

Contributions to a Macrolepidoptera Biodiversity Inventory of the Kettle Moraine Fen and Low Prairie State Natural Area in Waukesha County, Wisconsin

Hugo L. Kons Jr.

2001 DRAFT
Last Update: 2011

Abstract

Two hundred twenty-two species of Macrolepidoptera were collected at the Kettle Moraine Fen and Low Prairie State Natural Area in Waukesha, County, Wisconsin from July to September during 1992 to 1994. Species records by date, area, habitat, and survey method are presented. Most surveys were strictly diurnal. However, all night surveys were conducted on two 1994 September dates with a UV sheet, and on 28 July 1993 with a UV trap and bait trap. Species accounts based upon observations at the site are presented for all of the diurnal species reported and some of the nocturnal species. Several species recorded are candidates for prairie remnant dependency in Wisconsin, including *Oarisma powesheik*, *Hydraecia immanis*, *Papaipema silphii*, *Papaipema beeriana*, *Papaipema sciata*, and *Tricholita notata*. A list of potentially wetland dependent species recorded from the site is also provided.

Introduction

The Kettle Moraine Fen and Low Prairie (KMFLP) is a Wisconsin State Natural Area, an area managed by the Wisconsin Department of Natural Resources (DNR) that is supposed to exist for the preservation of natural communities and scientific research. It is located in southeastern Waukesha County within the Southern Kettle Moraine State Forest. A variety of habitat types are present, the approximate locations of which are indicated in Figure 1. This report includes Lepidoptera records collected from Highway 67 west to the western border of the SNA (just beyond the western edge of an oak forest), north to the Scuppernong River, and south as far as a heavily wooded ditch south of Stark Lane (Figure 1: Area A). Some of the old field and forested patches along Stark Lane just east of Highway 67 are east of the eastern boundary of the State Natural Area.

The most notable habitat is an area of native prairie remnant. Much of the prairie is low and hydric and interspersed with patches of calcareous fen and sedge meadow (Figure 1: Area B). This habitat occurs north of Stark Lane and west of an area of mesic to semi xeric oak forest (Figure 1: Area F). More mesic to semi xeric areas of prairie occur south of Stark Lane and the oak forest (Figure 1: Area C), and also north and northeast of the oak forest. Between highway 67 and the prairie areas the landscape is old field (Figure 1: Area G) interspersed with patches of hardwood forest (including Figure 1: Area E) and shrubby willow dominated wetlands.

From 1992-1994, and to a lesser extent prior to this, I conducted Lepidoptera surveys in the Southern Kettle Moraine State Forest at a variety of locations and habitats, in collaboration with my colleagues Robert Borth and Tom Barina. From our cumulative efforts we recorded 744 species of Macrolepidoptera from all Southern Kettle Moraine sites combined, although coverage of all of the individual sites was spotty and incomplete. The vast majority of this survey data was obtained from mid July-September. The spring-early summer and adult overwintering Lepidoptera fauna of the Southern Kettle Moraine remains extremely poorly known, but additional survey is badly needed at all sites at all times of year to develop a more comprehensive historical base line of the Lepidoptera species present at each site.

Between December 1992 and April 1995 I submitted four unpublished reports covering Lepidoptera surveys at this site to the WI DNR's Bureau of Endangered Resources and the Southern Kettle Moraine State Forest Headquarters, including "*Southeast Wisconsin Survey for Wetland Associated Butterflies*" (Dec. 1992), "*Southeast Wisconsin 1993 Moth Surveys*" (March 1994), "*1993 Butterfly*

Surveys in Southeast Wisconsin" (January 1995), and "*1994 Lepidoptera Surveys in Wisconsin*" (April 1995). The purpose of this paper is to publish a synthesis of the information on this site that was formerly only available in these unpublished reports, plus add some records for material that was determined after these reports were written or inadvertently omitted from them.

Despite these contributions, my research on this and all WI State Natural Areas was terminated in 1995 by an employee of the Wisconsin DNR. He declined to renew the State Natural Areas permit I had conducted research under from 1992-1994, and instead imposed new restrictions on specimen depositing and reporting of donations. As a personal collection based researcher who only could occasionally visit Wisconsin institutional collections, conducting Lepidoptera surveys in compliance with the new rules was a complete impossibility.

In order to even evaluate if the natural features of a site are being preserved, a base line of historical inventory data on the species that occur there must be compiled and updated regularly. This is especially urgent in early successional remnant habitats that require active management to maintain an early successional state, and where the impact of excessive use of controlled burns on Lepidoptera has been a major conservation concern (see Borth and Barina (1991) for a published example). Positions for Lepidopterists in institutional collections are very limited, and a large portion of the information on Lepidoptera distribution, flight season, habitat affiliation, and site check lists has been contributed by personal collection based researchers, both in Wisconsin and more broadly in North America. Claims of management for conservation purposes are not credible when policies are instated which prevent critical biodiversity inventory contributions.

Materials and Methods

Habitat coverage, approximate survey locations, survey method employed, and notes on weather conditions on each date are presented in Table 1. Global Positioning Coordinates were estimated from Google Earth and field notes. Surveys were primarily conducted with diurnal netting, but two all night UV Sheet, one UV Trap, and one bait trap sample were also obtained. The UV sheet contained a 22 watt circuline BL UV light on one side and a 15 watt BL UV light tube on the other side, both purchased from BioQuip Products. The light trap had the same 15 watt BL UV light, and is the same design described in Kons and Borth (2006). The bait trap was the type P inverted cone variety described in Kons and Borth (2006), and baited with rotten bananas.

To the best of my ability at the time, I collected a minimum of one voucher specimen of each Macrolepidoptera species I encountered on each survey date and each nocturnal survey station, with the exception of *Oarisma powesheik*. For diurnal surveys, I noted the habitat types and areas where species and specimens were encountered with field notes.

Voucher specimens of all species recorded from this site are currently housed in my research collection in Appleton, Wisconsin, with the exception of *Oarisma powesheik* and *Papaipema silphii*. Voucher specimens of *O. powesheik*, *P. silphii*, and duplicates of some of the other species have been donated to the Milwaukee Public Museum.

Results

A check list for 222 species of Macrolepidoptera recorded from the KFLP is presented in Table 2. Table 2 also includes what species were collected on each date, in what habitat, and by what method (diurnal survey, UV sheet, UV trap, or bait trap).

Discussion

The number of species recorded is undoubtedly a small fraction of those that were present during the times survey was conducted with respect to the nocturnal species, as nocturnal survey effort was minimal and one of the three survey dates had cold weather with low moth activity. Some nocturnal

species were only recorded because they were flushed out during the day. I expect the Rhopalocera (butterfly) check list to be a better representation of the species actually present at these times. However, some additional butterfly species were likely present but not encountered, based on comparisons with similar habitats at other Southern Kettle Moraine sites during the same seasons. Species with a flight season before mid July or after late September are entirely undocumented, as no surveys were conducted during these times. The drier mesic prairie south of the oak forest has not been investigated for nocturnal species at all.

Habitat Specialists

Hypotheses of habitat dependency for Wisconsin Lepidoptera are based on a data set of 13,390 unique distributional records from site checklists for in excess of 80,000 specimens collected by the author, Robert Borth, and Thomas Barina. [Cite a WI summary paper with an analysis of habitat dependency to be published prior to or concurrently with this paper]. These surveys were conducted primarily from 1989-1995 (with more limited survey before and after this interval) and include data from a wide variety of habitat types at localities throughout the state. The majority of Wisconsin Lepidoptera species are hypothesized to be habitat generalists, species recorded from a variety of different habitats with likely resident populations in multiple habitat types. A smaller number of species have been found exclusively or primarily (minus a few individuals presumed to be dispersers) where particular types of habitats occur.

The majority of Lepidoptera species recorded from the KFLP and any other site I have surveyed in Wisconsin are habitat generalists-species which occur as probable residents in a variety of different habitat types. The habitat specialists recorded from the KFLP are primarily wetland dependent species, some of which occur in multiple types of wetlands, some which appear to be sedge meadow dependent, and a few of which may be wet prairie dependent. All of these species are in the families Hesperidae or Noctuidae and all are treated in the species accounts below. *Polites origines* has been primarily found at dry-mesic prairie sites, although the single individual collected at KFLP was in old field, and there are other Southern Kettle Moraine records from old fields. *Hydraecia immanis* and *Tricholita notata* are good candidates for prairie dependency, and are among the few potentially prairie dependent species that I have found in both xeric sand prairie and wet prairie. Some butterfly species were exclusively found in association with patches of forest within the KFLP study area, as noted below. Numerous KFLP species have hardwoods or oaks as larval hosts but they occur at some sites where their host trees are present but forest is not. Numerous other KFLP species are dependent on grasslands and/or open habitats but are not particular to prairie remnants.

KFLP species hypothesized to be wetland dependent in WI include: *Ancyloxpha numitor*, *Oarisma powesheik*, *Poanes massasoit*, *Poanes viator*, *Euphyes conspicua*, *Euphyes bimacula*, *Satyrium acadicum*, *Euphydryas phaeton*, *Clossiana selene*, *Satyroides eurydice*, *Macrochilo absorptalis*, *Macrochilo bivittata*, *Phalaenostola hanhami*, *Hypenodes caducus*, *Luperina stipata*, *Eremobina jocasta*, *Lemmeria digitalis*, *Papaipema cataphracta*, *Papaipema impecuniosa*, *Papaipema lysimachiae*, *Papaipema inquaesita*, *Papaipema nephelptena*, *Papaipema silphii*, *Papaipema maritima*, *Papaipema eupatori*, *Papaipema sciata*, *Papaipema beeriana*, *Papaipema unimoda*, *Papaipema near unimoda*, *Xanthia togata*, *Hillia iris*, *Sutyna* species, *Leucania linita*, and *Agrotis gladiaria*. Of these species, the candidates for sedge meadow dependency include: *P. massasoit*, *P. viator*, *E. conspicua*, *E. bimacula*, *S. eurydice*, *E. jocasta*, *L. digitalis*, *P. cataphracta*, *P. impecuniosa*, *P. nephelptena*, *P. eupatori*, *Hillia iris*, *Leucania linita*, and *Agrotis gladiaria*. The species potentially dependent on wet or wet-mesic prairie include *O. powesheik*, *P. silphii*, *P. beeriana*, and *P. near unimoda*. There are additional phenotypes of uncertain taxonomic status in the genera *Papaipema* and *Sutyna* that I have only collected from wet prairies in Wisconsin.

