

Michigan Natural Features Inventory

Biennial Report 2004-2005



Red-shouldered hawk chicks



Great Lakes Marsh



Aquatic surveys



American lotus



Wetland training



Crawford red pines

Mission Statement

The mission of MNFI is to deliver the highest quality information that contributes to the conservation of biodiversity, especially rare and declining plants and animals and the diversity of ecosystems native to Michigan.

Cover photos:

Red-shouldered hawk chicks (*Buteo lineatus*)

Photo by: David Cuthrell, Michigan Natural Features Inventory

Great Lakes Marsh, Cheboygan State Park, June 2004)

Photo by: Michael Kost, Michigan Natural Features Inventory

Aquatic surveys

Photo by: Amy Derosier, Michigan Natural Features Inventory

American lotus (*Nelumbo lutea*, state threatened) growing in a Great Lakes marsh at Lake Erie Metropark. Photo by: Ryan O'Connor, Michigan Natural Features Inventory

Coastal fen natural community at Thompson Harbor State Park, June 2004, during a field training session for DEQ staff on rare wetlands. Photo by Michael Kost.

Crawford Red Pines Dry Northern Forest, Camp Grayling, northern Lower Michigan.

Photo by: Michael Kost, Michigan Natural Features Inventory

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Introduction

The Michigan Natural Features Inventory (MNFI) conducts a wide variety of research and education efforts focusing on conservation of biodiversity in Michigan, with an emphasis on rare plants and animals and natural communities. MNFI manages the Natural Heritage Database for the state that records the location and status of Michigan's threatened and endangered species and rare natural communities. Information is gathered through field research and the work of other biologists and naturalists. MNFI provides training, management recommendations, and educational materials for land managers and private landowners and is also provides guidance to state and local governments and private entities for land programs that aid in protection of Michigan's natural resources.

MNFI belongs to a network of similar programs in all 50 U.S. states, several tribes, all Canadian provinces, and many countries in Latin America and the Caribbean. MNFI joined MSU Extension in 2000 and each year the group's scope of activities has broadened. During the past year, MNFI carried out a program of research, data development, service, inventory, and production and delivery of information products, workshops, consultations, and presentations. The long-working relationship with the Michigan Department of Natural Resources and other agencies has deepened and grown and new partnerships have been formed with The Nature Conservancy and other groups. Overall, the MNFI has grown at a rapid rate during the past two years and the dedicated staff continues to show great dedication and commitment in pursuing their work that helps conserve Michigan's living natural resources.

Highlights

1. The Natural Heritage Database expanded to include 14,000 records of rare plants, animals, and natural communities.
2. 65 ongoing projects conducted throughout the state.
3. More than 5,500 environmental reviews were provided to the MDNR and the Web database was accessed more than 5000 times.
4. More than 1200 consultations and information requests were filled
5. In 2004-05, MNFI received 65 grants totaling more than \$3.5 million in expenditures
6. More than 80 presentations were made at professional meetings and conferences.
7. Staff published 6 refereed articles in professional journals.
8. Plans were made to conduct a first ever statewide survey.

Current Employees

ADMINISTRATION

Program Director	Patrick W. Brown
Secretary III	Connie L. Brinson
Administrative Asst. II	Suzanne M. Ridge
Administrative Asst. III – Project Mgmt.	Lyn J. Scrimger

AQUATIC ECOLOGY

Conservation Scientist – Aquatic Ecologist	Peter J. Badra
Senior Conservation Scientist – Aquatic Ecology	Reuben R. Goforth
Conservation Scientist – Acting Lead Aquatic Ecology	Amy L. Derosier

BOTANY

Senior Conservation Scientist – Lead Botanist	Michael R. Penskar
Conservation Associate – Botany	Ryan P. O’Connor
Conservation Associate – Botany	Beverly S. Walters

CONSERVATION EDUCATION

Senior Conservation Scientist – Conserv. Education Lead	Phyllis J. Higman
Conservation Associate – Conservation Education	Brian L. Beachy
Conservation Education Assistant	Suzan L. Campbell

CONSERVATION GEOGRAPHIC INFORMATION MANAGEMENT

Senior Conservation Scientist – CGIS Lead	Edward H. Schools
Data Technician/Environmental Review Asst	Kimberley J. Borland
Information Technologist II	Helen D. Enander
Information Technologist II	Kraig M. Korroch
Information Technologist I	Rebecca L. Rogers

CONSERVATION PLANNING

Senior Conservation Scientist – Cons. Planning Lead	John J. Paskus, Jr.
Conservation Scientist – Cons. Planning	Daria A. Hyde
Conservation Scientist – Environmental Review	Jennifer A. Olson

ECOLOGY

Senior Conservation Scientist – Lead Ecologist	Michael A. Kost
Senior Conservation Scientist – Ecology	Dennis A. Albert
Conservation Associate – Ecology	Adrienne L. Bozic
Conservation Scientist – Ecology	Joshua G. Cohen
Conservation Associate – Ecology	Jeffrey G. Lee
Conservation Associate – Ecology	Rebecca K. Schillo
Conservation Associate – Ecology	Bradford S. Slaughter
Conservation Associate – Ecology	Christopher R. Weber

ZOOLOGY

Senior Conservation Scientist – Lead Zoologist	Joelle L. Gehring
Conservation Associate– Zoology	Barbara J. Barton
Conservation Scientist – Zoology	David L. Cuthrell
Conservation Associate– Zoology	Julie M. Gibson
Conservation Scientist – Zoology	Yu Man Lee
Conservation Scientist – Zoology	Michael J. Monfils
Zoology Assistant	Michael A. Sanders

Short term employees, graduate students and interns also assist with projects and surveys.

Former Employees

CGIS

Burns, Meghan D., labor employee 2002-2004
Fashoway, Michael T., - Info. Tech Professional 2000-04
Konath, Kristen R., student aide and clerical/technical 2003-2005
Springfield, Emily C. - Extension Program Associate - 2004

Aquatics

Bingle, Caroline M. - Extension Program Associate 2005
Campbell, Holly A. - Extension Program Associate 2005
Magyar, Jr., Francis M. - Extension Program Associate 2004
Rodney, Jensen CD. - Extension Program Associate 2004
Simmons, Fredrick J. - Extension Program Associate 2005
Swart, Stephanie L. - Extension Program Associate 2004-2005

Ecology

Gregory, Sharolyn K. - Extension Program Associate 2003-05
Tepley, Alan J. - Extension Program Associate 2004-2004

Zoology

Bassett, Tyler J. - Extension Program Assistant 2005
Bogosian III, Victor - Extension Program Assistant 2004
Clark, Jessica L. - Extension Program Assistant 2005
Cottrell, Katherine A. - Extension Program Assistant 2005
Egeler, Jayson L. - Extension Program Assistant 2005
Feldpausch, Andrea - Extension Program Assistant 2004
Fettinger (Kleitch), Jennifer L., Associate Program Leader 2002-05
Gibson, Julie M - Conservation Associate – Zoology 2005-2007
Herbert, Nathan R. - Extension Program Assistant 2004-2006
Mifsud, David A. - Extension Program Assistant 2003-2005
Osborn, Rachel - Extension Program Assistant 2005
Pagel, Mark L. - Extension Program Assistant 2005
Pearman, Peter B. - Zoology Program Leader 2003-2005
Putnam, Caleb G. - Extension Program Assistant 2004
Rose, ShunahSii - Extension Program Assistant 2005
Rutherford, Ryne D. - Extension Program Assistant 2004
Schwartz, Adessa J. - Extension Program Assistant 2005
Warner, Sarah - Extension Program Assistant 2005
Yocum, Bradford J. - Extension Program Assistant 2005

Cooperators

Bean/Tiffin Watershed Coalition

Cornell University: Marci Mixler

Detroit Zoo: Andy Snider

Environment Canada: Joel Ingram, Greg Grabas and Krista Holmes

Federal Highway Administration (FHWA): Abdelmoez Abdalla

Grand Valley University, Annis Institute: Don Uzarski

Huron-Clinton Metropolitan Authority: Paul Muelle and David Moilanen

Illinois State Museum: Dr. Everett D. Cashatt

Indiana-Purdue University, Ft. Wayne, IN: Dr. Bruce Kingsbury, Joe Sage, and Omar Attum

Kalamazoo Nature Center: Raymond Adams

Long Point Bird Observatory of Ontario: S. Timmerman

Michigan Dept. of Environmental Quality staff and wetland contractors.

Michigan Dept of Natural Resources, Fisheries Division:

Liz Hay-Chmielewski, Tom Goniea, and Richard O'Neal

Michigan Dept of Natural Resources, Forest Management Division: Cara Boucher and Rich Hausler

Michigan Dept of Natural Resources, Parks Division:

Ray Fahlsing, Glenn Palmgren, Charles Dennison, Gary Jones, Jon LaBossiere, Bob Clancy

Michigan Dept of Natural Resources, Parks Division, Sterling State Park

Michigan Dept. of Natural Resources, Wildlife Division: Lori Sargent, Todd Hogrefe, Raymond Rustem, Karen Cleveland, Amy Clark Eagle, Kevin Gardiner, Patrick Lederle, John Lerg, Maria Albright, John Niewoonder, Donna Jones, Tyson Edwards, Nik Kalejs, Chris Hoving, Ernest Kafcas, John Schafer, Barb Avers, Don Avers, Steve Beyer, Mark Bishop, Don Bonnette, Greg Bragdon, Dave Brauer, Steve Chadwick, Rodney Clute, Jon Curtis, Earl Flegler, Tammy Giroux, Shannon Hanna, Christine Hanaburgh, Arnie Karr, Lyle Melkerson, Julie Oakes, Richard Robertson, Joe Robison, Sara Schaefer, Julie Oakes, Tim Gierman, Dan Kennedy, Matthew Herbert, Shelli Dubay

Michigan Dept. of Transportation: Dave Schuen, Ulri Zay and Richard Wolinski

Michigan Nature Association: Sheri Laier

Michigan SeaGrant in Ann Arbor: Jennifer Reid

Michigan State University, Dept. of Fisheries & Wildlife: Patricia Soranno, Kendra Cheruvellil.

Michigan State University: Rebecca Christoffel and Dr. Shawn Riley

Michigan State University, University Relations

Michigan State University, Zoology Department: Thomas Burton

Missouri Department of Natural Resources: Tim Vogt

Oakland County Parks: John Noyes

Southwest Michigan Land Conservancy: Nate Fuller and Jodi Simoes

The Nature Conservancy: John Legge

Toronto Zoo: Bob Johnson and Andrew Lentini

U.S. Environmental Protection Agency: Diane Berger

U.S. Fish and Wildlife Service: Barbara Hosler, Mike DeCapita, Carrie Tansy & Greg Soulliere

U.S. Forest Service, Hiawatha National Forest: Steve Sjogren

USGS Great Lakes Science Center: Doug Wilcox

USGS Indiana: Todd Thompson

USGS, Columbus, Ohio: Laura Simonson

University of Michigan: Mark O'Brien and Dr. Tony Reznicek

University of Michigan, Museum of Zoology

Arch Reeves, retired forester

Leah Minc, contractor

PROJECT DESCRIPTIONS

Aquatic Ecology

Aquatic Inventory in Three State Recreation Areas: Island Lake, Pontiac Lake, and Proud Lake

Investigator: Stephanie L. Swart

Expected Completion: September 2005

Funding: Michigan Department of Natural Features, Parks and Recreation Division (PRD)

Cooperators: Ray Fahlsing (PRD)

We surveyed four lakes (Kent, Proud, Moss, and Trout) and multiple sites along the Huron River for fish and mussels. In the Huron River at Island Lake State Recreation Area (SRA), 14 species of fish and 9 mussel species were found. We collected the first records of special concern species brindled madtom (*Noturus miurus*) and elktoe (*Alasmidonta marginata*) and the threatened wavy-rayed lampmussel (*Lampsilis fasciola*) in that portion of the river. Game fish such as largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*) dominated Kent Lake and Trout Lake (in Island Lake SRA). No mussels were collected in the Huron River at Pontiac Lake SRA and darters (*Etheostoma* sp.) and bluegill dominated the fish community. Proud Lake SRA had 19 species of fish and 5 species of mussels. Sunfish (*Lepomis* sp.) and shiners (*Notropis* sp.) dominated the fish community. We collected the first occurrence of brindled madtom and shells of wavy-rayed lampmussel in the Huron at Proud Lake SRA. Moss Lake and Proud Lake (in Proud Lake SRA) had 6 and 12 species of fish respectively, both dominated by game fish such as bluegill and rock bass. Management recommendations provided to the recreation areas included preserving riparian buffers, educating the public, and considering aquatic needs during maintenance activities.

Determining Sampling Effort to Estimate Biological Community Composition of Small Lakes

Investigator: Amy L. Derosier

Expected Completion: September 2006

Funding: Michigan Department of Natural Resources Wildlife Division

Cooperators: Michigan State University, Department of Fisheries and Wildlife, Patricia Soranno and Kendra Cheruvellil.

We extensively sampled ten lakes (5 in 2003 and 5 in 2005) for fish, macroinvertebrates, and habitat elements to determine sampling effort required to effectively estimate species composition in small lakes. Lakes were sampled in two distinct regions of the state, the western Upper Peninsula and the southern Lower Peninsula. Macroinvertebrate samples are currently being processed; to date five lakes have been completed. Preliminary analysis shows major differences between sampling effort required for macroinvertebrates in the littoral zone vs. the pelagic zone. Macroinvertebrate inventories are generally expensive and time consuming. Hence, we are also recording sample processing time to allow us to look at cost per new species collected by sample. This analysis will allow for better project management in the future. Further analyses include: producing species accumulation curves to determine efficiency of inventories dependent upon number of samples collected within the pelagic and littoral zones; examining sampling effort by macroinvertebrate order to provide guidance when conducting species specific or taxa group sampling; additionally this data will be used in defining lake natural communities. This work will help guide macroinvertebrate species inventories in both cost estimation and thoroughness of species lists.

