 11, 15

| | | | |
|---|---|---|---|
| **UTM Coordinates**: | Waypoint(s) | 92 | 16S 405002 4180111 |
| | | 93 | 16S 404232 4180038 |
| | | 94 | 16S 403762 4178439 |
| | | 95 | 16S 404129 4178381 |
| | | 96 | 16S 404596 4178739 |
| | | 97 | 16S 405286 4179168 |
| | | 98 | 16S 405666 4179424 |
| | | 99 | 16S 405785 4179568 |
| | | 100 | 16S 405512 4179991 |

**Substrate**: *Quercus, Carya, Celtis, Fraxinus, Populus*

**Notes**: Fehrer Lake is a Deep Cypress Swamp (Voigt and Mohlenbrock 1964) and *Taxodium distichum* is emergent in the shallower areas of the oxbow lake. Thalli are visible on emergent Taxodium and shoreline tree species associated with the oxbow lake as well as along the margins of bottomland woodlands, fencerows, well lit woodland clearings, abandoned logging roadcuts, and roadside areas along Bickett's Ditch Lane. Due to the number of thalli observed, Fehrer Lake is recognized as a core site for *P. leana* in Gallatin County. Associated tree species observed supporting thalli include: *Populus deltoides, Taxodium distichum, Fraxinus pennsylvanica* var. *subintegerrima, Acer saccharum, Acer saccharinum, Carya ovata, Carya illinoensis, Carya laciniosa, Quercus palustris, Celtis occidentalis, Quercus imbricaria* Michx., *Quercus alba, Ulmus americana,* and *Ulmus rubra*. The bottomland roadway along the section line between sections 10 and 15 to the south of Round Pond is paralleled by a fencerow for a portion of its length. The fencerow was inhabited by the lichen in a similar manner to the roadside substrates associated with the Bickett's Ditch roadway to the north of Round Pond.Thalli visible on emergent *Taxodium* and shoreline tree species as well as along the margins of bottomland woodlands, well lit woodland clearings, and logging roadcuts.

A survey track to Black Lake, south of Fehrer Lake, during the growing season yielded no discoveries but summer herbaceous vegetative growth, primarily *Toxicodendron radicans*, was so extreme that it is likely that thalli could have been overlooked. Further analysis of the Black Lake INAI Site is required in the future as it is likely that Black Lake supports populations of *P. leana* in much the same manner as Fehrer Lake.

**Observer**: R. N. Gillespie

## Big Lake / Fish Lake Population (Fig. 18; WP159-164)

**Location:** In the vicinity of oxbow lake communities near Bell Island, Kentucky. Approximately 3 kilometers northeast of Old Shawneetown.

**Description:** Two large oxbow lakes (Deep Cypress Swamp communities) with associated surrounding bottomland forests

**Ownership:** Logsdon Farms & Bickett Farms

**Located / Date Last Observed:** 24 February 2002 / 24 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: Thalli scattered throughout bottomland complex. Confluent mats on *Taxodium* emergent in oxbow lakes as well as substrate trees in surrounding woodlands

**Population Size**: Core Site (Extensive Population)

**Topographic Map(s)**: Grove Center quadrangle 7.5

**Legal Description**: T9S R10E S15, 21, 22

**UTM Coordinates**:

| Waypoint(s) | | |
|---|---|---|
| | 159 | 16S 402861 4176181 |
| | 160 | 16S 402987 4176857 |
| | 161 | 16S 403321 4177116 |
| | 162 | 16S 403699 4177241 |
| | 163 | 16S 403614 4176680 |
| | 164 | 16S 403614 4176502 |

**Substrate**: Principally *Taxodium* but also observed on *Quercus, Carya, Celtis, Fraxinus, Populus*

**Notes:** The survey along the upper eastern shoreline of Big Lake yielded confluent mats of *P. leana* thalli within rain tracks and associated bark micro-habitats present on *Taxodium distichum* emergent along the shorelines of the oxbow lake. The major substrate utilized for growth was *Taxodium distichum*, although thalli were observed on a host of bottomland tree species. Thalli are very common along the western shoreline of Big Lake and within the fishing village. Fish Lake has higher levels of disturbance than Big Lake and supports *P. leana* but not to the degree that Big Lake does. Nonetheless, the Big Lake / Fish Lake area is regarded as a core site for *P. leana* in Gallatin County.

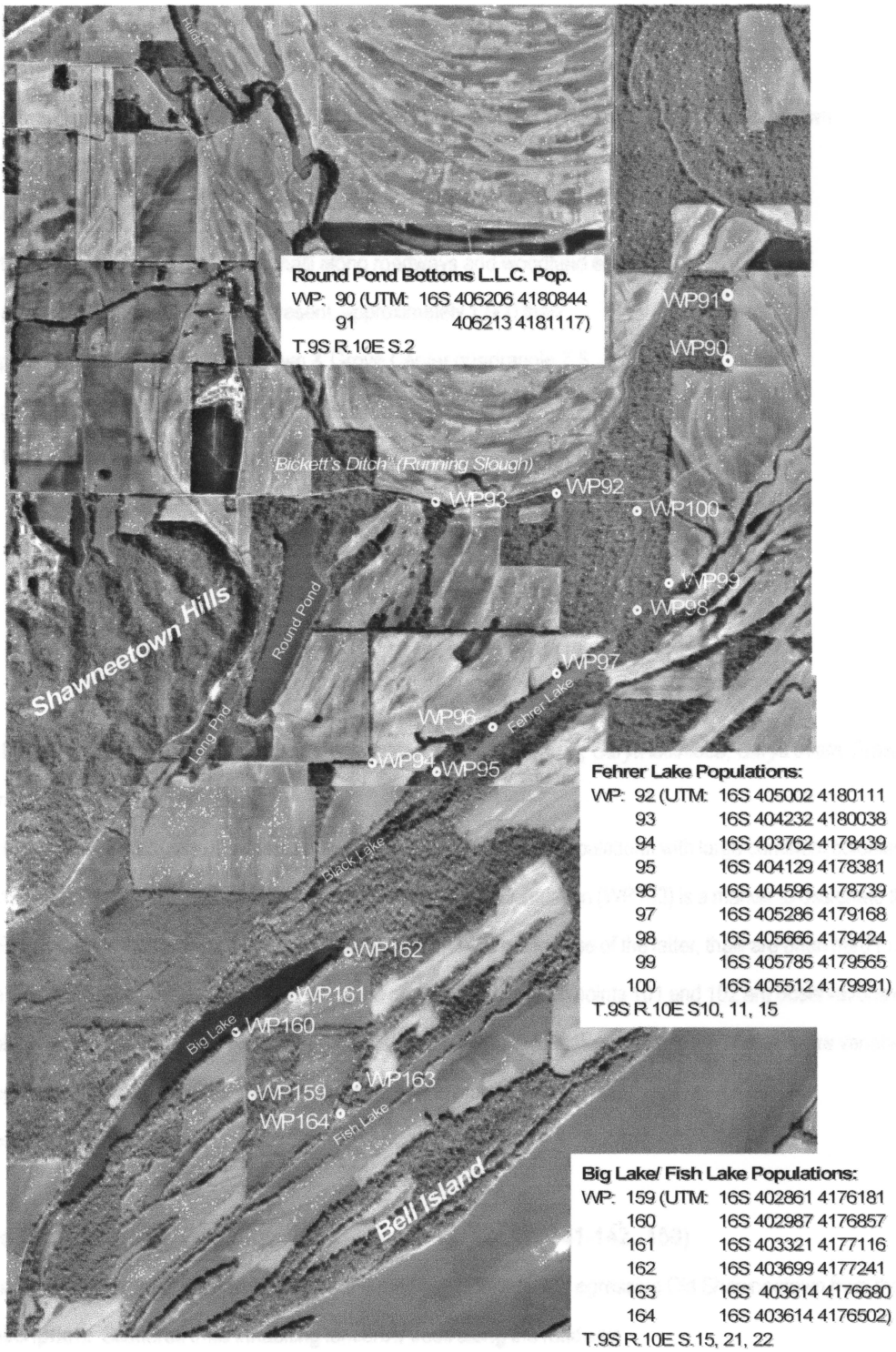


**Figure 18.** Digital orthoquadrangle of the large oxbow lakes north of Old Shawneetown.

## Big Lake / Old Shawneetown - Old Shawneetown Levee Populations

## (Fig. 19; WP101-103, 123-124, 140)

**Location:** Populations are located along roadways north of Old Shawneetown. Populations can be accessed via two gravel roadways that cross the northern Old Shawneetown levee.

**Description:** Roadside trees and woodland edges

**Ownership:** Taylor, Union Colliery Company, some unknown smaller tracts near Old Shawneetown.

**Located / Date Last Observed:** 22 February 2002 / 22February 2002

**County**: Gallatin Co., IL

**Extent of Population**: Scattered thalli along roadways and woodland edges

**Population Size**: Confluent mats present, approximately 1,000 thalli

**Topographic Map(s)**: Shawneetown & Grove Center quadrangle 7.5

**Legal Description**: T9S R10E S20, 29

**UTM Coordinates**:

| Waypoint(s) | | |
|---|---|---|
| | 101 | 16S 399797 4173920 |
| | 102 | 16S 399777 4174245 |
| | 103 | 16S 400047 4175869 |
| | 123 | 16S 401192 4176752 |
| | 124 | 16S 401025 4176271 |
| | 140 | 16S 400431 4174817 |

**Substrate**: *Quercus imbricaria, Quercus palustris, Celtis occidentalis, Carya laciniosa, Carya ovata, Fraxinus pennsylvanica* var. *subintegerrima*

**Notes**: Waypoint 123, and to a lesser extent WP124, reveal visible populations with large confluent colonies and numerous thalli along a roadway. The Shawneetown Woods Population (WP103) is a marker to designate the populations of *P. leana* along the woodland edge, as is waypoint WP140. In the case of the latter, thalli are often hard to discern due to the limestone dust produced by traffic along the gravel roadway. Waypoints 101 and 102 are observations of *P. leana* thalli associated with borrow pits utilized for construction of the Old Shawneetown levee. Aspects are variable in all cases mentioned although WP124 is predominantly easterly in orientation.

**Observer**: R. N. Gillespie

## Old Shawneetown Fencerow Population (Fig. 19; WP141-142, 158)

**Location:** Scattered thalli observed along the roadway (Elasser Rd.) egressing Old Shawneetown from the south.

**Description:** Scattered thalli inhabiting fencerow trees along the roadway.

**Ownership:** Agrarian Enterprises Inc.

**Located / Date Last Observed:** 24 February 2002 / 24 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: 2 km of wooded fencerows along roadway

**Population Size:** Approximately 100 thalli

**Topographic Map(s)**: Shawneetown quadrangle 7.5

**Legal Description**: T10S R9,10E S1,6

| | | | |
|---|---|---|---|
| **UTM Coordinates**: | Waypoint(s) | 141 | 16S 398981 4171886 |
| | | 142 | 16S 398761 4171596 |
| | | 158 | 16S 398158 4171618 |

**Substrate**: Substrate trees are located within the fencerows paralleling the roadway and include *Fraxinus pennsylvanica* var. *subintegerrima, Celtis occidentalis, Gleditsia triacanthos, Quercus ovata,* and *Quercus palustris*.