Species Accounts

RHOPALOCERA (BUTTERFLIES)

***Epargyreus clarus*:** This easily recognized widespread habitat generalist was regularly encountered in the prairie and old field habitats, but it was not common at this site on any survey date. On 26 July 1992 10-20 individuals were seen, but 1-10 individuals were seen on the remaining dates it was recorded. It was not encountered during cloudy conditions and was typically seen during periods of sustained clear and sunny conditions, and only one individual was found during the mostly cloudy conditions plaguing 1993 surveys. On 26 July 1992 one individual was observed feeding on a bird dropping on a grape leaf.

***Ancyloxypha numitor*:** This species was plentiful in the wet low prairie and sedge meadow habitats on 29 July 1993. An occasional individual was also seen along Stark Lane and in the old field, particularly in areas with *Melilotus alba*, which this species utilizes for nectar. Most individuals were seen flying low to the ground in the low wetlands. Activity would greatly decrease when conditions became cloudy, but individuals would be flushed up walking through the wetlands. Oddly, this species was not seen at the site during 1992. Scott (1986) reports various genera of grasses as larval hosts.

***Oarisma powesheik*:** This is almost certainly among the most localized and habitat restricted of all the Lepidoptera species found at this site. It was locally common in a small area of wet-mesic low prairie at Scuppernong Prairie State Natural Area (1992-1993), but despite what appears to be more extensive prairie habitat at KFLP few individuals were seen. The area where most individuals were encountered is the wet low prairie east of the oak forest and north of Stark Lane. Seven individuals were seen on 16 July 1992, five in the wet prairie north of Stark Lane and two in the more mesic prairie farther north beyond the oak forest. Seven individuals were seen on 17 July 1992, five in the wet prairie north of Stark Lane, one nectaring on *Melilotus alba* on Stark Lane itself (but immediately adjacent to wet low prairie to the north), and one in the more mesic prairie farther north beyond the oak woods. Six more possible individuals were seen on this date but they were not examined closely enough to make a reliable field determination. All individuals found in 1992 were in areas with plentiful *Silphium terebinthinaceum* (prairie dock) and low grasses and sedges. The distribution of *Silphium terebinthinaceum* north of Stark Lane appeared to approximate the distribution of *O. powesheik* north of the lane, although this is not the host plant (see below).

Fewer individuals were seen in 1993, as was true of butterflies in general due to the paucity of sunny conditions during the survey times. On 2 July one individual was found at about 7:15pm in wet low prairie north of Stark Lane during a brief survey under sunny conditions. During the more extensive survey on 14 July 1993 conditions were often cloudy with scattered brief periods of sun. Three individuals were seen in total, two in the wet low prairie north of Stark Lane, and one west beyond Stark Lane and south of the oak forest, in mesic prairie. Conditions were predominately cloudy during the survey of the prairie habitat south of the oak forest.

The predominate nectar source at Scuppernong was *Rudbeckia hirta* (black eyed susan) which was blooming interspersed among the *Silphium* and low grasses and sedges at both Scuppernong and KFLP. However, in 1992 only one individual was seen nectaring on this plant at KFLP. *Melilotus alba* was also observed as a nectar source at KFLP once. Most individuals seen at KFLP were not observed nectaring.

Oarisma powesheik usually did not fly more than a foot above the ground unless it was disturbed or interacting with other Hesperiid. It was observed flying up in territorial whirl flights after it encountered individuals of *Polites coras*, *Euphyes vestris*, and *Poanes massasoit* while patrolling low over the vegetation. When it lands it is low to the ground but not on the ground, on low vegetation

including grasses, sedges, *Silphium*, and *Rudbeckia* (when nectaring). Even when nectaring on *Melilotus* it was on a bent over stalk near the ground rather than on the taller flowers. I never observed it landing on the tops of shrubs or in trees.

In contrast to the prime habitat at Scuppernong Prairie, *O. powesheik* constituted a very small fraction of the Hesperiid species seen in the areas it was encountered at this site. In the area where *O. powesheik* is concentrated at Scuppernong, all other Hesperiid species are relatively uncommon during the peak of its flight. However, on the other side of Highway N at the Scuppernong site, *O. powesheik* was seldom seen but many individuals of other Hesperiid species were encountered.

My knowledge of the habitats was insufficient to hypothesize why *O. powesheik* was so densely concentrated in a portion of Scuppernong Prairie relative to the areas I found it at KFLP. The two areas have many similar characteristics: low wet-mesic prairie with abundant *Silphium*, *Rudbeckia*, and low grasses and sedges. I encountered habitat which appeared similar at Genesee Prairie-Fen (also Waukesha County) and Chiwaukee Prairie (Kenosha County). These sites have wet prairie associated moth species that also occur at Scuppernong and the Kettle Moraine Fen and Low Prairie, including *Papaipema silphii*, *Papaipema beeriana*, *Papaipema sciata*, *Tricholita notata*, and *Papaipema* nr. *unimoda* (the later not yet recorded from the Genesee site). However, I could not find *O. powesheik* at either during surveys in 1992 and 1993 (Chiwaukee) and 1993 (Genesee site).

I observed *O. powesheik* ovipositing one ovum at a time on a low growing sedge at Scuppernong Prairie (*Carex bauxmii*??). I collected one plant of the sedge containing an ovum but the larva died soon after emerging. Unfortunately I did not make a herbarium voucher of the sedge, which in retrospect was extremely foolish. Scott (1986) reported an oviposition record for Cyperaceae: *Eleocharis elliptica*.

I found another area of potential low prairie habitat in the fall of 1994 (too late to survey for *O. powesheik*) between the railroad tracks and Highway 59 along the south side of the road east of where Highway Z crosses Highway 59. Both *Papaipema silphii* and *P. beeriana* were found in a UV light trap sample on a cold and unfavorable night on 16 September 1994. This area had the characteristic low grasses and sedges with plentiful *Silphium*; the habitat is not extensive but it may not be isolated either due to its proximity to Scuppernong and the KMFLP. It would be interesting to survey it during the flight of *O. powesheik*; I have not done so.

***Thymelicus lineola*:** This is an established Palearctic species (Ebner 1970) that can be locally common in old fields, bogs, and other open habitats (pers. obsv.). In 1993 it was numerous along Stark Lane just west of Hwy 67 and in adjacent old field habitat, but it was not found farther west in the low prairie habitats. It usually flies low to the ground and lands on low vegetation and low growing nectar sources.

***Hylephila phyleus*:** This species is a common and widespread generalist of the gulf states that occurs in Wisconsin as an ephemeral migrant that may establish temporary breeding populations during some seasons, or occur as isolated records of strays. A male and female in fresh condition were collected nectaring on *Aster* on 24 September 1994, in the old field along Stark Lane.

***Polites coras*:** This species was most often encountered in the old field habitats where it utilized blooming thistles for nectar. It also was observed in low numbers in the wet-mesic prairie habitats. Fewer than 10 individuals were seen per day on the survey dates when it was encountered. This species is overall common and widespread in Wisconsin in a variety of open habitats and is often seen in old fields (pers. obsv.).

***Polites origines*:** This species is locally common in dry prairie habitat in Wisconsin but I have seldom encountered it in other habitat types. I found one individual on Stark Lane just west of Hwy 67, but did not find any in the prairie habitats. Another individual was found nearby in a picnic area on Highway 67, also in old field. I am unclear if the occasional specimens I have collected in old fields in the southern Kettle Moraine are dispersers from prairie habitat or if there may be populations associated with old fields. The best site I found for it in the southern Kettle Moraine is xeric sand prairie along railroad tracks

west of Highway S. Scott (1986) reports two grasses as larval hosts: *Tridens flavus* and *Andropogon scoparius*.

***Polites mystic*:** Two worn females were collected in the old Field north of Stark Lane on 16 July 1992. This species was at the extreme end of its flight season when surveys in the Kettle Moraine State forest were conducted, but worn specimens were found in various field, fen, and prairie habitats during mid July surveys of several sites.

***Wallengrenia egeremet*:** This species was encountered in the old field habitat and along the edge of patches of hardwoods. It was common during 1993 surveys but fewer than ten per day were seen during 1992 surveys. This species is common and widespread overall in the southern Kettle Moraine. It was not found in the prairie habitats at KFLP, but was routinely seen in this type of habitat at Scuppernong Prairie.

***Atalopedes campestris*:** This species is a common and widespread generalist of the deep south that occurs in Wisconsin as an ephemeral migrant that may establish temporary breeding populations during some seasons, or occur as isolated records of strays. One male was collected nectaring on *Aster* in the field north of Stark Lane on 17 September 1994.

***Poanes massasoit*:** This is one of the most widespread of the sedge meadow dependent species in southeastern Wisconsin, where I have collected it in sixteen sedge meadow sites. I saw about 20 and 10 individuals in and around sedge meadow and fen habitats north of Stark Lane on 16 and 17 July 1992, and six individuals in the same area under mostly cloudy conditions on 14 July 1993. Individuals disperse out of the sedge meadow and fen habitats into the adjacent low prairie to nectar at flowers. A single individual was found in the old field nectaring on a thistle on 16 July 1992. This species typically flies low over the vegetation and perches on low growing sedges, shrubs, and flowers, but it will fly rapidly higher above the ground when disturbed or engaging in territorial whirl flights with other Hesperiiids. Scott (1986) reports a larval host is *Carex stricta*.

***Poanes viator*:** This is one of the more localized sedge meadow dependent species but it is often common where it is found. However, I found only three individuals in the KFLP, two on 16 July 1992 and one on 29 July 1993. On 16 July 1992 one individual was on Stark Lane near the wet prairie nectaring on a thistle, and the other was in a sedge meadow along the southeastern side of the Scuppernong River. Both individuals were males in very fresh condition. It is possible the core habitat for this species at the KFLP is the sedge meadow along the Scuppernong River but this area was only investigated on the 16 July 1992 survey, which was probably at the very beginning of this species' flight season. On 29 July 1993 one male was found in a patch of sedge meadow within the low prairie complex north of Stark Lane. Scott (1986) reports larval hosts are *Carex lacustris* and *Carex rostrata*.

