

**The First Annual**

# **Biodiversity Research Symposium**

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**Sponsored by the Department of Natural Resources**

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## **Agenda and Abstracts**

**January 30, 2007  
8:30 am to 5:00 pm  
Holiday Inn West  
7501 West Saginaw Hwy  
Lansing, Michigan**



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## **Biodiversity Research Symposium Agenda**

### **Welcome and Introduction (8:30) – Patrick Brown**

#### **Coarse Filter Network Design**

- The DNR's biodiversity conservation planning process (Michael Donovan - MDNR) 8:45
- Updating the Natural Community Classification for Michigan (Michael Kost) 9:00
- Assessing Michigan's Biological Diversity (John Paskus) 9:15
- Identifying Priority Conservation Areas in Michigan (Patrick Brown) 9:30
- Landscape-Scale Conservation Planning in the Northern Lower Peninsula: Identifying a System of Ecological Reserves to Conserve Matrix Systems (Patrick Doran - TNC) 9:45

### **Break (10:00)**

#### **Fine Filter Rare Species Research**

- Long Term Monitoring and Characterization of a Coastal Plain Marsh, a Globally Imperiled Wetland Community, and the Ecology of a Rare, Fugitive Seed Banked Species (Mike Penskar) 10:15
- Surveys and Conservation Efforts for the Eastern Massasauga Rattlesnake in Michigan (Yu Man Lee) 10:30
- Freshwater Mussels in Michigan (Peter Badra) 10:45
- A Decade of Mitchell's Satyr Research: What Have We Learned? (Barb Barton) 11:00

### **Break (11:15)**

#### **Fine Filter Rare Species Research cont.**

- Status and Ecology of the Red-shouldered Hawk in Northern Michigan (David Cuthrell) 11:30
- Microhabitat Characteristics of Red-shouldered Hawk Habitat in Managed Northern Hardwood Forests of Northern Lower Michigan (Christopher Weber) 11:45
- Results of a Three-year Survey of Forest Owls in Michigan (Michael Monfils) 12:00
- The Michigan Natural Features Inventory Grassland Bird Project (Julie Gibson/Joelle Gehring) 12:15

### **Lunch (12:15) [Bulletin Board pin up questions/research ideas]**

#### **Working Landscape Assessments**

- Identifying Stopover Sites for Migratory Birds in the Western Lake Erie Basin (David Ewert) 1:15
- Restoring Prairies and Savanna's in Michigan (Ryan O'Connor) 1:30
- Systematic Evaluation of Oak Regeneration in Lower Michigan (Jeffrey Lee) 1:45
- Coarse Woody Debris in Northern Michigan Forests (Christopher Weber) 2:00
- Red Book Protection Manuals (Ulrika Zay - MDOT) 2:15

### **Break (2:30)**

#### **Threats**

- Developing a Strategy to Address Invasive Plant Species (Phyllis Higman) 2:45
- Current and Potential Impacts of Beech Bark Disease on Moths in Michigan Forests (Brian Beachy) 3:00
- Bird Collisions with Communication Towers and Wind Turbines (Joelle Gehring) 3:15

### **Break (3:30)**

#### **Metrics and Data Availability**

- The Department of Natural Resources Biodiversity GIS Data (Lisa Dygert - MDNR) 3:45
- MNFI Explorer: An Online Guide to the Rare Species of Michigan (Kraig Korroch) shared time  
Database of Element Occurrences in Michigan State Forest Compartments (Beverly Walters) 4:00
- Metrics for Assessing Ecological Indicators of Biodiversity (Brad Slaughter) 4:15
- Integration of Natural Resources Information in Land Use Planning & Zoning (Jennifer Olson) 4:30
- The Evolution of a Comprehensive Protected Lands Database for the State of Michigan – The CARL Project (Patrick Doran) 4:45

### **Additional Abstracts**

- Conservation Education and Volunteer Training in Marquette and Alger Counties (Brian Beachy, Phyllis Higman)
- LANDFIRE Vegetation Modeling for the Great Lakes Region (Michael Kost – MNFI, Rebecca Schillo –MNFI, and Randy Swaty – TNC)
- Assessment of Turtle Use and Mortality along the US-31 Highway Crossing of the Muskegon River in Muskegon County, Michigan (Yu Man Lee – MNFI, Nathan Herbert, Richard O’Neal – MDNR, and Richard Wolinski – MDOT)

**Title: The DNR's Biodiversity Conservation Planning Process**

**Authors:** Michael Donovan (MDNR)

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**Abstract:** The DNR's Biodiversity Conservation Planning Process (BCPP) was approved by the Michigan Department of Natural Resources' (MDNR) Statewide Council in April of 2005. The goal of BCPP is to establish a network of representative natural community types that contribute to functioning ecosystems across the state. The areas that will eventually comprise this network will be high quality natural communities called Biodiversity Stewardship Areas (BSAs). This presentation reports on the initial work of MDNR's Statewide Biodiversity Team in developing a consistent framework for the selection of candidate BSAs by Ecoregional Core Design Teams. Development of a consistent process, a set of conservation objectives, and identifying data and analyses useful for selecting and evaluating a proposed network of BSAs in each ecoregion is discussed.