**Notes**: Thalli often coated with limestone dust from gravel roadway.

**Observer**: R. N. Gillespie

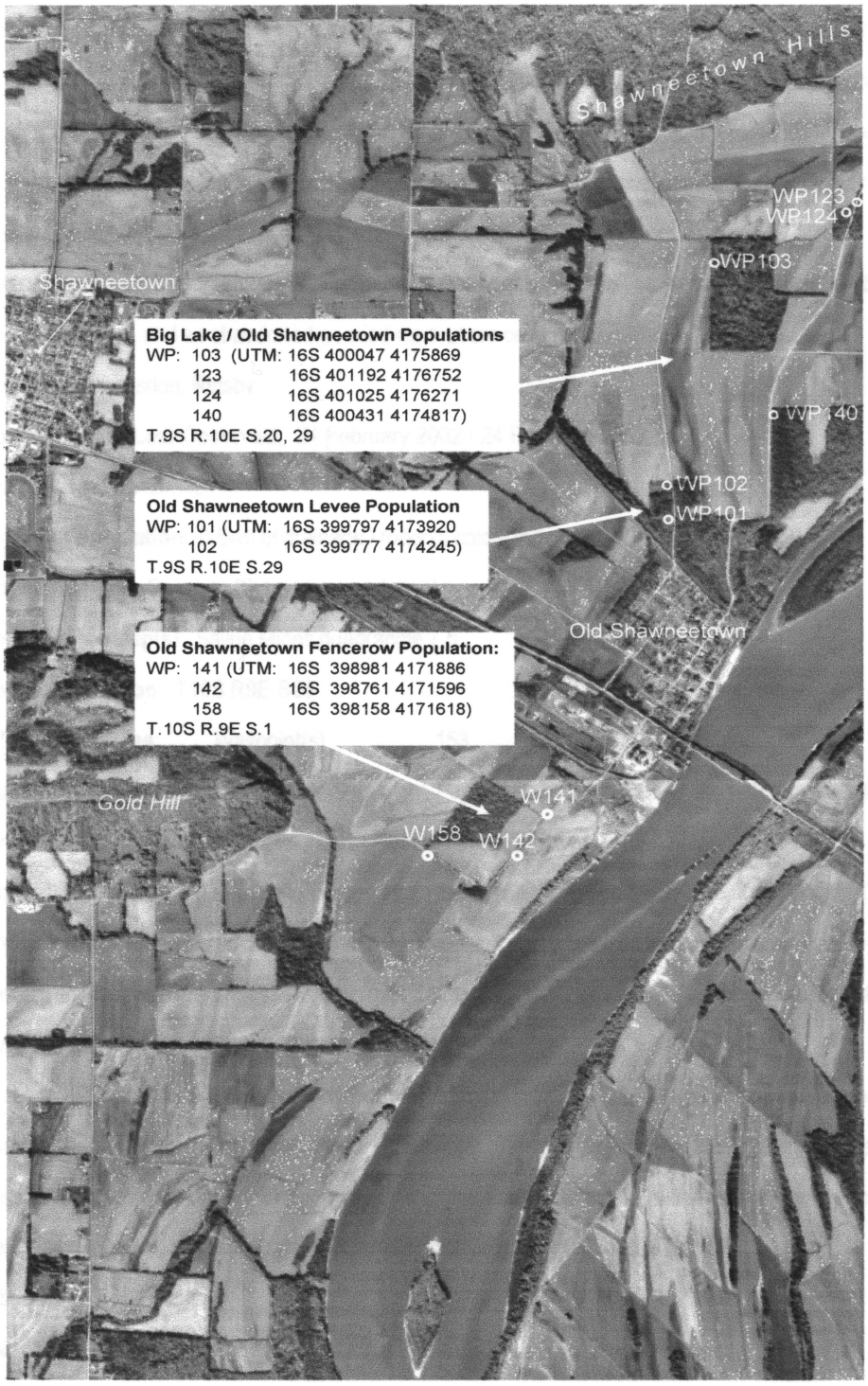


**Figure 19.** Aerial of populations in close proximity to Old Shawneetown

## Saline Mines Population (Fig. 20; WP153)

**Location:** Approximately 1 kilometer east of Saline Mines on a bottomland gravel roadway (Mud Lake Road). The population is located within the first drainage encountered. The majority of the population is located west of the bridge spanning this drainage on the north side of the road. From this bridge the population extends for approximately 0.5 kilometer(s) north of the Mud Lake road throughout the drainage but is most apparent along an old roadcut bordering the western boundary of the woodlot.

**Description:** Wooded drainage in the vicinity of Saline Mines that receives floodwaters from the Ohio River. Woodland edges, openings, and an abandoned wooded roadcut are colonized.

**Ownership:** Logsdon, Rigsby

**Located / Date Last Observed:** 24 February 2002 / 24 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: 0.5km of drainage / roadcut colonized

**Population Size**: Core site (Extensive population)

**Topographic Map(s)**: Saline Mines quadrangle 7.5

**Legal Description**: T10S R9E S26

**UTM Coordinates**: Waypoint(s) 153 16S 396208 4164454

**Substrate**: Substrates utilized include *Salix nigra, Populus deltoides, Celtis occidentalis, Gleditsia triacanthos, Carya ovata, Carya laciniosa, Quercus imbricaria, Fraxinus pennsylvanica* var. *subintegerrima*.

**Notes**: The population is a core site located within the Saline Mines floodplain of southern Gallatin County. The population is located within a drainage paralleling the section line between sections 25 and 26. A large number of thalli are present and form confluent mats extending over 3 meters vertically up a substrate tree's trunk indicating high flood levels during overflow events of the Ohio River.

This population has been disturbed several times in the past including drainage improvements, berm construction within the drainage and breach (to the north of the population), land clearing, agricultural runoff (silt, herbicides, nutrient loads), and timber harvest within the woodlot associated with the population. Although this population is designated as a core site at this time, disturbance patterns suggest a tenuous future.

**Observer**: R. N. Gillespie

## Saline Mines Populations (Fig. 20; WP 151-152)

**Location:** Located approximately 3 km east of Saline Mines along Mud Lake road in close proximity to the Ohio River at River Mile 864.

**Description:** Roadside fencerows

**Ownership:** Patrick Henshaw

**Located / Date Last Observed:** 24 February 2002 / 24 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: Scattered thalli noted on trees near roadway

**Population Size**: Approximately 25 thalli

**Topographic Map(s)**: Saline Mines quadrangle 7.5

**Legal Description**: T10S R9E S25

| | | | |
|---|---|---|---|
| **UTM Coordinates**: | Waypoint(s) | 151 | 16S 397742 4164087 |
| | | 152 | 16S 397844 4164034 |

**Substrates:** Scattered thalli are located upon roadside fencerow on *Gleditsia triacanthos, Cary ovata, Quercus imbricaria, Quercus palustris,* and *Celtis occidentalis.*

**Notes**: Aspects are variable but the majority of thalli observed have southerly orientations..

**Observer**: R. N. Gillespie

## Mud Lake Population (Fig. 20; WP 154-157)

**Location:** Approximately 3.5 kilometers southeast of Saline Mines or 5.5 kilometers upstream on the Saline River from its confluence with the Ohio River at Saline Landing (Ohio River Mile 867).

**Description:** Greatly disturbed oxbow lake with some emergent *Taxodium.* The floodplain is cultivated to the edge of the wetland.

**Ownership:** William Brazier

**Located / Date Last Observed:** 24 February 2002 / 24 February 2002

**County**: Gallatin Co., IL

**Extent of Population**: Southern end of oxbow lake surveyed

**Population Size**: 25 thalli

**Topographic Map(s)**: Saline Mines quadrangle 7.5

**Legal Description**: T11S R9E S1

| | | | |
|---|---|---|---|
| **UTM Coordinates**: | Waypoint (s) | 154 | 16S 397096 4161530 |
| | | 155 | 16S 397098 4161646 |
| | | 156 | 16S 397093 4161597 |
| | | 157 | 16S 397091 4161529 |

**Substrate**: *Salix nigra*

**Notes**: The Mud Lake population within the Saline Mines floodplain has received significant disturbance. The oxbow lake itself has little remaining habitat left to support *P. leana.* Land clearing for agricultural pursuits has been the major cause in

the reduction of quality lacustrine border substrates at this site. Agricultural runoff and associated siltation, nutrient deposition, and pesticide transmittance to the wetland are also detrimental to the health of the Mud Lake population. Available substrates are confined to a *Salix nigra* grove at the extreme southern end of Mud Lake as all peripheral substrates associated with the shorelines have been cleared except for a small number of *Taxodium distichum* emergent along the lake shores. Thalli observed were located high on the substrates (above 3 meters). Disturbance patterns will likely continue to erode this population.

