
**Surveys, assessing impacts of management, and
conservation plans for Mitchell's satyr (*Neonympha
mitchellii*) in southern Michigan:
2005 progress report**



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Cover Photos: Prairie Fen, Jackson County West Site, July 2005. Daria Hyde. **Top Inset:** *Neonympha mitchellii*, Branch County Site, July 2005. Adrienne Bozic. **Middle inset:** Recording a satyr location, Jackson County Central, July 2005, Barbara Barton. **Lower inset:** Blanding's turtle, St. Joseph County East, July 2005, Adrienne Bozic.

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Introduction

The Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*) is a rare butterfly species whose worldwide distribution is restricted to Michigan and Indiana. It is currently only known from 19 sites in southern Lower Michigan and 2 sites in northern Indiana. This species is currently listed as endangered in Michigan and Indiana, and was federally listed as endangered in 1992. The long-term viability of these populations is unknown. This year, one new site was discovered and satyrs were confirmed at sixteen known sites in Michigan. The status of two additional known sites is uncertain. All but two of the known satyr sites occur on private land. The butterfly appears to be restricted to calcareous wetlands that range along a continuum from open fen, wet prairie, prairie fen, and sedge meadow to shrub-carr and tamarack savanna (McAlpine et al. 1960, Shuey 1997, Szymanski 1999). It appears that the Mitchell's satyr occupies areas in these fen communities where woody and herbaceous vegetation occurs as a mosaic (Szymanski and Shuey 2002).

To reclassify to federal threatened status, 16 geographically distinct populations or meta-populations must be established range wide, including 12 in Michigan; to de-list, nine more populations must be established. These populations must remain viable for five consecutive years following reclassification, which will require a valid, repeatable monitoring protocol. At least 15 of the 25 recovered populations also must be protected and managed for the benefit of this species (U.S. Fish and Wildlife Service 1997). Currently, only eight occupied sites in Michigan are considered to have potential to contain viable populations. Satyrs at the remaining sites either occur in much lower numbers or the amount of suitable habitat is limited in size. In addition, some sites are threatened by development, making their long-term viability uncertain.

Field studies continue to be extremely difficult for this species because of its ephemeral nature, the fragility of its habitat, the short survey window, and the difficulties in observing this species. Despite these challenges our understanding of the satyr's biological and ecological requirements and habitat affinities has increased over the past decade. In addition, site conservation plans have been completed for over half of the occupied sites and at some sites management is already being implemented.

The Michigan Natural Features Inventory has participated in numerous working group meetings for the Mitchell's satyr butterfly sponsored by the U.S. Fish and Wildlife East Lansing Office since the inception of the working group in 1997. It has been a concern of the group that most of the occupied sites are in dire need of management to control non-native species and to mimic natural disturbance regimes. Working group members have stressed the need to intensively monitor the Mitchell's satyr and its associated habitat at sites undergoing active management to evaluate the response of the satyr to these activities. This information is crucial to developing effective long term management strategies at occupied sites. Establishing baseline densities and trends is an important part of this process. In addition, long-term monitoring has been identified as essential for determining the overall health of satyr populations.

Expanding searches for the Mitchell's satyr in potential habitat in the vicinity of newly discovered or re-discovered sites as well as at historical sites that have not been re-surveyed is also an important task to determine if there is additional occupied habitat. Many satyr sites were only recently discovered and some historical sites have not been thoroughly surveyed. This report summarizes the work completed during the second year of this project and highlights relevant findings. Objectives for this project are listed below.

Project Objectives

1. Conduct landowner contact to provide information and obtain permission to survey.
2. Develop and begin implementation of a long-term monitoring study to assess the response of the Mitchell's satyr to management activities at two sites.
3. Complete one site conservation plan for a Mitchell's satyr site.
4. Conduct surveys around extant and historic satyr sites in southern Michigan.
5. Transcribe and analyze data collected from surveys and monitoring activities.

