St. Clair Delta Lakeplain Prairie and Oak Savanna Ecosystem Project: Rare Plant and Insect Surveys 2000

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NOTE: specific location information for some species has been removed from this version

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INTRODUCTION

Lakeplain prairie formed a significant part of the natural landscape of southern Lower Michigan at the time of European settlement (Comer et al. 1995). Over 80% of historical lakeplain prairie acreage was found in the southeast region of the state, especially in the counties of Monroe, Wayne, and St. Clair. The amount of lakeplain prairie has decreased greatly as a result of conversion of prairie to agriculture, in addition to the suppression of natural ecosystem processes such as wildfire and hydrological fluctuations, and, more recently, conversion of lands to residential and commercial development. At present the amount of lakeplain prairie is approximately 1000 acres, comprising only 1/2 of 1 percent of the original prairie present at the time of settlement and scattered throughout the southern Lower Peninsula of Michigan (Comer et al. 1995). Even though much of the historical lakeplain prairie community of Michigan has been severely fragmented and degraded, high quality remnants can be found that still retain a good representation of native plant diversity and likely insect species. Rare plant species historically known from lakeplain prairies have been documented in some of the highest quality remnants and there is similar potential for rare insect populations associated with this community to persist as well. In order to protect these remaining remnants and their associated rarities, it will be important to assess where they occur and design and implement management strategies that will maximize the conservation of the system as a whole, including multiple rare species. This is especially critical if we are to conserve the rarities associated with these communities.

Historically, fire functioned to impede or reduce the establishment of woody plants in these systems, that would otherwise result in the succession from lakeplain prairie to a different community type. Fire also functioned to create germination sites, release nutrients, and maintain the structure and diversity of the open prairies. Restoration efforts are currently underway in several lakeplain prairie and oak savanna remnants in southern Michigan focusing primarily on the mechanical removal of woody vegetation and re-introduction of fire as a natural ecological process (Albert et al. 1996). While such management efforts seem to have resulted in fairly good recovery of the vegetation of lakeplain prairie communities, it is important to remember that management activities rarely impact all species in the same way. For example, some insects are not fire tolerant during any part of their life cycle, thus the use of prescribed fire must be carefully considered and implemented when such insects are a conservation target. Without careful planning and the use of information on species' abundance and distribution, burning regimes designed to enhance native plant species may lead to the extirpation of rare or habitat-restricted insect species. It will be important with these and future restoration projects, to consider the impact of specific management activities on multiple conservation targets and plan accordingly.

Detailed baseline data and subsequent monitoring are essential for evaluating the impact of specific management activities on species of concern. It is essential that such studies be undertaken in order to inform future management decisions. Although systematic inventories of lakeplain prairie remnants in Michigan were conducted by Michigan Natural Features Inventory from 1994 through 1996, much of this work was focused on identifying remnant prairies within their historically known distribution and documenting occurrences of rare plant species. Much less emphasis was placed on the identification of insect populations, especially in southern Lower Michigan, owing to the scope of this statewide study. Although these inventories successfully identified numerous, if not most of the best prairie remnants in the state, as well as numerous rare plant occurrences, as well as selected rare insect occurrences, the detailed

baseline data necessary to conduct subsequent monitoring was either lacking or incomplete. This was the case for the St. Clair Delta Region in southeastern Lower Michigan, where significant lakeplain prairie remnants, rare plant and rare insect occurrences were identified. The current study was undertaken to establish baseline data on the number, location, and status of rare plant and insect species in Algonac State Park and targeted adjacent sites within the St. Clair Delta region. Extensive efforts are currently underway to restore and maintain prairie within the park. Further inventories were necessary in order to be better able to assess impacts resulting from active lakeplain prairie management, which includes prescribed burning and mechanical removal of woody plant species. Our inventories were also conducted to provide information regarding the success of these initial large-scale restoration activities such that future management can be more optimally directed.

ORGANIZATION OF REPORT

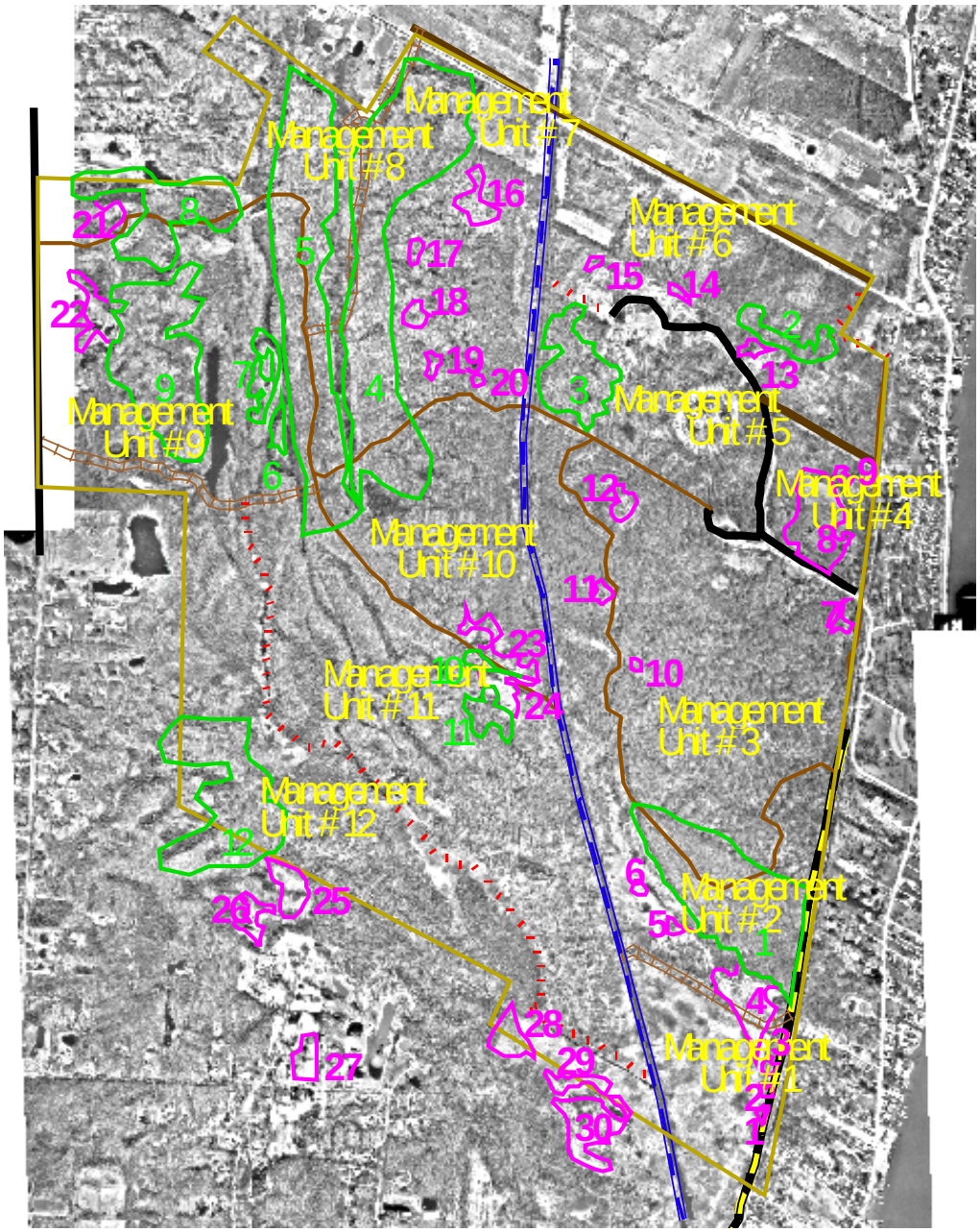
The body of the report is divided into two sections corresponding to the dual focus of the study; insect surveys and rare plant surveys. Each section provides background information on these respective groups within the St. Clair Delta Region, followed by a description of the sampling or survey methods utilized to conduct the surveys. The results and discussion are then presented in sequence. The two sections are brought together in the final section of the report, which presents a brief discussion of management and monitoring recommendations for the entire study area by each region or by management unit in the case of Algonac State Park. In Appendix I, resource managers will find selected Michigan Natural Features Inventory rare species abstracts, which are important references to help acquaint them with each of the insect and plant species of conservation concern. Annotated species lists for each of the prairie sites sampled in the St. Clair Delta are on file with the Michigan Natural Features Inventory.

THE STUDY AREA

The study area, St. Clair Delta Region, includes four sub-units; Algonac State Park, St. John's Marsh, Harsens Island, and Dickinson Island in southeastern Lower Michigan. The most extensive work occurred within Algonac State Park and the 12 management units which are identified and outlined on the map below (Figure 1). The prairie openings within Algonac State Park are classified as wet-mesic prairie and the high quality sites are dominated by little bluestem (*Andropogon scoparius*), big bluestem (*A. gerardii*), and Indian grass (*Sorghastrum nutans*). Other common plants include marsh blazing star (*Liatris spicata*), common mountain mint (*Pycnanthemum virginianum*), Ohio goldenrod (*Solidago ohioensis*) and ironweed (*Veronia missurica*). The surrounding oak forest is dominated by black oak (*Quercus velutina*), white oak (*Q. alba*), with swamp white oak (*Q. bicolor*), black cherry (*Prunus serotina*) and sassafrass (*Sassafras albidum*). The lowland hardwood forest included red maple (*Acer rubrum*), sugar maple (*A. sacchrum*), red ash (*Fraxinus pensylvanica*), American elm (*Ulmus americana*), and pin oak (*Q. palustris*).

The prairie remnant within St. John's Marsh lies inland of an extensive Great Lakes marsh and is bordered by oak forest. The prairie is classified as lakeplain wet prairie and is dominated by big bluestem,

Figure 1. Algonac State Park with Management Units and Prairie Remnants Delineated
(Map Courtesy of Robert Clancy, MDNR Parks Division, May 19, 1999).



Indian grass, and blue-joint (*Calamagrostis canadensis*). Other common prairie species include dogbane (*Apocynum sibiricum*), sedges (*Carex aurea*) and (*C. aquatilis*), Ohio goldenrod, ironweed, culver's root, marsh blazing star, wild bergamot (*Monardo fistulosa*), and giant evening primrose (*Oenothera pilosella*). The Great Lakes marsh is dominated by narrow leaved cattail (*Typha angustifolia*), with hard stemmed bulrush (*Scirpus acutus*), soft stemmed bulrush (*S. validus*), blue cattail (*Typha glauca*), mermaid weed (*Proserpinaca palustris*), and the weedy feather grass (*Phragmites australis*). The oak forest is dominated by black oak, with bur oak (*Q. macrocarpa*) and pin oak also present.

The Middle Channel lakeplain wet-mesic prairie is located on Harson's Island contained within a golf course. Four acres of prairie habitat remain although much of it has shrubbed in. The prairie is dominated by blue-joint, big bluestem, and Indian grass. Other common plants include New England aster (*Aster nova-angliea*), marsh blazing star, switch grass (*Panicum virgatum*), Ohio goldenrod, and several sedge species.

The Dickinson Island lakeplain wet prairie is located on Dickinson Island in St. Clair County. A few small pockets of prairie persist on the island although much of the original prairie has reverted to oak forest with large bur oaks, swamp white oaks, and pin oaks. The wet prairie here is dominated by blue-joint, prairie cord grass (*Spartina pectinata*), and meadow sedge (*Carex stricta*).

METHODS FOR INSECT SURVEYS

Very little insect survey work has been completed in the lakeplain prairies of the St. Clair Delta, or for that matter in all of southern Lower Michigan. In one study, over 15 lakeplain prairies were sampled for insects on at least one occasion (Comer et al. 1995), but only four prairies received intensive sampling throughout the growing season, (Albert et al. 1996) which is needed to adequately address insect biodiversity within prairies. An additional insect study was completed in September and October, 1998 but was again very limited in scope and sampling occurred in some cases 2-3 weeks too late to record rarities (DeNike 1999).

