

## ALL WETLANDS HABITAT NARRATIVE

The results below are the aggregated data from all wetland sub-habitat responses.

### Habitat description

Wetlands include: Areas shallowly flooded temporarily or permanently to cover the base of plants but not prolonged inundation of the entire plant; Areas temporarily flooded often supporting aquatic plants and animals; Areas temporarily or permanently flooded with woody vegetation taller than 6 meters; Areas of usually shallow wetlands dominated by non-woody plants such as cattail, reeds or rushes; Areas with moist non-vegetated soil, often produced in shallow wetlands by advance and retreat of water levels; Areas permanently flooded and often supporting aquatic plants and animals; and Areas flooded temporarily or permanently with woody vegetation shorter than 6 meters.

### Problems affecting species and habitats

#### Species threats

Respondents ranked the following threats to wildlife in all wetland habitats in Indiana:

Rank	Threats to wildlife in all wetland habitats
1	Habitat loss (breeding range)
2	Habitat loss (feeding/foraging areas)
3	Dependence on irregular resources (cyclical annual variations) (e.g., food, water, habitat limited due to annual variations in availability)
4	Near limits of natural geographic range
5	Degradation of movement/migration routes (overwintering habitats, nesting and staging sites)
6	Bioaccumulation of contaminants
7	Predators (native or domesticated)
8	Viable reproductive population size or availability
9	Specialized reproductive behavior or low reproductive rates
10	High sensitivity to pollution
11	Invasive/non-native species
12	Unintentional take/ direct mortality (e.g., vehicle collisions, power line collisions, by-catch, harvesting equipment, land preparation machinery)
13	Diseases/parasites (of the species itself)
14	Small native range (high endemism)
15	Genetic pollution (hybridization)
16	Large home range requirements

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- 17 Species overpopulation
- 18 Unregulated collection pressure
- 19 Dependence on other species (mutualism, pollinators)
- 20 Regulated hunting/fishing pressure (too much)

Respondents offered additional threats to wildlife in all wetland habitats in Indiana (not ranked):

- Habitat loss, degradation, fragmentation
  - Continued loss and degradation of emergent wetland habitat in portions of the state due to development and poor agricultural practices
- Human interaction
  - With wildlife species trapping, relocation, scaring
  - Reproductive intervention by humans
- Devaluing of wildlife species due to overpopulation
- Restricted management options
  - Although not habitat specific, the inability to responsibly and proactively manage muskrats according to the wildlife conservation model, as opposed to reactive measures through nuisance practices, is a concern regarding conservation of muskrats. This concern applies across the landscape, not just in urban and suburban environments
- Artificial manipulation of water levels
  - In wetlands seems, this will likely increase mortality of over wintering snakes. Snakes hibernate underground at the groundwater interface. Raising water levels in the winter could drown snakes and lowering water table could expose them to extreme cold temperatures. Both activities are likely to kill over wintering snakes

Respondents listed top threats to wildlife in all wetland habitats in Indiana (not ranked):

- Habitat loss, degradation, fragmentation
  - Loss of early successional habitat
  - Loss of shallow marshes due to drainage for development and poor agricultural practices
  - Habitat loss through annual cycle
  - Water quality
  - Loss due to urbanization
  - Continuing loss and/or degradation of emergent wetlands
  - Increase in migration distance to breeding sites as a result of habitat loss
  - Loss of ephemeral wetlands is the top threat; unfortunately, most existing ephemeral wetlands have been destroyed in Indiana. Even more unfortunately, many of them were destroyed with the misguided notion that deep water was better for wildlife; landowners were advised to dredge out the ephemeral wetlands to provide duck habitat. These fish-infested deep waters have no habitat for plains leopard frog
  - Loss and degradation of upland forested habitat
  - Loss of winter feed due to fall tillage
  - Loss of permanent wetland areas that include huge open/prairie buffer zones for nesting
  - Fragmentation of populations due to habitat loss. Wetlands are managed as landscape scale systems relative to Blanding's turtle, resulting in metapopulation

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disruption and potential metapopulation decline. Because of low densities and small population sizes, populations that have become isolated are likely not viable