Methods

Landowner Contact

In 2005, MNFI contacted landowners of occupied satyr sites as well as at sites with potential for satyr habitat during the month prior to the flight period. In addition, we worked closely with staff from Southwest Michigan Land Conservancy (SWMLC) and The Nature Conservancy (TNC) to coordinate landowner contact at sites where their volunteers were conducting surveys. In the year 2005 we contacted a total of 26 individual landowners to request permission to survey their property for Mitchell's satyr and other fen associated species. Landowners were usually contacted by telephone or in some cases by knocking on their door. Discussions with each landowner emphasized the importance of wetland communities, fens in particular, and the status of the Mitchell's satyr and other associated rare species. Photographs of the Mitchell's satyr butterfly, other butterflies which are often confused with the satyr and prairie fen habitat were copied and laminated and used when talking with landowners and describing the butterfly and its habitat. Landowners that had a prairie fen on their property were provided with information emphasizing the value of this natural community and outlining activities that threaten fens and fen-associated plants and animals. Those individuals that had Mitchell's satyr on their land were informed of the status of the species and the significance of finding the satyr on their property. They were provided with information on how to manage their land in a way that will preserve or enhance the satyr's habitat and informed about activities that pose a threat to the satyr. Finally they were encouraged to contact us if they had any questions or concerns.

Satyr Surveys and Threat Assessments

Teams of two or more scientists conducted walk-through surveys of potential habitat during the satyr flight period. Surveys were conducted during optimal weather conditions, avoiding days that had significant wind or rain. Surveys were generally conducted in the late morning, late afternoon and early evening, avoiding the mid-day period since satyrs tend to be more sedentary during this time. Satyrs typically fly during a two to three-week period ranging from late June through mid-July (Lee 2000). Satyr surveys and monitoring in 2005 were conducted from June 26 to July 15. Observers walked in a meandering pattern looking forward, to the sides, and behind to increase the likelihood that all butterflies were seen. Particular attention was paid to areas containing fine-leaved sedges growing in association with low growing shrubs and tamarack (*Larix laricina*), seeps and springs, and small openings along streams and between the shrubs. Adult Mitchell's satyr butterflies are most easily confused with the eyed-brown (*Satyroides eurydice*), the Appalachian eyed-brown (*S. appalachia*), and the little wood satyr (*Megisto cymela*). Mitchell's satyr was distinguished from these similar species by its characteristic slow, erratic and low flight pattern, its smaller size and darker coloration, and the number and arrangement of eye spots on the wings. Individuals were identified as they flew or rested. Close-focusing binoculars were often used to aid in this identification and it was not necessary to capture butterflies with a net or handle them in any way. If a Mitchell's satyr was found, extreme care was taken to avoid trampling the vegetation in the event that eggs were present. Surveyors used existing game trails whenever possible to minimize impacts to the habitat. Photographs of sites and the habitat occupied by the satyr were taken and when possible, photographs of adult satyrs were taken as well.

A threat assessment was conducted at all occupied sites visited in 2005 by documenting current disturbances and noting potential threats. Threats may include: altered hydrology; off road vehicle (ORV) use; livestock grazing; shrub encroachment; development and land use changes; lack of landowner interest in managing for the satyr; point and non-point sources of pollution; or the presence of invasive species such as purple loosestrife (*Lythrum salicaria*), reed canary-grass (*Phalaris arundinacea*), glossy buckthorn (*Rhamnus frangula*), and cattails (*Typha* spp.). Management needs also were identified. An MNFI Mitchell's Satyr Survey Form was completed at each site where surveys were conducted for the butterfly. Recorded data included site information, land ownership, animal species observed, current disturbances, potential threats and detailed habitat descriptions. In addition an MNFI Special Animal Form was completed for any listed animals that were observed. Similarly an MNFI Special Plant Form or MNFI Natural Community Form was completed when a listed plant or high quality natural community was documented. Data were then entered into the MNFI Database (Biotics 4.02). In addition, a Global Positioning System (GPS) unit was used to record satyr locations and these coordinates were then saved in an Arc View project file for each site.

