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POPULATION SURVEYS OF HABITAT RESTRICTED WETLAND BUTTERFLIES IN THREE NORTHEASTERN ILLINOIS IDNR NATURAL AREAS

(CONTRACT NO. RC07-L05W)

Powesheik Skipper
(Gone But Not Forgotten; Extirpated in Illinois)

PREPARED FOR:

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INTRODUCTION

The use of butterflies to evaluate the extant quality of natural areas and to track changes in quality as such areas are managed over extended time periods has become a standard evaluation and monitoring tool in much of the Chicago Region. Dr. Ron Panzer of Northeastern Illinois University has conducted insect surveys of prairie, wetland, and savanna remnants since 1981. His work has been concentrated in the southern Chicago area counties and northwest Indiana, though it has not been limited either to this subsection of the region or its butterflies and other insects (Panzer and Derkovitz 2001, Panzer, et.al., 1995). His research on the native insect fauna of open-structured communities has tested the relationship of remnant size and vegetation quality to insect diversity, and clearly distinguished those species which are of greatest conservation concern (Panzer, Shuey, and Stillwaugh 1997). These are known as "remnant dependent". For butterflies, this term refers to those species confined to patches of native vegetation because their larvae feed only on plant species found in such remnants. Panzer's work has also tried to discern the impacts of rotational burning practices on insect populations (Panzer and Schwartz 1998). The Butterfly Monitoring Network, led by Doug Taron at the Notebaert Nature Center, has been monitoring butterfly populations on Chicago region natural areas since the latter half of the 1980's. These volunteers have amassed an "encyclopedia" of information useful in determining species composition and trends in population numbers.

Chiwaukee Prairie, Wisconsin

Illinois Beach State Park

Both examples of excellent butterfly habitats

The largest mass of information on butterflies of the upper Fox River Valley has come from three sources: quantitative data from volunteer stewards at selected natural areas; checklists for three Illinois Department of Natural Resources sites (Schennum 1999), assessing the potential impact of gypsy moth control on non-target butterflies; and butterfly monitoring data from several McHenry County Conservation District natural and restored areas, gathered beginning in 1986 (Schennum and Collins 2003). Their work has focused on temporal trends in butterfly abundance and composition on natural areas managed with fire, brush removal, hydrological restoration, and native grassland reconstruction. The present study focuses on seven wetlands in three IDNR owned and managed sites. The specific purposes of this study are as follows:

1. Collect and analyze data on the population sizes and diversity of restricted (and associated) butterflies of wetlands and wetland community complexes in three upper Fox River watershed sites; Moraine Hills State Park., Chain O' Lakes State Park, and Volo Bog State Natural Area. Use this data to determine the butterfly composition and quality of these wetlands and the viability of remnant restricted (and associated) species populations.

2. Establish permanent census routes which traverse much of the suitable habitat for remnant dependent wetland species. Train volunteers in butterfly identification and recruit them to annually census these butterflies along these routes. Their participation will provide long term data for each species, which can then be related to management practices by IDNR heritage biologists.

3. Conduct one census in early August to search for populations of the state endangered Swamp metalmark (*Calephelis muticum*). This species is restricted to patches of fen and sedge meadow vegetation containing the butterfly's sole larval food plant, Swamp thistle (*Cirsium muticum*). It is known from a few wetlands in adjacent Wisconsin. Evaluate patches of wetland as potential habitat for reintroduction if it is absent.

METHODS

Data collection and analyses began with the selection of high quality wetlands found in the three IDNR sites. The locations and boundaries of these three areas are shown in Exhibit 1. With the assistance of IDNR Heritage Biologists Brad Semel and Deborah Nelson, Schennum selected 7 routes: 3 at Moraine Hills State Park (Lake Defiance, Pike Marsh, and Willow Marsh), 2 at Volo or Pistakee Bog (Wilson Prairie, Pistakee Meadow) and 2 at Chain O' Lakes State Park (Central Fen, Turner Lake). Five of these routes are identical to those used by Schennum eight years ago (1999). Lake Defiance was added to establish a second

route ecologically similar to Pike Marsh. Pistakee Meadow was added by Deb Nelson because it was recently discovered after extensive brush cutting revealed an intact sedge meadow. All routes were delineated to traverse high quality wetlands at each location, including graminoid fen, sedge meadow, calcareous floating mat, and marsh, as described in White and Madany (1978). The precise locations of 6 routes are shown in Exhibits 2A – 2C. Pistakee Meadow was omitted from Exhibit 2B because it was added to the study after the maps were prepared. It is located in the extreme northwest corner of Pistakee Bog Nature Preserve. To magnify the routes and illustrate vegetation patterns, the routes are shown individually on 1 inch = 100 feet or 200 feet aerial photos. These maps are presented in Exhibits 2A-1 to 2A-3 (Moraine Hills), 2B-1 (Pistakee Bog), and 2C-1 to 2C-2 (Chain O' Lakes). No magnified aerial photo is shown for the Pistakee Meadow route again because it was added to the study after map preparation was completed.

Volunteer recruitment for the IDNR butterfly study was accomplished by advertisement in the Volo Bog newsletter and by direct contact with known interested individuals. A total of 10 people agreed to participate, meaning that some routes had 2 volunteer monitors. On May 4, a training session was held for all volunteers. Schennum gave a presentation on habitat-restricted butterflies, wetland communities, and survey routes, data recording, and identification methods. This was followed by a slide program in which all of the potential wetland species occurring in northeast Illinois were shown. Routes were then assigned to each volunteer. Several handouts were then distributed, including a copy of the presentation outline; a list of the volunteers with their addresses, phone numbers; e-mail addresses, and site assigned or chosen; a list of the wetland dependent butterflies in northeast Illinois (presented later); a key to the wetland-restricted and –associated (wetland dependent) butterflies of this area; several copies of a field tally sheet with all regional butterfly species listed; a list of common butterflies often seen in wetlands; a second list of wetland remnant butterflies, annotated with larval food plant information. In addition, three books were recommended as sources of information on butterfly life history, identification features, habitats, and phenology: Butterflies through Binoculars (1999) by Glassberg; Field Guide to Eastern Butterflies (1992) by Opler and Malikul; Field Guide to Butterflies of Illinois (2001) by Bouseman and Sternburg. All volunteers were instructed to focus on learning the habitat wetland remnant species.

Census routes for all seven routes were visited 4 times at approximately 2-week intervals. The weeks/dates were selected to maximize potential exposure to all wetland remnant butterflies while minimizing vegetation trampling and duplication of counts. The weeks selected were the third week in June, first and third weeks

of July, and the first week of August. The latter time was chosen to coincide with the adult flight period of the state endangered Swamp Metalmark (Glassberg 1999, Ill.End.Spp.Prot.Bd. 2006). Specific days within each weekly sampling period were chosen to follow weather forecasts which predicted mostly sunny to partly cloudy days with warm temperatures and wind speeds below 10 mph. These conditions are preferred by all butterfly species. Cool temperatures, overcast skies, and high winds all suppress adult flight behavior. All visits were conducted between 10:00 a.m. and 4:00 p.m., the primary daily flight period for adult butterflies. During every visit the following information was recorded: location; date; starting and ending time; sun/cloud condition description; air temperature; wind speed and direction. Each route was traversed at a slow walking pace, stopping to confirm identification and to teach the volunteers about field marks, flight behavior, and habitat preferences. The number of each species observed was tallied on the field sheet handouts by both the instructor and volunteers, educating the latter in basic scientific field methods. Virtually all individuals were identified in flight or landed. Capture-and-release techniques using a standard insect sweep net were employed when rapid flight or long flight periods made identification difficult. These methods were also an excellent tool for teaching the volunteers specific identification characteristics. In the August search for the elusive Swamp metalmark field techniques were altered to increase the probability of finding this butterfly. Individual Swamp thistle plants were examined for the butterfly, as was the vegetation (sedges and grasses) around them, which was also swept with butterfly nets to induce flight. This butterfly is known to be a slow flier that is usually found hanging on vegetation in the immediate vicinity of the larval food plant (Ebner 1970 and Panzer, pers. comm).

In order to analyze the collective data for 4 survey dates, a summary of each route was prepared. Using a blank field tally sheet, the maximum number observed for each butterfly (both common and restricted species) was recorded. Theoretically, because the survey dates were selected to span the adult flight period for most wetland remnant species, the maximum value recorded represents an estimate of each species' population size in the area sampled. To assess the butterfly composition quality for each site, two "butterfly rating index" values were calculated, one for all species present and one for remnant dependent species only. This butterfly rating index was developed by Schennum and Collins (1987) for evaluation of McHenry County Conservation District butterfly monitoring data sets. Each species is assigned a numeric value based on a combination of 4 features -- # larval food plants, # generations/year, fidelity to particular plant communities, and position within its geographic range. The lower the rating assigned to a butterfly, the more "conservative" its status in the region's landscape as true in Hilsenhoff's index (1982) for stream macroinvertebrate community quality assessment. The scale of values ranges from 1 to 10. Schennum and

Collins (1987) unpublished manuscript contains the assigned values for each of the 4 factors used to compute the index, as well as the index formula itself. Table 1 gives the "coefficients of conservatism" for wetland-restricted" (and "associated") species in the Chicago region. Remnant associated refers to wetland species which frequent uplands as well.

Table 1: Quality Ratings for Wetland Butterflies

Wetland Restricted Species		
Common Name	Scientific Name	Rating
Dion skipper	*Euphyes dion*	3
Black dash	*Euphyes conspicua*	3
Two-spotted skipper	*Euphyes bimacula*	2
Mulberry wing	*Poanes massosoit*	2
Broad-winged skipper	*Poanes viator*	2
Long dash	*Polites mystic*	2
Powesheik skipper	*Oarisma powesheik*	1
Swamp metalmark	*Calephelis muticum*	1
Acadian hairstreak	*Satyryium acadicum*	2
Bronze copper	*Lycaena thoe*	5
Great copper	*Lycaena xanthoides*	1
Purplish copper	*Lycaena helloides*	3
Silvery checkerspot	*Chlosyne nycteis*	4
Harris' checkerspot	*Chlosyne harrisi*	1
Baltimore checkerspot	*Euphydryas phaeton*	2
Silver-bordered fritillary	*Boloria selene*	2
Meadow fritillary	*Boloria bellona*	3
Aphrodite	*Speyeria aphrodite*	2
Northern eyed brown	*Lethe eurydice*	2
Wetland Associated Species		
Delaware skipper	*Atrytone delaware*	3
Coral hairstreak	*Harkenclenus titus*	3
Great spangled fritillary	*Speyeria cybele*	3
Common wood nymph	*Cercyonis pegala*	4

To calculate the butterfly rating index for each route, each species' rating value is multiplied by the maximum number of individuals observed and recorded on the summary form. These multiplicands are then summed to obtain an abundance-weighted total "R" for all species. The R value is then divided by the total of the maxima for all species "T" to obtain "X", the butterfly rating index. As stated previously, an index value was calculated for all species "Xn" and for remnant-restricted and remnant-associated species "Xr" separately. A symbolic mathematical summary of the calculation of X values for all species in a sample is depicted for clarification below. These X values are similar to the mean rated quality (formerly MRQ, now

C) calculated for plants by Swink and Wilhelm (1994), with one differentiating factor, C values, unlike X values, are not based on frequency rated sums. Hilsenhoff's (1982) macroinvertebrate index "MBI" is derived using a frequency weighted sum.

$$Xt = \frac{\text{SUM}_{i=1}^{N_T} n_i \; r_i}{T_T}$$

Where: N_T is the total number of species
n_i is the maximum number recorded for the ith species
r_i is the ith species' individual rating value (coefficient of conservatism)
T_T is the total maximum number of individuals in the sample

(note that the numerator in the equation is R_T , as discussed in the text)

Finally, the ratio of Xr to Xt was calculated for each route to obtain a numerically based representation of the percent contribution made by remnant-restricted and –associated species to the observed butterfly fauna of the route (or site, e.g. Willow Marsh). The closer this value is to 100%, the greater the butterfly fauna is dominated by species characteristic of remnant wetland communities.

RESULTS

The data summaries for each of the 3 IDNR sites and 7 wetlands studied in 2007 are given in Tables 2 – 8. These tables include, for each wetland, the maximum number of individuals observed for each species (column 1); the quality ratings for each species (column 2), and the product of columns 1 and 2 (column 3) for each species, used to calculate the quality ratings. Below the data are 5 numbers which can be used to assess the quality and composition of each wetland's butterflies. They include T, the total maximum number of individuals observed in the field surveys; R, the summed products of columns 1 and 2; Xt, the butterfly index value for all species recorded on the 4 survey dates; Xr, the butterfly index value for remnant-restricted and remnant-associated wetland species recorded on the 4 survey dates; and Xr/Xt, the percentage contributed by the remnant species to the quality of each wetland.

Lake Defiance

Among the 23 species that were present at Lake Defiance wetland, 7 are remnant-restricted or associated, 5 of the former and 2 of the latter. Within this critical group only one species, the Baltimore checkerspot, has a relatively large population of 14, which is still a low number for a wetland of this size, quality, and diversity. Three natural communities – graminoid fen, calcareous floating mat, and sedge meadow – dominate the site. Figure 1 is a mid-summer photo of this wetland complex. Table 2 summarizes the field data and indices for this wetland.

Figure 1: Lake Defiance - fen and calcareous floating mat

The total maximum number of individuals, 117, is low. The total number of wetland-restricted and associated butterflies is 34, or only 29% of the total. The ratio of R values, Rr/Rt, is very low at 13%, somewhat reflected in the Xr/Xt value of 54%. The latter value can be considered moderate; the index for remnant species is also a moderate value of 2.91. The total index Xt is a relatively high 5.34. Although the Xr value is of moderate value, nevertheless, the majority of wetland remnant species have very low numbers, uncharacteristic of the large wetland complex present. Examples of these are the mulberry wing (1), bronze copper (1), and northern eyed brown (7). See Table 2 for other examples.