Previous sampling at Algonac State Park has resulted in the discovery of four state-listed special concern insect species including the red-legged spittlebug (*Prosapia ignipectus*), a leafhopper (*Flexamia delongi*), the blazing star borer moth (*Papaipema beeriana*), and the culver's root borer moth (*Papaipema sciata*) (Albert et al, 1996). This site has the most diverse insect fauna of any in the St. Clair Delta and contains the highest number of state-listed insects of any state park in southern Michigan.

At St. John's Marsh previous sampling had not located any listed insect species (Comer et al. 1995, DeNike 1999), although the habitat looked promising for prairie species including the red-legged spittlebug, rare prairie leafhoppers, and several *Papaipema* moth species. Past fire management may have already eliminated some species but we will never know because very little pre-management insect survey work occurred here.

Very limited insect sampling occurred on Harsen's Island during 1995 and no rare or state-listed insects were recorded. On Dickinson Island previous sampling had occurred on a few small prairie remnants on the island but no listed species were reported (DeNike 1999). The prairie remnants remaining on the island appear very small and there is very little chance that it could support rare prairie insect populations.

The goal of this project was to inventory the remnant oak savannas and lakeplain

prairie areas known within Algonac State Park, St. John's Marsh, and Dickinson Island for rare insect species. An emphasis was placed on four insect species including the red-legged spittlebug (*Prosapia ignipectus*) and the following Noctuid moths; the blazing star borer, *Papaipema beeriana* (Plate 1a), culver's root borer, *P. sciata* Plate 1b), and the maritime sunflower borer, *P. maritima*. The specific objectives of this study were to:

- Provide precise collection information by providing GPS data and topographic maps delineating the extent of any rare insects located.
- Process data and enter it into the Biological Conservation Data system.
- Prepare a report and provide monitoring recommendations for the located rare insects.

Sweepnetting

At each location, vegetation along designated transects was sampled using sweepnets. A standard sample consisted of sixty swings of a sweepnet, with one swing taken with each step as the collector walked perpendicular to the water level transect. The contents of the net were emptied into a large killing jar charged with ethyl acetate. When the specimens had stopped moving we transferred the sample to a zip-lock plastic bag and placed it into a cooler. Bagged samples were then frozen until they could be processed in the fall.

Upon completion of the field seasons insect samples were processed. This included sorting all of the insects from the vegetation, pinning larger specimens and pointing smaller ones. We proceeded to label all specimens and identify to genus and species all specimens in the orders Homoptera and Lepidoptera. In difficult groups, where keys were unclear or where the specimens required detailed genitalic dissections, specimens were sent to experts for identification. All specimens are currently in the Michigan Natural Features Inventory Insect Reference Collection. A set of voucher specimens will be reposited in the University of Michigan Insect Collection, Ann Arbor or in the case of Lepidoptera in the Michigan State University Insect Collection, East Lansing.

Larval Searches

Surveys to assess the population size and distribution of *Papaipema sciata* occurred during the larval brood in July of 1999. Surveys for this species are most easily attempted during the larval brood when feeding damage can be readily observed on the foodplant. The feeding damage is characterized by wilted leaves, stunted plant growth, and imperfect flower inflorescences (figure 2). In addition, a small hole in the stem, 1 to 6 inches from the ground with large amounts of brown or reddish brown "frass" (caterpillar droppings) can be observed in the field (figures 3-4). During late July1999, two days were spent at Algonac State Park and one day at St. John's Marsh in search of larval feeding sign for the culver's root borer moth. Prairie parcels which contained the larval host plant, were surveyed. A total of 500 plants (fewer if 500 plants were not available) were sampled at each of the parcels.

Adult *Papaipema* Surveys

Light trapping consisted of standard mercury-vapor and UV lights, powered by a portable Honda generator. A 2 x 2 meter metal conduit frame supporting a large white sheet was used as a collecting surface (Figure 5). This frame was placed in the field in a central location with larval host plants on all sides to maximize the likelihood of collecting *Papaipema* adults.

Figure 2. Stunted Culver's root infested with Culver's root borer moth larva.

Figure 3. Characteristic larval feeding signs for culver's root borer moth, *Papaipema sciata*.

Figure 4. Characteristic larval frass pile produced by culver's root borer moth at base of host plant.

Figure 5. Blacklighting set-up at Algonac State Park, September, 1999.

METHODS FOR PLANT SURVEYS

Previous Botanical Surveys

The St. Clair Delta region is well known for numerous rare plant records. Many of these derive from collections made in the early 1900s by C.K. Dodge, a well known early Michigan botanist who concentrated a large portion of his botanical work in St. Clair County (Voss 1972). Much later, botanists such as Paul Thompson, representing the Michigan Natural Areas Council (MNAC), explored the region and identified prairie remnants within Algonac State Park. MNAC then recommended certain areas for formal natural area dedication.

Subsequent to Thompson's work, several inventories within and adjacent to Algonac State Park were conducted by MNFI ecologists and botanists. These surveys included a notable inventory of the western portion of the park (MNFI 1988), resulting in the identification of numerous new plant records, including Atlantic Coastal Plain disjuncts and a state record for the globally rare Skinner's gerardia (*Agalinis skinneriana*). In addition to the aforementioned, among the newly discovered species were *Agalinis gattingeri* (Gattinger's gerardia), *Aristida longespica* (three-awned grass), *Hemicarpha micrantha* (dwarf bulrush), *Hypericum gentianoides* (gentian-leaved St. John's-wort), *Juncus brachycarpus* (short-fruited rush), and *Ludwigia alternifolia* (seedbox). Several of these species were found in shallow, former borrow pit excavations and other areas that supported a succession of secondary prairie vegetation. Algonac State Park and its environs were further evaluated during a statewide inventory of lakeplain prairie, a globally imperiled natural community type studied by Comer et al. (1995) and during a statewide status survey for *Agalinis skinneriana* (Penskar and Comer 1996). During the latter study, it was determined that three of the four identified state populations for this species were the result of false reports, based on misidentifications of the common *Agalinis tenuifolia* (narrow-leaved gerardia). Algonac State Park thus was determined to support the only known state population for *A. skinneriana*, where its specific status was poorly known, and further survey was recommended. It was also during this survey that *Lycopodiella subappressa* (northern appressed clubmoss) was first identified and collected, and *Lycopodiella margueritae* (northern prostrate clubmoss) was also suspected as occurring within the swarm of clubmosses found, which included the common bog clubmoss (*Lycopodiella inundata*) and putative backcrosses.

Two islands within the St. Clair delta, Harsens Island and Dickinson Island, are also known to support remnant lakeplain prairie communities and rare plant elements, the most significant being *Platanthera leucophaea* (eastern prairie-fringed orchid), a federal threatened and state endangered species classified as globally imperiled (G2) by The Nature Conservancy. Michigan represents one of the strongholds for this species within its eastern North America and largely United States range. It is thus important to ascertain the status of all remaining populations, including small colonies that are able to persist in regions where restoration efforts are taking place or have been seriously considered. Harsens and Dickinson islands were therefore targeted in this survey primarily to determine the current status of *Platanthera leucophaea* in prairie remnants where it has been previously documented.

The specific objectives of this survey were to:

- Inventory Algonac State Park to provide detailed location information for known rare plant species, with an emphasis on the globally rare Skinner's agalinis

(*Agalinis skinneriana*) and state endangered and threatened species, to assist ongoing stewardship work and preparation of a park monitoring plan.
- Inventory Dickinson Island and Harsons Island to conduct status assessment of previously documented populations of eastern prairie-fringed orchid, *Platanthera leucophaea*.

Survey Methods

Reconnaissance was conducted in late June with Parks and Recreation Division staff (Robert Clancy and Glenn Palmgren) to become familiarized with the identified Management Units in Algonac State Park, receive training on a Trimble Global Positioning System (GPS) backpack unit, and to discuss survey and GPS methodologies. Surveys were conducted on July 6-7 and August 23-25, consisting of early and late season inventories, in order to capture the flowering and/or fruiting periods of targeted rare plant species within the most optimal survey windows. Early season surveys focused on *Platanthera leucophaea* and selected species such as *Asclepias purpurascens* (purple milkweed), *A. sullivantii* (Sullivant's milkweed), *Scirpus clintonii* (Clinton's bulrush) and other potential rarities, such as *Polygala incarnata* (pink milkwort), while late season surveys focused on the numerous species (e.g. Coastal Plain disjuncts et al.) known from the northwestern portion of the park. No late season surveys were conducted on Harsens and Dickinsons Islands since only *Platanthera leucophaea* and the aforementioned milkweeds were expected there. No surveys were targeted for St. John's marsh, based on intensive work performed previously by staff ecologists.

Surveys were conducted by systematically meandering throughout appropriate habitats, concentrating on most of the mapped prairie remnants identified by parks stewardship staff within the several Management Units (Figure 1) We noted all plant species encountered while seeking out specific microhabitats that could potentially harbor the target species. General species lists were compiled and attached to field forms. All colonies of rare species encountered were recorded via the Trimble GPS backpack unit, with the exception of *Asclepias purpurascens*, which was found to be widely scattered in most prairie remnants and ubiquitous. During early reconnaissance, it was decided in collaboration with Parks Division staff that we would not attempt to geo-reference the latter species, based on its abundance and widely disparate distribution of stems. Geo-referencing was completed by the recordation of point locations (if a single stem was encountered), or by delimiting an observed colony boundary and recording it as necessary. In some instances an isolated habitat remnant within which a rare plant was located was also delimited and recorded (e.g. the Middle Channel golf course prairie remnant).

Standard MNFI field forms (site summary and special plant forms) reporting the status of each rare species were completed. Photographs of habitats and selected target species were taken where appropriate. Occasional specimens and plant fragments were collected for keying and determination in order to be added to the general plant lists for each examined prairie remnant. Specimens of clubmosses (*Lycopodiella* species) thought to be rarities (Bruce and Wagner 1991) were formally collected as vouchers for examination by a specialist at the University of Michigan, Dr. Warren H. Wagner, Jr[1]. Throughout both early and late-season surveys, recorded GPS data were remanded to Parks Bureau staff for post-processing within one to two days of the survey date.

Botanical references for keying and nomenclature largely consisted of Voss (1996, 1985, 1972) for the majority of the flora, Case (1987) for orchids, Morin (1993) for pteridophytes and Gleason and Cronquist (1991) and Holmgren (1998) for additional species treated differently than the preceding.

[1] Deceased as of January, 2000.

RESULTS AND DISCUSSION FOR INSECT SURVEYS

Several new insect occurrences were documented from Algonac State Park and St. John's Marsh. GIS and topographic maps delineating Element Occurrences (EOs) are currently housed with Robert Clancy, Parks and Recreation Division. In addition, all animal occurrences have been added to MNFI's Biological Conservation Database (BCD).

Sweepnetting

Numerous insect specimens were collected as part of our survey mostly specimens of Homoptera (cicadas, hoppers), Hemiptera (true bugs), and Orthoptera (grasshoppers, crickets). The most significant discovery resulting from the sweepnetting was the new discovery of the red-legged spittlebug (*Prosapia ignipectus*) at St. John's Marsh. This spittlebug species was recorded from both prairie openings at St. John's Marsh while sweeping big bluestem (*Andropogon gerardii*), an abundant grass at this prairie. We failed to relocate *ignipectus* from prairie # 21 and prairie # 23/24 at Algonac State Park. No other state-listed insects were recorded from the 1999 sweep samples.

Larval Searches

Nearly 4,000 stems of culver's root, *Veronicastrum virginicum*, were inspected for the presence of culver's root borer moth larvae (Table 1). The highest infestation rate occurred at Algonac State Park, Prairie # 23 (4.6%) an area which has been burned in the past, most recently in the spring of 1995. This area also appeared to have the highest concentration of the moth's hostplant, culver's root, although this was not quantified. Also keep in mind that Prairie # 24 occurs adjacent to Prairie # 23 and has not been burned in recent years and never have both prairies been burned during the same year. This might explain the persistence of the moth in this area; the unburned portions of the prairie acting as refugia when the adjacent patch was burned. The close proximity allowed recolinization to the burned habitat as the larval host plant responded to fire.