Surveys for Associated Rare Species

Observers were vigilant in searching for other rare plant and animal species while conducting Mitchell's satyr surveys at known or potential sites in 2005. Some rare animals and plants were found incidental to satyr behavioral observation work. The state threatened poweshiek skipper (*Oarisma poweshiek*) occurs in prairie fen communities and its flight period overlaps (at least in part) with that of the satyr. Because of its affinity for nectaring on yellow flowers, surveyors carefully looked for this skipper on shrubs and plants, such as shrubby cinquefoil (*Potentilla fruticosa*) and black-eyed-Susan (*Rudbeckia hirta*), while conducting satyr surveys.

The state special concern swamp metalmark (*Calephelis mutica*) is another fen inhabiting lepidopteran species. Its adult flight period also overlaps that of the satyr; however, it flies for an additional one to two weeks after the satyr flight ends. This species also shows an affinity for nectaring on yellow flowers so surveyors carefully looked for this butterfly on species such as black-eyed Susan and shrubby cinquefoil. In addition, this butterfly exhibits moth-like flight behavior (flying and alighting under the surface of leaves) so surveyors walked through the fen looking for any lepidopteran which exhibited this behavior and occasionally tapped the stem of certain plants to potentially knock roosting butterflies from their perches. These surveys focused on areas with concentrations of the larval host plant, swamp thistle (*Cirsium muticum*). In addition, some time was spent looking for larval feeding damage on the thistles.

Surveys for the eastern massasauga rattlesnake (*Sistrurus c. catenatus*, SC), were conducted at all occupied satyr sites while doing surveys for the satyr. Although daily activity cycles appear to vary widely, they tend to be the most active during the warmest parts of the day in spring and fall. In the summer months they typically shift their activity periods to the cooler parts of the day and may even become nocturnal (Seigel 1986). Surveys for this species are difficult. When they are threatened, eastern massasaugas will typically remain motionless, relying on their cryptic coloration to blend into their surroundings. They are often difficult to see in the vegetation that occurs in their preferred wetland habitats. Thus, surveys are usually conducted by simply walking through suitable habitat during times of the year and times of the day when they are likely to be most active. During the numerous visits to occupied and potential satyr habitat that occurred in July, surveyors were always looking for massasaugas.

Mitchell's Satyr Monitoring

The Mitchell's Satyr Working Group met on May 24, 1997 to discuss monitoring needs for the satyr. At that time it was agreed that Pollard transects conducted during the satyr flight period were the preferred method for monitoring this species (Pollard and Yates, 1993). The group also discussed a variety of factors that likely affect the number of adults seen during a Pollard walk and recognized the need to evaluate these factors. A Mitchell's satyr monitoring form was developed to document these factors as well as to record observations of satyrs and other butterflies. The group also identified priority sites where monitoring activities would be initiated. Monitoring was conducted at these sites in 1997, and 1998. On February 24, 1999 Working Group members agreed to re-evaluate the effectiveness of Pollard counts and to consider using a different technique, potentially a timed area search (meander survey). Members agree to do both a Pollard count and timed area search at several sites in 1999 to evaluate the effectiveness of the Pollards and develop an index relating satyr numbers to the Pollard counts.

On January 19, 2000, the Working Group determined that it was important to conduct meander surveys at occupied sites on more than one occasion during the field season to more effectively monitor these populations. It was decided that visiting sites three times during the flight period and conducting timed meander surveys would provide valuable data on the distribution and number of butterflies and would help determine long-term site viability as well as reflect the impacts of various management activities. MNFI staff monitored ten occupied sites in 2005 to assess the distribution and population status of the satyr using timed meander surveys. These sites include: Barry County South, Barry County Southwest, Branch County Site, Cass County East, Cass County Southeast, Jackson County East, Jackson County Central, Jackson County

West, St. Joseph County East and Washtenaw County West. One of these sites, Cass County Southeast was just discovered this year by an MSU professor. MNFI staff conducted a survey at this site with the professor and the land manager. Assessments were conducted at these sites to document current and potential threats and to identify management needs.