- Degradation of habitat by invasive plant species
  - Invasive species like reed canary grass are proliferating in the habitats that remain, decreasing plant diversity, cover, and the overall health of the wetland
- Increased migration distance; loss of connectivity
  - Increase in migration distance to breeding sites as a result of habitat loss are the biggest threats to birds
  - Overland movement for nesting invites road kill of otherwise long-lived adults
- Specialized habitat
  - Only a few locations are known to have green salamanders in Indiana and this is a habitat specialist needing rocky outcrops in forested areas
- Genetic pollution
  - Hybridization with blue-winged warbler
- Overpopulation
  - Possible disease outbreaks due to large concentrations of birds often in small areas
- Human intervention during nesting process
- Predation
  - Suboptimal size nesting areas focuses nest depredation
- Artificial manipulation of habitat/improper management
  - Artificial manipulation of water levels in wetlands seems likely to increase mortality of overwintering snakes. Snakes hibernate underground at the groundwater interface. Raising water levels in the winter could drown snakes and lowering water table could expose them to extreme cold temperatures. Both activities are likely to kill overwintering snakes
  - Inappropriate management of sandy fire breaks in managed areas that are disked at inappropriate times, or are managed in inappropriate cover types. I have seen dead massasauga that have been disced on DNR lands

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the threats to all wildlife in all wetlands habitats. Their responses included:

- Yes.

### Habitat threats

Respondents ranked threats to all wetland habitats in Indiana:

Rank	Threats to all wetland habitats in Indiana
1	Habitat degradation
2	Habitat fragmentation
3	Agricultural/forestry practices

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- 4 Commercial or residential development (sprawl)
- 5 Nonpoint source pollution (sedimentation and nutrients)
- 6 (tie) Point source pollution (continuing)
- 6 (tie) Successional change
- 6 (tie) Counterproductive financial incentives or regulations
- 7 Drainage practices (stormwater runoff)
- 8 Invasive/non-native species
- 9 Impoundment of water/flow regulation
- 10 Stream channelization
- 11 Mining/acidification
- 12 Residual contamination (persistent toxins)
- 13 Climate change
- 14 Diseases (of plants that create habitat)

Respondents noted additional threats to all wetland habitats in Indiana (not ranked):

- Drainage of wetland areas
- Legal jurisprudence issues unclear; draft of state isolated wetland law out for comment

Respondents listed top threats to all wetland habitats in Indiana (not ranked):

- Habitat loss degradation, fragmentation
  - Loss of early successional woody habitat
  - Loss by filling or draining wetlands
  - Stream and lake "renovation" have degraded habitat back to where it was when the original habitat destruction occurred
  - Due to development
    - Agricultural practices
    - Drainage practices
    - Road construction
    - Urban sprawl
    - Coal mining
  - Loss due to deforestation
  - Development encroachment on some colonies
  - Destruction of nesting trees
  - Little or no protection of isolated wetlands
  - Loss through drainage/tiny stream ditching
  - Conversion of sand prairie nesting habitat to cropland or something else (e.g., forestation via fire prevention)
  - Pollution/increased sediment and nutrient loads
  - Blanding's turtles: Loss of adjacent uplands or inappropriate cover/management. Blanding's requires nesting habitats that are secure from disturbance and that are within a reasonable distance to wetland habitats. Loss of appropriate habitat (either due to tradition conversion to agriculture or to conversion of inappropriate conservation cover types) is negatively impacting reproductive success in this species

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- Loss that leads to loss of connectivity
  - Affects Blanding's turtles and other species
- Invasive species
  - Degradation of plant community by exotic plants invading wetland habitats
  - Loss of ephemeral wetland habitat, invasion of wetlands by species like reed canary grass, cattails, purple loosestrife or other invasives that create monocultures, agricultural practices that destroy ephemeral wetlands
- Overpopulation
  - Canada Geese are their own worst enemy. Their concentrations by large numbers of geese on small wetlands have the capacity to pollute the water and cause increased erosion due to their feeding habits
- Improper management practices
  - Fire suppression in graminoid wetland habitat creates late successional wetlands that are not appropriate habitat. Conversely, late spring fire in these habitats is likely to cause direct adult mortality
  - Artificial manipulation of water levels in wetlands seems likely to increase mortality of over wintering snakes. Snakes hibernate underground at the groundwater interface. Raising water levels in the winter could drown snakes and lowering water table could expose them to extreme cold temperatures. Both activities are likely to kill over wintering snakes. In addition, herbaceous wetlands are lost under this management regime, replaced by open water wetlands
  - Blanding's turtles: Manipulation of natural wetlands for management of other species has a disruptive impact on natural wetland dynamics. This may include reduced survival of Blanding's or reduced productivity of the habitat

A respondent noted, "The participant has to speculate about the meaning of successional change. Is a 'change' an increase or decrease in early successional habitats? Climate change also is speculative. Agriculture/forestry practices have different effects. Grouping these practices into a single category does not appropriately represent each individual practice. Point and nonpoint pollution may have a positive or negative effect."

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the threats to all wetland habitats. Their responses included:

- I would emphasize that wetland conservation must not be limited to the wetland as a single entity. Wetlands must be managed in the context of the surrounding uplands. Wetlands should be managed as complexes rather than singly, striving for numerous and hydrologically diverse wetlands in an area.