***Euphyes conspicua*:** This is one of the more widespread sedge meadow dependent species, which I have collected at seventeen sedge meadow sites in southeastern Wisconsin. At the KFLP it occurs in sedge meadow and wet prairie habitats north of Stark Lane and east and north of the oak forest, including along the southeast side of the Scuppernong River. This species sometimes disperses into old fields to nectar on thistles but I did not observe this at the KFLP. This species was observed landing on the tops of sedges and shrubs, and the males engaged in territorial whirl flights with their own and other species of Hesperiiids. The minimum number of individuals seen on the survey dates was 16 July 1992 (9), 17 July 1992 (6), 26 July 1992 (10), and 29 July 1993 (7). A number of additional individuals may have been this species but were not examined close enough to enable a reliable field determination. Scott (1986) reports a host is *Carex stricta*.

Euphyes bimacula: A single worn female was collected on 29 July 1993 in a patch of sedge meadow within the wet low prairie complex north of Stark Lane. This record was not reported in the earlier unpublished reports as I did not identify the specimen until years later. It was so worn I could not reliably identify it from wing pattern, but I suspected *bimacula* as a possibility and compared the genitalia with a known specimen and found they were a good match. This is a sedge meadow dependent species which can be locally common in central Wisconsin but I have seldom encountered it in the southeast part of the state. The only other locality I collected it in my surveys of 21 sedge meadow sites in southeast Wisconsin (Washington, Waukesha, Walworth, Racine, and Kenosha Counties) was Chiwaukee Prairie. Scott (1986) reported a host as *Carex trichocarpa*.

Euphyes vestris: Overall this is one of the most common and widespread Hesperiid in the southern Kettle Moraine and it occurs in a wide variety of different habitats. It was found throughout the KFLP in all of the habitat types, but was most numerous in the field nectaring on purple flowers. It was not especially common during the 1992 surveys with ten or fewer observed for certain on each survey date, although many of the unknown Hesperiid not examined close enough to identify could have been this species. It was more common at the KFLP during 1993 and roughly 50 were seen on 29 July. It was observed landing at a wide variety of heights including on the ground, on low vegetation, on medium and high shrubs, and on the leaves of trees. At the KFLP it engaged in whirl flights with a variety of other species of Hesperiid, including *Oarisma powesheik*, *Wallengrenia egeremet*, *Polites coras*, *Poanes massasoit*, and *Euphyes conspicua*.

Papilio polyxenus: Single individuals of this widespread species were collected on 29 July 1993 and 17 September 1994, in the low prairie north of Stark Lane and in the old field east of the prairie, respectively. While this species is widespread in open habitats in Wisconsin, I seldom encountered it in the Southern Kettle Moraine during 1992-1994.

Papilio glaucus: One fresh male was collected in old field along Stark Lane on 9 August 1992. 9-10 August 1992 surveys were likely conducted at the very beginning of the second brood when few individuals had yet emerged, whereas the July survey dates were outside the adult flight season, between the first and second broods. This was the earliest record of a second brood adult from Southern Kettle Moraine surveys from 1992-1993.

Pieris rapae: This species was introduced from Europe (Ebner 1970, Scott 1986) and is now common and widespread throughout Wisconsin in open habitats. It was common in the old field and along Stark Lane on all survey dates when conditions were sunny; however, it was much less common in the prairie habitats, with occasional individuals encountered on the prairies during the 1993 surveys.

Colias philodice: This is another one of Wisconsin's most common and widespread butterfly species. It was common in the fields and prairies on all survey dates when conditions were sunny.

Colias eurytheme: This species was numerous in the field and prairie habitats, but less common than the preceding two species. Ten-twenty individuals were seen on 9-10 August 1992, two were seen on 14 July 1993, and the species was common on 29 July 1993 and 17-18 September 1994.

Satyrrium liparops: I collected a single specimen of this species at the KFLP, on 26 July 1992. It was nectaring on the low prairie near the eastern edge of the oak forest. Scott (1986) reports the host plants include numerous different trees and shrubs.

Satyrrium calanus: This species is very common at the KFLP. It is found in and along patches of forest and commonly nectars on *Melilotus alba*. Approximately, 40, 50, and 30 individuals were seen on 16, 17, and 26 July 1992. During a sunny period on 14 July 1993 over 100 individuals were seen along Stark

Lane just east of Highway 67. Many were nectaring on *Melilotus alba*, while others were perching and engaging in whirl flights along the edges of patches of forest. Scott (1986) reports various oaks and hardwoods as larval hosts.

***Satyrium edwardsii*:** This species is common at the KFLP and flies alongside *S. calanus*. It occurs along the edges of patches of forest along Stark Lane and commonly nectars on *Melilotus alba*. It was also found in the oak forest west of the low prairie during the 1993 survey dates, where it was perching in the trees and shrubs growing along the edge. It was common in the same area *S. calanus* was abundant near Highway 67 on 14 July 1993, with over 50 individuals seen on that date. However, in the oak forest west of the low prairie all of the individuals netted or examined closely were *S. edwardsii*. About 30 and 20 individuals were seen along Stark Lane east of the prairie on 16 and 17 July, 1992, respectively. Sites where *S. edwardsii* is numerous contain areas of xeric oak forest, whereas *S. calanus* occurs in hydric, mesic, and xeric forested habitats. Scott (1986) reports various species of oaks as larval hosts.

***Satyrium caryaevorum*:** This species is difficult to study in the field because it can only be reliably determined from genitalia dissection. The wing pattern is like extreme forms of *S. calanus*, although most individuals of *S. calanus* are outside the range of wing pattern variation in *S. caryaevorum*. Two specimens of *S. caryaevorum* were verified from genitalic dissection from the KFLP, a male from 26 July 1992 and a female from 9 August 1992. Both were found along Stark Lane just west of Highway 67, in an area where *S. calanus* and *S. edwardsii* were common. It is possible some other individuals were collected that have not been dissected. I am not sure if the host plant of this species, *Carya cordiformis*, actually occurs within the boundary of the SNA, and both specimens were collected east of the SNA boundary. Scott (1986) reports other *Carya* plus some *Fraxinus* and *Quercus* as hosts, but based on specimens confirmed with genitalic dissection the WI distribution is sites with *Carya cordiformis*; although I am not sure if this tree occurs in the KFLP, it does occur nearby.

***Satyrium titus*:** This species was encountered in the old field and along Stark Lane, usually when nectaring on *Melilotus alba*. Less than ten individuals were seen per survey date. Within the Southern Kettle Moraine State Forest this species is more common in sand prairie habitat along the tracks W of Highway S. At the KFLP it was not found in the prairie areas. Scott (1986) reports the larval hosts include various species of *Prunus*.

***Satyrium acadicum*:** This wetland species was found numerous times in the wet prairie and sedge meadow habitats during 1992. About 20 were seen on 16 July and about ten on 17 July 1992. The majority of individuals were found nectaring in the low prairie, whereas individuals in the sedge meadows were perching on sedges or low shrubs. On 16 July when conditions were often cloudy this species was primarily seen during sunny intervals or right after them. On 14 July 1993 only one individual was found, during a brief period of sun during mostly cloudy conditions.

***Everes comyntas*:** This widespread species of open areas was common in the old field habitats and along Stark Lane during 1993 and 1994 surveys, but oddly I did not record it in 1992. I did not encounter it in the prairie areas, although it occurs in mesic and xeric prairie at other sites.

***Celastrina ladon*:** This widespread habitat generalist species was common at the KFLP during 1992 and 1993 surveys, and I noted 30-50 individuals were seen on all 1992 survey dates. It was found in all habitats throughout the site but most individuals were seen along Stark Lane east of the prairie areas, especially along the edges of patches of forest. It was only occasionally seen flying over the prairies or along the edge of the oak forest.

Polygonia comma: This widespread species was found along or near the edges of forested patches along Stark Lane. It was observed landing on trees, shrubs, and sometimes on patches of open ground. Fewer than ten individuals were seen on 1992 survey dates, but it was more common on 29 July 1993.

Nymphalis antiopa: A few individuals were seen along the edges of patches of forest on 29 July 1993. This is a common species of mesic to hydric forested habitats and even suburban landscapes but I have seldom seen it in grasslands. The best way to survey for it is with rotten banana bait, but the only bait trap sample for KFLP was overnight.

Vanessa virginiensis: Several individuals were seen along Stark Lane east of the prairie on 17 September 1994. I only encountered a few individuals during surveys in the Southern Kettle Moraine during July and none in August. In the Outagamie County area I have found this species most common during the spring, and it is common and widespread in many open habitats in Wisconsin.

Vanessa cardui: This species is migratory to Wisconsin and it is not known to survive the winter. From 1987-1996 it varied in abundance greatly between seasons, and was common some years but rare others. 1992 was one of the years it was common by late summer. About 45 individuals were seen at KFLP each date from 9-10 August, and about 10 were seen on 26 July. Most were found nectaring in the old fields, but it was also nectaring in both the wet and mesic prairie areas. Some individuals were landing on patches of bare ground on Stark Lane. I did not find this species during summer surveys in the Southern Kettle Moraine during 1993.

Vanessa atlanta: This species was regularly seen along Stark Lane east of the prairie areas. It flew and landed along the edge of the patches of forest, and was also found nectaring in the old field. Some individuals were seen landing on patches of bare ground on Stark Lane. In 1994 it was also seen in the prairie areas near the edge of the oak forest. Fewer than ten individuals were seen per date from 26 July-10 August 1992, but this species was more common on 29 July 1993 and 17-18 September 1994. This is one of Wisconsin's most common and widespread butterfly species, but it may not survive most winters and varies greatly in abundance between seasons.

Speyeria cybele: This is a common species at the KFLP in both the field and prairie habitats. It nectars on a wide variety of flowers growing in the prairies and the fields and in shrubby wetlands. It is a fast rapid flier but frequently lands on flowers to take nectar. For 1992 survey dates abundance notes are as follows: 16 July (about 40), 17 July (about 30), 26 July (about 30), 9-10 August (50-100 each day). I also noted it was common on the 1993 survey dates when conditions were sunny. Smaller numbers of worn individuals were still present on the mid September 1994 surveys, near the end of this species' flight season.

