

## DEVELOPED LANDS HABITATS NARRATIVE

### Habitat description

Developed lands habitats are characterized by a high percentage (30 percent or greater) of constructed materials (e.g. asphalt, concrete, buildings, etc).

### Problems affecting species and habitats

#### Species threats

Respondents ranked threats to wildlife in developed lands habitats in Indiana:

Rank	Threats to wildlife in developed lands habitats
1	Degradation of movement/migration routes (overwintering habitats, nesting and staging sites)
2	Species over population
3	Disease/parasites (of the species itself)
4 (tie)	Genetic pollution (hybridization)
4 (tie)	High sensitivity to pollution
5	Bioaccumulation of contaminants
6	Invasive/non-native species
7	Habitat loss (breeding range)
8 (tie)	Habitat loss (feeding/foraging areas)
8 (tie)	Dependence on irregular resources (cyclical annual variations) (e.g., food, water, habitat limited due to annual variations in variability)
9 (tie)	Unintentional take/direct mortality (e.g., vehicle collisions, power line collisions, by-catch, harvesting equipment, land preparation machinery)
9 (tie)	Predators (native or domesticated)
10	Regulated hunting and fishing (too much)
11	Unregulated collection pressure
12	Dependence on other species (mutualism, pollinators)
13 (tie)	Viable reproductive population size or availability
13 (tie)	Specialized reproductive behavior or low reproductive rates

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A respondent added that threats to wildlife in developed lands habitats in Indiana include genetic pollution due to “urbanization and domestication of ‘wild’ mallards, leading to the hybridization with domestic stock of ducks. This threat constitutes displacement of mallards into undesirable/unnatural areas, creating nuisance problems and genetic integrity concerns.”

Another respondent focused on Canada goose/human conflicts in developed areas.

A third respondent noted that abrupt changes in drainage patterns due to development could affect Kirtland’s snakes, which also can be adversely affected by moving, moving or clearing debris.

Respondents noted top threats to wildlife in developed lands habitats in Indiana (not ranked):

- Overpopulation
- Habitat loss

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the threats to wildlife in developed lands habitat. There were no responses.

### Habitat threats

Respondents ranked threats to developed lands habitats in Indiana:

Rank	Threats to developed lands habitats
1	Stream channelization
2	Commercial or residential development (sprawl)
3 (tie)	Counterproductive financial incentives or regulations
3 (tie)	Habitat degradation
3 (tie)	Impoundment of water/flow regulation
4 (tie)	Habitat fragmentation
4 (tie)	Drainage practices (stormwater runoff)
5 (tie)	Residual contamination (persistent toxins)
5 (tie)	Point source pollution (continuing)
6	Agricultural/forestry practices
7	Nonpoint source pollution (sedimentation and nutrients)
8 (tie)	Invasive/non-native species
8 (tie)	Diseases (of plants that create habitat)
9	Climate change
10	Successional change
11	Mining/acidification

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Respondents listed additional threats to developed lands habitats in Indiana (not ranked):

- Developed land creates a threat to quality habitat for mallards. Mallards in an urban setting face a host of problems for humans and mallards (genetic pollution, nuisance ducks, possible fecal contamination, etc.
- The impact of non-native earthworms should be closely monitored, as the Kirtland's snake's natural diet is believed to be comprised predominantly of earthworms and slugs. The ecological impact of non-native invertebrates has not been adequately studied

Respondents listed top threats to developed lands habitats in Indiana (not ranked):

- Urban, commercial and residential development (sprawl, destruction of wetland and water habitats, fragmentation, development of drainage areas and flood plains)
  - Allows Canada geese to overpopulate and become nuisances
  - Allows mallards to become more domesticated. People who feed birds is an issue in these settings
  - Respondents placed a large focus on destruction or development of water-based habitats, such as conversion of wetlands to retention ponds, and development of parks resulting in removal of natural cover
  - Fragmentation disrupts gene flow and recolonization
- Regulations (urban development)

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the threats to developed lands habitat. There were no responses.

## Additional research and survey efforts

### Current body of research

#### Species research

One-third of respondents indicated that the current body of science is adequate for wildlife in developed lands habitats in Indiana. Two-thirds indicated that species science is inadequate or non-existent.