## **Additional research and survey efforts**

### **Current body of research**

#### Species research

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Twenty-three percent respondents stated that the current body of science is complete, up-to-date and extensive or adequate for wildlife in all wetland habitats in Indiana; seventy-two percent stated that it is inadequate or nonexistent.

Respondents identified the following citations (title, author, date, publisher) that would give the best overview of wildlife in all wetland habitats in Indiana.

Title = Spring Breeding Duck Survey;  
Author = Kristen Chodachek;  
Date = 2003;  
Publisher = IDNR

Title = Waterfowl Ecology & Management;  
Author = Compiled by: Ratti, Flake, Wentz;  
Date = 1982;  
Publisher = The Wildlife Society

Title = The Birds of Indiana;  
Author = Russel E. Mumford, Charles E. Keller;  
Date = 1984;  
Publisher = Indiana University Press

Title = Atlas of Breeding Birds of Indiana;  
Author = John S. Castrale, Edward M. Hopkins, Charles E. Keller;  
Date = 1998;  
Publisher = Indiana Department of Natural Resources

Title = Canada Goose Management;  
Author = Clarence Schoenfield/Ruth L. Hine;  
Date = 1977;  
Publisher = University of Wisconsin, Stevens Point

Title = Managing Canada Geese in Urban Environments;  
Author = Smith/Craven/Curtis;  
Date = 1999;  
Publisher = Jack Berryman Institute Publication #16/ Cornell University Cooperative Extension, Ithaca, NY

Title = Atlas of Breeding Bird of Indiana;  
Author = Castrale, Hopkins & Keller;  
Date = 1998;  
Publisher = Indiana Dept. of Natural Resources

Title = Birds of Indiana;  
Author = Mumford;  
Date = ?;  
Publisher = Indiana University Press?

Title = Amphibians and reptiles from 23 counties of Indiana.;  
Author = Robert Brodman;  
Date = 2003;  
Publisher = Proceedings of the Indiana Academy of Science, 112: 43-54.

Title = various theses;  
Author = Bruce Kingsbury et al

Author = Mumford and Whitaker 1982

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Title = Fur animals of Indiana;  
Author = David Brooks;  
Date = 1959;  
Publisher = IDF&W

Author = review Minton's guide;  
Date = 2001;  
Publisher = Get BioBlitz & IUPFW reports from DNR

Title = ongoing background work in NE & MN  
Title = BNA Account - Golden-winged Warbler;  
Author = JL Confer;  
Date = 1992;  
Publisher = American Ornithologists' Union

Title = Birds of Indiana;  
Author = R Mumford and C. Keller;  
Date = 1984;  
Publisher = Indiana University Press

Title = Canada Goose Management;  
Author = uk;  
Date = uk;  
Publisher = uk

Title = Not my expertise;  
Author = contact JW Lang for NE & MN

Title = Status and Distribution of candidate endangered herpetofauna in the Fish Creek watershed;  
Author = Bruce Kingsbury, Spencer Cortwright;  
Date = 1994;  
Publisher = IDNR Division of Fish and Wildlife

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the current body of science for wildlife for all wetland habitats. There were no responses.

### Habitat research

Twenty-eight percent respondents stated that the current body of science is adequate for all wetland habitats in Indiana; sixty-seven percent stated that it is inadequate or nonexistent.

Respondents identified the following citations (title, author, date, publisher) that would give the best overview of all wetland habitats in Indiana.

Title = Waterfowl & Wetlands- Integrated Review;  
Author = Edited : Bookhout;  
Date = 1979;  
Publisher = The Wildlife Society

Title = Creating Freshwater Wetlands;  
Author = Hammer;  
Date = 1997;

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Publisher = CRC Press

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the current body of science for all wetland habitats. Their responses included:

- Understanding the influences of management practices is still limited. Great emphasis must be placed on monitoring the effects of management to improve approach.