Past and current management of the Lake Defiance wetland has included regular prescribed burning covering the entire site and extensive removal of invasive shrubs, such as Glossy buckthorn (*Rhamnus frangula*). The latter greatly increased the area of restored fen and sedge meadow. The only other major impact on this wetland is a periodic rise in water level, caused by occasional heavy rains or beaver damming of the lake's outlet.

Table 2: IDNR Butterfly Survey Data: Lake Defiance – Moraine Hills State Park

Common Name	Scientific Name	Total	Rating	Total # x Rating
Dion skipper	*Euphyes dion*		3	
Black dash	*Euphyes conspicua*	4	3	12
Dun skipper	*Euphyes vestris*		4	
Mulberry wing	*Poanes massasoit*	1	2	2
Delaware skipper	*Atrytone delaware*		3	
Peck's skipper	*Polites coras*	1	8	8
Long dash	*Polites mystic*		2	
Least skipper	*Ancyloxphya numitor*	15	7	105
Fiery skipper	*Hylephila phyleus*	1	5	5
Silver-spotted skipper	*Epargyreus clarus*	3	7	21
Black swallowtail	*Papilio polyxenes*	1	6	6
Giant swallowtail	*Papilio cresphontes*		4	
Tiger swallowtail	*Papilio glaucus*	8	7	56
Cabbage white	*Pieris rapae*	2	9	18
Alfalfa butterfly	*Colias eurytheme*	2	8	16
Clouded sulfur	*Colias philodice*	5	8	40
Acadian hairstreak	*Satyrium acadicum*		2	
Bronze copper	*Lycaena hyllus*	1	5	5
Purplish copper	*Lycaena helloides*		3	
Eastern tailed blue	*Everes comyntas*	1	8	8
Spring azure	*Celastrina neglecta*		8	
Snout butterfly	*Libytheana carinenta*		4	
Red-spotted purple	*Limenitis astyanax*		7	
Viceroy	*Limenitis archippus*	5	5	25
American painted lady	*Vanessa virginiensis*		5	
Red admiral	*Vanessa atlanta*	25	6	150
Buckeye	*Junonia coenia*	1	5	5
Mourning cloak	*Nymphalis antiopa*	2	7	14
Question mark	*Polygonia interrogationis*		7	
Baltimore checkerspot	*Euphydryas phaeton*	14	2	28
Pearl crescent	*Phyciodes tharos*	1	6	6
Silver-bordered fritillary	*Boloria selene*		2	
Great spangled fritillary	*Speyeria cybele*	5	3	15
Monarch	*Danaus plexippus*	10	6	60
Northern pearly eye	*Enodia anthedon*		3	
Northern eyed brown	*Satyrodes eurydice*	7	2	14
Little wood satyr	*Megisto cymela*		5	
Common wood nymph	*Cercyonis pegala*	2	4	8
		T = 117		R = 625
				Xt = 5.34188
				Xr = 2.91
				Xr/Xt = 54%

Pike Marsh

A total of 28 species were observed at Pike Marsh in Moraine Hills, of which 10 are remnant-restricted or associated; 7 are in the former group and 3 are in the latter. Within this critical group only 2 species, the Baltimore checkerspot (11) and the Northern eyed brown (22), are relatively frequent. These values are still quite low for a wetland of this size, quality, and diversity. The natural communities present include graminoid fen, sedge meadow, calcareous floating mat and marsh. A fall overview of this large and diverse wetland is shown in Figure 2. Table 3 summarizes the field data and indices for this wetland.

Figure 2: Pike Marsh - overview of wetland complex

The total maximum number of individuals is 152, a moderately low value. The total number of wetland restricted and associated butterflies is 52, or 34% of the total. One noteworthy point is the presence of 5 wetland remnant skippers, though all are in low numbers. The ratio of R values is a very low 17%, somewhat reflected in the Xr/Xt value 49%. The latter is in the moderate range; the index for wetland remnant species is reasonably good at 2.42. The total index Xt is a relatively high 4.89. Although the Xr value is relatively good, the majority of wetland remnant species have very low numbers, uncharacteristic of a large wetland complex like Pike Marsh. Examples of these are the Black dash (5) and Great spangled fritillary (4). See Table 3 for other examples.

Table 3: IDNR Butterfly Survey Data: Pike Marsh – Moraine Hills State Park

Common Name	Scientific Name	Total	Rating	Total # x Rating
Dion skipper	*Euphyes dion*	2	3	6
Black dash	*Euphyes conspicua*	5	3	15
Dun skipper	*Euphyes vestris*		4	
Mulberry wing	*Poanes massasoit*	2	2	4
Delaware skipper	*Atrytone delaware*	1	3	3
Peck's skipper	*Polites coras*	2	8	16
Tawny-edge skipper	*Polites themistocles*	1	6	6
Long dash	*Polites mystic*	1	2	2
Least skipper	*Ancyloxphya numitor*	16	7	112
Fiery skipper	*Hylephila phyleus*	1	5	5
Silver-spotted skipper	*Epargyreus clarus*	2	7	14
Black swallowtail	*Papilio polyxenes*	2	6	12
Giant swallowtail	*Papilio cresphontes*		4	
Tiger swallowtail	*Papilio glaucus*	5	7	35
Cabbage white	*Pieris rapae*	3	9	27
Alfalfa butterfly	*Colias eurytheme*	1	8	8
Clouded sulfur	*Colias philodice*	4	8	32
Acadian hairstreak	*Satyrium acadicum*		2	
Bronze copper	*Lycaena hyllus*	2	5	10
Purplish copper	*Lycaena helloides*		3	
Eastern tailed blue	*Everes comyntas*	2	8	16
Spring azure	*Celastrina neglecta*	1	8	8
Snout butterfly	*Libytheana carinenta*		4	
Red-spotted purple	*Limenitis astyanax*		7	
Viceroy	*Limenitis archippus*	11	5	55
American painted lady	*Vanessa virginiensis*		5	
Red admiral	*Vanessa atlanta*	7	6	42
Buckeye	*Junonia coenia*	3	5	15
Mourning cloak	*Nymphalis antiopa*		7	
Question mark	*Polygonia interrogationis*		7	
Baltimore checkerspot	*Euphydryas phaeton*	11	2	22
Pearl crescent	*Phyciodes tharos*	23	6	138
Silver-bordered fritillary	*Boloria selene*		2	
Great spangled fritillary	*Speyeria cybele*	4	3	12
Monarch	*Danaus plexippus*	15	6	90
Northern pearly eye	*Enodia anthedon*	1	3	3
Northern eyed brown	*Satyrodes eurydice*	22	2	44
Little wood satyr	*Megisto cymela*		5	
Common wood nymph	*Cercyonis pegala*	2	4	8
		T = 152		R = 744
				Xt = 4.894737
				Xr = 2.42
				Xr/Xt = 49%

Past management of the Pike Marsh wetland has included regular prescribed burning and complete removal of invasive shrubs. Adjacent brush-covered uplands have been opened and remnant gravel prairies and savannas restored. Shallow flooding, caused by a water control structure on the old ditch leading from the marsh and sedge meadow on the north side of the wetland, can be troublesome.

Willow Marsh

A total of 25 species were observed in 4 visits to Willow Marsh at Moraine Hills, of which 8 are remnant-restricted or associated. Of these 8, 6 are from the former group and 2 are from the latter. Within the critical species group of 8, 3 are present in relatively sufficient number for the sample. These are the Black dash (11), Baltimore checkerspot (15), and Eyed brown (43). Only the Eyed brown has a substantial breeding resident population for a wetland of this size and quality. Three natural communities are represented – restored graminoid fen, sedge meadow, and very shallow marsh (dominated by Lake sedge (*Carex lacustris)*). Sedge meadow is the dominant community, occupying most of the site. Figure 3 is a ground level picture of the eastern portion of Willow Marsh. Table 4 summarizes the field and calculated data.

Figure 3: Willow Marsh - extensive sedge meadow

The total maximum number of individuals, 258, is a moderate number. The total number of wetland-restricted and -associated butterflies is 85, or 33% of the total, which is adequate but insufficient for a large sedge meadow. The ratio of R values, Rr/Rt, is very low at 15%, as reflected in Xr/Xt value of 46%. The remnant species insect community does have a low (very good) index of 2.39. Although this Xr value

indicates good quality, the majority of remnant wetland species have very small sample populations, atypical of such a large moderate to high quality natural area. Examples are the Dion skipper (3) and the Silver-bordered fritillary (2).

Table 4: IDNR Butterfly Survey Data: Willow Marsh – Moraine Hills State Park

Common Name	Scientific Name	Total	Rating	Total # x Rating
Dion skipper	*Euphyes dion*	3	3	9
Black dash	*Euphyes conspicua*	11	3	33
Dun skipper	*Euphyes vestris*		4	
Mulberry wing	*Poanes massasoit*		2	
Delaware skipper	*Atrytone delaware*		3	
Peck's skipper	*Polites coras*		8	
Long dash	*Polites mystic*		2	
Least skipper	*Ancyloxphya numitor*	35	7	245
Fiery skipper	*Hylephila phyleus*	3	5	15
Silver-spotted skipper	*Epargyreus clarus*	1	7	7
Black swallowtail	*Papilio polyxenes*	3	6	18
Giant swallowtail	*Papilio cresphontes*		4	
Tiger swallowtail	*Papilio glaucus*	4	7	28
Cabbage white	*Pieris rapae*	8	9	72
Alfalfa butterfly	*Colias eurytheme*		8	
Clouded sulfur	*Colias philodice*	10	8	80
Acadian hairstreak	*Satyrium acadicum*		2	
Bronze copper	*Lycaena hyllus*	1	5	5
Purplish copper	*Lycaena helloides*		3	
Eastern tailed blue	*Everes comyntas*	6	8	48
Spring azure	*Celastrina neglecta*	1	8	8
Snout butterfly	*Libytheana carinenta*		4	
Red-spotted purple	*Limenitis astyanax*	2	7	14
Viceroy	*Limenitis archippus*	10	5	50
American painted lady	*Vanessa virginiensis*		5	
Red admiral	*Vanessa atlanta*	14	6	84
Buckeye	*Junonia coenia*	3	5	15
Mourning cloak	*Nymphalis antiopa*	1	7	7
Question mark	*Polygonia interrogationis*	3	7	21
Baltimore checkerspot	*Euphydryas phaeton*	15	2	30
Pearl crescent	*Phyciodes tharos*	50	6	300
Silver-bordered fritillary	*Boloria selene*	2	2	4
Great spangled fritillary	*Speyeria cybele*	4	3	12
Monarch	*Danaus plexippus*	19	6	114
Northern pearly eye	*Enodia anthedon*		3	
Northern eyed brown	*Satyrodes eurydice*	43	2	86
Little wood satyr	*Megisto cymela*		5	
Common wood nymph	*Cercyonis pegala*	6	4	24
		T = 258		R = 1329
				Xt = 5.151163
				Xr = 2.39
				Xr/Xt = 46%

Willow Marsh has been a prime target of restoration work. Former fens covered in buckthorn were cleared of brush and resurrected from a community lacking few native species. Major hydrological restoration was accomplished by breaking tile lines and filling a wide ditch while clearing it of adventive woody vegetation. The wetland also is regularly burned totally, probably due to a lack of firebreaks.

Central Fen

A total of 21 butterfly species were observed at Central Fen in Chain O' Lakes State Park. Of these, 6 species are remnant-restricted or -associated species, 4 are the former and 2 are the latter. Within this restored wetland complex, only one species, the Great spangled fritillary has a relatively large sample population of 22 individuals. This is a more than sufficient number to support a viable population for this large butterfly in such a small natural area. This wetland is a combination of graminoid fen and sedge meadow, and is split into two pieces by a bicycle path. Figure 4 is a fall photo of the smaller southern piece of this wetland. Table 5 summarizes the field and analyzed data for this site.

Figure 4: Central Fen – sedge meadow and fen

The total maximum number of individuals is low at 127. The total number of wetland-restricted and -associated butterflies is 43, or 34% of the total. The ratio of R values, Rr/Rt, is low at 19%, somewhat reflected in the Xr/Xt value of 55%. The latter is high for a wetland with an Xr value of 2.91. The total index Xt is relatively high at 5.25. Although Xr is a moderate value, 6 wetland remnant species is a very low number for even a small, high quality wetland. Also, most of these 6 butterflies have small sample

populations. Examples are the Black dash (1) and Northern eyed brown (4). See Table 5 for more examples.

Table 5: IDNR Butterfly Survey Data: Central Fen – Chain O'Lakes State Park

Common Name	Scientific Name	Total	Rating	Total # x Rating
Dion skipper	*Euphyes dion*		3	
Black dash	*Euphyes conspicua*	1	3	3
Dun skipper	*Euphyes vestris*		4	
Mulberry wing	*Poanes massasoit*		2	
Delaware skipper	*Atrytone delaware*		3	
Peck's skipper	*Polites coras*		8	
Long dash	*Polites mystic*		2	
Least skipper	*Ancyloxphya numitor*	14	7	98
Fiery skipper	*Hylephila phyleus*		5	
Silver-spotted skipper	*Epargyreus clarus*		7	
Black swallowtail	*Papilio polyxenes*	5	6	30
Giant swallowtail	*Papilio cresphontes*		4	
Tiger swallowtail	*Papilio glaucus*	2	7	14
Cabbage white	*Pieris rapae*	3	9	27
Alfalfa butterfly	*Colias eurytheme*	1	8	8
Clouded sulfur	*Colias philodice*	4	8	32
Acadian hairstreak	*Satyrium acadicum*		2	
Bronze copper	*Lycaena hyllus*		5	
Purplish copper	*Lycaena helloides*		3	
Eastern tailed blue	*Everes comyntas*	1	8	8
Spring azure	*Celastrina neglecta*	2	8	16
Snout butterfly	*Libytheana carinenta*		4	
Red-spotted purple	*Limenitis astyanax*	2	7	14
Viceroy	*Limenitis archippus*	5	5	25
American painted lady	*Vanessa virginiensis*	1	5	5
Red admiral	*Vanessa atlanta*	13	6	78
Buckeye	*Junonia coenia*		5	
Mourning cloak	*Nymphalis antiopa*		7	
Question mark	*Polygonia interrogationis*	1	7	7
Baltimore checkerspot	*Euphydryas phaeton*	7	2	14
Pearl crescent	*Phyciodes tharos*	15	6	90
Silver-bordered fritillary	*Boloria selene*	1	2	2
Great spangled fritillary	*Speyeria cybele*	22	3	66
Monarch	*Danaus plexippus*	15	6	90
Northern pearly eye	*Enodia anthedon*		3	
Northern eyed brown	*Satyrodes eurydice*	4	2	8
Little wood satyr	*Megisto cymela*		5	
Common wood nymph	*Cercyonis pegala*	8	4	32
		T = 127		R = 667
				Xt = 5.251969
				Xr = 2.91
				Xr/Xt = 55%

Central Fen is the product of hydrological restoration. Prior to the removal of tile lines, this small, remnant native wetland was not visible in an otherwise mass of Reed canary grass. Apparently, it was hidden within this mass as it seems unlikely that a fen of such high quality could be resurrected from the only seedbank. Brush removal also has been employed on the wetland's margins. The bicycle path serves as a firebreak permitting rotational burning of the fen on each side.