**Observer**: R. N. Gillespie

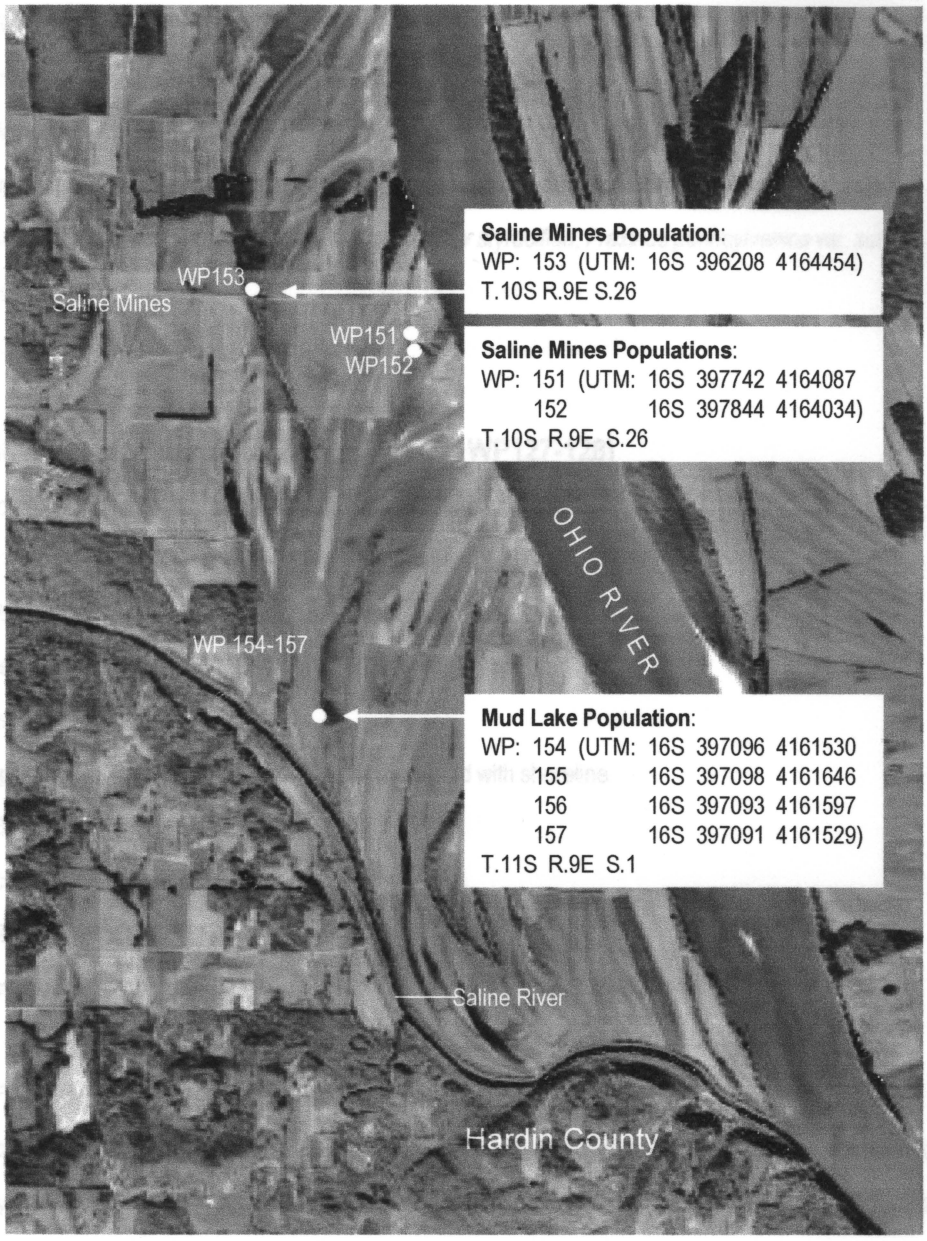


**Figure 20.** Digital orthoquadrangle aerial of the Saline Mines floodplain at the terminus of the Saline River.

## Gray Ridge Populations (Fig. 21; WP129)

**Location:** South of Unionville, IL along an unimproved field roadway in the Gray Ridge area of the Black Bottom

**Description:** Bottomland fencerow surrounded by rowcrop fields but within the drainage of Gray Ridge sloughs

**Ownership:** Unknown

**Located / Date Last Observed:** 16 February 2002 / 16 February 2002

**County**: Massac Co., IL

**Extent of Population**: Scattered thalli along fencerow

**Population Size**: Approximately 25 thalli

**Topographic Map(s)**: Paducah East quadrangle 7.5

**Legal Description**: T16S R6E S35

**UTM Coordinates**: Waypoint(s) 129 16S 364469 4105420

**Substrate**: Substrates include *Celtis occidentalis*, *Liquidambar styraciflua*, *Fraxinus pennsylvanica* var. *subintegerrima*, and *Sassafras albidum*.

**Observer**: R. N. Gillespie

## South Bank Kinneman Lake Population (Fig. 21; WP127-128)

**Location:** South of Unionville, IL along the south bank of Kinneman Lake

**Description:** Ribbon of wooded shoreline along Kinneman Lake

**Ownership:** Unknown

**Located / Date Last Observed:** 16 February 2002 / 16 February 2002

**County**: Massac Co., IL

**Extent of Population**: 2 colonized substrate trees associated with shoreline

**Population Size**: Less than 5 thalli observed

**Topographic Map(s)**: Paducah East quadrangle 7.5

**Legal Description**: T16S R6E S34

**UTM Coordinates**: Waypoint(s) 127 16S 362557 4105207

128 16S 362758 4105094

**Substrate**: *Fraxinus pennsylvanica var. subintegerrima*

**Notes**: Rowcrop fields extend up to the shoreline of the lake and very little wooded corridor remains surrounding the wetland. Only two trees support the population on the south bank of Kinneman Lake, roughly opposite the Pearcy camp fishing village. Less than 5 thalli were observed on southerly aspects of the substrates.

**Observer**: R. N. Gillespie .

## Gray Ridge Populations (Fig. 21; WP125-126)

**Location:** South of Unionville along bottomland roadway near drainage ditch originating from Gray Ridge within an area known as the Devil's Washboard.

**Description:** Roadside substrate trees

**Ownership:** Unknown

**Located / Date Last Observed:** 16 February 2002 / 16 February 2002

**County**: Massac Co., IL

**Extent of Population**: Scattered thalli along roadway

**Population Size**: Approximately 50 thalli

**Topographic Map(s)**: Paducah East quadrangle 7.5

**Legal Description**: T16S R6E S21

**UTM Coordinates**: Waypoint(s) 125 16S 361785 4107488

126 16S 361562 4107259

**Substrate**: *Quercus, Carya*

**Notes**: Several thalli can be observed within a meter of the soil surface along the Mt. Sterling Road, south of Unionville, in close proximity to the Gray Ridge drainage ditch. Substrates and thalli are influenced by floodwaters from the "Gray Ridge" drainage and are at times coated with sediment as a result. Thalli are also influenced by road dust. Large thalli were observed and in some cases formed confluent mats on trees along the roadway. Approximately 50 thalli on eastern and southern aspects are present.

**Observer**: R. N. Gillespie

## Kinneman Lake Grove Population (Fig. 21; WP12)

**Location:** South of Unionville near the Kinneman Lake bridge. The population is located within a grove of *Carya illinoensis* at a curve in the roadway after crossing the Kinneman Lake bridge.

**Description:** Roadside grove of *Carya illinoensis*. Lone trees surrounded by agricultural fields and roadways. Understory very rudimentary.

**Ownership:** Unknown

**Located / Date Last Observed:** 30 December 2001 / 23 February 2002

**County**: Massac Co., IL

**Extent of Population**: 5 substrate trees colonized

**Population Size**: Approximately 30 individuals

**Topographic Map(s)**: Paducah East quadrangle 7.5

**Legal Description**: T16S R6E S29

**UTM Coordinates**: Waypoint(s) 12 16S 360800 4105904

**Substrate**: *Carya illinoensis*

**Notes**: Kinneman Lake Grove was the first *P. leana* stand located within the Black Bottom and represents the first report within Massac County since the loss of the Fort Massac population. The stand is located south of the Kinneman Lake bridge at the "Y" in the road. Approximately 30 thalli are located at the base of several *Carya illinoensis* located at the site. Thalli are generally less than a meter from the soil surface and display varying orientations.

**Observer**: R. N. Gillespie, J. C. Gillespie

## Loon Lake Population (Fig. 21; W13-14, 143)

**Location:** South of Unionville along shores of Loon Lake.

**Description:** Deep Cypress Swamp community

**Ownership:** Unknown

**Located / Date Last Observed:** 23 February 2002 / 23 February 2002

**County**: Massac Co., IL

**Extent of Population**: Sporadic thalli discovered on emergent *Taxodium*

**Population Size**: Approximately 20 thalli

**Topographic Map(s)**: Paducah East quadrangle 7.5

**Legal Description**: T16S R6E S20, 30

**UTM Coordinates**: Waypoint(s) 13 16S 360081 4107183

14 16S 359427 4107717

143 16S 359581 4107401

**Substrate**: *Taxodium distichum, Populus deltoides*

**Aspect of Thalli on Substrate**: (variable) N, S, ESE

**Notes**: The Loon Lake population is a compilation of *P. leana* stands associated with the Loon Lake natural channel lake. Thalli were observed on *Populus deltoides* and emergent *Taxodium distichum* along the shorelines of the oxbow lake. The number of individual thalli observed is approximated at 20 individuals on variable aspects (N, S, ESE). Thalli occupy rain tracks or ameliorated micro-habitats on substrate bark.

**Observer**: R. N. Gillespie, J. C. Gillespie

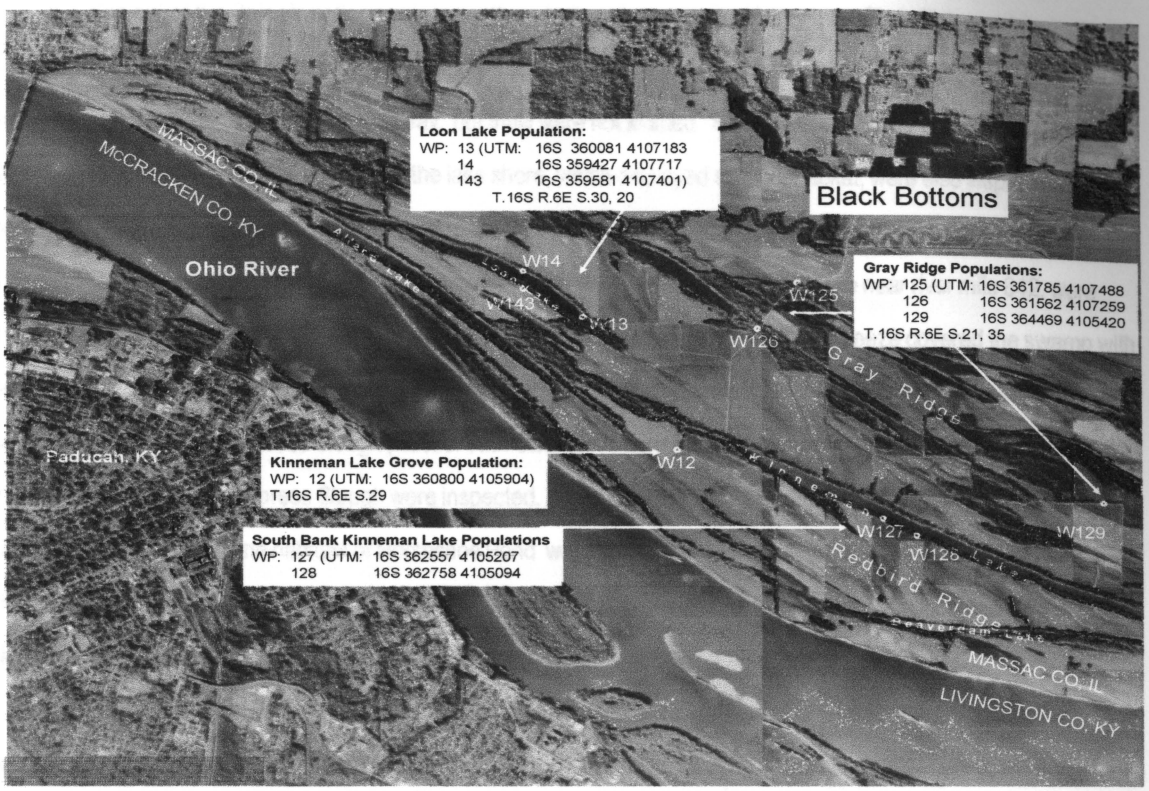


**Figure 21.** Digital orthoquadrangle of the Black Bottom.

## Surveys of the Ohio River floodplain in Indiana and Kentucky

Surveys of the Ohio River floodplain in southern Indiana began at the Hovey Lake State Fish and Wildlife Area on January 13, 2002. Areas accessible from route 69 and site roadways were inspected for *P. leana,* as were the shorelines of Hovey Lake abutting the roadway, but thalli were not located. Surveys of the Hovey Lake boat launch site, lake shoreline, and campground areas near the lake shore, which displayed suitable habitat, were also inspected. The bottomland roadways originating from the Hovey Lake facility were utilized and promising habitats along Hovey Lake and the Ohio River shoreline, including areas in the vicinity of the Hovey Lake public access site near river mile 842, were inspected. Twin Swamps Nature Preserve was surveyed on February 5, 2002 as a hard freeze covered the swamp with solid ice and allowed for thorough inspection of the area. The gravel roadway south of Twin Swamps Nature Preserve was utilized for access to Cypress Slough (west of Twin Swamps Nature Preserve) and suitable substrates adjacent to the roadway associated with Cypress Slough were inspected. From Cypress Slough, areas in the vicinity of Oak Grove, Uniontown, and the shoreline habitats of Horseshoe Pond were surveyed. Additional areas within the bottoms north of Hovey Lake, mainly woodland edge habitats, were also inspected. Since thalli of *P. leana* were not located in any of these sites the Posey County survey was discontinued.