Speyeria aphrodite: This species flies with *S. cybele* but is relatively less numerous. It was found in both the prairie and old field habitats and also on flowers growing along Stark Lane. A few individuals were found in sedge meadow during 1992. About 15 individuals were seen on 16 July 1992 but fewer than ten for certain on the other 1992 and 1993 survey dates. More individuals may have been seen in flight or from a distance that could have been either *aphrodite* or *cybele*.

Clossiana selene: About fifteen individuals of this species were seen in sedge meadow and wet prairie habitats on 17 September 1994. Most were flying low over the vegetation or landed on sedges, but a few were nectaring on flowers. This is a wetland dependent species that I have primarily encountered in sedge meadows, wet prairie/sedge meadow complexes, and bog/sedge meadow complexes. Almost all of my specimens and observations of this species in the Southern Kettle Moraine are from September (I did find this species on 11 August 1993 at Scuppernong), yet in Outagamie County I have numerous records from July and August.

Clossiana bellona: About ten individuals of this species were found in the wet low prairie/fen/sedge meadow habitat on 16 July 1992, and one individual was found in the same area on 10 August 1992. I did not see it at the KFLP during 1993 surveys, but in 1994 it was moderately common on 17 and 18 September and present in the old field, along Stark Lane, in both the mesic and wet prairies, and in sedge meadows. Most individuals were observed flying just over the vegetation, and some were flushed out walking through the vegetation. This species is overall common and widespread in Wisconsin in a variety of open habitats ranging from hydric-xeric, but it can vary greatly in abundance between seasons and broods.

Phyciodes tharos: This species was found in the old field and prairie habitats and along Stark Lane, usually flying low to the ground, perching on low vegetation, or nectaring on low flowers. The second brood was just beginning on 9-10 August 1992 survey dates and about ten fresh males were seen on each date. This species was fairly common on 17-18 September 1994 when many individuals were worn. This is one of Wisconsin's most common and widespread butterfly species.

Euphydryas phaeton: This species is overall rather common and widespread in Southern Kettle Moraine wetlands and it occurs in sedge meadow, fen, and wet prairie habitats. I have found the larvae several times on *Chelone glabra*, the host plant reported in the literature (Robinson et al. 2002 and included references). At the KFLP this species was only encountered in small numbers, and all were found in sedge meadow habitats flying low over the sedges or perching on sedges or small shrubs. Two individuals were found on 17 July 1992, one on 14 July 1993, and three on 29 July 1993.

Basilarchia arthemis: A few individuals of this species were seen on 9 and 10 August 1992, along the edges of forested tracts along Stark Lane. They were perching on leaves 6 feet or higher on trees at the edge of the patches of forest, or flying along the edge of these patches.

Basilarchia archippus: This species was found along Stark Lane and in shrubby wetlands primarily to the south of Stark Lane. It was usually found perching on *Salix* (including many growing on Stark Lane itself) or flying over areas with *Salix*. It was occasionally seen perching on other shrubs in shrubby wetlands. About ten were seen on 26 July 1992, about 15 each date from 9-10 August 1992, and about 20 on 29 July 1993.

Enodia anthedon: This species was found in mesic to hydric patches of forest along Stark Lane. Fewer than ten individuals were seen on each survey date it was recorded. It was never seen in the grassland habitats in either the fields or prairies, but some individuals were observed flying along Stark Lane in areas with old field on both sides. Some individuals were seen flying along Stark Lane and into patches of forest. Individuals were observed landing on tree trunks and on tree leaves along the edges of patches of forest. I never observed this species nectaring at this site.

Satyroides eurydice: This species was common in sedge meadow habitats on 14 July 1993, and was often flushed out of the sedges walking through them under cloudy conditions. This species would fly out over the low prairie areas when disturbed and occasionally when not disturbed, but individuals were clearly concentrated in sedge meadow. Only five and three individuals were seen in the low prairie/sedge meadow complex on 16 and 17 July 1992, respectively. I never observed this species nectaring at this site. It was flying just over the vegetation or landed on sedges. Scott (1986) reports a variety of *Carex* species as larval hosts.

Satyroides eurydice at the KFLP and elsewhere in the southern Kettle Moraine and southeast Wisconsin range from very light tan to dark greyish brown with every intermediate. Scott (1986) delimited the distribution of "subspecies" *fumosa* based on the political boundaries of states, and incorrectly stated subspecies *fumosa* was darker than subspecies *eurydice* elsewhere. By Scott's (1986)

delimitation, *fumosas* is in Iowa and western Illinois and *eurydice* in Wisconsin. In fact, my specimens from Mitchell County, Iowa are dark but indistinguishable from specimens from the dark end of the continuum of variation in southeastern Wisconsin (and occasional dark individuals occurring as far north as Forest County, with the populations averaging lighter south to north in eastern Wisconsin). In a checklist of Wisconsin butterflies published by L. Ferge in the Wisconsin Entomological Society Newsletter, he attributed both *eurydice* and *fumosas* to Wisconsin as if they were separate taxa. The *fumosas* phenotype is clearly an intrapopulation variant that occurs in *eurydice* populations exhibiting continuous variation between light and dark. Some have suggested *fumosas* is a prairie dependent subspecies, but there is no difference in habitat affiliation between the light, dark, and intermediate individuals. All are concentrated in sedge meadows, and all can be found in prairies that occur as part of prairie/sedge meadow complexes, and all can be found in sedge meadows far removed from any prairie. Treating *fumosas* as a separate taxon from *eurydice* in Wisconsin is indefensible in any scientific classification; political boundaries of states or arbitrary divisions of continuous intrapopulation variation are not a valid basis for delimiting taxa. Such false taxa are detrimental to biological studies when data for a valid taxon is incorrectly segregated based on some arbitrary criterion.

Megisto cymela: This species was found inside and along the edge of patches of forest along Stark Lane. A few individuals were also observed flying along Stark Lane in areas bordered by field on both sides. About 15 individuals were seen each date on 16-17 July 1992, fewer than 10 on 26 July 1992, and one worn female was found on 9 August 1992. The flight season was earlier in 1993 and about ten worn individuals were seen on 2 July 1993, but none were seen on 14 or 29 July 1993.

Cercyonis pegala: This was one of the most abundant butterfly species at KFLP, and it is common and widespread throughout the Southern Kettle Moraine and Wisconsin. It was most common in the old field habitats but also numerous in the hydric and mesic prairies. On 1992 survey dates 50-100 individuals were seen, and it was noted as common during 1993 surveys. Most individuals were seen flying low over the vegetation or landed down in the grass, but a few individuals were seen nectaring on *Rudbeckia*.

Danaus plexippus: This species was common throughout the KFLP on all survey dates, except inside of the forested habitats. 1992 abundance records include: 16 July (50-100), 17 July (about 50), 26 July (about 30), and 9-10 August (about 45 each date). It was noted to be common on the remaining survey dates. Common nectar sources at the KFLP include *Asclepias*, various other purple flowers, and in September *Solidago*. Larvae were routinely encountered on *Asclepias* during July and August survey dates.

NOCTUIDAE

Macrochilo absorptalis: This common and widespread wetland species was regularly flushed out of the vegetation walking through the wet prairie, fen, and sedge meadow habitats. While this is a nocturnal species, it is often flushed out walking through wetlands during the day, and numerous individuals were flushed out on all of the July 1993 survey dates. Rings et al. (1992) reports the larval host as *Carex*.

At the time of KFLP surveys I did not realize that a similar species, *Macrochilo hypocritialis*, also occurs in the Southern Kettle Moraine. All of the KFLP voucher specimens are *M. absorptalis*, but *M. hypocritialis* is much less common and I may have overlooked it at KFLP. In the Southern Kettle Moraine I have specimens of *M. hypocritialis* from Scuppernong Prairie and Ottawa Lake Fen. *M. hypocritialis* is not wetland dependent but both sites I have documented it in the Southern Kettle Moraine are wetlands.

Macrochilo bivittata: Three individuals were flushed out of the low prairie and two out of sedge meadow on 2 July 1993. Additional individuals were flushed on 14 July 1993 but none were captured. This univoltine species may not be exclusive to wetlands in WI as I have found it in small numbers at some

barrens and old field sites; however, most sites where I have found this species in numbers are wetlands. This species is nocturnal but it can sometimes be flushed during the day walking through wetlands.

Phlaenostola hanhami: One individual of this multivoltine wetland species was captured at the UV sheet on 23 September 2004 before 11pm. Most specimens from the Southern Kettle Moraine are from Ottawa Lake Fen, which was a convenient site for night collecting. I have also recorded it from sedge meadow, fen, and wet prairie habitats at other Southern Kettle Moraine area sites including a sedge meadow along the railroad tracks W of Highway S, Scuppernong Prairie, and a sedge meadow/fen area along Nature Road in the Lulu Lake State Natural Area. Elsewhere in Wisconsin I have found it in other types of wetlands as well including hydric hardwood forest and bogs. A few captures of singletons outside of wetlands are probably dispersing individuals.

Hypenodes caducus: One individual was flushed out of the wet low prairie north of Stark Road on 10 August 1992. This multivoltine species can be common at UV sheets in WI wetlands, but at the time of my Kettle Moraine surveys I was not yet skilled at recognizing the minute species of this genus among the Pyralids and microlepidoptera I was collecting much less intensively. I ended up with voucher specimens of *H. caducus* from six wetland sites in the Southern Kettle Moraine area, plus one presumed disperser from hardwood forest east of Highway Z.

Lithacodia bellicula: Four specimens of this species were flushed out of the vegetation during the day on 2 July 1993, including three from the low prairie and one from an adjacent sedge meadow. Additional individuals were seen but not documented in the low prairie habitat on 14 and 29 July 1993. In the Southern Kettle Moraine I have found this species in wet to mesic prairie habitats, and at the sand prairie west of Highway S. It also occurs in wet-mesic prairie at Chiwaukee Prairie. Elsewhere in WI I have found it in oak-pine barrens, bogs, sedge meadows, and dry prairie.