Turner Lake

Among the 22 species of butterflies (an unexpectedly low number for a complex wetland of this size) present at the Turner Lake wetlands, 8 species are remnant-restricted or associated, 6 of the former and 2 of the latter. Two of these remnant wetland butterflies are present in high numbers, including the Baltimore checkerspot (48) and Great spangled fritillary (30). These numbers are not unexpected for such a large and very high quality wetland composed of marsh, sedge meadow, graminoid fen, and calcareous floating mat. However, the species richness for such an area is low at 8. Figure 5 is a fall photograph of a very high quality fen at the south end of the wetland. Table 6 summarizes the field and analyzed data for the 4 visits to this site.

Figure 5: Turner Lake – high quality fen at south end

The total maximum number of individuals, 205, is somewhat low for such a large wetland. The total number of wetland-restricted and -associated butterflies is 108 or fully 53% of the total, as expected for a wetland with an Xr/Xt of 56%. The ratio of R values, Rr/Rt, is 30%, again low for such a large wetland. The index of remnant species, 2.41, is a very good average for this pool of species. The total index (Xt) of 4.27 is a moderate value. Nevertheless, many of the wetland remnant species have low sample population

sizes. Examples are the Mulberry wing (3) and the Northern eyed brown (11). Eyed browns are usually in very large numbers in fen-sedge meadow communities. See Table 6 for other examples.

Table 6: IDNR Butterfly Survey Data: Turner Lake – Chain O'Lakes State Park

Common Name	Scientific Name	Total	Rating	Total # x Rating
Dion skipper	*Euphyes dion*	1	3	3
Black dash	*Euphyes conspicua*	9	3	27
Dun skipper	*Euphyes vestris*		4	
Mulberry wing	*Poanes massasoit*	3	2	6
Delaware skipper	*Atrytone delaware*		3	
Peck's skipper	*Polites coras*		8	
Long dash	*Polites mystic*		2	
Least skipper	*Ancyloxphya numitor*	6	7	42
Fiery skipper	*Hylephila phyleus*	1	5	5
Silver-spotted skipper	*Epargyreus clarus*		7	
Black swallowtail	*Papilio polyxenes*	2	6	12
Giant swallowtail	*Papilio cresphontes*		4	
Tiger swallowtail	*Papilio glaucus*	9	7	63
Cabbage white	*Pieris rapae*	2	9	18
Alfalfa butterfly	*Colias eurytheme*	3	8	24
Clouded sulfur	*Colias philodice*	5	8	40
Acadian hairstreak	*Satyrium acadicum*		2	
Bronze copper	*Lycaena hyllus*		5	
Purplish copper	*Lycaena helloides*		3	
Eastern tailed blue	*Everes comyntas*	2	8	16
Spring azure	*Celastrina neglecta*		8	
Snout butterfly	*Libytheana carinenta*		4	
Red-spotted purple	*Limenitis astyanax*	1	7	7
Viceroy	*Limenitis archippus*	8	5	40
American painted lady	*Vanessa virginiensis*		5	
Red admiral	*Vanessa atlanta*	22	6	132
Buckeye	*Junonia coenia*		5	
Mourning cloak	*Nymphalis antiopa*	1	7	7
Question mark	*Polygonia interrogationis*		7	
Baltimore checkerspot	*Euphydryas phaeton*	48	2	96
Pearl crescent	*Phyciodes tharos*	22	6	132
Silver-bordered fritillary	*Boloria selene*	4	2	8
Great spangled fritillary	*Speyeria cybele*	30	3	90
Monarch	*Danaus plexippus*	13	6	78
Northern pearly eye	*Enodia anthedon*		3	
Northern eyed brown	*Satyrodes eurydice*	11	2	22
Little wood satyr	*Megisto cymela*		5	
Common wood nymph	*Cercyonis pegala*	2	4	8
		T = 205		R = 876
				Xt = 4.273171
				Xr = 2.41
				Xr/Xt = 56%

Management of Turner Lake wetlands includes frequent prescribed burning. Removal of invasive brush along the west edge has increased the acreage of fen and sedge meadow and prevented the spread of invasive buckthorns into very high quality patches of these communities. Hydrological restoration by removal of several tile lines has prevented the deterioration of high quality communities and improved the quality of the formally marginal formerly brush-infested marginal sedge meadows and fens.

Pistakee Meadow

Pistakee Meadow is a very small sedge meadow located in the extreme northern portion of Pistakee Bog Nature Preserve. It abuts a large and rare example of a forested fen (or bog). It is not only small but its composition is not typical of sedge meadows. The butterfly survey found 16 species, 5 of which are remnant-restricted or associated. Four of the former and one of the latter are present. Only one of these 5 species, the Baltimore checkerspot, has a large sample population of 34. This is a very high number for a small site lacking fen remnants. In fact, "sedge meadow" is the only natural community in this 10-acre wetland. Figure 6 is a fall photo of this community, showing remnant small trees and shrubs. Table 7 summarizes the field and analyzed data for this wetland.

Figure 6: Pistakee Meadow – dense sedge meadow and marsh vegetation

The total maximum number of 124 individuals seems small, but perhaps not for a 10-acre wetland dominated by the rank growth of sedges and grasses and broken up by brush/small tree copses. The total number of wetland-restricted and associated butterflies is 49, 40% of the total, higher than expected from the site's size and dominant vegetation. The ratio of R values, Rr/Rt, is a very low 18%, somewhat expected

from the Xr/Xt of 44%. The low value (high quality) of Xr at 2.17 shows a high proportion of very remnant-restricted individuals. However, the high value of Xt at 4.94 is a moderate to high value. Although the Xr is of high value, nevertheless, all species except the Baltimore checkerspot have small sample populations. Examples of these are the Black dash (3) and the usually common Eyed brown (3). See Table 7 for numbers of the other two remnant wetland species.

Table 7: IDNR Butterfly Survey Data: Pistakee Meadow – Volo Bog State National Area

Common Name	Scientific Name	Total	Rating	Total # x Rating
Dion skipper	*Euphyes dion*		3	
Black dash	*Euphyes conspicua*	3	3	9
Dun skipper	*Euphyes vestris*	1	4	4
Mulberry wing	*Poanes massasoit*		2	
Delaware skipper	*Atrytone delaware*		3	
Peck's skipper	*Polites coras*		8	
Long dash	*Polites mystic*		2	
Least skipper	*Ancyloxphya numitor*	15	7	105
Fiery skipper	*Hylephila phyleus*		5	
Silver-spotted skipper	*Epargyreus clarus*		7	
Black swallowtail	*Papilio polyxenes*		6	
Giant swallowtail	*Papilio cresphontes*		4	
Tiger swallowtail	*Papilio glaucus*	4	7	28
Cabbage white	*Pieris rapae*	11	9	99
Alfalfa butterfly	*Colias eurytheme*		8	
Clouded sulfur	*Colias philodice*		8	
Acadian hairstreak	*Satyrium acadicum*	1	2	2
Bronze copper	*Lycaena hyllus*		5	
Purplish copper	*Lycaena helloides*		3	
Eastern tailed blue	*Everes comyntas*		8	
Spring azure	*Celastrina neglecta*	3	8	24
Snout butterfly	*Libytheana carinenta*	1	4	4
Red-spotted purple	*Limenitis astyanax*	2	7	14
Viceroy	*Limenitis archippus*	4	5	20
American painted lady	*Vanessa virginiensis*		5	
Red admiral	*Vanessa atlanta*	12	6	72
Buckeye	*Junonia coenia*		5	
Mourning cloak	*Nymphalis antiopa*		7	
Question mark	*Polygonia interrogationis*	2	7	14
Baltimore checkerspot	*Euphydryas phaeton*	34	2	68
Pearl crescent	*Phyciodes tharos*	1	6	6
Silver-bordered fritillary	*Boloria selene*		2	
Great spangled fritillary	*Speyeria cybele*	8	3	24
Monarch	*Danaus plexippus*	19	6	114
Northern pearly eye	*Enodia anthedon*		3	
Northern eyed brown	*Satyrodes eurydice*	3	2	6
Little wood satyr	*Megisto cymela*		5	
Common wood nymph	*Cercyonis pegala*		4	
		T = 124		R = 612
				Xt = 4.935484
				Xr = 2.17
				Xr/Xt = 44%

Pistakee Meadow is a recent discovery by IDNR heritage biologists. A 10-acre wetland was cleared of much exotic brush (*Rhamnus spp.*), which revealed a moderate to high quality sedge meadow. Scattered native brush copses remained (see Fig. 6) in a matrix dominated by both sedge meadow and marsh plants, similar

to the communities found in grassy moats bordering bogs, as is the case here. The native meadow has been burned at least once since the brush clearing revealed this unusual wetland. Purple loosestrife (*Lythrum salicaria*) control has also been implemented in this wetland but scattered plants remain.

Wilson Prairie

Among the 25 species present in Wilson Prairie, 8 are remnant-restricted or associated, 6 of the former and 2 of the latter. Within this critical group three had relatively large sample populations, including the Baltimore checkerspot (20), Great spangled fritillary (22), and Northern eyed brown (20). The numbers of these three species are expected for a relatively small wetland, although the Northern eyed brown usually has twice as many individuals in a population. The natural communities present are sedge meadow and wet prairie, the former covering far more area than the latter. Figure 7 is a fall photo of the sedge meadow portion of this wetland. Table 8 summarizes the field and analytical data for Wilson Prairie.

Figure 7: Wilson Prairie – sedge meadow at north end

The total maximum number of individuals, 198, is relatively high for a small high quality wetland. The total number of remnant-restricted and associated butterflies is 77, or 39% of the total. This a moderate proportion of the total for small sedge meadow-wet prairie communities. The ratio of R values, Rr/Rt is 19%, a low figure reflected in the Xr/Xt value of 56%. The latter value can be considered moderate, as is the Xr value of 2.93. The total index Xt is a relatively high 5.22. Although the Xr value is a moderate value, nevertheless, 5 of the 8 wetland remnant species are found in very low numbers. Examples are the Black dash (4) and the Bronze copper (2).

Table 8: IDNR Butterfly Survey Data: Wilson Prairie – Volo Bog State National Area

Common Name	Scientific Name	Total	Rating	Total # x Rating
Dion skipper	*Euphyes dion*		3	
Black dash	*Euphyes conspicua*	4	3	12
Dun skipper	*Euphyes vestris*		4	
Mulberry wing	*Poanes massasoit*	2	2	4
Delaware skipper	*Atrytone delaware*		3	
Peck's skipper	*Polites coras*		8	
Long dash	*Polites mystic*		2	
Least skipper	*Ancyloxphya numitor*	5	7	35
Fiery skipper	*Hylephila phyleus*		5	
Silver-spotted skipper	*Epargyreus clarus*	1	7	7
Black swallowtail	*Papilio polyxenes*	3	6	18
Giant swallowtail	*Papilio cresphontes*	1	4	4
Tiger swallowtail	*Papilio glaucus*	8	7	56
Cabbage white	*Pieris rapae*	6	9	54
Alfalfa butterfly	*Colias eurytheme*	4	8	32
Clouded sulfur	*Colias philodice*	28	8	224
Acadian hairstreak	*Satyrium acadicum*		2	
Bronze copper	*Lycaena hyllus*	2	5	10
Purplish copper	*Lycaena helloides*	1	3	3
Eastern tailed blue	*Everes comyntas*	4	8	32
Spring azure	*Celastrina neglecta*	7	8	56
Snout butterfly	*Libytheana carinenta*		4	
Red-spotted purple	*Limenitis astyanax*	1	7	7
Viceroy	*Limenitis archippus*	6	5	30
American painted lady	*Vanessa virginiensis*	1	5	5
Red admiral	*Vanessa atlanta*	4	6	24
Buckeye	*Junonia coenia*		5	
Mourning cloak	*Nymphalis antiopa*		7	
Question mark	*Polygonia interrogationis*		7	
Baltimore checkerspot	*Euphydryas phaeton*	20	2	40
Pearl crescent	*Phyciodes tharos*	13	6	78
Silver-bordered fritillary	*Boloria selene*		2	
Great spangled fritillary	*Speyeria cybele*	22	3	66
Monarch	*Danaus plexippus*	28	6	168
Northern pearly eye	*Enodia anthedon*		3	
Northern eyed brown	*Satyrodes eurydice*	20	2	40
Little wood satyr	*Megisto cymela*	1	5	5
Common wood nymph	*Cercyonis pegala*	6	4	24
		T = 198		R = 1034
				Xt = 5.222222
				Xr = 2.93
				Xr/Xt = 56%

Management of Wilson Prairie has included both prescribed burning and progressive removal of invasive brush and small trees. The latter activity has improved and expanded the acreage of sedge meadow and wet prairie since the discovery and purchase of Wilson Prairie in the late 1990's.