**Title: Updating the Natural Community Classification for Michigan**

**Authors:** Michael Kost, Joshua Cohen, Dennis Albert, Bradford Slaughter, Rebecca Schillo, Christopher Weber, and Kraig Korroch

**Sponsor of work:** Wildlife Division and Forest, Mineral, and Fire Management Division, Michigan Department of Natural Resources

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**Abstract:** The natural community classification plays an important role in biodiversity conservation. Multiple natural resource and conservation agencies rely on the community classification in setting biodiversity protection and management priorities. The community classification also serves as an essential tool for building models to identify and evaluate habitat for species of greatest conservation need. The current classification has not been systematically reviewed since its development in the 1980s and many of the community descriptions are incomplete, which limits its effectiveness as a conservation and management tool. With funding provided by the DNR, we are currently conducting a systematic review of each community and writing detailed community descriptions. The new descriptions along with photographs of each community will be available for viewing and printing on the MNFI web site. Links to lists of rare plant and animal species and abstracts associated with each community will also be provided. Lastly, a key to the natural communities will be constructed to aid in field identification of each community type.

**Title: Assessing Michigan's Biological Diversity**

**Authors:** John Paskus, Amy Derosier, Edward Schools, Helen Enander

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**Abstract:** Michigan's natural landscape has undergone major changes over the last century and the pace of this change is rapidly increasing. Between 1982 and 1997, acreage of developed land in Michigan grew by over 30 percent. It has also been projected that between 1990 and 2020, 1.4 to 2 million acres of undeveloped land will be converted to urban development. Since the mid 1800's, Michigan has lost over 99 percent of its prairies, oak savannas, and oak and oak-pine barrens, and 35 percent of its wetlands through conversion to urban and agricultural land uses. In addition to direct habitat destruction, recent sprawling development patterns are continuing to fragment Michigan's remaining forests, grasslands, and wetlands.

The primary purpose of this project was to identify and prioritize important places on the landscape for conserving Michigan's biodiversity. The first step was enhancing the MNFI heritage database. To date, all existing records in the database have been reviewed, and over 3,000 new element occurrences have been added. Step 2, the analysis, was divided into a terrestrial and aquatic assessment. A fine filter, coarse filter, prioritization approach was used in an attempt to efficiently capture the majority of Michigan's biodiversity. Key concepts of both the terrestrial and aquatic assessments are: 1) regionalization, 2) representation, 3) viability, and 4) core ecological areas. To date, a draft of the terrestrial analysis, and a draft of the methodology for the aquatic assessment have been completed. A technical report along with a series of GIS data layers will be delivered to the Wildlife Division in September, 2007.

**Title: Identifying priority conservation areas in Michigan**

**Authors:** Patrick W. Brown, Amy Derosier, Joelle Gehring, Edward Schools, Mike Penskar, Mike Kost, John Paskus, Mike Donovan (MDNR), and Patrick Doran (MI TNC).

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**Abstract:** The goal of this project is to identify priority conservation areas in Michigan in support of various initiatives within the Michigan DNR including the Wildlife Action Plan, Forest Certification process, and Natural Areas Program. The general approach is to conduct a *GIS-based analysis* using all known information and a *Long term field-based survey* of the state. The *GIS-based analysis* is nearing completion and uses currently available databases and models to identify: (a) important forest, grassland, and wetland communities, (b) lands that perform important ecosystem services, (c) endangered and threatened species, and (c) rare natural communities. The first year of field work on the *Long term field-based survey* has been completed and was centered around Newaygo County. Field metrics (including botanical, zoological, and ecological) are being collected to compare against GIS metrics. We expect to complete analysis of Newaygo County after the final field season in 2008. As designed, this project is likely to be among the first few full state analyses that will provide comprehensive information about the states lands and be useful for later research in identifying how much land is needed to meet specific biodiversity conservation goals.

**Title: Landscape-Scale Conservation Planning in the Northern Lower Peninsula:  
Identifying a System of Ecological Reserves to Conserve Matrix Systems**

**Authors:** Patrick Doran, John Legge, Doug Pearsall, Steve Sobaski, Randy Swaty, Edward Schools, Michael Kost, Joshua Cohen

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**Abstract:** In the Northern Lower Peninsula of Michigan U.S.A., currently identified priority conservation areas inadequately represent ecological systems that occur at the matrix, or large-patch, scale. Here we report on an analysis designed to identify areas (i.e., system of ecological reserves) in which matrix ecological systems can be represented at a scale and in a condition that will allow, as much as possible, for all native species and ecological processes to occur. To identify such areas, we used information on historic land cover (circa 1800s) in combination with a data layer of the degree of alteration in land cover from historic to current times. We next applied a reserve design algorithm using the software MARXAN, to identify a system of spatially cohesive sites that met our biodiversity targets. In this analysis we examined 11 matrix community types that occur within the Northern Lower Peninsula. Initial results have identified a system of reserves that, if managed for conservation, could act to protect all matrix community types at levels ranging from ~8-30% of historic distribution. After initial identification of sites we refined the network design with consideration to urbanized areas and roads. Furthermore, we conducted a series of a posteriori analyses to evaluate the identified areas in terms of overlap with independent data sets such as National Forest designated old growth areas, MNFI element occurrences, TNC portfolio sites, and protected area boundaries. The results of this analysis will be used to inform forest planning efforts of federal, state, and private land owners.

**Title: Long Term Monitoring and Characterization of a Coastal Plain Marsh, a Globally Imperiled Wetland Community, and the Ecology of a Rare, Fugitive Seed Bank Species**

**Authors:** Mike Penskar and Phyllis Higman

**Sponsor of work:** U.S. Fish and Wildlife Service and Michigan Dept. of Natural Resources

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**Abstract:** Among the numerous wetland community types of the Great Lakes, coastal plain marshes are both biologically rich and globally rare. These wetlands are named for their distinctive flora, comprised of species that are often markedly disjunct from their main range along the Atlantic Coastal Plain and Gulf Coast. Botanists and ecologists have long been fascinated by coastal plain marshes because of several features, including their unpredictable inter- and intra-seasonal hydrological fluctuations, the unknown role of fire, their unique plant assemblages, and the presence of numerous rare species whose emergence cannot be simply correlated with annual flooding and drawdown cycles.

