REPORT OF A SURVEY FOR EXTANT POPULATIONS OF PRICE'S POTATO BEAN IN ILLINOIS

June - October, 1990

by
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I. Need

Although two earlier collections of the federally threatened Price's Potato Bean (Apios priceana) have been made in Illinois, no populations are currently known to exist in the state. It was felt that an intensive search would discover new populations of this species.

II. Objective

The objective of this study was to discover and document new populations of Apios priceana in Illinois.

III. Expected Results and Benefits

The discovery of new populations of this species would aid its recovery. As it appears (in other sites where it is known) to be an edge species, it is likely that active management will be necessary to keep possible existing populations in Illinois from dying out in heavy shade (Figures 11 and 14).

The locations of populations discovered were to be mapped and described. Voucher specimens were to be collected.

IV. Approach

This project was contracted by the Department of Conservation with the Natural Land Institute of Rockford, Illinois. Field work was performed by Max D. Hutchison, Field Representative for the Natural Land Institute, who lives at RR 1, Belknap, Illinois, in Johnson County. Volunteers, particularly Robert Craig of Goreville, Illinois, provided equipment and helped considerably with the survey.

Field work was primarily accomplished during July at the peak flowering period of this species. It was assumed that the conspicuous flowers would help spot the plant, which is normally not easy to distinguish from a distance (Figure 16). A boat was used to provide access into remote areas along the Ohio River bluffs and to provide a good view (with binoculars) of the bank vegetation from the river edge (Figure 33). Stretches where the

habitat appeared ideal for the species were viewed both from a boat and on foot (Figure 34).

The survey sites were identified by the Department of Conservation and centered around two areas: Pine Hills-LaRue Swamp-Wolf lake in Union County, and the Ohio River bluffs in the Bay City to Elizabethtown area, in Pope and Hardin counties (Figures 6-9). The LaRue Swamp-Wolf Lake area was chosen because the only known Illinois records for Apios priceana are from LaRue Swamp and/or Wolf Lake. The Ohio River edge was chosen because of its proximity to an existing Apios priceana site across the river in Kentucky and because the habitat here appeared to be suitable (Figures 4 and 8).

Two western Kentucky sites where Apios priceana is known to occur were visited prior to beginning the field search in Illinois (Figures 11, 12, 14-16). Identification characters were checked so that sterile plants could be identified by using leaf veination (Figures 10 and 13).

V. Procedures:

Searches were made mostly on foot, particularly looking for the conspicuous flowers of the species. Canopy openings and edges were selected. Dense thickets of tall saplings and shrubs were avoided. Mature forest stands with dense shade were not searched. Most of the survey time was concentrated on sites where vines seemed to thrive, particularly where wisteria and the common ground nut (Apios americana) were noted (Figures 23 and 27). Sites similar to those where Apios priceana occurs in western Kentucky were assumed to have the best potential (Figures 35 and 38).

Most of the survey time was spent searching the Ohio River bluff site, because of: 1) its proximity to an existing population in Kentucky, 2) the amount of habitat that appears ideal (the bluffs on the Illinois side are in many places very similar in character to the existing Apios priceana site near Carrsville, in Livingston Co., Kentucky, just across the river from Shetlerville), and 3) the fact that little botanical survey work has been conducted in this river bluff area (probably because of its inaccessibility), and an uncommon species such as Apios priceana could have easily been missed.

The Pine Hills-LaRue Swamp-Wolf Lake area was considered important as a potential site, because that is where the historical records for the species occur, but field work there was limited in this survey (Figures 18, 19, 21). One reason is that it was more difficult to survey. The swamps have been greatly modified in the last 40 years by beaver flooding (Figure 18). Timber kill has left a lot of open canopy along the edges, but most of that is where the ground is covered with water or is very muddy. Where the forest borders the swamp, the shade is

fairly dense in most places, and the thick understory shrubs and vines make it very difficult for one to walk and examine the vegetation well. It was not practical to use a boat. The aquatic vegetation was too thick in LaRue Swamp (especially during July) to use either a motor or a paddle. Although there is open water in Otter Pond and Wolf Lake, the aquatic vegetation along the edges is too thick and too broad to see the shore from a boat (Figure 21). Also, this Pine Hills-LaRue Swamp-Wolf Lake area is where most of the searches for Apios priceana have been conducted in the last few years. Competent botanists have checked the old collecting sites many times, and a graduate student from Southern Illinois University (at nearby Carbondale) spent a considerable amount of time three or four years ago looking for the species in this area as a part of his thesis project. Another problem that hindered the survey work in this area was the difficulty of obtaining permission to search Wolf Lake. The Trojan Powder Company officials are reluctant to allow any trespassing on their property, and they own most of the lake. I was able to get permission to search most of the area, but this was in September, probably too late in the season to have found any Apios priceana in flower.

VI. Results and recommendations

No Illinois Apios priceana populations were found in this survey, but there is still a good chance that the species may yet be found here. What appears to be good habitat occurs in many places along the Ohio River bluffs, but the brushy viney openings and bouldery slopes are difficult to search or even walk along in some areas. A small population of Apios priceana could easily have been missed, especially if it was not in flower. There is still good potential for finding the species at Wolf Lake. The habitat looks good along the eastern edge of the north part, and my brief and hurried search was after the flowering time for the species, so a small population could have been missed there.

I recommend that the eastern edge of Wolf Lake, the Ropers Bluff area, and the river bluffs east of Rosiclare be checked again another season, particularly during the month of July when the Apios priceana should be in flower.

Record of field survey activities

July 2-6: checked Price's potato bean (Apios priceana) sites in western Kentucky with Robert Craig (volunteer), John Schwegman (IDOC), Chris Schwegman (volunteer), and Raymond Athy (botanist from Paducah who first found those populations); noted the topography, bedrock, soils, and associate plant species at the Carrsville (Livingston Co.) and Confederate (Lyon Co.) sites; examined the species to verify identifying characters, checked disturbances and health of populations, noted flowering condition, and took photos (Figures 4, 5, 11-16)

-- went to Pine Hills-LaRue Swamp-Wolf Lake area in Union Co., Illinois with Robert Craig, John Schwegman, and Chris Schwegman to search for Apios priceana; checked one of reported sites near old spillway and railroad south of LaRue Road (Figures 19, 20); searched spring sites and swamp edges at several places, and examined the Apios americana population at LaRue Spring; talked to Trojan Powder Co. plant manager about checking Wolf Lake, but did not get permission; (John said that he and Chris had already searched the western edge of Wolf Lake, north from the powder plant road)

July 9-13: searched about 1 1/2 miles of Ohio River bluffs, north from Golconda to Giddeonson Hollow, Pope Co., Illinois, with Robert Craig; walked area from base of bluffs to river edge; noted a lot of viney, weedy habitat; wisteria (Wisteria macrostachya) is locally abundant; noted no Apios (Figure 8)

July 16-20: searched about 6 miles of Ohio River bluffs in Pope and Hardin counties, north and south from Golconda and in Rosiclare area, part of time with Robert Craig; used boat and binoculars to search river edges; walked stretches of slopes from base of bluffs to water's edge; noted a lot of limestone and places where vines of many species dominate the community; saw a lot of wisteria and a few small populations of Apios americana, but no Apios priceana; saw wisteria in flower and in fruit, but did not see any flowering Apios americana (Figures 8, 9, 25, 26, 35, 37, 43)

-- went to the Confederate, Kentucky site with Robert Craig; checked identifying characteristics and flowering condition of Apios priceana; most in full bloom, but a lot of flowers are still developing; noted how conspicuous the flowers are, even from a distance (Figures 14, 16)

July 23-27: searched bluff and swamp edges at Pine Hills-LaRue Swamp area in Union Co. with Donald Hutchison; noted a lot of Apios americana along roadside at LaRue Spring but none in flower; most of swamp edge habitat is dense thicket of shrubs

and vines with a lot of shade, and where the canopy is open, the ground is very wet with shallow water; the base of the bluffs in most places has little undergrowth and is shaded (Figure 6)

-- searched about 1 1/2 miles of Ohio River bluff on foot in vicinity of Big Grand Pierre Creek and Shetlerville limestone quarry, Pope and Hardin counties; this is directly across from the Carrsville, Kentucky, Apios site; noted a lot of ideal-looking habitat but no Apios (Figures 28, 31)

July 30 - August 3: searched about 1/2 mile of Ohio River bluff on foot near Ropers Landing, south of Golconda; noted acres of wisteria; a lot of limestone, and habitat appears ideal, but no Apios (Figure 27)

August 20-24: searched about 2 1/2 miles of Ohio River bluff with Robert Craig, north from Ropers Landing; used boat and binoculars and walked some stretches; bouldery slopes are very rugged and difficult to walk; noted a lot of wisteria and many vine species but no Apios (Figures 36, 38)

-- noted a lot of Apios americana along the boardwalk at Murphy Pond in Fulton Co., Kentucky; a few vines were in flower (Figure 24)

September 24-28: received permission and searched the eastern edge of Wolf Lake and the western edge south from the Trojan Powder Co. road in Union Co.; Wolf Lake is the site of an old collection for Apios priceana; noted a lot of wisteria and Apios americana, but no A. priceana (Figures 21, 22)

Description of Kentucky Apios priceana sites visited

A. Confederate Site -- Lyon County (Figure 5)

This is one of the four western Kentucky sites for Apios priceana discovered by a local botanist, Mr. Raymond Athy. About two dozen individual vines are scattered some 25 yards along a brushy powerline right of way next to a graveled county road. Saplings and bushes have been recently cut (chopped off high above the ground) for maintenance of the right of way, and shrubs, vines, and stump sprouts are thick. The Apios priceana seems to be doing well in the open sun, climbing over the shrubs and saplings, and trailing near the ground in places (Figure 16).

The canopy trees on the dry-mesic to mesic rocky slope adjacent to the right of way include sugar maple, red oak, beech, basswood, white oak, black gum, and mockernut hickory. The right of way has shrubby redbud, sweetgum, sassafras, dogwood, river birch, smooth sumac, black walnut, red elm, chinkapin oak, and cane. Vines include grape, Virginia creeper, ampelopsis, and climbing milkweed. Forbs and grasses include bellflower, hypoxis, wingstem, avens, jewelweed, fleabane, beggar's tick, and monarda.

Nothing appears particularly different or distinctive about this site. Many of the surrounding wooded ravines leading into the Cumberland River (now Lake Barkley) look similar.

The Apios priceana was in bud on July 2 and in full bloom on July 20 Figures 15, 16). The population appears to be healthy and doing well.

B. Carrsville Site -- Livingston County

The Apios priceana site nearest to Illinois is west of Carrsville, Kentucky and directly across the Ohio River from Shetlerville, Hardin County, Illinois (Figure 4). According to Raymond Athy and John Schwegman, this population has been declining in recent years, and only four living stems were located on July 2 (Figure 12). None were going to flower this season. Livestock grazing is affecting the site, and cattle are probably eliminating the species (Figure 11).

The Apios priceana grows here at the base of a stony limestone slope, near the edge of the highest floodplain of the Ohio River (Figure 11). It grows in the woods, near the edge of a field and an old roadway. The soil is quite sandy. Canopy trees on the bouldery slope include sugar maple, red oak, and white oak. The floodplain has ash, sycamore, silver maple, and box elder. Browse damage is evident in the woods. It is likely that the surviving Apios stems are somewhat protected by the

boulders. Apios americana and wisteria were both noted here along with the Apios priceana.

Description of Illinois sites surveyed

A. Pine Hills-LaRue Swamp-Wolf Lake area -- Union County (Figure 6)

This is a highly significant and well-known natural area, most of which is owned and protected by the Shawnee National Forest. Pine Hills is the local name for a stretch of rugged upland bordering the Mississippi River bottomland. The upland here is considered to be a part of the Ozark Natural Division. Sheer west-facing limestone cliffs, up to 180 feet high, rise above the low flat swampland. Springs are common along the bluff base. The bottomland is primarily floodplain forest with extensive areas of open swamps (primarily known as the LaRue Swamp) and shallow ponds (including Otter Pond and Wolf Lake) (Figures 17, 18).

A great diversity of plants and animals occurs here with many species that are uncommon or rare, both in Illinois and in the Midwest. Many reach the edges of their range at this site. The only verified Illinois records for Apios priceana are here: one at a site along the edge of LaRue Swamp, and one along the edge of Wolf Lake (Figures 19-21).

Although there is a great diversity of habitats here, much of the area is unsuitable for Apios priceana. It is either shaded by mature timber or, where open, most of the bottomland area is very wet. Where shrubs, saplings, and vines are dominant, the vegetation is very dense, and little light reaches the ground. Beaver have held water levels higher in the swamps than normal during the last 30 years, and this has affected the original edge vegetation considerably (Figure 18). Many places that are now open flooded swamp were once wet floodplain forest. Many of the trees that once stood in and along the swamp edges are now dead. The talus slopes along the bluff base are mostly shaded, although there is one open area near the north end that has dense mats of vines. Otter Pond has edges that are shaded by mature timber; one edge is sheer cliffs of bedrock. Wolf lake has edges that are mostly disturbed, and in many places, there is a rather wide strip of saplings, brush, weeds, and vines. Wisteria and Apios americana occur here in abundance, and this appears to be one of the best potential sites for Apios priceana. The roadsides, field edges, and railroad rights of way also appear to be good habitat.

B. Ohio River bluffs in Pope and Hardin Counties

The Ohio River separates the Illinois counties of Pope and Hardin from the Kentucky counties of Livingston and Crittendon. Along most of this stretch, the river curves against the Illinois shore, so that there is little floodplain on that side (Figures 7-9). The area searched was primarily where high bluffs border the river. Vertical cliffs are common, and from their bases, the steep short slopes are covered with boulders down to the water's edge (Figures 31, 35, 36). Good exposures of both limestone and sandstone units are represented (Figures 31, 38, 40). Erosion has removed much of the soil from the banks here, and many of the trees have their roots exposed (Figures 39-42). Almost all of the stretch searched is forested. The construction of Smithland Dam during the 1970's has raised the pool elevation several feet, and changed the character of the edge (Figures 40-42). Dead and fallen trees are now common in most places along the shore (Figure 32). The stretch north from Golconda to Rosiclare was disturbed many years ago by the construction of a railroad line along the base of the bluff and near the river's edge. Several exotics occur along it that were probably introduced during its construction and operation. This railroad is now abandoned, and the rails and ties have been removed. The old right of way is rapidly growing up in bushes and saplings. Many vines occur here, and the habitat along the old railroad grade appears ideal for Apios priceana.