### Research needs

#### Species research

Respondents ranked research needs for wildlife in all wetland habitats in Indiana:

Rank	Research needs for wildlife in all wetland habitats
1	Limiting factors (food, shelter, water, breeding sites)
2	Threats (predators/competition, contamination)
3	Relationship/dependence on specific habitats
4	Population health (genetic and physical)
5	Distribution and abundance
6	Life cycle

Respondents noted other research needs for wildlife in all wetland habitats in Indiana (not ranked):

- Research is needed to justify extending or modifying hunting seasons to eliminate the problem of the so-called nuisance goose in urban areas, around lakes and golf courses
- Food availability throughout annual cycle
- ways to deter use
- Impact of high snow goose populations on Canada geese nesting sites
- Develop more effective dispersal, relocation or removal techniques for maxima geese
- Information on metapopulation dynamics and migration distances to and from ephemeral wetlands are needed. Information on how many ephemeral wetland habitats within the landscape are needed to maintain healthy populations of the Spotted salamander is also needed. Information on buffer size and vegetation composition around ephemeral wetlands is needed
- Quite little is known about much of the basic natural history of this species
- Research needs related to muskrats are not habitat specific
- Long-term fidelity to specific sites
- Limits to sand prairie needs for nesting.
- Limits to recruitment when forced to nest in row crop areas

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the research needs for wildlife in all wetland habitats. Their responses included:

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- No. The rankings are fine, but the written responses are presented focusing on migratory waterfowl. Much emphasis should be given to nongame.

### Habitat research

Respondents ranked research needs for all wetland habitats in Indiana:

Rank	Research needs for all wetland habitats
1	Threats (land use change/competition, contamination/global warming)
2	Distribution and abundance (fragmentation)
3	Relationship/dependence on specific site conditions
4	Growth and development of individual components of the habitat
5	Successional changes

Respondents noted additional research needs for all wetland habitats in Indiana (not ranked):

- Habitat needs should be researched in an attempt to find and propagate habitats that are esthetically pleasing to humans for urban settings yet displeasing to geese
- Availability throughout annual cycle
- Information on metapopulation dynamics and migration distances to and from ephemeral wetlands are needed. Information on how many ephemeral wetland habitats within the landscape are needed to maintain healthy populations of the species is also needed. Information on buffer size and vegetation composition around ephemeral wetlands is needed
- Spatial relationships between occupied wetlands relative to population dynamics
- Physical characteristics of overwintering sites

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the research needs for all wetland habitats. There were no responses.

## **Conservation actions necessary**

### Species actions

Respondents ranked conservation efforts by how well they address threats to wildlife in all wetland habitats in Indiana:

Rank	Conservation efforts for wildlife in wetland habitats
1 (tie)	Reintroduction (restoration)
1 (tie)	Stocking
2 (tie)	Population management (hunting, trapping)
2 (tie)	Food plots

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- 3 Protection of migration routes
- 4 Disease/parasite management
- 5 Habitat protection
- 6 Regulation of collecting
- 7 Exotic/invasive species control
- 8 Threats reduction
- 9 (tie) Native predator control
- 9 (tie) Translocation to new geographic range
- 9 (tie) Limiting contact with pollutants/contaminants
- 9 (tie) Public education to reduce human disturbance
- 9 (tie) Culling/selective removal

Respondents noted other current conservation practices for wildlife in all wetland habitats in Indiana (not ranked):

- Wetland restoration
- Invasive species control (buckthorn, autumn olive, phragmites) to keep open herbaceous habitat suitable for massasauga
- Preserve wetlands

Respondents recommended these practices for more effective conservation of wildlife in all wetland habitats in Indiana (not ranked):

- Habitat protection, manipulation, restoration
  - Provide quality upland nesting cover adjoining these wetlands.
  - Reduce fall tillage near wetlands
  - Habitat protection throughout annual cycle
  - Enhance migratory/staging habitat
  - Enhance breeding habitat where populations do not conflict with land use
  - Ephemeral wetland and forested upland habitat protection
  - Design and manage conservation areas that specifically incorporate life history requirements of the Blanding's turtle across relatively large habitats (>1,000 acres). This species is too often subjected to management decisions that favor other species, and these often have a negative impact on available wetland and nesting habitat. In some cases (water level manipulations, late spring prescribed fire), these management decisions seem likely to result in direct mortality of adults
  - Restoration in new, very large natural areas in northwest Indiana
  - Restore connectivity
- Surveys
  - Continue five-year surveys
- Hunting seasons
  - Modify hunting seasons and open urban areas to hunting to reduce numbers of so-called nuisance geese populations in lieu of nest destruction and egg shaking
  - Develop practices and procedures to increase harvest of local birds
- Public outreach

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- Outreach programs are needed to effectively and accurately educate citizens about wildlife (game and non-game), the wildlife conservation model (for game and non-game), and the need for effective muskrat management programs
- Predator management
  - Raccoon reduction near constrained (small) areas of occupied habitat in northeast Indiana

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the conservation needs for all wildlife in all wetland habitats. There were no responses.