Development of Michigan's Wildlife Conservation Strategy (now Wildlife Action Plan)

Investigator: Amy L. Derosier

Expected Completion: September 2005.

Funding: Michigan Department of Natural Resources Fisheries Division

Cooperators: Liz Hay-Chmielewski (Fish Division), Amy Clark Eagle, Raymond Rustem, Matthew Herbert, Karen Cleveland (Wildlife Division).

I was part of the core development team of the state of Michigan's Wildlife Conservation Strategy, now referred to as the Wildlife Action Plan (WAP). The WAP provides a strategic framework and set of management tools that will enable the state and its conservation partners to implement a long-term holistic conservation approach to all aquatic and terrestrial wildlife species. The development team consisted of four Wildlife Division personnel, one Fisheries Division personnel, and one MNFI personnel on contract to the Fisheries Division (from 2004-2005). This group was responsible for the coordination of the WAP development, data collection, coordination of non-DNR participation, primary writing of document, and coordination of review and revision. The WAP provides information at both a coarse (habitat) and a fine (species) scale. The document provides known distribution, threats, conservation actions, research and survey needs, and monitoring needs for all habitats and species of greatest conservation need. All states were required to submit and have approved a WAP to be eligible for federal dollars through the State Wildlife Grants (SWG). Michigan was one of the first states in the country and the first state in the Midwest to have their Wildlife Action Plan federally approved.

Fish and Mussel Communities in the Hudson Mills Metropark, Huron River

Investigator: Peter J. Badra and Amy L. Derosier

Expected Completion: December 2005

Funding: Huron-Clinton Metroparks

Cooperators: M. E. Herbert (Michigan Department of Natural Resources)

Huron-Clinton Metroparks is considering constructing a bridge across the Huron River, within the Hudson Mills Metropark. MNFI was requested to perform mussel and fish surveys at the potential construction site to determine if listed species were present. We performed mussel transect searches at the location of the proposed bridge, and approximately 50 meters downstream and upstream. This placement of transects will allow for a before and after assessment of impacts due to bridge construction. Nine unionid mussel species were found including the special concern purple wartyback (*Cyclonaias tuberculata*), state threatened wavy-rayed lampmussel (*Lampsilis fasciola*), and three other species of special concern. The exotic zebra mussel (*Dreissena polymorpha*) and Asian clam (*Corbicula fluminea*) were found live in all three transects. One half of all the purple wartybacks and wavy-rayed lampmussels had at least one live zebra mussel attached, which in itself is a threat to these populations. We used a small barge electro-shocker to sample the fish community at the bridge site. A relatively diverse fish community was present in this river reach including the state endangered northern madtom (*Noturus stigmosus*) and special concern brindled madtom (*Noturus miurus*). The habitat at the proposed bridge site appears to be ideal madtom habitat.

Great Lakes Nearshore Monitoring to Inform Efforts to Attain Water Quality Standards in Michigan-Year 1

Investigator: Reuben R. Goforth

Expected Completion: September 2006

Funding: Clean Michigan Initiative

Cooperators: Michigan Department of Environmental Quality.

We have developed and begun implementing a monitoring program for biological community (i.e., benthic macroinvertebrates and zooplankton) and water quality status, condition, and trends in nearshore zones of Lakes Michigan, Superior, Huron, and Erie, including connecting waters. This program includes sampling of 14 randomly chosen nearshore sites in each Lake, with the sites for Lake Erie distributed among the small portion of Lake Erie coast in Michigan, the Detroit River, The Saint Clair River, and Lake Saint Clair. Samples are taken on a two-year rotation, with samples collected during the first year for Lakes Michigan and Erie, and during the second year for Lakes Huron and Superior. In addition, two of the sites in each Lake are visited every year to detect annual variations that may not be detected via the bi-annual sampling program. To date, we have collected samples from the Lake Michigan and Lake Erie/connecting water sites, as well as the annual sites in Lakes Superior and Huron. Sample processing has been completed for Lake Michigan and is on-going for Lake Erie and the connecting waters. The resulting data will be used to help inform efforts by MDEQ to attain water quality standards in Michigan.

Michigan Department of Transportation Endangered Species Clearance Protocol

Investigators: Stephanie L. Swart, Patrick W. Brown, and Reuben R. Goforth

Expected Completion: November 2005

Funding: Federal Highways Administration (FHWA)

Cooperators: Dave Schuen, Ulri Zay, and Dick Wolinski (MDOT), Lori Sargent and Todd Hogrefe (MDNR), Barbara Hosler (USFWS), Abdelmoez Abdalla (FHWA)

We developed a protocol for the Michigan Department of Transportation (MDOT) to standardize their evaluation of projects concerning threatened and endangered species, which included regulations by the Michigan Department of Natural Resources (MDNR) and the U.S. Fish and Wildlife Service (USFWS). The final product contains guidelines for all MDOT personnel to adhere to before and after construction begins on a transportation project. These guidelines include experience and educational requirements to conduct the rare species surveys, permit requirements, and procedures for working with the MDNR and USFWS. Additionally, MNFI provided recommendations for conducting site surveys and developed a 'natural features reference database' that will allow MDOT Environmental Section personnel to view information such as habitat and sampling methodology for all species of concern in order to assist their efforts of assessing project sites prior to construction.

Monitoring Clubshell Populations and Surveys for the Northern Riffleshell in Michigan

Investigator: Peter J. Badra

Expected Completion: June 2004

Funding: U.S. Fish and Wildlife Service and Michigan Department of Natural Resources

Cooperators: The Nature Conservancy

The goal of this project was to further the conservation of these two federally endangered species. The clubshell (*Pleurobema clava*) portion of this project included monitoring of known occurrences, searching for new occurrences, and the creation of a guide for residents of the watershed titled "Aquatic

Animal Life of the St. Joseph River (Maumee Drainage)”. Monitoring activities at known clubshell sites included estimating clubshell densities, determining associated unionid community composition, collecting demographic information, and assessing the impact of predators. One new clubshell occurrence consisting of a single shell was documented. Past surveys of have documented the occurrence of riffleshell at sites within the northern portion of the Black River watershed (St. Clair and Sanilac Co.). Channelization and dredging in the late 1980’s was expected to lead to the extirpation of riffleshell from the Black River. MNFI performed surveys to determine the status of these populations. Twelve sites in the Black River watershed were surveyed. Though twenty-three unionid species were found, no live riffleshell or empty riffleshell shells were found. Volunteers from The Nature Conservancy, DNR, and Hillsdale County assisted with this project.

Mussel Surveys in the Bean Creek Watershed, Hillsdale and Lenawee Counties

Investigator: J. Kauffman and Peter J. Badra

Expected Completion: October 2004

Funding: Sierra Club

Cooperators: Bean/Tiffin Watershed Coalition

This survey of the native mussels (Unionidae) of the Bean Creek watershed was initiated by Janet Kauffman, a resident in the watershed. A total of nine sites were surveyed in St. Joseph, Silver, Lime, and Bean Creek. Fieldwork was performed by MNFI staff, Janet Kauffman, and two volunteers from the Bean/Tiffin Watershed Coalition. A property owner of one of the sites also assisted with fieldwork. Sixteen species were documented, including the special concern slippershell (*Alasmodonta viridis*), round pigtoe (*Pleurobema sintoxia*), and rainbow (*Villosa iris*). Two articles about MNFI’s work on this project were published in a local newspaper.

Mussels of Michigan Poster and Surveys in Great Lakes Tributary Rivers.

Investigator: Peter J. Badra

Expected Completion: September 2005

Funding: Department of Environmental Quality, Coastal Management Program

Cooperators: University of Michigan Museum of Zoology and Michigan State University, University Relations

The first component of this project involved producing and distributing a poster and brochure on the freshwater mussels of Michigan. Shells representing the mussels of Michigan were selected and borrowed from the University of Michigan Museum of Zoology. A 24 x 36 inch poster was created that presents photographs of the native unionid mussel species that occur in Michigan. The brochure includes text and figures that describe the range of bivalve taxa found in Michigan, the life history of unionid mussels, their ecological role and value, conservation, and how to find them. These materials were distributed to resource management agencies, environmental education centers, watershed groups, and universities that are incorporating these materials into their educational programs and distributing them to interested individuals. For the research component of this project, a total of 25 sites were surveyed in the St. Joseph (Lake Michigan drainage), Manistee, Au Sable, and Pinnebog and Pigeon (Huron Co.) watersheds in the summer and fall of 2005. Twenty-one native mussel species were found during the surveys including occurrences for one state endangered and six special concern species. Substrate composition, and rate and intensity of colonization by zebra mussels (*Dreissenidae*) were also investigated.

Nearshore Benthic Community Patterns Related to Multi-scale Land Cover Properties of Lake Michigan Shorelines (2003)

Investigators: Reuben R. Goforth, Stephanie. M. Carman Expected Completion: January 2005

Funding: Michigan Department of Environmental Quality, Coastal Management Program

Cooperators: Michigan Department of Environmental Quality, Office of the Great Lakes, Michigan Great Lakes Protection Fund

We sought to determine whether local nearshore biological community measures for native and non-native taxa were associated with local and larger scale shoreline environmental properties, including land cover composition and the number of shore structures present within specified geographic areas (e.g., revetments, groin fields, jetties, piers, etc). Our primary goal was to provide a comprehensive assessment of native and aquatic nuisance species (ANS) community responses to multi-scale shoreline environmental properties based on field surveys of nearshore waters adjacent to local shorelines with high and low disturbance regimes. Our results suggested that benthic macroinvertebrate and zooplankton communities did not exhibit significant responses to local shoreline condition, and most of the variation explained in these measures was attributed to urban land use and/or the number of shoreline structures within shoreline buffers of larger landscape contexts updrift from the study sites. In contrast, shallow water fish exhibited greater responses to smaller scale shoreline condition and urban land use, and nearshore piscivorous fish appeared to track with the prey fish patterns. Fish communities also exhibited negative relationships with increasing numbers of shore structures within larger landscape contexts. These patterns of response suggest that nearshore food webs in sand-based systems integrate responses of multiple trophic levels to environmental properties operating at multiple spatial scales. Although the specific mechanisms influencing different food web components were not evident, little doubt remains that sustaining biodiversity within Great Lakes nearshore zones will require resource management at multiple scales. The general absence of adult aquatic nuisance species in southeastern Lake Michigan despite the availability of substantial pools of larvae and juveniles (i.e., *Dreissena* sp. and *Neogobius melanostomous*, respectively) also suggested that sand-based nearshore systems may discourage or impede successful colonization by these largely lithophilic species. This further suggests the importance of maintaining natural sand dynamics in nearshore zones of Lake Michigan as a management priority. A manuscript based on this work is currently in preparation to be submitted for publication in a peer-reviewed journal.

Nearshore Benthic Community Patterns Related to Multi-scale Land Cover Properties of Lake Michigan Shorelines (2005)

Investigator: Reuben R. Goforth

Expected Completion: September 2005

Funding: Michigan Department of Environmental Quality, Coastal Management Program

Cooperators: Clean Michigan Initiative

This proposed research will evaluate benthic community patterns related to local and larger scale land cover properties of adjacent eastern Lake Michigan shorelines. This research will contribute to a larger multi-year research effort, funded in part by the Department of Environmental Quality Coastal Zone Management, Clean Michigan Initiative, and the Great Lakes National Program Office of the Environmental Protection Agency (GLNPO). The larger project is assessing fish, zooplankton, and benthic invertebrate community patterns for the selected nearshore areas. Combined with updated shoreline land cover data to be incorporated into a GIS, analyses of the benthic, fish, and zooplankton community data will be used to address several research hypotheses regarding biological community and habitat relationships with shoreline environmental properties.

Nearshore Habitat Inventory and Mapping in Western Lake Michigan

Investigator: Reuben R. Goforth

Expected Completion: March 2007

Funding: Great Lakes National Program Office of the US Environmental Protection Agency, National Fish and Wildlife Foundation

Cooperators: Clean Michigan Initiative, Michigan Department of Environmental Quality-Coastal Management Program

This project seeks to increase understanding of Great Lakes nearshore habitats with regard to the types of habitats that exist, habitat distributions, spatial extents of habitats, habitat conditions relative to adjacent shoreline characteristics, habitat stability and relevance of these habitats to prey fish and benthic macroinvertebrate communities. The resulting data will fill significant information gaps that currently exist in Great Lakes science. The map products and conceptual models resulting from this work will also provide a stronger foundation upon which agency personnel, land use planners, conservation interests, and other Great Lakes workers can make decisions with regard to nearshore habitat management, protection, and restoration. This information will also help to provide a basis for devising appropriate protection and restoration strategies for Great Lakes nearshore habitats. Finally, our analyses should contribute to development of models for predicting habitat type, distribution, and condition in unsurveyed nearshore zones, as well as predicting nearshore ecosystem response to future potential stressors. To date, project personnel have collected benthic macroinvertebrate and fish samples from all sites, and side-scan sonar mosaics have been developed for eight of the 12 sites. Additional fieldwork and data collection will be conducted during summer 2006, followed by data analysis and modeling in fall 2006. A final report and peer-reviewed journal manuscripts will be completed by March 2007.

