

Development of a Monitoring Framework for Michigan's Wildlife Action Plan: Final Report

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Introduction

Monitoring the status and condition of species of greatest conservation need (SGCN) and landscape features identified in Michigan's Wildlife Action Plan (WAP) is essential for examining trends, evaluating changes in condition, and assessing progress and success of conservation actions. However, given the limited availability of resources and large number and vast complexity of SGCN and landscape features, rigorous on-the-ground monitoring for all SGCN and landscape features across the state is not feasible. As a result, monitoring efforts will need to focus on a well defined subset of appropriate indicators, criteria, and/or metrics for assessing status and condition. This approach involves identifying and monitoring indicator, keystone, or umbrella species (i.e., focal species), and appropriate landscape features or other metrics useful for assessing the status of various species, and species groups.

The aim of this project was to develop a monitoring framework for effectively assessing the status and condition of landscape features and SGCN identified as a high priority for the WAP. This effort was envisioned as a four-year project with the convening of a multi-agency partner team during the first year, development of a draft monitoring framework, expert review, and limited field testing in years two and three, and completion of a revised and final monitoring framework in the fourth year of the project. However, due to budget cutbacks, funding to continue this project in future years was eliminated.

Methods

At the start of the project, key collaborators were identified and brought together from MNFI, MDNR Wildlife Division, MSU Fisheries and Wildlife Department. Meetings were held to discuss project goals and develop a conceptual framework for monitoring the status and trends of SGCN and landscape features in the WAP. Select team members were assigned to develop a list of current monitoring programs for each terrestrial SGCN and landscape feature. Both SGCN and landscape features were categorized by the current level of available data. Categories for this analysis included inventory, surveillance, and monitoring. Definitions were developed for each of these categories and for several other related terms of reference.

Results

Four meetings were held that included staff from MNFI, MDNR Wildlife Division, and MSU Fisheries Wildlife Department. The agendas, meeting notes, and staff in attendance at the meetings are included in Appendix 1. The initial discussions centered on developing a common set of definitions for terms such as inventory, surveillance, monitoring, assessment, etc. (see Appendix 2). The definitions were derived from a presentation delivered by Scott Jones, MDNR WLD, at the second project meeting.

In recognition of Wildlife Division's focus on terrestrial species (as opposed to Fish Division's focus on aquatic species) and the need for status and trends information to assess SGCN and landscape features, the group settled on the following objective for the project:

To develop a framework for a status and trends program for terrestrial Species of Greatest Conservation Need (SGCN) and landscape features to inform the implementation and revision of the Wildlife Action Plan. A status and trends program will involve inventory, surveillance, assessment, and reporting. The identification of research needs is within the scope of this project.

Monitoring for this project was defined as the collection of specific information for management purposes in response to hypotheses derived from assessment activities. Thus, monitoring as so defined was likely beyond the scope of the project or would be limited to only a few species and or landscape features.

To explore developing a framework for a status and trends program for SGCN and landscape features, the group discussed two approaches, one using an ecosystem representation model and the other based on species. Gary Roloff, MSU, presented a diversity matrix as an example of an ecosystem representation model at the third meeting. In this approach, ecological factors such as climate, moisture, dominant vegetation (e.g., forest vs. grassland), etc., are used to develop a matrix of ecosystems that represent the diversity of ecological conditions known for a given geographic area. Focal species can then be selected to represent each of the major ecosystem types (e.g., upland forests, wetland forests, grasslands, etc.). Assessing the status and trends of these focal species can provide information on the condition of the associated species and ecosystems.

Members of the project team communicated with staff from the Institute for Fisheries Research who are working with MDNR Fish Division in developing and implementing a status and trends program for aquatic SGCN and landscape features. Their approach, which uses both species and habitat data, appears to be a hybrid of the two approaches discussed above.

To gain an understanding of information needs, the group elected to categorize all terrestrial SGCN and natural features as either inventory, surveillance, or monitoring, based on the type of information currently being gathered for these species and features (see Appendices 3a and 3b). For the 285 terrestrial SGCN we reviewed, the current level of survey effort is as follows: 171, inventory; 110, surveillance; and 4, monitoring. For the 171 species listed in the inventory category, no consistent and regular data collection effort currently exists to reliably assess their population status statewide. The 110 species within the surveillance category includes all birds, frogs, and toads, three mammals (snowshoe hare, lynx, least weasel), and two butterflies (Mitchell's satyr and Poweshiek skipperling). Several ongoing programs collect annual data on the presence and absence of birds, frogs and toads (see Appendix 3a). Some of these efforts include the Breeding Bird Survey, Christmas Bird Count, Marsh Monitoring Program, and Frog and Toad Survey. For the mammals included in the surveillance category, data from annual hunter surveys provides a consistent source for assessing status and trends. The four species included in the monitoring category include moose, grey wolf, American marten, and Karner blue butterfly. These species are actively studied and monitored by the MDNR Wildlife Division. Based on our analysis, the information being collected on all landscape features is best described as inventory (Appendix 3b). Although monitoring is being carried out at a few select sites, none of the landscape features are consistently surveyed or monitored across their range within the state.

Discussion

This project set out to develop a process and structure (i.e., framework) by which SGCN and landscape features could be monitored. Early in our discussions, we realized that the information needed for this effort was better characterized as status and trend data rather than monitoring data. The use of standard definitions for terms such as inventory, surveillance, and monitoring proved very helpful in our discussions.

Because of the large number of terrestrial SGCN and landscape features, the group agreed that it would be practical to use focal species to represent groups of associated species and or landscape features. Most understood that focal species could be used in a species-based approach, an ecosystem representation model such as diversity matrix, or a hybrid of the two approaches (as Fish Division appears to be using). Some also agreed that data on particular aspects of landscape features (e.g., vegetation structure and composition, canopy closure, etc.) could provide criteria to assess the status of some taxa (also similar to the approach being used by Fish Division). It was widely recognized that for many rare species, especially those that use a broad range of habitats, a focal species approach will not provide reliable status or trend information. For most rare species, reliable status and trend information will require collecting data on each individual species rather than on associated focal species or habitat characteristics.