In 1999 we established a permanent, long-term monitoring macroplot within a high quality coastal plain marsh containing the state's largest population of Hall's bulrush (*Schoenoplectus hallii*, Cyperaceae), a rare sedge nominated for federal listing by the U.S. Fish and Wildlife Service. Although Hall's bulrush is not a coastal plain disjunct species, it is known only in Michigan from five coastal plain marsh complexes, and is frequently associated with rare coastal plain species throughout its Midwest and eastern USA range. Here we describe the results of an eight-year study to characterize and compare the coastal plain marsh habitat of Hall's bulrush sites and the implementation of a long-term monitoring plot to better determine the conditions necessary for the emergence of this sporadically occurring sedge and associated coastal plain disjunct taxa.

**Title: Surveys and conservation efforts for the Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*) in Michigan**

**Authors:** Yu Man Lee, Bruce Kingsbury(IPFW), Lori Sargent (MDNR), Rebecca Christoffel (MSU), Daria Hyde, and Andrew Snider

**Sponsor of work:** Wildlife Division, Michigan Department of Natural Resources, U. S. Fish and Wildlife Service, and U. S. Environmental Protection Agency

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**Abstract:** The Eastern Massasauga Rattlesnake (*Sistrurus catenatus catenatus*) has declined throughout its range, primarily due to habitat loss and fragmentation, human persecution, and illegal collection. In 1997, this species was designated a Federal candidate for listing by the U.S. Fish and Wildlife Service (USFWS). Michigan appears to be the last stronghold for this snake. Thus, the long-term viability of the Eastern Massasauga in Michigan has important implications for conservation of this species across its range. In support of the Michigan Department of Natural Resources' (MDNR) efforts to develop an Eastern Massasauga Candidate Conservation Agreement with Assurances (CCAA) with the USFWS, extensive massasauga surveys were conducted from 2001-2004 and in 2006 to assess the species' current status and distribution in the state and identify core populations for inclusion in the CCAA. Surveys were conducted at over 175 locations associated with 72 protected properties and 28 private properties in 46 counties throughout Michigan's Lower Peninsula. In addition to field surveys, reliable or confirmed massasauga reports from natural resource professionals and the general public were compiled. In 2004 and 2006, mark-recapture surveys also were conducted at eight sites in an attempt to estimate relative abundances of massasaugas at these sites and assess population viability. Tissue and/or blood samples also were collected for analysis of genetic diversity within and among populations in Michigan in collaboration with Dr. Brad Swanson at Central Michigan University. Massasauga surveys and confirmed reports from 2001-2004 and 2006 have identified over 80 extant sites in 27 counties. These include at least 27 new occurrences including a new county record and reconfirmation of at least 52 previously documented occurrences. Although a large number of extant populations has been documented, the long-term viability of most populations and the number of viable populations in the state remain unclear. In addition to inventory and monitoring, targeted education and outreach efforts also have been conducted for the Eastern Massasauga including development of education and outreach products; development and delivery of training programs for resource professionals, educators, general public, and other partners and stakeholders; and initiation of a volunteer snake responder network in southeast Michigan.

**Title: Freshwater mussels in Michigan**

**Authors:** Peter J. Badra

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**Abstract:** Michigan Natural Features Inventory began work focused on freshwater mussels in 1998. This presentation will provide a brief overview of this work to date, as it relates to three main themes: outreach and education, status and distribution, and ecological research. Outreach and education targeting landowners/residents in particular watersheds has included both informal interaction, participation in workshops presented by multiple natural resource agencies and conservation groups, and leading field trips.

Examples of educational products focused on native mussels include: a guide to aquatic animal life for the St. Joseph River (Maumee Drainage) and a freshwater mussels of Michigan poster and brochure. There are 45 species of native freshwater mussels (Unionidae) that occur in Michigan. More than one-third of these are at risk. Unionid mussels have a unique life history that provides a memorable example of the interrelated nature of aquatic ecosystems. MNFI has performed surveys in most of the major watersheds in Michigan's lower peninsula. Although Michigan's rivers support globally significant populations of native mussels, these are at risk from a variety of threats including colonization by zebra and quagga mussels (Dreissenidae) throughout the state. Mean intensities of colonization (dreissenid mussels/native mussel) ranged from 1 in the Kalamazoo River to 15.3 in the Manistee River. Analysis of internal growth rings of the Federally listed as endangered clubshell (*Pleurobema clava*) revealed a lifespan of up to 46 years. The estimated mean age for live clubshell from Michigan's only population was  $29 \pm 11$  years. A mark-recapture study revealed substantial net movement in the upstream direction for this population. Current ecological research includes analysis of statewide mussel occurrence data and comparisons of in-stream measures of site quality based on mussel, aquatic insect, and habitat data with predicted values of site quality based on watershed characteristics.

**Title: A Decade of Mitchell's Satyr Research: What Have We Learned?**

**Authors:** Barbara J. Barton

**Sponsor of work:** Michigan Natural Features Inventory, Department of Entomology, Michigan State University

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**Abstract:** Mitchell's satyr was discovered over 100 years ago, yet many questions remain about the life history of this species. At the time the butterfly was listed as endangered by the US Fish and Wildlife Service in 1991, information critical to the conservation of the species was lacking. Researchers began to examine Mitchell's satyr distribution, population ecology, movement capabilities, behavior, habitat preferences, and larval foodplants. The sense of urgency surrounding this work cannot be overemphasized since Mitchell's satyr populations are geographically isolated from one another, and in many instances their habitat is shrinking due to encroachment of woody vegetation and/or invasive species. Currently only 25% of the known populations are thought to be viable (five out of 20), and land managers are working hard to preserve and enhance Mitchell's satyr habitat. Research studies have directly impacted management activities, and future projects are planned to examine the effects of different management practices on Mitchell's satyr. This discussion will cover what we have learned and have yet to learn about the Mitchell's satyr, and the difficulties associated with studying this rare butterfly.