Large *Populus deltoides* stands associated with the waterfront to the east of the Falls of the Ohio State Park, as well as many potential substrates adjacent to park shoreline trails traveling west from the interpretive center, were surveyed beginning May 5, 2002. No thalli were discovered at the site although suitable substrates in potentially productive habitats were abundant. Some trees displayed bark abrasions from flood-propelled particulates and driftwood impacts. Traveling west from Louisville along Route 111 to the vicinity of Fishtown revealed few accessible areas to survey. Elizabeth and Corydon were passed through to access the Harrison-Crawford State Forest. Areas of the Harrison-Crawford State Forest adjacent to the Ohio River were surveyed but were found not to support *P. leana*. Surveys of bottomland areas between Magnet and Dexter did not reveal populations of *P. leana*. The Mano Point Population was discovered shortly after entering the Hoosier National Forest. Mano Point (i.e. Oil Creek Access Site), near Derby, supported a large population of *P. leana* although a high river stage obscured thalli on substrate trees closest to the Ohio River channel. A *Liquidambar styraciflua* planting along the entrance roadway to the boat launch was found to support large healthy thalli . Continuing westward to Rome,the Rome river access area and bottomlands associated with Bear Creek were surveyed with no success. Areas near Dodd and Tobinsport were surveyed but did not support *P. leana* or particularly suitable habitats. The river access at Cannelton and substrates present at Sunset Park beyond the Tell City flood wall were also inspected. The Troy boat launch and the Grandview riverside park and river access site near Sandy Creek, via route 66, were surveyed, but no thalli of *P. leana* were discovered.

Thalli were discovered near Enterprise west of the Jackson Creek terminus. From Enterprise the survey continued back through Evansville to the industrialized Mt. Vernon waterfront . Bottomland areas associated with Goose Pond and

Cypress Slough southeast of Mt. Vernon were surveyed beginning June 15, 2002 but trees were not found to be colonized. The bottomlands and river shoreline areas where accessible across from Henderson, Kentucky (in the vicinity of the river village of Cypressdale) and along the border of the Rahm peninsula were surveyed without success. The survey progressed to the city of Evansville (through the villages of Vaughn and Cypress) then through the Evansville waterfront eastward to Newburgh and Vanada to bottomland areas near Yankeetown. Additional riverside habitat in the vicinity of Enterprise south from Hatfield through the village of Eureka to the French Island Marina was surveyed. From Enterprise the survey effort continued westward to the village of Rockport, riverside habitats were surveyed but did not reveal *P. leana* populations. The survey continued eastward to the route 66 / 166 intersection with stops to survey substrates adjacent to the river, then through Dodd to Tobinsport but thalli or suitable habitats were not located. Entering the Hoosier National Forest on route 66, Anspaugh Flats forest roads were utilized to survey riverside habitats with limited success. The Mano Point core site was visited before continuing on to Leavenworth were *P. leana* was discovered on a line of *Populus* associated with the old lock and dam facility below the town. The Blue River public access site and areas near Mauckport and Titus were also surveyed before crossing the Route 135 (Matthew-Welsh) Ohio River bridge to Kentucky.

In Kentucky the Brandenburg waterfront (river access and marina) was surveyed with no success. The survey continued west to the Concordia public access site and associated areas but thalli were not found. Areas associated with the Yellowbank Wildlife Management Area were surveyed as were the Ohio River waterfront areas at Stephensport but substrates inspected did not support *P. leana*. Riverfronts at both Cloverport and Hawesville were surveyed without locating stands of *P. leana*. The survey entered Owensboro on route 60 to briefly inspect the river access there. Areas near the French Islands were surveyed as were several fishing villages north of Spottsville along the Green River Road before continuing on through Henderson to access areas associated with the Sloughs Wildlife Management Area. Although suitable substrates were located adjacent to the Ohio no thalli were located. Surveys of riverside and floodplain areas near Uniontown and in the vicinity of Grundy Hill and the village of Raleigh were completed. Several riverside *Populus* along the gravel roadway paralleling the Ohio River (Rt 667) as well as the Blackburn public access site across from Old Shawneetown were surveyed to no avail.

From Louisville Charlestown State Park was surveyed on July 28, 2002, along with bottomlands associated with the confluence of Licking Creek / Fourteenmile Creek with the Ohio River. Substrates were present but the floodplain area available for colonization at the site was minimal and no thalli were located. The riverside villages of Owen and Sunset Village, through Hibernia were also surveyed before returning to New Washington. The riverfront areas associated with Bethlehem, Miles Point, and Marble Hill were inspected with no success as were riverfront areas in the town of Hanover. The Madison / Milton river bridge was utilized to inspect the Milton, KY public access site.

The Milton boatlaunch supported a small, highly disturbed population of *P. leana*. After crossing back to the Indiana-side, surveys were continued along route 56 from Lamb to Vevay. Thalli were located at the Vevay riverfront park on *Populus* along the shoreline. From Vevay surveys continued through Markland and Florence to the Bryant Creek public access site and areas of the Egypt Bottoms without success. Travel to Patriot (including the Patriot public access site), through the Mexico Bottom, to riverside areas at Rising Sun, including the Arnold Creek public access site, revealed no populations of *P. leana*.

## Populations of *P. leana* discovered in Indiana and northern Kentucky

Populations of *P. leana* located within the Big Rivers Natural Region in Indiana occupy habitats including fishing villages, boat launch facilities, and park-like settings associated with the Wabash and Ohio River shorelines (Jackson 1997). Populations discovered along the Ohio River occupy peculiar habitat areas which receive continuous anthropogenic manipulation, primarily mowing and brush removal, which produce park-like settings with substrate trees exposed to air currents and high levels of incident light. Populations discovered in Indiana to date occupy very limited land areas in direct association with the present channel of the Ohio River. Larger floodplains along the Ohio River in Indiana have not displayed the level of abundance which characterized the Gallatin Bottoms in Illinois. Nevertheless, surveys for *P. leana* populations within the Hoosier National Forest and the Harrison-Crawford State Forest located the largest population of *P. leana* in Indiana at the Mano Point Ohio River Access facility near Derby. Surveys undertaken in Indiana also provided the nearest population, to date, to the holotype station. This section is arranged geographically, progressing easterly from the Enterprise population (east of Evansville) near Little Hurricane Island, KY, to the Vevay riverfront park population. Maps of the sites, UTM coordinates, and other relevant information for future visitation to these areas are included.

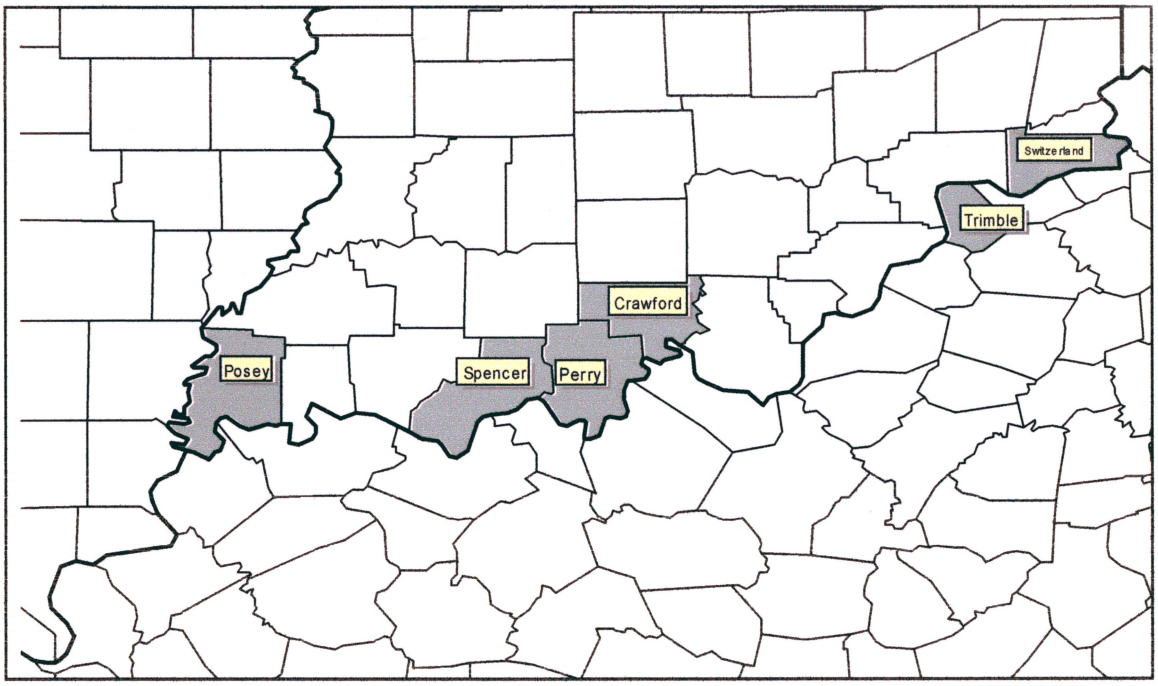


**Figure 22.** Counties containing populations of *P. leana* in southern Indiana and northern Kentucky.

## Enterprise Population (Fig. 23; WP195)

**Location:** The Enterprise population is located within the fishing village of Enterprise associated with the French Island Marina settlement, approximately 11km NW of Owensboro, Kentucky and 11.4km SE of Hatfield, Indiana.

**Description:** Park-like area provided by fishing village located near Jackson Creek confluence

**Ownership:** Unknown

**Located / Last Observed:** 6 May 2002

**County:** Spencer Co.

**Extent of Population:** Thalli observed on a single substrate tree

**Population Size:** 10 thalli

**Topographic Map(s):** Owensboro West quadrangle 7.5

**UTM Coordinates:** Waypoint(s) 195 16S 484077 4188304


**Figure 23.** Digital orthoquadrangle of the population at Enterprise, Indiana

**ubstrate:** *Populus deltoides*

**lotes:** Thalli were observed west of the Jackson Creek confluence with the Ohio River. French Islands No. 1 and No. 2 nd Ellis Island are located to the east and Little Hurricane Island is located to the southeast of the population. Areas urveyed included portions of the river shoreline between River Miles 763 and 764 as well as shoreline areas between

Ohio River Mile 764-768 beyond the French Island Marina river access ramp. It should be noted that most areas surveyed were visually inspected with field glasses during the winter and a limited amount of reconnaissance on foot was practical. The majority of thalli discovered were located at ground level on *Populus deltoides*. Orientations displayed by the examined thalli were southerly. At this time, the Enterprise population consists of approximately 10 thalli on one tree. This population provides an example of the affinity of the lichen for areas associated with fishing villages.

**Observer(s):** R.N. Gillespie, M.A. Urfer

## Mano Point Population (Fig. 24; WP196)


**Figure 24.** Digital orthoquadrangle of the Mano Point Ohio River Access Site near Derby, Indiana

**Location:** The Mano Point Ohio River access area, situated within landholdings of the Hoosier National Forest, is located 1.5 km east of Derby along state route 66, east of the Oil Creek confluence with the Ohio River at river mile 691.7.