Patterns of Aquatic Nuisance Species Distribution and Abundance Related to Multi-scale Environmental Properties of Great Lakes Shorelines

Investigators: Reuben R. Goforth, Stephanie M. Carman

Expected Completion: January 2005

Funding: Michigan Department of Environmental Quality, Office of the Great Lakes, Michigan Great Lakes Protection Fund

Cooperators: Michigan Department of Environmental Quality, Coastal Management Program

We sought to determine whether local nearshore biological community measures for native and non-native taxa were associated with local and larger scale shoreline environmental properties, including land cover composition and the number of shore structures present within specified geographic areas (e.g., revetments, groin fields, jetties, piers, etc). Our primary goal was to provide a comprehensive assessment of native and aquatic nuisance species (ANS) community responses to multi-scale shoreline environmental properties based on field surveys of nearshore waters adjacent to local shorelines with high and low disturbance regimes. Our results suggested that benthic macroinvertebrate and zooplankton communities did not exhibit significant responses to local shoreline condition, and most of the variation explained in these measures was attributed to urban land use and/or the number of shoreline structures within shoreline buffers of larger landscape contexts updrift from the study sites. In contrast, shallow water fish exhibited greater responses to smaller scale shoreline condition and urban land use, and nearshore piscivorous fish appeared to track with the prey fish patterns. Fish communities also exhibited negative relationships with increasing numbers of shore structures within larger landscape contexts. These patterns of response suggest that nearshore food webs in sand-based systems integrate responses of multiple trophic levels to environmental properties operating at multiple spatial scales. Although the specific mechanisms influencing different food web components were not evident, little doubt remains that sustaining biodiversity within Great Lakes nearshore zones will require resource

management at multiple scales. The general absence of adult aquatic nuisance species in southeastern Lake Michigan despite the availability of substantial pools of larvae and juveniles (i.e., *Dreissena* sp. and *Neogobius melanostomus*, respectively) also suggested that sand-based nearshore systems may discourage or impede successful colonization by these largely lithophilic species. This further suggests the importance of maintaining natural sand dynamics in nearshore zones of Lake Michigan as a management priority. A manuscript based on this work is currently in preparation to be submitted for publication in a peer-reviewed journal.

Surveys of Freshwater Mussels in Great Lakes Tributary Rivers in Michigan

Investigator: Peter J. Badra

Expected Completion: September 2004

Funding: Department of Environmental Quality, Coastal Management Program

This project is part of an ongoing effort by MNFI to develop a more complete understanding of the status, distribution, and ecology of the freshwater mussels (Unionidae) in Michigan. A total of 58 sites were surveyed in the Cass, Pere Marquette, Rifle, and White Watersheds. Twenty native mussel species were found during the surveys including occurrences for five special concern species. Substrate composition, and rate and intensity of colonization by zebra mussels (Dreissenidae) were also investigated. Similar surveys have been conducted each year from 2001 to the present with the goal of assisting in the management of this endangered group and of aquatic ecosystems as a whole. This information is being incorporated into decision making tools (such as the MNFI and NatureServe databases) to assist in the management of aquatic ecosystems and provide information needed to evaluate the State of Michigan and global status and distribution of native freshwater species and communities.

Botany

Habitat Assessment and Monitoring of Hall's Bulrush in SW Michigan

Investigators: Phyllis J. Higman & Michael R. Penskar (2004) M.R. Penskar & P.J. Higman (2005)

Expected Completion: March 2007

Funding: USFWS Section 6

Collaborators: MDNR, USFWS

This study was initiated to continue long-term monitoring of a large population of Hall's bulrush at Allegan State Game Area. We also assessed the status of four other sites where this species has been previously documented in Michigan and conducted de novo surveys for additional occurrences in Allegan, Muskegon, and Van Buren counties. Habitat characteristics and population data from all sites will be compared to better elucidate the ecological requirements of this globally rare species. The Allegan SGA monitoring site experienced severe drawdowns in both 2004 and 2005, and no aerial shoots were observed emerging from the seed bank. The bulrush was not observed at any other site during 2004-2005. In 2004, two new coastal plain marsh occurrences were documented, one harboring an occurrence of state special concern tall beak rush (*Rhynchospora macrostaycha*) and the other, state threatened bald-rush (*Psilocarya scirpoides*). In 2005, a new occurrence of the state threatened *Panicum verrucosum* was discovered in Van Buren County, and a new occurrence of the state threatened *Eupatorium fistulosum* was found near the Allegan County monitoring site, a county record.

USFWS Dwarf Lake Iris Recovery Plan

Investigator: Michael R. Penskar

Expected Completion: September, 2004

Funding: USFWS Section 6

Collaborators: Pat Lederle, MDNR, Mike DeCapita, USFWS

The purpose of this cooperative agreement was primarily to improve the global database for dwarf lake iris (*Iris lacustris*) to assist in completion of the long dormant draft recovery plan for this species. Prior to its ultimate release for public and peer review, considerable revisions are anticipated, many of them predicated on updating global distribution records, the majority of which occur in Michigan. The tasks of this project were to: 1) initiate revision of the Element Global Rank (EGR) standard in collaboration NatureServe central databases, 2) modify the Michigan database according to the revised EGR rank criteria, and 3) compile new accumulated data for dwarf lake iris and update records where appropriate. A new draft EGR standard was developed under guidance from NatureServe, and the Michigan database was examined and updated as appropriate (though not spatially). In addition, contacts were made with data managers from Wisconsin and Ontario heritage programs, representing the remainder of the global range, to encourage them to apply the new EGR standards such that they would ultimately be comparable for all occurrence records throughout the range of this upper Great Lakes endemic plant.

Conservation Geographic Information Systems

DEQ CZM Planning Models

Investigator: Edward H. Schools

Expected completion: March 2006

Funding: Michigan Department of Environmental Quality Coastal Zone Management

Under this grant, MNFI will prepare GIS models based on the MNFI database of rare, threatened and endangered species and high quality natural communities. The models are designed to facilitate the incorporation of sensitive MNFI information into the planning process by providing planners with easy to use information while still protecting the sensitive nature of the information. The models are designed to aid land use planning efforts and conservation efforts by determining the likelihood of finding a species or community occurrence in any given area and assigning a biodiversity value to that area.

MDOT Managed Areas

Investigator: Edward H. Schools

Expected completion: September 2005

Funding: Michigan Department of Transportation

We identified those areas along MDOT right of ways where MDOT management actions could affect rare species or natural communities. MDOT personnel will use this information to designate protected areas where management actions will be restricted. In addition to defining important areas we prepared information that will be used to update MDOT management manuals (A.K.A. Red Books).

Newaygo County Surveys

Investigator: Edward H. Schools

Expected completion: December 2006

Funding: Fremont Area Community Foundation

We are surveying Newaygo County for high quality natural communities and rare plants. In addition to the on the ground surveys, we are producing several Geographic Information System models for use in land use planning efforts. During the 2005 field season, MNFI staff performed surveys at thirty sites. Six MNFI staff participated in the survey efforts. Survey highlights include finding Creeping St. John's Wort (*Hypericum adpressum*) a new plant species for Michigan. In addition, we found tall green milkweed (*Asclepias hirtella*), a plant that has not been recorded in that region since the early 1900s.

SWG WCS Planning Assistance

Investigator: Edward H. Schools

Expected completion: September 2005

Funding: Michigan Department of Natural Resources Wildlife Division

MNFI provided technical assistance and consulting to Wildlife Division personnel to help prepare the Comprehensive Wildlife Strategy. In addition to assistance, MNFI performed upgrades to the Natural Heritage database, including entering backlog records into the database, and performing spatial and tabular quality assurance checks on existing records. Finally, MNFI also created various landscape and species GIS models.

Conservation Education

Conservation Steward Program

Investigator: Phyllis J. Higman

Expected Completion: Pilot programs in Oakland and Livingston counties, Spring 2006. Completion of the research component, August 2006. Funding to expand the program is currently being sought.

Funding: MDNR SWGG

Collaborators: Shari Dann, MSU-Fish and Wildlife Dept.; MSUE Fish and Wildlife AoE; Heather VandenBerg, MSU student; Ray Rustem, Amy Clark-Eagle, Kelly Siciliano-Carter, MDNR Wildlife; Scott Loveridge, MSUE; Bruce Smith, Liesl Bowen, The Nature Conservancy; Ray Fahlsing, MDNR Parks; Lisa Brush, The Stewardship

We assisted in the development of a curriculum and teaching materials for a Conservation Steward Program in SE Michigan. It is designed to provide an overview of ecological principles, the history of natural resource management in Michigan, and the ecosystem approach to managing natural resources. It will provide a solid background in Michigan's dominant and unique ecosystems and their values, and will introduce participants to a decision-making process founded upon principles of ecosystem management. Participants will emerge equipped for meaningful engagement in volunteer programs with the MDNR and other land management agencies, as well as private land-owners. The program will be delivered during eight three-hour evening sessions and three seven-hour Saturday field experiences. Participants design and complete a conservation project to be shared with the group during the last meeting. They will have an opportunity to interact with representatives of local groups offering volunteer opportunities. Graduates are eligible for certification after successful completion of the entire curriculum and 40 hours of volunteer work. Research on the effectiveness of the program for changing citizen attitudes and knowledge will be conducted by MSUE.

DMVA Camp Grayling Exotics

Investigator: Phyllis J. Higman

Expected Completion: June 2005

Funding: Michigan Department of Military and Veterans Affairs (MDMVA)

Cooperators: MDMVA

We assessed the threat of invasive exotic plant species and pilot-tested an invasive species mapping tool at Camp Grayling Maneuver Center. Mapping was accomplished using a hand-held IPAQ computer with ESRI Arc Pad mapping software in conjunction with a Global Sat GPS receiver. Drop-down menus were used to identify the invasive species and assign a density, buffer width, and spatial distribution category. Occurrences were mapped as points, lines, or polygons by the GPS unit, as the surveyor walked around an infestation, or by manual digitization of the occurrence using the aerial photo data layer for reference. Surveys were prioritized in high quality natural communities and rare species locations, then in representative natural communities, and lastly on degraded areas, roads and trails. Dominant invasive species included spotted knapweed, common St. John's-wort, and Canada bluegrass. Other high-threat species detected in relatively low numbers included leafy spurge, reed canary grass, reed grass, and purple loosestrife. A comprehensive management strategy was developed, focusing on prevention, early detection-rapid response, control and management at high priority sites, and restoration. Specific management recommendations were also provided for the documented dominant and high threat species.

DMVA Camp Grayling T & E Species

Investigator: Phyllis J. Higman and David L. Cuthrell

Expected Completion: March 2005

Funding: Michigan Department of Military and Veterans Affairs (MDMVA)

Cooperators: MDMVA

Field surveys were conducted to assess the status of previously documented rare plant and animal occurrences at Camp Grayling. Surveys were also conducted for additional occurrences of selected rare species. Occurrences of Hill's thistle, rough fescue, Alleghany plum, Houghton's goldenrod, prairie dropseed, Vasey's rush, Clinton's bulrush and New England violet were found flourishing in the Camp, while previously documented occurrences of Canada rice grass, prairie moonwort, whorled pogonia, and northern appressed clubmoss were not rediscovered. No new rare plant species were discovered. Two Kirtland's Warbler occurrences were re-confirmed and one secretive locust occurrence was expanded significantly in extent. Four Red-shouldered Hawk, one Common Loon, one American Bittern, one secretive locust, and seven dusted skipper occurrences were newly documented. Management recommendations were provided for each rare species and recommendations for future survey were made.

FMFM Biodiversity Training 04

Investigator: Phyllis J. Higman

Expected Completion: September 2004

Funding: MDNR Forest, Mineral, and Fire Management

Cooperators: Mark MacKay, MDNR Wildlife Division, Jim Ferris, Don Kuhr, MDNR Forest, Mineral, and Fire Management Division; Bill Zeigler, Jim Waybrant, MDNR-Fisheries Division.

We conducted four workshops in coordination with MDNR-FMD and MDNR and initiated the development of a new workshop anticipated for delivery in FY 2005. An introductory workshop in St. Ignace provided an overview of the Endangered Species legislation, the Natural Features of Michigan,

and the work, products, and services of Michigan Natural Features Inventory. Access to natural features data and other Web-based products were demonstrated through projected computer images. A one-day field workshop was held in Marquette, featuring the identification of ground cover plant species that are used in the Kotar habitat type classification system. The riparian workshops, held in Newberry and Marquette, included an overview of the draft riparian management zone guidelines and presentations on wildlife, fisheries, forestry, and biodiversity values. Participants worked in teams to practice application of the management guidelines to various management scenarios. We also began compiling information on classification systems for a new workshop focusing on issues of scale and classification systems. Delivery is anticipated in 2005.

FMFM Biodiversity Training 05

Investigator: Phyllis J. Higman

Expected Completion: September 2005

Funding: Forest, Mineral, and Fire Management Division

Cooperators: MDNR-FMFMD, MDNR-WD, MDNR-Fish Division

We delivered plant identification workshops in the northern Lower Peninsula and the eastern Upper Peninsula. Participants observed key ground flora used in the Kotar Classification System in their natural field setting and began to associate them with differing habitat types. We also developed materials for riparian management zone workshops to be held in the northeast and northwest Lower Peninsula in FY06. We will present overviews of wildlife, forestry, fish, and biodiversity values for each region, and discuss the MDNR riparian management guidelines. Participants will work in teams to practice application of the guidelines using scenarios involving competing values. We continued development of a workshop featuring the use of multiple scales and classification systems to assist biodiversity conservation planning. Appropriate uses of the myriad of classification and planning tools at different scales will be discussed. Participants will learn how these tools can be used to help define specific management objectives for their region or site. We participated in review and discussion of the biodiversity criteria for Forest Certification and the Biodiversity Conservation Planning Process, and will incorporate relevant concepts into the workshop to be delivered in 2006.

SFI Logger Biodiversity Workshop

Investigator: Phyllis J. Higman

Expected Completion: March 2005

Funding: MSUE

Collaborators: Russell Kidd, MSUE Educator

We delivered a presentation to private loggers as part of a SFI sponsored training program conducted by MSUE in Mio, Michigan. We discussed the endangered species legislation and provided an overview of Michigan Natural Features Inventory and how our data is collected and used. Then we reviewed the array of natural communities in the northeastern Lower Peninsula, highlighting significant natural processes and rare species. Management recommendations that enhance biodiversity conservation were discussed.