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### Habitat actions

Respondents ranked conservation efforts by how well they address threats to all wetland habitats in Indiana:

<b>Rank</b>	<b>Conservation efforts for all wetland habitats</b>
1	Habitat protection on public lands
2	Succession control (fire, mowing)
3	Cooperative land management agreements (conservation easements)
4	Habitat restoration on public lands
5	Corridor development/protection
6 (tie)	Land use planning
6 (tie)	Protection of adjacent buffer zone
7 (tie)	Habitat protection incentives (financial)
7 (tie)	Artificial habitat creation (artificial reefs, nesting platforms)
8	Habitat restoration through regulation
9 (tie)	Habitat restoration incentives (financial)
9 (tie)	Managing water regimes
10	Habitat protection through regulation
11	Restrict public access and disturbance
12	Technical assistance
13 (tie)	Selective use of functionally equivalent exotic species in place of extirpated natives
13 (tie)	Pollution reduction

Respondents listed other current conservation practices for all wetland habitats in Indiana (not ranked):

- Many current conservation practices and incentives programs promoted by biologists seem to be aimed at ducks and actually manage against this species

Respondents recommended the following practices for more effective conservation of all wetland habitats in Indiana (not ranked):

- Retard succession to desired habitat stage; incentives to conserve shrubby habitats
- Regulations are needed to protect small wetlands and other habitat
- Habitat protection and restoration incentives for private landowners and for conservation easements
- Continue efforts to protect and enhance wetland and riparian habitats
- Control plant species that spread by vegetative means that from thick colonies such as cattail
- Food plots

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- Refuge areas
- Protect forested ephemeral wetlands and forests

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the conservation of all wetland habitats. There were no responses.

## Partner agencies/organizations

The following organizations indicated that they work in Wetland habitats.

<b>Organization</b>	<b>Percent of time spent in Wetland habitats</b>
Little River Wetlands Project, Inc.	90
Ducks Unlimited	85
Indiana Grand Kankakee Marsh Restoration Project	70
Wawasee Area Conservancy Foundation, Inc.	70
Ducks Unlimited, Inc.	65
U.S. Fish and Wildlife Service - Indiana Private Lands Office	60
Dunes-Calumet Audubon Chapter	50
Earth Source, Inc.	50
Valparasio Chain of Lakes Watershed Group, Inc.	50
Blue Heron Ministries, Inc.	40
Muscatatuck National Wildlife Refuge US FWS	40
Patoka River National Wildlife Refuge & Management Area	40
American Consulting, Inc.	35
Indiana state trappers assoc	35
Red-tail Conservancy, Inc.	33
ACRES, Inc.	30
Indiana Division of the Izaak Walton League of America	30
Indiana Dunes National Lakeshore	30
Indiana Native Plant and Wildflower Society	30
JFNew and Associates	30
Merry Lea Environmental Learning Center of Goshen College	30
Division of Fish and Wildlife	28
Robert Cooper Audubon Society	25
Sassafras Audubon Society	25
Save the Dunes Conservation Fund	25
The Nature Conservancy	25
Trillium Land Conservancy, Inc.	25
US Fish and Wildlife Service Ecological Services (does not include national wildlife refuges)	25
Big Oaks National Wildlife Refuge, USFWS	20

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EnviroScience Incorporated	20
Indiana Bass Chapter Federation	20
Lake Maxinkuckee Environmental Council (LMEC)	20
Lost River Conservation Association	20
MWH Americas, Inc.	20
NICHES Land Trust	20
Pheasants Forever Inc.	20
Sierra Club Hoosier Chapter	20
Wabash River Heritage Corridor Commission	20
Cinergy Corp.	15
IDNR- Division of Forestry- Cooperative Forest Management Section (Private Lands)	15
Arrow Head Country Resource Conservation & Development Area, Inc.	10
South Bend-Elkhart Audubon Society	10-20?
Clark's Valley Land Trust	10
Hoosier Environmental Council	10
Indian Deer Hunters Association	10
Indiana Association of Soil and Water Conservation Districts	10
Indiana Chamber of Commerce	10
Indiana Environmental Institute	10
Lake Bruce Conservancy district	10
Lincoln Hills RC&D	10
Northern Indiana Public Service Company (NIPSCO) a Subsidiary of NiSource	10
Northwestern Indiana Regional Planning Commission (NIRPC)	10
Steelheaders of Northwest Indiana (Northwest Indiana Steelheaders)	10
Sycamore Land Trust	10
Whitewater Valley Land Trust, Inc.	10
St. Joseph River Watershed Initiative	7
Central Indiana Land Trust	5
fish lake conservancy district	5
Four Rivers Resource Conservation & Development Area	5
Indiana Association of Cities and Towns	5
Indiana Quail Unlimited	5
Indiana Smallmouth Club (ISC)	5
Mason & Hanger Corp. Newport Chemical Depot	5
Naval Support Activity Crane	5
St. Joseph County Soil & Water Conservation District (SWCD)	5
U.S. Department of Agriculture, Forest Service Hoosier National Forest	5
Valparaiso Lakes Area Conservancy District	5
Veolia Water Indianapolis, LLC	5
Bartholomew County Conservation Council, Inc.	2
Indiana Department of Natural Resources	1