**Description:** Ohio River access facility with associated shoreline substrates colonized

**Ownership:** US Department of Agricultural, Forest Service

**Located / Date Last Observed:** 6 May 2002

**County:** Perry Co., IN

**Extent of Population:** Grove of *Populus deltoides* colonized near boat launch and edges of planted woodlot nearby

**Population Size:** Thousands of individual thalli

**Topographic Map(s):** Derby quadrangle 7.5

**UTM Coordinates:** Waypoint(s) 196 16S 542300 4210643

**Substrate(s)**: *Populus deltoides, Liquidambar styraciflua, Acer saccharinum*, and *Juglans nigra*

**Notes:** The Mano Point population is the largest *P. leana* population presently known in Indiana. The population is located predominantly along the shoreline of the Ohio River channel particularly within a grove of *Populus deltoides* adjacent to the boatramp. The lichen also populates the margins of the woodlot bordering the access lane to the site where thalli can be observed on *Populus deltoides* and *Liquidambar styraciflua*. Thalli were also observed on *Acer saccharinum* and *Juglans nigra*. Thalli form confluent mats and *Populus* substrate trees nearest the river are consistently populated up to 3 meters from the soil surface. Many thalli observed were of significant size, and approached 10 centimeters in diameter in many instances. Thalli display good health overall but thalli positioned within the grove of *Populus* nearest the river exhibit some disintegration. Substrates within this zone are also exposed to silt laden waters, and after higher river stage fluctuations, substrate surfaces and thalli present are coated with silt and detritus. The number of thalli present at the site must exceed a thousand individuals but the determination of individual thalli is significantly hampered by comingling growth within the population.

**Observer(s)**: R.N. Gillespie, M.A. Urfer

## Leavenworth Population (Old Lock and Dam No. 44) (Fig. 25; WP197)

**Location:**The Leavenworth population is located approximately 1.6km southeast of Leavenworth at the Old Lock and Dam No. 44 site (River Mile 663.2).

**Description**: Yard of "mothballed" Lock and Dam No. 44, *Populus deltoides* in swale area near access roadway

**Ownership**: US Army Corp of Engineers

**Located / Date Last Observed**: 6 May 2002

**County**: Crawford Co, IN

**Extent of Population**: Three substrate trees colonized

**Population Size:** 10 thalli

**Topographic Map(s)**: Leavenworth quadrangle 7.5

**UTM Coordinates**: Waypoint(s) 195 16S 484077 4188304

**Substrate**: Populus deltoides

**Notes:** The population of *P. leana* occupies a row of open-grown *Populus deltoides* northeast of the abandoned lock house within a swale area. A limited number of thalli are present at this site and not all trees in the line of *Populus* support thalli. Thalli are at ground level and the aspect occupied is easterly. Thalli can be obscured by groundcover near the bases of the trees and were observed on *Toxicodendron radicans* ascending the trunks of the substrate trees.

**Observer**: R.N. Gillespie

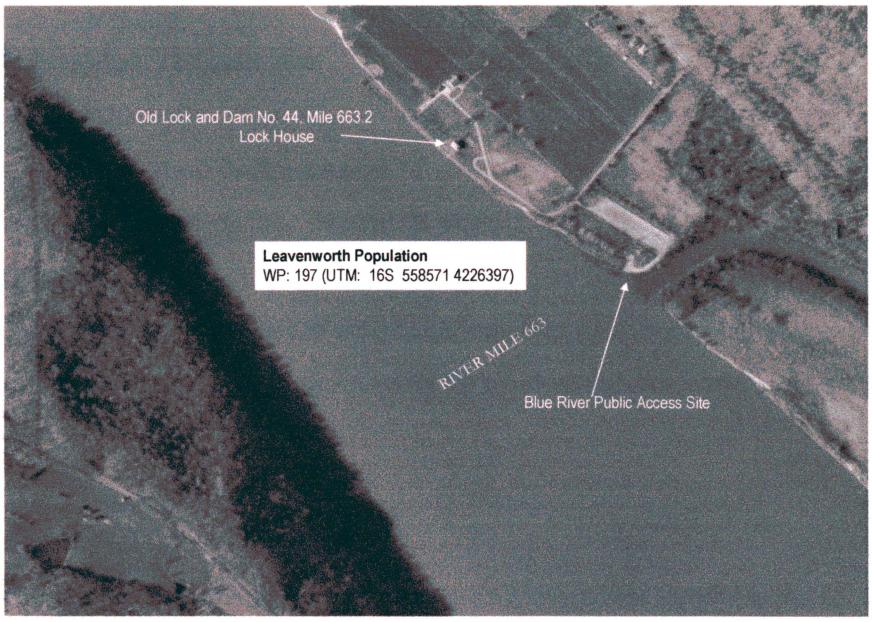


**Figure 25.** Aerial image of the Lock and Dam No. 44 site and the Blue River Ohio River Access Site

## Vevay Population (Switzerland Co.) (Fig. 26; WP194)

**Location:** The Vevay riverfront park (near River Mile 538) and Ohio River access facility.

**Description:** Riverfront park and river access facility with shoreline *Populus deltoides* colonized

**Ownership:** City of Vevay, IN

**Located / Date Last Observed:** 25 Jul. 02

**County:** Switzerland Co., IN


**Figure 26.** Digital orthoquadrangle of the city of Vevay, Indiana

**Extent of Population:** 3 substrate trees

**Population Size:** 100 thalli

**Topographic Map(s):** Vevay South quadrangle 7.5

**UTM Coordinates:** Waypoint(s) 194 16S 668108 4290143

**Substrate:** *Populus deltoides*

**Notes:** This population is the furthest east and is closest to the holotype locality at Riddley's Bog in Hamilton Co., Ohio. The population is not particularly large, approximately 100 individuals that occupy 3 trees but is in excellent health.

**Observer:** R. N. Gillespie

## Milton Population (Fig. 27; WP193)

**Location:** The Milton population is adjacent to the Milton Ohio River Access Site at River Mile 557.2, in close proximity to the Madison Highway Bridge on US Route 421.

**Description:** River access facility with shoreline *Populus deltoides* colonized

**Ownership:** City of Milton, KY

**Located / Date Last Observed:** 25 Jul. 02

**County:** Trimble Co., KY

**Extent of Population:** 3 substrate trees


**Figure 27.** Digital orthoquadrangle of Milton, Kentucky opposite Madison, Indiana

**Population Size:** 20 thalli

**Topographic Map(s):** Madison East quadrangle 7.5

**UTM Coordinates:** Waypoint(s) 193 16S 641772 4287645

**Substrate:** *Populus deltoides*

**Notes:** Approximately 20 thalli were observed on a small grove of *Populus* deltoides located to the west of the boatramp. Often utilized by local fishermen, the substrates receive the typical disturbances, driven nails, lantern scars, watercraft tie-off abrasions, and fire damage. Essentially any order of cambium damage can be observed, certainly undermining the future support of the population. Thalli are present on eastern aspects and *Campsis radicans* occupies areas of the trunk also inhabited by *P. leana*.

**Observer:** R. N. Gillespie

## Survey of the Cumberland and Caney Fork Rivers

The survey of the Cumberland River began in Kentucky at Burkesville on June 22, 2002. The Burkesville river access and areas associated with Herefords Bend were visited. Near Burkesville, Dale Hollow Lake State Park and shoreline areas near the marina were accessed via a trail system and surveyed for *P. leana* as were areas near Neelays Ferry. Across the state line, the waterfront areas associated with Celina, TN were surveyed. Potential sites along Route 53 were surveyed including the areas of Butlers Landing, Sugar Creek, areas in the vicinity of Gainesboro, in particular the Roaring River Recreation Area, areas near Granville, the Granville Recreation Area, areas associated with Helms Bend and Boulton Bend, near Carthage, and the Carthage public access site to the Cumberland River. West from Hartsville, Cragfront and Bledsoe Creek State Park were visited as were areas near the village of Cairo. Trees in these areas were not found to support *P. leana*. The Hell's Bend population (Fig. 28, pg. 84) discovered by Phillippe could not be accessed (landowner permission could not be obtained) , but some thalli were noted on the north shoreline of the Caney Fork River bordering a public recreation area (Soccer Fields).

The Hartsville Public Access Site (Fig. 30, pg. 86) to the west of Carthage was surveyed and found to support a population of *P. leana*. The Defeated Creek Recreation Area on Cordell Hull Lake was visited as was the tailwater boatramp below the Cordell Hull Lock and Dam on the Cumberland River but both were found to be uninhabited by *P. leana*. River access areas associated with route 96 approaching Edgar Evins State Park, were surveyed as were areas near the Center Hill Dam. Although the documented population located on Wolf Creek Island (Fig. 29, pg. 84) could not be visited due to high water levels associated with discharge from Center Hill Dam, thalli of *P. leana* were discovered on substrates along the shorelines of the Caney Fork River in close association with the island .


**Figure 28.** Digital orthoquadrangle aerial map of the location of the Hell's Bend population on the Caney Fork River downstream from Carthage. The population defined by Phillippe is located on the south bank of the river above the mouth of Bluff Creek.

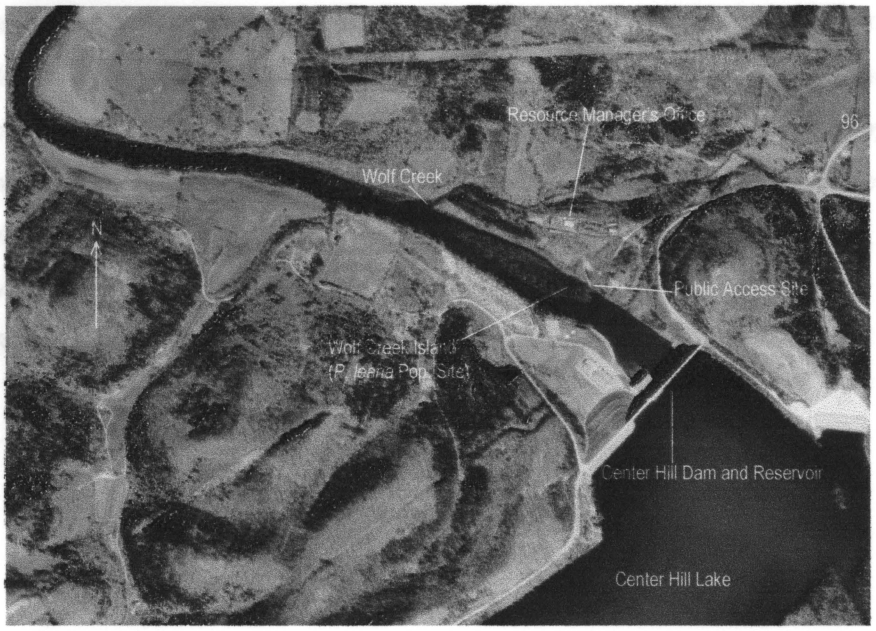


**Figure 29.** Digital orthoquadrangle aerial map of the Center Hill Dam population documented by Phillippe.

## Population of *P. leana* discovered near Hartsville, Tennessee

### Hartsville Public Access Site Population (Fig. 30; WP192)

**Location:** The Hartsville public access site to the Cumberland River is south of Hartsville, Tennesse in the vicinity of state route 141 and within sight of the Coleman-Winston Memorial Bridge. The Hartsville boat launch provides access to backwaters of the Old Hickory Lake impoundment, a mainstrem reservoir maintained by the Army Corp of Engineers on the Cumberland River.