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

Title = Amphibians and Reptiles of Indiana;

Author = Sherman A. Minton, Jr.;

Date = 2001;

Publisher = Indiana Academy of Sciences

Author = [www.natureserve.org/explorer](http://www.natureserve.org/explorer)

Title = Managing Canada Geese in Urban Environments;

Author = Arthur E. Smith, Scott R. Craven and Paul D. Curtis;

Date = 1199;

Publisher = Cornell Cooperative Extension

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Title = Prevention and Control of Wildlife Damage;  
Date = 1994;  
Publisher = University of Nebraska

Title = Conservation Assessment for Kirtland's Snake (*Clonophis kirtlandii*);  
Author = Jonanna Gibson and Bruce Kingsbury;  
Date = 2004;  
Publisher = USDA Forest Service, Eastern Region

Title = Kirtland's Snake;  
Author = [www.natureserve.org](http://www.natureserve.org)

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the current body of science to wildlife in developed lands habitat. There were no responses.

### Habitat research

Seventeen percent of respondents said that current body of science for developed lands habitats in Indiana is adequate. Fifty percent said that habitat science in inadequate or non-existent. Seventeen percent said marked "unknown," with the added comment that "developed lands is not quality habitat for mallards; therefore, it should not be addressed or perceived as such."

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

Title = Managing Canada Geese in Urban Environments;  
Author = Arthur E. Smith, Scott R. Craven and Paul D. Curtis;  
Date = 1999;  
Publisher = Cornell Cooperative Extension

Title = Amphibians and Reptiles of Indiana;  
Author = Sherman A. Minton, Jr.;  
Date = 2001;  
Publisher = Indiana Academy of Science

Title = Indiana Heritage Database;  
Author = Indiana Division of Nature Preserves

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 developed lands habitat. There were no responses.

## **Research needs**

### Species research

Respondents ranked research needs for wildlife in developed lands habitats in Indiana:

Rank	Research needs for wildlife in developed lands habitats
1	Distribution and abundance

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- 2 (tie) Limiting factors (food, shelter, water, breeding sites)
- 2 (tie) Relationship/dependence on specific habitats
- 3 (tie) Threats (predators/competition, contamination)
- 3 (tie) Population health (genetic and physical)
  
- 4 Life cycle

Other research needs for wildlife in developed lands habitats in Indiana include (not ranked):

- Movement patterns of Canada geese: to understand how geese hatched in an urban environment move or migrate to similar environments
- Ways to reduce urban populations
- Ways to determine genetic integrity of mallards in developed areas and to determine effective management tools/plans for mallards in developed 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 developed lands habitat. There were no responses.

### Habitat research

Respondents ranked research needs for developed lands habitats in Indiana:

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

Respondents specified additional research needs for developed lands habitats in Indiana (not ranked):

- Need research on ways to “exclude Canada geese”
- Need to determine long-term effects of mallards in developed lands on overall mallard population. Also need to devise management tools and concepts to help manage mallards in developed lands

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- We need to understand why Kirtland's snakes occur where we currently find them. With that information, we can maintain current populations before we determine the feasibility of increasing their numbers and distribution

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

### Conservation actions necessary

#### Species actions

Respondents ranked conservation efforts that best address threats to wildlife in developed lands habitats in Indiana:

Rank	Conservation efforts for wildlife in developed lands habitats
1	Protection of migration routes
2 (tie)	Habitat protection
2 (tie)	Population management (hunting, trapping)
2 (tie)	Regulation of collecting
2 (tie)	Food plots
3	Public education to reduce human disturbance
4 (tie)	Culling selective removal
4 (tie)	Limiting contact with pollutants/contaminants
4 (tie)	Threats reduction
4 (tie)	Translocation to new geographic range

A respondent listed "habitat alteration" as another current conservation practice for wildlife in developed lands habitats in Indiana.

Respondents recommended the following practices for more effective conservation of wildlife in developed lands habitats in Indiana (not ranked):

- Habitat reduction or alteration
- Hunting and population reduction
- Effective conservation for urban Canada geese should deal with how to limit numbers. Education and habitat modifications are critical. The best conservation practice is to limit Canada goose numbers in developed lands habitats using a partnership of state, municipal and federal government, as well as private landowners
- Bullfrogs are mobile, hearty and a habitat generalist. They are believed to be detrimental to other frogs. They should be monitored as an environmental sentinel
- Mallards in developed lands habitats must be handled in a responsible manner to maintain genetic integrity in more nature or less developed habitats. As the size and distribution of mallards grows, this situation becomes more complex (involving genetic pollution, fecal contamination, habitat loss or destruction, nuisance animal complaints,

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- nutrient loading, etc.) We need proper planning and management of mallards in developed lands, better understanding of mallard and developed lands dynamics, and a reduction of problems and conflicts
- When areas known or suspected to have Kirtland's snakes are threatened with development, work with developers to include shrubs and rock features near drainages to provide cover, and reduce mowing in Kirtland's snake habitat

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the effective conservation of wildlife in developed lands habitat. There were no responses.