Table 1. 1999 Culver's root borer (*Papaipema sciata*) monitoring data for the St. Clair Delta, St. Clair County, Michigan.

Site and Management Unit (MU)	Total stems sampled	% habitat sampled	Stems infested	Infestation rate	Burn/Management History
Algonac State Park					
MU 10, Prairie # 23	500	25%	23	4.60%	last burned spring 1995
MU 11, Prairie # 24	500	99%	16	2.20%	unburned recently (last 5 years)
MU 2, Prairie # 4	500	75%	2	0.40%	burned spring 1998
MU 4, Prairie # 8	0	100%	0	0.00%	burned spring of 1998 and 99
MU 7, Prairie # 16	443	99%	17	3.80%	not burned
Total	**1943**		**58**	**3.00%**	
St. John's Prairie					
South	514	33%	0	0.00%	last burned spring 1999
North	500	99%	0	0.00%	last burned spring 1999
Total	**1014**		**0**	**0.00%**	

The next highest infestation rate occurred in Prairie # 16 (3.8%). This prairie opening was becoming overgrown with shrubs and so it was hydro-axed during the winter of 1997-98. It appears that culver's root responded favorably with nearly 450 flowering stems occupying this small opening during the summer of 1999. This site has not been burned in recent years but is scheduled to be burned in the spring of 2000.

Prairie # 4 contained only two moth larva or an infestation rate of 0.4%. The site had been burned the previous two years with a wildfire burning the south half during the spring of 1999. One could argue that burning has all but eliminated the moth from the site but one could also suggest that burning created additional habitat that is recently being exploited by the moth. Unfortunately we have no pre-management data from the site so we can not further discuss the data in relation to the implications of burning.

The two prairie patches at St. John's Marsh failed to produce any culver's root borer moth larvae despite the abundance of flowering culver's root. Again, we have no pre-management data from this site so we can not elaborate any further. This area does appear to be a site where one could attempt introductions (or reintroduction) of the species.

While there were a few plants of culver's root on Dickinson Island we did spend some time searching for larvae but we did not conduct blacklight surveys later in the season in search of adults. Based on our larval searching and the fact that there is not a large concentration of the host plant it is unlikely that the prairie here supports a population of the moth on the island. As prairie restoration continues at the site, and if culver's root becomes more numerous then surveys for the moth should be undertaken.

Adult *Papaipema* Surveys

Blacklighting occurred at several sites within the study area. Algonac State Park was sampled on five different nights during September and St. John's Marsh was surveyed on one additional night during September. Three new prairie parcels contained the blazing star borer moth (Algonac #8, #14, and St. John's Marsh). In addition, the blazing star borer moth was reconfirmed from one site (Algonac #23/24). Further surveys will likely yield similar results from additional prairies in Algonac State Park (i.e., Algonac # 4, # 22, # 5, # 6). The culver's root borer was collected only from the previously known Algonac # 23/24 site even though larvae were observed earlier in the season from three prairies within Algonac State Park (# 23/24, # 16, and # 4). Our blacklighting surveys may have been a little early based on the freshness of the two adult moths collected. Further blacklighting surveys will likely record adults from all prairies in Algonac which contained larval feeding damage. Several rare insect occurrences have been documented in recent years at lakeplain prairie sites within the St. Clair Delta and are summarized in Table 2. Species in bold were located during 1999 surveys. Several different collecting techniques have been utilized including the sweep netting, blacklighting, and larval searching.

Table 2. Rare insect occurrences in the St. Clair Delta Region.

Site & Management Unit (MU)	Species	Common Name	Host plant	State Status
Algonac State Park				
MU 2, Prairie # X	**Papaipema sciata**	Culver's root borer moth	Culver's root	SC
MU 4, Prairie # X	**Papaipema beeriana**	Blazing star borer moth	Blazing star	SC
MU 4, Prairie # X	**Papaipema beeriana**	Blazing star borer moth	Blazing star	SC
MU 7, Prairie # X	**Papaipema sciata**	Blazing star borer moth	Blazing star	SC
MU 8, Prairie # X	Prosapia ignipectus	Red-legged spittlebug	Bluestem grasses	SC
	Flexamia delongi	A leafhopper	Little bluestem	SC
	Flexamia reflexa	A leafhopper	Indian grass	SC
MU 10/11, Prairie # X	Prosapia ignipectus	Red-legged spittlebug	Bluestem grasses	SC
	Papaipema sciata	Culver's root borer moth	Culver's root	SC
	Papaipema beeriana	Blazing star borer moth	Blazing star	SC
MU 12, Prairie # X	Prosapia ignipectus	Red-legged spittlebug	Bluestem grasses	SC
St. John's Marsh				
North	**Prosapia ignipectus**	Red-legged spittlebug	Bluestem grasses	SC
South	**Prosapia ignipectus**	Red-legged spittlebug	Bluestem grasses	SC
South	**Papaipema beeriana**	Blazing star borer moth	Blazing star	SC
Harsen's Island	no rarities found	-	-	
Dickinson Island	no rarities found	-	-	

X= specific location removed to protect sensitive species

RESULTS AND DISCUSSION FOR PLANT SURVEYS

Algonac State Park- Several colonies of state special concern purple milkweed (Plate 2a) were identified in Algonac State Park, in addition to less frequent clumps of state threatened Sullivant's milkweed. A reported colony of state special concern Clinton's bulrush (*Scirpus clintonii*) was also located, while the state extirpated pink milkwort (*Polygala incarnata*) known only from a general historical record for the Algonac vicinity, was unsuccessfully sought in all potential areas. Eastern prairie-fringed orchid was not relocated on Dickinson Island, nor any additional rare plant species, whereas on Harsen's Island, two individuals of prairie fringed orchid was discovered in the remnant prairie habitat of a previously known site within a golf course, and a small population of Sullivant's milkweed (Plate 2b) was also relocated at the same site.

The state endangered Skinner's gerardia (*Agalinis skinnerina*), a potential federal candidate species was sought carefully within all potential sites without success, although this species has been documented previously in prairie remnants # 21-22 within Management Unit 9 (Brodowicz 1990). Although some possible specimens of this species here and in other areas were collected for subsequent verification, it is suspected that reports of this species in some areas of Algonac State Park were invalid, based on the incorrect identification of the common narrow-leaved gerardia (*Agalinis tenuifolia*). We believe that Skinner's gerardia is likely extant within the park, but conclude that it is extremely rare and local, or perhaps subject to wide population fluctuations from year to year. All specimens obtained for examination by Dr. Anton Reznicek of the University of Michigan Herbarium were verified as narrow-leaved gerardia. Gattinger's gerardia (*Agalinis gattingeri*)(Plate 3a), a

rare associate whose only known extant population is within Algonac State Park, was found in remnant #21, precisely where it has been observed in previous surveys (Penskar and Comer 1996; MNFI 1988).

Previously known populations of three-awned grass (*Aristida longespica*), short-fruited rush (*Juncus brachycarpus*), nut-rush (*Scleria triglomerata*), gentian-leaved St. John's-wort (*Hypericum gentianoides*), and seedbox (*Ludwigia alternifolia*) were found, and element occurrence records were updated within BCD accordingly. Lastly, a colony of bog clubmoss was carefully examined and tentatively identified as containing one and possibly two state listed clubmoss species, consisting of state special concern northern appressed clubmoss (*Lycopodiella subappressa*) (Plate 3b), and potentially the state threatened northern prostrate clubmoss (*Lycopodiella margueritae*); collections of specimens of these putative taxa will require confirmation by a specialist, although we are reasonably certain of the presence of *L. subappressa*. A summary of all plant occurrences is provided in table 3, with a breakdown by management unit and prairie for Algonac State Park. Species located during the inventory are identified in bold text.

Dickinson Island- No individuals of Eastern prairie-fringed orchid were found despite careful inventory of the previously documented site and searching of several other adjacent areas. Droughty summers have apparently resulted in severely reduced population numbers of this species elsewhere, and thus this population may be dormant. However, examination of apparently moist suitable habitat in a nearby area also revealed no plants. It is possible that this small population is longer extant on the island, based on the current condition of the habitat. Although prairie vegetation was present, and was highlighted as our principal survey areas, we found the habitat to be of relatively poor quality. Much of the island periphery, and even shaded areas within the exterior, are colonized by the highly invasive giant bulrush (*Phragmites australis*), whereas prairie vegetation on the south side of the island is largely confined to the edges of mowed areas. Further survey may have merit in less droughty years, but we have low expectations based on the diminished quality of the little available habitat that remains.

Harsens Island- Eastern prairie-fringed orchid has been documented previously within remnant prairie habitat occurring at Middle Channel golf course. Careful inventory of a distinctive yet isolated prairie fragment within a golf course fairway resulted in the discovery of two flowering stems. It is thus also highly likely that vegetative individuals (sterile juveniles) are present as well. Thus this isolated population continues to persist, and finding flowering plants during a fairly droughty season is perhaps an indicator of the robustness of this small colony. Its viability is compromised by its context within a golf course, yet the colony is important to maintain, perhaps to serve as stock for introducing into more viable habitats within prairie restorations. In addition to the orchid, a small previously known population of Sullivant's milkweed was also observed.

Table 3. Rare plant species occurrences in St. Clair Delta Region.

Site & Management Unit (MU)	Species	Common Name	State Status
Algonac State Park			
MU 1, Prairie #X	**Asclepias sullivantii**	Sullivant's milweed	T
MU 4, Prairie # X	**Asclepias sullivantii**	Sullivant's milkweed	T
	Asclepias purpurascens	purple milkweed	SC
MU 6, Prairie # X	**Asclepias purpurascens**	purple milkweed	SC
	Asclepias sullivantii	Sullivant's milkweed	T
MU 7, Prairie #X	**Asclepias purpurascens**	purple milkweed	SC
	Asclepias sullivantii	Sullivant's milkweed	T
	Scirpus clintonii	Clinton's bulrush	SC
MU9, Prairie #X	**Agalinis gattingeri**	Gattinger's gerardia	E
	Agalinis skinneriana	Skinner's agalinis	E
	Aristida longespica	three-awned grass	T
	Hemicarpha micrantha	dwarf bulrush	SC
	Hypericum gentianoides	orange-grass	SC
	Juncus brachycarpus	short-fruited rush	T
	Ludwigia alternifolia	seedbox	SC
	Lycopodiella subappressa	northern appressed clubmoss	SC
	Lycopodiella margueritae	northern prostrate clubmoss	T
	Scleria triglomerata	Tall nut-rush	SC
Harsens Island			
XXXXXXXXXX XXXXXXXXXXX	**Asclepias sullivantii**	Sullivant's milkweed	T
	Platanthera leucophaea	eastern prairie-fringed orchid	LT, T
Dickinsons Island	Platanthera leucophaea	eastern prairie-fringed orchid	LT, T

X= specific location removed to protect sensitive species

MANAGEMENT RECOMMENDATIONS

General Management Considerations for Insects

Much recent attention has been given to the subject of managing prairies compatibly with insects although no study, to my knowledge, has yet offered a definitive solution. There is no one magical formula that will protect all insects from effects of management or succession. There are, however, several suggested guidelines which managers should heed if their goal is to manage areas for native biodiversity. Below are comments from various sources:

- It is not valid to assume that an intact plant community ensures an intact animal community (Reed 1995).

- Panzer (1988) notes that habitat deficiencies, excessive levels of competition and predation, and intensive burning regimes can contribute to the local extinction of insects from prairie remnants; therefore, management should minimize these problems by restoring habitat diversity, eliminating unnatural habitat features, and burning with restraint.

- Opler (1981) recommends surveying and mapping sensitive insects on prairie remnants on a regionally coordinated basis, followed by monitoring of presence and relative population levels.

- Burning and mowing should be done on a rotational scale, and the entire extent of an insect's host or nectar plant should not be burned or mowed simultaneously (Reed 1995).

- Burning need not be eliminated as a management tool, but should be done cautiously. Fifty to 75% of an intact plant community should be spared from burning each year, while severely degraded areas should be burned intensively to expand and restore prairie plant communities (Reed 1995). Further, unburned skips should be left as they occur, and fires should be cool.

