6

CHAPTER VI.

INDIANA'S PLANNING REGIONS

OUTLINE

A. Great Lakes Region
B. Kankakee Region
C. Corn Belt Region
D. Valleys and Hills Region
E. Interior Plateau Region
F. Drift Plains Region

A. GREAT LAKES REGION

Introduction

This section summarizes habitat conditions, threats to SGCN and their habitats, and conservation actions for species and habitats in the Great Lakes Region. This section also reviews land cover changes over the past decade and identifies unique habitat types in this region. Summaries of threats to and conservation actions for SGCN and their habitats that were generated from two surveys can be found at the end of this section.

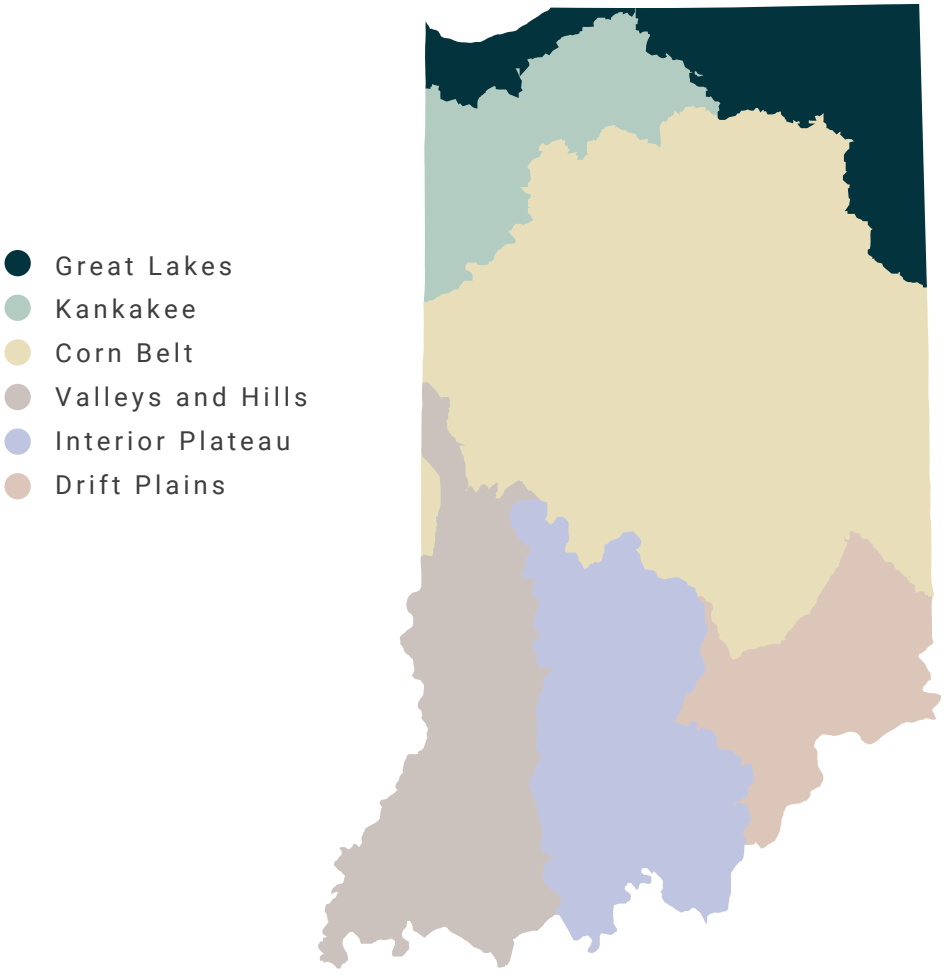

Figure 6-1. Outline of the Great Lakes Region in Indiana.

In addition to the threats and actions identified in the Habitat Survey and the Species Survey, the DFW recognized the need to identify threats aligned with specific actions. Several threats and actions were identified as ubiquitous across all six regions. These include:

- **Habitat Loss:** Develop and promote farming technologies and practices that have conservation benefits (e.g., cover crops, no-till)
- **Invasive Species:** Build external capacity (form and facilitate partnerships, alliances, and networks of organizations to address invasive species)
- **Law and Policy:** Develop, change, influence and help implement formal legislation, regulations and voluntary standards
- **Dams and Water Management and Use:** Remove unnecessary dams and utilize necessary dams with effective fish passage structures

The DFW also identified specific threats and actions for each SWAP region based on DFW priorities. These threats were identified due to their high level of relevancy to the specific region and the workability of the associated actions. These threats and actions for the Great Lakes Region include:

- **Fish Passage:** *Remove dams and create fish ladders.*
- **Pollution:** *Reduce nutrient and toxin loads (e.g., heavy metals, pharmaceuticals, fertilizers, and pesticides).*
- **Habitat Loss to Barrens and Bogs/Fens:** *Build external capacity by forming partnerships and networks, raising and providing funds and resources for conservation organizations to maintain and protect barrens and bogs/fens.*

Current Habitat Conditions

During the Species Survey, respondents were asked to identify SGCN within the Great Lakes Region. A full summary of the Species Survey results can be found in Appendix P.

Table 6-1. Distribution of SGCN across the Great Lakes Region.

Taxa	Scientific Name	Common Name
Birds	*Grus americana*	Whooping Crane[1]
Birds	*Grus canadensis*	Sandhill Crane[2]
Birds	*Ardea alba*	Great Egret[3]
Birds	*Botaurus lentiginosus*	American Bittern
Birds	*Ixobrychus exilis*	Least Bittern

