Population Studies of Threatened and Endangered Plants of Barker Woods Nature Preserve, LaPorte County, Indiana

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Barker Woods Nature Preserve covers 12 ha in Michigan City, LaPorte County, Indiana. The geomorphic features of the preserve reflect their origin as part of an ancient great lake shoreline (Figure 1). The soils on the site are deep, sandy, acid,

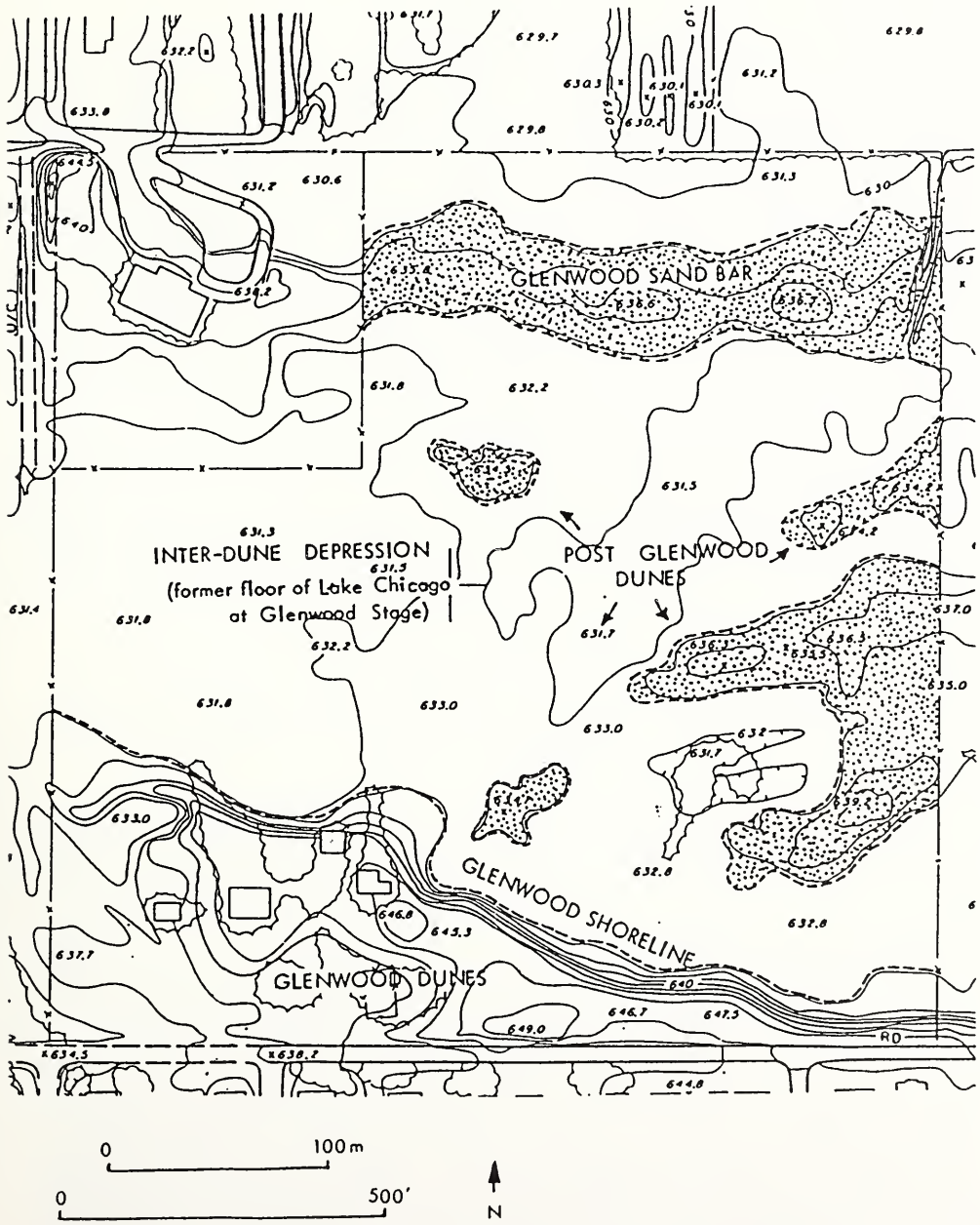

FIGURE 1. Geomorphic Features of the Barker Woods Nature Preserve. 61 cm contour interval.

moderate in organic content and characterized by a seasonally high water table. The preserve includes pin oak—red maple hydric upland depressional woods, and white oak—red oak—black oak dry mesic upland forest (Tom Post, personal communication). Riemenschneider and Reed (11) further describes the property and its history.