- In Ohio, Metzler and Zebold (1993) recommend a four-year burn rotation with no more than 25% of Huffman Prairie to be burned in any year.

- To benefit most prairie insects, sites should include unburned and recently burned areas, at the spatial scales insects use. To develop a mix of fire tolerant and intolerant insects, keep each site patchy in terms of time since burning or mowing. Burning can be done on a three year rotation with the usual cautions such as: do not burn a whole patch of any kind in the same year, do not burn adjacent units in consecutive years, and leave ample refuges for fire intolerant species. Most importantly, maintain complete records of all management actions and monitor the results (Reed 1995).

Site Specific Management Considerations

Algonac State Park- There are currently several small prairie openings throughout the park, each representing various stages of recovery from past land-use and fire suppression. The most recent management plan delineates a total of 12 management units. Each unit contains at least one identified prairie remnant or restoration effort, with the exception of management units 5 and 8.

Management Unit 1: [Prairies 1, 2, 3 and part of 4] Continue with current management scenario with brush cutting (hydro-axing) and burning. No rare insect species have been identified from any of the prairie parcels within this management unit. Continue to periodically search for rare invertebrates to see if they can become established in restored prairie habitats. Continue to survey for rare plant species as management actions proceed. Prairie remnant #4 appears to have potential to serve as a reintroduction site for Eastern prairie-fringed orchid, should this be considered a viable option.

Management Unit 2: [Prairies 5, 6, 11, and part of 4] The culver's root borer moth occurs in very small numbers in prairie # 4. Concentrations of the host plant should be identified within this parcel and efforts to minimize the intensity of burns within these host plant concentrations should be implemented (i.e., water down plants, use foam to create skips in the burn, etc.). Continue to survey for additional rare plant taxa that may appear following management activities.

Management Unit 3: [Prairies 7, 10, 12] No rare insects were recorded from any of the prairies within this management unit. A combination of burning and hydro-axing (when the ground is frozen) should help restore prairie and eventually provide habitat for the culver's root borer moth, the blazing

star borer moth, the red-legged spittlebug and other prairie inhabiting insects.

Management Unit 4: [Prairies 8, 9] Prairie # 8 contains the blazingstar borer moth. Burning could be initiated within this management unit if burns are not complete and host plant concentrations are identified and protected from hot burns. Maintain observations of rare plant species.

Management Unit 5: [Oak woods remnant 3] No prairie parcels are located within this management unit.

Management Unit 6: [Prairies 13, 14, and 15] This management unit contains three small prairie parcels with one of them (prairie # 14) containing the blazing star borer moth. While surveying for adult *Papaipema* moths last summer, much of this prairie had been mowed. If mowing is to occur here the blades should be raised to the 6 to 8" range at a minimum to allow enough of a duff layer for adults to lay eggs for subsequent generations. Hydro-axing should continue at this site to open up even more habitat. Burning can also continue if burns are not complete and host plant concentrations are identified and protected from hot burns. Maintain making qualitative observations of rare plant species (purple and Sullivant's milkweeds).

Management Unit 7: [Prairies 16, 17, 18, 19 and 20] The only prairie in this management unit that contains any rare insects is prairie # 16. This site contains the culver's root borer moth. Initial management activities appear to be highly beneficial to rare plant species. Additional rarities may emerge as management proceeds.

Management Unit 8: Contains no prairie areas or identified prairie restorations.

Management Unit 9: [Prairie 21, 22] This parcel of lakeplain prairie contains records for the red-legged spittlebug and for two special concern leafhoppers (*Flexamia delongi*, *F. reflexa*). Sampling during 1999 failed to relocate any of these species and further sampling should be undertaken to see if these species persist at this prairie. Burning every 3-5 years should be continued at this site in order to restore more prairie habitat. This is the area of highest rare plant diversity, and thus a high degree of protection is encouraged. Skinner's gerardia was documented within one of these prairie remnants, and appears to be highly local and rare. Further survey is necessary to determine the status of this species.

Management Unit 10: Management unit 10/11 contains one of the largest and most diverse prairies (23/24) just west of the drain. Because this area contains a diversity of prairie forbs and native, warm season grasses it also contains the most sensitive insect species including several prairie leafhoppers, the red-legged spittlebug, and two rare *Papaipema* species. Burning the entire prairie could have a significant impact on the invertebrate diversity within Algonac State Park. This prairie needs to be managed carefully in order to provide refugia for several prairie invertebrates. The fact that this entire prairie has never been burned in any single year likely owes to its rich invertebrate fauna. One one rare plant was observed in this area, purple milkweed, yet this is one of the highest quality habitats within the park. It is likely that additional rarities will appear as management proceeds. Skinner's gerardia should be carefully sought in this remnant.

Management Unit 12: [Prairies 28, 29, north 1/2 30] Management in these parcels depends on cooperation with private landowners to the south of the park. Hydro-axing would open this area up and restore additional prairie habitat although access to these prairies may be difficult. Further survey work should be conducted at these prairies for rare insects especially *Papaipema* species.

St. John's Marsh- Divide the prairies into two or more management units and burn every 3-5 years alternating so that no two units are burned in consecutive years. Periodically sample for *Papaipema* moths and rare leafhoppers.

Dickinson Island- No rare insects found on the island. Continue with burning to restore the prairie on the island. Continue to periodically sample for rare insects as restoration work continues on the island. The possibility of finding rarities in terms of plants and insects exists once the restoration work restores areas of higher quality lakeplain prairie. Giant bulrush is invading much of the island and requires management to contain it. Further inventory in less droughty years is recommended to determine if Eastern prairie-fringed orchid remains extant.

Harsens Island- No rare insects were documented on the island. Several areas within the state game area, although not examined during this inventory, provide prairie habitat and should be considered for management, including prescribed burning, shrub removal, etc. A small prairie remnant within Middle Channel golf course maintains small colonies of Eastern prairie-fringed orchid and Sullivant's milkweed. Landowner contact, or a continuation of the presumed earlier registry of this tract, is emphasized, with a possibility for conducting future management to perpetuate these rare plant populations.

MONITORING RECOMMENDATIONS

Insects

The results of this and other studies (Albert et al. 1996, Comer et al. 1995, De Nike 1999) indicate that the remaining lakeplain prairie remnants of Michigan contain a very rich invertebrate fauna. While it is impossible to monitor the impact of management on every species or even groups (i.e., order, family, subfamily) of invertebrates, it is still important for land managers to consider them in their plans. The idea of indicator assemblages is not a new concept as it has been used with vertebrate groups for some time (Arenz and Joern 1996). Certain invertebrate taxa can be monitored to determine how they respond to management activities, providing information that may be able to be extrapolated to all the remaining invertebrate biota (Kremen et al. 1993; Samways 1994). A few groups of insects are logical choices for monitoring purposes including certain species of leafhoppers (Homoptera: Cicadellidae), spittlebugs (Homoptera: Cercopidae), and *Papaipema* moths (Lepidoptera: Noctuidae) (Arenz and Joern, 1996). These indicator groups contain many species that are very host-plant specific (Panzer et al. 1995) and can be surveyed for relatively easily (sweep netting for the leafhoppers and spittlebugs; black lighting and visually searching for the moth larvae or feeding damage). The challenge is not obtaining specimens but rather getting specimens identified or identified accurately, as many of the leafhoppers are quite small and both groups contain many similar looking species. Expertise in these groups is available, however, and this challenge should not outweigh the need to preserve biotic diversity at these sites.

Two insect groups that lend themselves particularly well for monitoring within the St. Clair Delta, include the red-legged spittlebug (Homoptera: Cercopidae) and *Papaipema* moths (Lepidoptera: Noctuidae). Sweep netting transects have been established with GPS coordinates at several sites within Algonac State Park and at St. John's Marsh. These transects should be swept for insect rarities on a continuing basis to help determine if management effects the health or persistence of red-

legged spittlebug populations (or other rare insects, e.g., leafhoppers) within these prairie remnants. Sampling should occur in late July or early August during which time the red-legged spittlebugs are adults. Sampling should occur after 10:00 am and before 5:00 pm on sunny days with little or no wind and should **not** occur if the vegetation is wet from recent rains or heavy dews. Sweep samples should be collected, placed into containers and processed back in the laboratory. Voucher specimens should be identified by qualified entomologists and retained in an established university insect collection.

The culver's root borer moth, as mentioned earlier, is a species that can readily be located from larval feeding damage on its hostplant. Monitoring plots have already been established at three sites within Algonac State Park and two sites within St. John's Marsh. Differing management is currently being prescribed at these sites within Algonac, therefore the effects of various management could be monitored at these predetermined plots. In addition to monitoring the insect directly, in this case where you have a host specific insect, you could map (with GPS units) the locations of hostplant and use this in future management and conservation planning efforts. For instance, if you were to split a prairie into two management units you might determine the split based on locations of larval hostplant. Or if a trail was to be placed through a prairie you could avoid known locations of hostplants. These surveys will allow managers to practice adaptive management by providing them with the most current distribution of culver's root or the associated moth (culver's root borer) within the prairies. Locations of rare elements and management plans should be evaluated on a yearly basis, therefore management options can remain flexible based on sound biological data.

While larval sampling works fine for the culver's root borer, it doesn't work for the blazing star borer since the larvae burrow in the root stock and are more difficult to find in the field and sampling is destructive to the host plant. In this case, blacklighting is the best monitoring technique. Adult *Papaipema* blacklight stations have already been established at five sites within Algonac State Park and at one site in St. John's Marsh. Blacklighting, to document presence or absence, should continue at a minimum of one night (more if budget allows) during the peak flights for *Papaipema* moths. More rigorous monitoring would require several nights of blacklighting during the months of September and early October.

Plants

Management of Algonac State Park's prairie remnants clearly indicates the high degree to which these communities rapidly respond to woody plant removal and prescribed burning. Initial efforts show an immediate response to hydro-axing and fire, and it is expected that rare plants will continue to emerge and expand their distribution within the managed sites. Qualitative monitoring, consisting of the ongoing reconnaissance of the prairie openings, is suggested on an annual basis to assess the status of number of rare plant colonies; for many of the prairie remnants, this consists largely of noting the colonies of purple milkweed and Sullivant's milkweed. In addition, new species that may appear should be sought, particularly in wet depressions or seasonally moist sandy soil. Historically documented species for the Algonac area, such as few-flowered nut-rush (*Scleria pauciflora*) and pink milkwort (*Polygonum incarnata*) may yet appear as the prairie remnants continue to be opened up and carefully subjected to prescribed burn regimes. In general, quantitative vegetation monitoring should be considered in selected areas to determine the specific effects of management treatments on both the native and non-native flora.

If management proceeds within prairie remnants #21-22, a site with high plant diversity, several rare plant populations should be monitored carefully to determine their response. Several of these species are restricted to the seasonally moist soil of

abandoned sand borrow pit excavations, and the emergence or abundance of species may be related to moisture conditions and seasonal climate regimes. Monitoring should be strongly considered even if active management is not implemented to compile baseline information concerning the dynamics of these populations. For example, many of these species colonized this area following the former artificial disturbance of sand removal. As additional vegetation colonizes and dominates this area, these early successional species may become diminished. Management may be required in order to perpetuate the conditions necessary to maintain some of the species, and thus monitoring is necessary in order to determine the results of experimental management treatments.

SUMMARY AND CONCLUSIONS

Lakeplain prairie once formed a significant part of the natural landscape of the St. Clair Delta at the time of European settlement. The amount of lakeplain prairie has decreased greatly as a result of conversion of prairie to agriculture, and the conversion of habitat due to commercial and residential development. Rare plants and animals have been documented in recent years in some of the highest quality remnants that persist. In order to protect these remaining remnants and their associated rare flora and fauna, it is important to assess where they occur and design and implement management strategies that will maximize the conservation of the system.