Taxa	Scientific Name	Common Name
Birds	*Nycticorax nycticorax*	Black-crowned Night-Heron
Birds	*Antrostomus vociferus*	Eastern Whip-poor-will
Birds	*Chordeiles minor*	Common Nighthawk
Birds	*Gallinula galeata*	Common Gallinule
Birds	*Laterallus jamaicensis*	Black Rail
Birds	*Rallus elegans*	King Rail
Birds	*Rallus limicola*	Virginia Rail
Birds	*Accipiter striatus*	Sharp-shinned Hawk
Birds	*Asio flammeus*	Short-eared Owl
Birds	*Buteo lineatus*	Red-shouldered Hawk
Birds	*Buteo platypterus*	Broad-winged Hawk
Birds	*Circus cyaneus*	Northern Harrier
Birds	*Falco peregrinus*	Peregrine Falcon
Birds	*Haliaeetus leucocephalus*	Bald Eagle
Birds	*Ictinia mississippiensis*	Mississippi Kite
Birds	*Pandion haliaetus*	Osprey
Birds	*Tyto alba*	Barn Owl
Birds	*Arenaria interpres*	Ruddy Turnstone
Birds	*Bartramia longicauda*	Upland Sandpiper
Birds	*Calidris subruficollis*	Buff-breasted Sandpiper
Birds	*Charadrius melodus*	Piping Plover
Birds	*Limnodromus griseus*	Short-billed Dowitcher
Birds	*Phalaropus tricolor*	Wilson's Phalarope
Birds	*Pluvialis dominica*	American Golden-plover
Birds	*Tringa melanoleuca*	Greater Yellowlegs
Birds	*Tringa solitaria*	Solitary Sandpiper
Birds	*Ammodramus henslowii*	Henslow's Sparrow
Birds	*Cistothorus palustris*	Marsh Wren
Birds	*Cistothorus platensis*	Sedge Wren
Birds	*Helmitheros vermivorum*	Worm-eating Warbler
Birds	*Lanius ludovicianus*	Loggerhead Shrike
Birds	*Mniotilta varia*	Black-and-white Warbler
Birds	*Setophaga cerulea*	Cerulean Warbler
Birds	*Setophaga citrina*	Hooded Warbler
Birds	*Setophaga kirtlandii*	Kirtland's Warbler
Birds	*Sturnella neglecta*	Western Meadowlark
Birds	*Vermivora chrysoptera*	Golden-winged Warbler

Taxa	Scientific Name	Common Name
Birds	*Xanthocephalus xanthocephalus*	Yellow-headed Blackbird[4]
Birds	*Chlidonias niger*	Black Tern
Birds	*Sternula antillarum athalassos*	Interior Least Tern
Birds	*Cygnus buccinator*	Trumpeter Swan
Mammals	*Lasionycteris noctivagans*	Silver-haired Bat
Mammals	*Lasiurus borealis*	Eastern Red Bat
Mammals	*Lasiurus cinereus*	Hoary Bat
Mammals	*Myotis lucifugus*	Little Brown Myotis
Mammals	*Myotis septentrionalis*	Northern Long-eared Myotis
Mammals	*Myotis sodalis*	Indiana Myotis
Mammals	*Nycticeius humeralis*	Evening Bat
Mammals	*Mustela nivalis*	Least Weasel
Mammals	*Taxidea taxus*	American Badger
Mammals	*Spermophilus franklinii*	Franklin's Ground Squirrel
Mammals	*Condylura cristata*	Star-nosed Mole
Amphibians	*Necturus maculosus*	Common Mudpuppy
Amphibians	*Acris crepitans*	Northern Cricket Frog
Amphibians	*Lithobates pipiens*	Northern Leopard Frog
Amphibians	*Ambystoma laterale*	Blue-spotted Salamander
Amphibians	*Hemidactylium scutatum*	Four-toed Salamander
Reptiles	*Clonophis kirtlandii*	Kirtland's Snake[6]
Reptiles	*Nerodia erythrogaster neglecta*	Copper-bellied Watersnake
Reptiles	*Opheodrys vernalis*	Smooth Greensnake
Reptiles	*Sistrurus catenatus*	Massasauga
Reptiles	*Thamnophis butleri*	Butler's Gartersnake
Reptiles	*Thamnophis proximus*	Western Ribbonsnake
Reptiles	*Clemmys guttata*	Spotted Turtle
Reptiles	*Emydoidea blandingii*	Blanding's Turtle
Reptiles	*Terrapene carolina*	Eastern Box Turtle
Fish	*Notropis anogenus*	Pugnose Shiner
Fish	*Rhinichthys cataractae*	Longnose Dace
Fish	*Ichthyomyzon fossor*	Northern Brook Lamprey
Fish	*Cottus cognatus*	Slimy Sculpin
Fish	*Acipenser fulvescens*	Lake Sturgeon
Fish	*Catostomus catostomus*	Longnose Sucker
Fish	*Moxostoma valenciennesi*	Greater Redhorse
Fish	*Percopsis omiscomaycus*	Trout-perch

Taxa	Scientific Name	Common Name
Fish	*Coregonus artedi*	Cisco
Fish	*Coregonus clupeaformis*	Lake Whitefish
Mollusks	*Lampsilis fasciola*	Wavyrayed Lampmussel
Mollusks	*Pleurobema clava*	Clubshell
Mollusks	*Ptychobranchus fasciolaris*	Kidneyshell
Mollusks	*Simpsonaias ambigua*	Salamander Mussel
Mollusks	*Venustaconcha ellipsiformis*	Ellipse
Mollusks	*Villosa fabalis*	Rayed Bean
Mollusks	*Campeloma decisum*	Pointed Campeloma
Mollusks	*Lymnaea stagnalis*	Swamp Lymnaea

During the Habitat Survey, respondents were asked to evaluate the overall quality of fish and wildlife habitats in the Great Lakes Region (Fig. 6-2), estimate changes in overall quality since 2005 (Fig. 6-3), and predict changes in overall quality over the next ten years (Fig. 6-4). Each respondent was asked to respond for one or more of the eight major habitat types within the region and results were aggregated at the regional level. A full list of the Habitat Survey results can be found in Appendix Q.

Figure 6-2. Overall quality of fish and wildlife habitats in the Great Lakes Region.

