Development of a Best Management Practices Manual to Conserve Wetland Herpetofauna in Michigan

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Why A BMP?

MI amphibian and reptile populations are declining

- Over 60% Species of Greatest Conservation Need (SGCN) Michigan Department of Natural Resources Wildlife Action Plan
 - Greatest impacts to herpetofauna are from habitat loss and fragmentation (from development) and poor land management





Wetland Herps...

- Are sensitive to environmental disturbance.
- Aquatic and terrestrial life cycles.
- Mid-level position in food webs.
- High degree of sensitivity to toxins and other environmental stressors.
- Bioaccumulators of toxins and contaminants.
- Many species are seasonally wetland dependent.
- Need a mosaic of different wetland types with intact upland habitat joining them.





Wetland Herps...

- Can be used as gauges of environmental health (bioindicators).
- Are often not specifically considered when determining the environmental impacts from development and management practices.







Herpetofauna in Michigan

18 species of Snakes
10 species of Turtles
2 species of Lizards
15 species of Frogs and Toads
14 species of Salamander and Newts





Herpetofauna in Michigan

18 species of Snakes

- 10 species of Turtles
- 2 species of Lizards
- 15 species of Frogs
- 14 species of Salamander and Newts
- MORE THAN HALF ARE SPECIES OF GREATEST CONSERVATION NEED !!!





Frog and Toad Status

Frog and Toad Species	State Rank	Wildlife Action Plan
American Toad		1 2 2 1 1
Fowler's Toad		SGCN
Green Frog		
Mink Frog	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	2 - and all
Bullfrog	and the second	Seller -
Pickerel Frog		SGCN
Leopard Frog		SGCN
Wood Frog	Same and	States M.
Cope's Gray Treefrog	Test all	Tr. Will
Eastern Gray Treefrog		1. J. J. M.
Blanchard's Cricket Frog	T	SGCN
Spring Peeper		June 1
Western Chorus Frog	Sum -	SGCN
Boreal Chorus Frog	SC	SGCN
Western Chorus Frog		



Salamander Status

Salamanders Species	State Rank	Wildlife Action Plan
Western Lesser Siren	SC	SGCN
Mudpuppy	Ser Bay	SGCN
Blue-spotted Salamander	22.2	SGCN
Unisexual Hybrids	N/R	
Spotted Salamander		SGCN
Marbled Salamander	Т	SGCN
Small-mouthed Salamander	E	SGCN
Eastern Tiger Salamander		SGCN
Red-spotted Newt	2000	a ser all
Central Newt	The local of the	to the parts
Four-toed Salamander	et and	SGCN
Red-backed Salamander		4.6.6.2.203
Dusky Salamander	N/R	
Two-lined Salamanders	N/R	



Lizard Status

Lizard Species	State Rank	Wildlife Action Plan
Five-lined Skink	1.5	
Six-lined Racerunner	Т	SGCN







Snake Status

Snakes	State Rank	Wildlife Action Plan	Snakes	State Rank	Wildlife Action Plan
Kirtland's Snake	E	SGCN	Eastern Smooth	JUL EN	11 28 2
Queen Snake	SC	SGCN	Green Snake		SGCN
Butler's Garter Snake		2-13-13-12 ×	Eastern Milk Snake	15475	12 2 2
Eastern Ribbon Snake	10 and	A CAR	Blue Racer	Sec. 1	SGCN
Eastern Garter Snake	6	1.000	Black Rat Snake	SC	SGCN
Copper-bellied Water	Same	and allerter	Western Fox Snake		SGCN
Snake*	E	SGCN	Eastern Fox Snake	T	SGCN
Northern Water Snake	Station of the		Eastern Hog-nosed		The first
Northern Brown Snake	12220	All Martin	Snake	1520	SGCN
Northern Red-bellied Snake			Eastern Massasauga Rattlesnake**	SC	SGCN
Northern Ring-necked Snake	17 Sec	SGCN		H	X
Eastern Smooth Green Snake		SGCN	Support		