The ForestLand Group Biodiversity Workshop

Investigators: Phyllis J. Higman and Edward H. Schools

Expected Completion: June 2005

Funding: The Forestland Group

Collaborators: Janet Marr, Consulting Botanist

We delivered a biodiversity workshop in collaboration with Janet Marr, UP Consulting Botanist, for foresters employed by The ForestLand Group, LLC. This group recently entered an agreement to protect over 271,000 acres of forest through a working forest easement on lands reaching across eight Upper Peninsula counties. We presented an overview of the endangered species legislation, SFI and FSC Forest Certification criteria relating to biodiversity, and the Michigan Natural Features Inventory. We then reviewed the array of natural communities on their land-holdings, highlighting significant natural processes and management recommendations for enhancing biodiversity conservation. Following this, we provided a detailed overview of MNFI data products and services, and allowed participants an opportunity to access our web database. Finally, we assisted with a field trip to view selected rare species in the field and identify herbaceous and woody plant species used in the Berger & Kotar habitat classification system.

Conservation Planning

Assistance to MDNR Landowner Incentive Program

Investigators: John J. Paskus, Jr. and Ryan P. O'Connor

Expected Completion: renewed on annual basis

Funding Source: MDNR Wildlife Division

This project provided assistance to the MDNR Wildlife Division Landowner Incentive Program Biologists working to improve rare species habitat on private land. Initially, MNFI provided significant input in the design and implementation of this new program, helping biologists identify key landscapes for target species and providing advice on ecological aspects of habitat restoration. Upon commencement of fieldwork, MNFI staff conducted surveys, provided on-site management advice, and provided one-on-one training on biodiversity values and ecology of target species and systems. During the 2004 and 2005 field seasons, we surveyed over 6000 acres belonging to more than 75 landowners. 45 new element occurrences were found, including a new population of the federally threatened Karner blue butterfly on a former pine plantation being restored to oak savanna.

We also developed several educational products, including a database of rare animals and their associated habitats which will be made available on the MNFI website, five new community abstracts, and a white paper on mesic conifer restoration in mesic northern forests. Several presentations were also given to community groups, at Mason building brownbag seminars, and at the Wildlife Division semiannual conference.

Assisting Michigan Counties and Local Governments in Conservation Planning

Investigators: John J. Paskus, Jr. and Edward H. Schools Expected Completion: Completed

Funding Source: Michigan State University, Land Policy Program

Michigan lacks a comprehensive statewide inventory of rare plants and animals, exemplary natural communities, and other significant natural features. Several other state Natural Heritage programs already have county inventory efforts in place. MNFI recently visited two state programs that utilize different approaches to their county survey efforts. MNFI is using the information gleaned from these efforts to determine the most appropriate approach for a comprehensive county level inventory in Michigan.

When comparing the Minnesota and Pennsylvania county survey programs, one finds advantages and disadvantages to each. Minnesota's more thorough in depth approach will take approximately 20-25 years to complete a systematic statewide biological survey, while Pennsylvania's quicker less thorough approach will take approximately 10 years to complete. Unfortunately, this approach would probably require another more thorough survey effort in the future, essentially costing more in the long-run.

We concluded that the information required to meet the needs of end users should determine the appropriate approach. Based on prior MNFI experience, local planners will be most interested in a set of consolidated ecological information that takes into account a variety of information types, is spatially explicit, and prioritized. In addition, it is critical that a consistent source of funding needs to be established over a long time frame (10-25 yrs). We estimated that a complete inventory in Michigan will cost between \$6 and \$25 million in today's dollars. In order to effectively utilize limited resources, we recommend counties or regions are prioritized based on current and projected growth rates, and potential biodiversity value.

Biodiversity Atlas

Investigator: John J. Paskus, Jr.

Expected Completion: December 2006

Funding Source: MDNR Wildlife Division

The purpose of the biodiversity atlas is to provide end users with scientifically based information to advance the protection of Michigan's biodiversity through the development of a statewide conservation network. The three primary tasks include: 1) enhance the MNFI database, 2) conduct analysis, and 3) develop products. To date, MNFI staff have added approximately 2,500 element occurrences to the database, and quality controlled the majority of existing plant and animal records for viability rank and spatial accuracy. Based on a study of other statewide biodiversity projects, it was decided that the most appropriate type of analysis for Michigan was the fine filter/fine filter/prioritization method. We also decided to conduct the terrestrial and aquatic analyses separately, and then identify the best areas for both terrestrial and aquatic biodiversity. In addition, analyses will be conducted at the statewide and ecoregional scale. Several draft statewide GIS analyses have been completed including element occurrence based models, as well as the development of numerous natural vegetation patch data layers.

Conservation of the Mitchell's satyr and Eastern massasauga rattlesnake in Southwest Michigan

Investigators: John J. Paskus, Jr. and Daria A. Hyde

Expected Completion: May 2004.

Funding Source: U.S. Fish and Wildlife Service, Region 3, Section 6, Endangered Species Grant

Cooperators: Nate Fuller and Jodi Simoes, Southwest Michigan Land Conservancy, MDNR Wildlife Division.

We completed the final year of a three-year project to initiate conservation actions for the Mitchell's satyr and eastern massasauga in southwest Michigan. We provided training to staff and volunteers at Southwest Michigan Land Conservancy (SWMLC) in identification, life history and management needs of these species. We contacted 96 landowners during this project to request permission to conduct surveys as well as provide them with information about these species. We made 201 visits to 74 properties during the satyr flight season, documenting several rare species (including the massasauga) and expanding the known habitat for the satyr. Nine site conservation plans were completed for southwest Michigan and the formation of a volunteer stewardship team was established to monitor the population and to conduct management activities at the occupied sites in this region. Management has been initiated at four sites by SWMLC and they will continue to monitor five of the nine occupied satyr sites. A draft of an educational publication about fens and associated rare species was also produced.

Great Lakes Shoreline Assessment

Investigator: John J. Paskus, Jr.

Expected Completion: September 2007

Funding Source: U.S. Fish and Wildlife Service, Region 3, Section 6, Endangered Species Grant

We initiated the first year of a three-year project to identify areas along the Great Lakes shoreline that support concentrations of threatened and endangered species and correlate these areas to land ownership, geo-ecological landscape features as well as piping plover designated critical habitat. We conducted a GIS analysis to assist in the prioritization of these unique shoreline areas, which resulted in the identification of twelve high priority sites. We produced maps showing element occurrence locations at six of the highest priority sites and conducted targeted plant and animal surveys at two of these sites in order to update and confirm old records, verify the status and quality of these occurrences, and document threats. In addition, we documented several new plant and animal occurrences at these sites.

Lake St. Clair Environmental Characterization

Investigator: John J. Paskus, Jr.

Expected Completion: Completed

Funding Source: NOAA Coastal Services Center via the Great Lakes Commission

MNFI's role in this collaborative project with the Great Lakes Commission, NOAA Coastal Services Center, and Walpole Island First Nation was to provide the biological and ecological expertise necessary for developing a draft habitat conservation plan and interactive, user friendly website for Lake St. Clair and surrounding near shore area. MNFI provided: 1) element occurrence based frequency, probability, and biological rarity score models for both Michigan and Ontario, 2) Potential Conservation Area maps for both Michigan and Ontario (using slightly different sets of criteria), 3) metadata for all models, 4) expertise and review of all natural community descriptions, and 5) 34 abstracts of species and communities found in the study area. The website (www.glc.org/habitat/lsc) is completed and contains: 1) Coastal Habitat Assessment report, 2) integrated coastal management decision support tool, 3) GIS digital data layers, and 4) habitat and species information. The website also contains a link to MNFI's website as well as direct links to 90 abstracts. MNFI staff contributed to and completed several sections of the Coastal Habitat Assessment report, primarily the Protection and Restoration Guidelines section. As a result of this project, we were able to digitize and quality control 414 existing Element Occurrences in the MNFI database.

Natural Resource Data Use

Investigator: Jennifer A. Olson

Expected Completion: September 2006

Funding Source: MDNR Wildlife Division, Natural Heritage Program

This project was conducted in conjunction with funding leveraged from the private lands support project. The first of a two part assessment of Michigan's 1,242 townships, 83 counties and 14 regional planning councils was conducted to understand the level of use, and interest in, natural resource information in local land use planning efforts. The majority of this project was spent in the development of a written survey targeted at local planning officials. Up to three mailed surveys, a reminder postcard, and a non-response survey were sent to all of the local governments above to elicit a response to the research project. Responses to the survey will be evaluated starting in January, 2006.

Oakland County Potential Conservation Area Analysis

Investigator: John J. Paskus, Jr.

Expected Completion: April 2004

Funding Source: Oakland County Planning and Economic Development Services

MNFI was contracted to update the 2002 potential conservation areas (PCA) as well as the PCAs that were identified in the original five-township area. The 2002 boundaries were revised and natural lands that had changed to development or agricultural lands were removed. As a result, the new boundaries are much more accurate. Over 800 PCAs were identified and ranked. These sites represent what appear to be the least disturbed natural areas. The increase in the number of sites is primarily due to the use of roads to define sites, not an increase in additional lands. In fact, 2002 acreage decreased from 110,000 acres to approximately 93,500 acres. These 93,500 acres represent approximately 16% of the total county acreage. Eighty-two sites totaling 38,236 acres (40.9% of delineated sites) fell into the priority one category.

As an interesting side note, the Huron Clinton Metropolitan Authority (HCMA) based the purchase of a property (>200 acres) on the results from our earlier Oakland PCA report, Springfield Township developed a natural resource overlay district based on our maps, and several other townships are in the process of developing a similar ordinance to protect their remaining natural areas. In addition, Brooks Patterson, Oakland County Chief Executive, provided a quote to MNFI that is very supportive of the work we have done there over the years.

Potential Conservation Area Analysis

Investigator: John J. Paskus, Jr.

Expected Completion: Completed

Funding Source: Macomb County Department of Planning & Economic Development

The purpose of this project was to identify and rank Potential Conservation Areas (PCAs) remaining in Macomb County. PCAs are defined as places on the landscape dominated by native vegetation that have various levels of potential for harboring high quality natural areas and unique natural features. A total of 359 sites, totaling 23,560 acres, were identified as PCAs, representing 7.6% of the county. Each site was given a total score based upon total size, core area, connectivity, restorability, and presence of river corridor, presence of rare species and/or natural communities, vegetation quality, and parcel fragmentation. With the element occurrences included in the criteria, total scores ranged from a high of 24 points (out of a possible 40 points) to a low of 2 points. The mean score was 8, while the median score was 7. Fifty six sites totaling 6,360 acres (27% of delineated site) were placed in the high priority category.

Private Lands Support

Investigator: John J. Paskus, Jr.

Expected Completion: renewed on annual basis

Funding Source: MDNR Wildlife Division

The primary focus of this year's work was to complete the final draft of the report entitled, "Minimizing the Negative Impacts of Development Patterns on Michigan's Natural Resources: the potential role of the MDNR and/or Wildlife Division". The report includes sections on: the values of nature, defining sprawl, land use trends in Michigan, impacts of sprawl, causes of sprawl, strategies, summary of state surveys, role of Michigan organizations, and the potential role of the MDNR. A large portion of this years work focused on developing, conducting, and analyzing the results of a mail survey for natural resource agencies across the country and organizations in Michigan involved with land use at the

statewide scale. In addition, Jennifer Olson initiated work on her Master's thesis focused on the use of natural resource information by local units of government throughout the state. This portion of the project was conducted in conjunction with funding leveraged from the MDNR Wildlife Division Natural Heritage small grants program. Lastly, a draft presentation was prepared for the Natural Resource Commission describing urban sprawl and its impacts on wildlife.

Ecology

Coastal Habitats

Investigator: Dennis A. Albert, Phyllis J. Higman, Yu Man Lee Expected Completion: March 2004
Funding: Great Lakes Program Office of the Michigan Department of Environmental Quality, The Nature Conservancy

We sampled swamp forests and Great Lakes coastal wetlands to begin development of a plant Index of Biotic Integrity (IBI). We also developed two products, a brochure on biodiversity important state and federal park and recreational sites, called *Ecological Jewels of the Straits*, and a book on Great Lakes coastal wetlands, called *Between Land and Lake*.

DEQ Wetland Training

Investigator: Dennis A. Albert, Michael A. Kost and Phyllis J. Higman
Expected Completion: September 2004
Funding: Michigan Department of Environmental Quality (USEPA funds)
Cooperators: DEQ and DEQ wetland contractors.

We trained DEQ wetland staff to identify common and rare nongame wetland species in several types of MI wetlands, including lake plain prairie, prairie fen, coastal plain marsh, northern fen, and coastal Great Lakes Marsh

DMVA Camp Grayling Alliance

Investigator: Joshua G. Cohen Expected Completion: March 2005
Funding: Michigan Department of Military and Veterans Affairs (MDMVA)
Cooperators: MDMVA

A digital map of plant alliances in the Pine Barrens Management Opportunity Area at Camp Grayling was prepared using a combination of GIS modeling and ground-truthing. This ~5007 acre site was identified in 1993 as an important restoration opportunity for the globally rare Pine Barrens natural community. The area was mapped using the U.S. National Vegetation Classification (USNVC) which provides a standardized classification system of natural communities for the U.S. This hierarchical system allows vegetation types to be consistently classified and mapped across administrative and political boundaries. Mapping at the alliance level requires characterizing the dominant or diagnostic species in the uppermost strata of the community. Recent satellite imagery, digital soils data, wetland data, and digital elevation data were used to assign preliminary vegetation classes, then field-checked for final classification. The map facilitates comparisons among sites at the local, regional and national levels, providing a useful tool for managers to assess the importance of the Grayling site to regional biodiversity and will be useful for monitoring changes in the vegetation and ecological integrity over time as restoration proceeds.