Luperina stipata: Three specimens of this univoltine wetland species were in the UV Trap sample of 28 July 1993 and one individual was collected at the UV sheet before 11pm on 23 September 2004. The 23 September record is unusually late in the season, and all of my other specimens from the Southern Kettle Moraine area are from late July to late August. I have found this species most common in wet prairie/sedge meadow/fen complexes, but it also occurs at sites with sedge meadow and no fen or prairie elements.

Eremobina jocasta: Three specimens of this univoltine sedge meadow species were in the UV Trap sample of 28 July 1993. Little else can be said about it at the KFLP as this was the only light sample during its flight season and adults of this species are rarely found without the use of lights at night. I have found it at six locations with sedge meadow or wet prairie/sedge meadow/fen complexes in the Southern Kettle Moraine area. A few specimens have been collected outside of but in close proximity to these habitats which are probably dispersers.

Lemmeria digitalis: Six specimens of this univoltine fall sedge meadow species were taken after 1am at the UV sheet on 23 September 1994. I found it at 4/4 sites in the Southern Kettle Moraine area where I sampled with UV lights in habitat containing sedge meadow; the other sites include Nature Road (Walworth County), Genesee Prairie-Fen (Waukesha County), and Scuppernong Prairie (Waukesha County).

Spartiniphaga inops: Six specimens of this univoltine fall species were collected at the UV Sheet on 23 September 1994, and numerous other individuals that were likely this species were seen at the sheet. Individuals came in to the sheet throughout the night. While the Kons-Borth-Barina data set includes records of this species from oak-pine barrens (Menominee County), Lake Michigan sand dunes (Sheboygan County), wet meadow (Outagamie County), and dry bluff prairie (Green County), the

majority of specimens were collected in prairie/sedge meadow/fen wetland complexes in southeastern Wisconsin. Other sites include Scuppernong Prairie, Genesee Prairie-Fen, and Chiwaukee Prairie. The only reported host in Robinson et al. (2002) is Graminae: *Spartina pectinata*. I was unfamiliar with this plant during my WI Lepidoptera surveys. Since *S. pectinata* is a wetland species, *S. inops* likely uses other host plants at least at the xeric sites such as oak-pine barrens and dry prairie.

***Macronoctua onusta*:** One specimen of this univoltine fall species was collected at the UV Sheet on 23 September 1994 around 3:30am. This is the only specimen I collected in Wisconsin other than a small series from a suburban yard in Appleton (Outagamie County). Reported larval hosts in Robinson et al. (2002) include Iridaceae: *Belamcanda chinensis*, *Iris*, and *Gladiolus*, Graminae: *Zea mays* (corn), and Liliaceae: *Lilium*. *Iris* is a possible host at both the Appleton site (where it is planted in gardens, including in the specific yard *M. onusta* has been collected) and KFLP. It is possible this species is very poorly attracted to lights and most specimens are from the Appleton yard because that is the most extensively sampled Wisconsin study site in the Kons-Borth-Barina data set.

***Papaipema* Species:** *Papaipema* is a strictly Nearctic genus best represented in the Transition and Upper Austral Life Zones of Eastern North America. Many of the Wisconsin species are potentially wetland dependent and a few may be particular to prairie remnants, although none of them can be confidently attributed as prairie specialists due to a bias towards areas with prairie during our fall sampling in the southern most part of the state. Kons, Borth, and Barina have recorded 23 species from the Southern Kettle Moraine, and some additional species are possible. At least eighteen-nineteen species (the exact number is uncertain due to taxonomic uncertainty) were collected at the KFLP at the UV Sheet on 23 September 1994, the highest total we have ever obtained for a given site on a single night. More species are reported here than in my initial unpublished report with 1994 survey data submitted to the WI DNR, as I was uncertain about the identification of a number of specimens at that time. It is possible the wet prairie/sedge meadow/fen wetland complexes of southeastern Wisconsin have the highest diversities of *Papaipema* species of any habitat in the state. A species account is provided for each species recorded from KFLP. All the species are univoltine and fly in late summer and/or the fall. The maximum diversity of *Papaipema* in southern Wisconsin appears to occur during mid-late September.

The behavior of *Papaipema* around a UV or MV light is typically a rapid darting flight even under cool conditions in the 40sF, although the moths tend to be more active the warmer conditions are. Many individuals never land on or around the sheet, and of those that do many only land briefly. Many individuals that are not collected quickly fly away, except for *P. arctivorens* and *P. pterisii* which often land on sheets and stay immobile for hours. Individuals fly in to the sheet from many different heights, some dart in from a height above the nearest trees, and/or fly to that height when leaving the light. It is usually difficult to associate behavior with individual specimens, as it cannot be determined which species they are in flight, and often multiple individuals fly in to a sheet at the same time between periods of inactivity. Some species have considerable dispersal ability, with occasional records of singletons far removed from any of the reported host plants or localities where they occur with any regularity.

Most of the *Papaipema* species are very similar in pattern to other *Papaipema* species, and many of them exhibit extensive variation in pattern within the same species. It is advantageous to collect series in the field for close examination later with a reference collection. Often among a group of similar species one species accounts for most of the individuals, and collecting just a few specimens of a similar phenotype would likely document just the most common of the similar species.

One *Papaipema* species, *Papaipema eryngii*, is reported to utilize *Eryngium yuccifolium* as a larval host, and there is a long series of this species from the Chicago area in the National Museum of Natural History. We have not seen any specimens from Wisconsin, but the host plant is present at the KFLP, but not in the area where the UV Sheet was set up. I was hoping to obtain UV light samples from areas of the KFLP with *E. yuccifolium* in 1995, but of course these plans had to be abandoned after the WI DNR refused to renew my SNA research permit. If collecting is permitted at this site in the future, a survey targeting *P. eryngii* would be a worthwhile project.

Papaipema cerina: One specimen was collected at the UV sheet on 17 September 1994 and four specimens on 23 September 1994. This species occurs in prairie/fen/sedge meadow complexes as well as dry bluff prairie (Muralt Prairie, Green County-Robert Borth collection) and a hillside with limestone cliffs with some prairie/barrens vegetation in mesic hardwood forest openings in Outagamie County.

Papaipema cataphracta: While this species is reported to use corn and tomatoes as larval hosts in addition to *Aster*, *Eupatorium*, *Helianthis*, irises and lilies (Covell 1984) plus a diverse array of other plant families and genera (Robinson et al. 2002), all of the Kons-Borth-Barina specimens are from wetlands including sedge meadow, except for one specimen from New Berlin (Tom Barina collection) which is a possible disperser. A fraction of the reported hosts include wetland dependent species that occur in sedge meadows and wet prairie/sedge meadow complexes, including at KFLP. One specimen was found at the KFLP around 12:30am at the UV Sheet on 23 September 1994. I have seldom encountered this species in the Southern Kettle Moraine area, but Robert Borth and myself have also recorded a few specimens from Scuppernong Prairie. Most records of this species from our WI surveys are from sedge meadow habitat in Outagamie County.

Papaipema arctivorens: One worn specimen of this species was collected at the UV Sheet on 23 September 1994 around 11:00pm, at the very end of its flight season. This is one of the earliest flying *Papaipema*, emerging in mid August, and the KFLP specimen is the latest record in the Kons-Borth-Barina data set for southeastern Wisconsin. The specimen is an extreme yellow phenotype of *P. arctivorens*, although it may appear more yellowish because it is worn. This species is common in the Southern Kettle Moraine earlier in the season, and occurs in a variety of habitat types in Wisconsin. Reported hosts include Compositae: *Arctium* and *Cirsium* and Dipsacaceae: *Dipsacus*. If this species' natural hosts include various *Arctium* and *Cirsium* species, that would explain its widespread distribution in many habitat types.

Papaipema impecuniosa: Eight specimens of this univoltine fall sedge meadow species were collected at the UV Sheet on 23 September 1994 between 11pm and 1am. Additional specimens which were possibly this species were seen during the same interval. This species was found at 4/4 sites with sedge meadow in the Southern Kettle Moraine Area surveyed during its flight season with UV lights. Reported host plants in Robinson et al. (2002) include Asteraceae: *Aster*, *A. puniceus*, *Doellingeria umbellata*, *Helenium*, *H. autumnale*, and Umbelliferae: *Heracleum maximum*.

Papaipema lysimachiae: One specimen of this wetland species was collected at the UV Sheet on 23 September 1994 at around 12:15am. Rings et al. (1992) report larval hosts as Primulaceae: *Lysimachia quadrifolia* and *L. terrestris*.

Papaipema inquaesita: One specimen of this wetland species was collected at the UV Sheet on 23 September 1994 around 12:30am. This is the only specimen in the Kons-Borth-Barina data set from the Southern Kettle Moraine area, yet this is one of the most common *Papaipema* in wetlands in Outagamie and Portage Counties. Rings et al. (1992) report the host is *Onoclea sensibilis*, which I have often seen growing in hydric forested areas, but the moth is often found in sedge meadows. I did not note this host plant in the immediate vicinity of the UV Sheet, so the specimen was likely not collected in its breeding habitat, and probably represents a disperser.

Papaipema baptisiae: One specimen of a pale yellowish phenotype was collected at the UV Sheet on 23 September 2004 around 2:30am. I have collected a few specimens of this phenotype in wet prairies in southeastern Wisconsin including Chiwaukee and Scuppernong Prairies. I was unsure of the determination and sent a photo of a Scuppernong specimen to *Papaipema* specialist Eric Quinter, who identified it as *Papaipema baptisiae*. The KFLP specimen is very similar. Typical darker reddish

specimens of *Papaipema baptisiae*, such as the one shown in Rings et al. (1992), occur in wetland habitats with and without prairie in Wisconsin, and also in hydric hardwood forest and open wetlands in southern Indiana. However, in WI I have seen the pale yellowish phenotypes only from three wet prairie sites. Robinson et al. (2002) and included references report larval hosts as *Apocynum*, *Cacalia tuberosa*, and *Baptisia* (including *B. alba* and *B. tinctoria*). Both the typical and pale *P. baptisiae* phenotypes were seldom encountered at lights (usually only as single individuals) during surveys in southeastern Wisconsin wetlands.