The purpose of this study was to investigate the population numbers and viability of seven state threatened or endangered plant species found on the preserve, and to describe their general physical habitat preferences. The state endangered species are *Carex arctata* Boott (Drooping wood sedge) and *C. folliculata* L. (Long sedge). The state threatened species include *Betula papyrifera* Marsh (Paper birch), *Epigaea repens* L. (Trailing arbutus), *Melampyrum lineare* Desr. (Cow wheat), *Pyrola americana* Sweet. (Round-leaved shinleaf) and *P. elliptica* Nutt. (Shinleaf).

Methods

Data was collected from field observations during 1983, personal interviews, and a literature search for each species of concern. A contour map of the general surface of the water table was made using data from U.S.G.S. 7.5' quadrangle maps. Additional maps were made over a base map with a 61 cm contour interval. Geomorphic features were interpreted with the assistance of Dr. Mark Reshkin of Indiana University Northwest. Basic soil data (7) were extrapolated to the 61 cm contour map. Two soil borings were taken with a hand auger and interpreted by Dr. Victor Riemenschneider of Indiana University South Bend.

Plant nomenclature was based on Kartesz and Kartesz (8) and endangered and threatened classifications were based on Bacone and Hedge (1). Data on species habitat and status were collected from the Natural Heritage Programs of Indiana, Illinois, Kentucky, Michigan, Ohio and Wisconsin.

Sixty-four random one meter square plots were sampled in the northeast corner of the preserve. This method was abandoned in July and replaced by a walking traverse of the property. All populations of endangered and threatened plants were counted and marked. For *Epigaea repens, Pyrola americana* and *P. elliptica* the ground surface covered was measured. Species locations were mapped with a plane table.

Results and Discussion

Carex arctata is common in Michigan and Wisconsin, is endangered in Ohio, and does not occur in Illinois. In Indiana it is reported only from two sites in La Porte County.

A total of 1583 individual clumps were found (68% with seed), over most of the preserve on Saugatuck-Pipestone complex, Brems fine sand, Newton loamy fine sand, Oakville fine sand and Urban land—Morocco complex soils (Figure 2). No *C. arctata* were found in the pin oak (*Quercus palustris*) openings, or in areas of planted pine. This sedge was most frequent in middle of an old trail, on spoils mounds beside drainage ditches, and atop low windthrow mounds. Some preference was shown for slightly high areas (192.6-193.2 m elevation) and for the north slopes of these higher areas. *C. arctata* occurred both in areas with and without evident fire scars.

The correlation of *Carex arctata* with disturbed areas (trails and ditches) may be due to several physical and biological factors. The trails and ditches are fairly open. Either the additional available light or the removal of competing growth may be a critical factor in the growth of the species. In addition, the mounds and the edges of the ditches are full of small mammal burrows, with the heaviest seed-producing *C. arctata* plants growing over heavily burrowed spots. It appears that small mammals have been a major factor in seed transportation of this sedge.

Carex folliculata is now extirpated in Illinois, is threatened in Wisconsin and Ohio,