Appendices

1. Meetings agendas and notes
 - a. March 4, 2009
 - b. March 23, 2009
 - c. April 8, 2009
 - d. April 21, 2009
2. Definitions of key terms
3. Tables
 - a. Status of information for Species of Greatest Conservation Need in relation to inventory, surveillance, and monitoring.
 - b. Status of information for Landscape Features in relation to inventory, surveillance, and monitoring.

Appendix 1a.

Meeting Notes WAP Monitoring Framework 4 March 2009 4 Central

Participants: Mike Kost, Gary Roloff, Mike Monfils, Pete Badra, Steve Thomas, Brian Klatt, Kerry Fitzpatrick, Sarah Mayhew, Yu Man Lee, Dave Cuthrell, Brad Slaughter, Amy Derosier, Mike Donovan.

Agenda

- I. Project Overview (15 minutes)
 - a. Developing a monitoring framework
 - b. Expectations
 - c. Outcomes
- II. WAP Goals (Amy) (15 minutes)
- III. Developing a Monitoring Net for SGCN and Landscape Features (30 minutes)
 - a. Umbrella species
 - b. Species with very strong ties to specific habitat attributes
 - c. Species that use a very broad range of habitats and very rare species
 - d. Landscape Features
- IV. What's been done elsewhere that is useful to MI (i.e., local, national, international) (30 minutes)
 - a. Data sets for evaluating status of SGCN and Landscape Features
 - b. Monitoring protocols
 - c. Who else needs to be involved (species and/or habitat specialists)? (10 minutes)
 - d. Next Steps (20 minutes)

Meeting Notes: March 4, 2009

- I. Project Overview
 - Developing a monitoring framework
 - Expectations: utilize partner interest and reach out to other parties to collect data and determine data gaps
 - Outcomes: identify key collaborators, determine what (framework) and how (methods). A review of the literature and existing data may help us answer these questions.
- II. WAP Goals (Amy)
 - The main goal of the WAP is to keep common species common to prevent the need to include them on the endangered species list
 - The WAP utilizes a coarse filter – fine filter approach that focuses on landscape features that support wildlife species, but the ultimate focus must be on the individual species, not the system
 - The DNR will develop conservation priorities in the coming years to focus efforts. These plans are reviewed every five years. A current focus is on identification of priority landscape features, threats to those features, and actions that can be taken to mitigate those threats.

Appendix 1a. (continued)

- We need to assess outcomes of the WAP and need to determine how to do this. We will likely have to report how federal funding has been used to benefit wildlife.
- **Question:** If the purpose of the WAP is to keep common species common, why are so many of the species of greatest conservation need (SGCN) listed species? **Response:** some states removed or considered removing rare species from their respective WAPs. Because recovery of listed species is a goal in MI, they were included in the WAP.
- **Question:** What are we monitoring? Success of our management efforts or population trends of the individual species? **Response:** We should do what we think is effective to determine if the funds we use are making a difference. The WAP description of monitoring includes measures of both success and trends.
- **Question:** Are we leaning on WAP for monitoring direction? **Response:** Likely not, but we need to ensure this process feeds into WAP priorities. Monitoring priorities will likely be independent of WAP priorities. Information on wildlife populations collected as part of the monitoring process will likely feed into and modify WAP priorities over time.

III. Developing a monitoring net for SGCN and Landscape Features

IV. *Umbrella species* (definitions added during development of meetings notes)

- Definition: A wide-ranging species whose requirements include those of many other species (Groom et al. 2006); a species with large area requirements for which protection of the species offers protection to other species that share the same habitat (Ozaki et al. 2006)
- Examples: large predators that occupy large ranges (e.g., grizzly bear).
- Other examples: red-shouldered hawk? Cerulean warbler?
- *Keystone species* (definitions added during development of meetings notes)
 - Definition: a species that has a disproportionate effect on its environment relative to its abundance (Paine 1995).
 - Beaver are a classic example, and may indicate the health of populations of a variety of species (e.g., muskrats, otter, Louisiana waterthrush, Hungerford's crawling water beetle).
 - We should perform a literature review to determine linkages between umbrella and keystone species and other species.
- Species with very strong ties to specific habitat attributes (e.g., red-shouldered hawk?)
- Species that use a very broad range of habitats and very rare species (e.g., Mitchell's satyr, Eastern massasauga, likely many of our listed spp.)
- **Question:** should focal species be SGCN? If we are aiming to keep common species common, should we focus on SGCN? **Response:** our focus must keep in mind the goal to meet our goals with minimal time and cost
- **Question:** what is the connection between the proposed monitoring protocol focused on landscape features, focal species, and listed species, and biodiversity? We need to establish the connection. **Response:** Our approach uses identified SGCN and landscape features as a surrogate for biodiversity, with the underlying assumption that these targets are reasonable indicators of biodiversity. We will need to keep this in mind when prioritizing the list of SGCN before beginning the process. Perhaps we should select species for which we already have a reasonable understanding of habitat requirements or species that are especially sensitive to habitat modification, loss, and degradation. This is a coarse filter-fine filter approach, which is well documented in the literature. Conceptually, we should tie species to ecosystems. Gary briefly discussed using an

Appendix 1a. (continued)

ecosystem diversity matrix to implement ecosystem management. It will be important to identify the suite of landscape features that we think inform us about the broadest suite of species.