During the summer of 1999, MNFI surveyed the remaining lakeplain prairies for rare plants and insects. Surveys focused on known prairie remnants within Algonac State Park, St. John's Marsh, Dickinson Island, and Harsen's Island. Emphasis was placed on four insect species including the red-legged spittlebug, Culver's root borer moth, blazing star borer moth, and the maritime sunflower borer moth. Three sampling techniques were utilized including sweepnetting, larval searching, and blacklight surveys. Plant surveys focused on the globally rare Skinner's gerardia and the Eastern prarie-fringed orchid, and included inventories of several other taxa, including Atlantic Coastal Plain disjuncts.

One new occurrence for the red-legged spittlebug was documented from St. John's Marsh and several new occurrences for the Culver's root borer moth and blazing star borer moth were recorded. We failed to locate any populations for the maritime sunflower borer moth. We also searched nearly 4,000 stems of culver's root for the presence of culver's root borer moth larvae. This work resulted in the documentation of larval concentrations at three lakeplain remnants within Algonac State Park. This information should allow managers to more carefully plan management activities that will be more compatible with the long-term viability of the moth.

Eastern prairie-fringed orchid was not relocated on Dickinson Island, where marginal habitat was observed. A previously known population of the orchid was found on Harsen’s Island, in addition to Sullivant’s milkweed. Skinner’s gerardia was not found in Algonac State Park despite careful searches of its known localities; the species is likely extant but may be very rare and local, and further survey is necessary. Several populations of additional rare plant taxa were located and geo-referenced, including tentatively identified colonies of northern appressed clubmoss (*Lycopodiella subappressa*) and possibly the rarer northern prostrate clubmoss (*Lycopodiella margueritae*).

COLOR PLATES

PLATE 1

A.) The state special concern blazing star borer moth (*Papaipema beeriana*) was recorded from four lakeplain prairie remnants within Algonac State Park. The specimen pictured here was photographed at Prairie # 8 amongst a large concentration of its larval food plant blazing star (*Liatris spicata*).

B.) The Culver's root borer moth (*Papaipema sciata*) a state special concern species which was recorded from four lakeplain prairie remnants within Algonac State Park.

PLATE 2

A.) Purple milkweed (*Asclepias purpurascens*) a state special concern species found in many prairie remnants of Algonac State Park.

B.) Colic root (*Aletris farinosa*) a lakeplain prairie indicator species found in prairie remnants 21 and 22. This species is nearly always associated with rare taxa.

B.) Sullivant's milkweed (*Asclepias sullivantii*) a state threatened species found in Algonac State Park and on Harsen's Island.

PLATE 3

A.) Gattinger's gerardia (*Agalinis gattingeri*) a state endangered species whose only known extant site occurs within Algonac State Park. This population is associated with Skinner's gerardia (*A. skinneriana*) a state endangered species only found in Algonac State Park. The photo displays an important diagnostic character, the extremely long flower stalks that much surpass the subtending leaf bract.

B.) Northern appressed clubmoss (*Lycopodiella subappressa*) a state special concern species tentatively identified within Algonac State Park prairie remnant # 22. This population represents one of the few known in southeastern Michigan. Diagnostic characters include the strongly appressed peduncle leaves and relatively short proportion of the strobilus.

PLATE 4

A.) Prairie remnant #14, a rich prairie landcape dominated by blazing star (*Liatris spicata*) bluestems, and several other species prior to peak blooming period of many forbs. This site is one of three sites within Algonac State Park that contained the blazing star borer moth.

B.) Algonac State Park prairie remnant # 21, displaying a response of prairie vegetation following an early spring burn; depicted are colic root and butterfly weed (*Asclepias tuberosa*). Gattinger's gerardia and several other rare species are known from this site.

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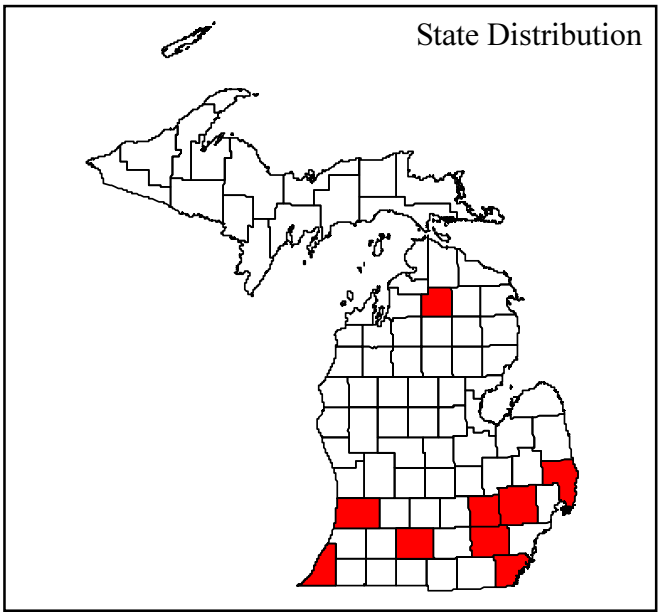
APPENDIX I

Species Abstracts

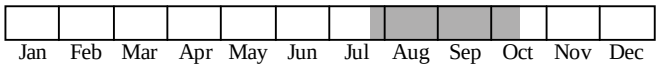
Blazing star borer moth (*Papaipema beeriana*)
Culver's root borer moth (*Papaipema sciata*)
Red-legged spittlebug (*Prosapia ignipectus*)
Sullivant's milkweed (*Asclepias sullivantii*)
Eastern prairie fringed orchid (*Platanthera leucophaea*)

Papaipema beeriana Bird — blazing star borer


Photo by David L. Cuthrell.



Best Survey Period



Status: State special concern

Global and state rank: G3/S1S2

Family: Noctuidae (owlet moths)

Range: The blazing star borer occurs as a series of disjunct populations throughout the midwestern United States having been recorded from the following states: Iowa, Illinois, Indiana, Ohio, Wisconsin, and Michigan.

State distribution: The blazing star borer is known from less than 12 sites in Michigan and has been reported from ten counties. It has been collected from several southern counties (Allegan, Berrien, Calhoun, Washtenaw, Monroe, Livingston, Oakland, and St. Clair) and one county in the northern lower peninsula (Otsego).

Recognition: This moth, in the family Noctuidae, has a wing-span of 31-36 mm (1.2-1.5 in). It has two color forms, both spotted and unspotted. **The unspotted form has forewings which are dull brownish, frosted with whitish scale-bases, and with scattered white scales**; markings practically absent or very faint (Forbes 1954). The hing wings are a paler and more uniform gray. **The spotted form, *lacinariae* Bird, has forewings similar to the unspotted form with the exception of white spots** (Forbes 1954). Many species of *Papaipema* are difficult to identify but most can be sorted into species groups (Rings et al. 1992). These species groups can then be sent to experts for positive identification. Series (5 to 10 individuals from the same location) of specimens are easier to work with because of the large amount of individual variation. In addition, many field-collected specimens can be quite worn (many of the scales missing) giving the specimen a lighter appearance than normal, or eliminating many of the scale characteristics important for identification. To add to the confusion some species, like the blazing star borer, have spotted and unspotted forms, both of which are sympatric (occur at the same location at the same time).

Best survey time: The blazing star borer is a late-season flier with Michigan adult capture dates ranging from 13 September through 5 October. The best way to survey for this species is by blacklighting, a technique where a sheet is stretched across two trees or poles and an ultraviolet light is used to attract moths to the sheet. Moths can be collected directly from the sheet. You also can search for the larvae of many species of *Papaipema* by searching for signs of feeding activity in late July or early August. This includes inspecting blazing star (*Liatris* spp.) plants that are wilted or otherwise stunted, for a small hole near the base of the plant and a pile of frass (caterpillar feces) near this opening. Often times you can see the pile of frass at the base of the plant and then locate the hole in the stem.

Habitat: The blazing star borer occurs with its larval host plant, blazing star or snakeroot (*Liatris* spp.) In Michigan the species has been recorded from a variety of plant communities crossing gradients from wet to dry including lakeplain prairies, prairie fens, and sand

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prairie or barrens. Many Michigan sites represent only small parcels of what was once widespread habitat. At known sites associated prairie plants typically include big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), common mountain mint (*Pycanthemum virginianum*), tall coreopsis (*Coreopsis tripteris*), Ohio goldenrod (*Solidago ohioensis*), Culver's root (*Veronicastrum virginicum*), and switch grass (*Panicum virgatum*).

Biology: Eggs are laid on or near the food plant in the fall and hatch in the spring around mid-May (Bird 1923). Larvae can be found in the root and lower stem of the host plant in most years from 14 July-7 August. Feeding and tunneling in the root causes the plants to wilt and the leaves can turn brown at the tips. The final instar leaves the root and pupates in the soil near the plant. Pupae can be found from 10 August until the adult flight times of 13 September through 5 October. *Papaipema* moths as a whole fly late in the season, usually late August through October. There is also limited data that suggest prairie *Papaipema* moths are active late in the evening (actually early morning hours) (Schweitzer 1999). Based on our blacklighting observations in southern Michigan, *beeriana* is active for a short period of time beginning around 2300 and ending near 2400 hours EST. Several factors need to be considered including ambient temperatures, humidity levels, precipitation, wind, and moon phase; all of which affect moth behavior. Major natural enemies of *Papaipema* include mammals such as rodents and skunks (Hessel 1954, Decker 1931, Schweitzer 1999), woodpeckers (Decker 1930) as well as numerous parasitoids and predatory insects. Small mammals in some cases can completely eradicate small populations (Hessel 1954). A tachinid fly, *Masicera senilis*, and a braconid wasp, *Apanteles papaipemae*, are probably the most important parasitoids of *Papaipema* (Decker 1930).

Conservation/management: Protection of known populations is essential to protect this species in Michigan. Almost all major workers on the genus have commented on the fire sensitivity of *Papaipema* eggs, and Decker (1930) highly recommends use of fire to control the pest species *P. nebris*. Land managers should heed Dana's (1986) general advice and always assume high mortality of *Papaipema* eggs in fall, winter, or spring burn units. To protect *Papaipema* populations, Schweitzer (1999) recommends protecting an adequate amount of the foodplant and to divide habitat into smaller burn units. No *Papaipema* site should ever be entirely burned in a single year. Foodplants spread over a large area or in several discrete patches reduce the risk from predators and parasitoids as compared to a comparable number of plants in a single dense patch. Most, if not all, of these parasitoids are native species and in most cases they do not need to be controlled. All known sites of *beeriana* on managed lands should be monitored periodically. There is no information to suggest how often this should be done and likely these surveys will be at the level of presence/absence, either of larvae or adults. Schweitzer does believe one could quantitatively sample larvae (or at least larval burrows) to estimate the actual size of a population. Monitoring is especially critical when planning to implement prescribed burns. Keep in mind that distribution of the *Papaipema* population among the various burn units will probably vary from year to year, so current information is needed. Generally decisions will be made on information from the previous growing season, since this is the best information on the distribution of *P. beeriana* eggs within a site.

Research needs: Major research needs, as outlined by Schweitzer (1999), include information on habitat requirements other than foodplants, on conditions under which females disperse, and on presence or absence of *Papaipema* on prairie preserves and other fire managed habitats. The latter is needed before dormant season burn regimens are implemented. Any information on speed of recolonization after prescribed burns would be useful. It would be important to try and document how recovery occurred, i.e., from other burn units, from outside the managed area, from skips in the burn, or from very wet microhabitats. More actual information on survival of *Papaipema* in mid or late summer burns is needed. More precise information as to what date *Papaipema* larvae have moved below ground is needed. This information can be used to better time burns, conduct mowing, or schedule grazing rotations. Information is needed to determine whether adults can locate suitable places for oviposition in foodplant patches burned or grazed earlier in the same season. For example, can adults (which typically occur October 1) find places to lay eggs in habitats burned in July or August. Information on how high eggs are placed on the host plant is needed so that the potential suitability of mowing as a management option can be evaluated.

Related abstracts: lakeplain prairie, prairie fen, pine barrens, culver's root borer moth

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Schweitzer, D. 1999. Draft copy of Element stewardship abstract for *Papaipema* moths. The Nature Conservancy, Arlington, VA. 21 pp.