DMVA Camp Grayling Community Assessment

Investigator: Michael A. Kost

Expected Completion: June 2005

Funding: Michigan Department of Military and Veterans Affairs (MDMVA)

Field surveys were conducted to assess the status of 14 high quality natural community occurrences documented during 1992 and 1993 on Camp Grayling Maneuver Training Center. Occurrence data were updated in Biotics and comprehensive management recommendations were provided for each site. Natural community descriptions were written for five of the seven high quality community types represented by this suite of occurrences, including mesic sand prairie, intermittent wetland, northern fen, poor fen, bog, and northern shrub thicket. In addition, each of the natural community occurrences was classified to plant alliance using the U.S. National Vegetation Classification System (Grossman et al. 1998, Anderson et al. 1998, Faber-Langendoen 2001).

Depressional Wetlands

Investigator: Dennis A. Albert

Expected Completion: March 2004

Funding: Michigan Department of Environmental Quality

Cooperators: T. Burton, MSU Zoology Department and D. Uzarski, Annis Institute of Grand Valley University.

We attempted to develop a plant Index of Biotic Integrity (IBI) for interior depressional wetlands, both forested and non-forested. While we were able to develop plant IBIs for forested wetlands, we were unable to identify effective IBIs for non-forested wetlands.

Element Occurrence Inventories of State Game and Recreation Areas

Investigator: Michael A. Kost

Expected Completion: September 2006

Funding: Michigan Department of Natural Resources

Cooperators: Sheri Laier, Michigan Nature Association; Tony Reznicek, Ph.D., University of Michigan; DNR: Maria Albright, Steve Beyer, Mark Bishop, Don Bonnette, Greg Bragdon, Dave Brauer, Steve Chadwick, Rod Clute, Jon Curtis, Charles Dennison, Shelli Dubay, Tyson Edwards, Earl Flegler, Tammy Giroux, Shannon Hanna, Christine Hanaburgh, Gary Jones, Ernie Kafkas, Nick Kalejs, Arnie Karr, Dan Kennedy, Jon LaBossiere, John Lerg, Lyle Melkerson, John Niewoonder, Julie Oakes, Dick Robertson, Joe Robison, and Sara Schaefer

The primary objectives of this project are to conduct surveys for rare and non-game species and their habitats on state lands and facilitate the exchange of information between staff from the DNR Wildlife Division and MNFI. This is an ongoing project that began in 2002 and has focused on state game areas and state recreation areas in the southern Lower Peninsula. The survey work has resulted in the identification of over 150 new element occurrences and provided the opportunity to update over 150 previously identified records. The newly documented and updated element occurrences of rare species and high quality natural communities provide critically important information for land management planning and biodiversity conservation. This project has allowed DNR and MNFI staff to jointly conduct site visits to many managed areas and discuss management aimed at maintaining and enhancing ecological integrity and habitat for rare and non-game species.

Fragmented Coastal Marshes

Investigator: Dennis A. Albert

Expected Completion: September 2005

Funding: Michigan Department of Environmental Quality (NOAA and EPA funds), Michigan Duck Hunters Association (Macatawa, Bay City, and State chapters).

Cooperators: T. Burton, MSU Zoology and D. Uzarski, Annis Institute of Grand Valley University.

We documented the response of aquatic vegetation in Great Lakes coastal marshes during low-water conditions to different forms of management by public owners and local government. Plowing, hand-picking of plants, and regular raking resulted in elimination of perennial wetland vegetation, especially bulrushes, over a two year period. While mowing decreased the amount of biomass, it did not decrease overall diversity from that found in unmanaged marshes. A report was produced for his project.

Great Lakes Coastal Marsh Training

Investigator: Dennis A. Albert

Expected Completion: September 2004.

Funding: Seagrant.

Cooperators: J. Reid of Michigan Seagrant in Ann Arbor.

We trained Seagrant staff to identify some of the common wetland plants in the Grand Traverse Bay and Saginaw Bay areas and showed them the effects of different types of management by shoreline landowners, including raking, disking, hand-weeding, and mowing. Training materials were developed by Seagrant staff.

Great Lakes Diked Wetlands

Investigator: Dennis A. Albert

Expected Completion: September 2007.

Funding: Michigan Department of Natural Resources Wildlife Division.

We are sampling wetland vegetation of diked and undiked wetlands on Harsens Island and at Wigwam Bay and Fish Point of Saginaw Bay to determine the effect of diking on biomass accumulation and plant species diversity and cover. Based on sampling in the summer of 2005, it appears that *Phragmites* has replaced both bulrushes and cattails in both diked and undiked wetlands during the recent low water conditions, with less replacement within the diked wetlands. Data will be used by M. Monfils as part of his study of the birds utilizing the marshes.

Great Lakes Wetland Inventory

Investigator: Dennis A. Albert

Expected Completion: March 2004.

Funding: The Great Lakes Consortium of the Great Lakes Commission, USEPA funds.

Cooperators: L. Simonson, USGS, Ohio; J. Ingram and K. Holmes of Environment Canada.

We mapped all of the U. S. wetlands of the Laurentian Great Lakes in GIS format, based on Herdendorf (USFWS) wetland maps from the 1980s and more recent wetland surveys. Wetlands were mapped in a standard format, with disturbance attributes. The project was done in cooperation with collaborators in Ontario, Canada. Maps are available on Great Lakes Consortium web site.

Lake Huron Wetlands

Investigator: Dennis A. Albert

Expected Completion: September 2004

Funding: Great Lakes Consortium (USEPA)

Cooperators: T. Burton of MSU Zoology Department, D. Uzarski of Annis Institute of Grand Valley University, J. Ingram and G. Grabas of Environment Canada, S. Timmerman of Long Point Bird Observatory (Ontario).

MNFI developed plant Indices of Biotic Diversity (IBIs) for Lake Michigan and Lake Huron wetlands, while Burton and Uzarski developed fish and invertebrate IBIs. Plants did not prove to be effective for development of IBIs in either open marshes or in swamp forests. A report was produced for this project

MSU Commuter Lot Wetland Restoration

Investigator: Dennis A. Albert

Expected Completion: December 2006.

Funding: Michigan Dept. of Environmental Quality (USEPA Funds) and MSU Plants Dept.

Cooperators: T. Burton of MSU Zoology.

We are sampling wetland vegetation in the restored and unrestored portions of the marsh along Mt. Hope Road. Parallel studies of the fauna of the wetland are being conducted by T. Burton's students. This multi-year study is tracking the changes that result from various restoration activities, including seeding, dike construction, and herbicide treatment of buckthorn. Flooding and herbicide treatment have resulted in major reductions in the amount of glossy buckthorn.

Natural Features Inventory and Management Recommendations for Huron-Clinton Metroparks

Investigator: Michael A. Kost

Expected Completion: March 2006

Funding: Huron-Clinton Metropolitan Authority (HCMA)

Cooperators: Paul Muelle and Dave Moilanen of HCMA, Tony Reznicek, PhD., University of Michigan

We completed inventory efforts for exemplary natural communities and rare plants in the following seven Huron-Clinton Metroparks: Lower Huron, Willow, Indian Springs Huron Meadows, Lake Erie, Wolcott Mills, and Metro Beach. The work conducted during this period builds on our previous efforts at another six metroparks and completes our natural community and rare plant inventory of the Huron-Clinton Metroparks. We have previously completed four reports summarizing our findings at the various Metroparks and will complete our last report for Wolcott Mills and Metro Beach in March, 2006. A primary component of the project has involved developing natural areas management recommendations, which have been discussed within each report and conveyed directly to land managers during site visits.

Natural Features Inventory and Management Recommendations for Oakland County Parks

Investigator: Michael A. Kost

Expected Completion: March 2006

Funding: Oakland County Parks

Cooperators: John Noyes, Oakland County Parks, Tony Reznicek, PhD., University of Michigan

We completed inventory efforts for exemplary natural communities and rare plants in the following three Oak County Parks: Independence Oaks, Lyon Oaks, and Rose Oaks. A primary component of the project has involved developing natural areas management recommendations aimed at protecting and restoring biodiversity. Site specific management recommendations are discussed within the project report and have been conveyed directly to land managers during site visits.

SOLEC Indicators

Investigator: Dennis A. Albert

Expected Completion: September 2004

Funding: Great Lakes Consortium (USEPA)

Cooperators: L. Minc (contractor), T. Burton of MSU Zoology Department, D. Uzarski of Annis Institute of Grand Valley University, J. Ingram and G. Grabas of Environment Canada, S. Timmerman of Long Point Bird Observatory (Ontario), D. Wilcox of USGS Great Lakes Science Center and T. Thompson of USGS Indiana, Environment Canada, and M. Mixler of Cornell University.

This project was an extension of Lake Huron Wetlands. MNFI continued development of plant Indices of Biotic Diversity (IBIs) for Lake Michigan and Lake Huron coastal herbaceous wetlands, incorporating data from partners in Ohio, NY, and Ontario. Plants did not prove to be effective for development of IBIs. As part of this study we also developed a Hydrogeomorphic classification, which will be published in a special issue of the Journal of Great Lakes Research in December 2005 or January 2006. The classification is jointly authored by D. Albert, D. Wilcox, T. Thompson, and J. Ingram.

State Forest Compartment Review

Investigator: Joshua G. Cohen

Expected Completion: Ongoing project

Funding: Forest, Mineral, and Fire Management Division (FMFM)

Cooperators: Cara Boucher.

Comments were compiled for 2006 and 2007 year of entry compartment (YOE) reviews. Attended public compartment reviews in numerous forest management units. Map checks were completed for all 15 forest management units for 2006 and 2007 YOE compartments. Reviewed close to 500 state forest compartments from the 2006 and 2007 YOEs; assessed the likelihood of rare species and community occurrences and provided information on current element occurrence data within these areas. Generated tables of survey targets, occurrences and potential occurrences for all 2006 and 2007 YOE compartments with increased utilization of GIS to direct this process; overlaying digitized compartment maps over Biotics, circa 1800 vegetation, LTA maps, IFMAP landcover maps and Digital Ortho Quads where available. Tables were distributed to all forest management units.

Environmental Review

Consultations, Environmental Review, and Administration (DNR WD-CEAD)

Investigator: Lyn J. Scrimger
basis

Expected Completion: Renewed on annual

Funding: Michigan Department of Natural Resources

Cooperators: Lori Sargent and Matt Herbert (MDNR)

Michigan Natural Features Inventory assists the Michigan Department of Natural Resources with the process of evaluating proposed projects for the potential to impact rare species and high quality natural communities statewide. A major accomplishment of fiscal year 2005 is the creation and implementation of the on-line MDNR Endangered Species Assessment website. This website provides a preliminary evaluation of whether rare species or high quality natural communities have been known to occur at or near a site of interest. A response is generated immediately upon submission of project and applicant information. MNFI staff provided significant input and database connections for the operation of this website.

During the fiscal year, the environmental review program received 3,415 projects and over 3,904 sites for review. We responded to 3,408 requests and had an average response time of 28 calendar days. The average number of monthly requests was 284, with a minimum of 183 and a maximum of 410. Of the 3,404 projects responded to, 10% (354) had no element occurrences nearby, 64% (2,166) were not expected to impact any element occurrences, and 26% (884) had the potential to impact element occurrences. Project requests come from State of Michigan agencies (79%), consultants (10%), the on-line Endangered Species Assessment application (6.5%), federal agencies (2%), local governments (2%), and individuals and organizations (0.5%). The Michigan Department of Environmental Quality, Land and Water Management Division, is the most frequent requestor and collaborator in the environmental review process.

DNR Core 04

Investigator: Lyn J. Scrimger

Expected Completion: Renewed on annual basis

Funding: Michigan Department of Natural Resources

Michigan Natural Features Inventory assists the Michigan Department of Natural Resources with the process of evaluating proposed projects for the potential to impact rare species and high quality natural communities statewide. During fiscal year 2004, we received 3,090 projects and over 3,377 sites for review. We responded to 2,984 requests and had an average response time of 27 calendar days. The average number of monthly requests was 249, with a minimum of 197 and a maximum of 430.

Of the 2,984 projects responded to, 9% (257) had no element occurrences nearby, 70% (2,086) were not expected to impact any element occurrences, and 21% (641) had the potential to impact element occurrences. Most project requests come from State of Michigan agencies (80%), followed by consultants (12%), federal agencies (6%), and local governments, individuals and organizations (2%). The Michigan Department of Environmental Quality, Land and Water Management Division is the most frequent requestor and collaborator in the environmental review process.

Zoology

Comprehensive Population and Habitat Surveys for the Karner Blue Butterfly in Michigan

Investigator: Jennifer L. Fetting

Expected Completion: April 2005

Funding: USFWS, MDNR Wildlife

Cooperators: Patrick Lederle, Ray Rustem, John Lerg, Maria Albright, John Niewoonder, Donna Jones, Tyson Edwards, Nik Kalejs, and Chris Hoving, MDNR Wildlife

The Karner blue butterfly is listed as federally and state endangered. This project was initiated in 2002 to provide improved data for the statewide Karner blue Habitat Conservation Plan. Lupine surveys, status surveys, and de novo searches were conducted during the summers of 2002-2004. Surveyors searched for Karner blue and lupine within 3,966 ha in the Lower Peninsula, re-verified Karner blue presence at 79 previously known occurrences, discovered 43 new Karner blue occurrences, and documented 6 township records. In addition, surveyors located over 320 ha of previously unknown habitat. Habitat was also evaluated at sites and habitat parameters recorded. From this data, a statistical model was produced that predicts Karner blue presence within a site. The final model indicates that sites with <50% canopy closure, that are within 1000m of occupied habitat, and contain dense lupine in addition to diverse flowering plant species are of high quality for Karner blue. Managers can use this model with habitat data collected within sites they manage to determine current habitat quality and

prioritize management activities. Land managers were provided with the habitat model and maps of predicted suitable and known occupied habitats to aid in management and conservation decision-making.