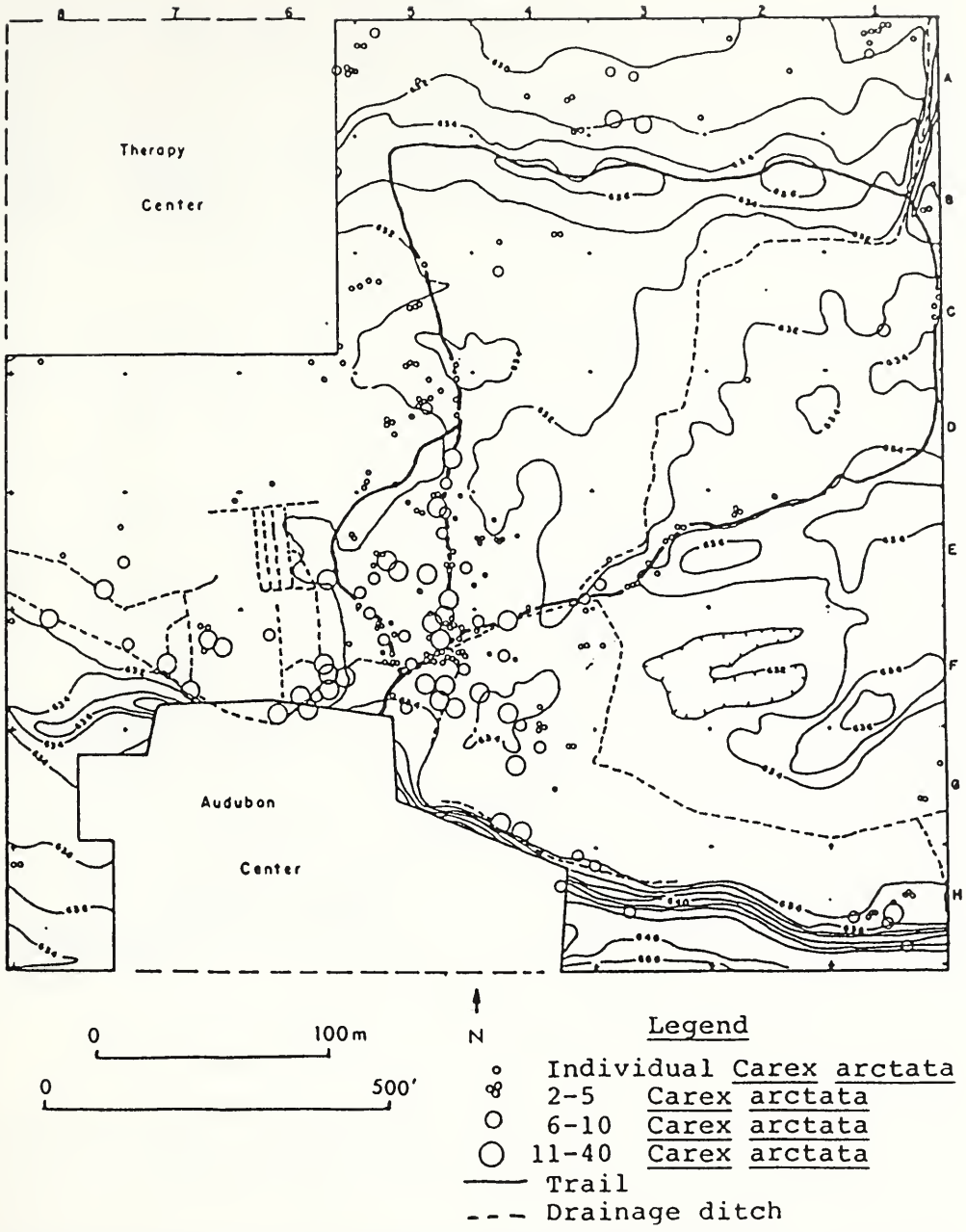

FIGURE 2. Locations of *Carex arctata* in Barker Woods Nature Preserve, Showing the Relationship to Trails and Ditches. 61 cm contour interval.

and is uncommon in Michigan. In Indiana it is found only in northern Porter and LaPorte Counties. Its habitat is usually swampy woods and bog thickets.

Ninety-seven plants were found in Barker Woods, 27% with seeds. The plants were found only at 192 to 193.2 m elevation on Saugatuck-Pipestone complex soils at the edge of the southeast pin oak opening (Figure 3). No fire scars were evident.

Historically, the water table stood at 192.6 m elevation, as evidenced today by the presence of pin oak openings. Mapping by the author of the current water table showed water under Barker Woods at 191.4 to 191.7 m elevation. This drop is due to drainage of the general area begun before the turn of the century and continued to this day. *Carex folliculata*, a species of wet woods, persists up to 1.8 m above the