**Title: Status and Ecology of the Red-shouldered Hawk in Northern Michigan**

**Authors:** David L. Cuthrell, Joshua G. Cohen, Helen D. Enander, and Christopher R. Weber

**Sponsor of work:** Forest, Mineral, and Fire Management, Michigan Department of Natural Resources

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**Abstract:** In the early part of the 20th century the Red-shouldered Hawk (*Buteo lineatus*) was a common bird in southern Michigan. Since that time their breeding range has shifted from southern Michigan to the northern Lower Peninsula (NLP). We conducted nest productivity surveys over an eight year period (1999 – 2006) in order to assess the status of the Red-shouldered Hawk population in northern Michigan. Over 500 nests were assessed for nest productivity measures such as nest-site fidelity, nest success, and average brood size. Nest predation rates were also calculated. We found that nesting territories had a high re-occupancy rate between years and territories tended to be evenly distributed ( $1.5 \text{ km} \pm 0.26 \text{ km}$ ) in areas that contained large contiguous tracts of suitable forest habitat. Nest productivity during this study tended to be high (65% of nests monitored were successful) and brood size averaged 2.05 young per successful nest, and 1.33 young per active nest. Nests lost to predation were fairly low at 10%. The primary predators implicated in nest failure were raccoon (*Procyon lotor*) and Great-horned Owl (*Bubo virginianus*). A GIS model was developed in 2004 that predicts where nesting Red-shouldered Hawks have the greatest potential to occur on the landscape. The model captured 86% of our nesting occurrences in the southern Lower Peninsula, 79% in the NLP, and 75% in the Upper Peninsula. Additionally, information from this study is being used to determine the appropriate state-listing status for this species and will be important in further developing compatible management practices.

**Title: Microhabitat Characteristics of Red-shouldered Hawk Habitat in Managed Northern Hardwood Forests of Northern Lower Michigan**

**Authors:** Christopher Weber, David Cuthrell, Joshua Cohen

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**Abstract:** The Red-shouldered Hawk (*Buteo lineatus lineatus*) is currently listed as a state threatened species in Michigan. Microhabitat data was collected in three different zones around 32 Red-shouldered Hawk nests in hardwood stands in northern Lower Michigan. Our goals were to further increase knowledge on nesting habitat of RSHs in northern hardwood forests, and to monitor management activities around the nest trees in order to ascertain the impact of timber management on RSH survival and reproductive viability. Utilizing seven years of nest activity and production data, we examined relationships between nesting success with stand level and nest tree attributes. Management at nest sites was highly variable, and strong conclusions of impact of silvicultural management were impractical. Nest zones had higher canopy basal area, canopy closure, and basal area of beech. Highly productive nests had more groundcover, slightly more basal area, and were usually not located in a beech tree. Beech, however, was the most common nest tree species. Stand thinning seemed to not directly affect hawk production, but may indirectly lead to a lack of suitable nest trees as beech constituted the majority of large diameter trees. Large diameter trees other than beech need to be promoted in northern hardwood stands managed for Red-shouldered Hawks.

**Title: Results of a three-year survey of forest owls in Michigan**

**Authors:** Michael Monfils

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**Abstract:** Large-scale breeding bird surveys, such as the North American Breeding Bird Survey (BBS) and state atlas programs, typically underestimate owl populations. MNFI conducted a three-year statewide survey of forest owls to gather data for the Michigan Breeding Bird Atlas II. We also wanted to collect baseline data for future owl monitoring and evaluate our survey techniques. We conducted point counts using broadcasted owl calls along randomly selected BBS routes. Three or four surveys were done at each point between mid January and mid May. We estimated probability of detection and proportion of sites occupied for Eastern Screech-Owl, Great Horned Owl, and Barred Owl using likelihood-based modeling. Environmental and landscape variables were included to evaluate their impact on detectability and site occupancy. We conducted more than 3,600 point counts along 40 routes from 2004 to 2006. MNFI staff recorded over 2,000 owl observations of six species, with Eastern Screech-Owl, Great Horned Owl, and Barred Owl detected most often. Barred Owl was the most common owl observed in northern Michigan, while we detected Eastern Screech-Owl most often on southern Lower Peninsula routes. Mean detection probability was highest for Eastern Screech-Owl, but Barred Owl detection probabilities were similar to Eastern Screech-Owl during later survey periods. Great Horned Owl detection probabilities were consistently lower than Eastern Screech-Owl in all periods and Barred Owl during the third and fourth periods. Although our methods appeared adequate for surveying Eastern Screech-Owl, we would need more survey effort for Great Horned Owl and Barred Owl to have high confidence that lack of detection equates to absence. We found wind speed negatively related to detection probability in several of our best-supported models. Relationships of site occupancy and landscape variables will be discussed.