- Landscape features
 - **SUMMARY:** most people prefer a coarse filter-fine filter approach based largely on landscape features that capture a series of species, but also potentially umbrella species, keystone species, focal/indicator species, and listed species. Kerry will discuss potential flaws in this approach in a future meeting (see VI).
- V. What's been done elsewhere that is useful to MI (i.e., local, national, international)
- Data sets for evaluating status of SGCN and Landscape Features. **Suggestion:** determine the framework we want to use before beginning significant literature and data review.
 - Monitoring protocols: USFS, etc. have protocols available. ***We must incorporate detection probabilities in any sample design to ensure scientific credibility.** Also, the quality of available survey data available is questionable, and we must be careful to not blindly incorporate bad data. **Question:** is the assessment of SGCN status linked to this monitoring plan? **Response:** no, the status assessment and monitoring plan are independent.
- VI. Who else needs to be involved (species and/or habitat specialists)? We need to ensure some "crossover" species that utilize terrestrial and aquatic habitats do not fall between the cracks. This may involve working with Fisheries Division. We are all free to reach out and identify people who can help develop plans following conceptualization of the framework.
- VII. Action:
- Amy will send email to species/habitat specialists to update them on the WAP monitoring process
 - Amy will communicate pathway for central storage of project materials to group
 - Mike K. scheduled a follow-up meeting featuring a presentation by Scott Jones on monitoring for **Monday, March 23, at 1:30 PM in 4-Central.**
 - Gary forwarded a paper detailing the ecosystem diversity matrix (Haufler et al. 1996) and will discuss this tool at a future meeting, probably in early April.
 - Yu Man forwarded monitoring-related reports from Scott Jones.
 - Kerry will offer dissenting view on a landscape feature/ecosystem-based approach to monitoring species and sent out several articles related to this discussion.

*Our overarching focus needs to be on a plan that can be implemented. When we spell out a framework, we need to list and discuss alternatives and explain the advantages and downfalls of each option. We need to be transparent about the assumptions underlying each of the options.

Relevant Literature:

Groom, M.J., G.K. Meffe and C.R. Carroll. 2006. Principles of Conservation Biology. Sunderland, Massachusetts, Sinauer Associates, Inc.

Haufler, J.B., C.A. Mehl, and G.J. Roloff. 1996. Using a coarse-filter approach with species assessment for ecosystem management. Wildlife Society Bulletin 24: 200-208.

Appendix 1a. (continued)

- Holthausen, Richard; Czaplewski, Raymond L.; DeLorenzo, Don; Hayward, Greg; Kessler, Winifred B.; Manley, Pat; McKelvey, Kevin S.; Powell, Douglas S.; Ruggiero, Leonard F.; Schwartz, Michael K.; Van Horne, Bea; Vojta, Christina D. 2005. **Strategies for monitoring terrestrial animals and habitats**. Gen. Tech. Rep. RMRS-GTR-161. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 34 p.
- Mulder, Barry S.; Noon, Barry R.; Spies, Thomas A.; Raphael, Martin G.; Palmer, Craig J.; Olsen, Anthony R.; Reeves, Gordon H.; Welsh, Hartwell H. 1999. The strategy and design of the effectiveness of monitoring program for the Northwest Forest Plan. Gen. Tech. Rep. PNW-GTR-437. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 138 p.
- Ozaki, K., M. Isono, T. Kawahara, S. Iida, T. Kudo and K. Fukuyama. 2006. A Mechanistic Approach to Evaluation of Umbrella Speices as Conservation Surrogates. *Conservation Biology* 20: 1507-1515.
- Paine, R.T. 1995. A Conversation on Refining the Concept of Keystone Species. *Conservation Biology* 9: 962-964.
- Vesely, D.; McComb, B.C.; Vojta, C.D.; Suring, L.H.; Halaj, J.; Holthausen, R.S.; Zuckerberg, B.; Manley, P.M. 2005. A technical guide for developing USDA Forest Service protocols to inventory or monitor wildlife, fish, and rare plants. Gen. Tech. Rep. WO-xx. Washington, DC: U.S. Department of Agriculture, Forest Service.

Appendix 1b.

Meeting Notes WAP Monitoring Framework 23 March 2009 4 Central

Participants: Mike Kost, Scott Jones, Mike Donovan, Sarah Mayhew, Kerry Fitzpatrick, Amy Derosier, Mike Monfils, Yu Man Lee, Brian Klatt, Pete Badra, Joelle Gehring, Brad Slaughter, Steve Thomas, Gary Roloff, Dave Cuthrell.

Agenda

- I. Updates
 - a. Meeting notes from March 4th
 - b. Public directory: S:\Public\WLD_MGT\7_Wildlife_Action_Plan\Monitoring
 - c. Gary Roloff and Kerry Fitzpatrick will present at next meeting
 - II. Presentation on monitoring by Scott Jones (45 minutes)
 - III. Discussion of developing a monitoring framework (70 minutes)
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Meeting notes: March 23, 2009

Summary

The goal of the project is to determine a framework to monitor the status and trends of species (SGCN) and landscape features contained in the WAP. At the next meeting we will consider options for the approach to developing the framework. After establishing an approach, we can identify what information is available for each SGCN and landscape feature and then place these into categories of inventory, surveillance, and monitoring based on the best available information. We can then identify a suite of associated focal species or landscape features that may represent a broader group within each category.

Notes

- I. Updates
 - a. Meeting notes from March 4th
 - b. Public directory: S:\Public\WLD_MGT\7_Wildlife_Action_Plan\Monitoring
 - c. Gary Roloff and Kerry Fitzpatrick will present at next meeting
- II. Scott Jones, Assistant Field Coordinator with MDNR Wildlife Division delivered a presentation on monitoring, highlighting weaknesses of past monitoring efforts and suggesting a seven-step method for development of a monitoring protocol. ***This PowerPoint file is attached to the accompanying email for reference. Refer to the notes section below each slide for detailed discussion.*** The following definitions guided discussion in III:
 - a. ***Inventory***: An intensive or extensive effort to determine location or condition of a resource, including the presence, class, distribution and status of plants, animals, and abiotic components.
 - b. ***Surveillance***: The collection of time-series information that is not hypothesis-driven
 - c. ***Monitoring***: Collection of specific information for management purposes in response to hypotheses derived from assessment activities

Appendix 1b. (continued)