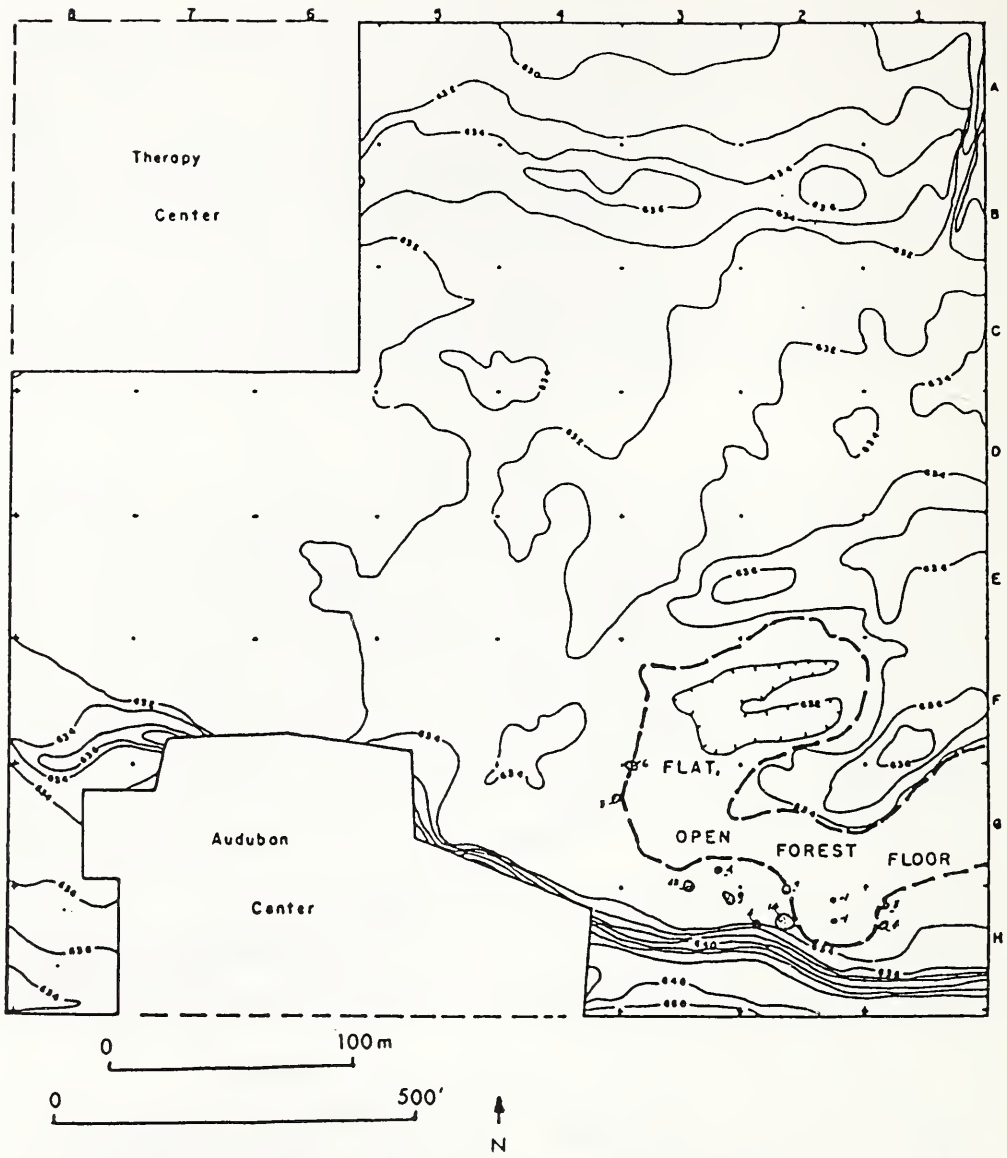

FIGURE 3. Location of *Carex folliculata* in Barker Woods Nature Preserve, Showing the Relationship to Flat, Open Forest Floor. 61 cm contour interval.

water table. A soil auger taken in the area of the *C. folliculata* in September of 1983, after a dry summer, showed moist soil within 60 cm of the surface. *C. folliculata* may be utilizing rain water suspended above the water table atop cemented layers of sand called iron pans, which are characteristic of the Saugatuck-Pipestone complex soils.

Betula papyrifera is common in Michigan and Wisconsin, and is found (but is not common) in northern Illinois. In Indiana it is native only to Lake, Porter and LaPorte Counties. *B. papyrifera* is considered an early successional species, lasting only one generation before being replaced by more shade tolerant species (5). Very young seedlings are very sensitive and need some shade, but as they grow they need overhead light (9).

A total of 202 individuals were found in the preserve in two groves (Figure 4). Grove A consisted of 77 widely scattered trees on the north slope of a Glenwood stage sandbar on Saugatuck-Pipestone complex, Newton loamy fine sand and Brems fine sand. Grove A is being over shaded by pin oak, red maple, tulip, and sassafras.