**Title: The Michigan Natural Features Inventory Grassland Bird Project**

**Authors:** Julie Gibson, Joelle Gehring, Pat Brown

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**Abstract:** The original Michigan Breeding Bird Atlas project was conducted from 1983 to 1988, with the primary goal of mapping the distribution of each bird species that breeds in Michigan. Information gathered during the first atlas project pointed to dramatic declines among some species guilds, including grassland birds. The Michigan Natural Features Inventory (MNFI) proposed to conduct systematic surveys for grassland birds to provide improved data for the Michigan Breeding Bird Atlas II. Federal, state, and private land historically and recently supporting state listed species, including Dickcissel (*Spiza americana*), Henslow's Sparrow (*Ammodramus henslowii*), and Grasshopper Sparrow (*Ammodramus savannarum*), were targeted for survey. Over 475 point counts were conducted during the 2005 and 2006 field seasons, detecting 427 individuals ranked as state listed species. Results of this project will identify high priority sites in Michigan that are important for several declining grassland bird species, assist the Michigan Department of Natural Resources Landowner Incentive Program, and will address several priorities in the state Wildlife Action Plan, including the identification and elimination of significant information gaps for Species of Greatest Conservation Need.

**Title: Identifying stopover sites for migratory birds in the western Lake Erie basin**

**Authors:** David Ewert (Great Lakes Program, TNC), Gregory Soulliere (USFWS), Robb Macleod (Ducks Unlimited), Mark Shieldcastle (Ohio Department of Natural Resources), Paul Rodewald (The Ohio State University), Elaine Fujimura (Ohio TNC), Julie Shieldcastle (Black Swamp Bird Observatory), Robert Gates (The Ohio State University)

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**Abstract:** Stopover sites provide resting and feeding sites for birds en route between breeding and wintering areas. The distribution of stopover sites across the landscape may determine the ability of a bird to successfully complete migration and the condition of an individual when it reaches the breeding or wintering area. Mortality may be relatively high during migration. Consequently, stopover sites should be considered when implementing conservation programs for migratory birds. Here I describe results of efforts to define attributes of stopover sites for several groups of birds in the western Lake Erie basin and how this information is being used for conservation efforts.

**Title: Restoring Prairies and Savannas in Michigan: What land managers need to know**

**Author:** Ryan O'Connor

**Sponsor of work:** Michigan Department of Natural Resources-Wildlife Division, Landowner Incentive Program

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**Abstract:** Prairies and savannas once occupied over two and a half million acres of land in Michigan, but over 99% has been lost to development, agriculture, and succession due to fire suppression. Numerous plants and animals utilize prairies and savannas for their primary habitat, but due to the near complete loss of these systems, many of these species have experienced drastic declines. Overall, prairies and savannas support more rare and declining species than any other single terrestrial habitat type in Michigan (Eagle et al. 2005). Therefore, managing and restoring these ecosystems is a high priority for land managers in multiple state and federal agencies and non-governmental organizations (NGOs). A number of tools and resources are available to assist land managers with accomplishing this goal, including a recent MNFI publication on the history, classification, and management of these communities. Traditional management strategies such as prescribed burning are discussed in addition to other alternatives. An emphasis is placed on finding the best strategy to accomplish management goals.

**Title: Systematic evaluation of oak regeneration in Lower Michigan**

**Authors:** Jeffrey G. Lee and Michael A. Kost

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**Abstract:** In fire-dependent oak ecosystems throughout the eastern United States, recruitment of oak saplings to the dominant overstory strata is poor. Though current overstory composition in dry-mesic and dry forest ecosystems is commonly represented by white oak (*Quercus alba*) and black oak (*Quercus velutina*), substrata composed of younger age classes exhibit an overwhelming dominance by red maple (*Acer rubrum*), black cherry (*Prunus serotina*), and sassafras (*Sassafras albidum*). This apparent succession towards a more mesophytic species composition has significant consequences for wildlife management, as faunal diversity is dependent on oak mast and the physical structures provided by oak snags, coarse woody debris, wood cavities, and litter. To document the current status of oak regeneration throughout Lower Michigan as it relates to forestry practices, deer browse, and physiography, an ongoing, three-year study was initiated February 2006. First year data collection at 56 sites in southern Lower Michigan was completed September 2006. Sites in northern Lower Michigan will be sampled during the field season of 2007. Sites chosen for sampling represented various landforms (e.g., end moraine, ice-contact kame, outwash, sand lake plain, and sand dunes) and management prescriptions (e.g., unmanaged, clearcut, selection, thinning, shelterwood, seed tree cuts, and prescribed burns) throughout several defined ecological units of southern Lower Michigan.

Preliminary results suggest that management prescriptions aimed at facilitating oak regeneration often fail when a substantial population of oak advanced regeneration is lacking prior to treatment. Decreasing stand basal area and canopy closure under such conditions causes opportunistic colonization and accelerated growth of red maple, aspen (*Populus tremuloides*), black cherry, and sassafras. Height class distribution generally showed high abundance of early-successional and mid-successional species in the smallest height classes (0-50 cm) and low representation of white oak and black oak in the intermediate and largest height classes (51-300 cm). The best oak regeneration occurred in the nutrient poor, xeric sandy lake plain of Allegan State Game Area. Competition from red maple was low, and oak seedlings and saplings were free to grow under a more open forest canopy when compared to sites on other landforms. Further analysis of all collected data is needed to develop general principles that will aid in oak management across gradients of soil fertility and moisture, landscape fragmentation, invasive species abundance, and management intensity.