- d. **Assessment:** The identification of the status of, and threats to, a resource as a basis for the collection of more specific information through monitoring activities.
 - e. **Reporting:** Turning information into knowledge by providing context
- III. Discussion of developing a monitoring framework
- **Question:** Is *monitoring*, as defined above, an appropriate framework for assessing outcomes associated with the WAP? Which method(s) listed above should we use to gain understanding on the impacts associated with implementation of the WAP? Inventory? Surveillance? Monitoring? Assessment? Monitoring may not be appropriate for WAP, as there is no associated hypothesis. **Response:** We should identify inventory needs, keeping a finger on the pulse of more common entities. We have to prioritize which species/guilds we need to focus on.
 - **Question:** Is there a specific question or questions we are trying to answer through monitoring? Did we define “monitoring” too loosely/broadly/inappropriately in the proposal? The proposal seems to focus on inventory and assessment, not monitoring. **Response:** Our goal is to determine a framework to assess the status and trends of species and landscape features (over time). We need to develop a glossary of terms to guide our discussions (*see a through e above*). Then, we need to decide which approach works best for particular species or guilds. For example, population fluctuations may make monitoring of small mammals difficult. Simple presence/absence inventory (or assessment and surveillance) may be suitable for this group. We could select species and landscape features and assign them to particular category needs (inventory, surveillance, monitoring, etc.). We can then determine what information we have for each entity, and information gaps that need to be filled.
 - **Question:** Should we identify individual species that have inventory needs, and define questions we need to answer about species that are of lower priority for inventory? **Response:** We could place each species in one or more categories (inventory, surveillance, monitoring, assessment) and identify associated focal species or landscape features. The conservation actions defined in the WAP are associated with the landscape features that harbor the species, which may influence how we proceed.
 - **Suggestion:** We could form a small subteam to develop a strawman monitoring framework for us to move forward. We can start with a foundation of terms with definitions the group accepts and follows.
- IV. Next steps: We will meet on Wednesday, 8 April from 10:00 AM to 12:00 PM in 4-Central. Gary Roloff and Kerry Fitzpatrick will discuss ecosystem- and species-based approaches to monitoring.

Appendix 1c.

Meeting Notes WAP Monitoring Framework 8 April 2009 4 Central

Participants: Pete Badra, Barb Barton, Amy Derosier, Mike Donovan, Scott Jones, Brian Klatt, Mike Kost, Yu Man Lee, Sarah Mayhew, Mike Monfils, Gary Roloff, Brad Slaughter, Steve Thomas

Agenda

- III. Summary recap of last meeting (15 minutes)
 - IV. Presentation by Gary Roloff followed by Q&A/discussion
 - a. Presentation (45 minutes)
 - b. Q&A/discussion (15 minutes)
 - V. Presentation by Kerry Fitzpatrick followed by Q&A/discussion (15 minutes)
 - a. Presentation (15 minutes)
 - b. Q&A/discussion (15 minutes)
 - VI. Next Steps (15 minutes)
-

Meeting notes: April 8, 2009

- I. Summary recap of last meeting
 - After the last meeting, Brad, Mike, and Amy developed a list of terms based on Scott's presentation to facilitate common understanding of the components of a monitoring program. The consistent use of these terms will facilitate and focus discussion.
 - We discussed several levels of a successful monitoring program, including inventory, surveillance, monitoring, assessment, and research. We can identify what information we have for specific focal species/landscape features, and what information gaps we have, to assign particular species or groups of species to one or more of the categories.
 - We need to determine if monitoring, specifically, is in the scope of this project. Some landscape features are managed by various agencies (e.g., pine barrens by USFS, DNR-WLD, DNR-FMFM), and we could derive hypotheses related to monitoring for those features in those particular areas. As there are no goals and objectives for particular SGCN in the WAP, we do not currently have a reference to develop hypotheses to test via monitoring. However, we could develop clear objectives and goals for particular SGCN within the WAP to frame monitoring questions.
 - **Question:** There are already monitoring plans being developed at the project level (e.g., karner blue, Mitchell's satyr). Is this project redundant? Can we really develop

Appendix 1c. (continued)

a monitoring program for the WAP/plan? The monitoring activities are at the species/project level. **Response:** We are trying to determine information needs for the SGCN.

- **Question:** How is the proposed plan for monitoring the WAP different than what the Habitat Working Group is doing? **Response:** HWG is developing overall habitat management suggestions/guidelines. Unless we have good guidance for general methods of habitat management, we may compromise non-focal species by managing specifically for focal species or SGCN.
- **Question:** What does monitoring at the large scale look like? **Response:** For example, by setting an overall acreage goal for “prairie” at the ecoregional or state level, savanna with lupine for karner blue, etc., we can assess if these goals are being met. **Suggestion:** Table discussion on monitoring and focus on information needs for the near future.
- **Question:** How are we determining focal species? **Response:** We will select species that are good indicators of various aspects of habitat quality.

II. Presentation by Gary Roloff followed by Q&A/discussion

“A Framework for Implementing an Inventory, Surveillance, and Monitoring Program” (see PowerPoint presentation located at:

S:\Public\WLD_MGT\7_Wildlife_Action_Plan\Monitoring on S drive).

- **Question:** Should landscape features be included in the WAP monitoring framework? Are landscape features coarse filters for capturing all wildlife species or good surrogates for SGCN for which we have information gaps?
- **Question:** Is the ecosystem diversity matrix something we can/should implement in Michigan? We have several data sets available that may be very helpful such as ecoregional map, circa 1800 vegetation map, current landcover map, ecological systems map, LANDFIRE successional models, soils maps, etc. How would we lump natural communities into appropriate landscape feature groupings? **Response:** The history of the DNR is tied to target species (deer, elk, etc.), and the present WAP is tied to ensuring “everything” continues to exist, an undefined target that makes management decisions difficult to grasp. Current management focuses on (1) game species, (2) best management practices (stand treatments, etc.) or “quality,” and (3) a coarse filter approach to native ecosystems designed to protect biodiversity at the species and genetic level. The WAP is a “keep everything” approach. One consistency is that most management plans use some type of ecoregional framework.

III. Presentation by Kerry Fitzpatrick followed by Q&A/discussion

- Kerry was unable to attend the meeting; his presentation has been rescheduled to April 21, 2009.