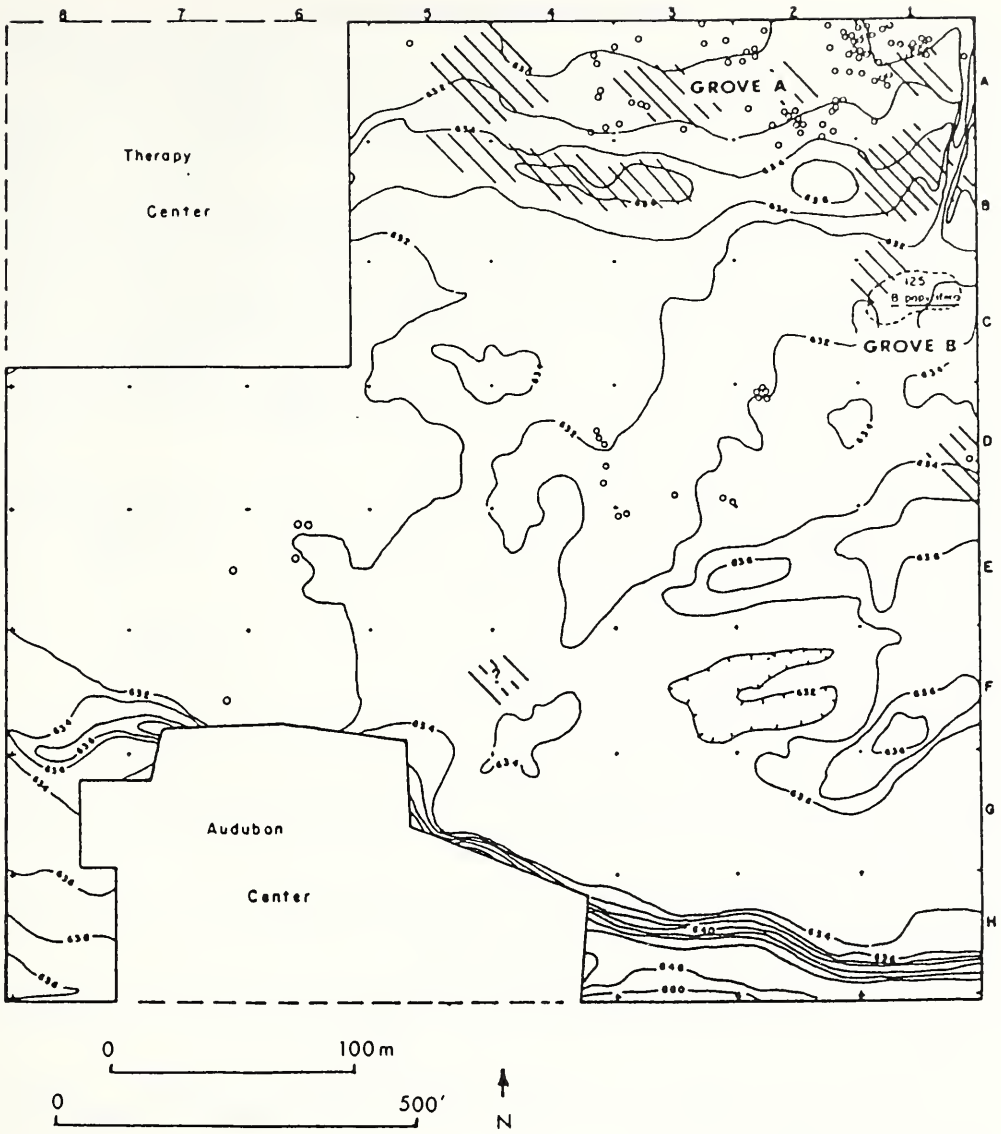

FIGURE 4. Locations of *Betula papyrifera* in Barker Woods Nature Preserve, Showing Relationship to Fire Scarred Areas. 61 cm contour interval.

Immediately north and east of this grove, on adjacent property, the paper birch trees were larger and healthier. This land was disturbed more recently and the paper birch are still the dominant trees.

Grove B is a concentration of 125 trees, including many young trees, on Saugatuck-Pipestone complex soils. Some overshading of birch is occurring, but the area has been kept fairly open by regular windthrows.

The most recent recorded fire on the preserve occurred in 1967 (Orphie Loomis, personal communication). Judging from the fire scars present, Grove B burned to a greater extent than Grove A, perhaps explaining the vigor of Grove B.

Epigaea repens was once common in Michigan, before being collected almost to extinction. It has been totally eliminated in Illinois. It is frequent in northern Wisconsin and eastern Ohio. In Indiana the species is reported from eight counties (Allen, Elkhart, LaGrange, Lake, LaPorte, Monroe and Washington).

Trailing arbutus occurred only in the northeast corner of Barker Woods (Figure 5).

