Rare Moth Surveys in Metroparks Toledo

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We collectively acknowledge that Michigan State University occupies the ancestral, traditional, and contemporary Lands of the Anishinaabeg – Three Fires Confederacy of Ojibwe, Odawa, and Potawatomi peoples. In particular, the University resides on Land ceded in the 1819 Treaty of Saginaw. We recognize, support, and advocate for the sovereignty of Michigan's twelve federally recognized Indian nations, for historic Indigenous communities in Michigan, for Indigenous individuals and communities who live here now, and for those who were forcibly removed from their Homelands. By offering this Land Acknowledgement, we affirm Indigenous sovereignty and will work to hold Michigan State University more accountable to the needs of American Indian and Indigenous peoples.

Cover: Silphium borer moth (*Papaipema silphii*) resting on a leaf of prairie rosinweed (*Silphium terebinthinaceum*) during surveys at Secor Metropark in 2025.

EXECUTIVE SUMMARY

Michigan Natural Features Inventory received funding from Metroparks Toledo to conduct rare moth surveys within the park system of the greater Toledo, Ohio region. Surveys were prioritized within park habitats with documented populations of host plants for moth species of concern, and utilized the technique of blacklighting, where a combination of ultraviolet and mercury vapor light sources were used to attract moths to a white sheet during nighttime hours. The primary objective of these surveys were to 1) determine the presence of moth species of concern within priority habitats of Metroparks Toledo and 2) provide recommendations for continued management to support rare species habitats.

In 2025, a total of 16 blacklight surveys were conducted across 8 preserves. Species of conservation concern were documented at 4 locations, including Oak Openings Metropark (Girdham Road Sand Dunes, Ostrich Barrens), Secor Metropark, and Side Cut Metropark. The most significant finding in 2025 includes a population of silphium borer moth (*Papaipema silphii*, State Endangered) at Secor Metropark. This discovery represents a new population of silphium borer moth in Metroparks Toledo, and the first documentation of the species in Ohio since 1987. Bracken fern borer moth (*Papaipema ptersii*, State Special Concern) and blazing star borer moth (*Papaipema beeriana*, Local Concern) were documented at Girdham Road Sand Dunes and Side Cut Metropark, respectively. Sweetfern underwing moth (*Catocala antinympha*, State Threatened) was documented at Ostrich Barrens. Additional moths that were documented are described in the results and provided in an associated iNaturalist project: Metropark Toledo Moths.

Rare moth surveys completed in 2025 provide a baseline dataset on site occupancy for moth species of concern within Metroparks Toledo. However, survey results are not conclusive, and additional targeted surveys may be warranted to determine species presence, especially in areas where suitable habitat is abundant. Maintaining a habitat management program that promotes the soil and vegetative conditions required by host plants and is applied during windows of reduced pressure on resident rare moth species, is the ideal combination to ensure suitable habitat persists over time within the parks. Developing and implementing a monitoring program for silphium borer moth at Secor Metropark is necessary to track population status. Additional surveys in parks with populations of prairie rosinweed (*Silphium terebinthinaceum*) is present are recommended to document the full extent of this species at Metroparks Toledo.

ACKNOWLEDGEMENTS

This project was funded through a service agreement with Metroparks Toledo: S2068-FFS45. Thank you to Jay Wright and Karen Menard from Metroparks Toledo for assistance in site selection and identifying rare moth survey priorities. Olivia Franklin assisted with specimen processing. Deborah Richardson, Sarah Carter, Katelyn Broklick and Mike Monfils provided administrative support.

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INTRODUCTION

Metroparks Toledo is a regional conservation agency dedicated to protecting and restoring natural areas throughout northwest Ohio, with a particular emphasis on the globally significant Oak Openings region (Figure 1). This unique ecological landscape, spanning parts of southeast Michigan and northwest Ohio, formed approximately 13,000 years ago as retreating glaciers and the recession of ancient Lake Warren shaped a complex system of sandy ridges and clay rich lowlands (Higley et al. 2014). The resulting pattern of excessively drained dunes interspersed with seasonally saturated swales created one of the most biologically diverse regions in the Great Lakes.