### Habitat actions

Respondents ranked how well the following conservation efforts address threats to developed lands habitats in Indiana:

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

A respondent cited "the development and proliferation of storm water retention ponds" as another current conservation practice for developed lands habitats in Indiana.

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Respondents cited top practices for more effective conservation of developed lands habitats in Indiana (not ranked):

- Habitat alteration and removal (particularly related to Canada geese)
- When areas known or suspected to have Kirtland's snakes are threatened with development, seek to have the developer include shrubs and rock features near drainages to provide cover and to reduce mowing in areas Kirtland's snakes are likely to use.

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the effective conservation of developed lands habitat. There were no responses.

## Partner agencies/organizations

The following organizations indicated that they work in Developed lands habitats.

<b>Organization</b>	<b>Percent of time spent in Developed lands habitats</b>
Midwest Peregrine Falcon Recovery Project	70
Indiana Department of Natural Resources Division of Forestry, Properties Section (State Forests)	60
American Consulting, Inc.	45
Cordry Sweetwater Conservancy District	45
JFNew and Associates	40
Hoosier Heartland Resource Conservation and Education council	35
Cinergy Corp.	30
MWH Americas, Inc.	30
Lake Lemon Conservancy District	25
Lake Maxinkuckee Environmental Council (LMEC)	25
Northwestern Indiana Regional Planning Commission (NIRPC)	25
Veolia Water Indianapolis, LLC	25
Wabash River Heritage Corridor Commission	25
Earth Source, Inc.	20
EnviroScience Incorporated	20
Indiana Association of Soil and Water Conservation Districts	20
Indiana Chamber of Commerce	20
Steelheaders of Northwest Indiana (Northwest Indiana Steelheaders)	20
Summit Lake State Park	20
Sierra Club Hoosier Chapter	15
St. Joseph County Soil & Water Conservation District (SWCD)	15
US Fish and Wildlife Service Ecological Services (does not include national wildlife refuges)	15
Arrow Head Country Resource Conservation & Development Area, Inc.	10
Indiana Association of Cities and Towns	10
Indiana Native Plant and Wildflower Society	10

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Indiana Quail Unlimited	10
Naval Support Activity Crane	10
Valparaiso Lakes Area Conservancy District	10
Valparasio Chain of Lakes Watershed Group, Inc.	10
St. Joseph River Watershed Initiative	7
Muscatatuck National Wildlife Refuge US FWS	6
Blue Heron Ministries, Inc.	5
IN DNR, Division of State Parks & Reservoirs, Interpretive Services	5
Indiana Environmental Institute	5
Indiana state trappers assoc	5
Indianapolis Power & Light Co.	5
Lost River Conservation Association	5
Northeastern Indiana Trout Association	5
Robert Cooper Audubon Society	5
U.S. Department of Agriculture, Forest Service Hoosier National Forest	5
Division of Fish and Wildlife	2.5
Indiana Division of the Izaak Walton League of America	2
American Society of Landscape Architects, Indiana Chapter	
Federal Highway Administration (FHWA)	
Fur Takers of America	
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Great Lakes Commission	
Indiana Land Resources Council	
Law Enforcement Division, Indiana Department of Natural Resources	

## Proposed plans for monitoring

### Current monitoring

#### Species monitoring

Respondents indicated that these monitoring efforts are conducted by state agencies for wildlife in developed lands habitats in Indiana (not ranked):

- Statewide once-a-year monitoring
- Regional or local once-a-year monitoring
- Statewide year-round 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
- 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
- Regional or local year-round monitoring

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Respondents indicated that these monitoring efforts are conducted by other organizations for wildlife in developed lands habitats in Indiana (not ranked):

- Statewide year-round monitoring
- Regional or local 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
- 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
- Regional or local year-round monitoring

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Respondents ranked the importance of monitoring efforts by state agencies for wildlife in developed lands habitats in Indiana:

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

Respondents ranked the importance of monitoring efforts by other organizations for wildlife in developed lands habitats in Indiana:

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

Respondents listed regional or local monitoring efforts by state agencies for wildlife in developed lands in Indiana (not ranked):

- Annual Canada goose banding
- Annual Indiana's North American Amphibian Monitoring and Frog Watch programs
- Regional waterfowl breeding status and population surveys