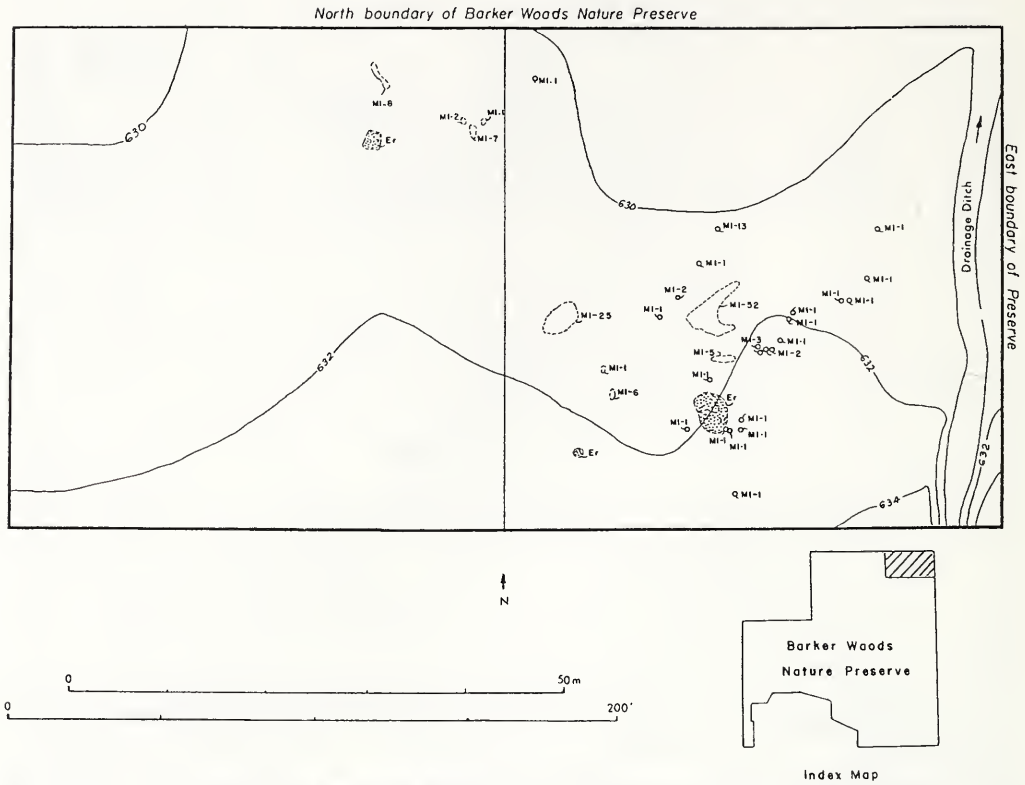

FIGURE 5. Locations of *Epigaea repens* (Er) and *Melampyrum lineare* (Ml) in the Two Northeast Sectors of Barker Woods Nature Preserve. 61 cm contour interval.

Three mats, covering 6.5 m^2 of ground surface were found on the north side of the sandbar on Brems fine sand and Newton loamy fine sand.

Reproduction data was not available for 1983, but flowers were present in 1984. Ants, important for pollination and seed transportation (3), were active on the plants in 1984.

Epigaea repens grew in one area of intense sunlight, and two areas of partial shade. Moderate leaf duff covered all plants. Fire scars were present in the area. The species tolerates five very well (3).

Melampyrum lineare is common in Michigan and Wisconsin, but is considered threatened in Illinois and Ohio. It is reported from six counties in Indiana (Lake, La Porte, LaGrange, Porter, Tippecanoe and White). Its habitat varies from bogs to dry, coniferous woods.

Cow wheat was found only in the northeast section of the preserve (Figure 5). It occurred on Newton loamy fine sand, Brems fine sand and Saugatuck-Pipestone complex soils on the north slope of the sandbar. Fire scars were present in the area.

One hundred and thirty-five plants were found, 93% of which bore seed. This was an increase from 44 plants in 1982. Even plants which were partially grazed or dried continued to produce flowers and seeds. Laboratory studies (2) have found that as many as 264 seeds are produced by one plant.

Melampyrum lineare is a non-obligatory root parasite, attaching itself to host roots or rhizomes by extremely fine roots bearing minute haustoria. Host plants include dicots, monocots, conifers, ferns and a bryophyte (*Sphagnum*). Cow wheat can also be saphrophytic, attaching to humus or dead plant tissue (10). In Barker Woods the *M. lineare* was concentrated in a sunny area opened up by the death of a large wild black cherry tree. *M. lineare* may have a saphrophytic relationship with the dead

roots of the cherry tree, or it may be parasitic on live plants such as the thick stand of bracken fern present.

Pyrola americana is common in northern Michigan and northern and central Wisconsin. It is frequent in eastern Ohio, but is considered endangered in Illinois. In Indiana it is reported from six counties (LaGrange, Lake, LaPorte, Porter, Steuben and St. Joseph).

In Barker Woods this species was found in one large, disjunct population, with five additional, small locations throughout the preserve (Figure 6). Three of the six locations showed evidence of fire. This shinleaf occurred on Newton loamy fine sand, Brems fine sand and Saugatuck-Pipestone complex soils, usually atop windthrow mounds in moderate shade.

The north fence population of *P. americana* covered 230.1 m^2 of ground surface, while the five smaller areas covered 31.5 m^2.