Mark-release-recapture Study

In order to gain a better understanding of habitat use, movement patterns, and population size, we conducted the second mark-release-recapture (MRR) study at Jackson County Central (JCC). We increased the number of field staff from the prior 2003 study to obtain higher recapture rates (which provides better vagility estimates). The study was conducted from 28 June-15 July (no capturing was done on 4 July) using standard methods. Spatial data were obtained from all capture points using Trimble GeoExplorer GPS units. CAPTABLE (Entomological Consultants, Ltd., Pleasant Hill, CA) and Animal Movement Extension (Hooge and Eichenlaub 1997) were used to analyze population data and vagility. Jolly-Seber methods were used to estimate population size. ArcView 3.2 (ESRI, Redlands, CA) GIS software was used for mapping.

Enclosure Study

The Nature Conservancy (TNC) conducted a prescribed burn in the spring of 2005 at JCC and we attempted to assess the impact of the fire on the larvae by monitoring adult emergence. Eight enclosures were placed within the burn unit and eight in a control plot in order to detect adult emergence. The cages were placed within 1m – 3m of wooded edges in areas known to have high concentrations of satyrs in 2003. The cages were placed on 24 June and removed at the end of the flight period. Cage frames were constructed using 2” PVC pipe and were placed over 2 ft pieces of rerod driven into the ground. A 6x6x6 ft Lumite screen cage (BioQuip Products, Inc.) was placed over each frame and staked into the ground using wire. Cages were checked daily after adult emergence. Temperature, relative humidity, and light intensity within and outside the cages were recorded every five days. All insects found flying inside the cages were recorded to species level if possible and released.

Results and Discussion

Landowner Contact

MNFI received permission to conduct surveys at 10 sites, which includes 26 properties. During visits to monitor the satyr, MNFI staff had many positive discussions with landowners, and 15 landowners from eight satyr sites expressed that they are very interested in actively supporting conservation efforts for the satyr on their property. As a result, some of these landowners are pursuing management activities on their land through the support of the LIP (Landowner Incentive Program) biologist and the LIP program, through the MDNR Wildlife Division and through TNC.

Site Conservation Plan

The site conservation plan for Turner Creek North Fen in Barry County was completed (See Appendix 1). This plan was co-written by an MNFI staff person and the wildlife biologist and wildlife technician at Barry State Game Area. During the process of completing the plan, we made several field visits, conducted satyr surveys during the flight, and had many discussions. As a result, we determined the most effective and feasible management strategy that will improve the fen community and positively affect the plant and animal species, found at this site. Management boundaries have been delineated and restoration activities will commence in early 2006.

Surveys

In 2005, the flight occurred from June 26 through July 23. Visits to conduct surveys and monitoring for the Mitchell’s satyr butterfly by MNFI were conducted at 10 sites on 26 properties. One of these sites was just discovered this year by an MSU professor. All of these sites were monitored by conducting timed meander surveys two to three times during the flight. Six of these ten sites are either currently undergoing fen restoration or are slated to have fen management activities initiated. A *de novo* survey was conducted at one

site that appeared to have suitable habitat but that had no historical record for the satyr. Staff and volunteers from Southwest Michigan Land Conservancy conducted surveys for the satyr in 2005 at seven known sites and conducted *de novo* surveys at one site. Staff and volunteers from TNC and the USFWS conducted surveys at two additional occupied sites. The Michigan Nature Association also conducted surveys at two sites, which they own and manage (See Appendix 2 and Appendix 3).

Associated rare species

Several rare species associated with prairie fens and surrounding upland communities were documented during surveys for the Mitchell's satyr in 2005 by MNFI and cooperators. Surveyors recorded an occurrence of Blanding's turtle (*Emys blandingii*) at the St. Joseph County East site and box turtles at sites in Berrien, Jackson, and Van Buren counties. Poweshiek skipperling (*Oarisma poweshiek*), Duke's skipper (*Euphyes dukesi*) and Swamp metalmark (*Calephelis mutica*) were found at the Jackson County Central site. White lady's slipper (*Cypripedium candidum*) was documented at sites in Jackson and Berrien County. Jacob's ladder (*Polemonium reptans*) was found at a site in Berrien County. Cut-leaved water parsnip (*Berula erecta*) was documented at a Cass County satyr site and pale Indian plantain (*Cacalia plantaginea*) and angular spittlebug (*Lepyronia angulifera*) were recorded during a *denovo* survey of a fen in Van Buren County. In addition, Virginia snakeroot (*Aristolochia serpentaria*), ginseng (*Panax quinquefolius*), and goldenseal (*Hydrastis canadensis*) were documented during surveys of adjacent uplands at the new satyr site, Cass County Southeast.