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Division of Forestry, Properties Section (State Forests)	
American Society of Landscape Architects, Indiana Chapter	
Amos W Butler Audubon Society	
Central Hardwoods Joint Venture/American Bird Conservancy	
DNR Division of Nature Preserves	
Fur Takers of America	
IN DNR, Division of State Parks & Reservoirs, Interpretive Services	
Indianapolis Flycasters	
Kankakee River Basin Commission	
Law Enforcement Division, Indiana Department of Natural Resources	
National Audubon Society - Indiana Important Bird Areas Program (IBA)	
U.S. Army Corps of Engineers Regulatory Branch, Louisville District (Please note this is only a part of the larger organization and while the greater organization may be involved in areas not noted below, our answers are specific to the Regulatory program.)	
USDA Natural Resources Conservation Service	
Great Lakes Commission	
Federal Highway Administration (FHWA)	
fur takers of america chapter 7-E north west in.	

## Proposed plans for monitoring

### Current monitoring

#### Species monitoring

Respondents were aware of the following monitoring efforts by state agencies for wildlife in all wetland habitats in Indiana (not ranked):

- Statewide year-round monitoring
- Statewide once-a-year monitoring
- Periodic statewide (less than once a year but still regularly scheduled) monitoring
- Occasional statewide (less than once a year and not regularly scheduled) monitoring
- Regional or local year-round monitoring
- Regional or local once-a-year monitoring
- Periodic regional or local (less than once a year but still regularly scheduled) monitoring
- Occasional regional or local (less than once a year and not regularly scheduled) monitoring

Respondents were aware of the following monitoring efforts by other organizations for wildlife in all wetland habitats in Indiana (not ranked):

- Statewide once-a-year monitoring
- Periodic statewide (less than once a year but still regularly scheduled) monitoring
- Occasional statewide (less than once a year and not regularly scheduled) monitoring
- Regional or local once-a-year monitoring
- Periodic regional or local (less than once a year but still regularly scheduled) monitoring
- Occasional regional or local (less than once a year and not regularly scheduled) monitoring

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Respondents ranked monitoring efforts by state agencies based on their importance for conservation of wildlife in all wetland habitats in Indiana:

Rank	Monitoring efforts by state agencies for conservation of wildlife in wetland habitats
1	Statewide year-round monitoring
2	Statewide once-a-year monitoring
3 (tie)	Occasional regional or local (less than once a year and not regularly scheduled) monitoring
3 (tie)	Periodic statewide (less than once a year but still regularly scheduled) monitoring
4	Occasional statewide (less than once a year and not regularly scheduled) monitoring
5	Regional or local year-round monitoring
6	Regional or local once-a-year monitoring
7	Periodic regional or local (less than once a year but still regularly scheduled) monitoring

Respondents ranked monitoring efforts by other organizations based on their importance for conservation of wildlife in all wetland habitats in Indiana:

Rank	Monitoring efforts by other organizations for conservation of wildlife in wetland habitats
1	Periodic regional or local (less than once a year but still regularly scheduled) monitoring
2	Regional or local once-a-year monitoring
3	Occasional regional or local (less than once a year and not regularly scheduled) monitoring
4 (tie)	Statewide once-a-year monitoring
4 (tie)	Occasional statewide (less than once a year and not regularly scheduled) monitoring
5	Periodic statewide (less than once a year but still regularly scheduled) monitoring
6	Regional or local year-round monitoring
7	Statewide year-round monitoring

Respondents listed regional or local monitoring by state agencies for wildlife in all wetland habitats in Indiana (not ranked):

- At present only when a permit for work in a wetland is applied for
- Smaller more numerous wetlands have little oversight
- Selected state fish and wildlife areas and reservoir properties operated by the Indiana Department of Natural Resources conduct counts during the fall migration period; same properties as part of the weekly Waterfowl survey from August to January

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- Statewide for existing and new colonies every five years
- Waterfowl neck collar observations statewide as encountered
- IDNR nongame herpetologist incorporates this as part of the annual field season
- INDR runs NAAMP frog monitoring program
- IDNR - Division of Nature Preserves
- Agencies that issue drainage permits
- Fish Creek, Patoka River, Pigeon Creek

Respondents listed regional or local monitoring by other organizations for wildlife in all wetland habitats in Indiana (not ranked):