A great diversity of plant species occurs along the river bluffs here, and several are uncommon elsewhere in the region. The river has probably been a migration route for many of these. The following plants were listed during the field visits for this survey:

TREES

Acer saccharinum -- silver maple
Acer saccharum -- sugar maple
Acer negundo -- box elder
Ailanthus altissima -- tree-of-heaven (introduced)
Carya illinoensis -- pecan
Carya cordiformis -- bitternut hickory
Catalpa bignonioides -- catalpa
Celtis laevigata -- sugarberry
Diospyros virginiana -- persimmon
Fraxinus pennsylvanica -- green ash
Gleditsia triacanthos -- honey locust
Gymnocladus dioica -- Kentucky coffee-tree
Juglans nigra -- black walnut
Juniperus virginiana -- redcedar
Liquidambar styraciflua -- sweetgum
Nyssa sylvatica -- black gum
Paulownia tomentosa -- princess-tree (introduced)
Platanus occidentalis -- sycamore
Populus deltoides -- eastern cottonwood

Prunus serotina -- wild black cherry
Quercus rubra -- red oak
Quercus macrocarpa -- bur oak
Quercus alba -- white oak
Quercus muehlenbergii -- chinkapin oak
Robinia pseudoacacia -- black locust
Ulmus rubra -- red elm

SHRUBS

Amorpha fruticosa -- Indigo bush
Aralia spinosa -- Hercule's club
Arundinaria gigantea -- cane
Asimina triloba -- pawpaw
Cephalanthus occidentalis -- buttonbush
Cercis canadensis -- redbud
Cornus racemosa -- gray dogwood
Crataegus crus-galli -- cockspur thorn
Crataegus mollis -- red haw
Desmanthus illinoensis -- prairie mimosa
Forestiera acuminata -- swamp privet
Hydrangea arborescens -- hydrangea
Lindera benzoin -- spicebush
Maclura pomifera -- osage orange (introduced)
Morus rubra -- red mulberry
Rhamnus caroliniana -- Carolina buckthorn
Rosa sp. -- wild rose
Rubus sp. -- blackberry
Rubus sp. -- dewberry
Salix nigra -- black willow
Sassafras albidum -- sassafras
Staphylea trifolia -- bladdernut
Symphoricarpos orbiculatus -- coralberry
Ulmus alata -- winged elm
Viburnum rufidulum -- southern black haw

VINES

Ampelopsis cordata -- heart-leaf ampelopsis
Apios americana -- groundnut
Aristolochia durior -- Dutchmans'-pipe
Bignonia capreolata -- cross-vine
Calycocarpum lyoni -- cupseed
Campsis radicana -- trumpet-creeper
Clitoria mariana -- butterfly-pea
Cocculus carolinus -- Carolina snailseed
Cuscuta gronovii -- dodder
Dioscoria quaternata -- wild yam
Gonolobus shortii -- angle-pod
Ipomoea pandurata -- wild potato vine
Ipomoea sp. -- morning-glory

Lonicera japonica -- Japanese honeysuckle
Menispermum canadense -- Canada moonseed
Parthenocissus quinquefolia -- Virginia creeper
Passiflora lutea -- yellow passion-flower
Passiflora incarnata -- passion-flower
Phaseolus polystachios -- wild bean
Rhus radicans -- poison ivy
Smilax sp.-- greenbrier
Vitis palmata -- catbird grape
Vitis aestivalis -- summer grape
Wisteria macrostachya -- wisteria

HERBS AND GRASSES

Achillea millefolium -- yarrow (introduced)
Asclepias variegata -- white milkweed
Asclepias syriaca -- common milkweed (introduced)
Blephilia ciliata -- downy wood-mint
Commelina communis -- dayflower (introduced)
Companula americana --tall bellflower
Desmodium spp. -- beggar's tick
Eupatorium fistulosum -- Joe-pye weed
Geranium maculatum -- wild geranium
Heucher sp. -- alum-root
Hydrophyllum macrophyllum -- large-leaf waterleaf
Hypericum sp. -- St. John's-wort
Hystrix patula -- bottle-brush grass
Isopyrum biternatum -- false rue anemone
Lespedeza virginica -- lespedeza
Melilotus officinalis -- yellow sweet clover (introduced)
Monarda fistulosa -- bergamot
Opuntia humifusa -- prickly pear cactus
Oxalis sp. -- wood-sorrel
Phytolacca americana -- poke
Polemonium reptans -- Jacob's-ladder
Ratibida pinnata -- gray-headed coneflower
Rudbeckia hirta -- black-eyed Susan
Sagittaria latifolia -- arrowhead
Saururus cornuus -- lizard's-tail
Solidago sphacelata -- false goldenrod
Stachys riddellii -- Riddell's hedge-nettle
Tradescantia subaspera -- zigzag spiderwort
Uniola latifolia -- spangle grass
Verbascum blattaria -- moth mullein (introduced)
Verbascum thapsus -- common mullein (introduced)

SELECTED REFERENCES

Bier, James A. 1980. Landforms of Illinois (map). University of Illinois at Urbana-Champaign. 1 sheet.

Illinois Highway Map. 1989-90. Illinois Department of Transportation, Springfield. 1 sheet (folded).

Kurz, Don. 1977. (untitled) a status report of Apios priceana in Illinois. Natural Land Institute, Rockford, Illinois. 7 pages plus maps (included as Appendix Item II in this report).

Lyon County, Kentucky, Highway Map. 1986. Frankfort. 1 sheet.

Raisz, Erwin. 1957. Landforms of the United States (map). Boston, Mass. 1 sheet.

Schwegman, John E. 1990. Drawings of leaf veination differences to distinguish Apios priceana from A. americana. Illinois Department of Conservation, Springfield (modified slightly and included in this report as Figure 10).

Schwegman, John E. 1990. Letter and herbarium specimen data for Apios priceana collections in Illinois (included as Appendix Item I in this report).

USGS topographic maps:
Alto Pass, Ill. 15'
Brownfield, Ill.-Ky. 15'
Golconda, Ill.-Ky. 15'
Smithland, Ky.-Ill. 7.5'

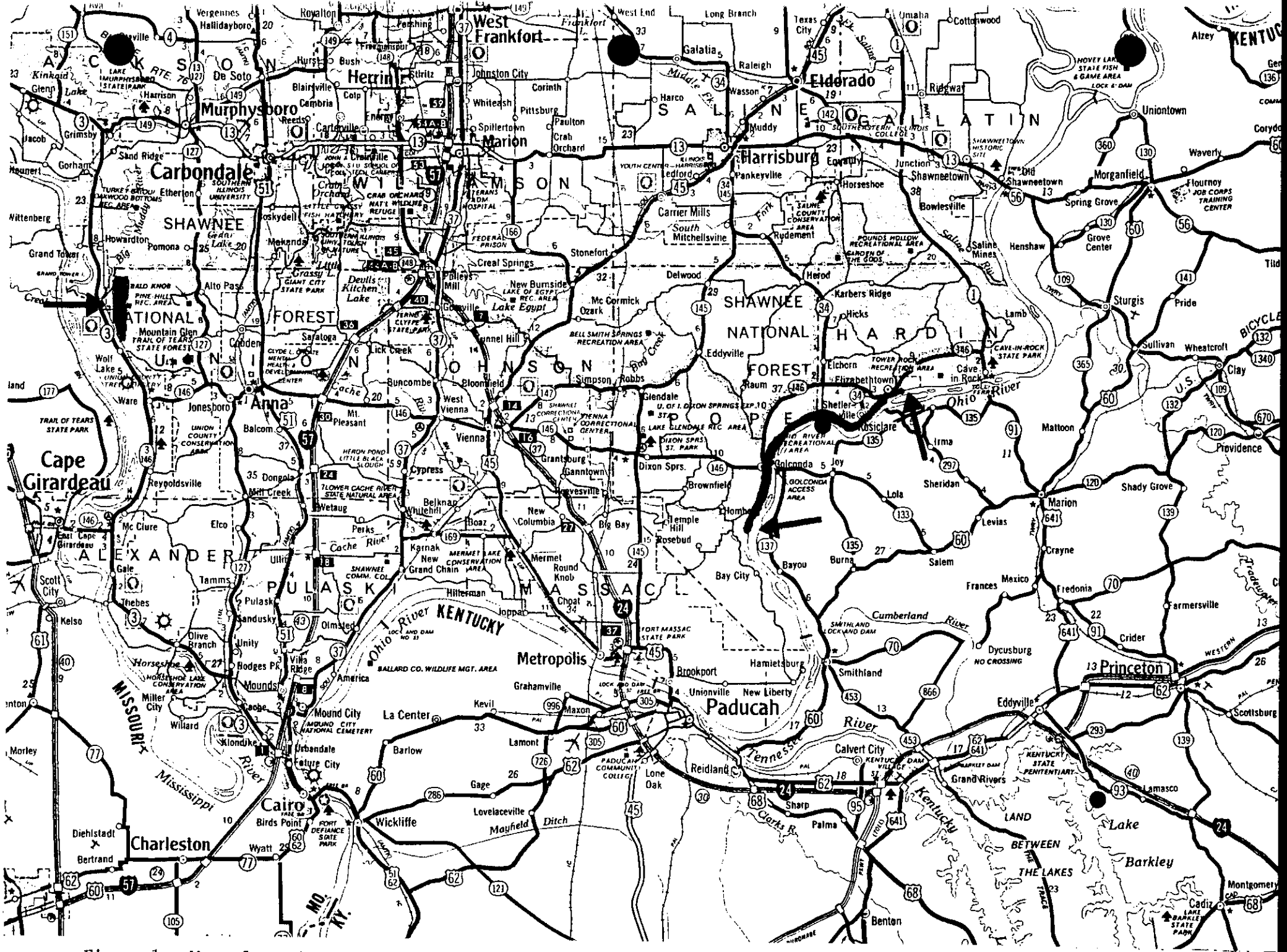


Figure 1. Map of southern Illinois and northwestern Kentucky showing areas surveyed for Apios priceana; sites where populations were previously known are shown with dots; sites surveyed, with shading and arrows

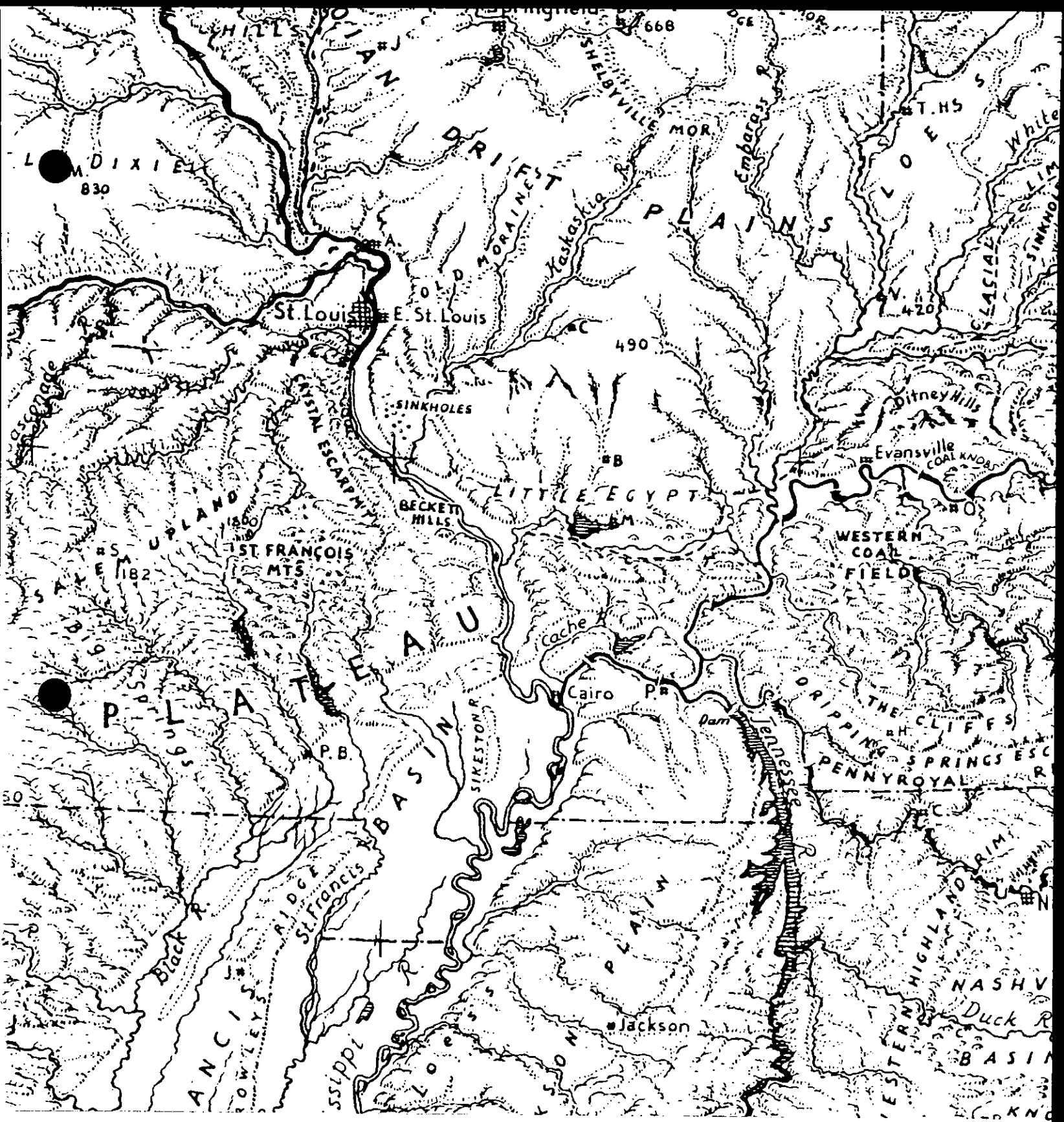


Figure 2. Physiographic map of the north end of the Mississippi Embayment region and area surveyed for Apios priceana (copied from Landform Map of the United States by E. Raisz, Boston, Mass., 1957)

Figure 3. Apios priceana survey area copied from Landforms of Illinois map by J. A. Bier, University of Illinois, 1980

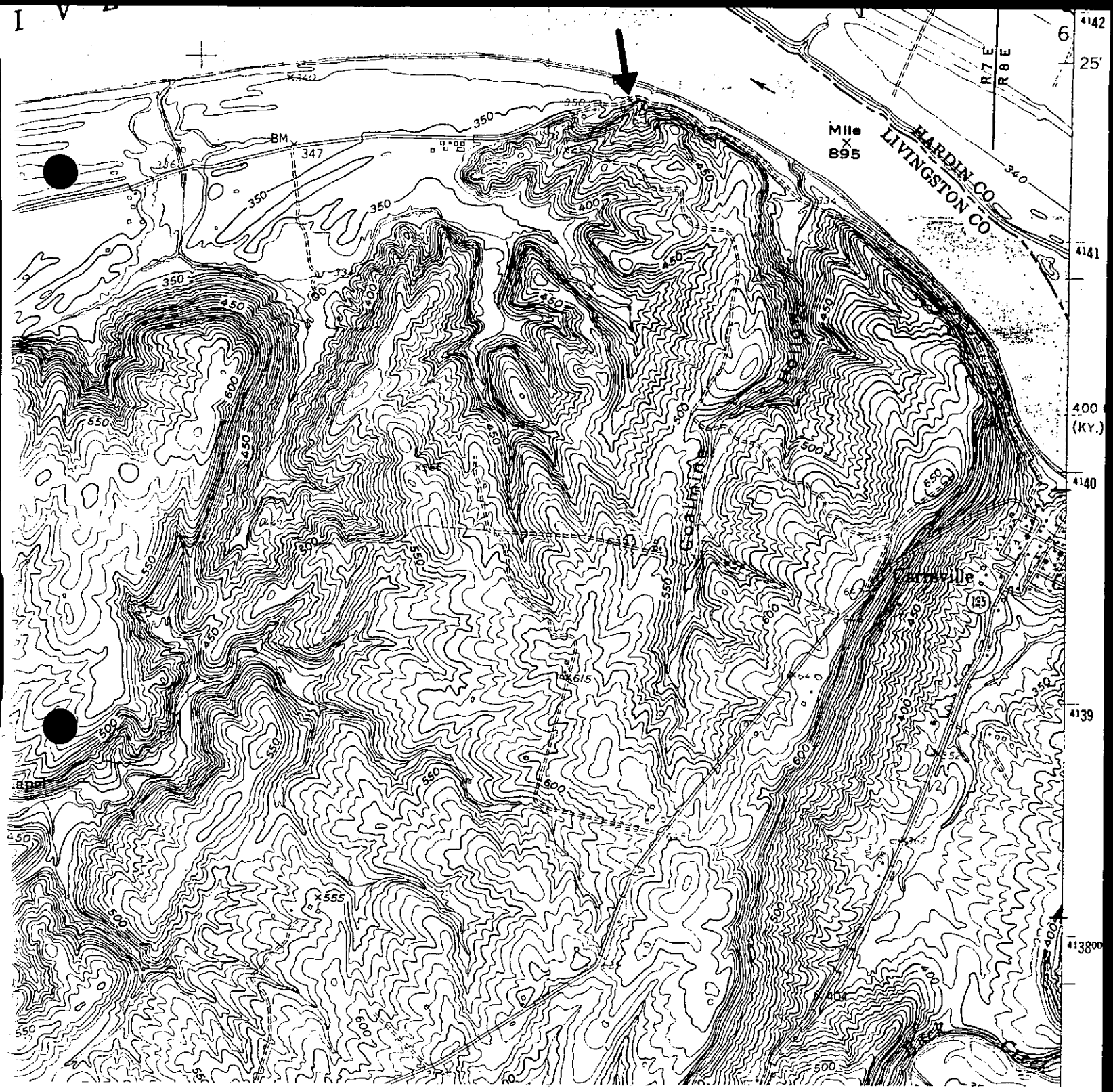


Figure 4. Location of previously known population of Apios priceana, shown (with arrow) on copy of USGS topographic map, Smithland 7.5' Quadrangle, Livingston County, Kentucky