The Oak Openings region supports an exceptional array of flora and fauna, including numerous rare, threatened, and globally imperiled species. Its distinctive soils and hydrology give rise to a mosaic of specialized plant communitiesl such as Black Oak/Lupine Barren, Midwest Sand Barren, Mesic Sand Tallgrass Prairie, Twig-rush Wet Prairie, and Great Lakes Pin Oak/Swamp White Oak Flatwoods, many of which occur nowhere else in Ohio. Metroparks Toledo plays a central role in conserving these communities, managing thousands of acres of high-quality habitat within its parks and preserves (Figure 2).

These habitats also support a rich assemblage of rare and sensitive wildlife. Species such as Lark Sparrow (*Chondestes grammacus*, State Endangered) and Blanding's Turtle (*Emydoidea blandingii*, State Threatened) rely on the region's open savannas, prairies, and wetlands. The Oak Openings are similarly important for invertebrate diversity, harboring rare butterflies and skippers (Lepidoptera), tiger beetles (Coleoptera), dragonflies and damselflies (Odonata), and grasshoppers and crickets (Orthoptera). Despite this diversity, some insect groups, particularly moths, have historically received less survey attention. In the Michigan portion of the Oak Openings region, Michigan Natural Features Inventory (MNFI) has conducted extensive surveys for *Papaipema* moths since 2012 (Cuthrell 2013, Cuthrell and Rowe 2021, 2025) and maintains a database of regional occurrences, highlighting the need for comparable efforts in Ohio.

In 2025, Metroparks Toledo partnered with MNFI to conduct rare moth surveys within priority habitats across the park system. Survey efforts focused on a suite of target species identified by Metroparks Toledo, representing moths with overlapping flight periods and habitat associations but differing host plant requirements (Table 1). Given the limited historical data available for these species within Metroparks Toledo, the primary objective of this project was to determine rare species presence within high priority sites. Information collected during these surveys will guide targeted habitat management and conservation strategies aimed at supporting rare moth populations across the Metroparks Toledo system.