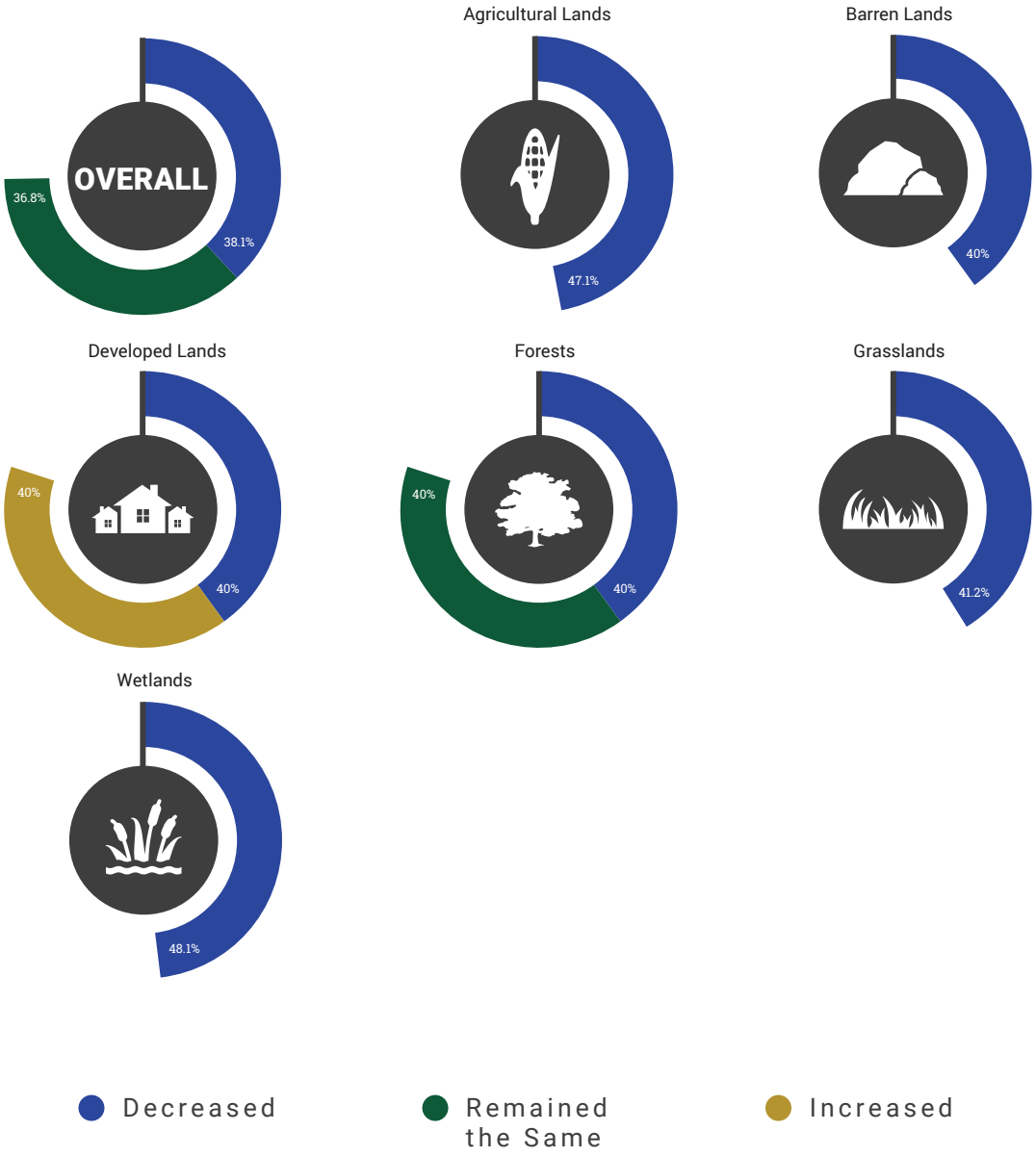

Figure 6-3. Estimated change in the overall quality of fish and wildlife habitats since 2005 for each of the major habitat types in the Great Lakes Region.