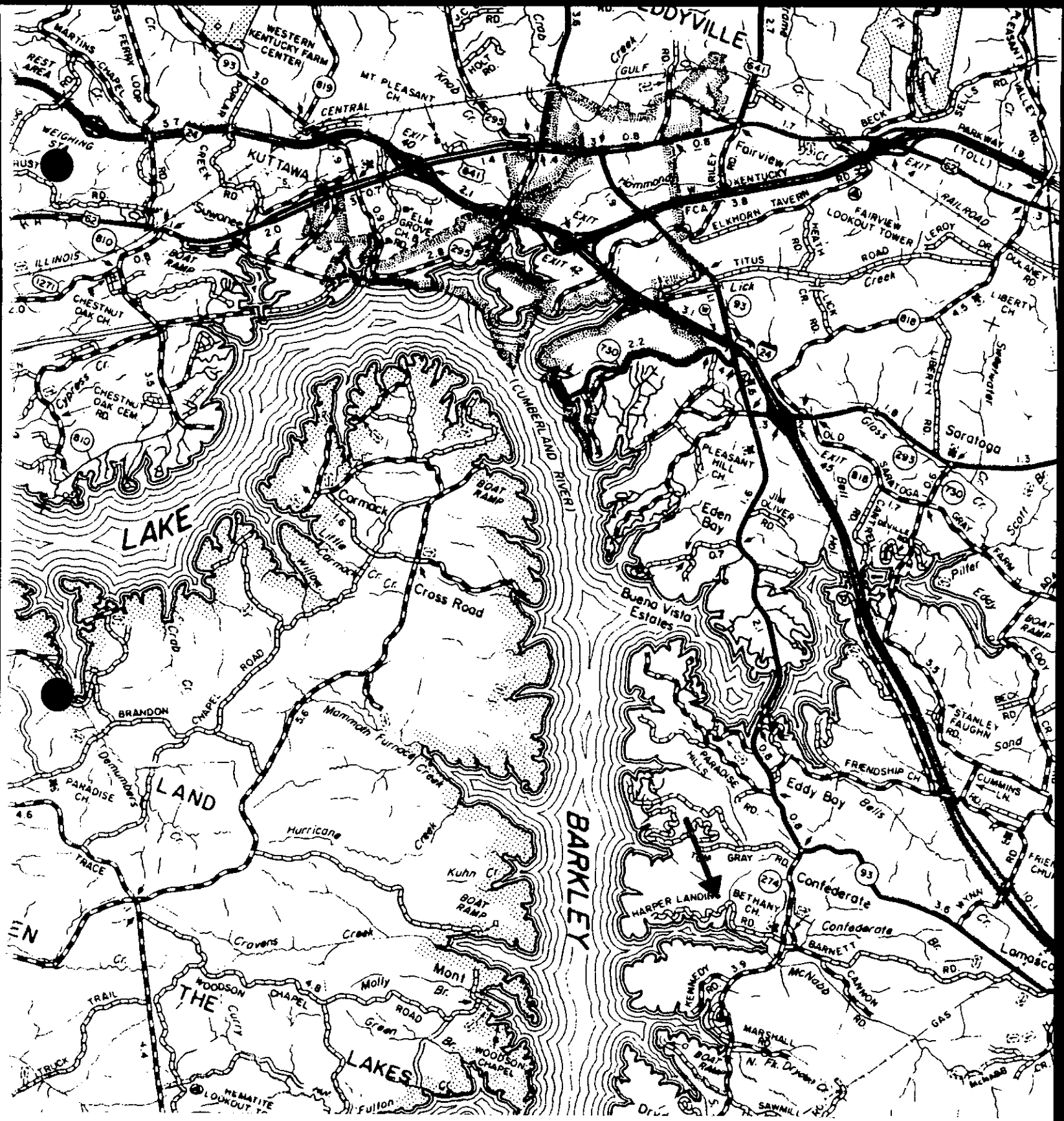


Figure 5. Location of previously known population of Apios priceana, shown (with arrow) on copy of County Highway Map of Lyon County, Kentucky

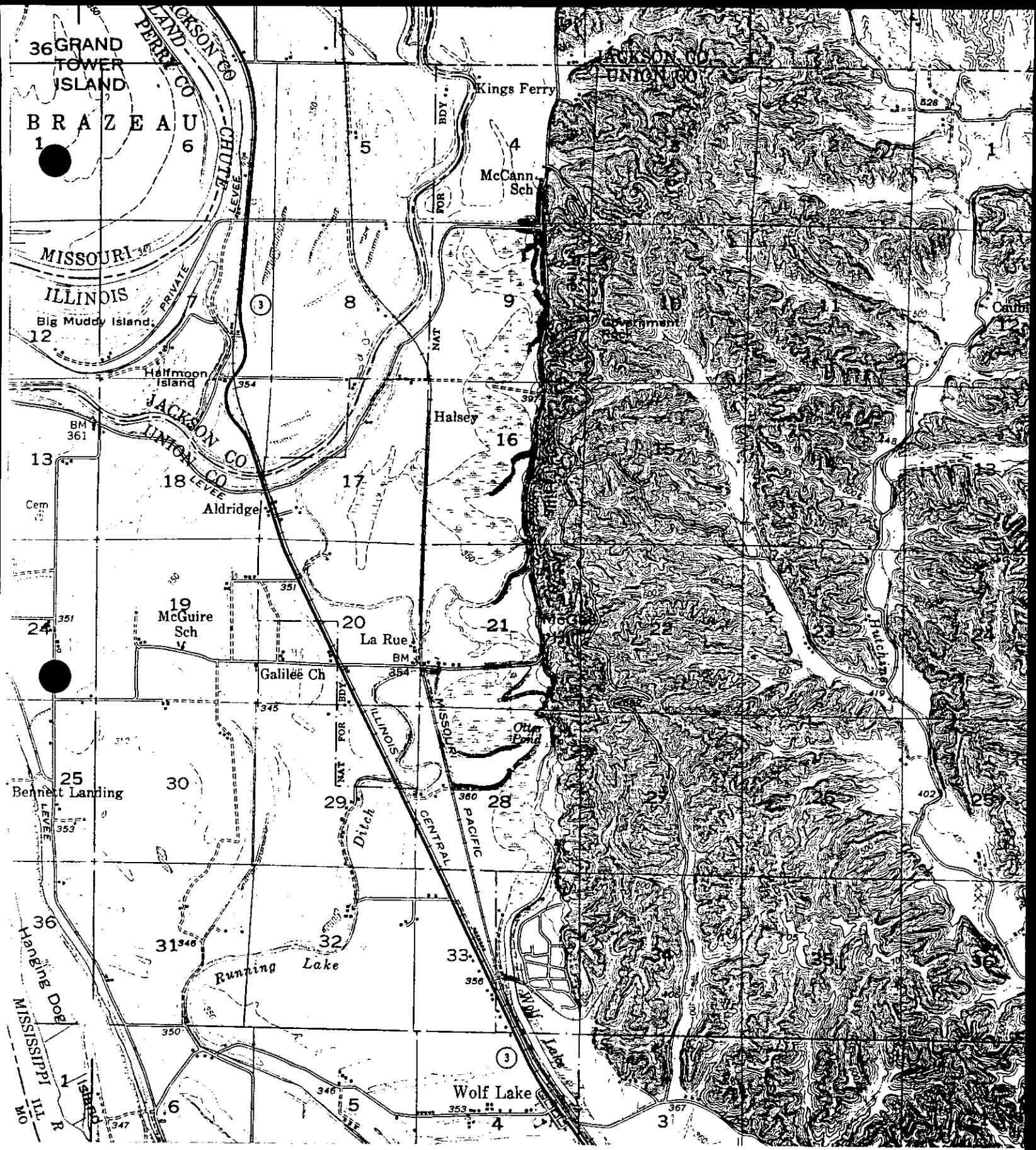


Figure 6. Specific sites searched during the survey for Apios priceana at Pine Hills-LaRue Swamp-Wolf Lake, Union County, Illinois; most of the survey time was during July, but Wolf Lake was searched During September (map is enlarged copy of USGS topographic map, Alto Pass 15' Quadrangle)

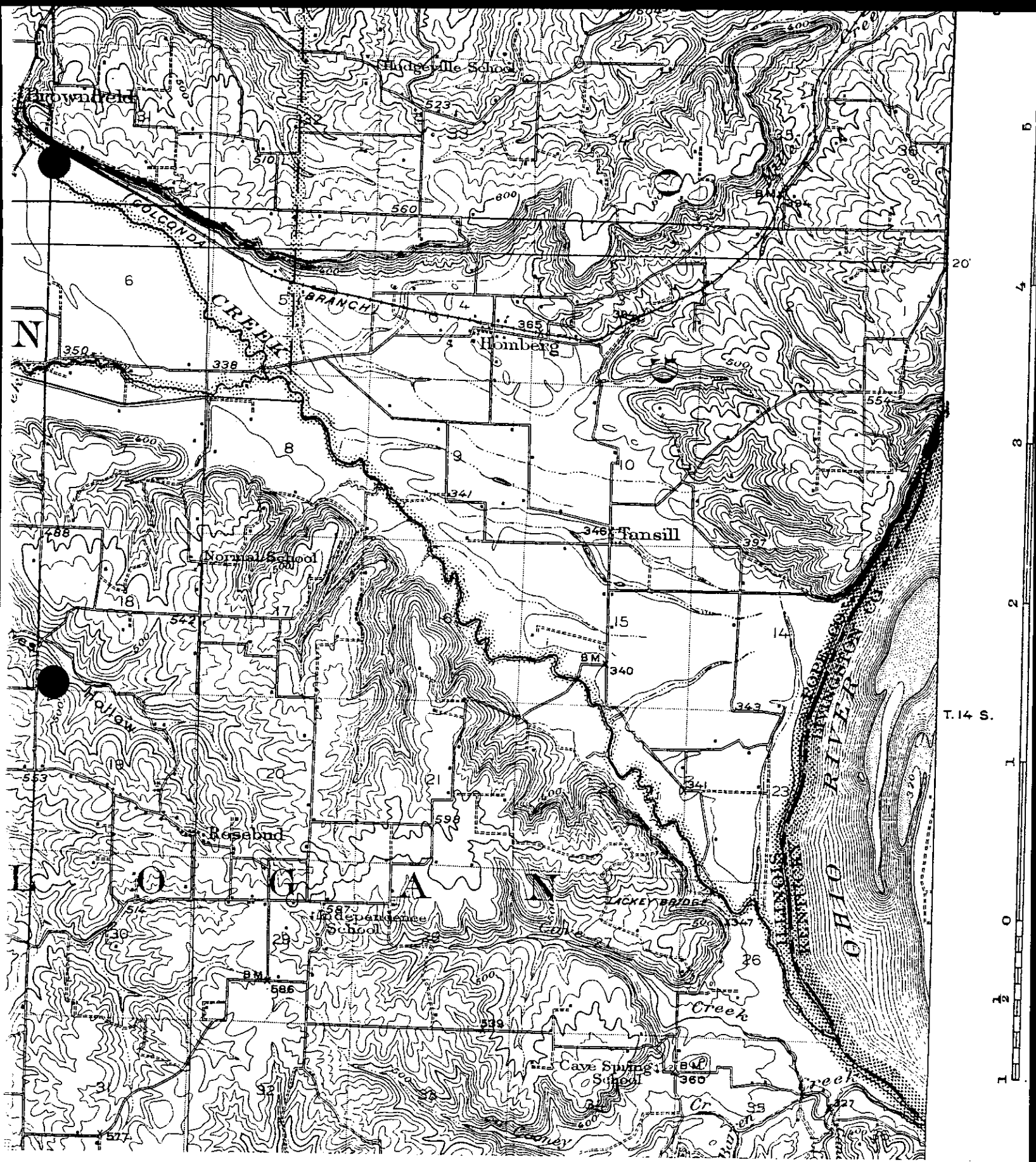


Figure 7. Specific sites searched during the survey for Apios priceana along the Ohio River bluffs in Pope County, Illinois; the survey of this part was both on foot and by boat, during July and August (map is enlarged copy of USGS topographic map, Brownfield 15' Quadrangle)

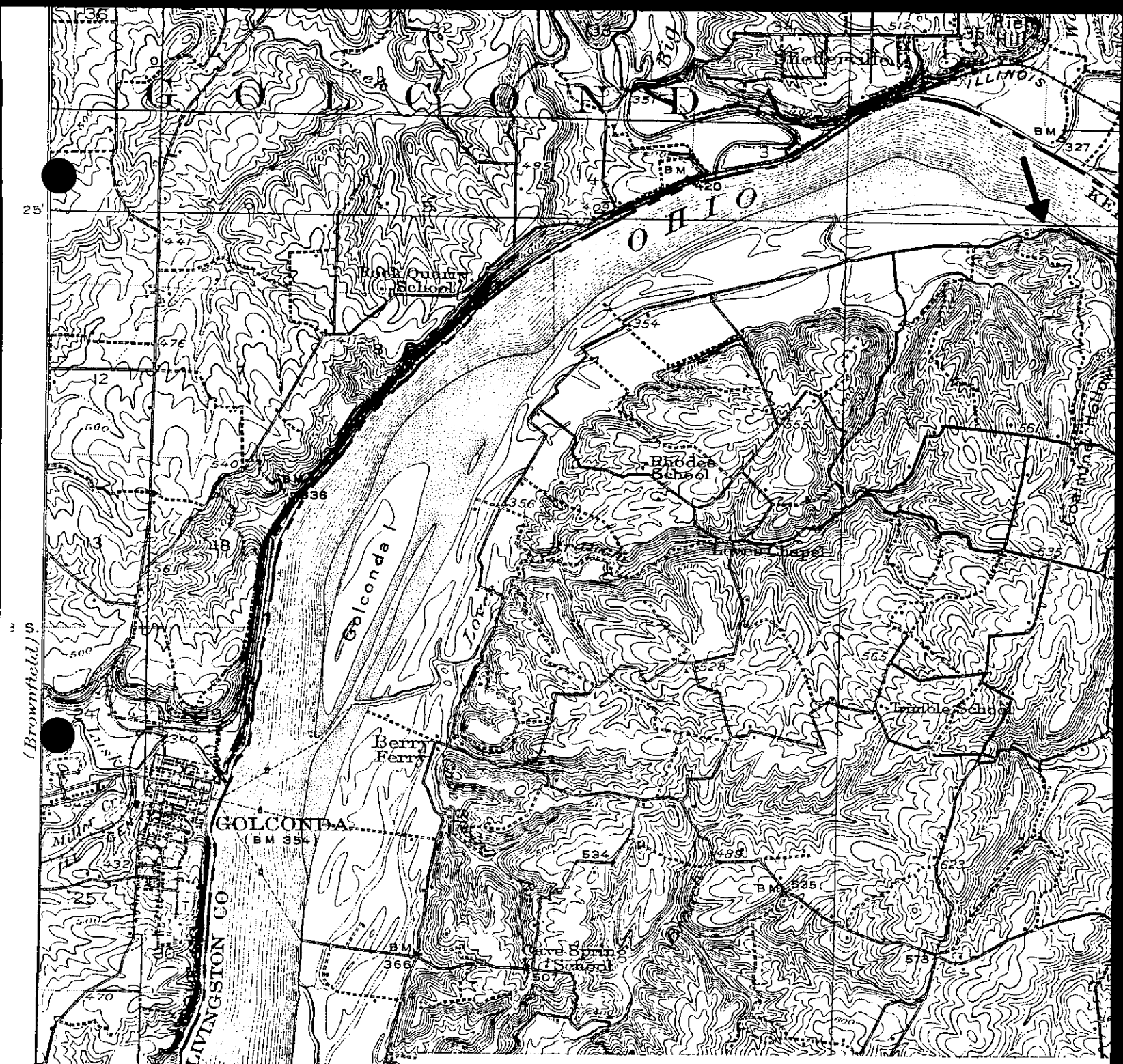


Figure 8. Specific sites searched during the survey for Apios priceana along the Ohio River bluffs in Pope and Hardin counties, Illinois; the surveys were conducted both on foot and by boat, during July and August; known location of Apios priceana in Livingston County, Kentucky is shown with arrow (map is enlarged copy of USGS topographic map, Golconda 15' Quadrangle)