Appendix 1c. (continued)

IV. Next Steps

- We will modify, clarify, and add terms to the glossary.
- We could start looking at placing species into categories of inventory, surveillance, and monitoring. We need to determine if we can use the ecosystem diversity matrix to organize our monitoring approach. We have not yet determined what our foci are going to be- SGCN? Focal species? Landscape features? Limited resources will determine in part which species and/or landscape features we target.
- There was general agreement we should invite someone from DNR-FISH to discuss their division's monitoring framework at a future meeting.

Appendix 1d.

Meeting Notes
WAP Monitoring Framework
21 April 2009
9:30 AM to 11:30 AM
3 Central

Participants: Pete Badra, Amy Derosier, Mike Donovan, Kerry Fitzpatrick, Brian Klatt, Mike Kost, Yu Man Lee, Sarah Mayhew, Mike Monfils, Gary Roloff, Brad Slaughter

Agenda

- VII. Presentation by Kerry Fitzpatrick followed by Q&A/discussion (30 minutes)
 - a. Presentation (15 minutes)
 - b. Q&A/discussion (15 minutes)

 - VIII. Discuss Potential Approaches for Monitoring Framework (60 minutes)
 - a. Ecosystem Diversity Matrix (30 minutes)
 - b. Species Assessment (30 minutes)

 - IX. Next Steps (30 minutes)
 - a. Ecosystem
 - b. Species
-

Meeting notes: April 21, 2009

- I. Presentation by Kerry Fitzpatrick followed by Q&A/discussion

“A Tale of Two Paradigms” (see PowerPoint Presentation located at:
S:\Public\WLD_MGT\7_Wildlife_Action_Plan\Monitoring)
 - **Presentation summary:** Our understanding of ecology has shifted from the paradigm of ecosystem stability, or “balance of nature,” to a paradigm of lack or stability or change (i.e., “ecosystems” are constantly in flux). The field of conservation is moving toward novel, non-analogue, and emerging ecosystems, the identification of focal species vs. “stable” ecosystems as targets, and the understanding and incorporation of human values and human dimensions in conservation practice.
 - **Question:** Given that some species assemblages are predictable at particular scales (e.g., years or decades in the case of characteristic species of beech – sugar maple forest), can we circumvent uncertainty about stability by defining spatial and temporal boundaries for our work?
 - **Response:** Maintaining a community in a particular configuration in perpetuity is not likely a viable model, despite possible short-term predictability of which species will persist. Our interest is in evaluating or monitoring a target. Monitoring a community that is constantly changing may not be informative.

Appendix 1d. (continued)

- **Question:** How is the discussion of ecosystem stability vs. ecosystem instability relevant to the project goal of designing a plan for inventory, surveillance, and monitoring?
 - **Response:** Wildlife species are relatively stable and predictable over time, whereas communities are an abstraction and in constant flux. Because wildlife species are the direct target of the WAP, our monitoring framework should address them specifically, rather than using stable-state concepts of communities as a surrogate target.
 - **Response:** We have good evidence for relative stability of human-managed ecosystems over the duration of thousands of years (e.g., oak savanna ecosystems in the Great Lakes region [Walpole Island]).
 - **Comment:** We need to specify our goals. Is our target wildlife? Wildlife habitat? Diversity? None of these goals are mutually exclusive. Communities are convenient constructs that allow us to manage for aggregates of species, rather than every single species. Our decisions will be based, in part, on human values and on our ability to measure something related to the potential target(s).
 - **Comment:** The discussion is important as we shift our thinking from conservation of exact conditions and species assemblages to a concept of *ecosystem resilience*, which is the ability of an ecosystem to maintain its function when faced with a novel disturbance (Webb 2007).

- **Question:** in practice, are the concepts of ecosystem stability and ecosystem instability mutually exclusive?
 - **Response:** in theory, these paradigms are mutually exclusive. However, many practitioners combine concepts from both paradigms. We will likely identify species assemblages we feel are linked by landscape features, and other species we must consider individually.
 - **Comment:** We should reconcile the flux of nature paradigm with the spatially explicit nature of conservation. How can the concept of ecosystem instability inform our monitoring framework to advance our goals of maintaining healthy populations of SGCN?
 - **Comment:** There is still debate as to whether we are developing a monitoring framework or an inventory and assessment framework. Developing monitoring plans for all SGCN in the next 20 years is not realistic. We need to pare down this task in some way (e.g., focal species, identifying specific species to monitor, using ecosystem diversity matrix for some species, etc.)
 - **Comment:** We can begin the process by placing SGCN into boxes to identify needs (inventory, assessment, surveillance, etc.). We may be able to use the ecosystem diversity matrix to guide this process.

- **Question:** Will collecting information on SGCN help us make a decision or focus our efforts?
 - **Response:** Perhaps we should collect information on stressors and threats for each SGCN. Our targets will depend on what we value and the availability of funding (human dimensions).

II. Discuss Potential Approaches for Monitoring Framework Summary

Appendix 1d. (continued)

- Over the course of the past meetings we have generated three ideas for proceeding:
 - Place species into categories of inventory, surveillance, and monitoring
 - Develop and present a straw-man ecosystem diversity matrix approach and a straw-man species-based approach to developing a monitoring framework and reconcile these approaches
 - Determine limiting factors or stressors for each SGCN

III. Next Steps

- We will schedule DNR-FISH to discuss their monitoring framework.
- Individuals will be assigned to research information needs (inventory, assessment, surveillance, etc.) and stressors/threats for each SGCN and Landscape Features to help us identify targets
- Amy Derosier will prepare a table for the WAP of SGCN and Landscape Features, which may contain information on associated threats and information sources (e.g., breeding bird survey).

Literature Cited

Webb, C.T. 2007. What is the role of ecology in understanding ecosystem resilience? *BioScience* 57: 470-471.

Appendix 2.

WAP Monitoring Project Terms of Reference

Inventory: An intensive or extensive effort to determine location or condition of a resource, including the presence, class, distribution and status of plants, animals, and abiotic components. Often point-in-time data; but, it can also be drawn out over a long time period as new data is contributed to a database.