Distribution and Abundance of Whip-poor-wills and Nighthawks in Michigan

Investigator: Barbara J. Barton and Michael J. Monfils Expected Completion: September 2007

Funding: MDNR, Wildlife Division

Cooperators: Ray Rustem, Michigan DNR; Ray Adams, Kalamazoo Nature Center.

We conducted surveys for Whip-poor-wills and Nighthawks in eastern Michigan during summer 2005. This was the first of a three-year project aimed at assessing the state-wide distribution, abundance, breeding status, and phenology of both species. Additional effort was targeted at evaluating the efficacy of broadcast call surveys in locating breeding Caprimulgids to improve future efforts. Four overnight surveys also were conducted to determine Whip-poor-will and Nighthawk calling behavior. Systematic roadside point counts using broadcast calls were conducted along 15 randomly selected Breeding Bird Survey routes. We heard 81 Whip-poor-wills and 70 Common Nighthawks during surveys in the northern Lower and Upper Peninsulas, primarily in upland coniferous forests and jack pine plantations. Neither species was observed in the southern Lower Peninsula. We assigned breeding status for Whip-poor-wills and Common Nighthawks in 70 Michigan Breeding Bird Atlas II survey blocks. Preliminary comparisons of the number of responses observed during equal length time periods occurring before and after broadcasts indicated that response to calls by either species did not increase after broadcasts. Average calling intensity and number of birds calling over time for both species appeared to be higher during full moon compared to quarter moon. Statewide surveys will be completed in 2007.

Distribution and Ecology of the Red-shouldered Hawk in Michigan

Investigator: David L. Cuthrell

Expected Completion: September 2007

Funding: MDNR, Forest, Mineral, and Fire Management

Cooperators: Arch Reeves, retired forester; Kevin Gardiner, Ray Rustem, MDNR Wildlife; numerous staff from MDNR Forest Management Division

The Red-shouldered Hawk (RSHA) is currently listed as a state threatened species in Michigan. From 1999-2005 the nesting behavior and productivity of 643 active RSHA territories were followed. Among these active territories, 413 active nests were located over the course of this study. Nest success rates among northern Michigan forest areas surveyed was high (67% successful). Nest success rates ranged from a high of 82% in 1999 to a low of 52% in 2004. Nest success rates for the study period by forest area ranged from a high of 80% for the Eastern UP to a low of 33% for the Western UP, although small sample sizes may explain the variability for these two forest areas. Reproductive rate from the nest site data combined for all forest areas between the years of 1999-2005 was 1.9 young per successful nest and 1.22 young per active nests. Nest predation was confirmed for 11% of occupied nests. The most frequent predator implicated was the Great Horned Owl. Over the next two years several RSHA nests will be monitored for territorial re-occupancy, nest site fidelity, nest success, brood size, and prey utilization. Habitat parameters will continue to be quantified and summarized for all nests.

Distribution and Status of the Hine's Emerald Dragonfly in Michigan

Investigator: David L. Cuthrell and Michael A. Kost Expected Completion: March 2006

Funding: US Fish and Wildlife, Section 6

Cooperators: Carrie Tansy, USFWS East Lansing Field Office; Matt Herbert, MDNR Wildlife; Steve Sjogren, US Forest Service, Hiawatha National Forest; Dr. Everett D. Cashatt, Illinois State Museum; Tim Vogt, Missouri Department of Natural Resources, and Mark O'Brien, University of Michigan

The Hine's emerald dragonfly (*Somatochlora hineana*) is one of North America's rarest dragonflies. To develop appropriate conservation and recovery efforts for the Hine's emerald dragonfly (HED), information on its current distribution, population status and viability is crucial. The major project objectives are to conduct surveys at known sites and new surveys within the historical range of the species to obtain current population status and distribution information needed to determine recovery, protection, and restoration priorities. Identify reproducing populations by documenting presence of aquatic nymphs and adult dragonflies. During the summers of 2004-05 we visited a total of 28 sites, 8 of which contained HED. We focused on northern fen communities in the Northern Lower and Upper Peninsula during 2004 and prairie fens in the Southern Lower Peninsula in 2005. We documented Hine's emerald from three new sites, all from Mackinac County. In addition we have documented the first Michigan larval and exuvial collections. Vegetation work has helped to characterize known adult oviposition and patrolling sites. A final report will be produced for the project.

Eastern Massasauga Surveys in Support of Michigan's CCAA

Investigator: Yu Man Lee

Expected Completion: September 2004

Funding: U.S. Fish and Wildlife Service and Michigan Dept. of Natural Resources, Wildlife Division

Cooperators: Ray Rustem and Lori Sargent, (Michigan DNR); Dr. Bruce Kingsbury (Indiana-Purdue University, Ft. Wayne, IN)

Michigan is in the process of developing an Eastern Massasauga Candidate Conservation Agreement with Assurances (CCAA) with the U.S. Fish and Wildlife Service. The goal of the CCAA is to conserve massasaugas by removing or minimizing threats to core populations on protected lands (i.e., lands publicly-owned or set aside for long-term preservation). Extensive surveys and collection of massasauga reports were conducted from 2001-2004 to identify core populations for protection and to gather baseline data on the species' current status and distribution. Surveys were conducted at over 175 locations associated with 72 protected properties and 28 private properties in 46 counties. These included previously known sites as well as *de novo* sites with potential for the species. In 2004, repeated surveys at eight sites also were conducted to assess relative abundance and viability. Massasaugas observed at these sites were captured and marked, and blood and tissue samples were collected for genetic analysis. Surveys and reports identified at least 79 extant sites in 27 counties including 26 new occurrences, 1 new county record and reconfirmation of 52 known sites. These are associated with 38 protected properties and 23 private properties. However, the long-term viability of most populations remains unknown at this time.

Effects of Wetland Isolation Via Dike Construction on Avian Communities Using Great Lakes Coastal Wetlands

Investigator: Michael J. Monfils and Patrick W. Brown Expected Completion: December 2007

Funding: Michigan Dept. of Natural Resources, Wildlife Division, and U.S. Fish and Wildlife Service, Upper Mississippi River and Great Lakes Region Joint Venture

Cooperators: Ernie Kafcas, John Schafer, Barb Avers, Don Avers, and Tim Gierman (Michigan DNR); Greg Soulliere (U.S. Fish and Wildlife Service)

The value of impounded coastal wetlands to birds has been questioned due to potential detrimental impacts caused to wetland functioning and monetary costs. Research is needed to better understand the value of these wetlands to birds so that effective management plans can be developed. In 2005 we began investigating the effects of wetland isolation through dike construction on avian communities using Great Lakes coastal wetlands. Our objectives are to 1) compare bird use of wetland vegetation zones present at diked and nearby undiked wetlands, 2) gather site-specific and landscape level information on the vegetative zones found in and around diked and undiked wetlands, and 3) collect data on the physical and chemical environment in diked and undiked wetlands. We conducted surveys for migrant waterfowl, waterfowl broods, breeding wetland birds and nests, and migrant shorebirds at several sites on the St. Clair River delta and Saginaw Bay. We also gathered information on habitat conditions and basic water chemistry. Data collection and analysis will continue through 2007.

Grassland Bird Surveys in Michigan

Investigator: Julie M. Gibson and David L. Cuthrell

Expected Completion: September 2007

Funding: MDNR Wildlife

Cooperators: Raymond Adams, Kalamazoo Nature Center; Ray Rustem, MDNR Wildlife Division.

The original Michigan Breeding Bird Atlas project spanned the years from 1983 to 1988, and the primary goal of the project was to map the distribution of each bird species that breeds in Michigan (McPeck and Adams 1991). Information gathered during the first atlas project pointed to dramatic declines among some species guilds, including grassland birds. In addition to this apparent decline, information is lacking on the distribution, abundance, breeding phenology, and habitat use of grassland birds. In 2004 the Michigan Natural Features Inventory (MNFI) proposed to conduct systematic surveys for grassland birds to provide improved data for the MBBA II. A total of 175 bird surveys were conducted during the 2005 field season. MNFI staff conducted 131 surveys and the Kalamazoo Nature Center completed an additional 44 surveys. In addition, 40 incidental species observations were noted on federal, public, and private land, which contained select Michigan Species of Greatest Conservation Need. Fifty sites contained state listed grassland bird species, including Dickcissel (*Spiza americana*), Henslow's Sparrow (*Ammodramus henslowii*), Grasshopper Sparrow (*Ammodramus savannarum*), Northern Harrier (*Circus cyaneus*), and Sharp-tailed Grouse (*Tympanuchus phasianellus*).

Learning to Live with the Eastern Massasauga

Investigator: Yu Man Lee and Daria A. Hyde

Expected Completion: June 2005

Funding: U.S. Environmental Protection Agency, Office of Environmental Education

Cooperators: Diane Berger (USEPA); Rebecca Christoffel and Dr. Shawn Riley (Michigan State University); Andy Snider (Detroit Zoo); Bob Johnson and Andrew Lentini (Toronto Zoo); Ray Rustem, Lori Sargent, Julie Oakes, Ray Fahlsing, Tom Goniea, Cara Boucher and Rich Hausler (Michigan DNR); David Moilanen (Huron-Clinton Metropolitan Authority); Dr. Bruce Kingsbury and Joe Sage (Indiana-Purdue University, Ft. Wayne, IN)

The purpose of this project was to develop and initiate a public education and outreach program on the eastern massasauga rattlesnake in southeast Michigan. The ultimate goal was to provide people with the factual information, resources and skills to make informed decisions about how to safely co-exist with the massasauga. Almost 200 targeted professional audiences and private landowners within the project area were identified. Their perceptions and attitudes toward the eastern massasauga and snakes in general were assessed through interviews and a mail survey. A number of massasauga-related education and outreach materials were developed and/or distributed. These include a poster, brochures, handouts, a

presentation and a web site that provide information on identification, biology and ecology of the massasauga and look-alike snakes in Michigan, avoidance and treatment of snake bites, land management recommendations, and resources for additional information. Twenty-four educational or training workshops on the massasauga were conducted in 2004 and 2005 which were attended by over 200 natural resource professionals and educators and over 500 landowners and general public. A volunteer snake responder network and a massasauga response protocol also were developed. Newsletter articles and a press packet were developed and distributed to promote balanced, fact-based media coverage.

Monitoring Eastern Fox Snakes in Response to Habitat Restoration

Investigator: Yu Man Lee

Expected Completion: September 2005

Funding: Michigan Department of Natural Resources, Parks and Recreation Division

Cooperators: Ray Fahlsing, Glenn Palmgren, Bob Clancy and Sterling State Park staff (Michigan DNR); Dr. Bruce Kingsbury (Indiana-Purdue University, Ft. Wayne, IN)

In 2003, we initiated a monitoring program for the state threatened eastern fox snake in areas undergoing ecological restoration at Sterling State Park in Monroe County in southeast Michigan. The goal of this project was to collect information on fox snake relative abundance and habitat use within the park to assess potential impacts of the habitat restoration efforts. Surveys were conducted from 2003-2005 in all nine management units within the park including six units that have been targeted for habitat restoration. Mark-recapture surveys, radio-telemetry and collection of blood and tissue samples for future genetic analysis also were conducted. To date, 24 fox snake observations consisting of 22 individual snakes and 2 recaptures have been documented. However, only 11 observations were documented during repeated monitoring surveys, consisting of four snakes found in 2003 prior to/during initiation of restoration activities, seven in 2004, and none in 2005. Fox snakes were found in four management units of which three have undergone habitat restoration. Small sample sizes and limited pre-treatment data make it difficult to assess impacts of recent restoration activities on fox snake abundance, although use of particular management units may have been impacted. Data collection and analysis will continue until 2007.

Smallmouth Salamander (*Ambystoma texanum*) Surveys in Southern Michigan

Investigator: Peter B. Pearman and Yu Man Lee

Expected Completion: September 2005

Funding: Michigan Department of Natural Resources, Wildlife Division

Cooperators: Ray Rustem (Michigan DNR)

Surveys for the state threatened smallmouth salamander (*Ambystoma texanum*) were conducted in 2005 obtain information on its current status and distribution in Michigan. Surveys were conducted at a subset of sites at which this species had been previously documented as well as *de novo* sites with potential for the species. A habitat model was developed to help identify potential survey sites. Landowner contact was conducted to obtain permission to survey sites on privately-owned lands. Tail clippings were collected from all salamanders that appeared to be smallmouth salamanders or hybrids of this species for future genetic analysis. Smallmouth salamanders and hybrids of this species were found in only four wetlands associated with one previously known site and two new sites in Hillsdale County. Only female salamanders which can be true or hybrid smallmouth salamanders were found in one wetland and will require genetic analysis to confirm species identification. Additional surveys, genetic analysis and research to develop genetic markers to accurately identify individuals of this species are warranted.

State Threatened and Endangered Species List Review

Investigator: Peter B. Pearman, David L. Cuthrell, and Michael R. Penskar

Expected Completion: April 2005

Funding: MDNR, Wildlife Division

Cooperators: Ray Rustem, Todd Hogrefe, and Matthew Herbert, Michigan DNR and many individuals that comprised the technical committees.

The Natural Resources and Environmental Protection Act (Act 451 of 1994), Part 365, Item 324.36503, stipulates that “The department shall conduct a review of the state list of endangered and threatened species within not more than two years after its effective date and every two years thereafter, and may amend the list by appropriate additions or deletions pursuant to Act No. 306 of the Public Acts of 1969. MNFI facilitated the review by working with DNR staff to assemble the several state Technical Committees (plants, birds, fishes, insects, mammals, mollusks, reptiles and amphibians); organize and prepare materials for committee members to reference and review (e.g. previous recommendations and background data), and finally, facilitate the systematic review of the state special plant and animal lists. In addition, MNFI helped organize and conduct Technical Committee meetings as appropriate. MNFI then assisted in the compilation of all recommendations in collaboration with the respective committee chairs, including preparation of the rationale for recommended listing changes and additions. A report detailing each committee’s set of recommendations was provided via the committee chair or MNFI representative.