Monitoring Activities at Managed Sites

Barry County Southwest: MDNR parks supervised the clearing of shrubs from 4.69 acres of potential habitat in the winter of 2005. This activity resulted in the creation of new openings with a sedge understory as well as a connecting corridor (approximately 100 meters long) between two patches of occupied habitat. An MNFI ecologist and the MDNR Parks Division, Stewardship Ecologist conducted a timed-meander survey on July 8. Due to staffing constraints, we were unable to conduct a second visit to this site this year. Six satyrs (two of them, females) were documented in the newly created corridor. It will be interesting to learn if this newly created habitat will continue to be utilized by the satyrs in the coming years and to document the response of the vegetation in the cleared areas.

Branch County Site: The primary management needs at this site are to reduce the amount of woody vegetation and to control or eliminate invasive species (particularly purple loosestrife) that are encroaching into the fen. SWMLC has initiated management activities to thin shrubs and expand fen openings in three different areas of the fen. Monitoring was conducted at five different times in 2005 to support and evaluate the management activities at this site. On May 17 MNFI, staff conducted spring monitoring at the site where the *Galerucella* beetles were released in 2004. It will be several years before the effectiveness of the beetle release can be evaluated as it generally takes 3-5 years for the beetles to impact the purple loosestrife. Similarly, the response of the vegetation and the satyrs to the clearing that has occurred at this site is not immediately evident and will take time to evaluate. Three timed meander surveys were conducted at this site on June 26, June 27, July 5 and July 6. In addition, MNFI staff assisted Peter Tolson and Mitch Magdivich from the Toledo Zoo on July 5 to capture and cage two female satyrs in an outdoor enclosure in order to collect eggs for a larval rearing study that the zoo initiated. The next day 38 eggs were successfully gathered and the females were safely released to the locations where they had been captured.

Cass County East: The private conservation organization which owns this site requested that MNFI conduct surveys to determine which areas of the fen are currently occupied in order to guide their management strategies. They would like to conduct shrub removal in the northwest corner of this site where satyrs were previously recorded but have not been documented for several years. Timed-meander surveys were conducted on July 8 by MNFI and TNC staff.

Cass County Southeast (New Site):

Surveys confirmed the presence of the Mitchell's satyr at a new site in Cass County (Cass County Southeast.

An MSU professor alerted MNFI, TNC and USFWS to his discovery of the satyr at a privately owned nature camp. An MNFI ecologist conducted surveys along with the professor, TNC staff, and a camp staff person. The satyr population and fen community were documented and described. An MNFI botanist, conservation planner, ecologist and a LIP biologist made a second visit, although no satyrs were documented at this time due to it being late in the flight period. A third site visit was made by an MNFI botanist and the LIP biologists in the fall to discuss management needs. The LIP biologist and the camp directors are currently discussing restoration strategies and activities. It is likely that management to control shrub growth and non-native species will be initiated in 2006 by the LIP program.

Jackson County Central:

Mark-release-recapture Study

A total of 819 individuals were marked; 509 males and 310 females. This represents an increase from 520 marked individuals in 2003 (Barton and Bach 2005). Forty-nine percent of marked females and 42% of marked males were recaptured for a total recapture rate of 44%. Daily population estimates for both 2003 and 2005 are presented in Appendix 4, Table 1, with a high for males in 2005 of 606.15 and 528.96 for females. The average distance moved for males was 98.29 m (n=302) and for females 57.7 m (n=164). The maximum distance flown between captures by males was 607.8 m and by females 376.9 m. The average minimum home ranges (minimum convex polygons) were .37 ha for males (n=78) and .06 ha for females (n=30).

Enclosure Study

Two satyrs emerged from two different enclosures, one in each study plot. The enclosure in the burn unit was actually located very close to the edge of the burned area and it is unclear whether the satyr in that cage emerged from burned or unburned vegetation. Three other species of invertebrates were identified in the burn unit enclosures; Tiger Moths (Arctiidae), Pearl Crescents (*Phycoides tharos*), and Little Wood Satyrs (*Megisto cymela*). Bluets (Odonate-*Enallagma* spp.) were found in unburned unit enclosures.