DISCUSSION

The analysis of butterfly community composition and quality, particularly for remnant-restricted and -associated butterflies (= remnant dependent), is most accurate when data are pooled over a multi-year period. Nevertheless, one year's data can provide an initial estimate of these population-based measures and establish the route which then can be repeated annually. There are a number of ways to analyze butterfly community composition and quality. These include examining the numbers of each remnant dependent species over all 7 sites, taking into account the differences in the size and community diversity between sites; interpreting the butterfly index values; comparing the 2007 IDNR results with those at other wetlands; and discussing some wetland species which failed to appear in the 2007 surveys. These analyses follow, with photos of selected species sprinkled in to put some biological reality behind all the words.

Table 9 summarizes the names and total maximum numbers of each species for each wetland. It is readily apparent that the numbers of wetland remnant skippers are low and their diversity over the 7 sites is also low. The Black dash is the only such species which is present consistently, though in numbers not exceeding a dozen. The highest numbered population samples, from Turner Lake (9) and Wilson Prairie (11), are still low for this typically local but common species (Ebner 1970). The remaining wetland remnant skippers were most often seen as only 1 or 2 individuals. One marsh species, the Broad-winged skipper (*Poanes viator*), was not observed. It was absent from inventories at all sites sampled by Schennum (1999), which included all but Lake Defiance and Pistakee Meadow. The wetland with the highest diversity of wetland remnant skippers is Pike Marsh, which is a large, very open-structured complex mosaic of fen, sedge meadow, calcareous floating mat and marsh. Such community diversity tends to support a wide variety of butterflies, but not at the large and similarly diverse Turner Lake and Lake Defiance, which have only 2 of these skippers each. The reason for the latter may be the large area covered by calcareous floating mat, a community which does not support many butterflies in the primary author's experience. Another possibility is the frequency, extent and intensity of prescribed burns. However, in wetlands, most burns are patchy and do not consume all of the litter in which these skippers' larvae overwinter. One species, the Long dash, is rare (only 1 at 1 site) because it has a mid-June flight period (Glassberg 1999 and Schennum

1999) which precedes the sample period. Another, the Delaware skipper, is equally rare, as it is primarily an upland prairie species venturing into fens because these communities are dominated in part by Big blue stem (*Andropogon gerardii*), a larval food plant of the Delaware.

Despite intense efforts during the fourth survey in late August and ample populations of the larval food plant Swamp thistle (*Cirsium muticum*) in fen and sedge meadow communities, no individuals of Swamp metalmark were observed or recorded. Efforts were made to search the vegetation and thistle food plants both off and on the survey route.

Table 9: IDNR Butterfly Survey Data: Comparitive Summary of Species Numbers

Common Name	Scientific Name	Lake Defiance	Pike Marsh	Willow Marsh	Central Fen	Turner Lake	Pistakee Meadow	Wilson Prairie
Dion skipper	*Euphyes dion*		2	3		1		
Black dash	*Euphyes conspicua*	4	5	11	1	9	3	4
Dun skipper	*Euphyes vestris*						1	
Mulberry wing	*Poanes massasoit*	1	2			3		2
Delaware skipper	*Atrytone delaware*		1					
Peck's skipper	*Polites coras*	1	2			1		
Long dash	*Polites mystic*		1					
Least skipper	*Ancyloxphya numitor*	15	16	35	14	6	15	5
Fiery skipper	*Hylephila phyleus*	1		3		1		
Silver-spotted skipper	*Epargyreus clarus*	3	2	1				1
Black swallowtail	*Papilio polyxenes*	1	2	3	5	2		3
Giant swallowtail	*Papilio cresphontes*							1
Tiger swallowtail	*Papilio glaucus*	8	5	4	2	9	4	8
Cabbage white	*Pieris rapae*	2	3	8	3	2	11	6
Alfalfa butterfly	*Colias eurytheme*	2	1		1	3		4
Clouded sulfur	*Colias philodice*	5	4	10	4	5		28
Acadian hairstreak	*Satyrium acadicum*						1	
Bronze copper	*Lycaena hyllus*	1		1				2
Purplish copper	*Lycaena helloides*							1
Eastern tailed blue	*Everes comyntas*	1	2	6	1	2		4
Spring azure	*Celastrina neglecta*		1	1	2		3	7
Snout butterfly	*Libytheana carinenta*						1	
Red-spotted purple	*Limenitis astyanax*			2	2	1	2	1
Viceroy	*Limenitis archippus*	5	11	10	5	8	4	6
American painted lady	*Vanessa virginiensis*				1			1
Red admiral	*Vanessa atlanta*	25	7		13	22	12	4
Buckeye	*Junonia coenia*	1	3	3				
Mourning cloak	*Nymphalis antiopa*	2		1		1		
Question mark	*Polygonia interrogationis*			3	1		2	
Baltimore checkerspot	*Euphydryas phaeton*	14	11	15	7	48	34	20
Pearl crescent	*Phyciodes tharos*	1	23	50	15	22	1	13
Silver-bordered fritillary	*Boloria selene*			2	1	4		
Great spangled fritillary	*Speyeria cybele*	5	4	4	22	30	8	22
Monarch	*Danaus plexippus*	10	15	19	15	13	19	28
Northern pearly eye	*Enodia anthedon*		1					
Northern eyed brown	*Satyrodes eurydice*	7	22	43	4	11	3	20
Little wood satyr	*Megisto cymela*							1
Common wood nymph	*Cercyonis pegala*	2	2	6	8	2		6

Black dash

Mulberry wing

The wetland-restricted coppers and hairstreaks were rarely encountered in the 2007 IDNR study. Where they occurred, numbers were very low (1 or 2 individuals). In fact, the Purplish copper was observed at only 1 site. The near absence of the Acadian hairstreak may be due to brush removal, as its larval food plants are willows, or to its vulnerability to fire since it overwinters as an egg inserted into willow stems. The Bronze and Purplish coppers are double-brooded. Their largest brood occurs in August when only one survey, concentrating on the Swamp metalmark, was conducted. Both coppers are shallow-water marsh species, with some occurrence in sedge meadows. Very few acres of marsh were surveyed on all 7 wetlands, and this may be the principal reason for the lack of these two species.

Acadian hairstreak

Purplish copper

The Silver-bordered fritillary is also seldom recorded, and always in very low numbers. It is a wetland species typical of sedge meadows and wet prairies. Wet prairies occurred (in relatively small acreages) only at Pistakee Meadow. The larger expansive sedge meadows and fens, which typically contain native wetland violets, the food plant of this butterfly's larvae, should support maximum populations of at least 10 to 15 individuals. However, this fritillary is double-brooded, like the 2 coppers, one appearing in mid-May and

early June and the second and largest extending from mid-July to early September. It is very likely that the highest population counts for this species are later than the majority of the 2007 survey period.

Silver-bordered fritillary

Three wetland-dependent butterflies, the Baltimore checkerspot, Great-spangled fritillary, and Northern eyed brown, have relatively large sample populations in most sites, though low maximum numbers even for these three species were recorded. Except for the Eyed brown, Turner Lake has very high sample populations for these species, with 48 Baltimores and 30 of the Fritillary. The Eyed brown and Baltimore are typically found in dense populations and are somewhat colonial (Opler and Krizek 1984), so numbers in the 20's or higher are not unexpected. The Eyed brown and Great spangled fritillary do appear in low numbers in 3 – 4 sites. This fritillary is a large territorial species for which low numbers are occasionally expected. However, the Eyed brown is always abundant, unless the area of suitable wetland is small. The low Eyed brown counts are at Lake Defiance, Central Fen, and Pistakee Meadow, where Tussock sedge (*Carex stricta*) (the larval food plant) and sedge meadow communities are relatively small.

Four of the most common butterflies found at the 7 wetlands are ubiquitous, disturbance-tolerant, common and widespread, and therefore, low rated species. These are the Least skipper, Red admiral, Pearl crescent, and Monarch, all with a quality rating of 6. The Least skipper is found only in wetlands, but it occurs regularly in extremely disturbed ones, such as roadside ditches and small wetland sedge pockets in old fields. The Red admiral's larva feeds on nettles, plants tolerant of severe hydrological disturbance (tile drainage and organic soil oxidation).

Baltimore checkerspot

N. Eyed brown

The Pearl crescent has several broods a year and its larvae feed on a variety of asters, both wetland and upland, even those in old fields. Finally the monarch is a highly vagile species (unlike the wetland-restricted species), whose larvae feed on milkweeds in both wetlands (Swamp milkweed (*Asclepias incarnate*)) and disturbed upland grassland (Common and Whorled milkweed (*Asclepias syriaca* and *Asclepias verticillatus*)).

These species are part of the wetland butterfly fauna, but if their numbers are high while those of wetland obligates are low, the wetland remnant butterfly community cannot be considered characteristic of a typical remnant fen-sedge meadow-marsh complex. All of the 7 IDNR wetlands surveyed in 2007 appear to support such a butterfly fauna. The composition and diversity of wetland-restricted and -associated species and the high numbers of some of them affirms this. The failure of some to support more of a wetland remnant fauna is due to extensive and more recent past disturbances (grazing, drainage, brush invasion, and lack of fire). Wilson Prairie, Central Fen, Willow Marsh, and especially Pistakee Meadow all fall in this category. They should recover following the massive 20 -year IDNR efforts to restore them with prescribed fire, brush removal, and tile network dismantling. However the rate of recovery of the wetland remnant butterflies will be slow because these butterflies colonize new habitat very slowly, and the restored community patches, with the appropriate larval food plants, recover at such a rate also. The disturbance tolerant more vagile species will colonize much faster. Examples of this have been observed by Schennum and Collins (2001) at a number of upland prairie restorations wherein two wetland-associated butterflies, the Great spangled fritillary and Common wood nymph, and disturbance-tolerant species, have been, to date, the only butterflies to colonize the restorations from adjacent quality wetlands and old fields (for widespread tolerant species). A simultaneous process is ongoing in the 7 IDNR wetlands, where remnant species in low numbers are jeopardized with extirpation as predicted by the tenets of island biogeography (Soule 1986). It is uncertain whether their populations will increase and/or expand home ranges in time to avoid local

extinction or the need to transport species from viable populations elsewhere. The following paragraphs examine numerical means of assessing the quality of butterfly communities in the context of the preceding composition treatise.

There are at least 2 measures of butterfly community quality, the butterfly population index (Schennum and Collins 1987) and a species richness index similar to that used for plants by Bowles and McBride (1996). The former is the average of total weighted sums for all species (See Methods section) (Xr and Xt), while the latter is the number of species (maximum) observed over the survey period (Sr and St). Percentages of remnant species can be calculated for either measure. Table 10 summarizes these values for the 7 sample sites.

Table 10: Indices of Butterfly Quality

Indices and Percentages								
Site	**Xt**	**Xr**	**St**	**Sr**	**%r**	**Total All spp**	**Total r spp**	**% Total r**
Lake Definace	5.34	2.91	23	7	30%	117	34	29%
Pike Marsh	4.89	2.42	28	10	36%	152	52	34%
Willow Marsh	5.15	2.39	25	8	32%	258	85	33%
Central Fen	5.25	2.91	21	6	29%	127	43	34%
Turner Lake	4.27	2.41	22	8	36%	205	108	53%
Pistakee Meadow	4.94	2.17	16	5	31%	124	49	40%
Wilson Prairie	5.22	2.93	25	8	32%	198	77	39%

The interpretation of biological indices is hardly an exact science. There are so many ecological variables contributing to such indices that it is not always possible to estimate quality precisely. Nevertheless, they can be useful for assessments of relative, and even absolute quality, especially if the index values can be related to the ecological characteristics of butterfly populations recorded at monitoring sites, as indicated by the successful use if the floral quality index of Swink and Wilhelm (1994). The Xt values of 6 of the 7 sites are relatively high for the high quality, diverse wetland communities present on most of the sites. Turner Lake has an Xt value of 4.27, only slightly higher than expected. This is further indicated by a % total r value of 53%, a low Xr value of 2.41, and a high total number of wetland-remnant individuals of 108. All 6 of the other sites have Xt values approaching or above 5, % total r values well below 50%, and, except for Willow Marsh, fewer than 80 total wetland-remnant species. Pike Marsh and Willow Marsh have fairly low Xr values, approximately the same as Turner Lake. All three of these wetlands are very large and diverse, with relatively little adjacent forest or old field habitat, and thus are capable of supporting a significantly high quality wetland remnant butterfly fauna. By contrast the other 4 wetlands are relatively small, with lower

acreages of each wetland community type and more adjacent forest edge and old field habitat. For the most part these 4 wetlands (with some exceptions) – Lake Defiance, Central Fen, Pistakee Meadow, Wilson Prairie – have poorer Xr values, high Xt values, a low % of wetland-remnant species, and a low total number of such species. These sites, especially the last 3 listed above, are also in an earlier transition to higher quality and higher acreage wetland complexes due to the extensive management actions (especially brush removal) of IDNR. Thus these smaller sites are more likely to have higher numbers and percentages of widespread disturbance-tolerant common species, such as Pearl crescents and Red admirals. These species may be replacing the wetland-remnant species by filling niches left vacant by the absent and more ecologically restricted species.

One characteristic common to all 7 wetlands is their low species richness values. Not one of the sites has more than 10, out of a possible 20, wetland-restricted and –associated butterflies, despite all but one having high total species richness (St). All of the wetlands have %r values between 29% and 36%. The major contributors to the pool of more conservative species are only 3 butterflies – the Baltimore checkerspot, Great spangled fritillary, and Northern eyed brown. All the others make little contribution to this prestigious group, while common species fill the void. Species richness is a reflection of the presence of abundant larval food sources and adult nectar sources, high plant community diversity, and, to a somewhat lesser degree, high floristic diversity and quality. High percentages of marsh and or calcareous floating mat communities, which naturally lack larval food plants and floristic diversity, are characteristic of Pike Marsh, Lake Defiance, and Turner Lake. Willow Marsh is probably 80% sedge meadow, with little contribution by other wetland types. The three small wetlands lack plant community diversity, partially due to the small size of each community and presence of no more than 2 communities (only 1 at Pistakee Meadow). An in-depth examination of the frequency, % coverage, and intensity of prescribed fires might provide additional explanations for low species richness values. Rotational burning (2-3 year cycle), partial coverage each year, and burning under more humid and cooler conditions should increase or support higher species richness. Quantitative food plant research and widening the survey period to mid-May to late-August would give clues to, or increase, species richness values, respectively.