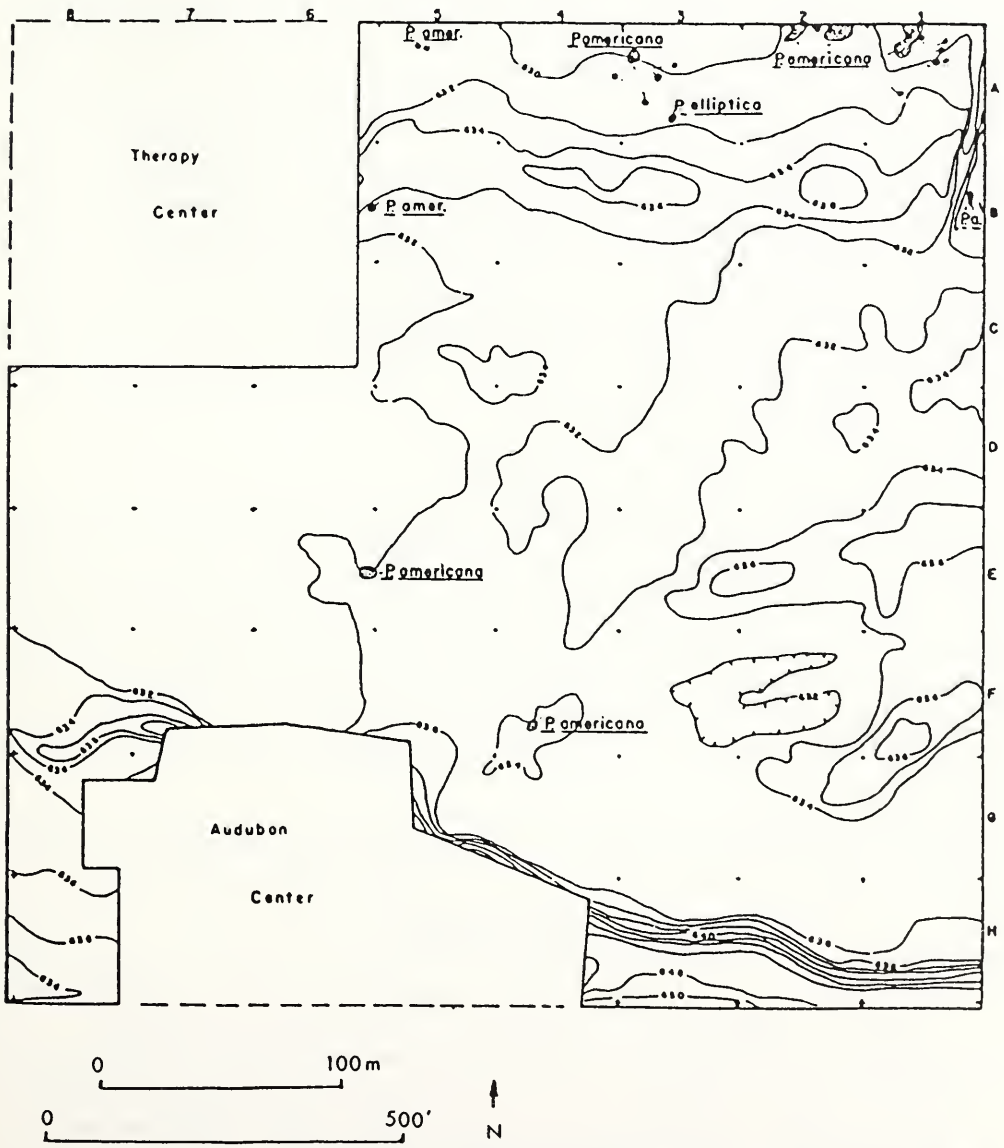

FIGURE 6. Locations of *Pyrola americana* and *P. elliptica* in Barker Woods Nature Preserve. 61 cm contour interval.

In 1983 only one flower stalk was produced by *P. americana* across the entire preserve, and this solitary stalk did not set seed. The lack of flowering may have been due to unfavorable environmental conditions, such as the dry summer, or to the general characteristic of the species to reproduce vegetatively (Dr. Eric Haber, personal communication).

Pyrola elliptica is common in Michigan, Wisconsin and Ohio. It occurs in northern Illinois, but is becoming more rare. Deam (4) considered this the most common species of the genus in Indiana. It is reported from 11 counties (Cass, Elkhart, Grant, Kosciusko, LaGrange, LaPorte, Parke, Porter, Putnam, Steuben and St. Joseph). The Barker Woods population is the only population in LaPorte Co.

P. elliptica was found in the preserve in only one 22 m^2 area of thinly scattered individuals (Figure 6). One flower stalk with seeds was produced in 1983. The plants were found on the north slope of the sandbar at the border of the Brems fine sand and the Newton loamy fine sand, among fire scars.

Of the seven species of concern, all but *Carex folliculata* have northern affinities. *Pyrola americana, P. elliptica* and *Epigaea repens* were considered boreal relics by Friesner (6). In this light, north to south profiles of Barker Woods were made, showing the locations of the seven species in relation to the geomorphic features (Figure 7).

In Profile A-A′ *Betula papyrifera, Pyrola americana, Melampyrum lineare,* and *Epigaea repens* were found on the north slope of the sandbar; *B. papyrifera* was found on the north slope of a slight rise, and *Carex arctata* and *C. folliculata* were found at the base of the north slope of the Glenwood dune. Profile B-B′ shows *C. arctata, P. americana, B. papyrifera* and *P. elliptica* occurring on the north slope of the sandbar, and *C. arctata* occurring at the base of the north slope of the Glenwood dune. In Profile C-C′, *C. arctata* was found on the north slope of two slight rises in the central low area. The conclusion is that north slopes are preferred habitat for six of the seven species of concern.