**Title: Coarse Woody Debris in Northern Michigan Forests**

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**Abstract:** Coarse woody debris (CWD) is an important element of forest structure and composition. As trees senesce, or are casualties of natural disturbances such as fire, windthrow, flooding, or insect infestation, their presence on the forest floor is a necessary component of forest ecology. Coarse woody debris provides many different types of habitat for a wide array of invertebrates, birds, and mammals. It is also crucial to forest nutrient cycling and strongly influences conifer regeneration by way of nurse logs. Many studies have focused on coarse woody debris in western forests, however little is known about the variation of CWD in Michigan forests. Not only are the variations in density and volume of CWD in Michigan forests not known, but the best way to measure these variables has yet to be determined. MNFI is in the third year of a study that involves sampling CWD in three different forest types, with four different methods. Our goal is to determine the best method for sampling CWD and to better understand the variations in levels of CWD in different forest types, including both managed and unmanaged stands. Preliminary results show a wide variation of CWD within aspen age classes, but little variation between sample types. Little difference exists between mature managed aspen stands and managed northern hardwood stands, however, unmanaged old growth (MNFI mesic northern forest element occurrences) exhibits a much higher volume of CWD.

**Title: MDOT Management on Adjacent Lands**

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**Title: Developing a Strategy to Address Invasive Plant Species**

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**Abstract:**

Invasive plant species are increasingly recognized as a serious threat to Michigan's native ecosystems. In fact The Michigan Wildlife Action Plan (WAP) identifies invasive species as one of two highest priority threats to wildlife and landscape features in the State (Eagle et al., 2005). There is a wealth of information available on invasive species and many effective control efforts have been implemented. However, it is not easy to sort out what information is relevant to Michigan or to specific sites, there is no comprehensive, coordinated strategy to prioritize action, long-term monitoring is rarely in place, and some control efforts are misapplied, thus aggravating the problem and driving costs up. Experience has shown that control of invasive species is most cost-effective through prevention, early detection-rapid response, and prioritized implementation of appropriate control mechanisms in appropriate places. Since invasive species do not acknowledge jurisdictional boundaries, successful mitigation of impacts from invasive plant species will require a comprehensive strategy, coordinated across Michigan's multiple land ownerships. This project will help better define the scope of the problem, identify appropriate prevention, control, and monitoring mechanisms, identify priorities and costs, provide ready access to current information and experts specific to Michigan, link with regional, national, and global efforts, and provide well-trained staff equipped to implement a long-term strategy.

The first year of the project focused on identifying key species, developing a field guide, gathering information for a central location, exploring inventory and mapping strategies, and training staff in early detection and rapid response for key species. Future work will include completion of a centralized web-site, inventory, mapping and prioritizing mechanisms, development of a statewide strategy and management guidance document, identification and implementation of priority research efforts and monitoring protocols, and delivery of training.

**Title:** Current and potential impacts of beech bark disease on moths in Michigan forests

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**Abstract:** Beech bark disease is a disease complex caused by a non-native scale insect and native and non-native fungi. The disease kills a large proportion of American beech within a stand, causing a loss of canopy trees over the short-term and changes in tree composition over the long-term. We conducted research to determine both the short-term and long-term impacts of beech bark disease on moth communities in hardwood forests containing American beech. Moth caterpillars are ecologically important as primary consumers and as prey for many neotropical migratory birds. The abundance of some moth species was significantly lower in stands with beech bark disease than in stands without the disease. Over the long-term, it is possible that moth species that prefer sugar maple as a food source may increase while those preferring American beech may decrease as stand composition changes. While long-term impacts of beech bark disease are difficult to determine, it seems clear that beech bark disease has negative impacts on moth populations in the short term. The results of this study point to the importance of limiting the introduction and spread of exotic forest pests and diseases as well as maintaining a diversity of tree species in a stand to minimize potential impacts of diseases such as beech bark disease.

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**Title: Bird collisions with communication towers and wind turbines: methods to reduce fatalities**

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**Abstract:** An estimated 4-50 million birds per year collide with communication towers and an estimated 10-40 thousand birds per year collide with wind turbines. In an effort to quantify and compare the numbers of avian fatalities related to various tower characteristics the Michigan State Police and other collaborators conducted a multi-year, landscape-scale, experimental study of 24 communication towers. Data comparing the relationships between bird fatalities, tower lighting systems, support systems, and height were collected simultaneously during 20 days (per season) of the peak of long-distance songbird migration in spring and fall of 2004 and 2005. Carcass removal rates and observer detection rates were measured. Towers taller than 305 m above ground level (AGL) were involved in significantly more avian fatalities than towers 116-146 m AGL and towers supported by guy wires were involved in significantly more avian fatalities than self-supported towers. Comparisons of bird fatalities at towers equipped with either white strobe lights, red strobe lights, or blinking, red incandescent lights determined that elimination of non-blinking red lights from tower light systems significantly reduced avian collisions. In general, these results can be applied to other tall structures, including wind turbines. As Michigan receives increased pressure to capture its abundant wind resources via the construction of wind turbines, these results can be utilized to make recommendations focused on minimizing the collision-related fatality of birds at both turbines and communication towers.

**Title: MNFI Explorer: An Online Guide to the Rare Species of Michigan**

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**Abstract:** Michigan Natural Features Inventory has developed a new web application that will allow users to easily find information on Michigan's rare plant and animal species. A search page allows users to quickly build species lists based on a combination of criteria such as taxonomic classification, survey time, habitat and community type, or protection status. The results of these queries also include further information on each species such as physical descriptions, survey times and techniques, habitat requirements, management needs and general occurrence data. Although this application is still undergoing a final review, it will be available on MNFI's website in the coming weeks.

**Title: Database of Element Occurrences in Michigan State Forest Compartments**

**Authors:** Beverly Walters, Joshua Cohen, Helen Enander, Rebecca Rogers

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**Abstract:** Michigan Natural Features Inventory (MNFI) scientists provide reports about rare species and high-quality natural communities in state forest lands to be considered in the State Forest Compartment Review process. The Element Occurrences in Michigan Forest Compartments Database was developed to improve our ability to simultaneously access attribute data from multiple GIS data layers so we could more efficiently write these reports. It uses data from spatial intersections of the GIS forest compartment data layer with layers of EOs, land type associations, circa 1800 vegetation, ecoregions, geology and locational data. In the future this database could be further developed to allow resource managers access to information that would be useful in decision making for setting conservation and restoration priorities.