The frequency of surveys, length of the survey period, and changes in species ratings can both influence the indices Xt and Xr, and species richness. In the present study only 4 biweekly butterfly censuses were conducted, all between late June and early August. Larger populations of wetland-remnant species can be reached if the surveys are conducted weekly, as was done by Schennum (2001) at a DuPage County FPD

wetland (see comparative studies later). The peaks (maxima) in numbers are likely to be more accurate and higher then, since many of these species are short-lived. Lengthening the survey period could be helpful as well, as at least a few of these species have larger broods in August, and some even in May. All of these actions are certain to increase species richness. Elevating Xr values could be accomplished by lowering ratings for some species, if supported by habitat affinities. For example, both the Dion skipper and Black dash are given 3's, though they are just as conservative as all the other wetland skippers which have ratings of 2. The Bronze and Purplish coppers (5 and 3 rated, respectively), Meadow fritillary (3), and Silvery checkerspot (4) could all have lower ratings. The impact of such changes probably would be minimal because all these species were rare or absent in the 2007 INDR wetlands study. Revision in the ratings of three species more frequently observed in higher numbers in 2007, including the Red admiral, Viceroy, Pearly crescent, and Monarch, would probably mean increasing their rating numbers slightly, resulting in higher (poorer) Xt values. In any event, any changes in species' ratings as assigned in Schennum and Collins (1987) only should be made if all species and all supporting ecological components of the ratings are reviewed collectively.

Comparisons of the IDNR 2007 wetland butterfly surveys might show whether the numbers and presence of species characteristic of upper Fox River Valley wetlands are similar to others in the Chicago Region. The largest source of information is the Butterfly Monitoring Network's results for 2007 (Taron and Manner 2007). A relatively thorough review of these results, including 742 surveys, found only two wetland-associated species frequently, the Great spangled fritillary and Common wood nymph, both of which are frequent in uplands. All of the other wetland-restricted and -- -associated species were rare or absent from these records, except at Markham Prairie which has more wet and mesic prairie than sedge meadow habitat. Wetlands were present, but not as large as in the IDNR 2007 wetland-only studies. Most of the communities and acreages thereof in the Butterfly Network sites were uplands.

Schennum (1999) studied 5 of the 7 wetlands reported here in an IDNR study of potential gypsy moth control impacts on native butterflies. Unfortunately, the 1999 surveys were not quantitative. Their species richness values for wetland-remnant butterflies can be compared to the 2007 surveys. Table 11 below summarizes these comparisons.

Table 11: Comparison of 1999 and 2007 Studies for Species Richness (Sr)

Site	2007	1999
Pike Marsh	10	12
Willow Marsh	8	10
Central Fen	6	8
Turner Lake	8	9
Wilson Prairie	8	10

The Chicago Butterfly Club (1980) found 7 wetland-remnant species on June 28, 1980. This date was too early to observe 4 wetland skippers and some true butterflies recorded in 2007 along the much longer Pike Marsh census route. The 1999 study had slightly higher, 1 or 2, more species at each of the 5 wetlands studied in 2007. The 1980 report would probably have recorded at least 3 more species if it had been repeated in early and mid-July. The differences in species richness values between 1999 and 2007 are so low at all 5 wetlands that they may be due to annual fluctuations in species and population numbers, and, because most wetland-remnant species were in low numbers in 2007, many may have been overlooked. Larger differences in wetland species richness could more likely be attributed to ecological factors and island biogeographically-related trends (Soule 1986).

A 2001 quantitative butterfly study at Pratts-Wayne Woods Forest Preserve in northwest DuPage County was conducted 6 times between June 17 and July 22 (Schennum 2001). A total of 10 wetland remnant species were recorded in this site, which is a small complex of sedge meadow and marsh with moderate vegetation quality. The most interesting result of this survey were the maximum numbers of 7 of the 10 wetland remnant species: Dion skipper 32; Black dash 35; Mulberry wing 29; Broad winged skipper 17; Baltimore checkerspot 55; Great spangled fritillary 17; Northern eyed brown 80. More wetland remnant species probably would have been discovered had the survey been extended weekly through August and started earlier in June. The Xr value for this survey was 2.34 and 73% of all individuals were wetland-restricted or -associated. The latter value is 20% points higher than Turner Lake, the best ratio of this type in the 2007 study, and twice or more the number in even the other larger 2007 wetlands. The butterfly community results at Pratts-Wayne could be due to the weekly frequency of the study. Certainly it is not due to size or amount of bordering edge habitat. The wetland has been burned, but frequency and intensity are unknown. Perhaps 2001 was a "good year" for butterflies in most wetlands. A comparative study of this site and the IDNR wetlands should be conducted with the same survey frequency over a period of several years to determine the cause of contradictions between these studies.

In 2001 and 2003, the east half of West Chicago Prairie was surveyed by Schennum (2001 and 2003). The former study was conducted 7 times, from June 17 to August 4). The latter study was conducted 7 times between June 22 and August 10. This part of West Chicago Prairie supports primarily a wetland butterfly community. The plant communities are a mosaic of wet to mesic prairie, sedge meadow and basin marsh. The area is very large and contiguous to an area of equal size and community mixture, but with more mesic prairie. The summary results are as follows: 2001 – 13 wetland-remnant butterflies out of 40, Xr = 2.82, 52% of total individual wetland-remnant; 2003 – 9 wetland remnant butterflies out of 27, Xr = 2.90, 65% of total individuals wetland remnant. A comparison between years shows a significant decrease in total species richness in 2003 and a similarly significant increase in the number of wetland-remnant individuals in 2003. Compared to IDNR wetland results from 2007, wetland-remnant species totals are similar to but typically higher at West Chicago in both years. Only Turner Lake has a % wetland-remnant species like West Chicago Prairie in 2001, but in 2003 West Chicago Prairie has a much higher value (65%) for this variable. (Note that West Chicago Prairie showed higher numbers for some skippers, coppers, and especially Northern eyed browns.) Key differences between West Chicago Prairie and IDNR's comparably large wetlands (Turner Lake, Willow Marsh, Pike Marsh) are the higher sampling frequencies and higher natural community diversity at West Chicago Prairie. Again, higher survey frequencies are more apt to find higher peak numbers for some species. The presence of prairie communities only at West Chicago adds not only new species which use both prairie and wetland, but also a higher number of adult nectar sources for wetland butterflies. Hence the upper Fox River Valley wetlands' diverse butterfly fauna is limited by the almost total lack of wet to wet mesic prairie borders or inclusions. This means that improving the Fox River valley sites' wetland butterfly communities may require the restoration of such prairies adjacent to the wetlands and the reintroduction of lowland prairie butterflies and adult food plants. The presence of prairie-like fen communities in the large wetlands is obviously not a substitute for lowland prairie.

McHenry County wetlands, other than those in the 2007 IDNR study, are closer to, and ecologically more similar to, the IDNR sites. They have little if any wet prairie and are primarily fen-sedge meadow-marsh complexes. One site sampled regularly for butterflies from May to September, is a 20-acre sedge meadow-marsh-restored wet prairie at Cotton Creek Marsh Nature Preserve. Steward Mike Bouska has been volunteer steward and aggressive restorationist there for 10 years. In 2007, he found 16 wetland-restricted or –associated butterflies (Taron and Manner 2007), though not in large numbers because of the site's relatively small size. Nevertheless, the high survey frequency and presence of remnant restored wet prairie enables it have a higher number of wetland-remnant species than the 2007 records for the 7 IDNR

wetlands. Schennum and Collins (2003) accumulated an encyclopedia of wetland butterfly data from 1987 to 2002. Compared to the IDNR wetlands, the MCCD ecologists found relatively more wetland-remnant skippers, especially the Black dash and Mulberry wing; a larger incidence of coppers, but similarly in low numbers; a similar lack of Acadian hairstreaks; an equal low frequency and number of Silver-bordered fritillaries; similarly large and frequent colonies of Baltimore checkerspots and Great spangled fritillaries; much higher numbers of Eyed browns and Common wood nymphs; similar Xr and Sr values. With some exceptions, MCCD site wetland butterfly communities are quite similar to those in the 2007 IDNR wetlands. Both wetland groups were sampled 4 times per season from late June to late July. Both have very similar natural communities and size ranges. However, some MCCD wetlands have small disturbed wet to wet mesic prairie remnants in them and all of them have been sampled for 15 years, not 1. The latter could account for the few differences noted. It would seem prudent then to continue annual censuses of butterflies along the same routes at all 7 wetlands for several years. This might lead to higher counts of skippers and eyed browns, and more frequent colonies of coppers. As mentioned already, more frequent censuses and an early June to late August sample season would improve the results at MCCD and IDNR wetlands. Differences between sites will then be caused by real ecological differences in size and wetland community diversity. The absence of necessary prairie community components can be compensated for by lowland and even upland prairie restoration, both plants and insects.

A number of wetland-restricted or –associated butterflies were not observed at all and are rarely, if ever, reported by the Butterfly Network (Taron and Manner 2007) or are just observed by others who know the region's Lepidoptera. Some of these are endangered (Swamp metalmark) or apparently extirpated (Harris' checkerspot, Powesheik skipper). Others are at least present and should be searched for, reared in captivity, and reintroduced to 6 of the 7 IDNR sites studied (omitting Pistakee Meadow for now because of its early state of restoration.) These are the Acadian hairstreak and Purplish copper (shown in earlier photos) and the 4 species presented below: Meadow fritillary, Aphrodite, Silvery checkerspot, and Great copper).

Great copper

Silvery checkerspot

Aphrodite

Meadow fritillary

The Great copper was noted at West Chicago Prairie by Panzer and Stillwaugh (1982) and observed by Schennum and Collins (2003) in the late 1980's at Parker Fen Nature Preserve in Bull Valley and the HUM Prairies (East), both sites in McHenry County. This is a species of marsh edges. The Silvery checkerspot has been reported in June in very small numbers at several wetlands scattered about the Chicago region, including some McHenry County fens (Taron and Manner 2007). The species may reach its peak in early to mid-June and has been observed as larvae on False sunflower (*Heliopsis helianthoides*) at the Harvard Railroad Savanna in the early 1990's. This species may prefer wet savanna and prairie. The Aphrodite is a large fritillary observed in one moderate quality wet prairie-sedge meadow in Glacial Park (Schennum and Collins 2003) as only a few males. It is reported in large colonies in moist prairie and/or sedge meadow at Markham Prairie (Taron and Manner, from Panzer, 2007), Illinois Beach State Park (Schennum pers. obs. 2005), and Chiwaukee Prairie (Collins and Schennum 1985). This species may be associated more with lowland prairie than sedge meadow, given the lack of records for it in the myriad numbers of sedge meadows in the northern part of the Chicago region. Finally, the Meadow fritillary was reported from Pleasant Valley in McHenry County in 2001 (Schennum pers. obs.), a few BCN sites (Taron and Manner 2007), and, perhaps, at Markham Prairie Nature Preserve (Panzer, pers. comm., Taron and Manner 2007).

This butterfly is a sedge meadow species in this region, but is more common northward. The reintroduction of these four species to at least the larger of the 7 IDNR sites will be a challenge because it will require more life history research, wet prairie restoration, and location of suitable donor populations. This should be done to produce a more diverse and typical butterfly fauna at these sites.

Volunteer Monitors

Five of 10 recruited volunteer butterfly monitors could serve as future citizen scientists in the IDNR effort to track species richness. All wetlands have a monitor except Lake Defiance in Moraine Hills State Park, and a new person should be recruited for this site for the 2008 season. The five established volunteers will cover the other 6 sites, with one person doing both sites at Volo (Pistakee) Bog. If any of the established volunteers are no longer available, reliable substitutes should be recruited in spring of 2008, leaving time for the same indoor class orientation and distribution of hand-out materials, and the same training session repeated as presented in early May of 2007.

Two entities could supply the indoor training and field identification personnel, representatives from the Butterfly Monitoring Network and/or the Heritage Biologists from IDNR. Any other entities would probably have to be paid consultants. The emphasis of future volunteer field training should be on identification of the wetland-restricted skippers, which are very important in assessing composition and quality of the butterfly community. While there are only 5 or 6 of them, they are very difficult to identify on the wing and even at rest at some distance away. Habitat and behavioral characteristics should be included in the training because they are relatively easy to learn for these small non-descript butterflies. Inability to identify many skippers in the field may be responsible for the low counts for these species in 2007. In 2008 each site volunteer should be accompanied in the field by a well-trained volunteer or other experienced person, since the single year of training is insufficient. This manner of collecting data should be repeated annually for each volunteer until they are confident butterfly monitors. It is important that data be gathered and reported to the BMN and IDNR annually (or biennially) in order to search for trends which can be related to weather patterns, plant community types and diversity, and natural area management activities. If this monitoring plan becomes successful, it is recommended that other IDNR wetlands be added, including selected wetlands at Illinois Beach State Park, the tamarack bogs (fens) in Pistakee and Volo Bogs, the marshes and sedge meadows and leatherleaf bog on the west side of Moraine Hills State Park and Mud Lake at Chain O' Lakes State Park. Consultation with IDNR biologists could provide other significant sites.

Swamp Metalmark

The state endangered Swamp metalmark (*Calephelis muticum*) (IESPB 1999) was not observed at any of the 7 wetlands in 2007, despite intensive efforts to find it. This butterfly is very small (1-1.5 inches) with an orange-brown dorsal surface sprinkled with black spots and lines (Ebner 1970, Bouseman and Sternburg 2001) (see photo below.)