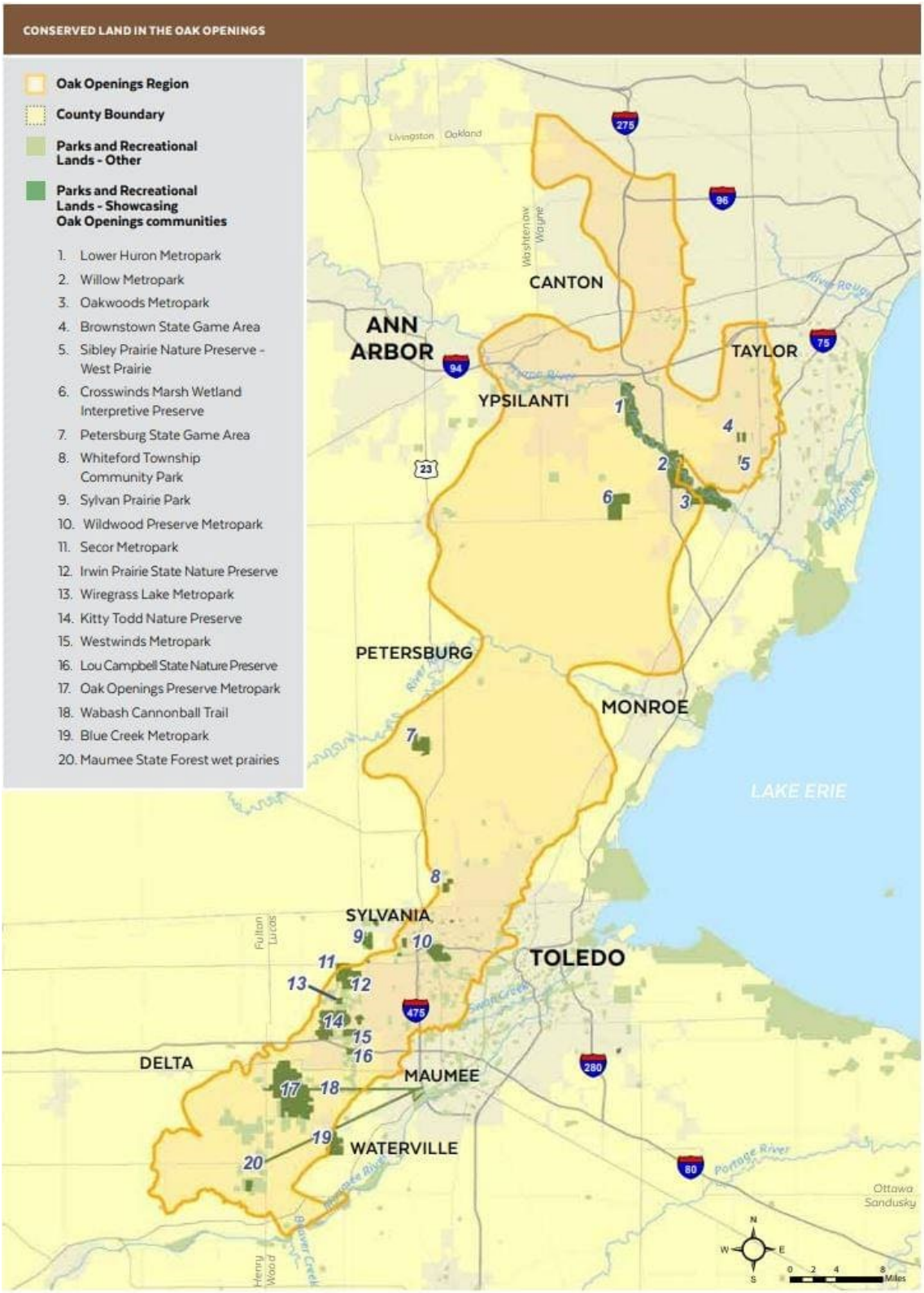

Figure 1. Spatial representation of the Oak Openings region spanning from Southeast Michigan to Northwest Ohio.

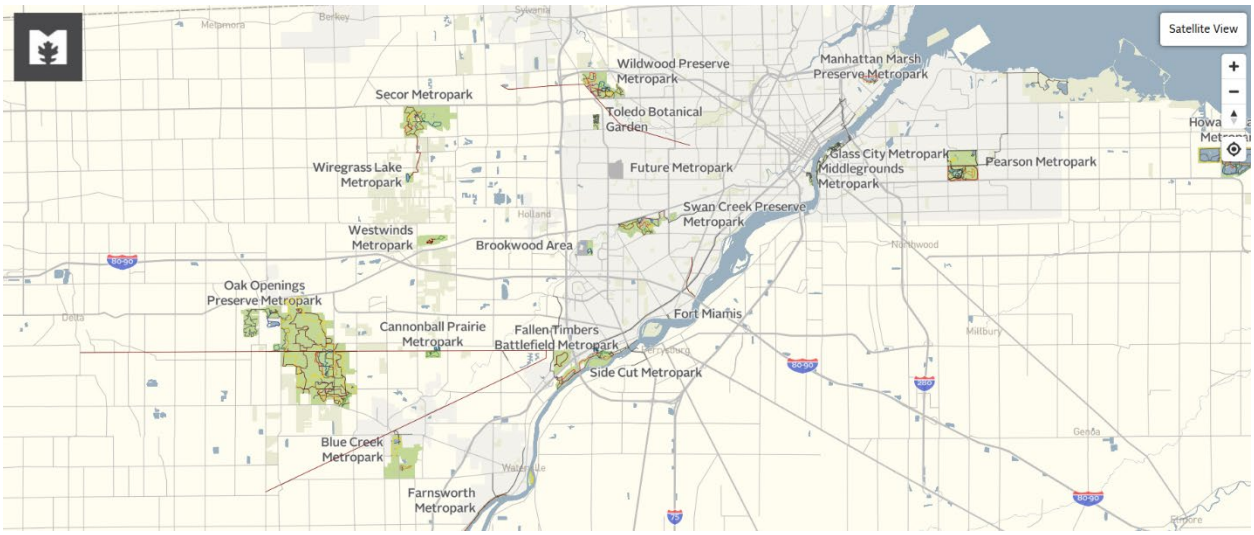

Figure 2. Parks managed by Metroparks Toledo within the Oak Openings region.