Surveillance: The collection of time-series information that is not hypothesis-driven. The collection of time-series information that is not hypothesis-driven or in the absence of management context should be termed **surveillance** rather than monitoring. Examples of surveillance include trend studies, baseline studies or monitoring, and long-term ecological studies.

Monitoring: Collection of specific information for management purposes in response to hypotheses derived from assessment activities. The results of monitoring are used to implement management. Monitoring is driven by objectives and should be limited to situations where there is an opportunity to influence management. Monitoring uses standard methods repeated over time.

Baseline Studies or Monitoring: This type of study or monitoring establishes a baseline reference conditions that can quantify change due to management actions. The assumption here is that differences in measurements taken in reference areas versus managed areas can be attributed to management (in general – if the design is adequate to detect differences and change).

Compliance Monitoring: Tracking to see if management direction is accurately interpreted and followed. Compliance monitoring is concerned with answering the question “did we do what we said we would do?” If something is not working it may be difficult to tell if it is because of non-compliance with direction or because the direction was wrong in the first place.

Effectiveness Monitoring: Intended to measure whether progress is being made towards an objective. This type of monitoring can be used to compare existing conditions to both past conditions and desired future conditions.

Validation Monitoring: Seeks to verify the assumed causal linkages between cause and effect. Validation monitoring requires a more intensive effort. It is intended to validate the basic assumptions under which the management direction was developed. This type of monitoring is usually done in the research realm. Effectiveness and Validation Monitoring are highly complementary if fully integrated.

Assessment: The identification of the status of, and threats to, a resource as a basis for the collection of more specific information through monitoring activities. Used in the development of an influence diagram. Assessment involves the identification of the status of, the threats to, and/or the impact of perturbations to the resource as a result of inventory, surveillance, and/or monitoring activities.

Reporting: Turning information into knowledge by providing context

Research: Performing a methodical study in order to test a hypothesis or answer a specific question.

Appendix 3a. Status of information for Species of Greatest Conservation Need in relation to inventory, surveillance, and monitoring.

Surveillance Criteria

The surveillance data must meet the following criteria: Minimum of 3 years of survey data. Last date of survey no more than 10 years prior.

Surveillance Data Reliability

High, H: Survey technique is appropriate for the species. Correct identification of species is highly reliable. Study design is unbiased and amenable to statistical analysis. Adequate sample size.

Medium, M: Survey technique may not be appropriate for the species but provides some trend data. Correct identification of species occasionally varies with observer. Study design is occasionally biased due to species detection for some species. Sample size may be low.

Low, L: Survey technique is not appropriate for the species. Correct identification of species frequently varies with observer. Study design is biased. Sample size may be low.

SGCN	Level of Info			Existing Survey Data																			
	Inventory	Surveillance	Monitoring	Frog and Toad Survey	Marsh Monitoring Program	Breeding Bird Survey	Christmas Bird Count	Audubon Seasonal Surveys	Aerial Breeding Waterfowl Survey	Breeding Bird Atlas	American Woodcock Singing-Ground Surveys	Piping Plover Surveys	Kirtland's Warbler Census	Trumpeter Swan Survey	Sharp-tailed Grouse Lek Surveys	U.S./ Midwest Nightjar Survey	North American Marsh Bird Survey	Michigan Lepidoptera Survey	Michigan Odonata Survey	MDNR Mail Harvest Surveys	MDNR Mandatory Registration	MDNR Field Surveys (wolf & moose)	
Common Name																							
Blanchard's cricket frog	-	1	-	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
blue-spotted salamander	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
spotted salamander	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
marbled salamander	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
smallmouth salamander	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eastern tiger salamander	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fowler's toad	-	1	-	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
four-toed salamander	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
boreal chorus frog	-	1	-	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
western chorus frog	-	1	-	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pickerel frog	-	1	-	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
northern leopard frog	-	1	-	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cooper's Hawk	-	1	-	-	-	M	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-	-
Northern Goshawk	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted Sandpiper	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-	-
Henslow's Sparrow	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-	-
Le Conte's Sparrow	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-	-
Grasshopper Sparrow	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-	-
Blue-winged Teal	-	1	-	-	L	L	-	L	H	L	-	-	-	-	-	-	M	-	-	-	-	-	-
American Black Duck	-	1	-	-	L	L	L	L	M	L	-	-	-	-	-	-	M	-	-	-	-	-	-

SGCN	Level of Info			Existing Survey Data																		
	Inventory	Surveillance	Monitoring	Frog and Toad Survey	Marsh Monitoring Program	Breeding Bird Survey	Christmas Bird Count	Audubon Seasonal Surveys	Aerial Breeding Waterfowl Survey	Breeding Bird Atlas	American Woodcock Singing-Ground Surveys	Piping Plover Surveys	Kirtland's Warbler Census	Trumpeter Swan Survey	Sharp-tailed Grouse Lek Surveys	U.S./ Midwest Nightjar Survey	North American Marsh Bird Survey	Michigan Lepidoptera Survey	Michigan Odonata Survey	MDNR Mail Harvest Surveys	MDNR Mandatory Registration	MDNR Field Surveys (wolf & moose)
Common Name																						
Great Blue Heron	-	1	-	-	L	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Short-eared Owl	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Long-eared Owl	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Upland Sandpiper	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
American Bittern	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-
Red-shouldered Hawk	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Green Heron	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-
Chuck-will's-widow	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	L	-	-	-	-	-	-
Whip-poor-will	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	L	-	-	-	-	-	-
Piping Plover	-	1	-	-	-	L	-	L	-	L	-	H	-	-	-	-	-	-	-	-	-	-
Killdeer	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Black Tern	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Common Nighthawk	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	L	-	-	-	-	-	-
Northern Harrier	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	L	-	-	-	-	-
Marsh Wren	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Sedge Wren	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Evening Grosbeak	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-billed Cuckoo	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Black-billed Cuckoo	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Northern Flicker	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Northern Bobwhite	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Olive-sided Flycatcher	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Rail	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Trumpeter Swan	-	1	-	-	-	L	L	L	L	L	-	-	-	H	-	-	L	-	-	-	-	-
Black-throated Blue Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Cerulean Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Prairie Warbler	-	1	-	-	-	L	-	L	-	L	-	-	L	-	-	-	-	-	-	-	-	-
Yellow-throated Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Blackburnian Warbler	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Kirtland's Warbler	-	1	-	-	-	L	-	L	-	L	-	-	H	-	-	-	-	-	-	-	-	-
Palm Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Bobolink	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Least Flycatcher	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Acadian Flycatcher	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Spruce Grouse	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-