Summary

Populations of *Carex arctata, Melampyrum lineare* and *Pyrola americana* are present in large numbers in Barker Woods Nature Preserve and are reproducing sexually or vegetatively. The population of *C. folliculata* is small but is reproducing. A species of wet habitats, it does not seem stressed by the lowered water table and may be utilizing water suspended above the water table by cemented layers of sand. The *Betula papyrifera* population is large but is declining due to succession. *Epigaea repens* and *P. elliptica* are present in small numbers and are reproducing. All species of concern, except *Carex folliculata*, appear to prefer north facing slopes, reflecting their northern affinities.

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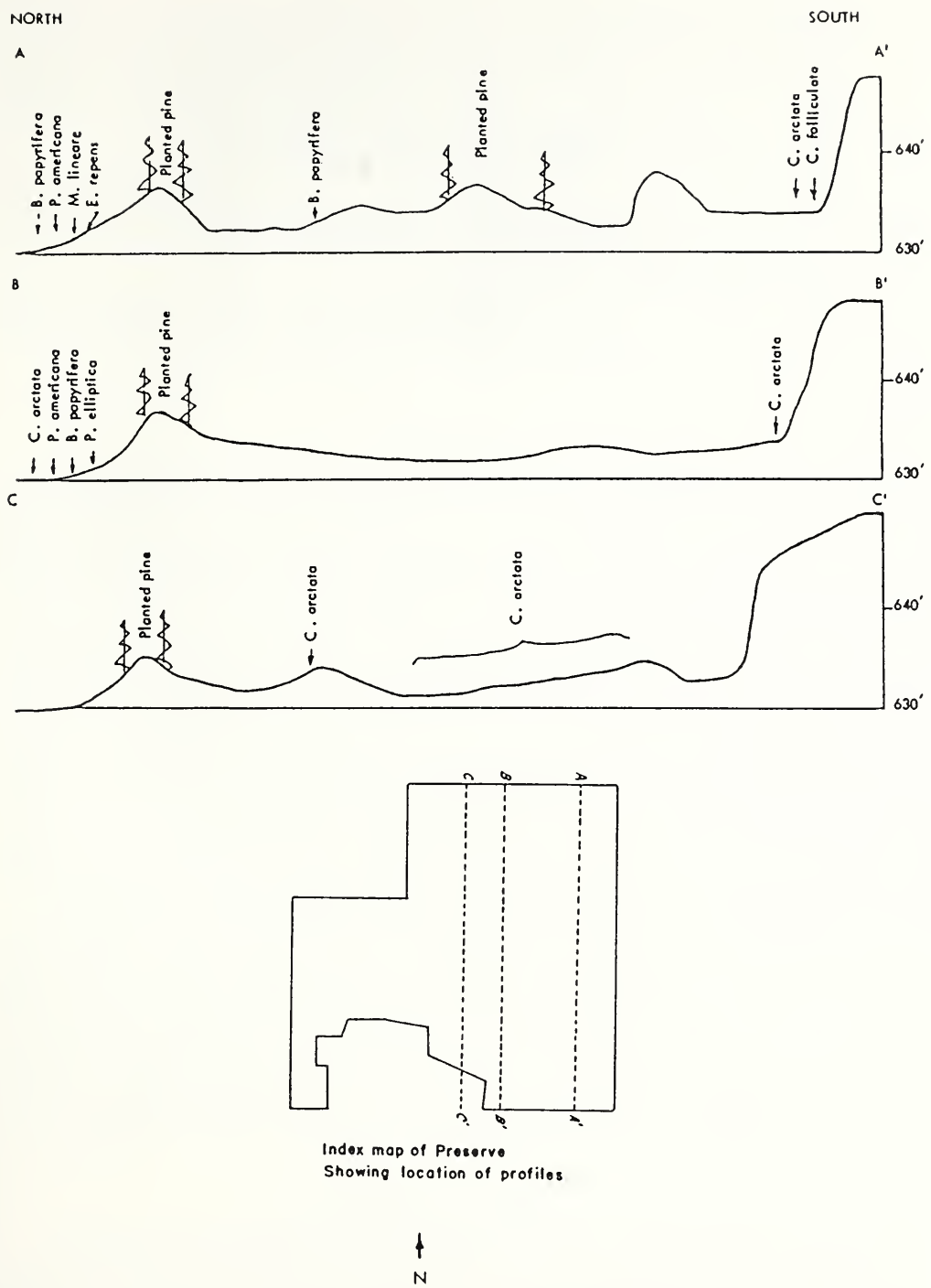

FIGURE 7. North to South Profiles of Barker Woods Nature Preserve, Showing Preferred Growth Locations of Threatened and Endangered Species. Vertical exaggeration 15X.

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