Ultraviolet blacklight station used to survey for rare moths in Metroparks Toledo. Photo from Dunes Trail on 09/25/2025.

METHODS

Rare moth survey sites were selected by Metroparks Toledo biologists and MNFI scientists, and included sites with rare species host plants. (Table 2). Sites were specifically selected for identifying opportunities to document multiple rare moth species at single locations as most sites contained multiple potential host plants for rare moths.

Blacklight surveys were conducted using standardized methodology used by MNFI scientists to document rare and declining moth species of concern at a local site. During each survey, a large white sheet was placed on a frame near or within the patch of documented host plant for the target moth species. At some sites, multiple sheet stations were used to survey in larger habitat patches, or areas where multiple host plant species were present. Standard mercury-vapor and UV lights powered by a portable generator were used to create a light source to attract moths to the sheet. Moths were collected when attracted to light and after landing on the sheet. When appropriate, reference specimens were collected for processing and identification in a laboratory setting. Blacklight surveys were completed between the hours of 8:00pm and 12:00am on multiple nights between 08/01/2025 and 10/02/2025. All data was collected using a Survey 123 form or paper forms. All pertinent data is summarized in this report, and copies of the data forms are in Appendix A.

Papaipema nebris (stalk borer moth) attracted to blacklight sheet at Side Cut Metropark on 09/18/2025.

Table 1. Rare moth species targets at Metroparks Toledo prioritized during 2025 blacklight survey efforts. Table includes information on listing status in Ohio, host plant use, and flight period for each moth species.

Species	Common Name	Ohio Status	Host Plant(s)	Flight Period
Catocala antinympha	Sweetfern underwing moth	Threatened	*Comptonia peregrina*	August - September
Chytonix sensilis	Barrens Chytonix	Species of Concern	*Quercus* spp.	July - October
Hemileuca maia	Buck moth	Species of Concern	*Quercus* spp.	September - October
Papaipema beeriana	Blazing star borer moth	Local Concern	*Liatris* spp.	September - October
Papaipema ptersii	Bracken borer moth	Species of Concern	*Pteridium* spp.	August
Papaipema sciata	Culver's root borer	Local Concern	*Veronicastrum virginicum*	September - October
Papaipema silphii	Silphium borer moth	Endangered	*Silphium* spp.	September - October
Ponometia binocula	Prairie bird-dropping moth	Species of Concern	*Ambrosia* spp.	June - September
Spartiniphaga inops	Spartina borer moth	Endangered	*Spartina* spp.	September
Tricholita notata	Noted sunflower moth	Endangered	*Solidago rigida*	August - October

Bracken fern borer moth (*P. ptersii*, left) and blazing star borer moth (*P. beeriana*, right). Two rare moth survey priorities during 2025 surveys at Metroparks Toledo.

RESULTS

We completed 16 rare moth surveys at 8 Metroparks Toledo preserves in 2025 (Table 2). The most significant findings include bracken borer moth (*Papaipema pterisii*) at Girdham Sand Dunes, blazing star borer moth (*Papaipema beeriana*) at Side Cut Metropark, sweetfern underwing moth (*Catocala antinympha*) at Ostrich Barrens, and silphium borer moth (*Papaipema silphii*) at Secor Metropark. In addition to target species, we provide a full list of *Papaipema* borer moth species documented during survey efforts in 2025 in Table 3.

Table 2. Rare moth targets and surveys completed at Metroparks Toledo parks in 2025. Significant species findings are **bolded**.