Surveys, Assessing Impacts of Management, and Conservation Plans for Mitchell’s Satyr.

Investigators: David L. Cuthrell, Daria A. Hyde and Barbara J. Barton

Expected Completion: arch 2007

Funding: U.S. Fish and Wildlife Service, Region 3, Section 6, Endangered Species Grant

Cooperators: MDNR Wildlife Division

During FY 2003 and FY 2004, we contacted 60 landowners and conducted multiple visits to survey and monitor 25 extant Mitchell’s satyr sites as well as several potential sites in southern Michigan. One new population was confirmed. We also conducted surveys at four historical sites but did not reconfirm the satyr. We recorded all sightings of the Mitchell’s satyr as well as other rare plant and animal species during surveys. We initiated monitoring of five occupied sites to better document the impacts of management activities. These included mark-release recapture studies and oviposition studies to learn more about the population ecology of the satyr as well as an enclosure study to determine larval survival after a prescribed burn. We conducted spring and fall sampling at a *Galerucella* release site to document effectiveness of this beetle in controlling purple loosestrife. We also conducted timed-meander surveys in newly created corridors and openings at a site to determine colonization by satyrs. Two site conservation plans have been completed which will guide management activities at these sites. Data from 2004 has been transcribe, analyzed and entered into the database, while 2005 data is pending.

Surveys to Assess the Status of the Copperbelly Water Snake

Investigator: Yu Man Lee

Expected Completion: September 2006

Funding: U.S. Fish and Wildlife Service and Michigan Dept. of Natural Resources, Wildlife Division

Cooperators: Dr. Bruce Kingsbury and Omar Attum (Indiana-Purdue University, Ft. Wayne, IN); Todd Hogrefe (Michigan DNR); and Carrie Tansy (USFWS)

The northern population of the copperbelly water snake is listed as federally threatened and state endangered in Michigan, Ohio and Indiana which comprise the species' range. Although this species has been afforded legal protection, the status and long-term viability of the northern copperbelly water snake population remain uncertain. Surveys and research conducted from 2001-2003 documented this species at only three habitat complexes in Michigan and Ohio. The purpose of this project is to continue efforts to determine the northern copperbelly water snake's current status, distribution and habitat needs. Surveys in 2004 and 2005 focused on monitoring and assessing the status and extent of the three extant copperbelly populations in Michigan and Ohio. In 2004, surveys were conducted only in Michigan. These surveys resulted in only 24 copperbelly water snake observations at the three extant sites with 7-9 observations per site. Survey results from 2005 need to be further analyzed and summarized. In general, fewer copperbellies were observed in 2004 and 2005 than had been documented in 2001-2003. Habitat characterization of known copperbelly sites and development of site-specific recommendations for habitat management and/or restoration also were conducted. Monitoring of extant populations and surveys to document additional populations will continue in 2006.

The Identification of Critical Nesting Habitat for Wetland Birds in Michigan

Investigator: David L. Cuthrell and Michael J. Monfils Expected Completion: March 2007
Funding: DEQ Coastal Zone Management
Cooperators: John Legge, The Nature Conservancy.

The purpose of this project is to identify the most critical sites in Michigan for the continued protection of wetland birds. Many projects (MNFI Great Lakes Marsh Work, Great Lakes Marsh Monitoring Program, MSU graduate studies, Important Bird Areas Programs, and the Michigan Breeding Bird Atlas Project) have already begun to study wetland birds in Michigan. Most, however, have been limited in scope or have answered specific research questions, therefore lacking the state-wide perspective needed to identify and potentially prioritize these critical wetlands. From our 2003-04 field work, a total of 129 element occurrences were either updated or newly transcribed. Of these, 78 were updated occurrences and 49 were either new occurrences or transcribed for the very first time. The data mining process was used to systematically examine all natural features information recorded along the Great Lakes shorelines of Michigan, resulting in the digitizing of 227 bird occurrences. Of these, 178 were updated element occurrences and 49 were newly transcribed. Results from 2005 are still being summarized. In addition, we have one more year of field work. A final report will be produced upon completion of this project.

Turtle Use and Mortality Along US-31 Crossing of the Muskegon River

Investigator: Yu Man Lee Expected Completion: September 2006
Funding: Michigan Department of Transportation (MDOT), Bureau of Transportation Planning, Environmental Section
Cooperators: Richard Wolinski (MDOT); Richard O'Neal (Michigan DNR)

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. Road mortality can significantly impact turtle populations by reducing numbers of reproductive adults, particularly gravid or nesting females, and causing skewed sex ratios which can lead to population decline and extirpation. The purpose of this project is to obtain baseline data on turtle use and mortality along this 1.6-mile stretch of US-31 to guide development of effective conservation measures. We conducted surveys for turtle mortalities, live turtles and turtle nests during the summer of 2005. A total of 135

mortalities of 5 turtle species were recorded during 18 survey visits to the study area, resulting in an average rate of 7.5 turtle mortalities per visit or day. These included 72 painted turtles, 50 common snapping turtles, 6 state special concern wood turtles, 3 state special concern Blanding's turtles and 1 state special concern eastern box turtle. A live individual of an additional turtle species, the common map turtle, also was found during surveys. A total of 303 destroyed turtle nests and 132 mortalities of other animal species also were documented. Surveys will continue in 2006.

Woodland Owl Surveys in Support of the Michigan Breeding Bird Atlas II Project

Investigator: Michael J. Monfils

Expected Completion: September 2006

Funding: Michigan Department of Natural Resources, Wildlife Division

Cooperators: Ray Rustem (Michigan DNR); Ray Adams (Kalamazoo Nature Center)

We conducted surveys in 2004 and 2005 for forest-nesting owl species as part of a three-year effort aimed at providing improved data for the Michigan Breeding Bird Atlas II project. The objectives of this project are to gather data on the relative abundance and distribution of woodland owls in Michigan, evaluate the effectiveness of roadside broadcast-call surveys in locating breeding owls, and gather information on the landscape-level habitat use of forest-nesting owls. We conducted point counts along Breeding Bird Survey routes that were spaced at approximately one-mile intervals. Calls of potential forest-nesting owl species were broadcast at each point. In 2004 we documented 456 owls, consisting of 157 Eastern Screech-Owls, 116 Great Horned Owls, 143 Barred Owls, five Long-eared Owls, and 35 Northern Saw-whet Owls. We recorded 634 owl observations in 2005, which consisted of 245 Eastern Screech-Owls, 111 Great Horned Owls, 234 Barred Owls, four Long-eared Owls, and 40 Northern Saw-whet Owls. Eastern Screech-Owl and Great Horned Owl were most common in the southern Lower Peninsula, while Barred Owl and Northern Saw-whet Owl were more abundant in the northern Lower Peninsula and Upper Peninsula. All but one of the Long-eared Owls was observed in the Upper Peninsula.

SCHOLARLY ACTIVITIES

Scientific Publications

Albert, D. A. 2004. **Between Land and Lake: Michigan's Great Lake Coastal Wetlands.** MSUE bulletin E2902, Michigan Natural Features Inventory, Lansing, MI.

Albert, D. A., and L. Simonson. 2004. **Coastal wetland inventory of the Great Lakes region** (GIS coverage of entire U.S. Great Lakes: www.glc.org/wtlands/inventory.html), Great Lakes Consortium, Great Lakes Commission, Ann Arbor, MI.

Albert, D. A., Tepley, A. J., and L. D. Minc. 2005. **Plants as indicators for Lake Michigan's Great Lakes coastal drowned river wetland health.** In Thomas P. Simon and Paul M. Stewart (Eds.), *Coastal Wetlands of the Laurentian Great Lakes: Heath, Habitat, and Indicators*, Authorhouse.

Albert, D. A., Wilcox, D. A., Ingram, J. W., and T. A. Thompson. 2005. **Hydrogeomorphic classification for Great Lakes coastal wetlands.** *Journal of Great Lakes Research*. 31(Supplement 1): 129-146.

Albert, D.A. 2005. **The Impacts of Various Types of Vegetation Removal on Great Lakes Coastal Wetlands of Saginaw Bay and Grand Traverse Bay.** Report for the Michigan Dept. of Environmental Quality and National Ocean and Atmospheric Administration. Michigan Natural Features Inventory report number 2005-16. 38pp.

- Albert, D.A. and A.J. Tepley. 2005. **Development of Bioassessment Procedures for Non-Forested Depressional Wetlands in Michigan.** Report for the Michigan Dept. of Environmental Quality and EPA Grant Number 03-WL-07. Michigan Natural Features Inventory report number 2005-09. 108pp.
- Albert, D.A. and L.D. Minc. 2004. **Plants as regional indicators of Great Lakes coastal wetland health.** Aquatic Ecosystem Health & Management Vol. 7 (2): 233-247.
- Badra, P. J. 2004. **Surveys for Freshwater Mussels (Unionidae) in the Bean Creek Watershed, Hillsdale and Lenawee Counties, Michigan.** Report for the Mackinac Chapter of the Sierra Club. Michigan Natural Features Inventory report number 2004-19. 8pp.
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Scientific Presentations

- 2/16/04 Adventures of a Michigan botanist and an overview of Coastal Plain Marshes. Requested by Becky Csia and presented to the SW Mich Chapter of the Mich Bot Club by M.Penskar.
- 2/25/04 Ecoregional planning, tools and data. Requested by Dennis Propst and presented to Parks and Rec Policy class by Edward Schools and Doug Pearsall.
- 2/26/04 MNFI tools for conservation and land use planning. Requested by Kelly Millenbah and presented to GIS class by E. Schools.
- 3/3/04 Lions, Tigers and Snakes - Oh My! Recent Surveys and Outreach Efforts for Rare Snakes in Michigan (specifically focused on massasaugas). Presented to MSUE Fish & Wildlife AoE by Y.Lee.
- 3/3/04 MNFI GIS Capabilities. Presented to the MSUE Fish & Wildlife AOE by E.Schools.
- 3/3/04 Ecology and Conservation of Red-shouldered Hawks in Michigan. Requested by the Capital Area Audubon Society and presented to members and the public by D.Cuthrell.
- 3/19/04 A Life in the Day of a Michigan Botanist. Requested by Burton Barnes and presented to the Advanced Forest ecology seminar, U-M SNRE, by M. Penskar.
- 3/25/04 Karner blue surveys/methods. Requested by John Lerg and presented to Partners in KBB HCP by J. Fettingner.

- 4/15/04 Life History and Conservation of Mitchell's Satyr and Associated Fen Species presented to the Muskegon Nature Club by D.Hyde.
- 4/19/04 Incorporating natural features into landuse planning, and the MDNR LIP program. Requested by Michelle West and presented to Community members in Johnson Creek Protection Group by R.O'Connor.
- 4/23/04 MNFI overview. Requested by Linda Hegstrom and presented to Michigan Natural Resources Trust Fund grant administrators by E.Schools.
- 5/1/04 Spring Flora (Field trip 1); U-M Adult Education Class for Matthaei Botanical Gardens. Requested by Ellen Weatherbee and presented to Oakland Co. road commission, consulting firms, DEQ staff and citizens by M.Penskar.
- 5/2/04 Wildflower hike; Waterloo Rec Area. Requested by Ebersole Nature Center and presented by M.Penskar.
- 5/8/04 A Life in the Day of a Michigan Botanist. Requested by Don Garling and presented to the Michigan Orchid Society by M.Penskar.
- 5/15/04 Spring Flora (Field trip 2); U-M Adult Education Class for Matthaei Botanical Gardens. Requested by Ellen Weatherbee and presented to Oakland Co. road commission, consulting firms, DEQ staff and citizens by M.Penskar.
- 5/20/04 Endangered Species. Requested by Peggy Dunn and presented to Central Elementary second grade by E.Schools.
- 5/20/04 Plenary Presentation: Great Lakes coastal wetlands. Presented for the Michigan Department of Environmental Quality 25th Anniversary Wetlands Conference by D.Albert.
- 5/22/04 Living with the Eastern Massasauga Rattlesnake. Requested by Matthaei Botanical Gardens and presented to the general public and volunteers by D.Hyde.
- 6/1/04 Provided interview on lakeplain prairies for Detroit News by D.Albert.
- 6/1/04 Provided recorded interview of "Between Land and Lake" for Michigan Public Radio by D.Albert.
- 7/12/04 Plenary Presentation: An overview of the forested ecosystems of the northern Lake States. Presented at the North American Forest Biology Workshop at Michigan Technical University, Houghton, MI by D.Albert.
- 7/18/04 Nature Hike for Washtenaw Land Trust. Requested by Suzanne Brucker Heiney and presented to Washtenaw Land Trust by M.Kost.
- 7/22/04 Plants as indicators of ecological diversity and site condition within Great Lakes coastal wetlands. Presented at the 25th Annual Society of Wetland Scientists Conference. Seattle, WA by D.Albert.
- 7/31/04 The Potential for Using Rare Species as Environmental Indicators. Presented to Conference attendees, multiple affiliations by M.Penskar.
- 8/1/04 Eastern Massasauga Surveys in Michigan - Poster Presentation to Conference attendees, multiple affiliations by Y.Lee.
- 8/20/04 Invasive species overview and walking tour of the MacCready Preserve presented to primarily Jackson County citizens by M.Penskar.
- 8/25/04 Natural History of a Cedar Swamp. Requested by Sherri Laier and presented to MNA Members by P. Higman.
- 9/11/04 Guided ecosystem and Wildflower hike in Donald E. Hart Plant Preserve-rich conifer swamp. Presented to Michigan Nature Association at semi-annual membership meeting by P. Higman.
- 9/20/04 MNFI GIS models. Requested by Judy Olson and presented to graduate seminar by E.Schools.
- 9/22/04 Karner blue surveys/methods. Requested by John Lerg and presented to the Partners in KBB HCP by J.Fettinger.
- 9/24/04 Importance of fringing Great Lakes coastal wetlands and effects of coastal manipulation. Presented at the 23rd International Submerged Lands Management Conference in Halifax, Nova Scotia by D.Albert.