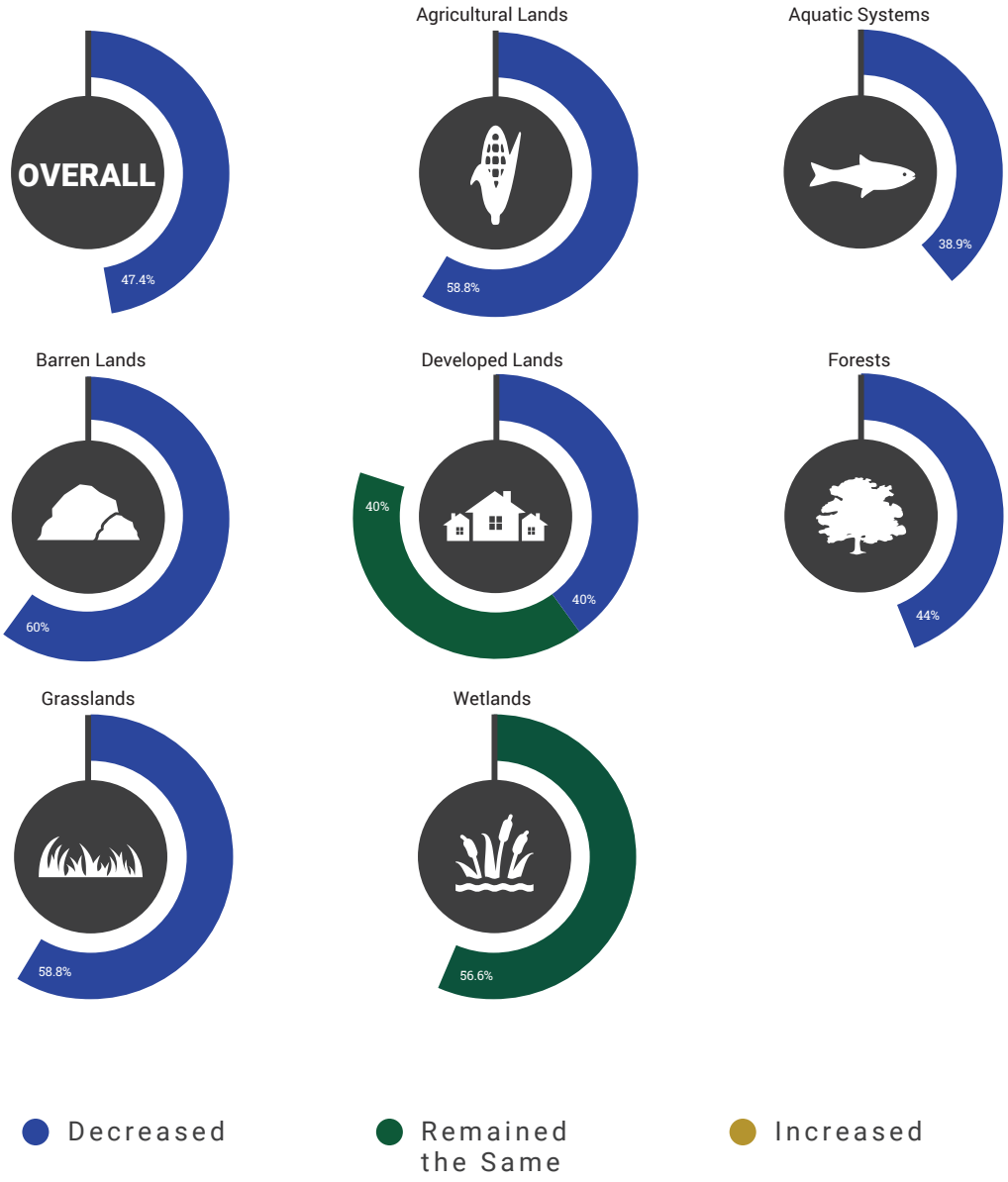

Figure 6-4. Predicted changes in overall quality of fish and wildlife habitats over the next ten years for each major habitat type in the Great Lakes Region.

Changes in Land Cover

Most land cover in the Great Lakes Region consists of cultivated crops and developed lands, followed by grasslands, wetlands, and forests (Fig. 6-5). Compared to other Indiana regions, the Great Lakes Region has a high percentage of aquatic systems, mainly due to the presence of Lake Michigan. The region is comprised of 20.4% developed lands, as most of the surrounding Lake Michigan and Chicago-area is developed, and 7.4% wetlands, due to the extensive wetland complexes present in the Eastern portion of the region.

Although the aquatic systems have increased marginally, the Great Lakes Region has experienced loss in most habitat types over the past ten years. Most habitats were lost to urban development, and agriculture lost the most cover in terms of total acreage (Fig. 6-5). Percentage-wise, the greatest losses were seen in forests with a 12.7% decrease, shrubland with a 12.3% decrease, herbaceous grasslands with a 9.7% decrease, and herbaceous wetlands with a 5.4% decrease. The greatest increases were seen in medium-intensity developed lands with a 19.5% increase, high-intensity developed lands with a 14.3% increase, and barren lands with a 8.3% increase.

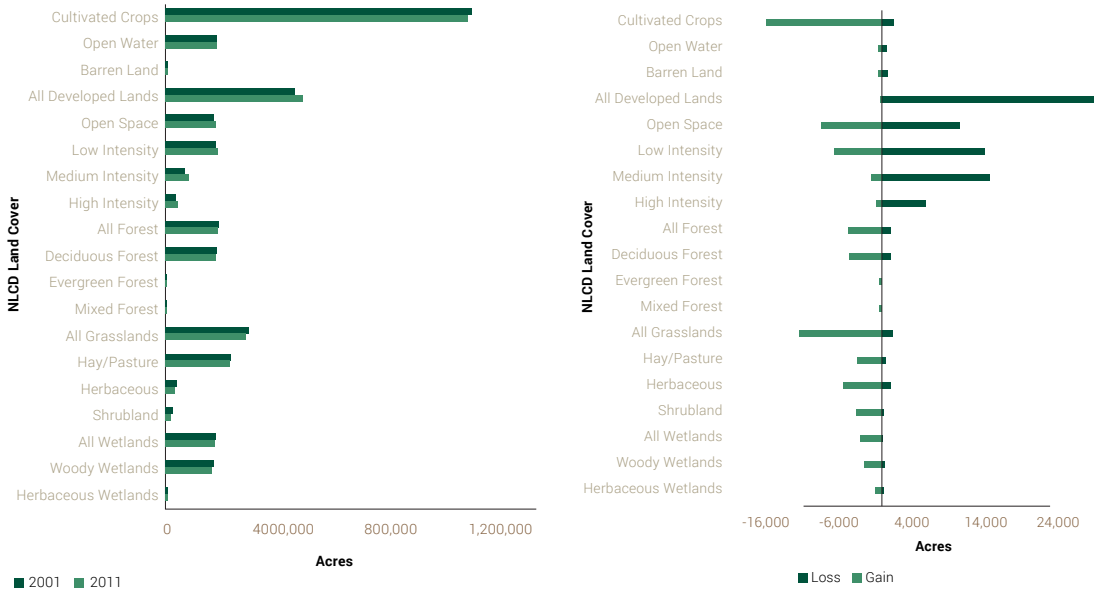

Figure 6-5. Distribution of land cover and losses and gains in land cover in the Great Lakes Region between 2001 and 2011.

Threats Affecting Habitats

Top Threat Categories

The third element requires the description of threats to SGCN and their habitats. The SWAP identifies a habitat perspective in order to manage for the conservation of species in Indiana. This section utilizes the same hierarchical method of identifying and rating threats based on Salafsky et al. (2008) that was outlined in Chapter V. Category rankings and specific threat rankings for habitats in this region are outlined below (Table 6-2). A full summary of the Habitat Survey results for the Great Lakes Region can be found in Appendix Q.

For first-level threat categories, invasive and other problematic species and genes, residential and commercial development, agriculture and aquaculture, natural systems modification, pollution, and human intrusion and disturbance had a mean ranking between significant and moderate threat level. Climate change and severe weather, transportation and service corridors, other stressors, biological resource use, and energy production and mining received average ratings between moderate and minor threat. No threat category landed in the minor to no threat range for this region.

The invasive and other problematic species and genes category was identified as the top first-level threat across the region and in each of the major habitat types except for barren lands and developed lands, where it was ranked second and third, respectively.

Within the category, the invasive and alien species category was identified as the top specific second-level threat. Residential and commercial development, including non-agricultural land uses such as housing development and urban areas, was ranked second overall for the region and first as a threat to barren lands and habitats within developed lands. Shoreline development along Lake Michigan and destruction of riparian habitat from development were specifically identified as residential and commercial development threats within this region. Agriculture and aquaculture also generally ranked high regionally and across all habitat types except barren lands and developed lands. Within the category, conversion of habitat to annual crops and already existing non-timber crops were identified as the most significant threats, while aquaculture and timber production received ratings between the minor to no threat range. Changes to drainage through tile installation and nutrient loading were identified as other threats by respondents especially in aquatic systems in this region. Loss of CRP was also identified as a concern.