**Title: The Department of Natural Resources Biodiversity GIS Data**

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**Abstract:** The DNR has put considerable effort into creating GIS data layers that are available to field staff to assure that if any biodiversity concerns exist, that those concerns are taken into account and land management practices are completed accordingly.

The data that has been created is still in development mode as many of the biodiversity concerns have not yet been transferred into any sort of spatial data (i.e. still in paper map or written document form). The data that does exist is also continually changing as new areas of concern arise or as standards of the digital data has changed over time.

Available to field staff are the High Conservation Value Areas (HCVA) datasets, the Special Conservation Areas (SCA) datasets, and the Michigan Natural Features Inventory (MNFI) Element Occurrence dataset.

    Show digital data and explain datasets within each type (HCVA, SCA)

This allows the field staff to be aware of what biodiversity concerns exist in what areas so that the appropriate action can be taken to assure the conservation, protection, and sustainability of these sensitive areas can be maintained.

**Title: Metrics for assessing ecological indicators of biodiversity**

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**Abstract:** In 2005, Michigan Natural Features Inventory (MNFI) began an effort to test the ability of GIS-based models to identify important areas for biodiversity conservation in the state. This required each discipline (Ecology, Botany, Zoology, and Aquatic Ecology) to develop measures by which to assess biodiversity in the field. The data collected will be used to improve and refine GIS analysis for the eventual completion of a conservation gazetteer. Based on literature review, the Ecology program decided to score indicators of structural and functional biodiversity in randomly placed plots in four natural cover types (upland forest, upland grassland/shrub, lowland forest, and non-forested wetland) located in Newaygo County, Michigan. We began by deriving 11 natural community classes, each of which represents a group of natural communities exhibiting similar structure, vegetation, and ecological processes. For each class, we identified a set of indicators as a basis for assessing landscape context, condition (including site intactness, natural and non-natural disturbances, and community structure and function), and threats to biodiversity. We then created metrics to score each indicator and plot on a scale of 1 (poor) to 4 (excellent). These scores were used to rank plots within each of the four cover types, and to compare plots across different cover types. Preliminary results based on 2006 field sampling indicate plots in grassland and upland forest communities tend to score lower than plots in forested and non-forested wetlands, indicating a greater scale and intensity of human land use in upland systems. The use of categorical metrics to score multiple biodiversity indicators allows us to rapidly assess ecological integrity at the landscape scale. Continued application and refinement of our metrics, in addition to the utilization of species-level data collected by other disciplines, will allow us to produce an informed, field-tested conservation gazetteer for the State of Michigan.

**Title: Integration of Natural Resources Information in Land Use Planning & Zoning**

**Author:** Jennifer Olson

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**Abstract:** If local government officials in Michigan are to evaluate the impacts of land use on the environment, they need the capacity to access and understand the various types of natural resource information available. With over 1,800 local units of government, it is unknown what types of natural resource information are readily or rarely used, how often natural resource information is incorporated into land use planning and zoning activities, how satisfied local governments are with existing natural resource information, how important natural resource information is to land use decision making, and what needs or services could improve the integration of natural resource information in land use planning and zoning decisions.

To assess these questions, a survey was mailed to all townships (1,242), counties (83) and regional planning commissions (14) in Michigan concerning the integration of natural resource information in local land use planning and zoning. Of the 1,339 local governments that were contacted, 940 (70%) returned a usable survey, of which 865 were from townships (70% of the townships), 60 were from counties (72% of the counties), and 13 were from regional planning commissions (93% of the regional planning commissions). Fifteen different types of natural resource information were defined in the survey including: agricultural, wetland vegetation, upland vegetation, invasive plant species, wildlife species, invasive animal species, endangered and threatened species, geology, surface water, ground water, soils, land cover / land use, topographic, comprehensive green space map, and other natural resource information.

The results of this study will help natural resource agencies and organizations address the information needs of township, county and regional governments in Michigan. The poster will identify what types of natural resource information are currently used and most important to local governments, along with what additional services or natural resource information needs are identified by local governments.

**Title: The Evolution of a Comprehensive Protected Lands Database for the State of Michigan – The CARL Project**

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**Abstract:** Information on the location, extent, and status of conservation lands is essential to organizations and agencies engaged in planning, implementing, assessing, and conducting research related to conservation at scales ranging from locally to globally. Some notable efforts, such as that of the state Land Stewardship databases developed for the USFWS GAP Analysis Program, have been made to gather such information into a comprehensive, GIS-based data set. In Michigan, the GAP program has documented over 8,000,000 acres of land in protection. While state and Federal ownership (99.8% of this total) are well represented, such effort under represent data from land conservancies and local governments. This poster presents a status report on the joint effort of Ducks Unlimited and The Nature Conservancy in Michigan to create the Conservation and Recreational Lands (CARL) database for Michigan. Through a concerted outreach effort to the state's more than 50 land trust and land conservancies, as well as local bodies of government, the CARL project aims to build upon the Michigan GAP database by documenting the location and status of protected land held in fee and easements by NGOs, counties, townships, municipalities, and private entities, as well as updating the State and Federal land holdings first compiled by the GAP program in 2000. Development of the ArcGIS-based database will be discussed as well as examples of its application.