* Federal Protected Status – Threatened

** Proposed for Federal Status



Turtle Status

Turtles Species	State Rank	Wildlife Action Plan
Common Snapping Turtle	atter the second	CHAR CARD
Common Musk Turtle	15-10-1250	al all and and
Western Painted Turtle	138-35	BAR DR.
Midland Painted Turtle		14-1-1-
Blanding's Turtle	SC	SGCN
Spotted Turtle	T	SGCN
Wood Turtle	SC	SGCN
Eastern Box Turtle	SC	SGCN
Red-eared Slider		
Common Map Turtle	8 1 5 3	
Eastern Spiny Soft-shell	Rolling	







How will the BMP Manual Help?

- Address threats to herp communities posed by development and landuse/management practices
- Provides alternative methods and techniques
 - Address timing of activates to minimize impacts MI herp Based on the best available science
 - Protect and conserve critical habitat and help keep common species common, stem the decline of imperiled species, and reducing the likelihood of species becoming listed as threatened or endangered

Target audience developers, environmental, planning and construction consultants, land managers, regulators, restoration practitioners, and those interested in protecting amphibians and reptiles in Michigan.



Development





- Current State of Herpetofuana in MI
- Overview of Natural Histories
- Threats
- Recommendations for Management, Development, Restoration, and Conservation
- Comprehensive Bibliography
- Anticipated publishing January 2014



Development

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1_ Introduction

Purpose and Intended Use ed This Manual

This manual was created for the Miclugan Department of Environmental Quality. (MDEQ) to provide a comprehensive guide of Best Management and Development. Practices (BMDPs) to help maintain the viability of native Michigan amphibian and reptile populations. This minimal addresses threats to herpesofiama communities posed by development and management practices and provides alternatives based on the best available stucion that facilitate the conservation and expansion of herpetofatina continuities. These BMDPs are deagned to guide land management, emaintenance, development, and conservation activities. This BMDP manual is a Michigan based guide that provides sitespecific management recommendations to regulators, agencies, land managers, consultants, developers, and catizers to protect and restore herpetofauna in Michigan.

BMDPs must be supported by scientifically sound information, and as such, must also be unonatored to assess the effectiveness of the BMDPs and revised to reflect new information. As they are assessed and new information heromes available, BMDPa will progress to improve protection for herpetofiuma and increase cost-effectiveness. This manual, while primarily targeted at specific ampliabian and reptile communities, also aligns with the ecowstein management approach as described in the Michigan DNR Wildlife Action Plan

(WAP) (Engle at al. 2005).



Spotted Turtle are a Threasened Species and a Species of (Harding 1997; Roe et al. 2003; Bell 2005; Moore and Constent Conservation Need in Michagari,

The creation of this minimal is part of the response to the need for communities at over 60% of Michigan herpeterfamil, as identified by the MDNR Wildlife Action Plan (Eagle et al. 2005) most of which are wetland dependant at some phase m their life. Habitat destruction, degradation, and fragmentation are the main factors for decline of some Amphibian and Reptile species in Michigan and the United States (Dodd et al. 2003; Marchand and Leventis 2004; Weyrouch and Grabb 2004). Decreases in water quality, habitat area, and connectivity coupled with annuive spenies, environmental contaminants, pathogens, and illegal collection pose a ognificant threat to many herpetofauna species in Michigan

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Problems Facing Herps in MI





Habitat Loss, Degradation, & Fragmentation

MI: 50% of wetlands lost increasing fragmentation.

- Connectivity is essential for viability. Results in:
 - increased mortality
 - reduced genetic diversity,
 - disrupted metapopulation structure
 - increased predation pressures
 - increased edge habitat
 - reduced habitat quality
 - reduced critical zones
 - invasive species colonization







Barriers: Seawall Impacts

Intended to reduce shoreline erosion, but prevent amphibians and reptiles from accessing upland habitat for basking, nesting, and foraging. Leads to reduced breeding success, greater competition for available resources, and reduced species richness.