Abstract citation

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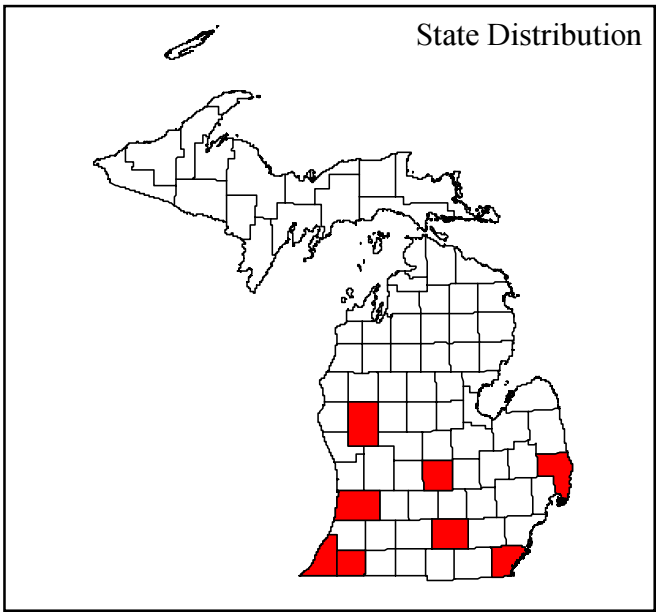
Papaipema sciata Bird — culver's root borer


Photo by David L. Cuthrell.



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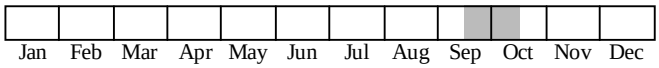

Status: State special concern

Global and state rank: G3G4/S2S3

Family: Noctuidae (owlet moths)

Range: The culver's root borer has been reported from several disjunct localities from the following states: historically Connecticut, Maine, New York, and New Jersey with current records from Iowa, Michigan, Missouri, Minnesota, Illinois, and Wisconsin (Forbes 1954; Peterson et al. 1990).

State distribution: Known from nine sites in eight counties in lower Michigan including Barry, Berrien, Cass, Clinton, Jackson, Monroe, Newaygo, and St. Clair. These moths are very local in occurrence and are rarely found a great distance from their larval food plants.

Recognition: The culver's root borer (Lepidoptera: Noctuidae) has a wingspan of near 40 mm (1.6 in.). Adult forewings with **basal (inner portion of wing nearest the body) two-thirds chocolate brown, marginal third bluish gray, typically with a series of yellowish lunules (crescent-shaped markings) surrounded with white; forewings also with a group of white spots** (Forbes 1954). Hind wings are a solid light chocolate brown. The more common ironweed borer, *Papaipema limpida*, is very similar in appearance but usually can be separated by the pattern of white spots on the forewings. Many species of *Papaipema* are difficult to identify but most can be sorted into species groups (Rings et al. 1992). These species groups can then be sent to experts for positive identification. Series of specimens, which are usually 5-10 individuals from the same location, are easier to work with because they capture the individual variation typical for each site. In addition, many field-collected specimens can be quite worn (many of the wing scales missing) which gives the specimen a lighter appearance than normal, and can eliminate many of the scale characteristics important for identification. To add to the confusion many similar *Papaipmea* species are sympatric (occur at the same location at the same time).

Best survey time: The culver's root borer is a late-season flier with Michigan capture dates ranging from mid-September to mid-October. The best way to survey for this species is by blacklighting, a technique where a sheet is stretched across two trees or poles and an ultraviolet light is used to attract moths to the sheet. Moths can be collected directly from the sheet. You also can search for the larvae of many species of *Papaipema* by searching for signs of feeding activity in late July or early August. This includes inspecting culver's-root (*Veronicastrum virginicum*) plants that are wilted or otherwise stunted, for a small hole near the base of the plant and a pile of frass (caterpillar feces) near this opening. Oftentimes you can see the pile of frass at the base of the plant and then locate the hole in the stem (see Nielsen 1995).

Habitat: The culver's root borer occurs with its larval host plant, culver's-root (*Veronicastrum virginicum*). In Michigan culver's-root has been recorded from a

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variety of plant communities crossing gradients from wet to dry including lakeplain prairies, prairie fens, and sand prairies. Many Michigan sites represent only small isolated parcels of what was once widespread habitat. At known sites, associated prairie plants typically include big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), common mountain mint (*Pycanthemum virginianum*), tall coreopsis (*Coreopsis tripteris*), Ohio goldenrod (*Solidago ohioensis*), marsh blazing star (*Liatris spicata*), and switch grass (*Panicum virgatum*).

Biology: Eggs are laid on or near the food plant in the fall and hatch in late spring or early summer. Larvae can be found in the root and lower stem of the host plant in most years from 21 July through 14 August. Feeding and tunneling in the root causes the plants to wilt, dry and become black. In extreme cases the stem becomes broken and dies. The final instar leaves the root and pupates in the soil near the plant. Pupae can be found from late August until adults fly, typically 28 September through 17 October. *Papaipema* moths as a whole fly late in the season, usually late August through October. *Papaipema sciata* adults have been recorded in Michigan from 19 September through 3 October. Limited data suggests that prairie *Papaipema* moths are active late in the evening (actually early morning hours) (Schweitzer 1999). Several factors seem to effect moth beahavior including ambient temperatures, humidity levels, precipitation, wind, and moon phase. Major natural enemies of *Papaipema* include mammals such as rodents and skunks (Hessel 1954, Decker 1931, Schweitzer 1999), woodpeckers (Decker 1930) as well as numerous parasitoids and predatory insects. Small mammals in some cases can completely eradicate small populations of *Papaipema* (Hessel 1954). A tachinid fly, *Masicera senilis*, and a braconid wasp, *Apanteles papaipemae*, are probably the most important parasitoids of *Papaipema* larvae (Decker 1930).

Conservation/management: Protection of known populations is essential to preserve this species in Michigan. Almost all major workers on the genus have commented on the fire sensitivity of *Papaipema* eggs, while Decker (1930) highly recommends use of fire to control the pest species *P. nebris*. Land managers should heed Dana's (1986) general advice and always assume high mortality of *Papaipema* eggs in fall, winter, or spring burn units. To preserve the rarer *Papaipema* populations, Schweitzer (1999) recommends protecting an adequate amount of the foodplant by dividing their habitat into smaller burn units. These smaller units can be burned in rotation with 3-5 years between burns of a single unit, and adjacent units should not be burned in consecutive years. **No *Papaipema* site should ever be entirely burned in a single year.** Foodplants spread over a large area or in several discrete patches reduce the risk from predators and parasitoids as compared to a comparable number of plants in a single dense patch. Most, if not all, of these parasitoids are native species and in most cases they do not need to be controlled. All known sites of *sciata* on managed lands should be monitored periodically. There is no information to suggest how often this should be done and likely these surveys will be at the level of presence/absence, either of larvae or adults. Researchers can quantitatively sample larvae (or at least larval burrows) to estimate the actual size of a population. Monitoring is especially critical when planning to implement prescribed dormant season burns. Keep in mind that distribution of the *Papaipema* population among the various burn units will probably vary from year to year, so current information is needed. Generally decisions will be made on information from the previous growing season, since this is the best information on the distribution of *P. sciata* eggs within a site.

Research needs: Major research needs, as outlined by Schweitzer (1999), include information on habitat requirements other than foodplants, on conditions under which females disperse, and on presence or absence of *Papaipema* on prairie preserves and other fire managed habitats. The latter is needed before any burn regimens are implemented. Any information on speed of recolonization after prescribed burns would be useful. It would be important to try and document how recovery occurred, i.e., from other burn units, from outside the managed area, from skips in the burn, or from very wet microhabitats. More actual information on survival of *Papaipema* in mid or late summer burns is needed. More precise information as to what date *Papaipema* larvae have moved below ground is needed. This information can be used to better time burns or schedule grazing/mowing rotations. Information is needed to determine whether adults can locate suitable places for oviposition in foodplant patches burned or grazed earlier in the same season. For example, can adults (which typically occur October 1) find places to lay eggs in habitats burned in July or August. Information on how high eggs are placed on the host plant is needed so that the potential suitability of mowing as a management option can be evaluated.

Related abstracts: lakeplain prairie, prairie fen, eastern prairie fringed orchid, blazing star borer, red-legged spittlebug

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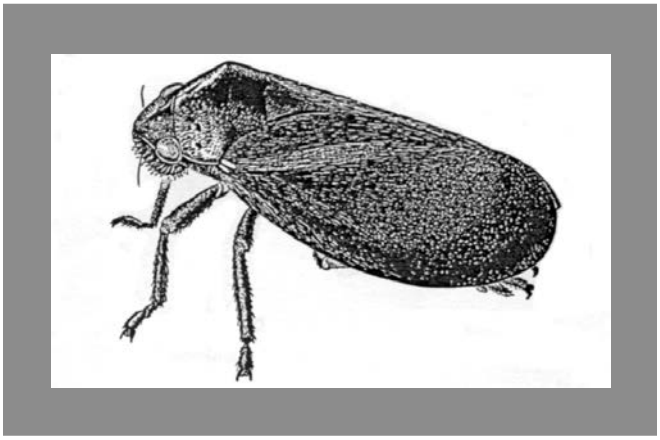
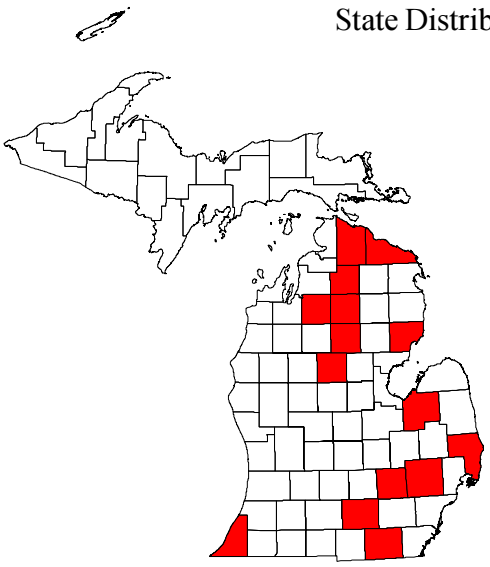
Prosapia ignipectus (Fitch) red-legged spittlebug



Drawing courtesy of:
Eastern Cereal and Oilseed Research Centre
For the Department of Agriculture and Agri-Food,
Government of Canada

State Distribution



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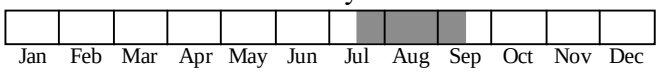

Status: State special concern

Global and state rank: G4/S2S3

Family: Cercopidae (spittlebug, froghopper)

Range: The spittlebug genus *Prosapia*, as defined by Fennah (1949, 1953) and later by Hamilton (1977), is restricted to North America with only two species (*bicincta*, *ignipectus*) occurring in the northern United States and Canada. These taxa were considered the same species (but separate subspecies) until futher work by Hamilton (1977) elevated each to full species status. The red-legged spittlebug in Canada is found locally in southernmost Ontario. In the United States it appears to occur commonly in sandy regions of the northeast, south to southern Pennsylvania (Hamilton 1982), and west through Wisconsin, Illinois, and into eastern Iowa.

State distribution: Only two verified collection localities (Presque Isle and Berrien counties) were known from the state prior to 1994. During inventories, by Michigan Natural Features Inventory (MNFI), for lakeplain prairies in southern Michigan the species was recorded from St. Clair and Tuscola counties (Comer et al. 1995). During 1995-1999 additional surveys by MNFI documented the red-legged spittlebug from Cheboygan, Clare, Crawford, Jackson, Kalkaska, Lenawee, and Livingston counties. The species is now known in Michigan from 20 locations in 15 counties.