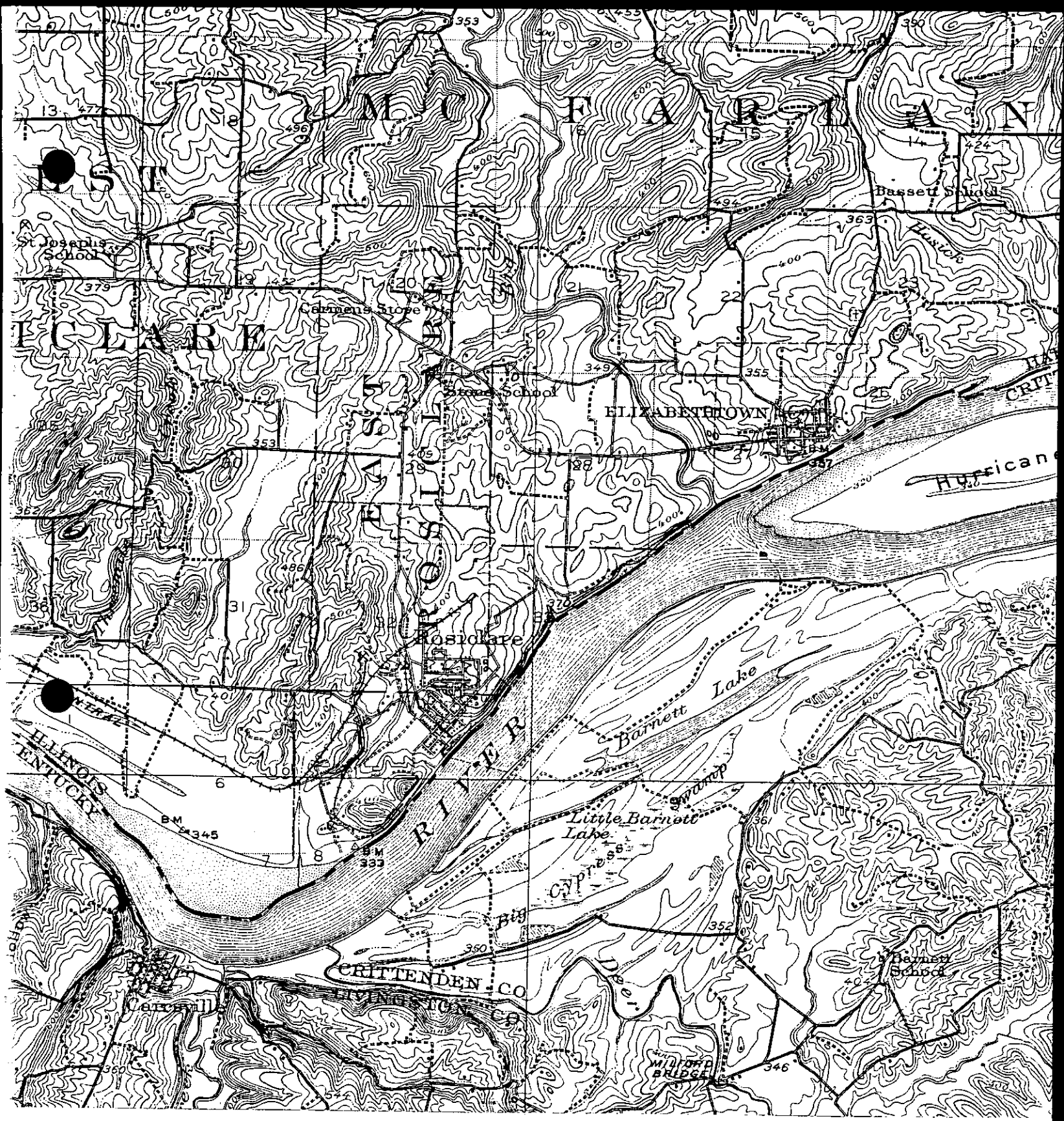
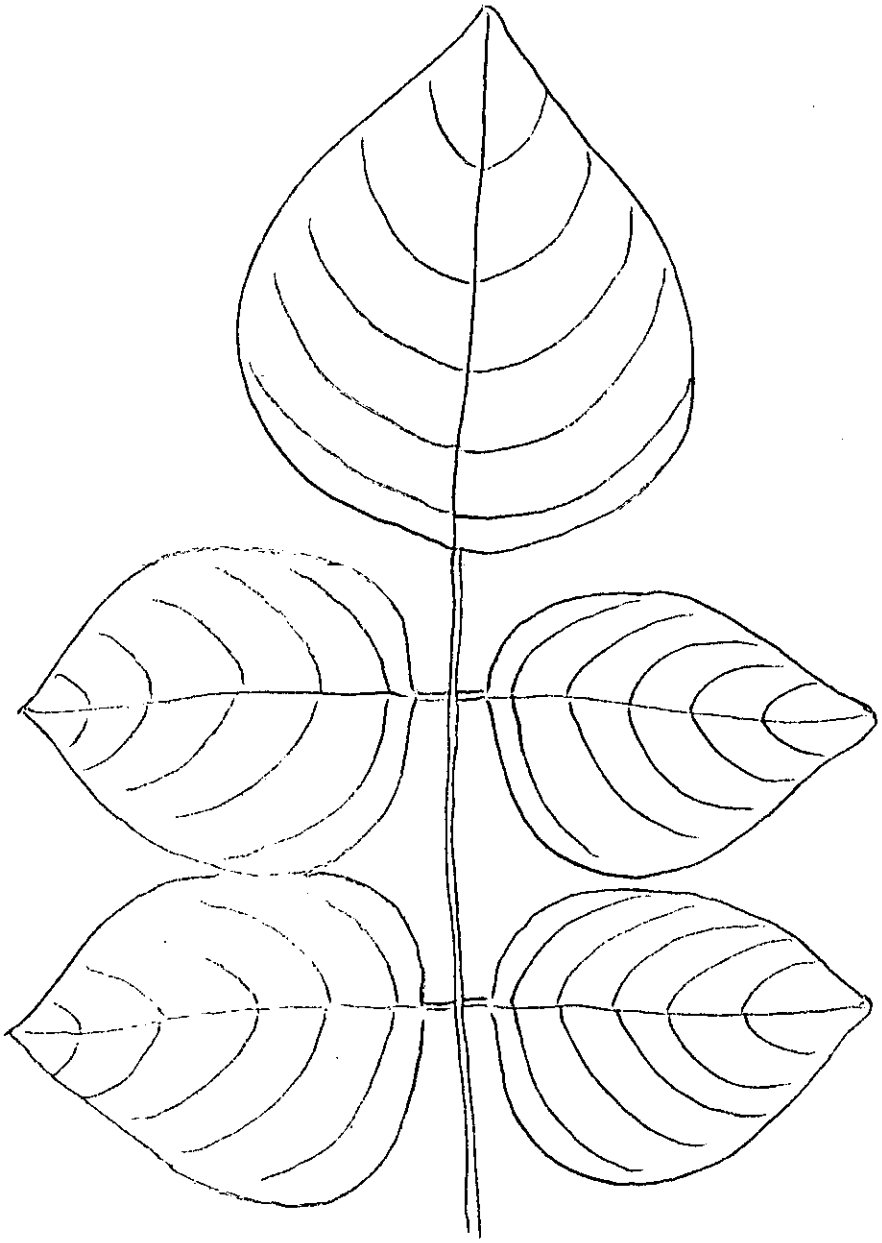


Figure 9. Specific sites searched during the survey for Apios priceana in Hardin County, Illinois; the survey of this part was conducted both on foot and by boat, during July (map is enlarged copy of USGS topographic map, Golconda 15' Quadrangle)

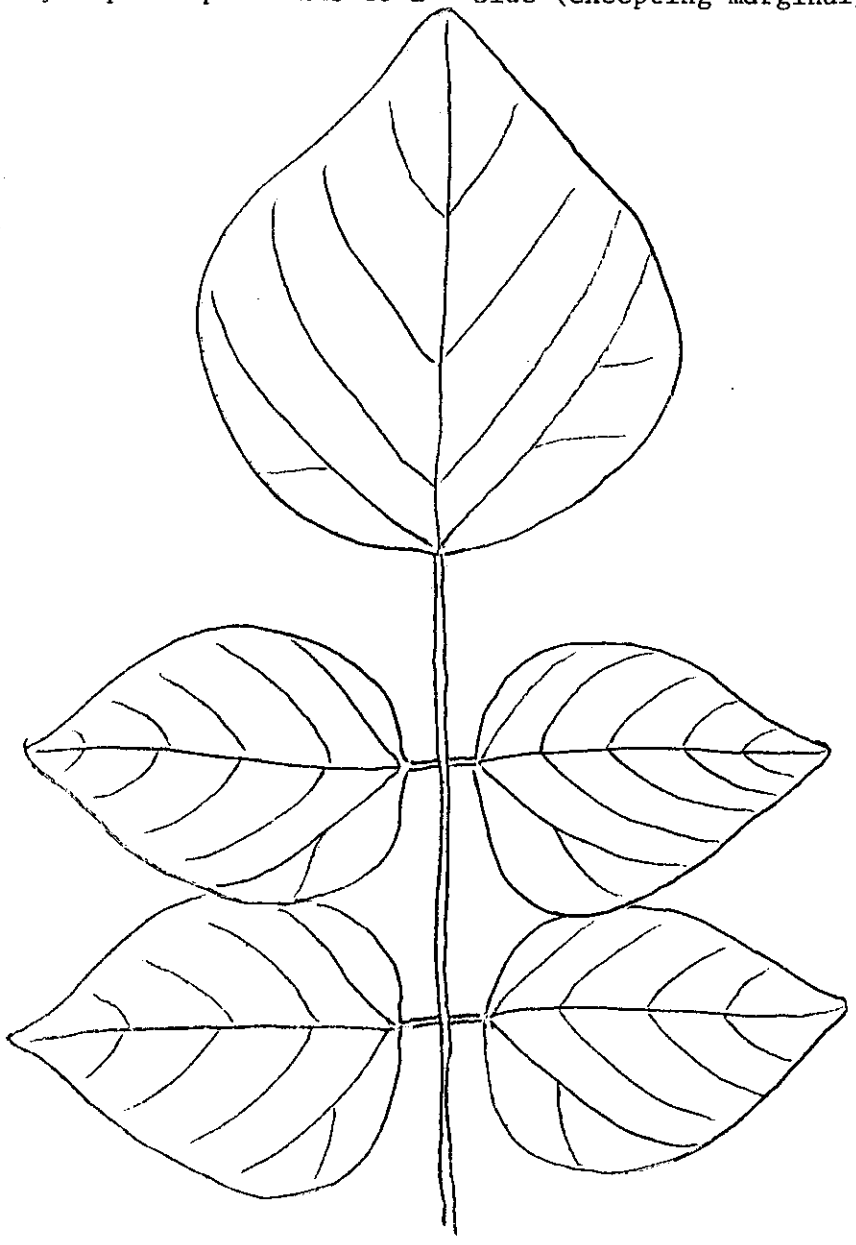
Figure 10. Differences in leaf veination between Apios americana and Apios priceana (Schwegman, 1990)

first vein (excepting the marginal vein) from the base of the leaflet usually branching 1 mm. or more from the base, forking at 60° or more from main vein and curving; usually 5 principal veins to a side (excepting marginal)



APIOS AMERICANA

first vein (excepting the marginal vein) from the base of the leaflet usually branching at or very near the base, at about 45° angle from the main vein and straight; usually 4 principal veins to a side (excepting marginal)



APIOS PRICEANA

Figure 11. Carrsville Site, Livingston Co., Kentucky; the Apios priceana (along with A. american and wisteria) occurs along the lower slope at the forest edge, near an old road -photo by M. Hutchison, July 2, 1990

Figure 12. Apios priceana growing among rotted logs and limestone boulders at the Carrsville, Kentucky Site (shown above) -photo by M. Hutchison, July 2, 1990

Figure 13. Investigators checking identification characters of Apios priceana at the Confederate Site, Lyon Co., Kentucky; from left to right: Raymond Athy, Robert Craig, and John Schwegman
-photo by M. Hutchison, July 2, 1990

Figure 14. Robert Craig and sons, Matthew and Stephen, checking flower characters of Apios priceana at the Confederate Site, Lyon Co., Kentucky
-photo by M. Hutchison, July 20, 1990

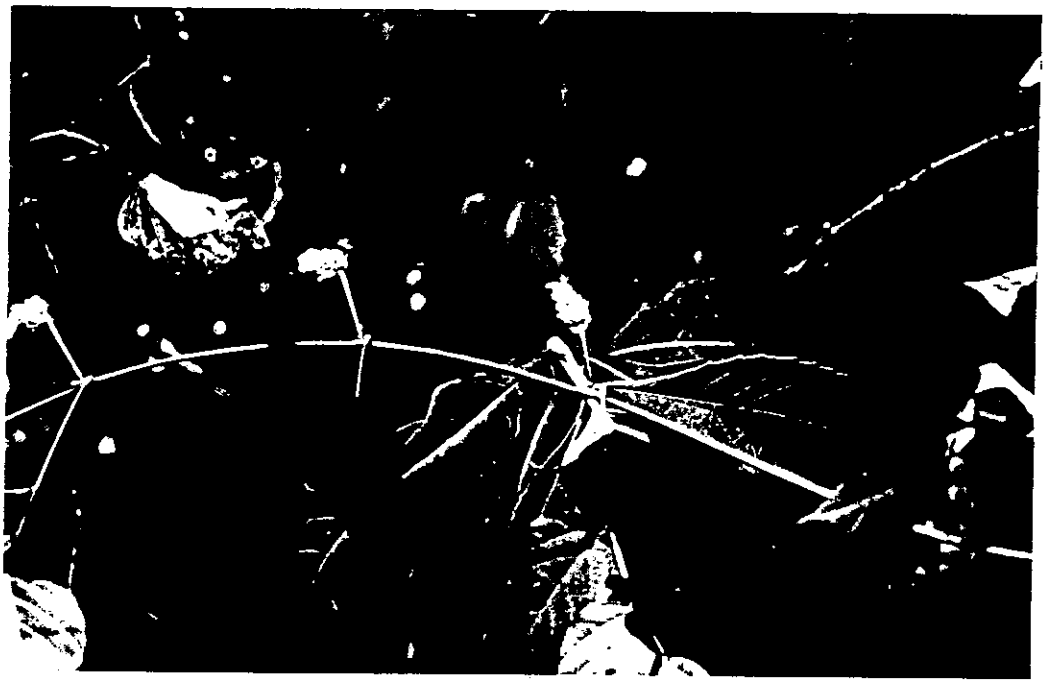


Figure 15. Buds and young flowers of Apios priceana at the Confederate Site, Lyon Co., Kentucky
-photo by M. Hutchison, July 2, 1990

Figure 16. Apios priceana in full bloom at the Confederate Site, Lyon Co., Kentucky
-photo by M. Hutchison, July 20, 1990

Figure 17. Summer view of LaRue Swamp from high on the Pine Hills bluffs, Union Co., Illinois; the only valid Illinois collection of Apios priceana was probably in this vicinity
-photo by M. Hutchison

Figure 18. Winter view of LaRue Swamp, Union Co., Illinois, showing beaver lodge in background; higher water levels from beaver dams have changed the character of the swamp edge vegetation considerably in recent years
-photo by M. Hutchison

Figure 19. Winter view of spillway at edge of LaRue Swamp (south of LaRue Road), Union Co., Illinois; this is an unverified location for Apios priceana
-photo by M. Hutchison

Figure 20. View looking downstream across spillway described in Figure 19; Apios priceana was not found here during the 1990 survey
-photo by M. Hutchison

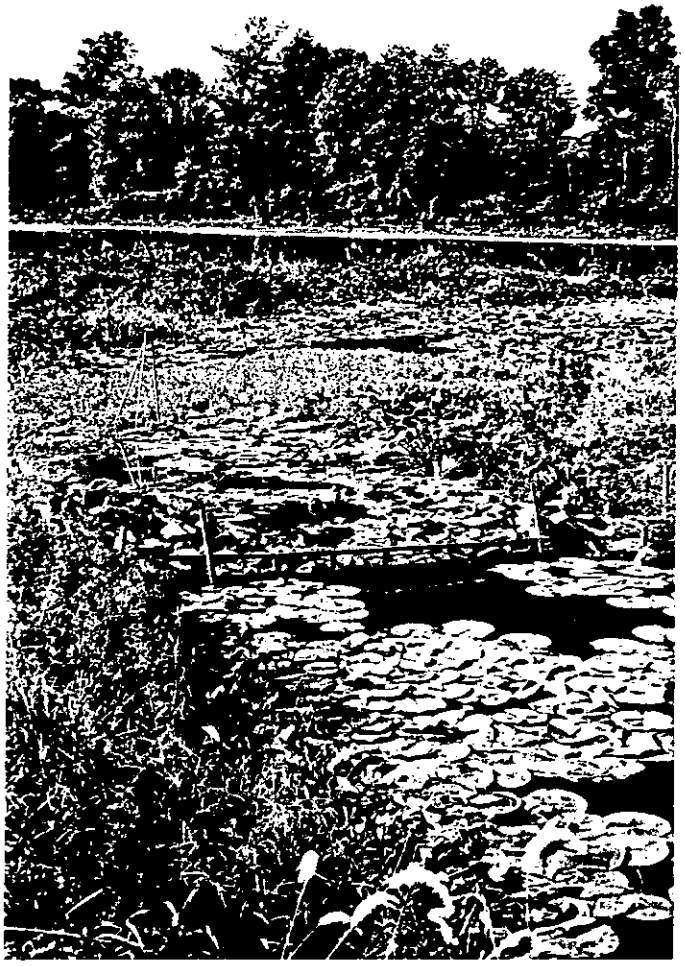


Figure 21. View looking west across Wolf Lake, Union Co., Illinois; this is an unvalidated location for Apios priceana
-photo by M. Hutchison, Sept. 20, 1990