Barriers: Erosion Control

Although important for reducing soil erosion and degradation to adjacent areas, erosion control measures can result in significant problems for herpetofauna including:

- Trapping animals in mesh resulting in death
- Creating wildlife barrier







Chemical Pollution

Urbanization, agriculture, & industry introduces

- acidification, heavy metals, salts, hydrocarbons, excess nutrients, pesticides, herbicides, & pharmaceuticals
- highly permeable skin + high sensitivity + extensive contact with water = weakened immune system, mortality, deformations, altered behavior, bioaccumulation
 Impacts entire ecosystem/food web – herps are indicators





Invasive Species

Phragmites: prevents movement, thermoregulation, nesting opportunities, and food sources. Results in habitat loss and reduction in species richness.

- Goldfish: increases competition for food and resources, reduce water quality for native herpetofauna species & feed on eggs and larvae of amphibians.
- Feral swine: create unsuitable wetland conditions for herps by digging, rooting, and wallowing. Also consume snakes and eat turtle eggs in large numbers.



http://www.fishingfury.com/wp-content/uploads/2011/07/frog-ride.jpg



Subsidized Predation

As habitat becomes increasingly urbanized predator accessibility and numbers increase

This leads to increased predation of herps (particularly turtle eggs). Reduction in overall population size, viability and skewed age class and sex ratios.



The usual outcome





Roads: Curb and Gutter Impacts

- Barrier: reduces ability to travel across roads resulting in greater road mortality
- Altered wetland hydrology: Gutters redirect surface water flow away from wetlands
 Pollution: discharged water is often
 - contaminated with hydrocarbons, heavy metals and salt







Road Mortality

Habitat loss & fragmentation: increases the risk to herps as they try to access seasonal habitat. They also serve as sinks for snakes seeking warm basking spots Predation: increase predation by

providing a corridor for nest predators







Climate Change

- Models show shifts in plant communities and wetland conditions in Michigan.
- May result in changes in the development, spatial distribution, abundance and species interactions of herps.
- Amphibians call and breed earlier in years with warmer temperatures.
- May affect reptile timing and nesting success.



Hayoe et al. 2010, Hellmann et al. 2010, Prasad et al. 2010, Nelson et al 2011Pounds et al., 1999

Altered Hydrology

Reasons:

- Undersized or too few culverts/pipes
- Draining or tiling
 Removals for irrigation & manufacturing
- Impermeable surfaces prevent recharge & increase runoff & erosion
- Stream channelization





Altered Hydrology

Impacts:

- Altered hydroperiod, habitat & connectivity loss, colonization of invasives
- Reduced habitat suitability & breeding and recruitment success
 - Changes in the wetland community dynamic and structure.
 - Changes in herp community composition





Lake Level Alteration Impacts

Fall drawdowns:

- significant mortality of hibernating amphibians and turtles.
- exposes shoreline and removes the insulating layer of ice.

Adding water in early spring:

 may drown overwintering herpetofauna.

Adding water to a shallow wetland may allow for fish to become established.





Aquatic Nuisance Control Impacts

Aquatic Weeds: Removal of aquatic vegetation removes critical habitat for larval amphibians, hatchling turtles.

- Reduces available prey items for multiple species.
- Direct mortality to herpetofauna.





Aquatic Nuisance Control Impacts

- Lampreys: Lampricide application can impact herp communities.
- Rotenone used for fish studies and eradication.
- Chemical developed to kill nuisance mollusks.
- Herbicides used to control unwanted aquatic vegetation.
- Documented non-target mortality and bioaccumulation impacts to aquatic herps.



www.michigan.gov



Controlled & Prescribed Burns

- Most MI herps are not adapted to frequent & intense burns.
- Limited opportunity for connectivity and migration to restored habitats.
- Vulnerable & rare species can be negatively impacted from burns.
- Growing body of evidence that it may also threaten resident herp populations.