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- Regional waterfowl trapping, banding and recapture efforts
- Citizens and scientists report Kirtland snake encounters to the Indiana Natural Heritage database sporadically. Environmental parameters of these sites have not been adequately studied or described to reveal important microhabitat associations

Respondents listed regional or local monitoring efforts by other organizations for wildlife in developed lands habitats in Indiana (not ranked):

- Ducks Unlimited waterfowl surveys
- Breeding and population surveys (organization not cited)

Respondents listed organizations involved in monitoring wildlife in developed lands habitats in Indiana (not ranked):

- Indiana Department of Natural Resources (Division of Fish and Wildlife; Division of Parks and Reservoirs; Division of Nature Preserves)
- U.S. Fish and Wildlife Service
- Ducks Unlimited
- Waterfowl USA

Respondents considered current monitoring techniques for wildlife in developed lands habitats in Indiana:

Monitoring techniques for wildlife in developed lands habitats	Used	Not used but possible with existing technology or data	Not economically feasible
Radio tracking and telemetry	--	X	X
Modeling	X	X	--
Coverboard routes	--	X	--
Spot mapping	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	--

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Respondents listed additional monitoring techniques for wildlife in developed lands habitats in Indiana (not ranked):

- Aerial surveys
- Bullfrog tadpoles and adults are often recorded during amphibian surveys of particular site such as military bases or Superfund sites. Bullfrogs also are counted and monitored during fish surveys

A respondent noted: "A standardized protocol could be developed as suggested by Gibson and Kingsbury 2004. However, a more difficult question might be where should standardized protocol be implemented to provide an adequate picture of the status of the Kirtland's snake in Indiana

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 developed lands habitat. There were no responses.

### Habitat inventory and assessment

Twenty percent of respondents were aware of the following inventory and assessment conducted by state agencies for lands habitats in Indiana:

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

Respondents were aware of no other inventory and assessment efforts.

Respondents were not aware of other organizations' habitat inventory and assessment efforts for developed lands habitats in Indiana.

Respondents ranked the importance of inventory and assessment efforts by state agencies for conservation of developed lands habitats in Indiana:

Rank	Monitoring efforts by state agencies for developed lands habitats
1 (tie)	Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment
1 (tie)	Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment
2 (tie)	Statewide annual inventory and assessment
2 (tie)	Statewide once a year inventory and assessment

Respondents ranked the following inventory and assessment efforts by organizations as having *equal* importance for conservation of developed lands habitats in Indiana:

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

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Respondents listed no regional or local inventory and assessment by state agencies or other organizations for developed lands habitats in Indiana.

A respondent commented: "At this time, the habitat characteristics of Kirtland's snakes are not sufficiently defined as to be monitored by general habitat measures (such as habitat classification based on remote sensing). More information on Kirtland's snake habitats is needed to define a reasonable habitat model for this species and to monitor the distribution and abundance of suitable habitat in the state.

Respondents considered current inventory and assessment techniques for developed lands habitats in Indiana:

<b>Inventory and assessment techniques for developed lands habitats</b>	<b>Used</b>	<b>Not used but possible with existing technology or data</b>	<b>Not economically feasible</b>
GIS mapping	X	X	--
Aerial photography and analysis	X	X	--
Systematic sampling	--	X	X
Participation in landuse programs	--	X	--
Modeling	--	X	--
Voluntary landowner reporting	X	--	--

A respondent cited feedback from frog hunters as an additional inventory and assessment technique for developed lands habitats in Indiana: "If there was a significant decline in bullfrog habitat on state-owned properties, the state would hear about it from frog hunters."

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 developed lands habitat. There were no responses.

### **Recommended monitoring** Species monitoring

Respondents recommended the following monitoring techniques for wildlife in developed lands habitats in Indiana (not ranked):

- Neck collars, leg bands and driving surveys
- Population surveys

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- Mark and recapture
- Modeling to determine population dynamics and genetic integrity of mallards in developed lands vs. wild mallards. Monitoring throughout annual cycle

A respondent noted: "I do not believe that an effective nationally or regionally accepted monitoring technique exists. This should be identified as a need in the CWS."

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 developed lands habitat. There were no responses.

### Habitat inventory and assessment

Respondents recommended the following inventory and assessment techniques for developed lands habitats in Indiana (not ranked):

- Aerial monitoring, photography and spring surveys
- Urban residents could be encouraged to participate in Frog Watch program

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 developed lands habitat. There were no responses.