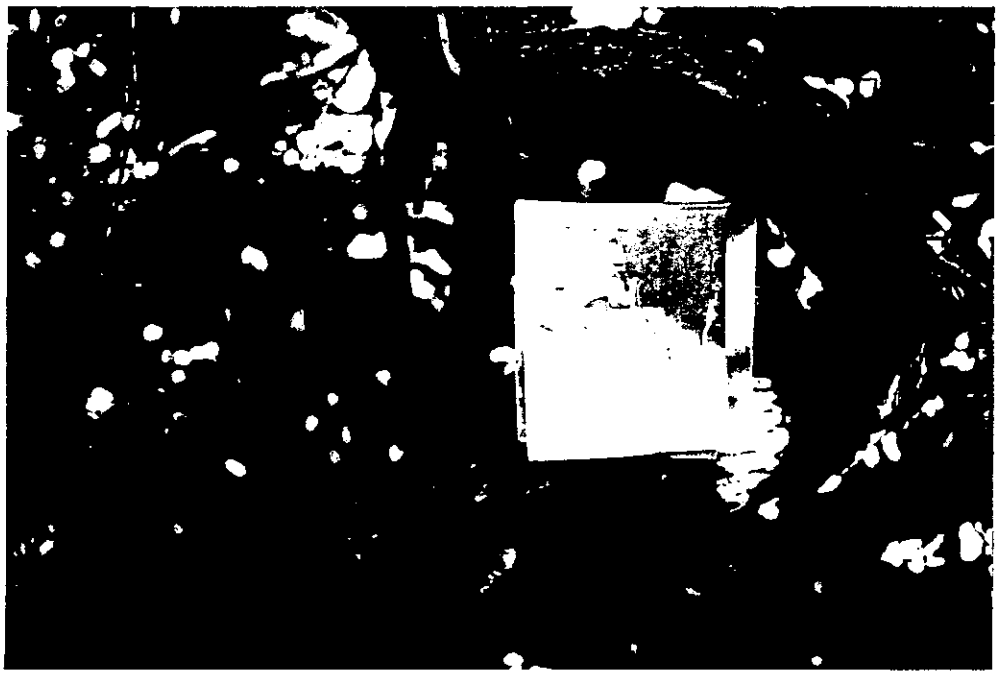


Figure 22. A large grape vine at Wolf Lake, Union Co., Illinois; the edge vegetation here is very viney and includes several localities for Apios americana and wisteria
-photo by M. Hutchison, Sept. 20, 1990

Figure 23. Apios americana growing among limestone boulders along the Ohio River bank in Hardin Co., Illinois; this species is difficult to distinguish from Apios priceana from a distance when not in flower -photo by M. Hutchison, July 19, 1990

Figure 24. A close view of Apios americana in flower; see Figure 16 for comparison with flowers of Apios priceana -photo by M. Hutchison, Aug. 24, Murphy Pond, Ky.

Figure 25. Wisteria (Wisteria machrostachya) in fruit along the bouldery limestone Ohio River bank in Pope Co., Illinois; young vines of this species are difficult to distinguish from Apios -photo by M. Hutchison, Aug. 24, 1990

Figure 26. Wisteria in flower along the rocky Ohio River bank in Pope Co., Illinois; compare with figures 16 and 24 -photo by M. Hutchison, July 17, 1990

Figure 27. A view of wisteria covering limestone boulders along the Ohio River bank in Pope Co., Illinois; this habitat was assumed to be suitable for Apios priceana
-photo by M. Hutchison, July 31, 1990

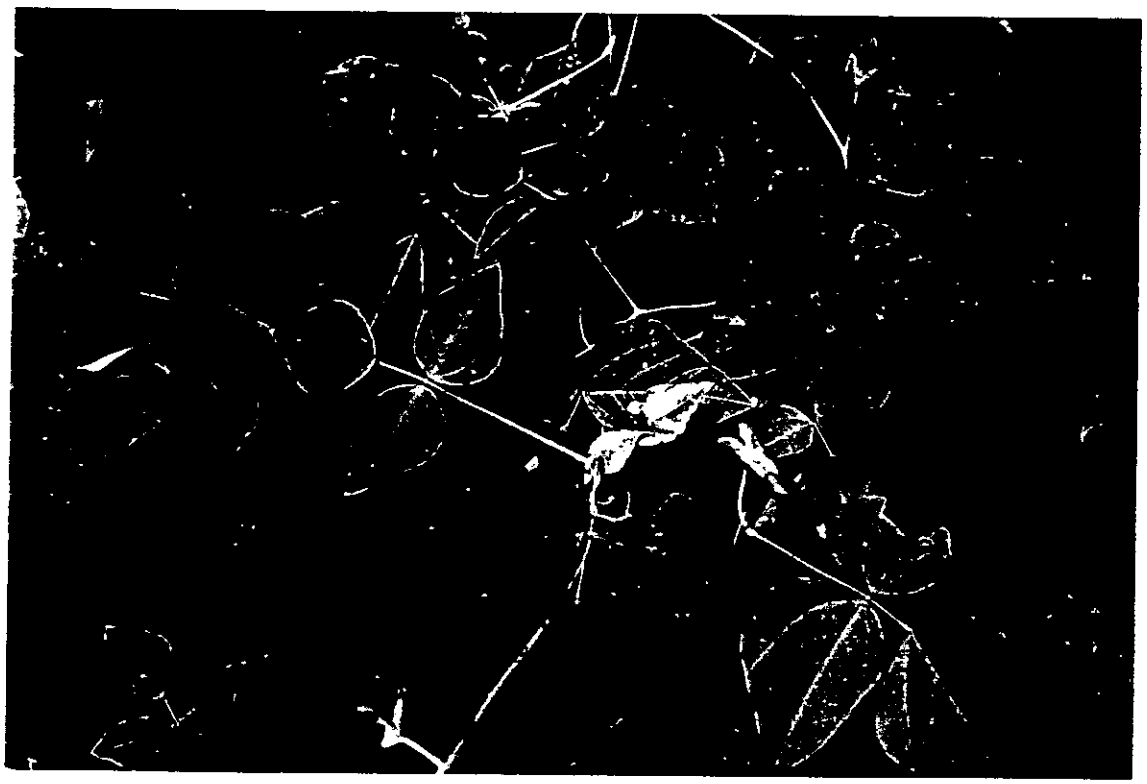


Figure 28. A vine (probably the wild bean, Phaseolus polystachios) growing along the Ohio River bank in Hardin Co., Illinois that closely resembles Apios priceana in leaf veination; Phaseolus has only three leaflets
-photo by M. Hutchison, July 27, 1990

Figure 29. Japanese honeysuckle (Lonicera japonica) is an exotic vine that covers the vegetation in several openings along the Ohio River bank in Hardin and Pope cos., Illinois
-photo by M. Hutchison, July 19, 1990

Figure 30. Johnson grass (Sorghum halepense) is an aggressive exotic species that forms dense stands in openings where there is good soil along the Ohio River bank in Hardin and Pope cos., Illinois
-photo by M. Hutchison, July 18, 1990

Figure 31. High sandstone cliffs bordering the Ohio River near the Hardin-Pope Co. line; many vines grow along the base and up the face of the cliffs
-photo by M. Hutchison, July 27, 1990

Figure 32. View of dead trees along the Ohio River due to construction of Smithland Dam just downstream from Golconda in Pope Co., Illinois
-photo by M. Hutchison, Aug. 22, 1990

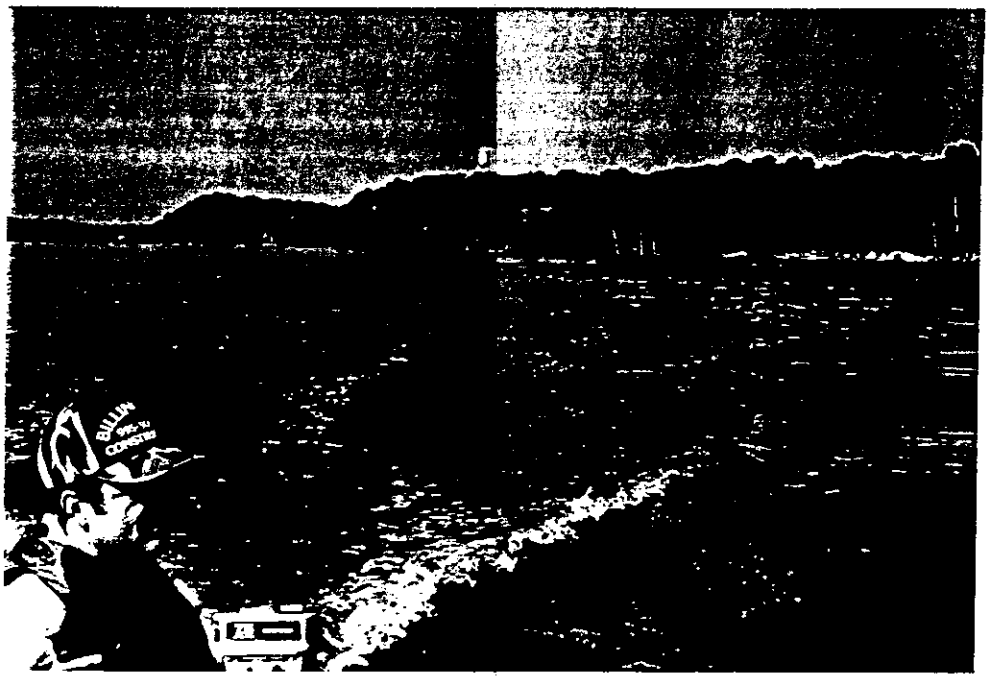


Figure 33. Distant view of Ohio River bank in Hardin Co., Illinois; much of this habitat was accessed by boat
-photo by M. Hutchison, July 19, 1990

Figure 34. Sites where the habitat appeared to be suitable for Apios priceana were scanned from the boat with binoculars; in ideal places, searchers left the boat and examined the banks on foot
-photo by M. Hutchison, Aug. 22, 1990

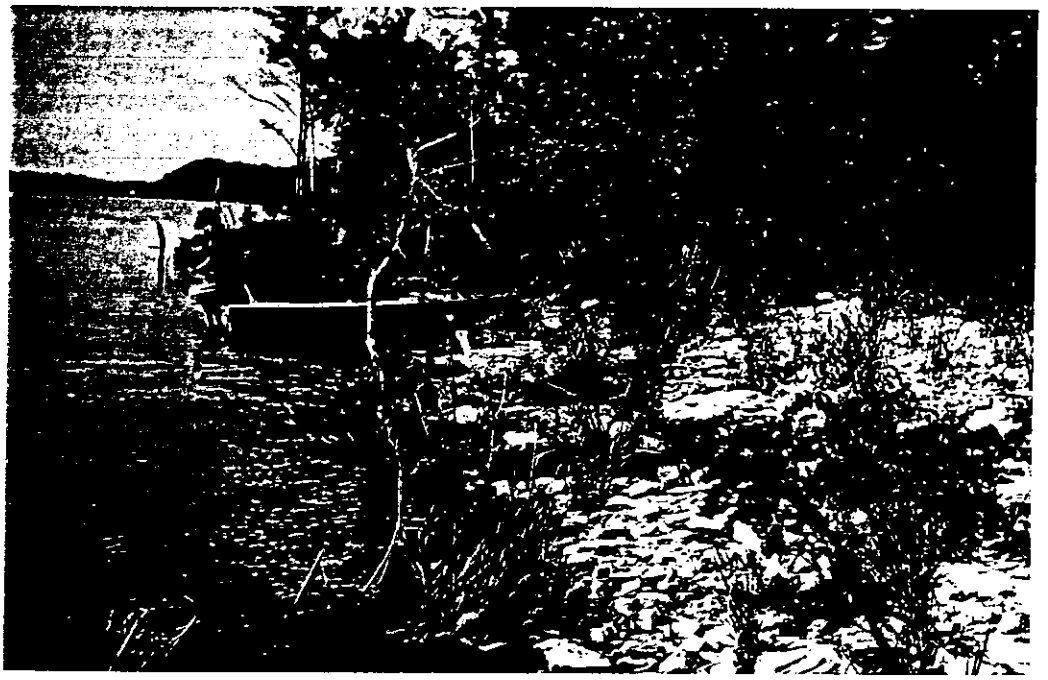


Figure 35. Typical view of Ohio River bank habitat in Hardin Co., Illinois, east from Rosiclare; most sites are very stony -photo by M. Hutchison, July 19, 1990

Figure 36. Typical view of bouldery limestone slope along Ohio River at Ropers Landing in Pope Co., Illinois -photo by M. Hutchison, Aug. 22, 1990

Figure 37. The limestone slopes along the Ohio River bank east from Rosiclare in Hardin Co., Illinois are "glade-like" in places with many shrubs and vines
-photo by M. Hutchison, July 19, 1990

Figure 38. The bouldery slopes south of Golconda in Pope Co., Illinois have a mixture of sandstone boulders and limestone outcrops where many shrubs, vines, and forbs occur
-photo by M. Hutchison, Aug. 22, 1990

Figure 39. View of eroding bank along the Ohio River east from Rosiclare in Hardin Co., Illinois; because of severe erosion occurring all along the outside curve of this stretch of the river, dirt banks occur only at the mouths of tributary streams
-photo by M. Hutchison, July 19, 1990

Figure 40. View of stony bank south of Golconda in Pope Co. where erosion has left little soil
-photo by M. Hutchison, July 18, 1990

Figure 41. Erosion has exposed the roots of many trees and removed much of the river bank vegetation since the construction of Smithland Dam in the 1970's
-photo by M. Hutchison, July 19, 1990

Figure 42. Another view of severe erosion high above the pool stage of Smithland Dam
-photo by M. Hutchison, July 18, 1990

Figure 43. The copperhead snake (Agkistrodon contortrix) occurs on the bouldery slopes bordering the Ohio River in Hardin and Pope cos., Illinois
-photo by M. Hutchison, July 11, 1990

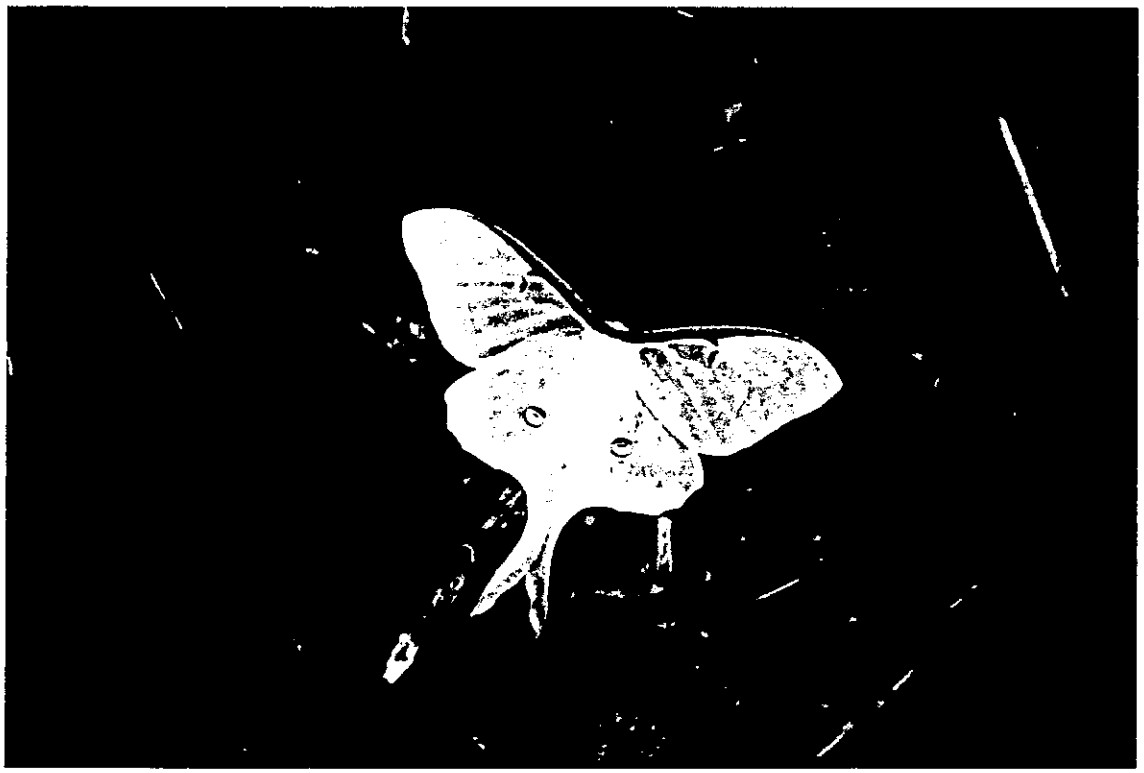


Figure 44. The luna moth (Actias luna) is common on the viney slopes bordering the Ohio River south of Golconda in Pope Co., Illinois
-photo by M. Hutchison, July 31, 1990

Figure 45. Girdling of trees and saplings by beaver is common all along the Ohio River banks in Hardin and Pope cos., Illinois
-photo by M. Hutchison, Aug. 22, 1990

95D Chamberlain Drive
Rock Island, Illinois 61201

September 28, 1986

Dr. Alfred C. Koelling
Botany Department
Illinois State Museum
Springfield, Illinois 62706

Dear Dr. Koelling,

Since my visit with you in early August, I've had a chance to complete a brief biographical sketch on my father-in-law, Ralph M. Fisher. The sketch along with a photograph taken of Ralph about the time of the actual collecting activity are enclosed. I certainly hope these meet your expectations. Putting this together has been great fun, and I would be most happy to add further details if you see a need for them.