Other Threats

- Persecution
- Disease
- Illegal Collection Insufficient Assessment







Solutions: Techniques & Strategies for Land Management, Development, & Conservation Planning & Design



Plan to Maintain Structure & Function at the Ecosystem Level





Minimize Impacts to Herps

- First assess the herp community present!!!
 Prioritize areas to protect/avoid critical areas.
 Preserve habitat to maintain connectivity and mosaic
 - character.
 - Weigh methods/techniques and consider alternatives.
- Time action to avoid herps and minimize impacts based on species' natural history and best available science.


Maintaining Landscapes

- Mow, burn, herbicide? Which will reduce fragmentation and habitat degradation?
- Avoid impacting an ample buffer around wetlands.
- If mowing, mow after turtle nesting season & avoid peak foraging & migration times.
- Set mower decks high (>6") to avoid snakes and frogs or low (<2") to discourage movement of herps into

mowed areas.





Managing Through Burning

- Inventory before burning to understand species using the site.
- Carefully consider potential impacts to vulnerable native animals populations and whether the actions can be modified or timed to reduce or eliminate mortality.
- Burn only when seasonally appropriate.
- Avoid burning brush piles and provide burn breaks around logs as these provide refugia in a fire.







Planning to Avoid & Reduce Fragmentation







Increase Connectivity & Decrease Road Mortality



Tunnels and fence systems can alleviate some threats from roads







Increase Connectivity & Decrease Road Mortality



After 220 millions years of success, human activities now threaten over two-thirds of all turtle species. It's time to give turtles a "brake"!!





Mitigate Runoff Pollution & Wetland Degradation

www.mvpaverdrivewav.com

- Vegetated buffer
- Adequate buffer widths
- Stop it at the source: Rain gardens, bioswales, permeable pavement, green roofs, detention basins
- Increased vegetation canopy can help to increase herp habitat & wetland water quality



Invasives Control

If chemical treatment is necessary, target areas without amphibians and reptiles or time application to minimize negative impacts.

Use alternatives or know the true impacts prior to use.



Wetland Mitigation & Restoration

Design using shallow gradients (1:15 to 1:20) to support a variety of herpetofauna and their prey items.

Create microtopography to provide a variety of niches with unique hydroperiods.

Focus on vegetative diversity to **drive** wildlife diversity.

Consider reestablisment of previously extirpated species and translocation from sites slated for destruction.



Topograhpy

- Excavate to change macrotopography and microtopography to create habitat suitable for a variety of herps
- Connect channels and change water levels
- Create habitat mounds, denning sites, nesting areas, greater plant diversity



Connecting channels













Create Habitat Features: Refugia/Hibernacula







Basking & Escape Structures



Turtle Hibernaculum



Turtle Nesting Site





Conservation Strategy: Headstarting



Thoughtfully designed and properly overseen captive hatching and headstarting programs can increase the success of rare and declining herps.





Control Subsidized Predators

Use aggressive control techniques to manage subsidized predator populations
Educate the public about ecological and human safety concerns







Public Awareness



Simple strategies, such as placing signs, can inform the public about local species conservation needs MI Herp Atlas can bring information to the public, and the public can contribute information www.miherpatlas.org



Future Needs and Goals

- As data continues to be collected, BMP's will be updated to reflect current science
- Improved species protection and enforcement.
- Improved collaboration and data sharing.
- Greater understanding of species habitat use and needs
- Communication among various groups on historic, current, and future projects.
- Contributions by EVERYONE to build on species data for MI herps and resolve NUMEROUS data gaps statewide on amphibian and reptile species, distribution, viability, and stressors.
 - Its not what we know about MI herps that is alarming, it is what we don't know that should scare us!





Michigan Herp Atlas Online www.miherpatlas.org

Michigan Herp Data Entry Framework

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Recent Records

Home

The BMP is a Community Effort

- A collaboration for herp conservation and best management.
- Contributions are welcome and encouraged.
- Suggestions for improving or adding sections
- Photos for highlighting various BMP components.
- Examples of herp friendly management and development techniques.





Questions?



Thank You!!!





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