SGCN	Level of Info			Existing Survey Data																		
	Inventory	Surveillance	Monitoring	Frog and Toad Survey	Marsh Monitoring Program	Breeding Bird Survey	Christmas Bird Count	Audubon Seasonal Surveys	Aerial Breeding Waterfowl Survey	Breeding Bird Atlas	American Woodcock Singing-Ground Surveys	Piping Plover Surveys	Kirtland's Warbler Census	Trumpeter Swan Survey	Sharp-tailed Grouse Lek Surveys	U.S./ Midwest Nightjar Survey	North American Marsh Bird Survey	Michigan Lepidoptera Survey	Michigan Odonata Survey	MDNR Mail Harvest Surveys	MDNR Mandatory Registration	MDNR Field Surveys (wolf & moose)
Common Name																						
Merlin	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Peregrine Falcon	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
American Coot	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-
Wilson's Snipe	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-
Common Moorhen	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-
Common Loon	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Bald Eagle	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Worm-eating Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Wood Thrush	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-breasted Chat	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Least Bittern	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-
Northern Shrike	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Migrant Loggerhead Shrike	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Red Crossbill	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
White-winged Crossbill	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Red-headed Woodpecker	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Northern Mockingbird	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Black-crowned Night-heron	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Connecticut Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Kentucky Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Osprey	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Northern Parula	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Savannah Sparrow	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
American White Pelican	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Gray Jay	-	1	-	-	-	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Wilson's Phalarope	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Black-backed Woodpecker	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Towhee	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Pied-billed Grebe	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-
Boreal Chickadee	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Vesper Sparrow	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Sora	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Purple Martin	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Prothonotary Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
King Rail	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-