Recognition: The red-legged spittlebug (Homoptera: Cercopidae) is a medium-sized spittlebug with adult males ranging from 6.8 to 8.3 mm (0.27 - 0.33 in.); females are slightly smaller on average ranging 7.5 to 7.9 mm (0.30 - 0.31 in.)(Hamilton 1982). **This is the only black spittlebug in Michigan that has an undersurface boldly marked with scarlet near the leg bases and leg joints, and on the abdomen.** A very similar species *Prosapia bicincta* is slightly wider in form and usually is marked with three fine crossbands of yellow, orange, or scarlet on the upper side (Hamilton 1982). Rarely an unmarked specimen of *bicincta* is reported, which requires comparison of genitalia to positively separate the two species (Hamilton 1977).

Best survey time: Adults of the red-legged spittlebug have been recorded in Michigan from July 17 through September 19. The best way to survey for this species is to use a standard insect sweep net in suitable habitat. Several sweep samples may be needed to detect adults of this species in an area because the red-legged spittlebug occurs in small colonies that occupy diminutive portions of available habitat (Hanna 1970). Nymphs (sub-adult life stages) are believed to feed on the subterranean parts of little bluestem, *Schizachyrium scoparium* (Hamilton 1982), and therefore sampling for this life stage could prove to be extremely time consuming and potentially destructive.

Habitat: The red-legged spittlebug has been recorded in associaton with alvar grassland in Presque Isle County, from prairie fens in Berrien and Jackson

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counties, from jack pine barrens in northern lower Michigan, and lakeplain prairie in southern Michigan. At the lakeplain prairie sites the spittlebug occurs in areas dominated by big (*Andropogon gerardii*) or little bluestem and other prairie species including: switch grass (*Panicum virgatum*), common mountain mint (*Pycnanthemum virginianum*), bush clover (*Lespedeza capitata*), common polygala (*Polygala sanguinia*), colic root (*Aletris farinosa*), heath aster (*Virgulus ericoides*), sedges (*Carex* spp.), tall coreopsis (*Coreopsis tripteris*), marsh blazing star (*Liatris spicata*), shrubby St. John's wort (*Hypericum kalmii*), fringed close gentian (*Gentiana andrewsii*), ironweed (*Veronia missurica*), tall sunflower (*Helianthus giganteus*), Ohio goldenrod (*Solidago ohioensis*), Riddell's goldenrod (*S. riddellii*), Culver's root (*Veronicastrum virginicum*), and the grass pink orchid (*Calopogon tuberosus*).

Biology: Little is known about the life history and ecology of most spittlebugs, except for a few species of economic importance. Recent studies by Peck indicate that a closely related *Prosapia* species undergoes five nymphal instars (Peck 1999). Cercopid nymphs, or spittlebugs, occur in the protection of masses of spittle which they produce to surround themselves at feeding sites on host plants (Peck 1999). Adults, commonly known as froghoppers, do not produce spittle but rely on their jumping ability and warning coloration for defense as they move about and feed on similar grass host plants (Peck 1996). Both life stages feed on xylem sap of their host plants which include little bluestem (Morse 1921) and other grasses (Hamilton 1982). Adult red-legged spittlebugs have been found from mid-July to mid-September in Michigan. Peck (1999) found in one *Prosapia* species that adult males peak in abundance 3-4 weeks in advance of the maturation of females. Female red-legged spittlebugs likely lay their eggs in the fall, with eggs being the overwintering life stage. In this group relatively few eggs are laid, usually not exceeding 35 (Hamilton 1982). The nymphs first appear in spring and establish spittle masses on the surface roots and fine stems of grasses. Later instars are still largely limited to the litter layer or soil surface. A wider variety of feeding sites become suitable to late instar nymphs including mature stems, sometimes several centimeters into the grass canopy (Peck 1998). While it is unlikely that the species is restricted to a single plant species, in Michigan adults have been found in association with either big or little bluestem grasses and one adult was collected from redbud. (Hanna and Moore 1966).

Conservation/management: The most significant threats to the existence of this species have been identified as habitat destruction or alteration. Types of direct habitat loss include commercial and residential development, constructing pipelines, and filling of wetlands. Alteration of habitats include changing the hydrology of sites, succession of habitat due to fire supression, and invasion of alien plant species such as purple loosestrife and glossy buckthorn in southern Michigan and leafy spurge in the northern barrens. Hydrology alterations may include building roads, railways, pipelines, and ditches. Wetland hydrology and quality should also be mantained by preventing improper off-road vehicle use and controlling invasive weeds in these areas. Protection of known populations (and associated habitats) is a priority for sustaining this species. Additional surveys should be conducted throughout the state in appropriate habitats including mesic lakeplain prairie, barrens, and alvar grassland communities. Until more is known about the life history of this insect, it should be considered sensitive to fire during all life stages. Management of the surrounding prairie fens, prairies, alvars, and barren communities with prescribed burns should take into account known population sites leaving some unburned areas of host plant essential for recolonization. Additional information on the ecology and life history of the red-legged spittlebug is also needed to provide a stronger basis for management planning efforts.

Research needs: Additional surveys are needed across the eastern United States to determine the present distribution of this spittlebug and to further evaluate habitat specificity. Research on this species' life history should also be a top priority.

Related abstracts: lakeplain prairie, prairie fen, pine barrens, eastern prairie fringed orchid, blazing star borer, culver's root borer

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Updated September 2000.

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Asclepias sullivantii Engelm. Sullivant's milkweed

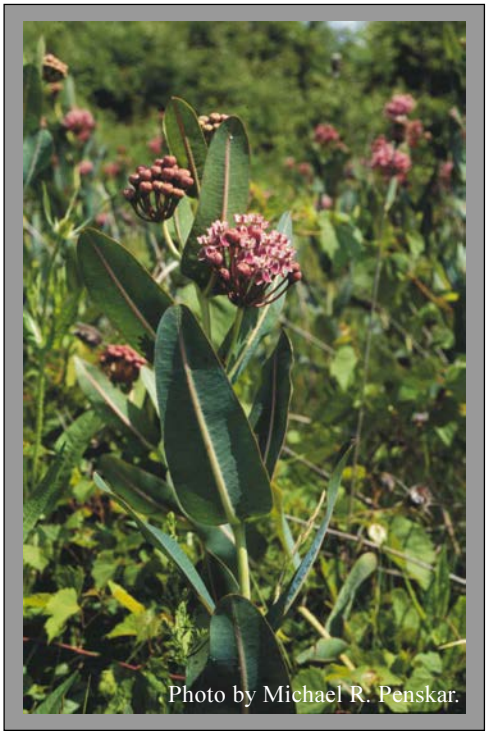
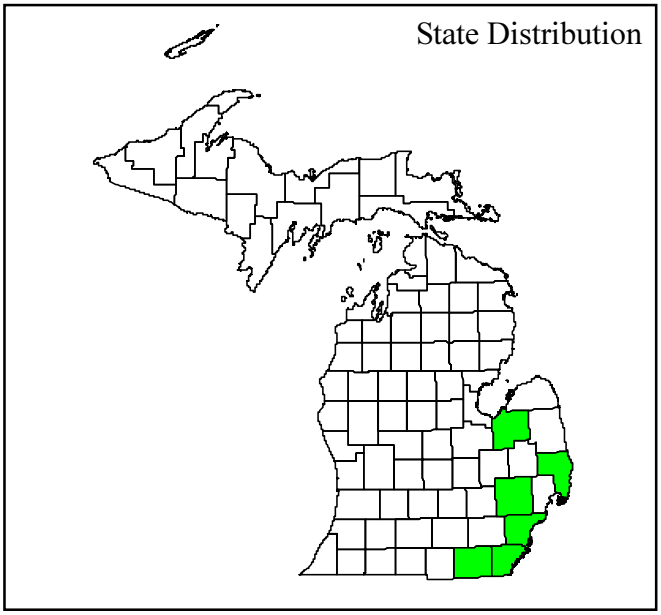


Photo by Michael R. Penskar.



Best Survey Period

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Legal status: State threatened

Global and state rank: G5/S2

Other common names: smooth milkweed, prairie milkweed

Family: Asclepiadaceae (milkweed)

Total range: This prairie species is concentrated in the Midwest, ranging north to Minnesota, east to southern Ontario and Ohio, west to Nebraska, Kansas, and south to Oklahoma. It is considered rare in Minnesota, Wisconsin, and Ontario, and is known only from historical records in North Dakota.

State distribution: Sullivant's milkweed is known from a total of 16 sites, with the majority of localities occurring in Monroe and St. Clair counties. Oakland, Wayne, Lenawee, and Tuscola counties all tally a single occurrence each. Although this species was reported by Davis (1906) to be "very abundant" in the lakeplain prairies of Tuscola County, extensive surveys there in recent years have failed to discover a single surviving colony. A Berrien County report (M. Kohring, pers. comm.) remains unconfirmed. Several of Michigan's colonies consist of small numbers of individuals persisting in highly disturbed sites, such as roadsides and railroad rights-of-way.

Recognition: Stems of *A. sullivantii*, which arise from deep, fleshy rhizomes, reach 4-11 dm in height. This species strongly resembles common milkweed, *A. syriaca* (also a native species but mistakenly considered exotic), both having broadly **ovate, opposite leaves, milky sap,** and dense, **globe-like clusters of flowers** borne from upper leaf axils. However, mature leaves of *A. sullivantii* are distinguished by their **reddish midveins, slightly undulate margins, somewhat acute tips, and complete lack of hair on the leaf underside**. In addition, the leaves of Sullivant's milkweed are usually **strongly upswept (see photo)**. In contrast, common milkweed has relatively blunt-tipped leaves that are densely pubescent beneath and remain roughly perpendicular to the stem. The flowers of *A. sullivantii* are also **larger, fewer**, and **pale to strongly pink-purple in color**, whereas those of *A. syriaca* are pink to dark purple, markedly smaller, and tend to be much more numerous in very dense inflorescences. The fruit of Sullivant's milkweed, a greenish-capsule termed a **follicle,** is relatively smooth in contrast to the warty follicle produced by common milkweed.

Sullivant's milkweed could be confused with stems of common dogbane (*Apocynum*), especially the species known as Indian hemp (*A. cannabinum*). Dogbane can be distinguished by its less robust growth habit, narrower leaves, dark stem, and especially its fruit, which consists of pairs of long, dangling, skinny follicles joined at their apex.

Habitat: Michigan colonies of this plant occur primarily in disturbed habitats such as old-fields with secondary prairies, and moist, grassy rights-of-way. At one St. Clair county locality, *Andropogon scoparius* (little bluestem) and *Hypericum kalmianum* (shrubby

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cinquefoil) dominate a secondary prairie with *Scleria triglomerata* (tall nut-rush), *Calopogon tuberosus* (grass pink), *Baptisia tinctoria* (yellow wild indigo), *Polygala sanguinea* (milkwort), *Aletris farinosa* (colic root), and *Aster dumosus*. Sullivant's milkweed also grows in an undisturbed habitat is a small lakeplain wet prairie remnant of the St. Clair River delta, dominated by *Andropogon gerardii* (big bluestem), *A. scoparius*, and *Panicum virgatum* (switchgrass). (Hayes 1964). A large population of this species – perhaps the state's biggest — was recently discovered on the outskirts of the city of Monroe, when a disturbed lakeplain prairie remnant was inventoried. Common associates at several sites include *Spartina pectinata* (prairie slough grass), *Pycnanthemum virginianum* (mountain mint), *Liatris spicata* (blazing star), *Solidago riddellii* (Riddell's goldenrod), *Coreopsis tripteris* (tall coreopsis), *Rudbeckia hirta* (black-eyed Susan), and many other typical prairie species. Soils are typically moist sandy clay or sandy loam.

Elsewhere in its range, *A. sullivantii* is primarily a plant of moist prairies. In the Chicago region, it grows with such species as *Andropogon gerardii*, *Aster ericoides* (heath aster), *Eryngium yuccifolium* (rattlesnake master), *Ratibida pinnata* (yellow coneflower), *Silphium laciniatum* (compass plant), and *Spartina pectinata* (Swink and Wilhelm 1979).