**Title: Conservation education and volunteer training in Marquette and Alger Counties**

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**Abstract:** The current threats facing natural systems in Michigan exceed the capacity and resources of governmental and non-governmental groups to address and mitigate these threats. Due to limited resources, utilizing volunteers to address threats to natural systems may be an important management tool, especially for non-governmental organizations. Education and identification of volunteer opportunities are necessary before volunteers can be utilized. This project attempts to train volunteers and provide volunteer opportunities for natural areas stewardship in Marquette and Alger Counties.

The Marquette area has a large number of groups active in conservation activities and significant time was initially devoted to networking with these diverse groups and identifying educational needs. A meeting was then convened with key players in the conservation arena to decide on workshop topics and partners for each workshop. Five workshops were scheduled. Three workshops have been completed thus far; invasive plant identification and detection, forest ecology and health, and planning for biodiversity conservation. Average attendance at these workshops has been approximately 19 people per workshop. The two remaining workshops cover the topics of monitoring and protecting aquatic habitats and conservation easements and monitoring. Each workshop was coordinated with at least one local conservation group to promote local support of the project.

In addition to the workshops, several group meetings have been convened on invasive species management in Marquette and Alger Counties. One of the goals of these meetings was to begin to develop a list of volunteer opportunities and a volunteer network. These meetings are ongoing, involve a number of community partners, and will result in a publicized series of workdays and educational sessions relating to invasive species throughout summer 2007.

Ongoing work includes assisting in organizing a meeting of Upper Peninsula land trusts to identify easement monitoring needs and to consider greater utilization of volunteers. Other discussions with local partners have been aimed at identifying ways to keep an education and volunteer coordinator in the Marquette area to further facilitate the work started by this project.

**Title: LANDFIRE Vegetation Modeling for the Great Lakes Region**

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**Abstract:** LANDFIRE is a nation-wide, multi-partner project designed to map and model vegetation, fire, and fuel characteristics using a consistent, peer-reviewed, scientifically based methodology. The five-year project was initiated by federal land agencies that recognized the need for comprehensive scientific information in order to prioritize areas for hazardous fuels reduction and conservation on both public and private lands. Once complete, this broad scientific analysis of the U.S. landscape will provide 24 spatial data layers, including information on existing and historical vegetation dynamics, fire regime condition class, fire effects, and information required for fire modeling applications.

The Michigan Natural Features Inventory (MNFI) is working with The Nature Conservancy to produce models and descriptions for all ecological systems in the Great Lakes Region, which includes eastern Minnesota, Wisconsin, Michigan, Illinois, Indiana, and Ohio. MNFI will assist The Nature Conservancy in facilitating and participating in expert workshops to model and describe ecological systems. Additionally, MNFI will provide technical expertise by reviewing and quality-controlling the final ecological models and descriptions. This comprehensive set of models and descriptions will provide the basis for the national LANDFIRE mapping effort and improve the scientific understanding of vegetation, fire, and fuel dynamics of Great Lakes ecosystems. Overall, increased scientific understanding of Great Lakes ecosystem dynamics will enhance management, planning, and stewardship of public and private wildlands.

**Title: Assessment of Turtle Use and Mortality along the US-31 Highway Crossing of the Muskegon River in Muskegon County, Michigan**

**Authors:** Yu Man Lee, Nathan Herbert, Richard O'Neal (MDNR), and Richard Wolinski (MDOT)

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**Abstract:** Road mortality can significantly impact turtle populations by reducing numbers of reproductive adults, causing skewed sex ratios, and providing travel corridors for predators which can lead to high levels of nest predation and low annual recruitment. Increased adult mortality, skewed sex ratios, and reduced annual recruitment in turtle populations can eventually lead to the decline and extirpation of local turtle populations. Significant turtle mortalities have been observed along the US-31 highway crossing of the Muskegon River and associated floodplain habitat in Muskegon County in west-central Michigan, potentially since the time the road was constructed (probably in the 1970's). Michigan Department of Natural Resources (MDNR) personnel have estimated between 100 and 200 turtle mortalities annually at this site. As a result, the Michigan Department of Transportation in collaboration with the MDNR and the Muskegon River Watershed Assembly have been considering installation of a fence in the right-of-way along the US-31 highway crossing of the Muskegon River to reduce the number of turtle mortalities at this site. In 2005 and 2006, the Michigan Natural Features Inventory conducted visual surveys to obtain baseline data on turtle use and mortality along this section of US-31. Study results in 2006 indicated significant turtle use and mortality and nest predation along the US-31 highway crossing of the Muskegon River. We documented over 100 dead turtles of 5 to 6 species in the study area along US-31 during surveys in 2005 and 2006. Painted turtles (*Chrysemys picta*) and common snapping turtles (*Chelydra serpentina serpentina*) comprised the majority of the turtle mortalities. Dead specimens of several turtle species that are currently listed as state special concern also were documented including the wood turtle (*Glyptemys insculpta*), Blanding's turtle (*Emydoidea blandingii*), and eastern box turtle (*Terrapene carolina carolina*). Turtle mortalities were documented throughout the study area, although the highest number of dead turtles was found along the outside shoulders of the northbound and southbound traffic corridors of US-31. Only 20 live turtles total were found during the surveys, of which many were nesting adult females. Over 300 turtle nests that had been destroyed or preyed upon by predators also were recorded in the study area. In addition to dead turtles, we also found substantial numbers of other dead animals including carcasses of at least 21 different bird species, 13 mammal species, and 6 amphibian and reptile species. Overall, study results were similar in both 2005 and 2006, and validated previous estimates and concerns regarding turtle use and mortality along the US-31 highway crossing of the Muskegon River. Thus, efforts to reduce road-associated mortality of turtles along this section of US-31 are warranted. Efforts to reduce nest predation and increase recruitment also should be considered.