SGCN	Level of Info			Existing Survey Data																		
	Inventory	Surveillance	Monitoring	Frog and Toad Survey	Marsh Monitoring Program	Breeding Bird Survey	Christmas Bird Count	Audubon Seasonal Surveys	Aerial Breeding Waterfowl Survey	Breeding Bird Atlas	American Woodcock Singing-Ground Surveys	Piping Plover Surveys	Kirtland's Warbler Census	Trumpeter Swan Survey	Sharp-tailed Grouse Lek Surveys	U.S./ Midwest Nightjar Survey	North American Marsh Bird Survey	Michigan Lepidoptera Survey	Michigan Odonata Survey	MDNR Mail Harvest Surveys	MDNR Mandatory Registration	MDNR Field Surveys (wolf & moose)
Common Name																						
Virginia Rail	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	H	-	-	-	-	-
Ruby-crowned Kinglet	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
American Woodcock	-	1	-	-	-	L	-	L	-	L	H	-	-	-	-	-	-	-	-	-	-	-
Louisiana Waterthrush	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Dickcissel	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Field Sparrow	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Caspian Tern	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Forster's Tern	-	1	-	-	L	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Common Tern	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Eastern Meadowlark	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Western Meadowlark	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Brown Thrasher	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Sharp-tailed Grouse	-	1	-	-	-	L	-	L	-	L	-	-	-	-	H	-	-	-	-	-	-	-
Eastern Kingbird	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Barn Owl	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Golden-winged Warbler	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Blue-winged Warbler	-	1	-	-	-	M	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
White-eyed Vireo	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Canada Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Hooded Warbler	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Yellow-headed Blackbird	-	1	-	-	-	L	-	L	-	L	-	-	-	-	-	-	M	-	-	-	-	-
Cicindela hirticollis rhodensis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
little white tiger beetle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cicindela limbalis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cicindela macra	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
six-banded longhorn beetle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
black lordithon rove beetle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American burying beetle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
corylus dagger moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dusted skipper	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
gold moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pipevine swallowtail	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
freija fritillary	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
frigga fritillary	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
boreal fan moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SGCN	Level of Info			Existing Survey Data																			
	Inventory	Surveillance	Monitoring	Frog and Toad Survey	Marsh Monitoring Program	Breeding Bird Survey	Christmas Bird Count	Audubon Seasonal Surveys	Aerial Breeding Waterfowl Survey	Breeding Bird Atlas	American Woodcock Singing-Ground Surveys	Piping Plover Surveys	Kirtland's Warbler Census	Trumpeter Swan Survey	Sharp-tailed Grouse Lek Surveys	U.S./ Midwest Nightjar Survey	North American Marsh Bird Survey	Michigan Lepidoptera Survey	Michigan Odonata Survey	MDNR Mail Harvest Surveys	MDNR Mandatory Registration	MDNR Field Surveys (wolf & moose)	
Common Name																							
swamp metalmark	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Henry's elfin	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
frosted elfin	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
three-staff underwing	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
quiet underwing	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
magdalen underwing	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Robinson's underwing	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
gorgone checkerspot	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pine imperial moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
red-disked alpine	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
early hairstreak	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
wild indigo duskywing	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
persius duskywing	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
large marble	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dukes' skipper	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dune cutworm	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
northern hairstreak	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
barrens buckmoth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
otloe skipper	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
small heterocampa	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
riley's lappet moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
northern blue	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Karner blue	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Doll's merolonche	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Newman's brocade	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mitchell's satyr	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
poweshiek skipperling	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Macoun's arctic	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3-striped oncocnemis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
three-horned moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
aweme borer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
blazing star borer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
golden borer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
maritime sunflower borer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Culvers root borer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SGCN	Level of Info			Existing Survey Data																			
	Inventory	Surveillance	Monitoring	Frog and Toad Survey	Marsh Monitoring Program	Breeding Bird Survey	Christmas Bird Count	Audubon Seasonal Surveys	Aerial Breeding Waterfowl Survey	Breeding Bird Atlas	American Woodcock Singing-Ground Surveys	Piping Plover Surveys	Kirtland's Warbler Census	Trumpeter Swan Survey	Sharp-tailed Grouse Lek Surveys	U.S./ Midwest Nightjar Survey	North American Marsh Bird Survey	Michigan Lepidoptera Survey	Michigan Odonata Survey	MDNR Mail Harvest Surveys	MDNR Mandatory Registration	MDNR Field Surveys (wolf & moose)	
Common Name																							
silphium borer moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
regal fern borer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tawny crescent	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
hoary comma	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
yellow-banded day-sphinx	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sprague's pygarctia	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
grizzled skipper	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phlox moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
leadplant flower moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
spartina borer moth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
regal fritillary	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dorydiella kansana	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flexamia delongi	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Huron River leafhopper	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flexamia reflexus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
angular spittlebug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
great plains spittlebug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Philaenarcys killa	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
red-legged spittlebug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sedge darner	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
spatterdock darner	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
zigzag darner	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
muskeg darner	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ocellated darner	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
subarctic bluet	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
arrowhead spiketail	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
smoky rubyspot	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lake emerald	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hine's emerald	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
incurvate emerald	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
russet-tipped clubtail	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
grey petaltail	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ebony boghaunter	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ringed boghaunter	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
secretive locust	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Common Name																							
Davis's shield-bearer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
woodland camel cricket	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
woodland camel cricket	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
woodland meadow katydid	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
post-oak grasshopper	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
melodious ground cricket	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
elanoplus eurycerus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
blue-legged locust	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hebard's green-legged locust	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
bog conehead	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
conehead grasshopper	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tamarack tree cricket	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pine tree cricket	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
red-faced meadow katydid	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
delicate meadow katydid	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
barrens locust	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoosier locust	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Atlantic-coast locust	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pine katydid	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lake Huron locust	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
banded globe	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
spike-lip crater	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pleistocene catinella	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
domed disc	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Euconulus alderi	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
lambda snaggletooth	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Guppya sterkii	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
proud globe	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
copper button	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pale mantleslug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foster mantleslug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
redfoot mantleslug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carolina mantleslug	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eastern flat-whorl	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
widespread column	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Common Name																							
Vallonia gracilicosta albula	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
delicate vertigo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vertigo cristata	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tapered vertigo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hubricht's vertigo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cross vertigo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vertigo modesta parietalis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
six-whorl vertigo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
deep-throat vertigo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vertigo paradoxa	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
crested vertigo	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
velvet wedge	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
moose	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H
gray wolf	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H
southern red-backed vole	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
least shrew	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
northern flying squirrel	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
silver-haired bat	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
red bat	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
hoary bat	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
snowshoe hare	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-
lynx	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American marten	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	H	H	-	-
prairie vole	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
woodland vole	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
least weasel	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-	-
northern bat or northern myotis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indiana bat or Indiana myotis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
woodland jumping mouse	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
evening bat	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
deer mouse	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eastern pipistrelle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cougar	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
arctic shrew	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
smoky shrew	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	Inventory	Surveillance	Monitoring	Frog and Toad Survey	Marsh Monitoring Program	Breeding Bird Survey	Christmas Bird Count	Audubon Seasonal Surveys	Aerial Breeding Waterfowl Survey	Breeding Bird Atlas	American Woodcock Singing-Ground Surveys	Piping Plover Surveys	Kirtland's Warbler Census	Trumpeter Swan Survey	Sharp-tailed Grouse Lek Surveys	U.S./ Midwest Nightjar Survey	North American Marsh Bird Survey	Michigan Lepidoptera Survey	Michigan Odonata Survey	MDNR Mail Harvest Surveys	MDNR Mandatory Registration	MDNR Field Surveys (wolf & moose)
Common Name																						
pygmy shrew	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
water shrew	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
southern bog lemming	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
least chipmunk	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
six-lined racerunner	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
spotted turtle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kirtland's snake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
blue racer	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
northern ringneck snake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eastern fox snake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
black rat snake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
western fox snake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blanding's turtle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
wood turtle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eastern hognose snake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
smooth green snake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
copperbelly watersnake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
queen snake	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eastern massasauga	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
eastern box turtle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	171	110	4																			

Appendix 3b. Status of information for Landscape Features in relation to inventory, surveillance, and monitoring.

Landscape Feature	Inventory	Surveillance	Monitoring
Prairie	1	-	-
Idle/old field	1	-	-
Hayland	1	-	-
Pasture	1	-	-
Row crop	1	-	-
Right-of-way	1	-	-
Fence row	1	-	-
Savanna	1	-	-
Orchard	1	-	-
Lowland shrub	1	-	-
Upland shrub	1	-	-
Lowland hardwood	1	-	-
Mesic hardwood	1	-	-
Dry hardwood	1	-	-
Lowland conifer	1	-	-
Mesic conifer	1	-	-
Dry conifer	1	-	-
Forest opening	1	-	-
Bog	1	-	-
Inland emergent wetland	1	-	-
Submergent wetland	1	-	-
Fen	1	-	-
Ephemeral wetland	1	-	-
Swamp	1	-	-
Pond	1	-	-
Inland lake	1	-	-
Inland island	1	-	-
River/stream/riparian/ floodplain corridor	1	-	-
Great Lakes offshore	1	-	-
Great Lakes nearshore	1	-	-
Coastal emergent wetland	1	-	-
Coastal dune/beach	1	-	-
Alvar/rock	1	-	-
Great Lakes island	1	-	-
Edge	1	-	-
Inland rock/cliff/ledge	1	-	-
Urban	1	-	-
Suburban/small town	1	-	-
Cave/mine	1	-	-
Snag/cavity	1	-	-
Large contiguous unfragmented landscape	1	-	-
Late successional forest	1	-	-
Down woody debris	1	-	-
Total	43	0	0