Papers of Mr. Fisher along with several long distance conversations to clarify a point or two, served as the source for my information. Mr. Fisher also reviewed my final draft. As I mentioned in our visit, Ralph now lives in Bella Vista, Arkansas, and I am sure he would welcome any correspondence or calls. His address is 53 Nantucket Drive, Bella Vista, Arkansas, phone (501) 855-3408.

On my next visit to Springfield, I'll try to stop by the Museum and see you. Again, thanks for suggesting this project. I certainly have enjoyed putting it together.

Yours truly,

Robert E. Mountz

Robert E. Mountz

Ralph Fisher is collector of only valid Illinois collection of Apios priceana G Fuller + R. Fisher #664 July 8, 1941. He was collecting all plants at State Forest for a WPA project (contract) Coll. by Fuller. He can't remember collecting anything at Wolf Lake but did at swamps north of Wolf Lake where he ran his coon dogs.

~~Indian mattica~~
~~[illegible]~~

☆ at ILL

Apios priceana Along Wolf Lake, Union Co Ill
damp rich soil. ~~Sept~~ July 8, 1941 as A. americana
annotated as A. priceana by H.E. Ahles 1951.
G.D. Fuller #664
specimen has 5-7 leaflets and in full bloom
this date.
there are 2 sheets, both #664 second one
annotated by Michael Woods Oct '87

Apios priceana
this is a. americana — Winterringer 2492 Nov 1, 1949
Pine Hills E of Aldridge Union Co IL
Edge of swamp. (in fruit) Dup + U of I herb
ISM # 27485

a. the first vein (excepting the marginal vein) from the base of the leaflet usually branching at or very near the base of the leaflet, at about 45° angle from it and straightish
Principal veins 4 to a side (excluding marginal vein) A. Priceana

a. first vein (ex marginal) from base of leaflet usually 1 mm or more from base, forking at 60° or more from main vein, more curving
usually 5 veins to a side (ex marginal) A. americana

at NH Survey

Apios priceana

Geo D. Fuller & Ralph Fisher

#664 in fl 7/8/41

Damp rich soil, Wolf Lake

Union Co IL.

My collection from

Eddyville KY July 30, 67

in fl

Pine Hills E of Aldridge

Edge of Swamp 1949

zewell Co

Along Wolf Lake, Union Co Ill

Sept 8, 1941 as A. americana

priceana by H.E. Ahles 1951

ller #664

7 leaflets and in full bloom

, both #664 second one

ubal Woods Oct '87

Apios priceana

Winterringer 2492 Nov 1, 1949

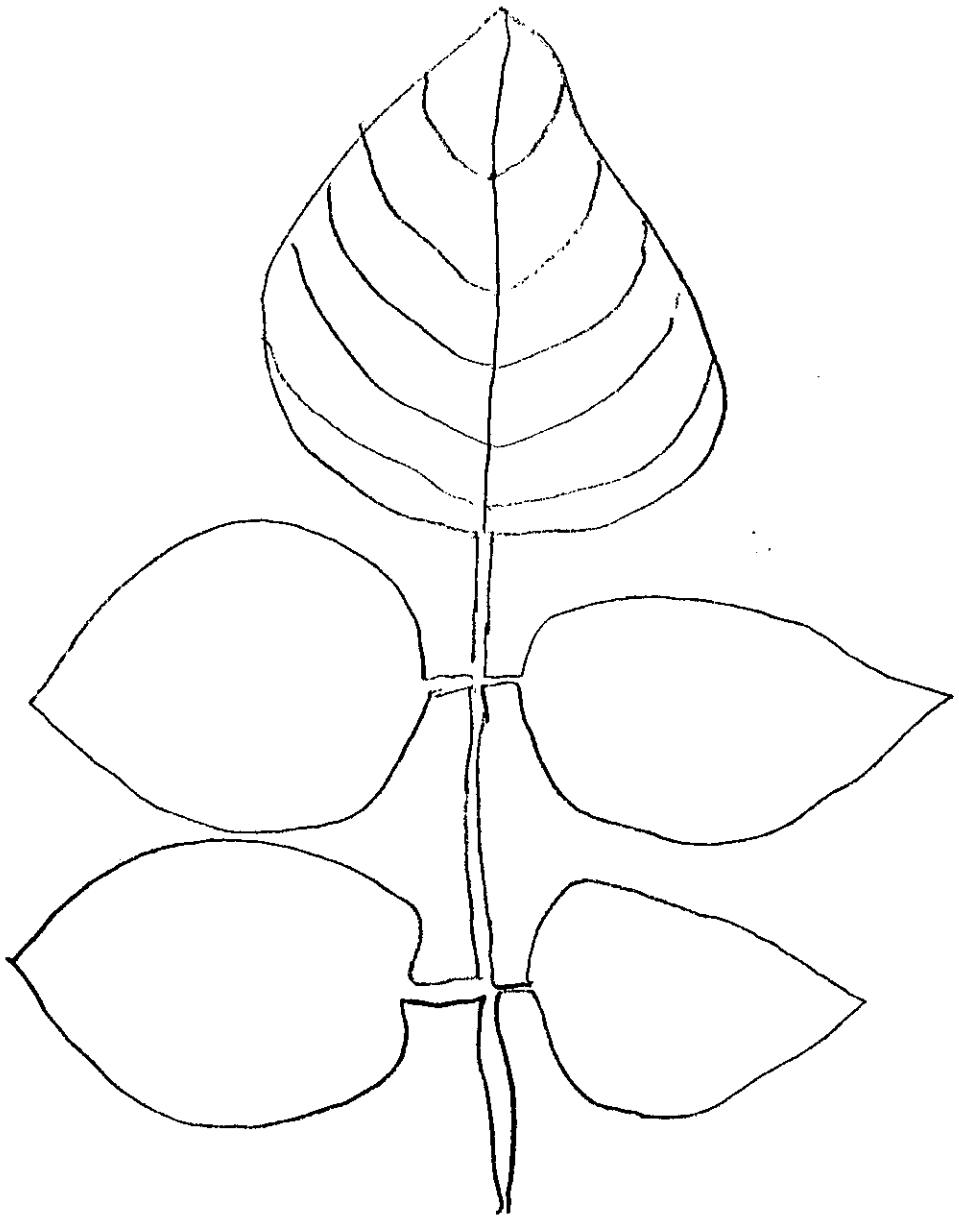
Pine Hills E of Aldridge Union Co IL

Edge of Swamp. (in fruit) Dup + U of I herb

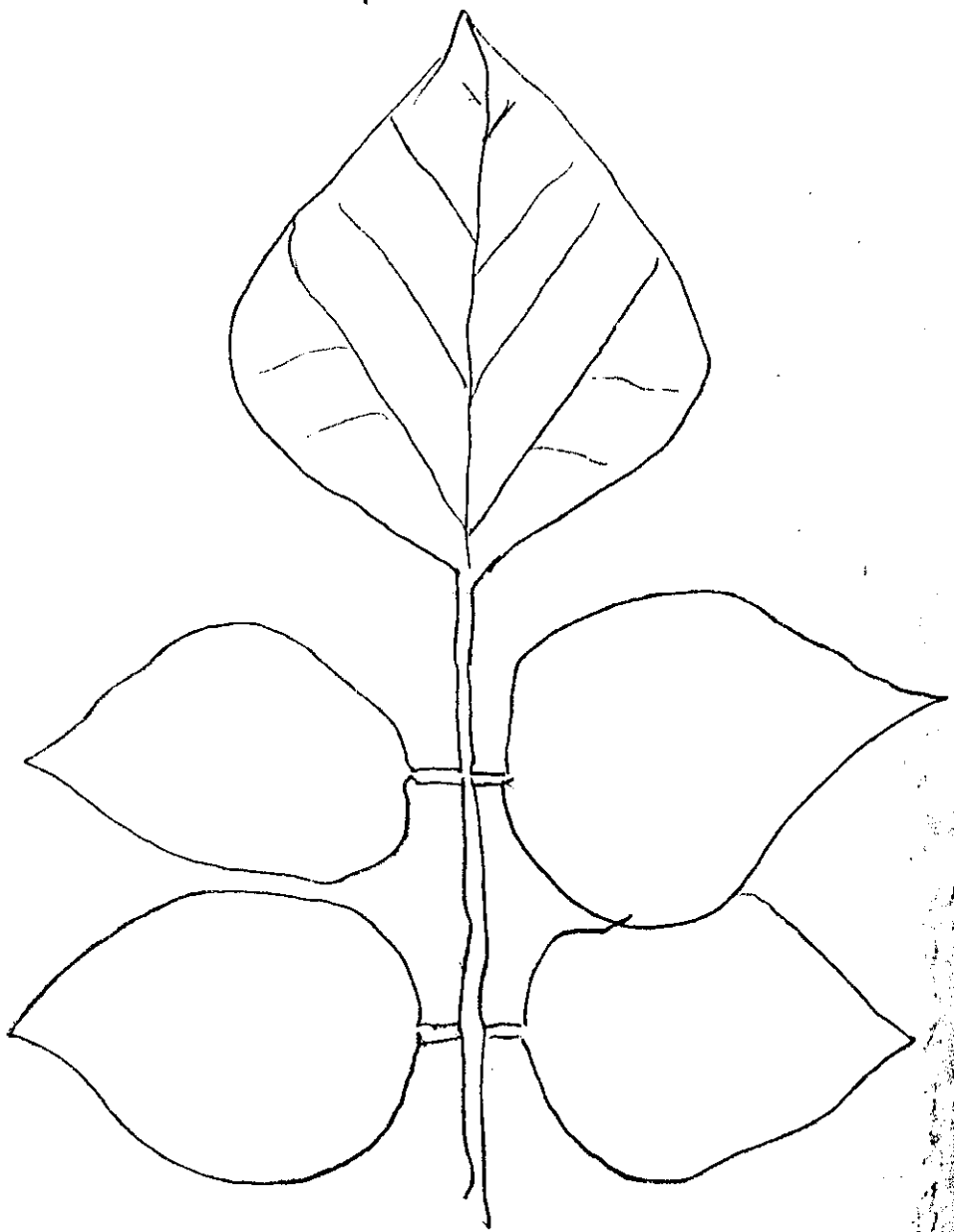
ISM # 27485

a. the first vein (excepting the marginal vein) from the base of the leaflet usually branching at or very near the base of the leaflet, at about 45° angle from it and strai of the

Apios a...



Apios pricana



APPENDIX ITEM II.

Apios priceana

Species Information

1. Classification and nomenclature

   A. Species or infraspecific taxon

      1) Scientific name

         Apios priceana Robins.

      2) Pertinent synonym: none

      3) Common name

         Price's groundnut

   B. Family classification

      Fabaceae (Leguminosae)

   C. Major group

      Dicot, Rosales

   D. Current alternative taxonomic treatment: none

2. Present Illinois status

   A. Officially listed 20 May 1980 as a State Endangered Species by Illinois Department of Conservation Administrative Order 154: Illinois List of Endangered and Threatened Species (Sheviak, 1981). This is an official listing which provides no legal protection.

   B. Other formal status recommendations: none

3. Description

   A. General nontechnical description

      Herbaceous vine growing from a single tuber up to 15 (-20) cm thick. Stems slender, glabrous, climbing or scrambling over vegetation. Leaves pinnately compound, alternate, divided into 5 (-7) leaflets; leaflets lanceolate to lance-ovate, acute at the apex, rounded or somewhat tapering at the base, up to 5.5 cm long, up to about half as wide, entire, usually glabrous. Inflorescence a dense raceme with several crowded flowers; flowers rose-colored or greenish-white tinged with purple, about 2 cm long; calyx 8-10 mm long, cup-like with apparently a single lobe; largest petal (standard) with a spongy projection at the tip. Legumes narrow, up to 10 cm long, twisting after dehiscence, containing several seeds. (Biotic Consultants, 1976)

B. Photographs: provided

4. Geographical distribution

A. Geographical range (Appendix I: State distribution map)

Apios priceana occurs very locally in the bottomlands on the east side of the lower Mississippi River in Union County. The only known Illinois collections were made in 1941 and 1949 from the borders of Otter Pond and Wolf Lake, respectively.

B. Precise occurrence (Appendix II: Locational information; Appendix III: Critical habitat maps)

Historically known populations where current status is not known:

The 1941 and 1949 collection sites could not be relocated for this study. A 1976 observation by Dr. Robert H. Mohlenbrock (Southern Illinois University, Carbondale) at Wolf Lake, however, may represent the 1949 collection site, but this also could not be relocated. Because the area has not recently been disturbed, the plant is believed to be extant.

5. General environment and habitat description

Wet floodplain forest and shrub swamp (White and Madany, 1978). Wet floodplain forest occurs along the edges of backwater sloughs or old meander scars. Flooding in this community is so frequent or prolonged that the diversity of trees is lowered and nettles and vines are often prominent. Characteristic plants include Acer saccharinum, Populus deltoides, Acer rubrum, and Quercus macrocarpa.

Concise statement of general environment and habitat:

The collection site for the Apios is a highly significant natural area, part of which was classified by the U.S. Forest Service as the Pine Hills-LaRue Swamp Ecological Area. The site includes eroded cherty limestone bluffs of the Mississippi River, uplands with a diverse deciduous forest, lowlands containing spring-fed ponds, and swamp forest with a high diversity of plant and animal species. The site is of national significance.

This site is the northern range limit of Apios priceana, at which its lowland habitat is apparently different from upland habitat in the southern parts of its range. The original Illinois collections describe the site as "damp rich soil" and "edge of swamp." The 1976 observation by Mohlenbrock was in a clearing in an apparently similar moist area. Nearby trees included Acer rubrum and Quercus macrocarpa. Herbaceous associates were Carex frankii, Carex lupulina (?), Glyceria striata, Impatiens biflora, and Scutellaria lateriflora.

6. Population biology of species

   A. General summary of population biology of the taxon--information not available

   B. Demography--information not available

   C. Phenology

      Apios priceana produces its first leaves from March 25 to April 6. Examination of herbarium specimens of this species from throughout its range indicates that it may begin to flower as early as July 6 and may continue to be found in flower as late as September 18. The original Illinois collection was made in flower on July 8. Kentucky specimens were observed in flower from July 6 until August 15. At the time of flowering, the leaves of this species have reached their maximum development. Young fruits begin to form shortly after flowering and are mature with viable seeds in approximately two months. Kentucky and Illinois material has been found in ripe fruit from September 5 to 22. Dehiscence occurs after the seeds have become viable. Open and empty legumes persist on the vines until at least mid-November, even though the leaves fall after the first severe frost. (Biotic Consultants, 1976)

7. Current land ownership and management responsibility

   A. General nature of ownership

      Exact location not known; may be on public or private land, or both.