Climate change and other severe weather received a moderate to minor threat ranking regionally and within each habitat type; however, the majority of respondents anticipated specific threats within this category to increase in significance over the next ten years. Pollution received a high threat ranking within barren lands and developed lands compared to the rest of the habitat types. Other stressors and biological resource use were ranked uniformly low across habitat types within this region. Energy production and mining was also ranked low regionally. Some respondents specifically identified wind farm installation development as a potential threat in this region.

Table 6-2. Threat category ranking to habitats in the Great Lakes Region. First-level threats categories are based on the hierarchical method of identifying threats outlined in Salafsky et al. (2008). Ranked threat categories for the entire region are arranged by each major habitat type.

Category	Regional Ranking	Aquatic Systems	Agricultural Lands	Barren Lands	Developed Lands	Forests	Grasslands	Wetlands
Invasive and Other Problematic Species and Genes	1	1	1	2	3	1	1	1
Residential and Commercial Development	2	4	3	1	1	2	3	4
Agriculture and Aquaculture	3	3	4	7	10	4	2	3
Natural Systems Modification	4	6	2	6	5	3	4	2
Pollution	5	2	5	3	2	6	8	6
Human Intrusion and Disturbance	6	5	7	4	4	5	5	5
Climate Change and Severe Weather	7	7	6	8	7	7	6	7
Transportation and Service Corridors	8	8	8	5	6	9	7	8
Other Stressors	9	9	9	9	8	8	9	9
Biological Resource Use	10	11	10	11	9	10	11	10
Energy Production and Mining	11	10	11	10	11	11	10	11

Top Specific Threats in Ranked Order

In the Habitat Survey, respondents were also asked to identify specific threats to major habitat types using the same threat category ranking system outlined in Salafsky et al. (2008). These second-level threats represent subcategories of threats within the major threat categories listed in the table above. The following are the top specific second-level threats to habitats in the Great Lakes Region, aggregated across habitat types:

1. Invasive and alien species
2. Conversion of natural habitats to other land uses
3. Changing frequency, duration, and intensity of drought
4. Changing frequency, duration, and intensity of floods
5. Housing and urban areas
6. Conversion of habitat to annual crops
7. Shifting and alteration of habitats due to climate change
8. Commercial and industrial areas
9. Temperature extremes due to climate change
10. Annual and perennial non-timber crops

In the Species Survey, respondents were also asked to identify threats to individual SGCN using the same threat category ranking system. The following are the top specific second-level threats to SGCN occurring in the Great Lakes Region, aggregated across all species:

1. Natural habitat conversion
2. Conversion of habitat to annual crops
3. Annual and perennial non-timber crops
4. Dams and water management and use
5. Livestock farming and ranching
6. Over-mowing of natural areas

Emerging/Anticipated Threats

Respondents were asked specifically to identify any emerging or anticipated threats over the next ten years for fish and wildlife habitats within the major habitat types for a region in a free-response question. A full summary of these results can be found in Appendix Q.

Respondents identified a concern for continued introduction and spread of invasive species, including Asian Carp in aquatic systems and exotic plant species. Although pollution was mid-ranked for current threats, contaminants like pharmaceuticals and pesticides, as well as plastics in the form of micro-beads, were identified as emerging specific threats in aquatic systems in this region. Respondents also reported an anticipated threat to conservation may be the lack of land being set aside for protection by state agencies as well as loss of the CRP.

Conservation Actions Needed

Top Action Categories

The fourth element requires that the SWAP describe conservation actions proposed to conserve identified species and habitats as well as outlining priorities for their implementation. This section outlines conservation actions identified at the regional level for each of the major habitat types. This section follows the same protocol to rate and rank actions in this region based on Salafsky et al. (2008) that was outlined in Chapter V. A full list of survey results can be found in Appendix Q. Category rankings for actions and specific actions are outlined in the list below (Table 6-3).

Land, water, and species management was ranked as the most important first-level category of actions regionally and in aquatic systems, barren lands, and wetlands specifically. Within the categories, means were used to determine the rankings. Because of this, some habitat-specific options with few respondents may have high means regionally. Overall, important actions reflected respondents identifying a need to control invasive species and restore habitats and natural systems in various habitat types. Reducing loss of habitat due to agricultural and residential development was identified as one of the highest rated actions across several habitat types. Reducing nutrient toxin load was also tied for the highest rated

action in aquatic systems within land, water, and species management. Education and awareness was also highly ranked for this region, ranking second regionally and first for agricultural lands, developed lands, forests, and grasslands. Education in general was ranked highest within the category, but three of the four actions in this category received a rating from respondents between very important and moderately important. Through the free-response option, respondents also indicated a general importance for public participation in conservation through opportunities for stakeholder engagement and development of educational programs specifically addressing topics related to natural lakes and climate change.

Within the law and policy top-level category, respondents emphasized an importance for compliance of current regulations over creation of new ones in general, though some respondents did suggest improving regulations on invasive species, as well as changing regulations with regards to drainage and agricultural runoff.

External capacity building was ranked last regionally, below livelihood, economic and other incentives; however, all categories of actions received an average rating between very important and moderately important. Of the 93 specific second-level conservation actions rated by respondents for this region, 73 received a rating between very important to moderately important. This indicated respondents identifying a range of actions that are vital to conservation within this region across the major habitat types.

Table 6-3. Action category rankings to habitats in the Great Lakes Region. First-level categories are based on the hierarchical method of identifying actions outlined in Salafsky et al. (2008). Ranked action categories for the entire region are broken up by each major habitat type. Additional habitat ranking information and Habitat Survey responses can be found in Appendix Q.