- Federal Breeding Bird Survey statewide; May Day Bird Count, Summer Bird Count
- Species is not monitored. Habitat changes requiring permits are checked by, IDNR, IDEM, USACOE (in some cases)
- Lake associations, businesses and anyone living around a emergent wetland with a yard with Canada goose complaints will monitor populations in order to prove they have a problem so they can destroy nests or eggs
- Christmas bird count
- Spencer Cortwright, IUN
- Robert Brodman, Saint Joseph's College
- University professors and members of the Herpetology Technical Advisory Committee for Indiana as part of their annual field seasons
- Northwest Indiana (Newton, Jasper, Pulaski, Lake, Porter counties)
- "BioBlitz" in Lake County
- Herp Center at IUPFW (I presume they've done something in Steuben and La Grange counties)
- Fish Creek, Patoka River, Pigeon Creek, Muscatatuck River

Respondents listed organizations that monitor wildlife in all wetland habitats in Indiana (not ranked):

- U.S. Geological Survey
- Birding groups
- Waterfowl USA
- Ducks Unlimited
- The Nature Conservancy
  - Funded research at Cline Lake Fen to better understand population dynamics, habitat use, etc.
- The Audubon Society
- Indiana Department of Natural Resources - Divisions of Fish and Wildlife
  - Population monitoring efforts at state, regional and local scales are to monitor annual trends. Monitoring programs used by IDFW are not habitat specific for muskrat
- IDNR – Division of Reservoirs
- U.S. Fish and Wildlife Service
- Spencer Cortwright, IUN
- Robert Brodman, Saint Joseph's College
- Ball State University; Tom Morrell.
- Bruce Kingsbury, IUPU Fort Wayne

Respondents considered monitoring techniques for wildlife in all wetland habitats in Indiana:

Monitoring techniques for wildlife in all	Used	Not used but	Not economically
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wetland habitats		possible with existing technology and data	feasible
Radio telemetry and tracking	X	X	--
Modeling	X	X	--
Coverboard routes	X	X	--
Spot mapping	X	X	--
Driving a survey route	X	X	--
Reporting from harvest, depredation, or unintentional take (road kill, by-catch)	X	--	--
Mark and recapture	X	X	--
Professional survey/census	X	X	--
Volunteer survey/census	X	X	--
Trapping (by any technique)	X	X	--
Representative sites	X	X	--
Probabilistic sites	X	X	--

Respondents noted other monitoring techniques for wildlife in all wetland habitats in Indiana (not ranked):

- Aerial surveys
- Look for burrows in muck

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the monitoring techniques for wildlife in all wetland habitats. Their responses included:

- Monitoring yearly in most cases is unnecessary. However, routine monitoring would be very valuable. A more reasonable regime for many needs is every 5-10 years or after a major disturbance, but then for 2-3 consecutive seasons.

### Habitat inventory and assessment

Respondents were aware of the following inventory and assessment efforts by state agencies for all wetland habitats in Indiana (not ranked):

- Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment

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- Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment
- Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment

Respondents were aware of the following inventory and assessment efforts by other organizations for all wetland habitats in Indiana (not ranked):

- Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment
- Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment
- Regional or local year-round inventory and assessment
- Regional or local once-a-year inventory and assessment
- Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment
- Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment

Respondents ranked inventory and assessment efforts by state agencies based on their importance for conservation of all wetland habitats in Indiana:

Rank	Inventory and assessment by state agencies for conservation of all wetland habitats
1	Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment
2	Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment
3	Statewide annual inventory and assessment
4	Statewide once-a-year inventory and assessment
5 (tie)	Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment
5 (tie)	Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment
6	Regional or local year-round inventory and assessment
7	Regional or local once-a-year inventory and assessment

Respondents ranked inventory and assessment efforts by other organizations based on their importance for conservation of all wetland habitats in Indiana:

Rank	Inventory and assessment by other
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### **organizations for conservation of all wetland habitats**

- 1 Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment
- 2 Regional or local once-a-year inventory and assessment
- 3 Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment
- 4 (tie) Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment
- 4 (tie) Regional or local year-round inventory and assessment
- 5 (tie) Statewide annual inventory and assessment
- 5 (tie) Statewide once-a-year inventory and assessment
- 6 Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment

Respondents listed regional or local inventory and assessment by state agencies for all wetland habitats in Indiana (not ranked):

- On state land
- Isolated wetlands law
- Northeast Indiana

Respondents listed regional or local inventory and assessment by other organizations agencies for all wetland habitats in Indiana (not ranked):