**Description:** Cumberland River access site with shoreline substrate trees colonized

**Ownership:** US Army Corp of Engineers

**Located / Date Last Observed:** 24 July 2002

**County:** Trousdale Co., TN

**Extent of Population:** 50 meters of riparian zone surveyed

**Population Size:** 50 individuals

**Topographic Map(s):** Hartsville quadrangle 7.5

**UTM Coordinates:** Waypoint(s) 192 16S 574643 4025595

**Substrate(s):** *Populus deltoides, Acer saccharinum*

Notes: The population is comprised of approximately 50 individual thalli, the majority of which display excellent health. Some of the thalli are particularly large with one individual spanning 20cm in diameter. Primary substrates include *Populus deltoides* and *Acer saccharinum*. Most thalli are found within 50 cm of the soil surface. The population extends along the shoreline on both sides of the boatramp. To the west, the shoreline habitat is disrupted near river mile 279 by a rock outcropping, and to the east, thalli are scattered regularly along the shoreline associated with areas utilized by bank fishermen. Herbaceous components of the understory included *Toxicodendron radicans*, *Campsis radicans*, *Microstegium vimineum* (Trin.) A. Caus, and *Uniola latifolia* Michx.

**Observer(s):** R.N. Gillespie


**Figure 30.** Digital orthoquadrangle of the Cumberland River (Old Hickory Lake) near Hartsville, Tennessee

## DISCUSSION

Larger populations of *P. leana* which appear secure and likely to persist are herein recognized as core sites (Gilbert and Purvis 1996). Wilhelm, Masters, and Shimp (2000) identified a total of eight core sites in Illinois, Kentucky, and Tennessee (Wilhelm and Masters 1994). In Illinois, the study site at Tower Rock, Hardin County is recognized as a core site supporting 1,530 or more thalli (Wilhelm and Masters 1994). The populations at Bell Island, Kentucky, the Round Pond / Long Pond oxbow lake complex, the Hulda Lake population, the Hulda Woods population, and the Beaver Pond population, all within Gallatin County, are regarded by Wilhelm, Masters, and Shimp (2000) as core populations of *P. leana* in Illinois (Wilhelm and Masters 1994).

| **Illinois** | **Indiana** | **Kentucky** | **Tennessee** |
|---|---|---|---|
| Tower Rock, Hardin Co. | *Mano Point , Perry Co. | Bell Island, Union Co. | Carthage Pop., Smith Co. |
| Round Pond, Gallatin Co. | | Birdsville, Livingston Co. | *Center Hill Dam, DeKalb Co.[2] |
| Hulda Lake, Gallatin Co. | | | *Hartsville Pop., Trousdale Co.[2] |
| Hulda Woods, Gallatin Co. | | | |
| Beaver Pond, Gallatin Co. | | | |
| Bell Island, KY[1] | | | |
| *Fehrer Lake, Gallatin Co. | | | |
| *Big Lake, Gallatin Co. | | | |
| *Saline Mines, Gallatin Co. | | | |

([1]Bell Island, Kentucky is also included with the Illinois populations since the landmass is not separated from Illinois by the Ohio River. [2]The Carthage Population (or Hell Bend Population) and the Center Hill Dam Population were located by Loy R. Phillippe of the Illinois Natural History Survey. *Asterisks denote core sites added during this study.)

Populations discovered to date have been assigned approximate sizes. Although the numbers of thalli were counted or estimated at many sites, the actual number of thalli composing larger populations are difficult to ascertain. Larger populations or core sites support thousands of individual thalli that are often densely distributed throughout wetland communities covering large areas of land. Larger floodplains with wetland communities and flooding regimes still intact support populations of *P. leana* that exhibit distributions over the majority of the floodplain. In bottomlands that have recieved high levels of disturbance, populations of *P. leana* are not as common, are widely seperated from each other or are absent altogether.

In discussing the susceptibility of *P. leana* populations to extirpation, a distinction must be made between small populations designated as vulnerable sites and larger populations regarded as core sites. Vulnerable sites have limited quality habitat available, declining thalli health, and a dwindling number of thalli; core sites occupy larger floodplain communities

which support high numbers of thalli in suitable habitats. Vulnerable sites susceptible to imminent destruction are best described as point populations. The Fort Massac population, the Haney Creek population, and the New Haven IDOC boatramp population were all point populations that are no longer extant (extinct sites). Each population had declined to a point at which thalli of *P. leana* inhabited a single substrate, and therefore was vulnerable to a single destructive event. Large functioning populations can withstand seasonal losses of individuals and exposure to disturbance patterns inherent to the specialized niche of *P. leana* that do not result in population decline. In fact, loss and replacement of individuals through the movement of thalline propagules in flood waters is the mode of dispersal and colonization and is not necessarily destructive.

In contemporary times, flooding disturbances provide essential elements to support populations of *P. leana*, but alteration of floodplain communities and flooding regimes through anthropogenic activity is resulting in the contraction of *P. leana* populations into vulnerable sites and point populations. Thus, flooding is more likely to result in destructive events since propagation strategies no longer appear to be adequate to maintain functioning populations particularly within contemporary floodplain ecosystems which have greatly diminished suitable habitats. Modern flood events are affected by levee protection of floodplains and by the construction of lock and dam facilities. Levee protection of floodplains influences the distribution of floodwaters through a river system, preventing needed water level fluctuations from occurring within the protected bottomlands, eliminating the disturbance pattern required by *P. leana*. By limiting the movement of floodwaters into select floodplains, floodplains which are not protected by levees are influenced by higher, swifter and more destructive overflow events. Modern high-lift lock and dam facilities maintain higher river stages and result in greater turbulence and suspension of sand and particulates within the water column, which can inundate substrates and cause the abrasion of bark surfaces. Hydroelectric lock and dam facilities observed within the Cumberland River basin inundate vast portions of the river valley, to a much greater degree than navigation dams on the Ohio River, and limit the continuity of available habitats for *P. leana* by creating reservoirs with controlled water levels, that do not provide flooding disturbances and therefore do not support *P. leana*.

Although *P. leana* is endangered throughout its range, and known populations are generally small, scattered, and subject to stochastic events, surveys revealed Gallatin County to be the population center for *P. leana* in Illinois. Surveys revealed a battery of locality waypoints within Gallatin County floodplains from the town of New Haven to the confluence of the Saline and Ohio Rivers. Wilhelm and Masters (1994) identified sixteen notable populations in southern Illinois, ten of which were located in the Gallatin Bottoms. Four populations were considered large and not vulnerable to foreseeable threats. Additions to Illinois core sites during this study include populations at Fehrer Lake, Big Lake / Fish Lake, and Saline Mines, all in Gallatin County. Each of these sites feature habitat characteristics which favor the growth of *P. leana,* support high numbers of thalli, have expansive areas of suitable forested floodplain and lacustrine habitats, and are relatively undisturbed. Of these three sites, the Saline Mines population displays the highest level of disturbance. The Big Lake / Fish Lake and Fehrer Lake sites support populations of *P. leana* on emergent substrates present within the

lakes and on substrates within surrounding bootomland forest communities. The natural oxbow lakes (including Big Lake, Fish Lake, and Fehrer Lake) of Gallatin County, near Old Shawneetown, support the greatest density of *P. leana* populations in Illinois.

The Gallatin County sloughs, including the wetlands of Yellowbank Slough, Running Slough, and Cattail Slough, among others, support sporadically distributed populations of *P. leana*. The sloughs occupy a swath of the Gallatin Bottoms from Hulda Lake to New Haven, an area of roughly 80 $km^2$. During flooding, the river reclaims the historic slough channels and river water surges through these waterways. Yellowbank Slough is perhaps the largest and best known of these channels and along its high banks habitat exists which supports *P. leana*. Trees occupying the immediate periphery of slough channels, which are situated within the cultivated floodplain, provide a linear border of old-growth trees that have escaped land clearing for agricultural purposes. Lines of exposed, open-grown trees occupying these habitats receive high incident light levels and air current fluctuations conducive to the growth of *P. leana*. The Gallatin County sloughs are not regarded as core sites since they are more susceptible to land clearing, drainage, and siltation than the oxbow lake communities which have intrinsic value for recreational pursuits evident by the placement of fishing villages along the shorelines of the lakes. The size of the Gallatin Bottom floodplain, and the expanse of wetland communities within it, have allowed these habitats to absorb disturbance events and provide a greater level of stability for *P. leana* populations than smaller floodplain areas with less extensive wetland communities. The remaining localities in Illinois are classified as vulnerable sites. Vulnerable sites contain small populations of *P. leana* that are under private ownership or which receive disturbance that suggests the imminent demise of the population.

A core site discovered in Indiana as part of this study is located at the Mano Point Ohio River access maintained by the USDA Forest Service. Located within the Hoosier National Forest, Mano Point supports a large population of *P. leana* that is protected to a greater extent than privately owned stations. However, substrate trees utilized by *P. leana* are more directly affected by the Ohio River channel than other core sites along the Ohio River. The most densely inhabited substrates at Mano Point are located on the shoreline and are regularly influenced by floodwaters of the Ohio River and wakes of commercial barge traffic, . The remaining populations discovered in Indiana are considered vulnerable sites due to their small sizes, lack of protection, and supporting habitats of diminishing quality. The Vevay and Leavenworth populations occupy a limited number of trees making them susceptible to wind throw, substrate mortality, and anthropogenic disruptions . The Mackey's Island population has been adversely affected by the loss of substrate trees as a result of riverbank erosion and is likely to be destroyed due to the proximity of the population to the eroded river bend to the east. The Enterprise population may succumb to anthropogenic disruptions due to its position within a fishing village.

Core sites in Kentucky include the Birdsville oxbow lake (Livingston County) and the Bell Island (Union Co.) population. The Birdsville oxbow lake supports thousands of thalli on *Taxodium distichum* emergent along the shorelines of the wetland (Wilhelm, Masters, and Shimp 2000). Disturbance of the population is noted along the western side of the

wetland where agricultural landuse extends to the edge of the lake. Vulnerable sites within Kentucky include the Milton population (Trimble County), the population in the vicinity of the Old Shawneetown bridge (Union Co.), the Tolu and Hurricane Island populations (Union Co.), the Givens Creek Ohio River access population (Livingston Co.), and a population located near the terminus of the Cumberland River (Livingston County).

Three core sites are recognized along the Cumberland and Caney Fork Rivers in Tennessee including the Hartsville Cumberland River access, the Hell Bend population near Carthage, and the Center Hill Dam population. The Hell Bend population has been documented to supports high number of thalli. The Center Hill Dam and Hartsville river access populations are recognized as core sites since they are protected stations.