Category	Regional Ranking	Aquatic Systems	Agricultural Lands	Barren Lands	Developed Lands	Forests	Grasslands	Wetlands
Land/Water/Species Management	1	1	2	1	2	3	3	1
Education and Awareness	2	2	1	3	1	1	1	4
Land/Water Protection	3	3	5	1	2	2	2	2
Law and Policy	4	4	4	4	4	5	5	3
Livelihood, Economic and Other Incentives	5	5	3	4	4	6	6	6
External Capacity Building	6	6	6	4	4	4	4	5

Top Specific Actions in Ranked Order

In the Habitat Survey, respondents were also asked to identify specific actions for major habitat types using the same action category ranking system outlined in Salafsky et al. (2008). These second-level actions represent subcategories of actions within the major action categories listed in the table above. The following are the top specific second-level conservation actions for habitats in the Great Lakes Region, aggregated across habitat types:

1. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)
2. Preserve currently existing corridors
3. Promote use of research and science in conservation decision-making processes
4. Acquire conservation easements to protect important wildlife habitats
5. Reduce nutrient and toxin loads (e.g., heavy metals, pharmaceuticals, fertilizers, insecticides)
6. Develop alliances and partnerships (e.g., between producers, landowners, and conservation professionals)
7. Develop educational programs in general
8. Develop and promote farming technologies and practices that have conservation benefits (e.g., cover crops, no-till)
9. Strengthen conservation financing
10. Increase acres of riparian buffers

In the Species Survey, respondents used a free-response question to discuss the most relevant conservation actions for individual SGCN. The following are top actions for SGCN occurring in the Great Lakes Region, as summarized from these free-response questions:

1. Educate and engage with landowners and citizens
2. Enhance connectivity of habitats
3. Increase CRP lands
4. Protect large contiguous forested areas
5. Limit conversion of habitat to non-habitat
6. Control invasive plants
7. Minimize disturbance to nesting birds
8. Use burning and mowing as management techniques
9. Protect and manage large wetland complexes

Prioritization of Actions

In order to prioritize these actions within an environment of limited resources, respondents were then asked to distribute hypothetical "effort points" to any action they had previously rated as "very important" for any of the major habitat types within a region. The effort ratings were averaged and then ranked to identify the top five actions for each region. A full list of these results can be found in Appendix P. Priority actions for the Great Lakes Region include:

1. Control invasive species in aquatic systems (e.g., Asian Carp, Zebra Mussels, invasive aquatic plants)
2. Develop and promote farming technologies and practices that have conservation benefits (e.g., cover crops, no-till)
3. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)
4. Develop educational programs in general
5. Reduce nutrient and toxin loads (e.g., heavy metals, pharmaceuticals, fertilizers, insecticides)

These top priority actions, sorted by average effort rating, reflect actions from land, water, and species management and education and awareness. Respondents placed an emphasis on conservation actions in aquatic systems in this region, as both controlling invasive species in this habitat type and reducing nutrient toxin load will directly benefit fish and wildlife habitats in aquatic systems.

Threats and Actions by Major Habitat Type

The following summaries break down threats and conservation actions in this region by major habitat type, based on responses to the Habitat Survey and the Species Survey. The SGCN that occur there, top threats to SGCN, top actions for SGCN, key threats to habitats, and priority actions for each major habitat type in this region are summarized below.

Threats and actions were only included in detail below if a majority of eligible survey respondents, greater than 50%, rated them, to avoid artificially elevating items, which were highly ranked but only by a few respondents. This approach left some threats and action lists with no items for certain habitats, which is illogical from a practical perspective. Therefore, in these situations, the top threats and actions are still listed but are denoted with an asterisk (*) to signify that there may be some items, which seem out-of-place, reflecting a lack of sufficient response for a particular habitat in the survey. This approach and the survey design also caused for some disparities between threats and actions.

Approximately ten items are given for each list below. Lists may be shorter if fewer than ten items were rated by a majority of survey respondents, or longer if there were tires between items.

Top actions for SGCN were summarized from free-response questions about individual species and do not follow the same categorizations as actions for habitats. A full summary of the Habitat Survey responses can be found in Appendix Q.

Agricultural Lands

Agricultural lands are defined as lands devoted to commodity production. Examples of agricultural lands include: intensively managed non-native grasses, row crops, fruit and nut-bearing trees, confined feeding operations, and feedlots.

Top threats to SGCN occurring in agricultural lands in the Great Lakes Region:

1. Natural habitat conversion
2. Conversion of habitat to annual crops
3. Annual and perennial non-timber crops

Top conservation actions for SGCN occurring in agricultural lands in the Great Lakes Region:

1. Educate and engage with landowners and citizens (benefits all species)
2. Enhance connectivity of forests and grasslands surrounding agricultural lands (benefits all species)
3. Increase use of CRP partnerships (benefits all species)
4. Implement agricultural practices that improve water quality in aquatic systems and wetlands (for aquatic/wetland species)
5. Maintain shallow-water areas for migrating shorebirds

Top threats to fish and wildlife habitats in agricultural lands in the Great Lakes Region:

1. Conversion of natural habitats to other land uses
2. Conversion of habitat to annual crops
3. Invasive and alien species
4. Changing frequency, duration, and intensity of drought
5. Changing frequency, duration, and intensity of floods
6. Housing and urban areas
7. Agriculture, residential, and forestry effluents
8. Household sewage and urban water waste
9. Introduced genetic material (such as crop, seed stock, bio-control, stocked/released species, etc.)
10. Point source pollution from commercial/industrial sources

Top conservation actions for fish and wildlife habitats in agricultural lands in the Great Lakes Region:

1. Acquire conservation easements to protect important wildlife habitats
2. Restore and integrate diversity of habitats into crop-production dominated landscapes
3. Build and strengthen CRP partnerships
4. Preserve currently existing corridors
5. Link existing habitat blocks through corridor enhancement in agricultural lands
6. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)
7. Increase acres of riparian buffers
8. Promote use of research and science in conservation decision-making processes

9. Develop and promote farming technologies and practices that have conservation benefits (e.g., cover crops, no-till)
10. Develop education programs in general

Aquatic Systems

Aquatic systems are defined as all water habitats, both flowing and stationary. Examples of aquatic systems include: manmade impoundments, natural lakes rivers, streams, oxbows, sloughs, embayments, and backwaters (not including wetlands).