   B. Specific landowners

      1) U.S. Forest Service, Harrisburg, Illinois 62946.

      2) Trojan Powder Company, Wolf Lake, Illinois 62998.

8. Evidence of threats to survival from present or threatened destruction, modification, or curtailment of habitat or range:

   The reported collection site is in a wetland that occasionally receives railroad spills and powder plant discharges. Chemical pollution is a threat to the plant's existence. The U.S. Forest Service classification of its ownership as an Ecological Area terminated in December, 1980. This classification should be renewed.

Assessment and Recommendations

9. Priority of listing or status change

   A. Recommended status:

      Endangered

   B. Recommended priority for federal action:

      Priority #1--very high (scale 1-5). The population status of this plant is uncertain. Generally, it is thought to occur in an area where many botanists have collected in the past. Since few records have been reported for the plant in the area and the exact locality is vague, it can be reasoned that the plant's numbers are low. This factor plus the present threat of water pollution from a nearby powder plant rate a very high priority recommendation.

10. Recommended critical habitat (Appendix III)

11. Interested parties

   A. Endangered Species Protection Board, Division of Forest Resources and Natural Heritage, Lincoln Tower Plaza, 524 South Second Street, Springfield, Illinois 62706.

   B. Illinois Department of Conservation, Division of Forest Resources and Natural Heritage, Lincoln Tower Plaza, 524 South Second Street, Springfield, Illinois 62706.

   C. Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820.

   D. Illinois Nature Preserves Commission, 320 South Third Street, Rockford, Illinois 61108.

   E. Natural Land Institute, 320 South Third Street, Rockford, Illinois 61108.

   F. Shawnee National Forest, U.S. Forest Service, Harrisburg, Illinois 62946.

Information Sources

12. Sources of information

A. Publications

1) References cited in the report

a) Biotic Consultants, Inc., 1976. Endangered, threatened and rare plants of the Shawnee National Forest (Illinois). Carbondale, Illinois. 39pp.

b) Sheviak, C. J. 1981. Illinois endangered and threatened plants. In: Bowles, M. L., et al., editors. Endangered and threatened species of Illinois: status and distribution. Illinois Department of Conservation, Springfield. 70-179.

c) White, J., and M. Madany. 1978. Classification of natural communities in Illinois. 311-405. In: White, J. Illinois Natural Areas Inventory technical report. Vol. I: survey methods and results. Illinois Natural Areas Inventory, Urbana.

2) Other pertinent publications and sources of information

a. Technical

1. Ashby, W. C., and R. W. Kelting. 1963. Vegetation of the Pine Hills Field Station in southeastern Illinois. Trans. Illinois Acad. Sci. 56:188-201.

2. Endangered Species Project herbarium registry cards. 1978. Natural Land Institute, Rockford.

3. Fernald, M. L. 1950. Gray's manual of botany. 8th ed. American Book Co., New York. 1632pp.

4. Gleason, H. A. 1952. The new Britton and Brown illustrated flora of the northeastern United States and adjacent Canada. 3 vols. The New York Botanical Garden, New York.

5. _____, and A. Cronquist. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. Van Nostrand Reinhold Co., New York. 810pp.

6. Illinois Natural Areas Inventory files. 1977. Illinois Department of Conservation, Springfield.

7. Jones, G. N. 1963. Flora of Illinois. 3rd ed. Am. Midl. Nat. Monogr. 7. University of Notre Dame Press, South Bend, Indiana. 401pp.

8. _____, and G. D. Fuller. 1955. Vascular plants of Illinois. Illinois State Mus. Sci. Ser. Vol. 6. 593pp.

9. Mohlenbrock, R. H. 1975. Guide to the vascular flora of Illinois. Southern Illinois University Press, Carbondale. 494pp.

10. _____, and D. M. Ladd. 1978. Distribution of Illinois vascular plants. Southern Illinois University Press, Carbondale.

11. _____, and J. W. Voigt. 1965. An annotated checklist of vascular plants of Southern Illinois University Pine Hills Field Station and environs. Trans. Illinois Acad. Sci. 58:268-301.

12. Winterringer, G. S. 1951. New and infrequently collected Illinois plants. Am. Midl. Nat. 45:504-506.

B. Museum collections cited

1) (ILL), Herbarium of the Department of Botany, University of Illinois, Urbana, Illinois 61801.

2) (ILLS), Illinois State Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820.

3) (ISM), Illinois State Museum Herbarium, Spring and Edwards Streets, Springfield, Illinois 62706.

C. Fieldwork

1) Information supplied for this report was in part provided by the Illinois Natural Areas Inventory. The INAI was performed under contract to the Illinois Department of Conservation by the Department of Landscape Architecture, University of Illinois, Urbana-Champaign, and the Natural Land Institute, Rockford, Illinois.

2) A search along the western shore of Wolf Lake and Otter Pond, Union County, in August, 1979, revealed no locations for Apios priceana. Investigator: Donald R. Kurz, Natural Land Institute.

D. Knowledgeable individuals

1) Robert H. Mohlenbrock, Department of Botany, Southern Illinois University, Carbondale, Illinois 62901.

2) Donald R. Kurz, Missouri Department of Conservation, Natural History Section, P.O. Box 180, Jefferson City, Missouri 65102.

3) John E. Schwegman, Division of Forest Resources and Natural Heritage, Illinois Department of Conservation, Lincoln Tower Plaza, 524 South Second Street, Springfield, Illinois 62706.

13. Initial authorship

Donald R. Kurz[1], Natural Land Institute, 320 South Third Street, Rockford, Illinois 61108.

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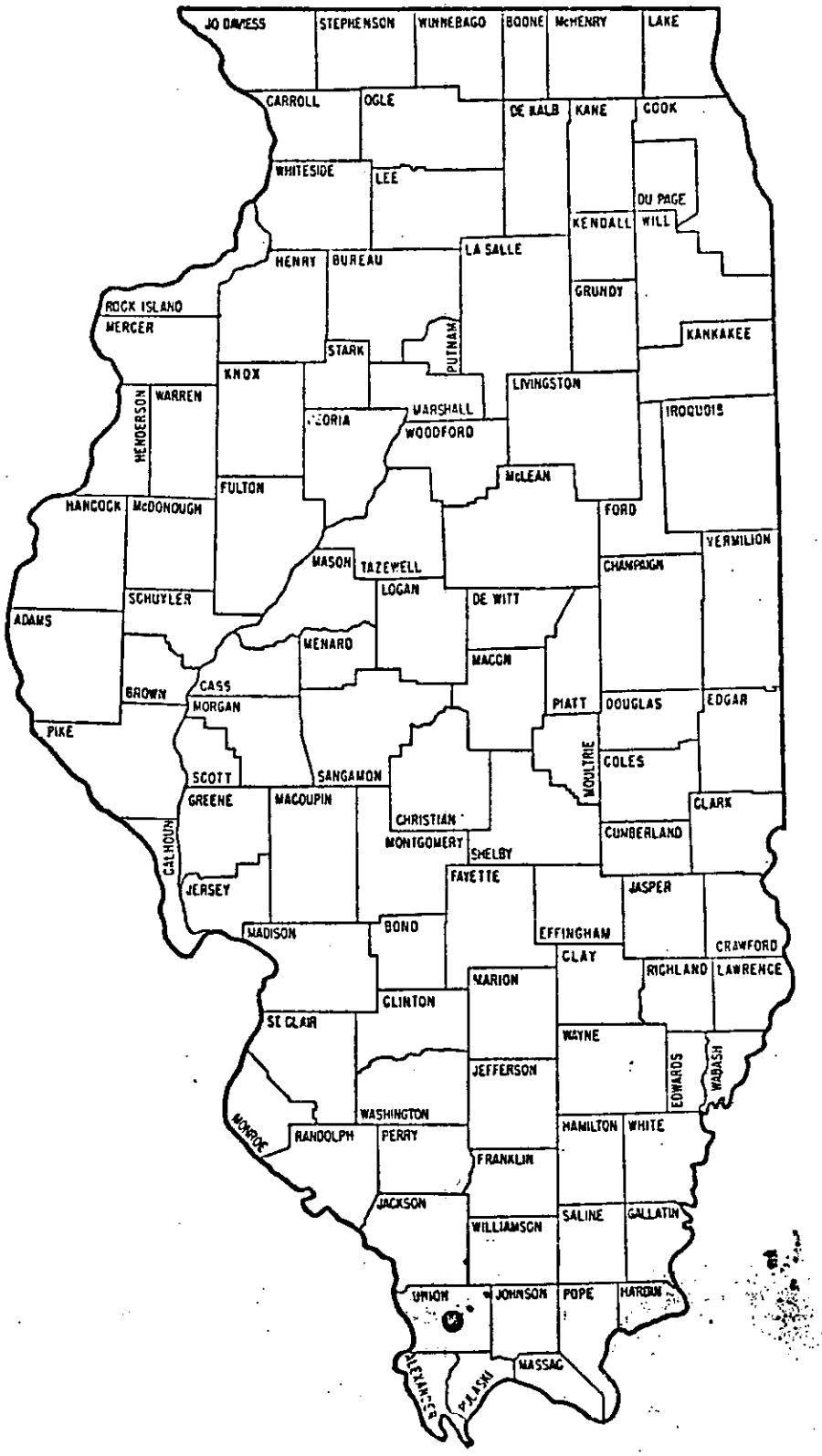
[1]Presently with Missouri Department of Conservation, Natural History Section, P.O. Box 180, Jefferson City, Missouri 65102.

STATE DISTRIBUTION MAP

APIOS PRICEANA



APIOS PRICEANA ROBINS

Illinois populations currently or recently

County	Quadrangle	Code	Legal location	Description of station
Union	Wolf Lake 7.5'	[B]	Sec. 28,33,T11S, R3W Sec. 4, T12S, R3W	Wolf Lake; damp rich w
Union	Wolf Lake 7.5'	[B]	Sec. 9,16,21,28, T11S, R3W	Pine Hills, east of Ald
Union	Wolf Lake 7.5'	A	Sec. 28, T11S, R3W	Wolf Lake
Union	Wolf Lake 7.5'	A	Sec. 21,218,33, T11S, R3W	Pine Hills - LaRue Swa

CRITICAL HABITAT MAP

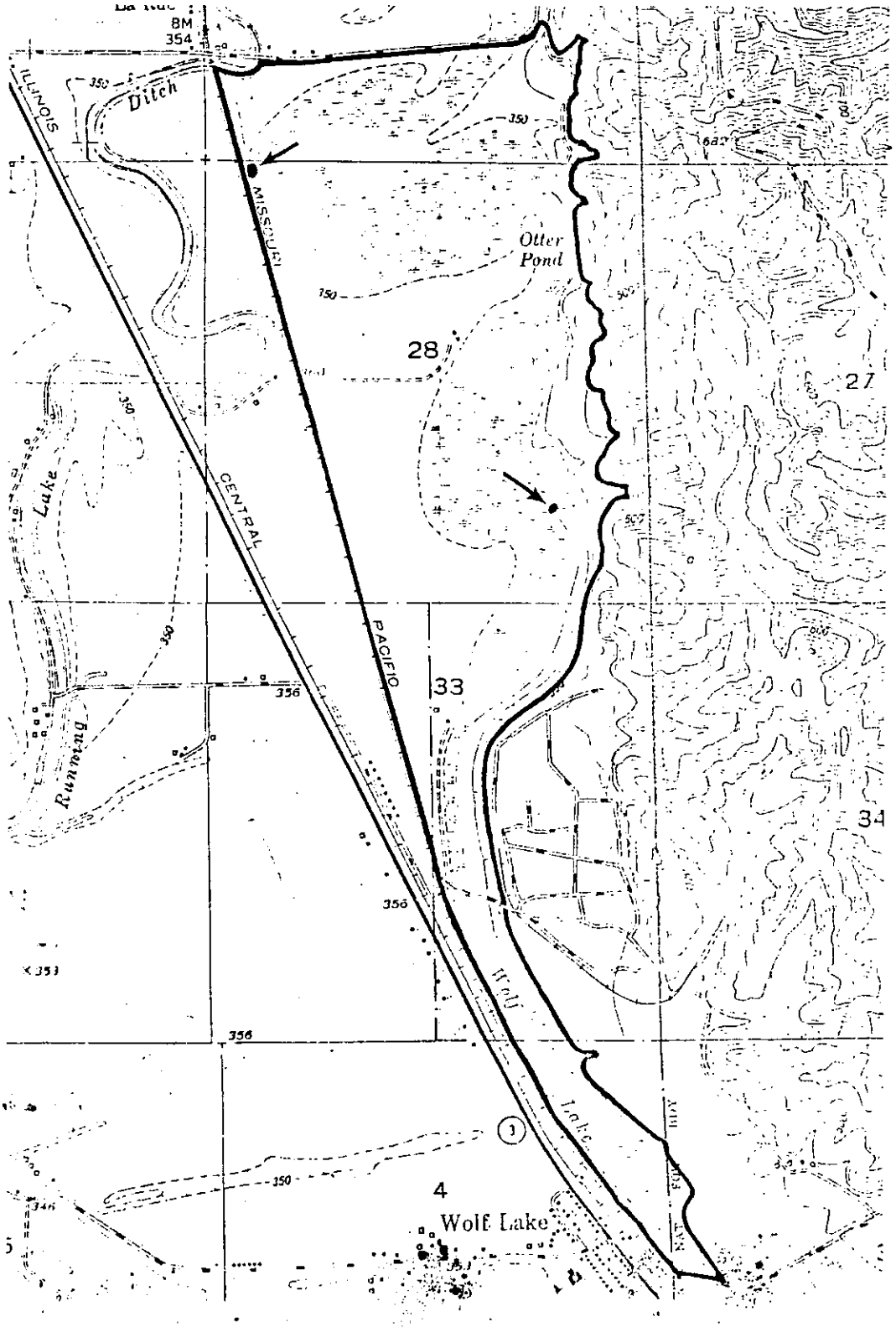


Figure 1. Location of *Apios priceana* at Wolf Lake, Union County, Illinois. The exact locations of the most recent observations are shown by the arrows; the solid line encloses an area that includes the plant and provides buffer and adjacent habitat. (Sections 21, 28 and 33, T11S, R3W, and Section 4, T12S, R2W. Wolf Lake 7.5' quadrangle.)

APPENDIX ITEM III.

Project Title: Survey for extant populations of Price's Potato Bean in Illinois

I Need:

The threatened Price's Potato Bean (Apios priceana) was collected on the shores of Wolf Lake, Union County, Illinois on July 7, 1941. It was also observed in the nearby LaRue Swamp in the 1970s. It is currently known from Livingston County, Kentucky less than half a mile from Hardin County, Illinois. In spite of these earlier collections and nearby extant populations, no populations are known to exist in Illinois. It is felt that an intensive search will discover new populations of this species in Illinois.

II Objective:

The objective is to discover and document new populations of this species in Illinois.

III Expected Results and Benefits:

The rediscovery of previous populations or discovery of new populations of this species will aid its recovery. There are only 13 extant populations known within the total species range. It is likely that any populations discovered will be on U. S. Forest Service land where active management can be undertaken. If populations are found on private land, this information can be used to guide protection actions such as public land acquisition and working with private landowners. This species is considered an edge or opening species that dies out under heavy shade. Knowing where plants are located is important to both protecting their habitat and managing it to maintain the needed open conditions.

A final report documenting the areas searched by date and giving the location of populations discovered on copies of 7.5 minute topographic maps will be provided. For each discovered population, the number of plants by flowering and sterile classes will be documented, the dominant vegetation will be noted as will any apparent and potential threats to the plants. Voucher specimens will be collected from each population and deposited in the Illinois State Museum Herbarium at Springfield.

IV Approach:

The project will be contracted by the Department of Conservation with the Natural Land Institute of Rockford Illinois. Work will be accomplished during July 1990 at the peak flowering period of this species. Due to remotness of the area, the Ohio River segment of the search will use a boat for access to search areas and for viewing river banks and bluffs. The Department will orient the contractor to the search image for the plant by leading them to the extant Livingston County population at the

beginning of the project. This species frequently exists in sterile condition if in intense shade but can be identified and separated from the similar Common Ground Nut by leaf veination characteristics. The contractor will be oriented to sterile plant identification as well.