Biology: This species is a perennial from deep, fleshy rhizomes, and vegetative reproduction is common. Flowers are produced by mid-July with fruits maturing through August. As in other species of *Asclepias*, the flowers are highly modified for insect pollination. Sullivant's milkweed may hybridize with common milkweed, these two species having been isolated in presettlement times by habitat specificity. However, the highly disturbed condition of remaining prairie remnants has allowed the opportunistic common milkweed to colonize, bringing these two taxa into greater contact. One Michigan population of over 100 *A. sullivantii* stems appears to have been genetically degraded through hybridization and introgression (i.e. backcrossing) with common milkeed.

Conservation/management: Small populations that persist in degraded, disturbed, and/or marginal habitats are difficult to manage. Also, the low numbers of individuals present at these sites may not be enough to maintain viable populations. Possible hybridization with *A. syriaca* may further genetically erode and diminish poorly insulated populations in disturbed habitats. However, small surviving colonies may be valuable as a source of stock for establishment or enhancement of sustainable populations.

Michigan's most viable colonies lie on State Park and Game Area lands in St. Clair County. A large set of colonies occurs within a state park that is being actively managed for prairie restoration. Prescribed burning is probably the best way to favorably manage habitat for this species. Applications of herbicides should be avoided along rights-of-way where this milkweed grows, although this species appears to be persisting along heavily maintained road rights-of-way.

Comments: This species of milkweed has been reputed to have a particulary high content of rubber in its milky latex, and has been investigated for usefulness in rubber production (Fox 1944).

Research needs: The principal need at present is the identification of viable colonies and the implementation of restoration management programs to perpetuate and maintain this species. Demographic and breeding systems studies

Related abstracts: eastern prairie fringed-orchid

Selected references

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Abstract citation

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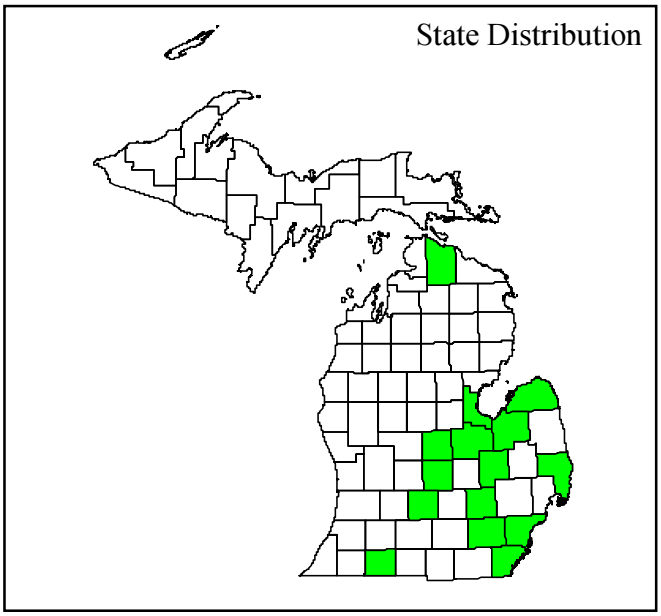
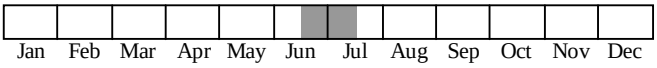
Platanthera leucophaea (Nutt.) Lindley — eastern prairie fringed-orchid


Photo by Susan R. Crispin.



Best Survey Period



Legal status: State endangered, Federal threatened

Global and state rank: G2/S1

Other common names: White fringed-orchid, prairie white fringed-orchid.

Family: Orchidaceae (orchid)

Synonyms: *Habenaria leucophaea* (Nutt.) A. Gray

Taxonomy: Formerly included within the genus *Habenaria* by Correll (1950), this species, in addition to several other Michigan taxa, is widely recognized as appropriately belonging to *Platanthera* (Case 1987). Western populations of what had once been considered *P. leucophaea*, comprising most populations west of the Mississippi River, have been distinguished by Sheviak and Bowles (1986) as *P. praeclara* (western prairie fringed-orchid) based on significant differences in morphology, pollination mechanism, and geographic distribution.

Total range: Centered about the Great Lakes, *P. leucophaea* occurs east to Virginia and along the St. Lawrence drainage to Maine, ranging west into the Great Plains to the Dakotas and Iowa, and south in the Mississippi drainage to Missouri and Oklahoma. Now near extinction throughout much of its range, most populations are concentrated in the southern Great Lakes region, occurring primarily in southern Wisconsin, Illinois, Ohio, and southern Lower Michigan. This species is considered rare in Illinois, Iowa, Maine, Missouri, Ohio, Oklahoma, Virginia, Wisconsin, and Ontario. It is considered extirpated in Indiana, New Jersey, and Pennsylvania, and is known only from historical records in New York and South Dakota.

State distribution: *Platanthera leucophaea* was once known from more than 20 counties, primarily in southern Lower Michigan, with one anomalous disjunct locality documented in Cheboygan County. Extensive habitat modification and destruction has caused this species to severely decline. It is now extant in fewer than 10 counties, persisting mostly in the remnant lakeplain prairies of Saginaw Bay and western Lake Erie. The relatively high numbers of plants observed in 1984 declined markedly following years of high lake levels and drought. An exhaustive 1990 inventory of this species' remaining strongholds in Michigan found approximately 1100 plants total, with few populations supporting large numbers of plants in good quality, viable habitat. In recent years, only a fraction of the plants tallied before have been observed in many habitats, apparently due to highly droughty growing seasons.

Recognition: Prairie fringed-orchid is a tall, striking plant. It produces single stems that range from approximately 20 cm to 1 m or more in height, bearing long, narrow, sharp-pointed leaves that become progressively reduced upward. The leaves are strongly sheathing, becoming bract-like beneath the inflorescence. The stems are terminated by relatively **wide, showy racemes of up to 40 or more creamy white, stalked flowers**. Each flower has a long (2-5

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cm), slender, downward-curving nectar spur behind and a **three-parted, prominently fringed lower lip, the fringe up to about half the length of the lip**. The small, wedge-shaped upper petals are rounded with **toothed or ragged margins**, forming a loose bonnet arching over the column. *Platanthera blephariglottis* and *P. lacera* are superficially similar species that can be easily distinguished. *Platanthera blephariglottis*, which occurs only in sphagnum bogs in Michigan, bears white flowers with fringed lower lips that are tongue-shaped and undivided. *Platanthera lacera* is a more common, widespread species of a variety of habitats; it bears white to greenish-white flowers with three-parted lower lips deeply divided into slender, often irregular, thread-like segments, and has upper petals that are linear.

Habitat: *Platanthera leucophaea* occurs in two distinct habitats in Michigan--wet prairies and bogs. It thrives best in the lakeplain wet or wet-mesic prairies that border Saginaw Bay and Lake Erie. These communities have relatively alkaline, lacustrine soils, and are dominated by *Carex aquatilis, C. stricta*, and *Calamagrostis canadensis*, as well as several prairie grasses and forbs. Common associates include *Andropogon scoparius* (little bluestem) and *A. gerardii* (big bluestem*), Spartina pectinata* (prairie slough grass*), Potentilla fruticosa* (shrubby cinquefoil), *Liatris spicata* (blazing star), *Linum medium* (flax), *Cornus stolonifera* and *C. amomum* (dogwoods), *Pycnanthemum virginianum* (mountain mint), *Gentianopsis crinita* (fringed gentian), *Solidago riddellii* (Riddell's goldenrod), *Cladium mariscoides* (twig-rush), *Typha latifolia* (cat-tail), *Juncus* spp. (rushes), and *Scirpus acutus* (hardstem bulrush). Prairie fringed-orchid frequently persists in degraded prairie remnants, and will frequently colonize ditches, railroad rights-of-way, fallow agricultural fields, and similar habitats where artificial disturbance creates a moist mineral surface conducive to germination.

Open or semi-open bog mats of *Sphagnum* and *Carex*, with slightly acidic, neutral, or somewhat alkaline lake water also support small populations of this orchid. Associates in these sites include *Thelypteris palustris* (marsh fern), *Sarracenia purpurea* (pitcher-plant), *Chamaedaphne calyculata* (leatherleaf), *Drosera rotundifolia* (sundew), *Potentilla fruticosa* (shrubby cinquefoil), *Larix laricina* (tamarack), *Betula pumila* (bog birch), and *Toxicodendron vernix* (poison sumac). Farther west and to the south, Eastern prairie fringed-orchid occurs in mesic and wet mesic black soil prairies, or rich, wet, sandy prairies, while to the east of Michigan, occurrences are generally restricted to bogs or sandy or peaty lakeshores.

Biology: Unlike many other *Platanthera* species, *P. leucophaea* is long-lived, with individuals documented to live more than 30 years (Case 1987). According to Case (1987), this perennial produces a bud on one of its roots that develops a new set of roots or tubers, becoming next season's new plant. The development and viability of this bud is highly dependent on the vigor of the old plant. In Michigan, flowering occurs during late June through early July. Case reports that the white blossoms produce a heavy fragrance at dusk and attract many moths, including the large Sphinx moths responsible for pollination. Sphinx moths are probably co-adapted pollinators, since their tongues are long enough to reach the nectar that lies deep in the spur of the flower (M. Bowles, pers. comm.). Prior to 1998, only three hawk moth species had been positively identified as pollinators. However, in 1998, during an MNFI study by Cuthrell et al. (1999), a previously unknown hawkmoth pollinator was documented. Capsules mature in September, releasing hundreds of thousands of airborne seeds. Plants do not flower every year, frequently producing only a single leaf above ground (M. Bowles, pers. comm) and possibly even becoming dormant when conditions are unsuitable, such as the onset of drought. Fire is thought to help break dormancy and stimulate flowering (Sheviak 1974), although its role in Michigan *Platanthera* sites is highly uncertain and controversial among some botanists.

Conservation/management: Competitive encroachment by native shrubs, especially dogwoods and willows, and pernicious exotics such as *Lythrum salicaria* (purple loosestrife) pose one of the greatest threats to Michigan's remaining prairie fringed-orchids. The large-scale destruction of lakeplain prairie habitat, primarily through alteration by ditching and diking, the conversion of areas for agricultural use, and other land settlement activities have rendered this species particularly vulnerable to extinction. In its last remaining viable sites, eastern prairie fringed-orchid is best protected by maintaining the natural hydrological cycles of the lakeplain wet prairies. Protection can only be adequately afforded when sufficient refugia are available during periods of high lake levels. Unfortunately, few natural areas are left that provide the necessary landward habitat. Where refugia are available, this species is able to seed inland during high water cycles, advancing shoreward again as lake levels recede (Case1987). This natural fluctuation along the Great Lakes shores maintains the necessary open, wet prairie habitat, preventing closure and shading by highly competitive woody plants such as dogwoods (*Cornus* spp).

In sites where active management may be required, shrub removal is of primary importance. Although fire is frequently recommended as a management tool (Bowles 1983), its role in Michigan's prairie fringed-orchid habitat is poorly understood. Case (pers. comm.) recommends great caution with the

consideration of fire management, noting that the orchid's shallow subterranean buds can be easily damaged during spring or fall burns. At present, fire should be employed only as a very selective experimental tool, to be used in testing alongside other approaches, such as mechanical brush removal and soil disking. Prescribed burns may be desirable when brush removal and soil scarification enhance the vulnerability of populations to exotics such as purple loosestrife and other invasives.

Lastly, one of the greatest recognized threats to this elegant species is poaching and trampling by orchid enthusiasts, photographers, and others. At least one Michigan colony has been obliterated by poachers, and thus great caution must be taken with regard to remaining sites. Based on the aforementioned threats and the great vulnerability of this species, Case (1987) considers Eastern prairie fringed-orchid to be possibly the most "severely endangered orchid of our region".

Comments: According to an early report, *P. leucophaea* once grew so abundantly near the bath houses on Belle Isle Park, Detroit, that visitors there gathered it in bouquets (Foerste 1882). Several decades ago, this species also grew in abundance along Saginaw Bay. These are, however, scenarios unlikely to be witnessed again.

Research needs: Important research areas include pollination and breeding system studies, and especially the role of various management techniques required to sustain viable populations and restore functioning lakeplain prairie communities and landscapes.

Related abstracts: lakeplain prairie, lakeplain wet prairie.

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