Top threats to SGCN occurring in aquatic systems in the Great Lakes Region:

1. Natural habitat conversion
2. Conversion of habitat to annual crops
3. Housing and urban areas
4. Annual and perennial non-timber crops
5. Commercial and industrial areas
6. Dams and water management/use
7. Livestock farming and ranching
8. Tourism and recreation areas

Top conservation actions for SGCN occurring in aquatic systems in the Great Lakes Region:

1. Enhance public, stakeholder, and landowner education and awareness
2. Reduce sediment and nutrient loads
3. Reduce point and non-point source pollution
4. Protect and restore riparian buffer zones
5. Reconnect floodplains and rivers
6. Remove dams
7. Implement agricultural best management practices to improve water quality
8. Reduce flashiness in watersheds

Top threats to fish and wildlife habitats in aquatic systems in the Great Lakes Region:

1. Invasive and alien species
2. Changing frequency, duration, and intensity of floods
3. Annual and perennial non-timber crops
4. Agriculture, residential, and forestry effluents
5. Shifting and alteration of habitats due to climate change
6. Conversion of habitat to annual crops
7. Changing frequency, duration, and intensity of drought
8. Runoff from roads and service corridors
9. Temperature extremes
10. Commercial and industrial areas

Top conservation actions for fish and wildlife habitats in aquatic systems in the Great Lakes Region:

1. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)
2. Reduce nutrient and toxin loads (e.g., heavy metals, pharmaceuticals, fertilizers, insecticides)
3. Preserve currently existing corridors
4. Acquire conservation easements to protect important wildlife habitats
5. Control invasive species in aquatic systems (e.g., Asian Carp, Zebra Mussels, invasive aquatic plants)
6. Develop and promote farming technologies and practices that have conservation benefits (e.g., cover crops, no-till)
7. Protect and enhance undeveloped shorelines
8. Improve compliance with and enforcement of current policies
9. Protect adjacent buffer zones
10. Promote use of research and science in conservation decision-making processes

Barren Lands

Barren lands are defined as lands dominated by exposed rock or minerals with sparse vegetation. Examples of barren lands include: sand/dunes, rock outcrops, cliffs, and bare rock.

Top threats to SGCN occurring in barren lands in the Great Lakes Region:

1. Natural habitat conversion
2. Annual and perennial non-timber crops
3. Conversion of habitat to annual crops
4. Dams and water management and use
5. Over-mowing of natural areas
6. Fire and fire suppression

Top conservation actions for SGCN occurring in barren lands in the Great Lakes Region:

1. Educate public about Peregrine Falcon
2. Protect Bald Eagle nest sites
3. Maintain stopover habitat for Kirtland's Warbler along Lake Michigan shoreline

Top threats to fish and wildlife habitats in barren lands in the Great Lakes Region:

1. Invasive and alien species
2. Housing and urban areas

3. Problematic native species (e.g., overabundant native deer or algae)
4. Runoff from roads and service corridors
5. Commercial and industrial areas
6. Tourism and recreation areas (e.g., sites with a substantial footprint, such as golf courses, campgrounds, etc.)
7. Roads and railroads
8. Point source pollution from commercial and industrial sources
9. Agriculture, residential, and forestry effluents

Top conservation actions for fish and wildlife habitats in barren lands in the Great Lakes Region:

1. Acquire currently unprotected barren lands
2. Control invasive species in barren lands
3. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)
4. Re-establish natural disturbance regimes in barren lands
5. Restore habitats and natural systems in barren lands
6. Preserve currently existing corridors
7. Protect adjacent buffer zones
8. Develop educational programs in general
9. Acquire conservation easements to protect important wildlife habitats
10. Link existing habitat blocks through corridor enhancement in barren lands
11. Establish training programs for stakeholders

Developed Lands

Developed lands are defined as highly impacted lands intensively modified to support human habitation, transportation, commerce, and recreation. Examples of developed lands include: urban lands, suburban lands, industrial areas, commercial areas, towers for communication and wind power generation, and recreational areas such as golf courses and soccer fields.

Top threats to SGCN occurring in developed lands in the Great Lakes Region:

1. Renewable energy production
2. Invasive and alien species
3. Diseases from domestic populations and unknown sources
4. Fossil fuel energy production
5. Mining and quarrying

Top conservation actions for SGCN occurring in developed lands in the Great Lakes Region:

1. Enhance public education and awareness about bat ecology and issues
2. Reduce urban sprawl and commercial property expansion
3. Manage urban areas for peregrine falcons; minimize disturbance during nesting

4. Increase gravel-surfaced rooftop habitat for breeding common nighthawks
5. Mitigate road hazards for wildlife

Top threats to fish and wildlife habitats in developed lands in the Great Lakes Region:

1. Conversion of natural habitats to other land uses
2. Housing and urban areas
3. Commercial and industrial areas
4. Temperature extremes
5. Runoff from roads and service corridors
6. Roads and railroads
7. Invasive and alien species
8. Changing frequency, duration, and intensity of floods
9. Shifting and alteration of habitats due to climate change
10. Dams and water management and use

Top conservation actions for fish and wildlife habitats in developed lands in the Great Lakes Region:

1. Preserve currently existing corridors
2. Acquire conservation easements to protect important wildlife habitats
3. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)
4. Reduce urban sprawl through planning and zoning
5. Promote green infrastructure
6. Develop educational programs in general
7. Link existing habitat blocks through corridor enhancement in developed lands
8. Restore and integrate diversity of habitats into developed landscapes
9. Control invasive species in developed lands
10. Promote use of research and science in conservation decision-making processes

Forests

Forests are defined as a plant community dominated by trees. Examples of forests include, but are not limited to, all stages of natural forest and plantations.