***Papaipema nepheleptena*:** Two specimens of this sedge meadow species were collected at the UV Sheet on 23 September 1994 around 3:30 and 4:15am. This species occurs in wet prairie/fen/sedge meadow wetland complexes as well as sedge meadows lacking fen or prairie elements. The reported larval host of Scrophulariaceae: *Chelone glabra* (Rings et al. 1992) is the same as the host of *Euphydryas phaeton* (see above).

***Papaipema nebris*:** One specimen of this species was collected at the UV Sheet on 23 September 1994 around 2:30am. I have only taken two specimens of this species in the Southern Kettle Moraine area; the other is from Scuppernong Prairie. Most Wisconsin specimens I have examined are from southwestern Wisconsin, but I have collected specimens in Outagamie, Winnebago, Portage, Waukesha, and Kenosha Counties in the eastern and central parts of the state, and Robert Borth has specimens from Jackson and Sheboygan Counties. Among WI localities a variety of habitat types are represented, including old field, sedge meadow, wet prairie/fen/sedge meadow complex, hydric hardwood forest, xeric oak-pine forest with barrens openings, Lake Michigan sand dunes, and dry prairie. Given the widespread distribution and diversity of habitat types among localities I do not know why the species is collected infrequently in eastern Wisconsin. Robinson et al. (2002) report an assortment of larval host genera from 31 different families of plants.

***Papaipema necopina*:** One specimen of this species was collected on 23 September 1993 at the UV Sheet around 3:30am. I have only two specimens from the Southern Kettle Moraine area, the other is from Genesee Prairie-Fen on 17 September 1993. This species may be overlooked in southeastern WI wet prairies because it is very similar to the much more common *C. beeriana* and the two are impossible to distinguish when they are flying around at a sheet. This species is represented by records of single specimens at a time in the Kons-Borth-Barina data set, but it does not appear to be particular in habitat. It has been collected in wet prairie/fen/sedge meadow complexes, sedge meadows, dry prairie, Lake Michigan sand dunes, and hydric hardwood forest. I suspect this species is very poorly attracted to lights and difficult to detect with surveys by standard collecting methods. Host plants reported in Robinson et al. (2002) and included references include the following Compositae: *Arctium lappa*, *Cacalia tuberosa*, and several species of *Helianthus* including *H. divaricatus*, *H. giganteus*, *H. grosseserratus*, and *H. tuberosus*.

***Papaipema silphii*:** Possibly six worn specimens of this species came to the UV Sheet on 23 September 1994, but only two were collected and can be reliably identified. The collected specimens were taken at about 12:45am and 3:45am. This species is reported to utilize four species of *Silphium* as a larval host (Robinson et al. 2002 and included references), and the primary or exclusive host at the KFLP is almost certainly *Silphium terebinthinaceum*, which is common in the low prairie including around the site of the UV Sheet. This species is a candidate for prairie dependency, and all localities in the Kons-Borth-Barina data set are wet or wet-mesic prairies with *Silphium*, also including Scuppernong Prairie, Genesee-Prairie Fen, Highway 59/Z low prairie, and Chiwaukee Prairie. However, *Silphium terebinthinaceum* also occurs in non prairie habitat along the edge of hydric hardwood forest at Ottawa Lake, and in xeric sand prairie along the railroad tracks west of Highway S. We never surveyed these areas with lights during the flight season of *P. silphii*, so we do not know if it occurs in these habitats as well. If *P. silphii* does occur at the Ottawa Lake site it would not be exclusively prairie dependent; however it would still be predominately

associated with prairies, as other sites where I have seen *Silphium terebinthinaceum* growing naturally in southern Wisconsin are prairie sites.

***Papaipema maritima*:** This is one of four similar grayish species of *Papaipema* that occur in wet prairie/sedge meadow/fen complexes in the Southern Kettle Moraine. Among eighteen specimens of these grayish species collected at the UV sheet on 23 September 1994, only two were *P. maritima*. As is the case at Chiwaukee Prairie, Scuppernong Prairie, and Genesee Prairie Fen the majority of greyish *Papaipema* specimens collected turned out to be *P. beeriana*, with the other species represented by few specimens if any on a given night. Both specimens were collected sometime after 1am. While I have collected a few specimens of *P. maritima* from non prairie sedge meadows in Outagamie and Portage Counties, most specimens in the Kons-Borth-Barina data set were collected in wet prairie/sedge meadow/fen complexes in southeastern Wisconsin. In the Appalachians of eastern Kentucky we collected one specimen in a power line cut through mesic hardwood forest, so perhaps this species is not wetland dependent throughout its range, or there may be non-wetland populations in Wisconsin we have not discovered. Robinson et al. (2002) report larval host records for *Helianthus*, including *H. divaricatus*, *H. giganteus*, *H. pauciflorus*, and *H. tuberosus*. Note these include some of the same host plants reported above for the very similar *Papaipema necopina*; and these two species are sometimes confused in collections. I recognized *Helianthus* as present at all of my WI localities for *P. maritima*, but did not distinguish among the species.

***Papaipema eupatori*:** This species is often encountered during September surveys in sedge meadows with *Eupatorium purpureum* (Linnaeus), and it appears to be particular to these habitats. Three specimens were collected at the UV Sheet on 23 September 1994 around 2:45, 3:30, and 5:15am. *Eupatorium purpureum* is the only host plant species reported in Robinson et al. (2002) and included references.

***Papaipema nelita*:**



For now I consider both of the above specimens to be *Papaipema nelita*, but with some reservations. Of these two phenotypes to my knowledge only one occurs in Wisconsin, represented in the above left photo of the KFLP voucher specimen, and also plated as *nelita* in Rings et al. (1992). This phenotype has a more washed out pattern, less contrast, and less intense coppery and purplish scaling than typical specimens of *nelita*. A single specimen collected at the UV Sheet on 23 September around 12:30am is the only specimen I have collected or examined from Wisconsin. Kons and Borth collected three specimens of the more typical *nelita* phenotype from mesic hardwood forest on Big Black Mountain in Harlan County Kentucky (see right photo for one example, a form with white dots in the reniform but otherwise similar pattern also occurs), with no wetlands or prairies in the vicinity, and most other specimens I have seen in collections are similar to the KY material. Robinson et al. (2002) and included references report host plant records for Compositae: *Arctium*, *Rudbeckia*, and *R. laciniata*.

***Papaipema sciata*:** Nine specimens of this species were collected at the UV Sheet on 23 September 1994 between 11pm and 1am. I have collected this species at five localities in southeastern Wisconsin with prairie/fen/sedge meadow complexes, but did not record it from sedge meadow sites lacking prairie elements, so I consider this species a candidate for prairie remnant dependency in the state. However, in the Kons-Borth-Barina data set, sampling in the fall (when this univoltine species flies) is biased towards sites with wet prairie for southeastern Wisconsin. Sedge meadow sites where this species was not found during fall surveys in Outagamie and Portage Counties may potentially lack this species because the climate is too cold rather than because prairie habitat is lacking. Surveys of sedge meadow sites in southeastern Wisconsin lacking prairie are needed to determine if this species is truly dependent on prairie remnants. Robinson et al. (2002) report a larval host as Scrophulariaceae: *Veronicastrum virginicum*, a plant I was not familiar with at the time of these Lepidoptera surveys.

***Papaipema beeriana*:** This is among the most common *Papaipema* species attracted to lights in mid and late September in the wet prairie/fen/sedge meadow complexes I have sampled in southeastern Wisconsin, and 14/18 of the plain grayish *Papaipema* specimens I collected at the UV Sheet on 23 September 1994 turned out to be this species. All but two of the specimens were collected between 1am and 5:45am, with one found about 10:45pm and another about 12:30am. Numerous additional plain grayish individuals were seen briefly, and following the percentages most of these were likely *beeriana* as well. In southeastern WI I have collected *P. beeriana* at the same five wet prairie sites mentioned above for *P. silphii*. I collected a moth that looks like *P. beeriana* on oak-pine barrens in Marinette County on 28 August 1995, but it seems questionable that this is really the same species. Reported larval hosts are *Liatris spicata* and *L. pycnostachya* (Rings et al. 1992), and at least the former *Liatris* is plentiful at all of the five wet prairie sites. However, some *Liatris spicata* also grow in non prairie fens around Ottawa Lake and in the Marl Pits across from Ottawa Lake Recreation Area south of Highway ZZ. These habitats have not been surveyed with lights during the flight season of *Papaipema beeriana*.

***Papaipema unimoda*:** This extremely variable species is typically among the most common *Papaipema* attracted to lights in wetlands with sedge meadow in the Transition Life Zone, but I have also found it in hydric hardwood forest and in bogs in the Canadian Life Zone. Twenty-three of the *Papaipema* specimens collected at the KFLP at the UV Sheet on 23 September 1994 turned out to be this species, and numerous other individuals were likely this species, although reliable field identifications are impossible, and one specimen of the very similar *P. nelita* was collected the same night. Most individuals came to the sheet between 11pm and 1am, with occasional individuals later. Reported larval hosts in Robinson et al. (2002) include *Rudbeckia*, *Polemonium reptans*, *Thalictrum pubescens*, and *Smilax herbacea*. *Rudbeckia* is common at the KFLP, but absent from some of the sedge meadow sites where this species occurs.

***Papaipema* nr. *unimoda*:**



This phenotype has not been formally named or recognized as distinct from *P. unimoda* to my knowledge. The male genitalia of one specimen I dissected were very similar to a specimen of a typical *P. unimoda*; however, the wing pattern is distinctly different. All three specimens I have found of this phenotype are from wet prairie/fen/sedge meadow complexes in southeastern Wisconsin (two from KFLP

and one from Chiwaukee Prairie) and no individuals of this phenotype are represented in long series of *P. unimoda* I have collected from non prairie wetlands. It is possible this phenotype represents a separate species more particular in habitat association than the widespread *P. unimoda*, and potentially dependent on prairie remnants. Alternatively, it may be a relatively uncommon form of *P. unimoda* that I happened to only collect at prairies due to chance. For now I am segregating records of this phenotype from those of typical *P. unimoda* to err on the side of recognizing too many species over too few.