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There are a number of individuals and organizations that we would like to acknowledge for their contributions to this project and to the conservation of the Mitchell's satyr in Michigan. This project was made possible with funding by the regional office of the USFWS. Our original project proposal was greatly strengthened by the able assistance of **Steve Beyer**, MDNR Federal Aid Coordinator and **Ray Rustem**, MDNR Wildlife Division Natural Heritage Supervisor. **Carrie Tansy**, Fish and Wildlife Biologist, USFWS, East Lansing Field Office, has provided instrumental leadership to the Mitchell's Satyr Working Group as well as valuable assistance to this project. **Mike Kost**, MNFI Ecologist, has offered his expertise and guidance to the Mitchell's Satyr Working Group and has provided valuable insights into fen ecology and stewardship. In addition his skill and dedication in conducting countless hours of intensive field surveys have contributed greatly to our understanding of the satyr and its habitat.

This project would not be possible without the valuable assistance of the following individuals who helped to identify potential satyr habitat and, often under grueling field conditions, conducted satyr surveys: **Adrienne Bozic**, MNFI Ecologist and **Ryan O'Conner**, MNFI Botanist; **Matt Herbert**, MDNR Assistant Endangered Species Biologist; **Larry Lyons**, SWMLC volunteer; **Roger Kuhlman**, North American Butterfly Association; **Dr. Peter Tolson** and **Mitch Magdivish**, Toledo Zoo; **Dr. Larry Nooden**, U.M. professor; **Sara Schaefer**, MDNR, SW MI Management Unit Supervisor for Wildlife, **Christine Hanaburgh**, MDNR Wildlife Biologist, **Mark Bishop**, MDNR Wildlife Technician, and **Abbie Allarding** and **Ryan Soulard**, MDNR Seasonal Employees, Barry SGA; **Shelli Dubay**, Wildlife Biologist and **Shannon Hanna** MDNR Wildlife Technician, MDNR Waterloo Wildlife Office; **Carrie Tansy** and **Tamika Dandridge**, Fish and Wildlife Biologists, USFWS; **Brad Cogden**, Education Director, Camp Friedenswald and **Randy Counterman**, graduate student, MSU. Finally, thanks to **Dick Irwin** for his tireless dedication to the conservation of the satyr and its habitat on his land.

Many partners have been instrumental in providing access for surveys, assisting with surveys and/or planning and initiating management activities at satyr sites. They have worked closely with us to insure that proposed management is compatible with the satyr and that it provides for the long term health of the fen ecosystem. These include: **Nate Fuller**, Stewardship Coordinator, **Jodi Simoes**, Land Protection Specialist, and numerous volunteers, Southwest Michigan Land Conservancy; **Glenn Palmgren**, Stewardship Ecologist and **Ray Fahlsing**, Stewardship Program Manager, MDNR Parks and Recreation Division; **Sue Tangora**, **Dan Kennedy** and **Chris Hoving**, MDNR LIP Program, **Sherri Laier**, Stewardship Director, Michigan Nature Association; **Doug Powless**, Science and Stewardship Coordinator, Land Conservancy of West Michigan; **Susan Lackey**, Washtenaw Land Trust; **John Legge**, West Michigan Conservation Director, **Jack McGowan-Stinski**, Land Steward-Fire Manager, **Doug Pearsall**, East MI Director of Science and Planning and **Patrick Doran**, Senior Scientist, and **Andrea Kline**, East Michigan Conservation Director, The Nature Conservancy.

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Appendix 1.

Cover Page: Site Conservation Plan for Barry County South, Turner Creek Fen

Site Conservation Plan for Mitchell's Satyr Butterfly: Turner Creek Fen Complex Barry County, Michigan



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Appendix 2.