Swamp metalmark

This rare butterfly is restricted to fens (rare and restricted communities) and some calcareous sedge meadows where its sole larval food plant, Swamp thistle occurs (Ebner 1970, Keuhn 1983, Bouseman and Sternburg 2001, Glassberg 1999). Its behavior further limits this species ecologically. Adults fly during the period from late July to early August and fly slowly close to the ground, staying near the larval food plant, or alighting on nearby sedges and grasses, while larvae feed mostly on basal leaves of Swamp thistle (Bouseman and Sternburg, Ebner 1970). It is very local and colonial and known from only a few wetlands in Midwestern states, including southeast Wisconsin, extreme southern, lower Michigan, northeast Indiana, and a few fens in the southeastern Ozarks of Missouri (Glassberg 1999). There are two Wisconsin locations near Illinois in Waukesha and Walworth Counties (Kuehn 1983). Irwin and Downey (1973) cite a location in Elgin, Illinois. Given the suitable habitat and former location, Taron (pers. com.) has successfully reintroduced the metalmark to Bluff Spring Fen in Elgin.

In the 2007 IDNR study, all 7 sites have populations of Swamp thistle, and 4 have fen communities. They were selected in part because such areas had a high probability of supporting Swamp metalmark populations. A number of factors could be responsible for their absence. In 2007, the adult metalmark may

have been active in the last week of July instead of the first week of August, especially if it is very short-lived, like the endangered Karner blue. The Swamp metalmark may be misidentified as the Pearl crescent, which is very similar in size, flight behavior, and flight period (Bouseman and Sternburg 2001). In any case, all 7 wetlands studied here, and other wetlands with fens in northeast Illinois, should be searched for this butterfly for the next several years. Specific searches for this butterfly should be conducted daily throughout late July and early August, as has been done for the Karner blue at Illinois Beach State Park. Since the reintroduction of the metalmark has been successful at Bluff Spring Fen Nature Preserve, similar attempts to reintroduce and closely monitor this elusive butterfly at release sites in the fens of the IDNR wetlands should be undertaken, provided suitable sample colonies can be located. Assistance in such an effort should be sought from Doug Taron and the Butterfly Monitoring Network.

CONCLUSION

The 2007 butterfly survey of 7 wetlands on 3 large IDNR properties proved that several species restricted or frequently associated with wetland communities are present. Populations of some species appear to be in sufficient numbers to be viable in at least the short term. Examples are the Baltimore checkerspot, Northern eyed brown, Common wood nymph, and Great spangled fritillary. Other species, such as 4 of the 5 wetland skippers, Purplish and Bronze coppers, Acadian hairstreak, and Silver-bordered fritillary, have low sample numbers at all wetlands. The skippers apparently have enough space, adult nectar sources, and larval food plants to thrive. The latter four species often have low numbers at other well-studied wetlands in the Chicago region. Their seasonal adult flight periods may lie outside the current sample window for these species; the necessary parameters for living (mentioned above) may be in insufficient quantities to support larger populations; the species were overlooked on the survey because of cryptic behaviors or very fast flights without landing; they require adjacent prairie habitat resources, such as preferred nectar plants, to live and reproduce. More exacerbating is the absence of 10 species restricted or heavily dependent on wetland resources, three of which are now extirpated in Illinois, and 7 of which are rare in the Chicago Region. The species richness (Sr) of the wetlands is definitely related to wetland size. Pike Marsh, Willow Marsh, and Turner Lake rank highest with 8 to 10 wetland-restricted and –associated butterflies. These three sites also have the best quality, with all having remnant-associated (Xr) values around 2.40 (except anomaly at Pistakee Meadow). Only the largest wetland, Turner Lake, has a relatively high number of individuals of wetland-remnant species at 53 %, but even this is lower than expected given its extensive and diverse set of wetland communities.

Volunteer monitor participation was somewhat less than expected, especially in the field, since 9 of 10 signed up and attended the orientation meeting. However, to the project's credit, the 5 who stayed with the entire program contributed much to the data collection. They are likely to become butterfly monitors, at least in the short term. Identification skills probably need to be honed both indoors and in the field.

The complete absence of Swamp metalmarks is a puzzle. All seven sites harbor the larval food plant in good numbers and all have a seemingly sufficient acreage of graminoid fen or calcareous sedge meadow. The species has been located at nearby Wisconsin wetlands. It is either extremely susceptible to slight environmental changes or is very difficult to see in the field. Further intense searches at the 7 wetlands here and elsewhere should find this species. Northeast Illinois has the highest quality suitable fen habitat in the state.

Following is a summary of management and inventory recommendations that should improve the species richness, composition, and quality of the wetlands surveyed in this study.

- Conduct only partial burns in wetlands supporting at least a moderate diversity of wetland-restricted and -associated butterflies.
- Conduct prescribed burning under somewhat humid and lower temperature conditions.
- Clear brush and thin trees on land adjacent to the wetlands to recreate savannas or prairies there.
- Burn on a three to four year return cycle.
- Restore mesic wet and mesic prairie communities adjacent to the wetlands.
- Reintroduce or augment populations of rarer butterfly species, given suitable donor populations.
- Conduct annual surveys at all quality wetlands.
- Extend survey season, starting in mid-May and ending in late-August.
- Conduct surveys on a weekly basis.
- Continue to recruit, train, and use volunteer butterfly monitors.
- Use professionals or experienced volunteers to assist with monitoring.
- Establish a close relationship with the Butterfly Monitoring Network and submit and share data with it.
- Analyze data every 5 years to uncover trends and fluctuations in butterfly species numbers.

- Establish a feedback loop between monitors and managers to ensure the best possible program for maintaining and/or increasing wetland-restricted and -associated butterflies.
- Develop a "search and rescue" plan for the Swamp metalmark, involving Doug Taron, Ron Panzer, INHS and Wisconsin lepidopterists, northeast Illinois DNR heritage biologists, and the Illinois Endangered Species Protection Board.

ACKNOWLEDGEMENTS

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The field collection and training of the volunteers was done by Mike Bouska, volunteer steward and butterfly monitor for Cotton Creek Marsh Nature Preserve for 10 years, and junior author for this project. Wayne Schennum was forced to withdraw from the field sessions because of hip replacement surgery and recovery. His contribution was organization of the program, pre-field training, and this report.

Regal fritillary (saved from the brink of extinction)

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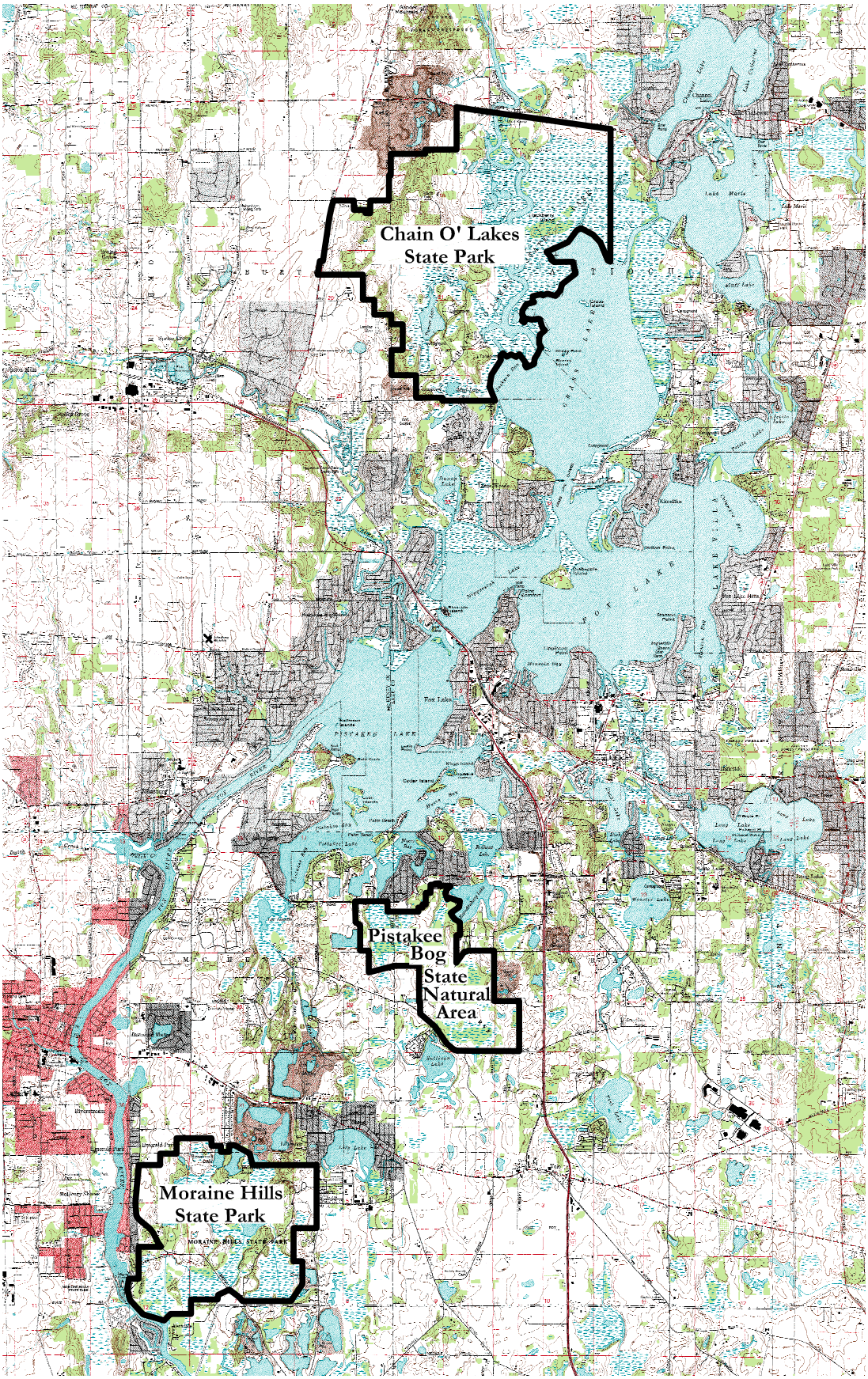

EXHIBIT 1

SITE LOCATION

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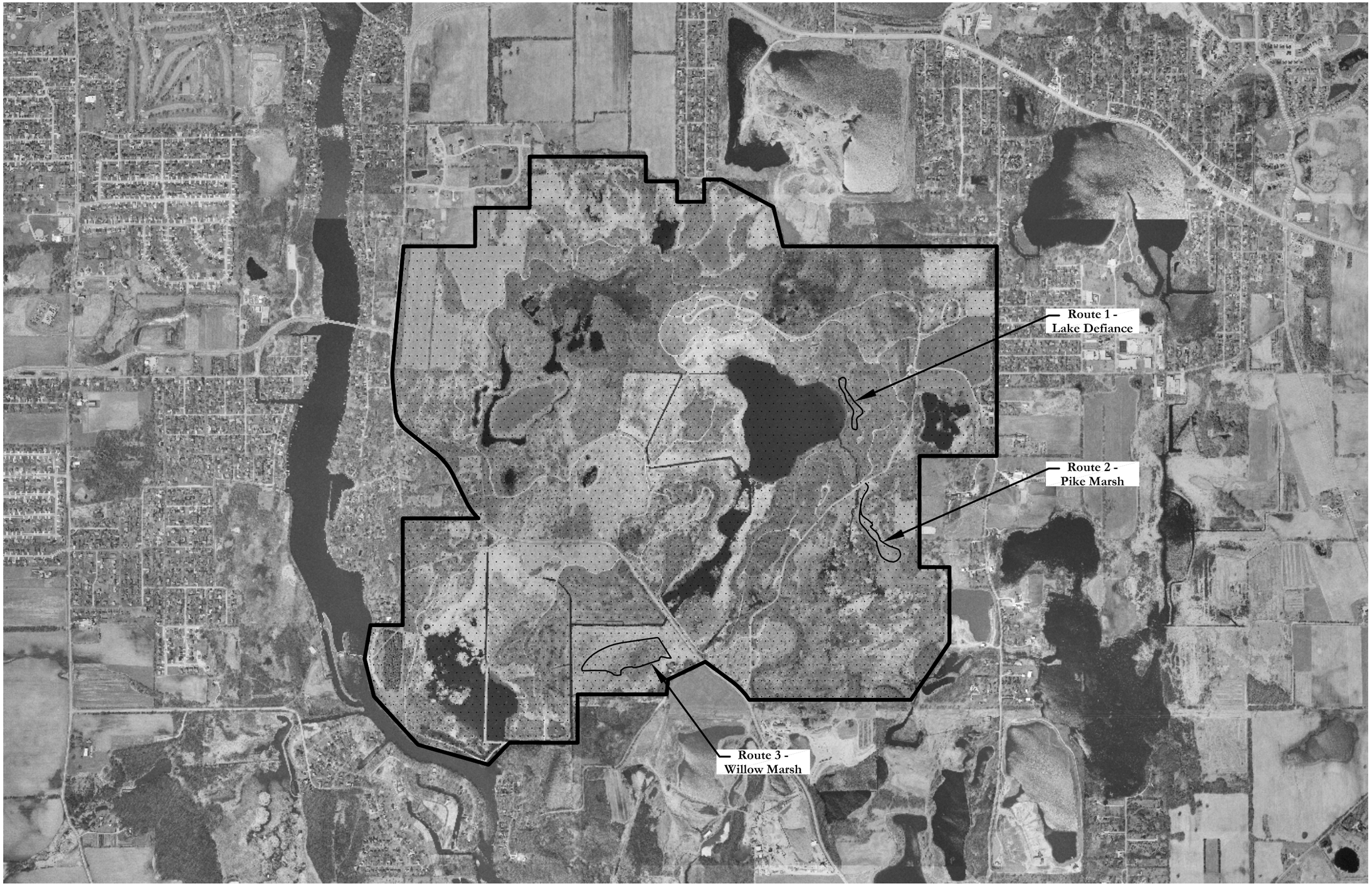

EXHIBIT 2A

MORAINE HILLS STATE PARK BOUNDARY ON AERIAL PHOTOGRAPH

DATE OF PHOTO: 2001

SCALE: 1" = 1500'