The relative stability of these large core site populations may provide some leeway for future conservation actions. Imminent destruction is not likely when dealing with core sites, providing additional time for the formulation of management strategies for these areas. Core sites may also provide thalli for transplantation research. Potential recipient transplantation sites could include a number of protected areas within the Ohio River Basin, including river islands managed as National Wildlife Refuges, state or federally owned lands, recreation areas, riparian buffer corridors, or privately owned lands with longterm management or conservation agreements. Recipient sites within the Ohio River Basin may also include stream systems such as the Wabash River which have not been colonized by *P. leana*. Recipient transplantation sites must be park-like, recieve regular understory opening disturbances, such as fire, flood events, or mechanical brush removal (mowing), and be regularly influenced by freshwater floods. Potential sites for transplantation must be chosen carefully and longterm monitoring protocols of the recipient sites should be in place at the outset of the program.

## Recommendations for Future Surveys

Larger floodplains of the Ohio River within Illinois should continue to be surveyed. Indiana's Ohio River floodplain areas with wetland communities should be surveyed more comprehensively and Posey County should be the immediate focus of future further exploration due to the proximity of the area to the Illinois Gallatin Bottoms population core. Continued surveillance south of Cairo along the Mississippi River should also be undertaken. Although, *P. leana* was not located along the Mississippi River during this study, surveys of the lower Mississippi River, below the confluence of the Ohio River, is far from complete. Further surveys of the Ohio River basin and other drainage systems within the eastern United States is needed. The Upper Cumberland, Kentucky, and Licking Rivers, as well as a host of other waterways within Kentucky deserve attention since surveys in Kentucky have been limited to areas along the Ohio River. Surveys of Ohio River shorelines and floodplains in Kentucky should continue and a more comprehensive survey of the Cumberland and Caney Fork Rivers in Tennessee is warranted as well as the Tennessee River and its major tributaries. Surveys should also be completed along the Ohio River within the state of Ohio. Although the search for *P. leana* along the Ohio River was discontinued near the city of Cincinnati it is likely that populations could be located as far east as the confluence of the Monongahela and Allegheny rivers.

## Conclusions

Surveys for populations of endangered or threatened organisms often result in further discovery as was the case with this study. While additional discoveries may suggest that an organism is less imperiled than previously believed; this is not the case with *Phaeophyscia leana*. Surveys have convinced me that *P. leana* remains endangered and that there is continued need for protection and management of floodplain communities that support populations of *P. leana*. Unfortunately, the scarcity of populations, documented losses of populations, limited understanding of the lichen's life history, and progressive and perhaps irreversible modifications of ecological conditions requisite for the lichen's survival suggest that conservation actions may not be effective in the protection of the organism. Core sites with significant land area coverages are the most suitable for conservation measures. Even so, larger populations of *P. leana* will be slowly eroded unless the protection of the lichen can be included in comprehensive management programs that protect bottomland, wetland, or forest communities as a unit. Protection of this organism will require not only the preservation of supporting habitats but also include provisions for disturbance patterns, primarily flooding, which are essential for the long term management of *P. leana* populations and floodplain ecosystems. Point populations will continue to succumb to anthropogenic disruptions, stochastic events, mortality, and erosional processes typical of riverine environments. Vulnerable sites which have declined to this level will not be conservable and will be lost. To date *P. leana* is listed as an endangered species in Illinois but has not recieved this designation in Indiana, Kentucky, or Tennessee. In my opinion *P. leana* should recieve reciprocal endangered listings within these states and remain a potential addition to the federal endangered species list pending more comprehensive research into the lichen's distribution nationwide.

## Acknowledgements

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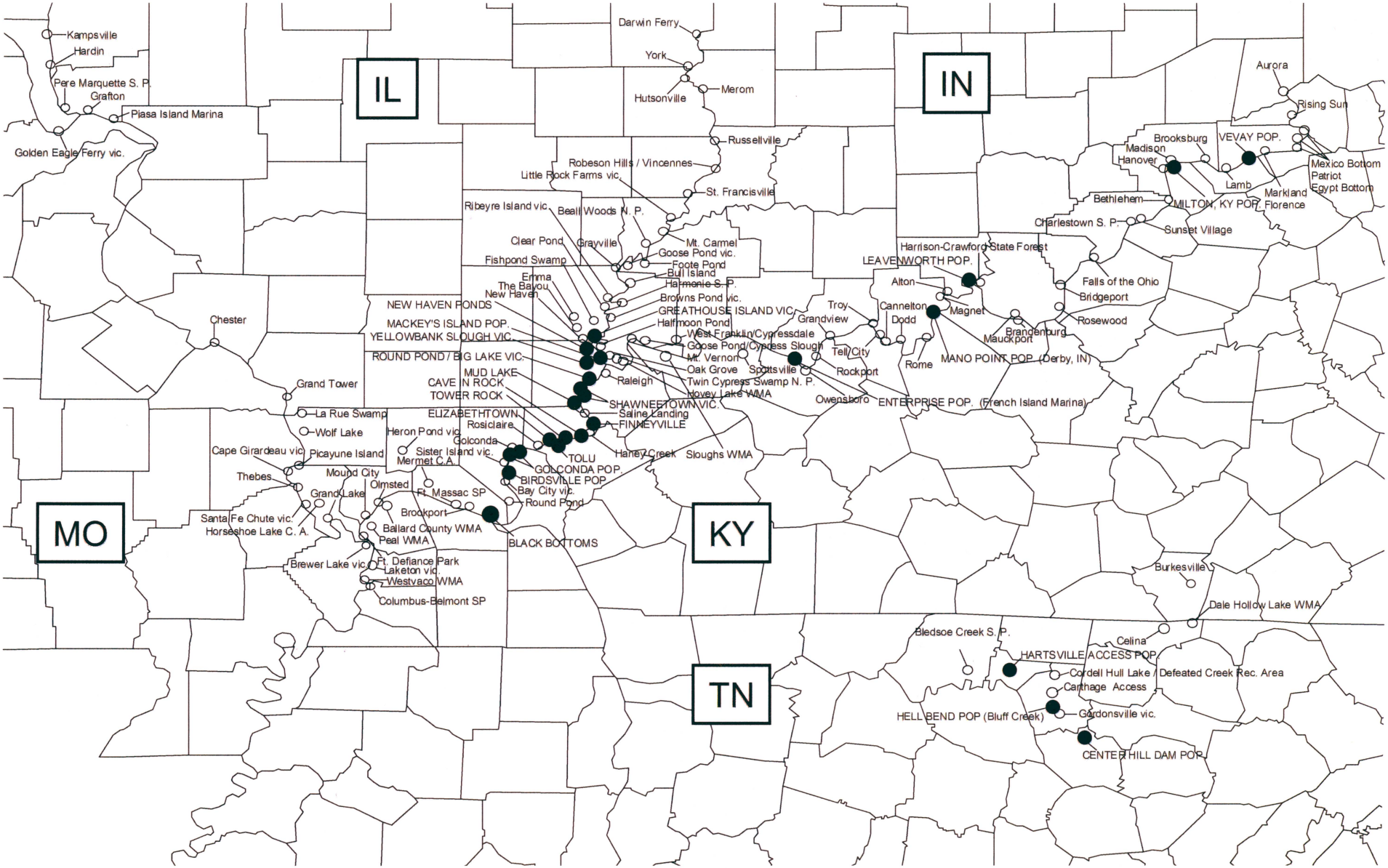
**Appendix A.** Plates of *Phaeophyscia leana* (Tuck.) Essl.

Confluent thalli on *Populus deltoides*. (20cm diameter)

Dichotomously branching lobes displaying moistened coloration. (10X)

Mature apothecia (10X)




**Appendix B.** Survey Log. Open circles (○) denote locations and landmarks visited during field work which do not support populations of *P. leana* solid circles (●) denote documented population sites.

**Appendix C.** GPS Coordinate Log Backup. Location and substrate data for populations of *P. leana* located during surveys.
UTM positioning data utilizes map datum WGS 84 / NAD 84, all coordinates are located within UTM zone 16S