Site	Date	X	Y	Targets(s)	Target Found (Y/N)
Girdham Dunes	08/01/2025	[redacted]	[redacted]	*Chytonix sensilis*	N
Ostrich Barrens	**08/05/2025**	[redacted]	[redacted]	*Chytonix sensilis*	N
		[redacted]	[redacted]	***Catocala antinympha***	**Y**
Blue Creek Glade A	09/05/2025	[redacted]	[redacted]	*Tricholita notata*	N
		[redacted]	[redacted]	*Ponometia binocula*	N
Blue Creek Glade B	09/05/2025	[redacted]	[redacted]	*Ponometia binocula*	N
Girdham Dunes	09/11/2025	[redacted]	[redacted]	*Catocala antinympha*	N
Girdham Dunes 2	**09/11/2025**	[redacted]	[redacted]	***Papaipema ptersii***	**Y**
				Papaipema beeriana	N
		[redacted]	[redacted]	*Catocala antinympha*	N
Blue Creek Glade	09/11/2025	[redacted]	[redacted]	*Tricholita notata*	N
		[redacted]	[redacted]	*Ponometia binocula*	N
Side Cut	**09/18/2025**	[redacted]	[redacted]	***Papaipema beeriana***	**Y**
				Papaipema silphii	N
		[redacted]	[redacted]	*Spartiniphaga inops*	N
		[redacted]	[redacted]	*Papaipema sciata*	N
Ostrich Barrens	09/18/2025	[redacted]	[redacted]	*Papaipema beeriana*	N
				Papaipema ptersii	N
Campbell Prairie	09/18/2025	[redacted]	[redacted]	*Catocala antinympha*	N
		[redacted]	[redacted]	*Hemilauca maia*	N
		[redacted]	[redacted]	*Papaipema ptersii*	N
Dunes Trail Area	09/25/2025	[redacted]	[redacted]	*Papaipema ptersii*	N
Dunes Trail East	09/25/2025	[redacted]	[redacted]	*Papaipema ptersii*	N
Side Cut	09/30/2025	[redacted]	[redacted]	*Papaipema silphii*	N
		[redacted]	[redacted]	*Spartiniphaga inops*	N
		[redacted]	[redacted]	*Papaipema sciata*	N
Ostrich Dunes Hill	10/01/2025	[redacted]	[redacted]	*Catocala antinympha*	N
		[redacted]	[redacted]	*Hemilauca maia*	N
		[redacted]	[redacted]	*Papaipema ptersii*	N
Secor Prairie	**10/02/2025**	[redacted]	[redacted]	***Papaipema silphii***	**Y**
Secor Prairie	**10/02/2025**	[redacted]	[redacted]	***Papaipema silphii***	**Y**

Table 3. *Papaipema* borer moths documented during surveys at Metroparks Toledo parks in 2025. Total abundance of each species documented during each survey event is provided.

		Species														
Site	**Date**	*P. arctivorens*	*P. beeriana*	*P. birdi*	*P. cataphracta*	*P. cerusata*	*P. eupatorii*	*P. impecuniosa*	*P. inquaesita*	*P. maritima*	*P. necopina*	*P. nebris*	*P. ptersii*	*P. silphii*	*P. unimoda*	**Grand Total**
Girdham Dunes	08/01/2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Ostritch Barrens	08/05/2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Blue Creek Glade A	09/05/2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Blue Creek Glade B	09/05/2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Girdham Dunes	09/11/2025	2	-	-	-	-	-	-	-	-	-	-	2	-	-	4
Girdham Dunes 2	09/11/2025	1	-	-	-	-	-	-	-	-	-	-	1	-	-	2
Blue Creek Glade	09/11/2025	11	-	1	-	-	-	-	-	-	-	-	-	-	-	12
Side Cut	09/18/2025	-	-	-	-	-	-	-	-	-	-	4	-	-	-	4
Ostrich Barrens	09/18/2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Campbell Prairie	09/18/2025	2	-	-	-	-	-	-	13	-	-	-	-	-	-	15
Dunes Trail Area	09/25/2025	-	-	-	-	-	-	-	3	-	-	-	-	-	-	3
Dunes Trail East	09/25/2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Side Cut	09/30/2025	-	2	-	1	-	-	1	-	1	1	10	-	-	3	19
Ostrich Dunes Hill	10/01/2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Secor Prairie	10/02/2025	1	-	-	-	1	-	-	-	-	-	-	-	6	-	8
Secor Prairie	10/02/2025	-	-	-	-	1	1	2	1	-	-	-	-	6	-	11
Total		**17**	**2**	**1**	**1**	**2**	**1**	**3**	**17**	**1**	**1**	**14**	**3**	**12**	**3**	**78**

DISCUSSION

The 2025 rare moth surveys conducted across Metroparks Toledo provide an important first assessment of the distribution and habitat associations of several conservation priority moth species within the Oak Openings region of northwest Ohio. Although survey effort was limited to a single field season and a relatively narrow late-summer to early-fall sampling window, the results demonstrate that high-quality habitats within the park system continue to support rare and specialized moths, including species not documented in Ohio for decades.