Table of 2005 Satyr Survey Data

2005 Satyr Survey Results

Site (Tract)	Date/Time	Date/Time	Date/Time	# of surveyors	# of Satyrs	# of Satyrs/hr/ person
	Visit #1	Visit #2	Visit #3			
Barry Co. South	6-27/1			1	6	6
		7-6/1		4	69	17.25
			7-13/1	2	6	3
Barry Co. SE	7-8/1			2	16	8
Berrien Co. North	7-5/.75hr			6	19	4.2
		7-12/.75		5	14	3.7
Berrien Co. South	7-11/.05			4	6	3.0
Site A						
Site B	7-11-0.75			2	1	
Site C	7-11/1			2	0	0.0
Berrien Co. SE	7-12/.5hr			5	10	4.0
Branch Co. Tract (A)	6-26/1			2	20	10.0
		7-5/2.5		5	125	10.0
Tract (B)	6-27/3			4	54	4.5
		7-5/3.5		3	35	3.0
Cass Co. East	7-8/1.5			2	8	1.3
Cass Co. NW	no survey					
Cass Co. SE	7-8/1.5			3	10	2.2
		7-14/1		4	0	0.0
Cass Co. SW Tract (A)	7-1/.5hr			6	0	0
		7-12/.25hr		3	0	0.0
Tract (B)	7-1/.25hr			3	0	0
		7-13/.5hr		3	0	0.0
Tract (D)	7-1/.5hr			3	14	9.3
		7-13/.25hr		3	4	5.3
	7-1/.75hr			3	6	2.6
		7-12/.5hr		2	0	0.0
Tract (E)	7-1/.5hr			3	36	24.0
		7-13/.5hr		3	5	3.3
Tract (F)	6-29/.5hr			5	22	8.8
		7-13/1hr		3	4	1.3
Tract (G)	7-1/.5hr			3	3	2.0
		7-13/.25hr		3	0	0.0

2005 Satyr Survey Results

Site (Tract)	Date/Time	Date/Time	Date/Time	# of surveyors	# of Satyrs	# of Satyrs/hr/ person
	Visit #1	Visit #2	Visit #3			
Jackson Co. Central	6-28-7-15 MRR study			many	19 marked	
Jackson Co. East	6-29/2	7-7/3		2 2	10 18	2.5 3.0
Jackson Co. West	7-6/2			4	11	1.4
Kalamazoo Co. North	7-4/.5hr	7-8/.5hr		1 1	0 0	0.0 0.0
Kalamazoo Co. West	6-30/2.0hr 7-7/2.0hr			1 2	5 3	2.5 0.8
St. Joseph Co. West Tract A	7-5/1.75hr			3	28	5.3
Tract B	7-11/2.0hr			4	14	1.8
Tract C	no survey					
St. Joseph Co. East	6-28/3	7-12/2.5		2 2	1 0	0.2 0.0
Van Buren Co. NE	7-8/3.5hr	7-11/3.5hr	7-15/3.0	5 5 3	121 56 14	6.9 3.2 1.5
Van Buren Co.	no survey					
Washtenaw Co. West	7-1/2	7-7/3		2 5	15 39	7.5 2.6

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Appendix 3

Summary of 2005 Activities

Summary of 2005 Mitchell Satyr Activities

Occupied Satyr Sites:

- Satyrs are **known to be extant at 17 sites** (all reconfirmed in 2005) in Barry, Berrien, Branch, Cass, Jackson, Kalamazoo, St. Joseph, Van Buren and Washtenaw counties. **One of these sites is a new site confirmed in Cass County!**
- Satyrs have **potential to be extant at 2 additional sites** – last observed in 2003 in Kalamazoo and in 1993 in Van Buren County (permission to survey had been denied by landowner at Van Buren site).
- Satyrs are **believed to be extirpated at 5 sites** in Cass, Kalamazoo (2), Lenawee and Washtenaw counties (last observed in 1993, 1956, 1978, 1980 and 1950's respectively).