Top threats to SGCN occurring in forests in the Great Lakes Region:

1. Natural habitat conversion
2. Conversion of habitat to annual crops
3. Housing and urban areas
4. Annual and perennial non-timber crops
5. Invasive and alien species

6. Commercial and industrial areas
7. Diseases from domestic populations and unknown sources
8. Wood and pulp plantations
9. Fire and fire suppression
10. Tourism and recreation areas
11. Livestock farming and ranching
12. Over-mowing of natural areas
13. Recreation activities (e.g., ATVs, trail use, horseback riding, high-speed boating, canoeing)
14. Problematic native species (e.g., overabundant native deer or algae)

Top conservation actions for SGCN occurring in forests in the Great Lakes Region:

1. Protect large contiguous forested areas and reduce forest fragmentation
2. Limit conversion of forests to non-forest land uses
3. Control invasive woody plants to benefit box turtles, whip-poor-wills, and other species
4. Reduce development in forested areas to benefit warblers and other species
5. Protect roost trees for bat species
6. Restore forests and woodlands (benefits all forest species)
7. Create small forest openings to increase diversity
8. Restrict clearing of forested bottomlands for Copper-bellied Water Snakes
9. Provide downed woody debris for the Least Weasel
10. Implement best management practices in forestry

Top threats to fish and wildlife habitats in forests in the Great Lakes Region:

1. Invasive and alien species
2. Housing and urban areas
3. Conversion of natural habitats to other land uses
4. Conversion of habitat to annual crops
5. Commercial and industrial areas
6. Changing frequency, duration, and intensity of drought
7. Point source pollution from commercial and industrial sources
8. Annual and perennial non-timber crops
9. Changing frequency, duration, and intensity of floods
10. Shifting and alteration of habitats due to climate change
11. Temperature extremes

Top conservation actions for fish and wildlife habitats in forests in the Great Lakes Region:

1. Preserve currently existing corridors
2. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)

3. Acquire currently unprotected forests
4. Control invasive species in forests
5. Promote use of research and science in conservation decision-making processes
6. Link existing habitat blocks through corridor enhancement in forests
7. Restore habitats and natural systems in forests
8. Increase regulations on invasive species
9. Reduce conversion to cropland
10. Acquire conservation easements to protect important wildlife habitats

Grasslands

Grasslands are defined as an open area dominated by grass species. Examples of grasslands include: haylands, pasture, prairies, savannahs, or reclaimed mine lands.

Top threats to SGCN occurring in grasslands in the Great Lakes Region:

1. Conversion of habitat to annual crops
2. Annual and perennial non-timber crops

Top conservation actions for SGCN occurring in grasslands in the Great Lakes Region:

1. Restore and improve connectivity of grasslands (benefits all grassland species)
2. Reduce woody encroachment on grasslands to benefit the Mississauga, sedge wren, and other species
3. Increase CRP grasslands (benefits all grassland species)
4. Implement burning regimes (but plan around active seasons, such as when the smooth green snake is active)
5. Minimize disturbance to nesting grassland birds (e.g., Henslow's Sparrow)
6. Mow properly (reduce mowing for shorebirds and owls)
7. Improve grazing practices
8. Translocation program for Franklin's Ground Squirrels

Top threats to fish and wildlife habitats in grasslands in the Great Lakes Region:

1. Conversion of natural habitats to other land uses
2. Invasive and alien species
3. Conversion of habitat to annual crops
4. Fire and fire suppression
5. Housing and urban areas
6. Annual and perennial non-timber crops
7. Commercial and industrial areas
8. Introduced genetic material (such as crop, seed stock, bio-control, stocked/released species, etc.)

9. Recreation activities (e.g., ATVs, trail use, horseback riding, high-speed boating, canoeing)
10. Over-mowing of natural areas

Top conservation actions for fish and wildlife habitats in grasslands in the Great Lakes Region:

1. Strengthen conservation financing
2. Develop alliances and partnerships (e.g., between producers, landowners, and conservation professionals)
3. Control invasive species in grasslands
4. Acquire currently unprotected grasslands
5. Restore habitats and natural systems in grasslands
6. Promote use of research and science in conservation decision-making processes.
7. Reduce conversion to cropland
8. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)
9. Promote conservation payment programs (e.g., payment for ecosystem services, conservation easements)
10. Preserve currently existing corridors
11. Build and strengthen CRP partnerships

Wetlands

Wetlands are defined as either ephemeral or permanently flooded habitat. Examples of wetlands include: swamps, marshes, bogs, fens, potholes, wetlands of farmed areas, and mudflats.

Top threats to SGCN occurring in wetlands in the Great Lakes Region:

1. Natural habitat conversion
2. Invasive and alien species
3. Conversion of habitat to annual crops
4. Housing and urban areas
5. Commercial and industrial areas
6. Annual and perennial non-timber crops
7. Dams and water management and use
8. Tourism and recreation areas
9. Problematic native species (e.g., overabundant native deer or algae)
10. Recreation activities (e.g., ATVs, trail use, horseback riding, high-speed boating, canoeing)
11. Fire and fire suppression

Top conservation actions for SGCN occurring in wetlands in the Great Lakes Region:

1. Protect and maintain large wetlands complexes
2. Restore wetlands
3. Protect buffers around wetlands
4. Control invasive plants in wetlands
5. Create shorebird management areas
6. In some cases, actively manage water levels (e.g., for black tern, common gallinule)
7. Mitigate road hazards to amphibians and reptiles when roads cross over wetlands
8. Minimize disturbance to nesting turtles
9. Provide stopover and roosting habitat for cranes

Top threats to fish and wildlife habitats in wetlands in the Great Lakes Region:

1. Invasive and alien species
2. Conversion of natural habitats to other land uses
3. Agriculture, residential, and forestry effluents
4. Runoff from roads and service corridors
5. Housing and urban areas
6. Annual and perennial non-timber crops
7. Commercial and industrial areas
8. Conversion of habitat to annual crops
9. Point source pollution from commercial and industrial sources
10. Chemical spills

Top conservation actions for fish and wildlife habitats in wetlands in the Great Lakes Region:

1. Acquire currently unprotected wetlands
2. Restore habitats and natural systems in wetlands
3. Control invasive species in wetlands
4. Develop alliances and partnerships (e.g., between producers, landowners, and conservation professionals)
5. Promote use of research and science in conservation decision-making processes
6. Reduce loss of fish and wildlife habitats (due to agriculture, urban sprawl, commercial development, etc.)
7. Acquire conservation easements to protect important wildlife habitats.
8. Preserve currently existing corridors
9. Protect and enhance undeveloped shorelines
10. Protect adjacent buffer zones
11. Promote diversity of wetland types and successional stage