The most significant finding of this project was the detection of silphium borer moth at Secor Metropark. This represents the first verified record of the species in Ohio since 1987 and confirms that suitable habitat and host plant populations of prairie rosinweed (*Silphium terebinthinaceum*) persist within the park. The presence of multiple individuals across two survey stations suggests an established population rather than an incidental occurrence. This discovery highlights the conservation value of Secor Metropark's prairie restorations and underscores the importance of continued management to maintain open structure, adequate host plant abundance, and appropriate disturbance regimes. Additional surveys for this species are highly recommended within Metroparks Toledo preserves due to the rarity of silphium borer moth in Ohio and the significant role Metroparks Toledo likely has for its overall conservation in the state.

Rare moth habitat containing dense pockets of prairie rosinweed at Secor metropark, where a population of silphium borer moth was discovered in 2025.

Similarly, documentation of sweetfern underwing moth at Ostrich Barrens in the Oak Openings Metropark represents another unique discovery. While this species is relatively stable across it's global range (NatureServe, 2025), Metroparks Toledo is on the southern edge of the species' range. Its hostplant, sweetfern (*Comptonia peregrina*) is not exceptionally rare, and additional blacklight surveys in Metroparks Toledo habitats with this species may identify additional sweetfern underwing moth populations and help identify conservation priorities.

The documentation of bracken borer moth at Girdham Road Sand Dunes and blazing star borer moth at Side Cut Metropark further illustrates the diversity of specialist moths supported within Metroparks Toledo. These species rely on intact patches of bracken fern (*Pteridium* spp.) and blazing stars (*Liatris* spp.), respectively. These plant species are sensitive to canopy closure, invasive species encroachment, and hydrologic alteration. Their presence indicates that portions of these preserves retain the ecological conditions necessary to support rare moth communities, though the limited number of detections suggests that populations may be small or patchily distributed.

The broader assemblage of *Papaipema* species documented across sites provides additional insight into habitat quality. Several species detected, such as *P. nebris*, *P. arctivorens*, and *P. inquaesita*, are associated with intact prairie, savanna, or wetland vegetation. Their presence suggests that many Metroparks Toledo preserves continue to support structurally diverse native plant communities capable of sustaining a range of specialist herbivores. Conversely, the absence of certain expected species may indicate areas where host plants have declined or where habitat structure has shifted due to succession or invasive species, providing opportunities for targeted management to improve habitat quality.

Despite these notable findings, many target species were not detected during the 2025 surveys. Several factors may explain these absences. First, flight periods for some species may not have fully overlapped with survey dates, particularly for early-emerging taxa. Second, blacklighting effectiveness can vary with weather, moon phase, and nightly temperature, all of which influence moth activity. Third, some species may occur at low densities or in microhabitats not captured by the selected survey stations. Finally, the distribution of host plants within some parks may be more limited or degraded than previously documented, reducing the likelihood of encountering associated moth species.

Collectively, these results emphasize the importance of continued habitat management within the Oak Openings region and highlight the value of long-term monitoring. Maintaining open-canopy conditions, controlling invasive species, and supporting robust populations of host plants are essential for sustaining rare moth species. In particular, prairie rosinweed populations at Secor Metropark (and other preserves) warrant close monitoring given their direct relevance to the newly rediscovered silphium borer moth population. Rare moth populations can fluctuate annually due to weather, disturbance, and host plant dynamics. Establishing a recurring monitoring program will allow Metroparks Toledo to track population trends, evaluate management outcomes, and adapt conservation strategies as needed. The 2025 dataset provides a strong baseline from which future assessments can build.