Surveys:

- **MNFI**- Conducted multiple surveys (2-3 visits) at **10 known satyr sites** (large habitat complexes with multiple landowners) in 6 southern Michigan counties. The satyr was confirmed from **1 new site** in Cass County (Private camp). MNFI also conducted de novo surveys at 1 site in Barry County and one site in Van Buren county but did not find the satyr.
- **Southwest Michigan Land Conservancy (SWMLC)** - Conducted multiple surveys (2-3 visits) at **7 known satyr sites** (large habitat complexes with multiple landowners) in 4 southern Michigan counties. SWMLC also conducted de novo surveys at **1 site** in Van Buren County but did not find any new satyr populations.
- **MDNR Wildlife Biologist's and LIP Program**- Assisted with surveys at **2 sites**.
- **USFWS** Conducted a survey at **1 site** in Berrien County.
- **TNC**- Conducted surveys at 1 site in Berrien County and 1 site in Cass County, and assisted with surveys at 1 site in Jackson County and 1 site in Washtenaw County.

Associated Fen Species:

- Blanding's turtle (*Emys blandingii*) at one satyr site in St. Joseph County.
- Virginia snakeroot (*Aristolochia serpentaria*), ginseng (*Panax quinquefolius*) and goldenseal (*Hydrastis canadensis*) documented adjacent to a satyr fen in Cass County.
- Cut-leaved water parsnip (*Berula erecta*) at a satyr site in Cass County
- White lady's-slipper (*Cypripedium candidum*) and Jacob's ladder (*Polemonium reptans*) found at a satyr site in Berrien County.
- Box turtle (*Terrapene carolina*) found at satyr sites in Berrien and Van Buren counties.
- Pale Indian-plantain (*Cacalia plantaginea*) and angular spittlebug (*Lepyronia angulifera*) found during a *denovo* survey of a fen in Van Buren County (not a satyr site).

Landowner contact:

- MNFI, TNC and the Washtenaw County Land Trust visited with two landowners at a site in Washtenaw Co. to discuss management opportunities and the potential to purchase development rights at this site.
- MNFI, and the LIP biologists have been in contact with the manager of the private camp where satyrs were newly documented this year. The LIP biologist will continue these discussions to implement management there. They have also met with many landowners and organizations in several counties to discuss habitat management options.
- SWMLC is working closely with landowners at four sites where they are conducting management. They are also discussing potential management options with landowners at a site in Cass County.

Local stewardship:

- **SWMLC** conducted management at **3 satyr sites in Berrien, Branch and Cass Counties**. This included brush removal, herbicide application and corridor creation.
- **TNC** conducted management at **1 satyr site in Jackson County**.
- **MDNR Parks** contracted and supervised the clearing of 4.69 acres of shrubs at a site in Barry County.

Site Conservation Planning:

- MNFI and MDNR completed one site conservation plan for Barry County South.

Appendix 4

Table of Population Estimates for the Mitchell's Satyr in 2003 and 2005 at Jackson
County Central

Table 1. Population estimates of male and females Mitchell's satyrs at JCC for 2003 and 2005 using the Jolly-Seber method.

Date	2003		2005	
	Males	Females	Males	Females
29-Jun	*	*	136.37	218.40
30-Jun	*	*	*	528.96
1-Jul	*	*	502.08	*
2-Jul	*	*	467.04	160.40
3-Jul	58.07	*	606.15	364.00
4-Jul	333.67	*	430.50	497.15
5-Jul	929.20	*	287.62	372.61
6-Jul	636.08	*	332.18	454.91
7-Jul	*	12.00	584.41	100.00
8-Jul	294.84	*	262.43	137.06
9-Jul	801.00	*	122.92	68.10
10-Jul	439.11	*	268.13	50.40
11-Jul	157.50	*	*	36.00
12-Jul	616.50	330.75	35.00	*
13-Jul	154.00	397.96	*	*
14-Jul	*	*	13.33	*
15 Jul	10.00	341.55	-	-
16 Jul	*	*	-	-
17 Jul	*	129.52	-	-
18 Jul	*	*	-	-
19 Jul	*	*	-	-
20 Jul	2.00	414.22	-	-
21 Jul	*	68.88	-	-
22 Jul	*	66.25	-	-

* = no estimate

- = study ended

Appendix 5

Photos of Enclosures Used at Jackson County Central



Erecting the enclosures at Jackson County Central



Completed enclosures at the control site in Jackson County Central fen