- 9/30/04 Newaygo County's rare plants, animals, and natural features. Requested by Rhoda DeJouge and presented to Newaygo Co. citizens by J.Fettinger.
- 10/7/04 Hydrogeomorphic classification of Great Lakes wetlands presented at the State of the Lakes Ecosystem Conference (SOLEC – USEPA and Environment Canada), Toronto, Ontario by D.Albert.
- 10/14/04 Panelist for workshop session on Landowner Contact/Land Protection entitled "A Skill Building Workshop: Emerging Issues in Land Protection; Enhancing Possibilities and Overcoming Perils. Requested by Judy Faulkner Dempsey, IL Nature Preserves Commission, and presented to Natural Areas Conference attendees by Y.Lee.
- 10/16/04 MNFI information. Requested by NEON/GLACEO by E.Schools.
- 10/25/04 The significance of Great Lakes islands: Results of a five year inventory. Requested by Philip Micklin and presented to the Audubon Society of Kalamazoo by J.Olson.
- 11/8/04 MNFI data. Requested by Chad Fizzel and presented to DEQ wetlands group by E.Schools.
- 11/18/04 Eastern Massasauga Rattlesnake Workshop and Outreach Initiative Development - Presentation by Y. Lee and Rebecca Christoffel, MSU F&W doctoral student, at the National Interpreters Workshop/ Annual Meeting of National Association of Interpreters.
- 11/23/04 MNFI presentation. Requested by Professor Gerhardus Schultink and presented to Resource Management & Planning class (RD 320) by J.Olson.
- 1/18/05 Developing a Conservation Strategy for the Eastern Massasauga in Michigan. Presented to the Biology of the Rattlesnakes Symposium attendees by Y.Lee.
- 1/18/05 The Eastern Massasauga (*Sistrurus c. catenatus*) in Michigan: Conservation through Education. Presented to Biology of the Rattlesnakes Symposium attendees by Y.Lee.
- 1/20/05 Summary of 2001-2004 Surveys for the Eastern Massasauga and Status Implications. Requested by Lori Sargent and presented to Michigan Eastern Massasauga Work Group by Y.Lee.
- 2/7/05 Ecosystem Management Education – What Does the Future Hold: Presentation to MDNR-Wildlife Division at Professional Development meeting in Shanty Creek, Michigan by P. Higman.
- 2/8/05 Prairie, Savanna, and Barrens Restoration: A Landscape Approach. Presented at MDNR Wildlife Division's training conference by R.O'Connor.
- 2/8/05 Going Native: The Invasive Plant Species Concern. Presentation to MDNR-Wildlife Division Professional Development meeting at Shanty Creek, Michigan, by P. Higman.
- 3/6/05 Using circa 1800s Vegetation for Natural Landscaping. Requested by Cherly Tolley and presented to Wildflower Association conference members by M.Kost.
- 3/21/05 Overview of MNFI. Requested by Paul Kindel and presented to Sierra Club members by E.Schools.
- 3/26/05 Eastern Massasauga Surveys and Status in Michigan. Requested by Frank Durbian and presented to University researchers and state and federal agency personnel at a workshop on the status of eastern massasauga populations in the Midwest by Y.Lee.
- 4/7/05 Conservation and ecology of the red-shouldered hawk in Michigan. Presented to the Audubon Society of Big Rapids by D.Cuthrell.
- 4/19/05 MNFI GIS. Requested by Kelly Millenbah and presented to FW 419 class by E.Schools.
- 4/26/05 MNFI. Requested by Dr. Paul Nickel and presented to RD 201 class by K.Korroch.
- 5/13/05 Using a Mobile GIS System to Map Invasive Species at Camp Grayling poster presentation at MSU sponsored Invasive Systems Symposium by P. Higman and E. Schools.
- 5/21/05 Ecology and Identification of Wild Flowers. Requested by Ebersole Nature Center and presented to Board Members, Teachers and students by P. Higman.
- 5/21/05 Guided ecosystem and wildflower hike in Sharon Hollow State Park requested by Ebersole Nature Center and presented by P. Higman.
- 5/22/05 MNFI data. Requested by Shawn Hagen and presented to Foresters by E.Schools.
- 5/26/05 Research Priorities for Rare Species and Critical Natural Communities and Habitats of Michigan's Coastal Areas: A Natural Heritage Program Perspective Requested by Emily Finnell and presented to attendees at U-M based conference for the International Assoc. for Great Lakes Env. Research by M.Penskar.

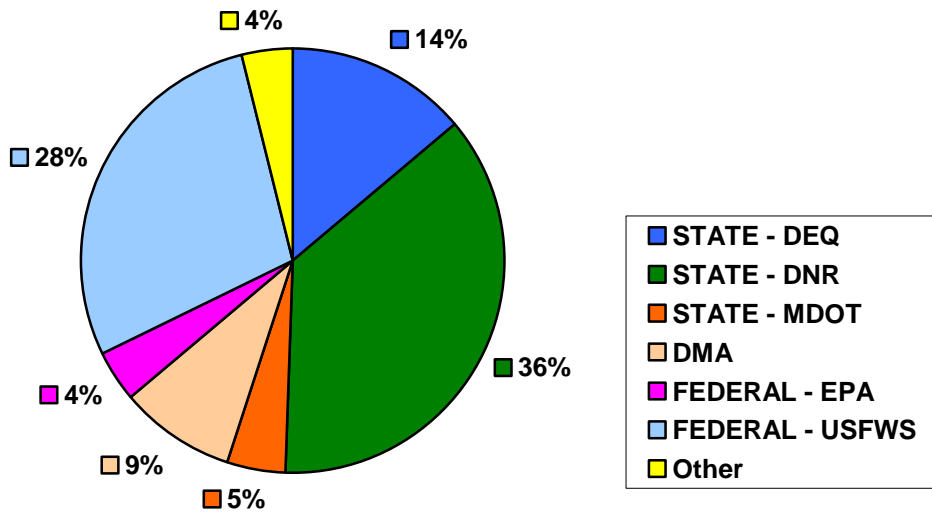
- 5/30/05 Natural Areas: What's Going On? Presentation to Michigan Botanical Club at Annual Spring Foray. Discussed the significance of Natural Areas, concept of representation, status of State Program and MDNR Planning, role of MNFI, and provided highlights from selected state Natural Areas by P. Higman.
- 5/31/05 Michigan Botanical Club. Requested by Kathleen Thomson and presented to Botany professionals and enthusiasts by P. Higman.
- 6/7/05 Rare Michigan Wetland Plants and Impacts to Critical and Rare Wetlands. Requested by Elaine Phol and presented to the Remediation and Redevelopment Division by M. Penskar.
- 8/1/05 Ecological Gardening: Presettlement Vegetation of Wayne County presented by P. Higman and S. Campbell.
- 9/1/05 Woodland Invasive Plant Species. Presented at a one day workshop for landowners in Howell, MI by P. Higman.
- 9/1/05 Invasive Species of Woodlots in southeast. Presented to Michigan Farm Radio interview for landowner field day by P. Higman.
- 9/9/05 Fire as an ecological process for maintaining biodiversity. Requested by John Lerg and presented to Michigan Prescribed Fire Council by M.Kost.
- 9/26/05 Great Lakes coastal wetlands and the effects of wetland isolation. Requested by Merritt Turetsky and presented to upper-level undergraduate students by M.Monfils.
- 10/1/05 Invasive Plant Species that Invade Southern Michigan Woodlands. Presented at MDNR Forest Stewardship Program-MSUE sponsored Landowner Field Day by P. Higman.
- 10/1/05 Ecological Foundations of Michigan: An Overview of a Conservation Stewardship Program Module. Presented at MSUE Annual Conference by P. Higman.
- 10/15/05 Fifty-two Years (1952-2004) of Band Recovery Data of Sharp-shinned Hawk (*Accipiter striatus*) at Cedar Grove Ornithological Station, Cedar Grove, Wisconsin USA. Presented at the Raptor Research Foundation Conference by J.Gibson.
- 10/19/05 Mobile GIS Technology Assist in the Conservation of the Federally Endangered Mitchell's Satyr Butterfly in Michigan. Presented at the Organizational Fish and Wildlife Information Managers Annual Meeting and Conference by D.Hyde.
- 12/13/05 Conservation of the Federally Endangered Mitchell's Satyr Butterfly in Michigan. Presented at the Midwest F&W conference by D.Hyde.
- 12/13/05 Michigan Grassland Bird Species Assemblages, Habitat Associations, and Priority Sites. Presented at Midwest F&W conference by J.Gibson
- 12/13/05 Factors affecting site occupancy and detectability of forest-nesting owls in Michigan. Presented at Midwest Fish and Wildlife Conference by M.Monfils.

Workshops:

- Training the trainers: Effects of management on Great Lakes coastal wetlands. Workshop presented to Michigan Seagrant and Michigan State University Extension in Bay City and Traverse City, MI, by D. Albert on August 23 and 27, 2004.
- MNFI, Biodiversity, and Logging; The Scoop in Northern Lower Michigan. Presentation by P. Higman at the EMSU Extension Logger Training Workshop in Mio, Michigan, on March 9, 2005. Provided ecological overview and information on Threatened and Endangered species as part of a private logger training workshop in the Northern Lower Peninsula, sponsored by the Sustainable Forestry Initiative.
- An overview of the State and Federal Endangered Species Act, MNFI, and Upper Peninsula Forests provided by P. Higman at the workshop for the Forestland Group, Professional Foresters, held in Munising, Michigan, on June 23-24, 2005, in tandem with a presentation on MNFI data and GIS applications by E. Schools. Assisted with field trip to identify rare plant species and indicator species associated with the Kotar Habitat Classification System.

- Riparian Management Zone Workshop for Michigan Department of Natural Resources (MDNR) staff in NW Lower Peninsula presented by P. Higman, J. Cohen, Y. Lee and R. Goforth of Michigan Natural Features Inventory, and Rich Hausler of MDNR- Forest, Mineral & Fire Mgmt. Division (MDNR-FMFM), Andy Nuhfer of MDNR-Fisheries Division, and Rex Ainslie of MDNR-Wildlife Division.
- Riparian Management Zone Workshop for MDNR staff in NE Lower Peninsula presented by P. Higman, J. Cohen, Y. Lee and R. Goforth of Michigan Natural Features Inventory, and Rich Hausler of MDNR- FMFM, Andy Nuhfer of MDNR-Fisheries Division, and Rex Ainslie of MDNR-Wildlife Division.
- Introduction to Michigan’s Biodiversity for MDNR staff in Western Upper Peninsula presented by P. Higman, E. Schools, M. Kost, R. Goforth, and J. Gehring of Michigan Natural Features Inventory and Kim Herman of MDNR-FMFM.
- Introduction to Michigan’s Biodiversity for MDNR staff in Eastern Upper Peninsula presented by P. Higman, E. Schools, M. Kost, R. Goforth, and J. Gehring of Michigan Natural Features Inventory and Kim Herman of MDNR-FMFM.
- Introduction to Michigan’s Biodiversity for MDNR staff in Northern Lower Peninsula presented by P. Higman, E. Schools, M. Kost, R. Goforth, and J. Gehring of Michigan Natural Features Inventory and Kim Herman of MDNR-FMFM.
- Introduction to Michigan’s Biodiversity for MDNR staff in Southern Lower Peninsula presented by P. Higman, E. Schools, M. Kost, R. Goforth, and J. Gehring of Michigan Natural Features Inventory and Kim Herman of MDNR-FMFM.
- Invasive Species Workshop for Forest Stewardship Plan Writers in the Upper Peninsula presented by P. Higman and R. O’Connor of Michigan Natural Features Inventory.
- Invasive Species Workshop for Forest Stewardship Plan Writers in Northern Lower Peninsula presented by P. Higman and R. O’Connor of Michigan Natural Features Inventory.
- Invasive Species Workshop for Forest Stewardship Plan Writers in Southern Lower Peninsula presented by P. Higman and R. O’Connor of Michigan Natural Features Inventory.
- Ecological Foundations Part A for Oakland County Conservation Steward Program presented by P. Higman of Michigan Natural Features Inventory.
- Ecological Foundations Part B for Oakland County Conservation Steward Program presented by P. Higman of Michigan Natural Features Inventory.
- Ecosystem Principles for Oakland County Conservation Steward Program presented by P. Higman of Michigan Natural Features Inventory.
- Michigan’s Grasslands for Oakland County Conservation Steward Program presented by P. Higman of Michigan Natural Features Inventory.
- Ecological Foundations for Livingston County Conservation Steward Program presented by P. Higman of Michigan Natural Features Inventory.
- Ecosystem Principles for Livingston County Conservation Steward Program presented by P. Higman of Michigan Natural Features Inventory.
- Michigan’s Grasslands for Livingston County Conservation Steward Program presented by P. Higman of Michigan Natural Features Inventory.
- Forest Biodiversity Module for 4-H Youth Leaders presented by P. Higman of Michigan Natural Features Inventory.
- Three part invasive species series with MNA and the Stewardship Network presented by P. Higman of Michigan Natural Features Inventory, Sherri Laier of Michigan Nature Association and David Mindell of PlantWise Consulting.
 - Part I. Identifying Native Communities, Native and Invasive Species
 - Part II. Site Assessment: What do I Manage for Here?
 - Part III. Control Strategies: Invasive Species Management

FY 2004 FUNDING SOURCES TOTAL \$1,968,641



FY 2005 FUNDING SOURCES TOTAL \$2,495,221