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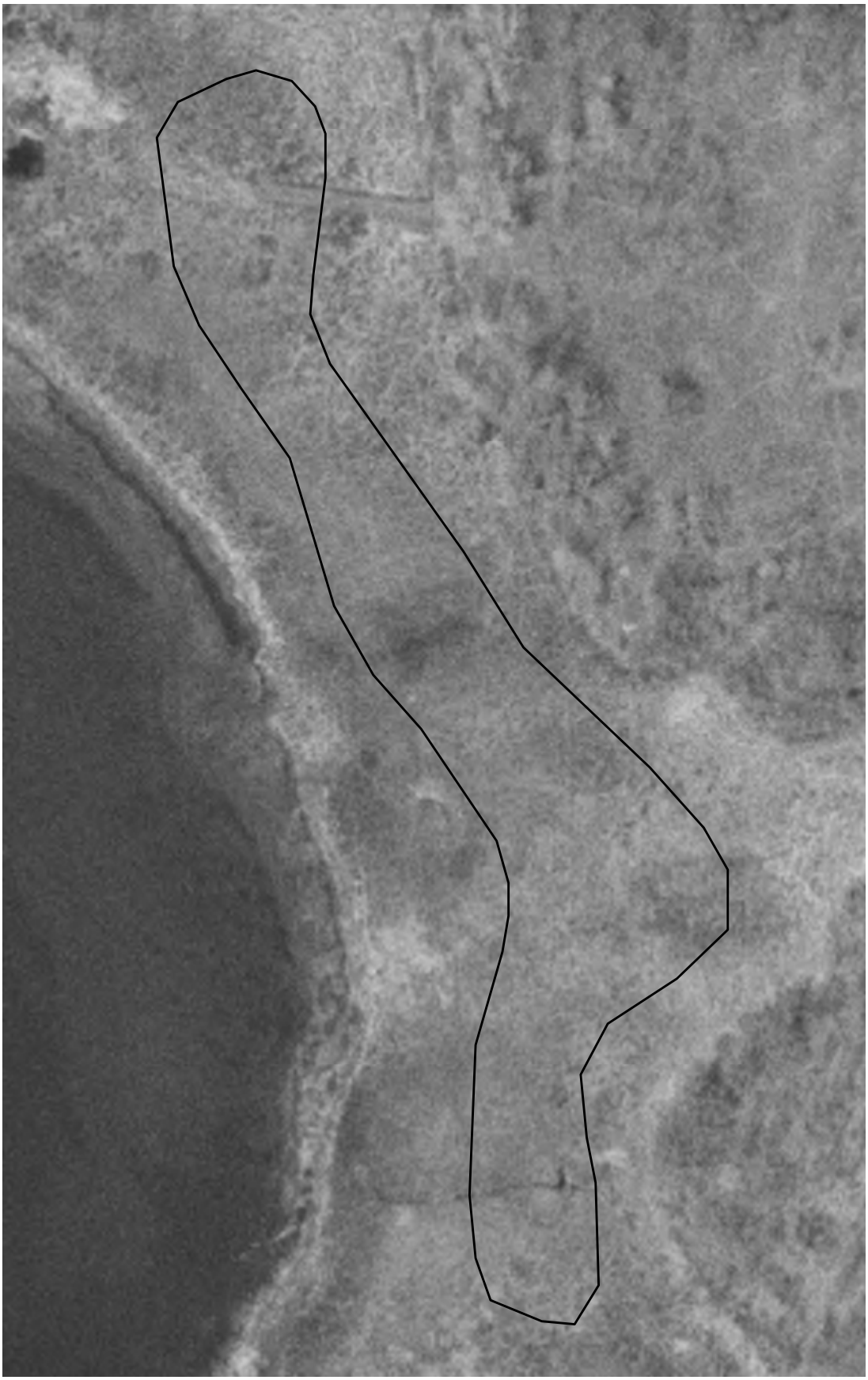

EXHIBIT 2A - 1

MORAINE HILLS
STATE PARK

ROUTE 1 -
LAKE DEFIANCE

SCALE:
1" = 100'

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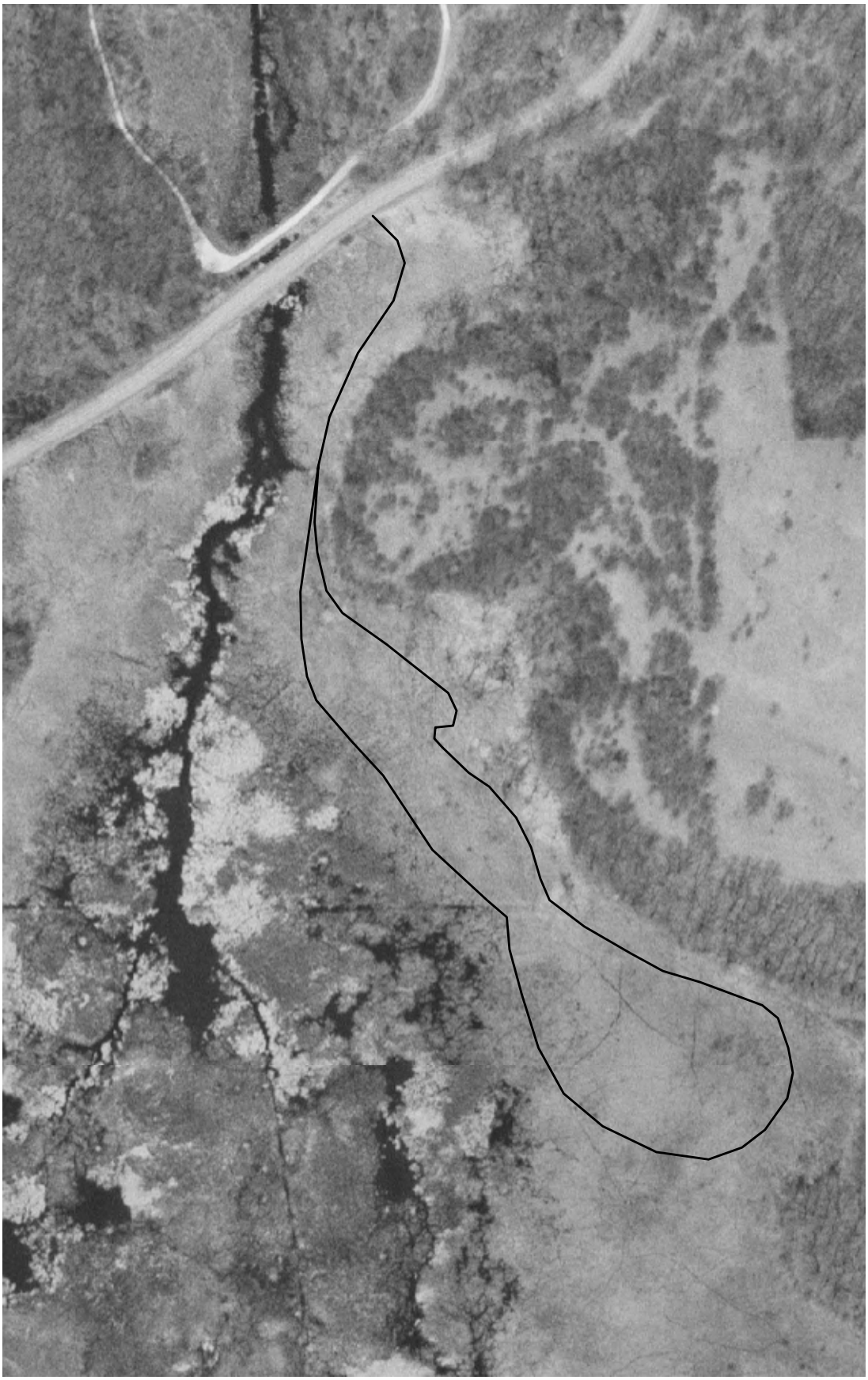

EXHIBIT 2A - 2

MORAINE HILLS
STATE PARK

ROUTE 2 -
PIKE MARSH

SCALE:
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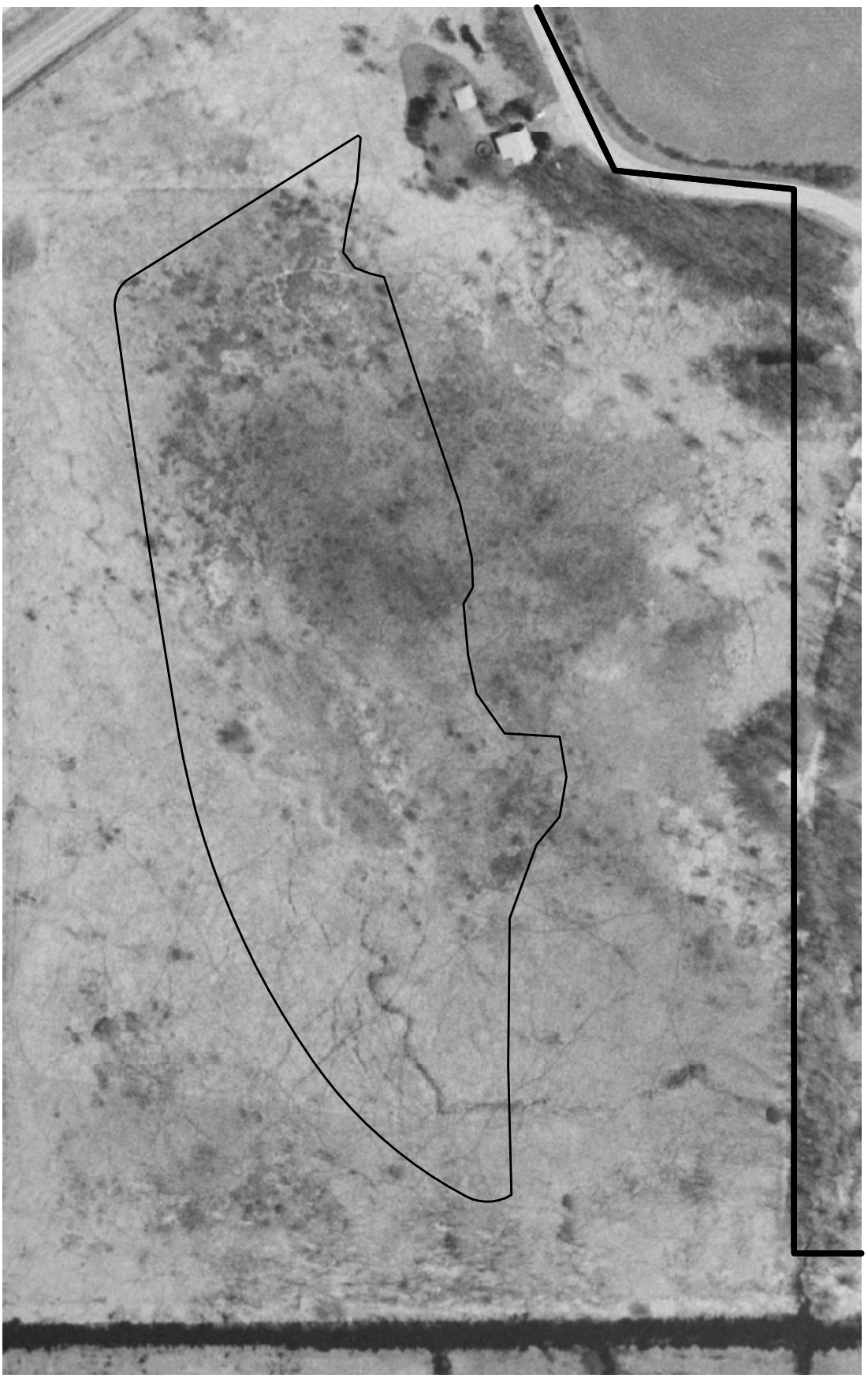

EXHIBIT 2A - 3

MORAINE HILLS
STATE PARK

ROUTE 3 -
WILLOW MARSH

SCALE:
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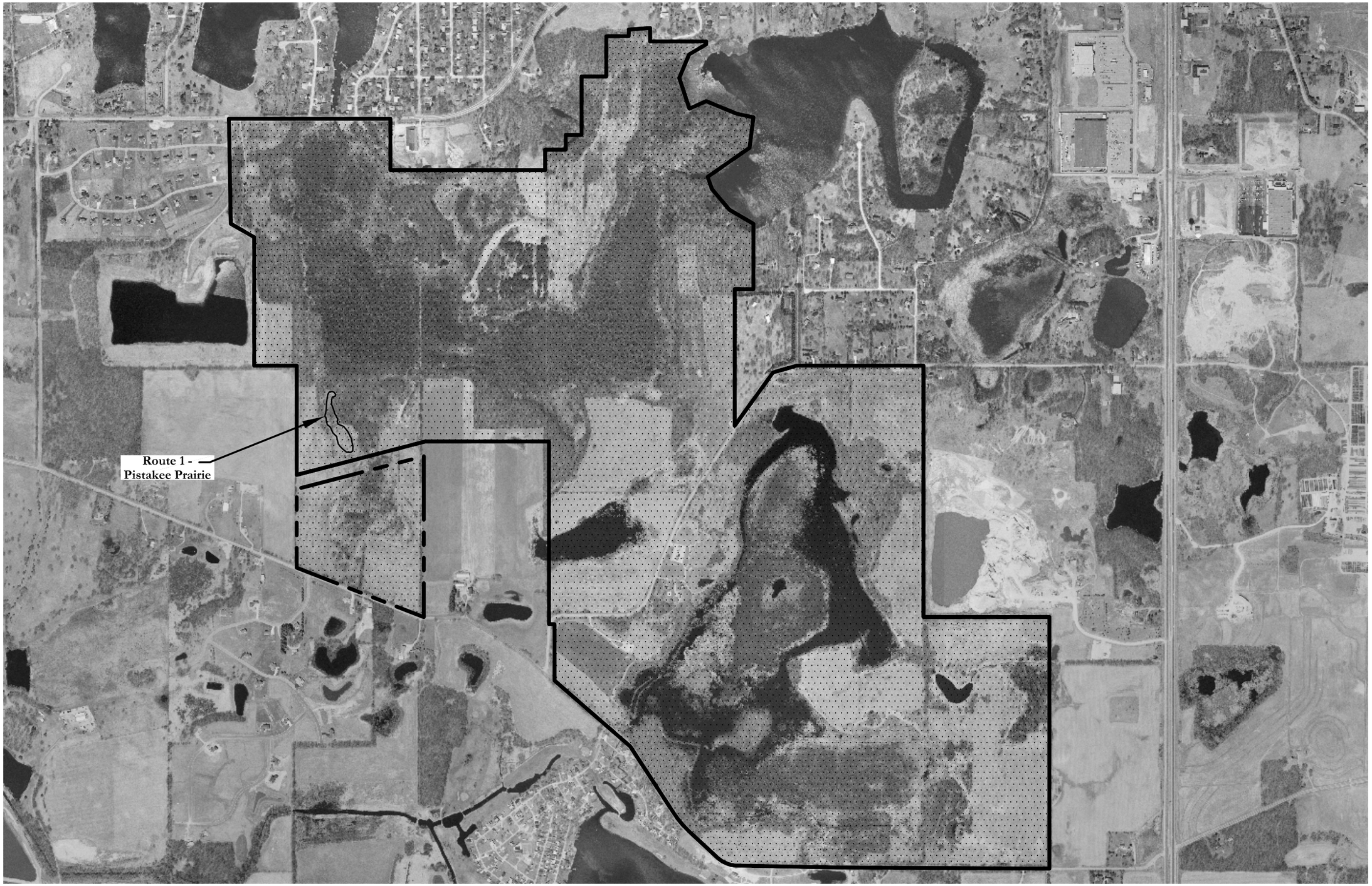