Study A: Search for new Illinois populations of Price's Potato Bean.

Problem: Although there are 2 previous reports of this species from Illinois, no extant populations are known.

Objectives: Relocate previously known and/or discover new populations of Prices's Potato Bean.

Justification: Since the habitat of this threatened species is still intact, chances are good it still occurrs in Illinois. Knowing the location of populations will enable their protection and management. This will aid in delisting of the species.

Status: This species was first collected in Illinois on July 8, 1941 by G. D. Fuller #664 from "along Wolf Lake, Union County, Illinois. It was observed in summer 1977 by Dr. Robert Mohlenbrock of Southern Illinois University at Carbondale about a mile from the previous collecting locality. Recent searches of some of the habitat in Union County has failed to locate any plants of this species. Although an extant population occurs very near the Illinois boundary along the Ohio River in Livingston County Kentucky, no searches have been made in apparently suitable Illinois habitat there.

Proceedures:

Job A1: Search suitable Illinois habitat for Price's Ground Potato.

Objectives: Locate populations of Price's Ground Potato in Illinois.

Cost: $4,200.00

Schedule: Searches will be conducted during July, 1990.

Job Description: Searches will be made on foot of the margins of Wolf Lake, Otter Pond, the edges of all open shrub swamps and rocky talus along the base of bluffs in Union

County as shown on the attached map. Searches will be made of rocky talus along the base of river bluffs and of open exposed bluff faces and habitats in Hardin and Pope Counties as shown on the attached map. This search will be aided by use of a boat and binoculars. Voucher specimens will be collected and pressed to document any populations discovered.

Job A2: Prepare Report on search and discoveries.

Objective: Document the search effort and findings.

Cost: $300.00

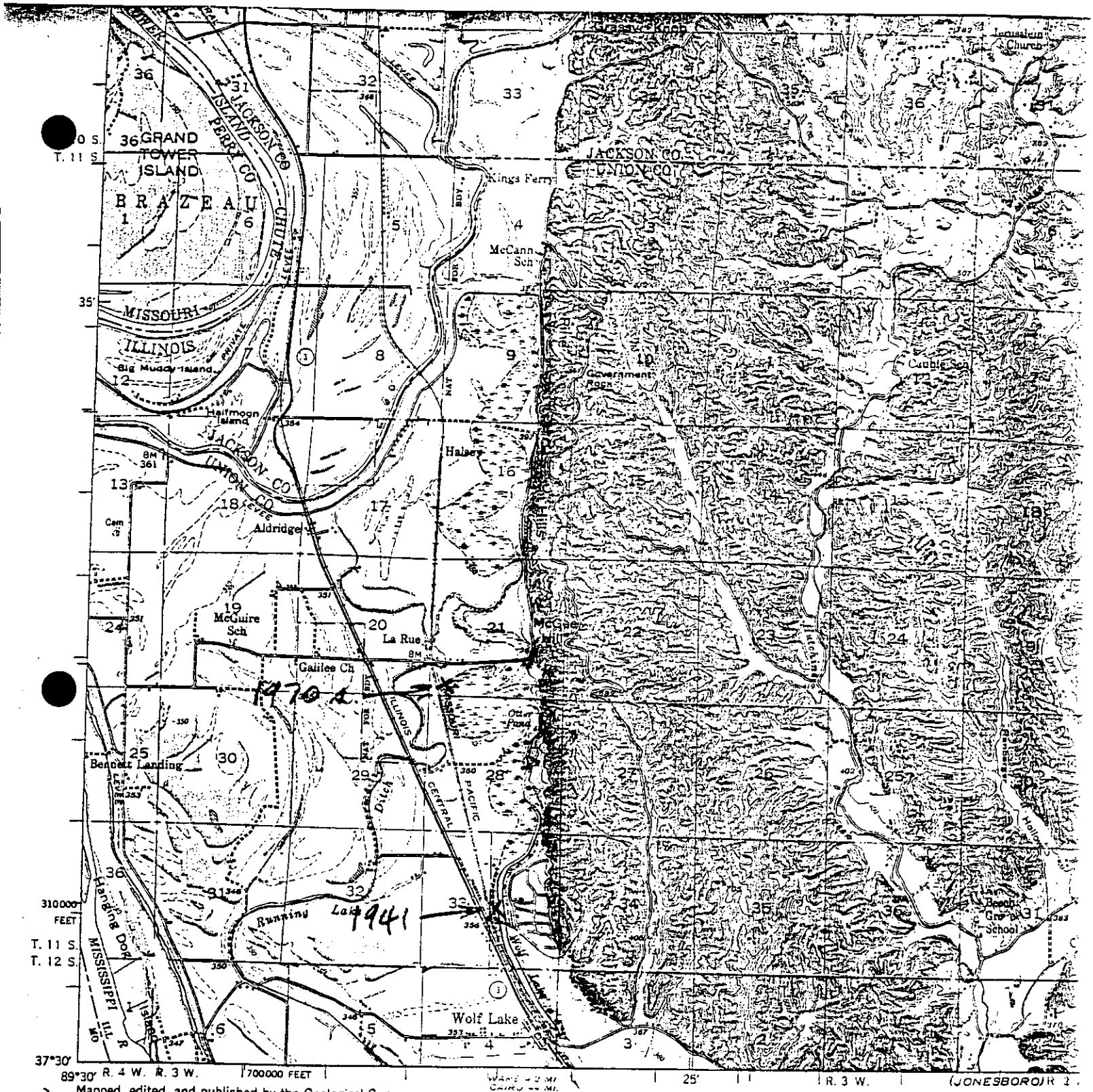
Schedule: This will be accomplished no later than August 17, 1990.

Job Description: The report will document areas searched and will show the locations of discovered populations on 7.5 minute topographic maps. It will include the number of plants by flowering and sterile classes for discovered populations and descriptions of the habitat occupied. It will note any apparent or potential threats to the plant and its habitat.

Personnel: Mr. Max Hutchison, Field Representative, Natural Land Institute, Belknap, IL 62908.

V Location:

Field Work will take place in Union, Pope and Hardin Counties Illinois as shown on the attached maps. The actural search zones are highlighted in green.



Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USED

Topography from aerial photographs by multiplex methods and plane-table methods, 1947
Aerial photographs taken 1946. Field check 1947

Transverse Mercator projection. 1927 North American datum
10,000-foot grid based on Illinois coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue

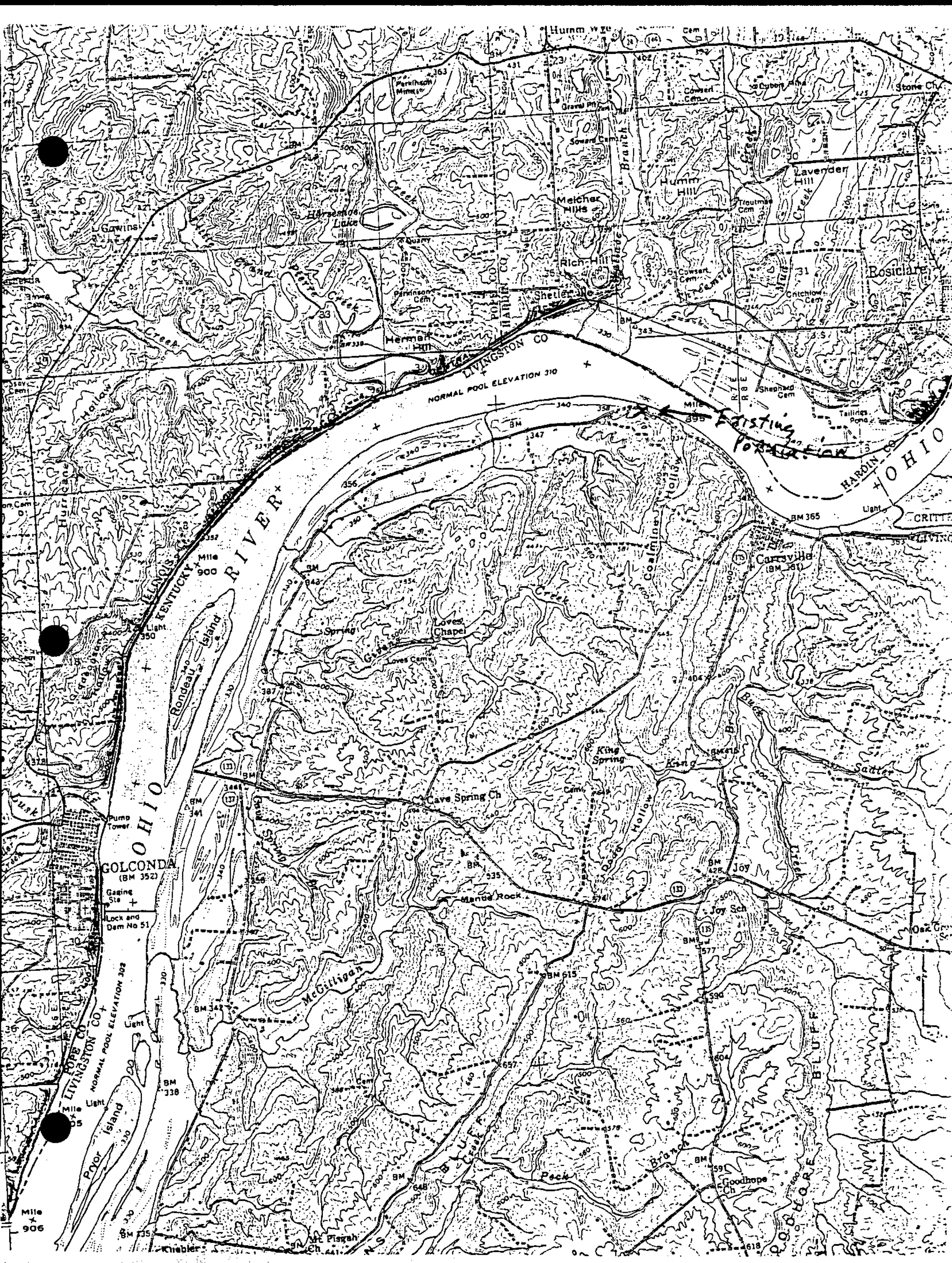
SCALE 1:62500

1 0 1 2
3000 0 3000 6000 9000 12000
1 5 0 1 2 3

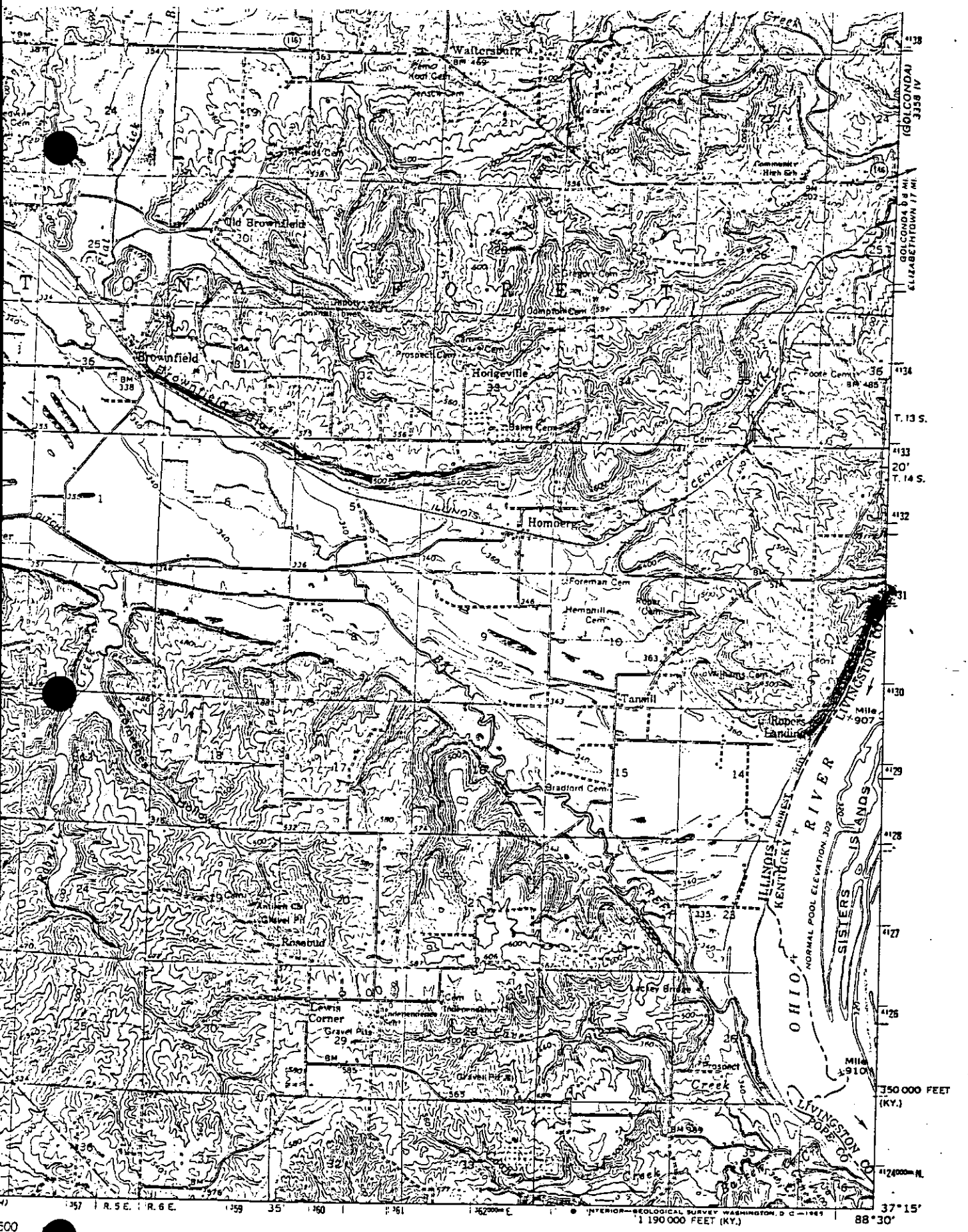
CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT HALF-INTERVAL C
DATUM IS MEAN SEA LEVEL

APPROXIMATE MEAN DECLINATION, 1947

THIS MAP COMPLIES WITH NATIONAL MAP ACCUR
FOR SALE BY U. S. GEOLOGICAL SURVEY, WAS
BY THE STATE GEOLOGICAL SURVEY, UR
AND BY THE MISSOURI GEOLOGICAL SURVEY
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOL



OHIO RIVER
OHIO
LIVINGSTON CO
HARDIN CO
POPE CO
POPE CO
ILLINOIS
KENTUCKY
NORMAL POOL ELEVATION 310
NORMAL POOL ELEVATION 302
Mile 899
Mile 900
Mile 905
Mile 906
Existing Population
GOLCONDA
(BM 352)
Pump Tower
Gaging Sta
Lock and Dam No 51
Rondeau Island
Pryor Island
Carrsville
(BM 361)
Rosiclare
Shetlerville
Joy
Joy Sch
Goodhope Ch
Cave Spring Ch
Loves Chapel
Loves Cem
Mantle Rock
Mt. Pisgah Ch
Horseshoe Lake
Melcher Hills
Rich Hill
Humm Hill
Lavender Hill
Herman Hill
Gawins
Coalmine Hollow
King Spring
Dodd Hollow
McGilligan
Peck
Branch
Sadler
Buck
Creek
Spring
Hurricane Hollow
Parkinson Cem
Cowsert Cem
Troutman Cem
Critchlow Cem
Shephard Cem
Tailings Pond
Stone Ch
Light
BLUFF
CRITTENDEN
LIVINGSTON



4 MILES
12000 15000 18000 21000 FEET
5 KILOMETERS

20 FEET
LEVEL

AP ACCURACY STANDARDS
EY, WASHINGTON, D. C. 20242.
URBANA, ILLINOIS.

ILLINOIS

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty ——— Light-duty - - -

Medium-duty ——— Unimproved dirt .....

State Route

This area also covered by 7.5-minute, 1:24 000-scale maps: Waltersburg 1962, Glendale 1962, Reevesville 1962, and Brownfield 1962

BROWNFIELD, ILL.—KY.

DEPARTMENT OF REGISTRATION AND EDUCATION
VERA M. BINKS, DIRECTOR
GEOLOGICAL SURVEY DIVISION, JOHN C. FRYE, CHIEF
URBANA, ILLINOIS

GOLCONDA QUADRANGLE
KENTUCKY—ILLINOIS
15 MINUTE SERIES (TOPOGRAPHIC)