***Hydraecia immanis*:** Seven worn specimens of this univoltine late summer/early fall species were collected at the UV Sheet on 23 September 1994, and a number of additional individuals were seen. This survey date was at the tail end of this species' flight season; we have records ranging from 12 August-3 October for southeastern Wisconsin but the period of peak abundance is late August and early September. All specimens from the Kons-Borth-Barina data set are from prairies with plentiful *Silphium terebinthinaceum*, with the exception of two specimens from a suburban yard in Appleton (Outagamie County) taken over eight years of intensive collecting. Most sites are wet-mesic prairies; however one Southern Kettle Moraine site is a sand prairie (along tracks west of highway S). Robinson et al. (2002) and included references provide larval host reports for *Silphium* (species not specified) in addition to an assortment of Graminae (including *Zea mays* (corn)), *Humulus* (Cannabaceae), and several species of Leguminosae: *Lupinus subvexus*, *Medicago sativa*, and *Trifolium pratense*. Our recorded WI distribution corresponds only to the distribution of and *Silphium* among these reported hosts, excluding the two Appleton specimens, which are invariably dispersers. I suspect the other host records are either errors, captive rearing records, or plants used on occasion by dispersing females, but not host plants that sustain permanent populations. *Hydraecia micacea* is a related species that occurs in a variety of different habitats including regularly in the suburban Appleton yard, and I wonder if some (most?) of the reported hosts for *H. immanis* may actually be for *H. micacea*. *Hydraecia micacea* is also reported from *Zea mays* (Robinson et al. 2002).

***Xanthia togata*:** One specimen of this univoltine fall wetland species was collected at the UV Sheet on 17 September 1994 and four more on 23 September 1994 between 11am and 1am. I have most often found this species in sedge meadow habitat, but it also occurs in hydric hardwood forest. The reported larval host is *Salix* (Robinson et al. 2002).

***Hillia iris*:** One specimen of this univoltine fall wetland species was collected at the UV Sheet on 17 September 1994 and four more on 23 September 1994 between 11am and 4:30am. We (Kons-Borth-Barina) have recorded this species from four sedge meadow/fen/wet prairie complexes in the Southern Kettle Moraine Area, including Scuppernong Prairie, Genesee Prairie-Fen, and wetlands along Nature Road. The reported host is *Salix* (Robinson et al. 2002) with no species specified. If the host is correct I suspect this species is exclusive to a limited range of *Salix* species, given its apparent local distribution.

***Sutyna* sp.:** One specimen of this phenotype was collected by the UV Sheet on 18 September 1994, the day following the 17 September night survey. It had crawled into a open blue canvas bag that had been lying next to the sheet, and I am uncertain what time it actually came to the sheet. This phenotype represents another taxonomic uncertainty. Typical *Sutyna privata* occurs in WI typically in acid soil habitats with Ericaceous plants, including oak-pine barrens and bogs in northern and central Wisconsin. Another *Sutyna* phenotype occurs in wet prairie/fen/sedge meadow complexes in southeastern Wisconsin: KFLP and Chiwaukee Prairie. The few prairie specimens I have collected are distinct in pattern from the acidic habitat specimens I have collected and examined from northern and central Wisconsin, and I am uncertain if they represent the same species. They could represent geographic or habitat induced variation within a single species, but I am aware any other Lepidoptera species in WI that I have recorded only from the combination of acid soil habitats and wet prairies (although see account for *P. beeriana* above). Other species which occur in oak-pine barrens, bogs, and wet prairies occur in a variety of other habitat types as well.

***Leucania linita*:** Six specimens of this multivoltine sedge meadow species were in the light trap sample of 28 July 1993. Rings et al. (1992) report a larval host is Graminae: *Dactylis glamoerata*.

***Tricholita notata*:** One worn specimen of this univoltine late summer/early fall species was collected at the UV Sheet on 17 September 1994. This was a cold night with low moth activity at the very end of this species flight season, with recorded dates in southeastern Wisconsin from ranging 12 August to 17 September. The peak abundance appears to be during late August and early September, when the species was common at Scuppernong Prairie and the sand prairie west of Highway S. The six WI localities I have collected this species are all prairies with *Silphium terebinthinaceum*, including one sand prairie (tracks west of Hwy S), four wet-mesic prairies (Scuppernong Prairie, Genesee Prairie-Fen, Chiwaukee Prairie, and KFLP) and one site that is predominately fen and sedge meadow but contains the *Silphium terebinthinaceum* and some other prairie plants (along Nature Road). Robinson et al. (2002) and included references report larval hosts as *Silphium compositum*, *Oligoneura rigidum*, and *Solidago*. The WI distribution corresponds to the distribution of *Silphium terebinthinaceum*; I found this species in all sites surveyed with lights during the flight season with this plant growing naturally, but not at sites without this plant. At Scuppernong Prairie compass plant (*Silphium laciniatum*) is also common, but *Silphium terebinthinaceum* is the only *Silphium* species I noted at the Highway S locality where *T. notata* was common.

***Agrotis gladiaria*:** One specimen of this sedge meadow univoltine fall species was collected at the UV Sheet on 17 September 1994. In the southern Kettle Moraine I have recorded it from Scuppernong Prairie, Genesee Prairie-Fen, Nature Road, and near a sedge meadow W of Highway S. I have also found it at several sedge meadow sites in Outagamie and Portage Counties. Robinson et al. (2002) report numerous host records from a diverse array of genera and families. I find this unlikely given the localized sedge meadow distribution. Two related species, *Agrotis ipsilon* and *A. venerabilis*, are widespread in numerous kinds of habitats, and I wonder if some of the supposed *A. gladiaria* host records are referable to one of these species.

Hypothetical Species

Several species of potential conservation interest have been recorded from similar habitats in the Southern Kettle Moraine area but not from the KFLP, but they are good candidates for occurring there. The mesic prairie south of the oak forest has never been investigated for moths at night, and some prairie/barrens specialists that require drier habitat than the low prairie north of Stark Lane could occur here, as well as numerous more widespread species that were not found in the wetter habitats. A few examples follow briefly. Some of the other prairie species we (Kons-Borth-Barina) have recorded from the Southern Kettle Moraine are species we have only found in xeric sites; such species are primarily or exclusively recorded from sand prairie west of Highway S in our Kettle Moraine data set, and are not expected at the KFLP or mentioned below.

Noctuidae

***Tathorhynchus exsiccatus*:** The only WI specimen I have collected (or examined) is from Ottawa Lake Campground on 19 July 1993. In Texas and Oklahoma Kons and Borth find this species in xeric grasslands, an in mesic black belt prairie in Mississippi. The mesic prairie south of the oak woods is a potential site to look for this species in mid July.

***Phytometra ernestinana*:** I have found this species exclusively in xeric-mesic prairie in WI, and Kons and Borth have found it in xeric-mesic grassland in Texas, Oklahoma, Mississippi, Missouri, and Florida (where it also occurs in salt marsh). In the Southern Kettle Moraine I have recorded it from sand prairie

west of Highway S and Scuppernong Prairie. It should be searched for in the mesic prairie south of the oak forest in mid July.

Heliothis ascecius: I have one specimen from Scuppernong Prairie from 27 July 1993, which is the only specimen I have seen from the Southern Kettle Moraine. Other WI I have collected or examined are from dry-mesic prairies or prairie plantings. This species may occur in the mesic prairie south of the oak woods. It may come poorly to light, and for some sites the only specimens were collected active at flowers during the day.

Tarachidia binocula: In the Kons-Borth-Barina data set most specimens are from xeric prairie or barrens with prairie elements, but we have collected this species in mesic prairie at Scuppernong and sand prairie west of Highway S. Southern Kettle Moraine records are from mid July and late September. This species should be sought in the mesic prairie south of the oak woods.

Tarachidia tortricina: The only WI specimen I have collected (or examined) is from Scuppernong Prairie on 27 July 1993. In Texas and Oklahoma Kons and Borth find this species in xeric prairie grasslands. The Scuppernong record suggests it may also occur in more mesic prairie, and this species should be sought in the mesic prairie south of the oak woods.

Chortodoes enervata: I collected one somewhat worn female of this species on 11 August 1993 at Scuppernong Prairie, and another WI specimen from Chiwaukee Prairie is plated in Rings et al. (1992). I have not seen other WI specimens, and this species may come poorly to lights.

Management

Management of the natural area should prioritize preservation of the natural communities and species with the most limited distribution, the prairie remnants and their associated species. For recorded Macrolepidoptera species those of highest conservation priority include *Oarisma powesheik*, *Papaipema silphii*, *Papaipema beeriana*, *Papaipema sciata*, and *Tricholita notata*. Perhaps other nocturnal species recorded are as localized as these species but are too poorly known, and species not yet recorded may be as localized as those mentioned. The "microlepidoptera" remain completely unknown.

One of the major concerns for the preservation of prairie Lepidoptera is the excessive use of controlled burns, such as burning too large a portion of the habitat during a given season and/or burning the habitat too frequently. Intensity and seasonality of burns are additional variables which could impact Lepidoptera species. However, enough active management must be employed to prevent the prairie habitat from advancing to a later state of succession. On dry prairies there is compelling evidence that excessive burning is detrimental to a number of Lepidoptera species, including *Catocala abbreviatella* and *Catocala whiyneyi* (Borth and Barina 1991). I am not aware of how controlled burns impact the specific prairie species recorded from KFLP, the species inventory is very incomplete, and a historical baseline of data prior to my surveys is limited to a few butterfly species.

In order to ensure no Lepidoptera species are extirpated or severely impacted from controlled burns, no more than a fraction of any type of prairie habitat should be burned during a given season. The wet, low prairie north of Stark Lane and east of the oak forest is distinctly different from the drier, mesic-semi xeric prairie that occurs south of the oak forest. A large portion of either of these areas should never be burned during a single season. The wet, low prairie north of Stark Lane appears to be the critical habitat for *Oarisma powesheik*, and is almost certainly critical habitat for prairie dependent moths recorded from KFLP. The drier mesic prairie south of the oak woods is totally unknown for moths as it has yet to be surveyed, but some dry-mesic prairie associated species recorded from elsewhere in the Kettle Moraine might occur there (see hypothetical species above).