| WP: | UTM | Easting | Northing | Date: | Population Name: | State: | County: | Substrate: |
|---|---|---|---|---|---|---|---|---|
| 8 | 16S | 403166 | 4179527 | 28 Dec. 01 | Round Pond Population | Illinois | Gallatin Co. | *Quercus pagodaefolia* |
| 9 | 16S | 402634 | 4178476 | 28 Dec. 01 | Round Pond Population | Illinois | Gallatin Co. | *Q. pagodaefolia, Q. palustris, Fraxinus pennsylvanica* var. *sub., Carya* spp. |
| 12 | 16S | 360800 | 4105904 | 30 Dec. 01 | Kinneman Lake Grove Population | Illinois | Massac Co. | *Carya illinoensis* |
| 13 | 16S | 360081 | 4107183 | 30 Dec. 01 | Loon Lake Population | Illinois | Massac Co. | *Taxodium distichum* |
| 14 | 16S | 359427 | 4107717 | 30 Dec. 01 | Loon Lake Population | Illinois | Massac Co. | *T. distichum* |
| 15 | 16S | 405967 | 4198193 | 1 Jan. 02 | Greathouse Island Population | Illinois | White Co. | *Quercus palustris* |
| 16 | 16S | 402555 | 4197921 | 1 Jan. 02 | Epworth Road Population | Illinois | White Co. | *Populus deltoides* |
| 21 | 16S | 396503 | 4164447 | 13 Jan. 02 | Saline Mines Population | Illinois | Gallatin Co. | *Gleditsia triacanthos, Quercus* spp., *F. pennsylvanica* var. *sub., C. occidentalis, Carya* s |
| 28 | 16S | 406735 | 4194404 | 15 Jan. 02 | River Mile 18 Island Population | Illinois | Posey Co. | *P. deltoides* |
| 29 | 16S | 406622 | 4194439 | 15 Jan. 02 | River Mile 18 Island Population | Illinois | Posey Co. | *P. deltoides* |
| 72 | 16S | 404626 | 4185164 | 27 Jan. 02 | Sander's Population | Illinois | Gallatin Co. | *P. deltoides* |
| 80 | 16S | 406601 | 4186549 | 27 Jan. 02 | Mackeys Island Population | Indiana | Posey Co. | *P. deltoides, A. saccharinum* |
| 81 | 16S | 406840 | 4186466 | 27 Jan. 02 | Mackeys Island Population | Indiana | Posey Co. | *P. deltoides, A. saccharinum* |
| 82 | 16S | 407443 | 4186295 | 27 Jan. 02 | Mackeys Island Population | Indiana | Posey Co. | *P. deltoides, A. saccharinum* |
| 85 | 16S | 406756 | 4189819 | 27 Jan. 02 | Hovey Lake Population | Indiana | Posey Co. | *P. deltoides* |
| 86 | 16S | 406818 | 4189763 | 27 Jan. 02 | Hovey Lake Population | Indiana | Posey Co. | *P. deltoides* |
| 88 | 16S | 403531 | 4194436 | 27 Jan. 02 | Little Wabash Population | Illinois | Gallatin Co. | *P. deltoides* |
| 90 | 16S | 406206 | 4180844 | 31 Jan. 02 | Round Pond Bottoms L. L. C. Pop. | Illinois | Gallatin Co. | *Quercus imbricaria* |
| 91 | 16S | 406213 | 4181117 | 31 Jan. 02 | Round Pond Bottoms L. L. C. Pop. | Illinois | Gallatin Co. | *Quercus imbricaria* |
| 92 | 16S | 405002 | 4180111 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 93 | 16S | 404232 | 4180038 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 94 | 16S | 403762 | 4178439 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 95 | 16S | 404129 | 4178381 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 96 | 16S | 404596 | 4178739 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 97 | 16S | 405286 | 4179168 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 98 | 16S | 405666 | 4179424 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 99 | 16S | 405785 | 4179565 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 100 | 16S | 405512 | 4179991 | 31 Jan. 02 | Fehrer Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 101 | 16S | 399797 | 4173920 | 01 Feb. 02 | Old Shawneetown Levee Pop. | Illinois | Gallatin Co. | *Celtis occidentalis* |
| 102 | 16S | 399777 | 4174245 | 01 Feb. 02 | Old Shawneetown Levee Pop. | Illinois | Gallatin Co. | *Quercus palustris* |
| 103 | 16S | 400047 | 4175869 | 01 Feb. 02 | Big Lake / Old Shawneetown Pop. | Illinois | Gallatin Co. | *Carya* spp. *Celtis occidentalis, Fraxinus pennsylvanica* var. *subintegerrima* |
| 104 | 16S | 403392 | 4184563 | 01 Feb. 02 | North Hulda Road Pins Population | Illinois | Gallatin Co. | Quercus palustris |
| 105 | 16S | 403188 | 4186944 | 01 Feb. 02 | Yellowbank Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp., *Celtis occidentalis, Fraxinus pennsylvanica* var *subintegerrim* |
| 106 | 16S | 402940 | 4187077 | 01 Feb. 02 | Yellowbank Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp., *Celtis occidentalis, Fraxinus pennsylvanica* var *subintegerrim* |
| 107 | 16S | 402821 | 4187033 | 01 Feb. 02 | Yellowbank Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp., *Celtis occidentalis, Fraxinus pennsylvanica* var *subintegerrim* |
| 108 | 16S | 402478 | 4186988 | 01 Feb. 02 | Yellowbank Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp., *Celtis occidentalis, Fraxinus pennsylvanica* var *subintegerrim* |
| 109 | 16S | 401974 | 4187283 | 01 Feb. 02 | Yellowbank Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp., *Celtis occidentalis, Fraxinus pennsylvanica* var *subintegerrim* |
| 110 | 16S | 401351 | 4187662 | 01 Feb. 02 | Yellowbank Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp., *Celtis occidentalis, Fraxinus pennsylvanica* var *subintegerrim* |
| 111 | 16S | 402345 | 4187016 | 01 Feb. 02 | Yellowbank Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp., *Celtis occidentalis, Fraxinus pennsylvanica* var *subintegerrim* |
| 114 | 16S | 400790 | 4190508 | 15 Feb. 02 | Yellowbank North Population | Illinois | Gallatin Co. | *Quercus palustris* |
| 118 | 16S | 403839 | 4188718 | 15 Feb. 02 | Running Slough Populations | Illinois | Gallatin Co. | *Fraxinus pennsylvanica var. subintegerrima* |
| 119 | 16S | 404248 | 4187861 | 15 Feb. 02 | Running Slough Populations | Illinois | Gallatin Co. | *Fraxinus pennsylvanica var. subintegerrima* |
| 120 | 16S | 402621 | 4189870 | 15 Feb. 02 | Running Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp. |
| 121 | 16S | 402003 | 4190563 | 15 Feb. 02 | Running Slough Populations | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp. |
| 123 | 16S | 401192 | 4176752 | 15 Feb. 02 | Big Lake / Old Shawneetown | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp. |
| 124 | 16S | 401025 | 4176271 | 15 Feb. 02 | Big Lake / Old Shawneetown | Illinois | Gallatin Co. | *Quercus* spp., *Carya* spp. |
| 125 | 16S | 361785 | 4107488 | 16 Feb. 02 | Kinneman Lake Road Population | Illinois | Massac Co. | *Quercus* spp., *Carya* spp. |
| 126 | 16S | 361562 | 4107259 | 16 Feb. 02 | Kinneman Lake Road Population | Illinois | Massac Co. | *Quercus* spp., *Carya* spp. |
| 127 | 16S | 362557 | 4105207 | 16 Feb. 02 | South Bank Kinneman Lake Pop. | Illinois | Massac Co. | *Fraxinus pennsylvanica var. subintegerrima* |
| 128 | 16S | 362758 | 4105094 | 16 Feb. 02 | South Bank Kinneman Lake Pop. | Illinois | Massac Co. | *Fraxinus pennsylvanica var. subintegerrima* |
| 129 | 16S | 364469 | 4105420 | 16 Feb. 02 | Gray Ridge Fencerow Population | Illinois | Massac Co. | *F. pennsylvanica* var. *sub., C. occidentalis, G. triacanthos, L. styraciflua, Diospyros virgin* |
| 130 | 16S | 402539 | 4191924 | 22 Feb. 02 | Gravel Pit Populations | Illinois | Gallatin Co. | *P. deltoides, Carya illinoensis* |
| 131 | 16S | 402445 | 4192343 | 22 Feb. 02 | Gravel Pit Populations | Illinois | Gallatin Co. | *P. deltoides, Carya illinoensis* |
| 132 | 16S | 402186 | 4192717 | 22 Feb. 02 | Gravel Pit Populations (Gravel Pit) | Illinois | Gallatin Co. | *P. deltoides, Carya illinoensis* |
| 133 | 16S | 401551 | 4193104 | 22 Feb. 02 | Gravel Pit Pop. (Gravel Pit Slough) | Illinois | Gallatin Co. | *Carya* spp., *Celtis occidentalis, Quercus* spp., *F. pennsylvanica* var. *subintegerrima* |
| 134 | 16S | 401510 | 4193097 | 22 Feb. 02 | Gravel Pit Pop. (Gravel Pit Slough) | Illinois | Gallatin Co. | *Carya* spp., *Celtis occidentalis, Quercus* spp., *F. pennsylvanica* var. *subintegerrima* |
| 135 | 16S | 401375 | 4193098 | 22 Feb. 02 | Gravel Pit Pop. (Gravel Pit Slough) | Illinois | Gallatin Co. | *Carya* spp., *Celtis occidentalis, Quercus* spp., *F. pennsylvanica* var. *subintegerrima* |
| 136 | 16S | 401339 | 4193076 | 22 Feb. 02 | Gravel Pit Pop. (Gravel Pit Slough) | Illinois | Gallatin Co. | *Carya* spp., *Celtis occidentalis, Quercus* spp., *F. pennsylvanica* var. *subintegerrima* |
| 137 | 16S | 400327 | 4192596 | 22 Feb. 02 | Gravel Pit Populations (Cattail) | Illinois | Gallatin Co. | *F. pennsylvanica* var. *subintegerrima* |
| 138 | 16S | 401014 | 4192090 | 22 Feb. 02 | Gavek Pit Populations (Cattail) | Illinois | Gallatin Co. | *Carya laciniosa, Carya ovata* |
| 139 | 16S | 401442 | 4192193 | 22 Feb. 02 | Gravel Pit South, Running Slough | Illinois | Gallatin Co. | *F. pennsylvanica* var *subintegerrima, Celtis occidentalis* |
| 140 | 16S | 400431 | 4174817 | 22 Feb. 02 | Big Lake / Old Shawneetown Pop. | Illinois | Gallatin Co. | *Quercus pagodaefolia, Carya* spp., *F. pennsylvanica* var. *subintegerrima* |
| 141 | 16S | 398981 | 4171886 | 22 Feb. 02 | Old Shawneetown Fencerow | Illinois | Gallatin Co. | *Celtis occidentalis, Quercus spp., Carya spp., F. pennsylvanica* var. *subintegerrima* |
| 142 | 16S | 398761 | 4171596 | 22 Feb. 02 | Old Shawneetown Fencerow | Illinois | Gallatin Co. | *Celtis occidentalis, Quercus spp., Carya spp., F. pennsylvanica* var. *subintegerrima* |
| 143 | 16S | 359581 | 4107401 | 23 Feb. 02 | Loon Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 151 | 16S | 397742 | 4164087 | 24 Feb. 02 | Saline Mines Populations | Illinois | Gallatin Co. | *Gleditsia triacanthos, Quercus* spp., *F. pennsylvanica* var. *subi., C. occidentalis, Carya s* |
| 152 | 16S | 397844 | 4164034 | 24 Feb. 02 | Saline Mines Populations | Illinois | Gallatin Co. | *Gleditsia triacanthos, Quercus* spp., *F. pennsylvanica* var. *subi., C. occidentalis, Carya s* |
| 153 | 16S | 396208 | 4164454 | 24 Feb. 02 | Saline Mines Population | Illinois | Gallatin Co. | *Gleditsia triacanthos, Quercus* spp., *F. pennsylvanica* var. *sub., C. occidentalis, Carya s* |
| 154 | 16S | 397096 | 4161530 | 24 Feb. 02 | Mud Lake Population | Illinois | Gallatin Co. | *Salix nigra* |
| 155 | 16S | 397098 | 4161646 | 24 Feb. 02 | Mud Lake Population | Illinois | Gallatin Co. | *Salix nigra* |
| 156 | 16S | 397093 | 4161597 | 24 Feb. 02 | Mud Lake Population | Illinois | Gallatin Co. | *Salix nigra* |
| 157 | 16S | 397091 | 4161529 | 24 Feb. 02 | Mud Lake Population | Illinois | Gallatin Co. | *Salix nigra* |
| 158 | 16S | 398158 | 4171618 | 24 Feb. 02 | Old Shawneetown Fencerow | Illinois | Gallatin Co. | *Celtis occidentalis, Quercus spp., Carya spp., F. pennsylvanica* var. *subintegerrima* |
| 159 | 16S | 402861 | 4176181 | 24 Feb. 02 | Big Lake/Fish Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 160 | 16S | 402987 | 4176857 | 24 Feb. 02 | Big Lake/Fish Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 161 | 16S | 403321 | 4177116 | 24 Feb. 02 | Big Lake/Fish Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 162 | 16S | 403699 | 4177241 | 24 Feb. 02 | Big Lake/Fish Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 163 | 16S | 403614 | 4176680 | 24 Feb. 02 | Big Lake/Fish Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 164 | 16S | 403614 | 4176502 | 24 Feb. 02 | Big Lake/Fish Lake Population | Illinois | Gallatin Co. | *T. distichum* |
| 192 | 16S | 574643 | 4025595 | 24 Jul. 02 | Hartsville Public Access Site Pop. | Tennesse | Trousdale Co. | *P. deltoides, A. saccharinum* |
| 193 | 16S | 641772 | 4287645 | 25 Jul. 02 | Milton Population | Indiana | Trimble Co. | *P. deltoides* |
| 194 | 16S | 668108 | 4290143 | 25 Jul. 02 | Vevay Population | Indiana | Switzerland | *P. deltoides* |
| 195 | 16S | 484077 | 4188304 | 6-May-102 | Enterprise Population | Indiana | Spencer Co. | *P. deltoides* |
| 196 | 16S | 542300 | 4210643 | 6-May-102 | Mano Point Population | Indiana | Perry Co. | *P. deltoides, Liquidambar styraciflua, A. saccharinum, Juglans nigra* |
| 197 | 16S | 558571 | 4226397 | 16-Jun-102 | Leavenworth Population | Indiana | Crawford Co. | *P. deltoides* |