- Statewide aerial imagery
- Indiana wetland inventory maps
- County aerial photos for NRCS
- Soils mapping county maps
- Cortright monitors populations in Brown and Porter counties; Brodman monitors populations in Owens County
- Kankakee Sands and other TNC preserves: Staff evaluates restored/created habitat to judge its ability to support plains leopard frog and other species of concern
- Robert Brodman, Saint Joseph's College in Northwest Indiana
- Northwest Indiana (Newton, Jasper, Pulaski, Lake and Porter counties)
- IUPUI-FW faculty and students work in wetlands with this species in NE Indiana

Respondents listed organizations that monitor all wetland habitats in Indiana (not ranked):

- USDA
- U.S. Fish Wildlife Service
- Natural Resource Conservation Service
- Indiana Department of Environmental Management

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- IDNR, nongame herpetologist, university professors, members of the Herpetology TAC Committee for Indiana
- The Nature Conservancy
- Robert Brodman, Saint Joseph's College
- Ball State University, Northeast Indiana
- Indiana State University, Northwest Indiana

Respondents considered inventory and assessment techniques for all wetland habitats in Indiana:

<b>Inventory and assessment techniques for all wetland habitats</b>	<b>Used</b>	<b>Not used but possible with existing technology and data</b>	<b>Not economically feasible</b>
GIS mapping	X	X	--
Aerial photography and analysis	X	X	--
Systematic sampling	X	X	--
Regulatory information	X	--	--
Participation in land use programs	X	X	--
Modeling	X	X	--
Voluntary landowner reporting	X	X	--

Respondents listed additional inventory and assessment techniques for all wetland habitats in Indiana (not ranked):

- Pit-fall trapping and cover board objects adjacent to ephemeral wetlands; mark and recapture
- Visual estimate of amount of appropriate habitat being provided in restored areas
- Look for runways in muck and trap for them

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the inventory and assessment techniques for all wetland habitats. There were no responses.

## **Recommended monitoring**

### Species monitoring

Respondents recommended the following monitoring techniques for effective conservation of wildlife in all wetland habitats in Indiana (not ranked):

- Spot-mapping in appropriate habitats
- Nesting and brood counts statewide
- Aerial survey
- Banding and neck collaring

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- Continue current state surveys every five years
- Mark and recapture: Means to track species movement and association with non-target species and times of interaction with non-target species
- Mark and harvest: Means to track species movement and association with non-target species and times of interaction with non-target species. Also eliminates and reduces concentrations in undesirable areas.
- Weekly waterfowl counts at selected sites. Samples most of the major concentration areas. Very good historical data for trend analysis
- Professional survey and either mark recapture or telemetry
- Pit-fall traps and coverboard objects near ephemeral wetland breeding sites
- Fall surveys at breeding sites
- Call surveys and systematic sampling
- Minnow trapping and possible either mark recapture or telemetry
- Look for burrows in muck connected with trapping
- IDNR – Division of Fish and Wildlife uses harvest reports and professional surveys. The assumption is that aquatic systems include all habitat types occupied by muskrats
- Radio track females to nesting sites and monitor nests for depredation (Both are somewhat labor-intensive for at least one person.)

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the monitoring techniques for effective conservation for wildlife in all wetland habitats. There were no responses.

### Habitat inventory and assessment

Respondents recommended the following inventory and assessment techniques for effective conservation of all wetland habitats in Indiana (not ranked):

- A variety of method centering on aerial surveys
  - Aerial/satellite imagery coupled with modeling
  - Wetlands should be monitored by overhead photo methods with ground truth checks. This should occur on a regular basis with aggressive enforcement against illegal wetlands destruction
  - Spring aerial surveys
  - Analysis of county aerial photos
  - Systematic surveys and GIS
  - High-resolution aerial photography at normal marsh water levels; digitize for GIS
- Canada geese
  - GIS mapping would be the most cost affective means for creating an inventory of emergent plant species that would support Canada geese in emergent wetlands
  - Systematic water sampling of high use areas would determine nutrient loading and water quality. (US Fish and Wildlife Service Draft Environmental Impact Statement, Resident Canada Goose Management, Feb.2002)
- Reports from state fish and wildlife areas
- Updating and ground truthing Wetland Inventory maps
- Pit-fall traps and cover boards can be used to assess population size and use of ephemeral wetlands for breeding; mark and recapture can be used to determine migration patterns and use of specific ephemeral wetlands for breeding

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- Blanding's turtles: Monitor wetland vegetation; Blanding's prefer floating emergents (e.g., duckweed) and get crowded out by cattail expansion

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the inventory and assessment techniques for effective conservation for all wetland habitats. Their responses included:

- Some components of habitat monitoring should be specifically designed to monitor the effects/utility of management efforts. This remains a very under represented area.