EXHIBIT 2B

PISTAKEE BOG STATE NATURAL AREA BOUNDARY ON AERIAL PHOTOGRAPH

DATE OF PHOTO: 2001

SCALE: 1" = 1000'

N

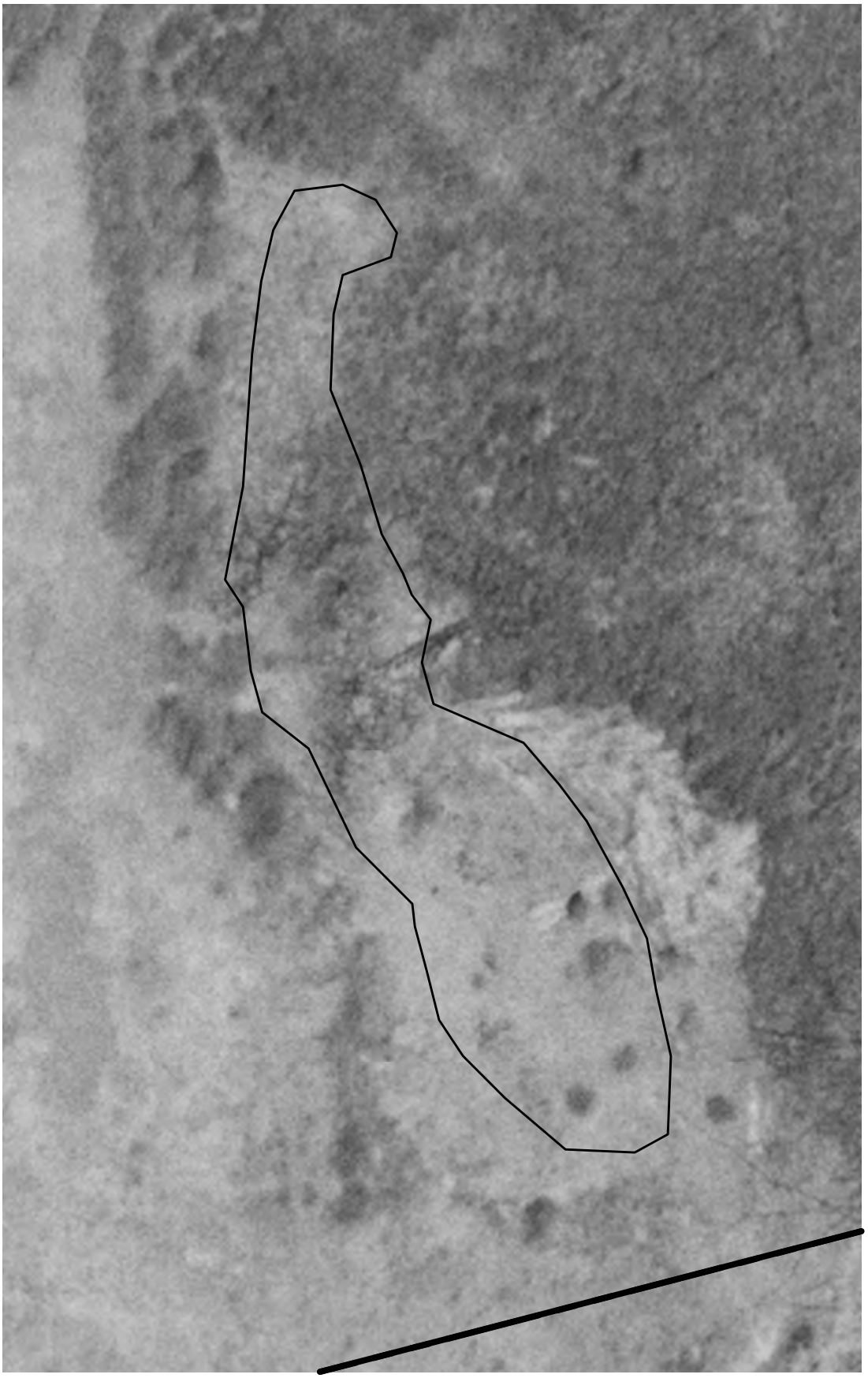

EXHIBIT 2B - 1

PISTAKEE BOG
STATE NATURAL
AREA

ROUTE 1 -
PISTAKEE PRAIRIE

SCALE:
1" = 100'

N

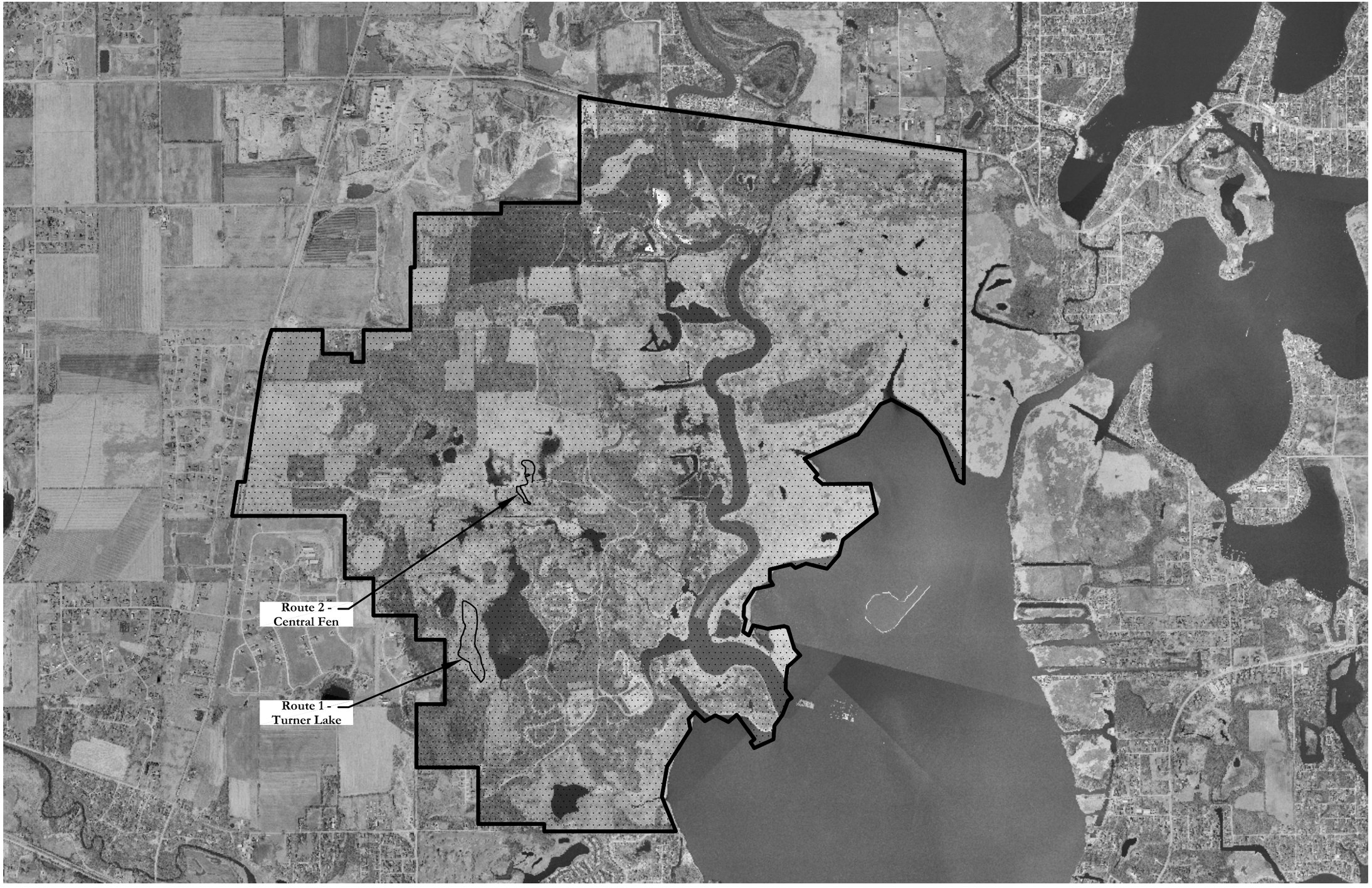

EXHIBIT 2C

CHAIN O' LAKES STATE PARK BOUNDARY ON AERIAL PHOTOGRAPH

DATE OF PHOTO: 2001

SCALE: 1" = 2000'

N

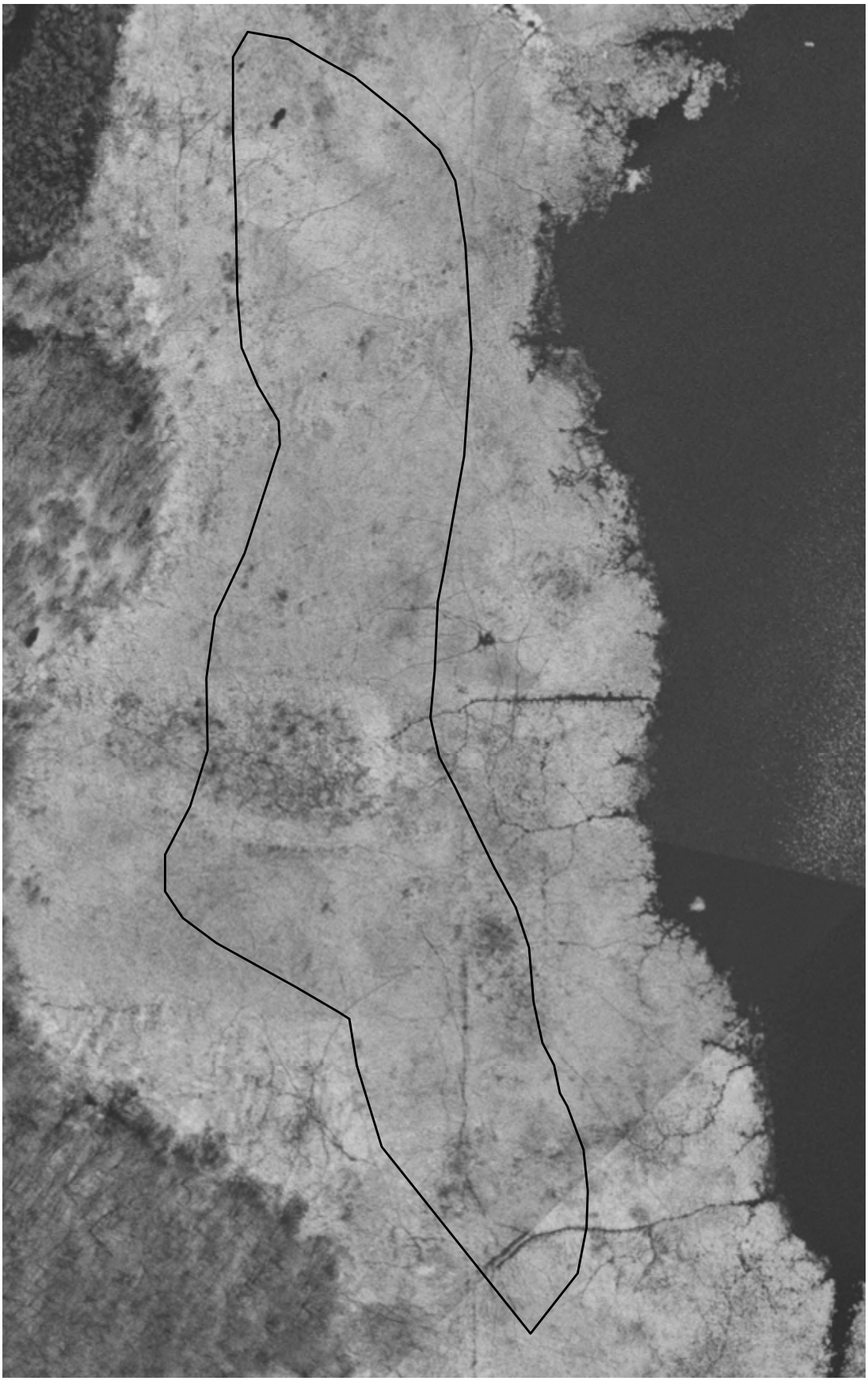

EXHIBIT 2C - 1

CHAIN O' LAKES
STATE PARK

ROUTE 1 -
TURNER LAKE

SCALE:
1" = 200'

N

EXHIBIT 2C - 2

CHAIN O' LAKES
STATE PARK

ROUTE 2 -
CENTRAL FEN

SCALE:
1" = 100'

N