Silphium terebinthinaceum is a recorded or suspected host of a number of potentially prairie dependent moth species recorded from KFLP, including *Papaipema silphii*, *Hydraecia immanis*, and

Tricholita notata. A large portion of the *Silphium terebinthinaceum* habitat should be left unburned during any given season to ensure these species are not unduly impacted.

Another severe limitation to the conservation of natural areas has been the Wisconsin DNR's restrictions on insect collecting for biodiversity surveys, especially the new rules instated in 1995 that ended all Lepidoptera research being conducted on state natural areas by the author, Robert Borth, and Thomas Barina. It is critical that natural areas be inventoried and that these inventories be updated frequently to the extent possible that there are volunteers qualified and willing to do this work. Otherwise management is blind, without even a base line of historical data by which to evaluate if the natural community is being preserved, let alone any indication of how management might be impacting species of conservation priority. Collecting is not the threat, rather it is lack of information. Whether those doing inventory work are based on institutional collections or personal collections is irrelevant to the purpose of the DNR and does not affect the value of the data provided. The need for inventory work far exceeds the resources of both institutional and personal collection based researchers combined, and both should be strongly encouraged to collect for inventories on state natural areas with no policies that discriminate against either type of researcher. In other words, specimen deposition MUST remain the discretion of individual researchers, who must be allowed to retain specimens in whatever collection they are using for as long as they will be active in Lepidoptera research. The DNR should make no rules or attempts to manage the disposition of specimens, and leave this solely up to researchers providing critical biodiversity inventory data. No other arbitrary rules should ever be instated that make insect biodiversity inventories impossible, such as requirements that many specimens be identified in the field before they are collected, something that is impossible for many difficult to identify insects and with critical trapping survey methods. The primary requirement for collecting insects on state natural areas should be submitting research reports to land managers.

Acknowledgments

I thank My colleagues Robert Borth and Thomas Barina for sharing the findings of their Lepidoptera research in the Southern Kettle Moraine Area. I thank Ron Kurowski for his support of Lepidoptera research in the Southern Kettle Moraine State Forest. I am indebted to my parents, Hugo and Sharon Kons Sr., for assistance with building light and bait traps and other support of my research activities over many years. Karen Agee of the WI DNR assisted with landowner or land manager contacts for southeast WI research in 1993. I thank Paul Matthiae of the WI DNR for cooperation with issuing Lepidoptera research permits for WI State Natural Areas prior to 1995.

References

- Borth, Robert J. and Thomas S. Barina.** 1991. Observations of *Amorpha*-feeding *Catocala* (Noctuidae) in Wisconsin. *J. Lep Soc.* 45:371-373.
- Covell, Charles V. Jr.** 1984. *A Field Guide to the Moths of Eastern North America.* Boston, Massachusetts, Houghton Mifflin Company. 496 pp.
- Curtis, John T.** 1959. *Vegetation of Wisconsin.* University of Wisconsin Press, Madison, Wisconsin.
- Ebner, James A.** 1970. *The Butterflies of Wisconsin.* Board of Trustees, Milwaukee Public Museum.
- Kons, Hugo L. Jr. and Robert J. Borth.** 2006. Contributions to a study of the diversity, distribution, habitat association, and phenology of the Lepidoptera of Northern Florida. *North American Journal of Lepidoptera Biodiversity.* Volume I: 1-231.
- Rings, Roy W., Eric H. Metzler, Fred J. Arnold, and David H. Harris.** 1992. *The Owllet Moths of Ohio.* Columbus, Ohio: Ohio State University.
- Robinson, Gaden S., Phillip R. Ackery, Ian J. Kitching, George W. Beccaloni, & Luis M.**

- Hernandez.** 2002. Hostplants of the Moth and Butterfly Caterpillars of America North of Mexico. *Memoirs of the American Entomological Institute*, Volume 69.
- Scott, James A.** 1986. *The Butterflies of North America*. Stanford University Press. Stanford, California.

Table 1: Dates and Locations of Lepidoptera Survey Stations at the Kettle Moraine Fen and Low Prairie

Survey Date	Survey Type	Survey Location	Approx. deg. N	Approx. deg. W	Habitat	Survey Time	Weather
16 July 1992	Diurnal	E and S of oak forest and N of ditch	42.9121	88.4858	Hydric-mesic low prairie/fen/sedge meadow complex	1:30-4:15pm	Mostly cloudy, light wind, hot
16 July 1992	Diurnal	Along Stark Lane W of Hwy 67 E of prairie	42.9116	88.482	Old Field	4:30-6:15pm	
16 July 1992	Diurnal	Hardwood Areas along Stark Lane W of Hwy 67	42.91155	88.47845	Small patches of mesic hardwood forest		
17 July 1992	Diurnal	E and S of oak forest and N of ditch	42.9121	88.4858	Hydric-mesic low prairie/fen/sedge meadow complex	12:30-2:45pm	Mostly sunny, windy
17 July 1992	Diurnal	Along Stark Lane W of Hwy 67 E of prairie	42.9116	88.482	Old Field		
17 July 1992	Diurnal	Hardwood Areas along Stark Lane W of Hwy 67	42.91155	88.47845	Small patches of mesic hardwood forest		
26 July 1992	Diurnal	E and S of oak forest and N of ditch	42.9121	88.4858	Hydric-mesic low prairie/fen/sedge meadow complex	3:00-5:00pm	Mostly sunny, calm-windy
26 July 1992	Diurnal	Along Stark Lane W of Hwy 67 E of prairie	42.9116	88.482	Old Field		
26 July 1992	Diurnal	Hardwood Areas along Stark Lane W of Hwy 67	42.91155	88.47845	Small patches of mesic hardwood forest		
9 Aug. 1992	Diurnal	E and S of oak forest and N of ditch	42.9121	88.4858	Hydric-mesic low prairie/fen/sedge meadow complex	12:00-5:00pm	Partly sunny, hot
9 Aug. 1992	Diurnal	Along Stark Lane W of Hwy 67 E of prairie	42.9116	88.482	Old Field		
9 Aug. 1992	Diurnal	Hardwood Areas along Stark Lane W of Hwy 67	42.91155	88.47845	Small patches of mesic hardwood forest		
10 Aug. 1992	Diurnal	E and S of oak forest and N of ditch	42.9121	88.4858	Hydric-mesic low prairie/fen/sedge meadow complex	2:00-4:00pm	Partly sunny, hot
10 Aug. 1992	Diurnal	Along Stark Lane W of Hwy 67 E of prairie	42.9116	88.482	Old Field		
10 Aug. 1992	Diurnal	Hardwood Areas along Stark Lane W of Hwy 67	42.91155	88.47845	Small patches of mesic hardwood forest		
2 July 1993	Diurnal	Along Stark Lane W of Hwy 67 E of first gate	42.91155	88.47845	Patches of mesic hardwood forest and old field	6:30-7:30pm	Sunny
2 July 1993	Diurnal	E and S of oak forest and N of ditch	42.9121	88.4858	Hydric-mesic low prairie and fen		
2 July 1993	Diurnal	E of oak forest and N of Stark Lane	42.913	88.483	Sedge meadow patches in the low prairie complex		
2 July 1993	Diurnal	Field E of low prairie area	42.9116	88.482	Old Field		
14 July 1993	Diurnal	Along Stark Lane W of Hwy 67 E of first gate	42.91155	88.47845	Patches of mesic hardwood forest and old field	11:35am-3:00pm	Mostly cloudy
14 July 1993	Diurnal	E and S of oak forest and N of ditch	42.9121	88.4858	Hydric-mesic low prairie and fen		
14 July 1993	Diurnal	E of oak forest and N of Stark Lane	42.913	88.483	Sedge meadow patches in the low prairie complex		
14 July 1993	Diurnal	Field E of low prairie area	42.9116	88.482	Old Field		
29 July 1993	Diurnal	Along Stark Lane W of Hwy 67 E of first gate	42.91155	88.47845	Patches of mesic hardwood forest and old field	3:30-6:30pm	Partly sunny,
29 July 1993	Diurnal	E and S of oak forest and N of ditch	42.9121	88.4858	Hydric-mesic low prairie and fen		
29 July 1993	Diurnal	E of oak forest and N of Stark Lane	42.913	88.483	Sedge meadow patches in the low prairie complex		
29 July 1993	Diurnal	Field E of low prairie area	42.9116	88.482	Old Field		
28 July 1993	UV Trap	Prairie E of oak forest N of Stark Lane	42.9121	88.4858	Hydric-mesic low prairie/fen/sedge meadow complex	All Night	Warm & clear
28 July 1993	Bait Trap	Patch of hardwoods on N side of Stark Lane just W of Hwy 67	42.91155	88.47845	Small patch of mesic hardwood forest	All Night	Warm & clear
17 Sep. 1994	Diurnal	Along Stark Lane W to edge of oak forest	42.9121	88.4858	Old field/hardwood patches/low prairie/fen		Sunny/warm
17 Sep. 1994	UV Sheet	Prairie E of oak forest N of Stark Lane	42.9121	88.4858	Hydric-mesic low prairie/fen/sedge meadow complex	All Night	cold/clear/moon
18 Sep. 1994	Diurnal	Along Stark Lane W to edge of oak forest	42.9121	88.4858	Old field/hardwood patches/low prairie/fen		Sunny/warm
23 Sep. 1994	UV Sheet	Prairie E of oak forest N of Stark Lane	42.9121	88.4858	Hydric-mesic low prairie/fen/sedge meadow complex	All Night	mid 50sF, light rain
24 Sep. 1994	Diurnal	Along Stark Lane W to edge of oak forest	42.9121	88.4858	Old field/hardwood patches/low prairie/fen		Mostly cloudy



Figure 1: The Kettle Moraine Fen and Low Prairie study area, and **approximate** locations of some areas of interest.

- A: Ditch representing the southern limit of surveys.
- B: Wet low prairie/fen/sedge meadow complex.
- C: Mesic prairie, with some dry areas containing *Lupinus*.
- D: Sedge meadow near Scuppernong River (rough location).
- E: Patch of forest where *Satyrium* were common; bait trap location.
- F: Mesic-xeric oak forest.
- G: Old field.
- UV: Location of UV Sheet and UV Trap samples.