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APPENDIX A: RARE MOTH SURVEY FORM USED DURING 2025 SURVEYS IN METROPARKS TOLEDO

Michigan Natural Features Inventory Papaipema Moth Survey Form

Survey Site:		Date __ - __ - __	Managed Area:
Surveyors:		overall start time :	
		overall end time :	
GPS coordinates of blacklight setup			Waypoint or file name:

	Scientific Name																	Environmental Data							
Start time of the period																	TOTALS	temperature [C] [F]	relative humidity - %	wind speed - max [km/h] [mph]	wind speed - avg [km/h] [mph]	cloud cover - %	precipitation level	moon visibility	barometric pressure [kPa] [inHg]
1st hour :																									
2nd hour :																									
3rd hour :																									
4th hour :																									
5th hour :																									
6th hour :																									
7th hour :																									
TOTALS																									

Dominant Plant Species		Notes/Comments/Diagrams

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Michigan Natural Features Inventory Papaipema Moth Survey Form

Instructions

1) **Survey Site**: the name of the specific location (e.g. Brandt Rd fen)

2) **Managed Area**: the name of the state game area, rec area, or nature preserve (e.g. Holly SRA)

3) Please write times using the **24 hr clock**

4) Please use **decimal degrees** or **degrees/minutes/seconds**

5) Check the box to indicate what **units** were used for the **temperature** and **wind speed** data.

6) **Cloud cover** should be estimated to the nearest 10%.

7) **Precipitation level**: **0** = none **T** = trace **1** = light **2** = moderate **3** = heavy

8) **Moon visibility**: **0** = not visible at all - obscured by clouds, other features, or below the horizon
1 = partially obscured by clouds or other features (e.g. trees, buildings)
2 = completely visible

9) **Barometric pressure**: The barometric pressure may be recorded at the same time as other env. data, if possible, but at a minimum it should be looked up later for either the beginning or end of the overall sampling period and noted whether the pressure was rising, stable, or falling.

10) You may begin the survey at any time but begin the "2nd hour" interval when the next full hour starts (e.g. you begin the 1st hour at 20:30 but the "2nd hour" begins at 21:00 and every hour thereafter is on the hour). Next to each hour designation write in the start time of that period. **Note that the first and last 1 hour periods may be partial hours so be sure to record the start and end times.**

11) You may place a small tick or question mark in the appropriate box when a known or suspect moth is collected or observed (e.g. a possible silphim borer is collected during the "3rd hour" so a "?" is marked under P. silphii next to "3rd hour"). Specimens collected within the same 1 hour period may be kept in the same kill jar and transferred later to reclosable storage bags with a slip indicating date, location, sampling period/time, and collector(s). Specimens will be ID'd later in the lab and the total number of each species will be written in the appropriate sampling hour row/column.

Papaipema spp. in Michgan in order by Hodges Number (special concern, threatened, or endangered are in bold):

(SC) *cerina* (Grt., 1874)	*lysimachiae* Bird, 1914	*appassionata* (Harv., 1876)	**(SC) *aweme*** (Lyman, 1908)
cataphracta (Grt., 1864)	*pterisii* Bird, 1907	*furcata* (Sm., 1899)	*cerussata* (Grt., 1864)
aerata (Lyman, 1901)	**(SC) *speciosissima*** (G. & R., 1868)	*nebris* (Gn., 1852)	**(SC) *sciata*** Bird, 1908
arctivorens Hamp., 1910	*inquaesita* (G. & R., 1868)	*necopina* (Grt., 1876)	*limpida* (Gn., 1852)
harrisii (Grt., 1881)	*rutila* (Gn., 1852)	**(T) *silphii*** Bird, 1915	**(SC) *beeriana*** Bird, 1923
impecuniosa (Grt., 1881)	*baptisiae* (Bird, 1902)	**(SC) *maritima*** Bird, 1909	*unimoda* (Sm., 1894)
verona (Sm., 1899)	nr. *Birdi* (Dyar, 1908)	*eupatorii* (Lyman, 1905)	
astuta Bird, 1907	*nepheleptena* (Dyar, 1908)	*nelita* (Stkr., 1898)	
leucostigma (Harr., 1841)	*circumlucens* (Sm., 1899)	*rigida* (Grt., 1877)	

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