

KEY DATA GAPS AND THREAT SUMMARY FOR REGIONAL SPECIES OF GREATEST CONSERVATION NEED IN THE MIDWEST

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INTRODUCTION

The Midwest Landscape Initiative (MLI) initiated the development of a Regional Species of Greatest Conservation Need (RSGCN) list in 2020-2021 to provide an effective, collaborative focus and approach for regional wildlife diversity conservation in the Midwest. The goal was to enhance their ability to work collaboratively and proactively to sustain populations of endemic and shared Species of Greatest Conservation Need (SGCN) that are supported primarily by Midwest waters and landscapes.

The most recent 2022-2023 data gaps and threat analyses effort aimed to identify data gaps and priority threats for RSGCN / At-Risk Species (ARS) to inform prioritization, next steps, and partnership opportunities for conservation action. The following data gaps reported by regional taxonomic teams are data needs that call for additional information to allow for conservation action. Identifying how to address them (funding, capacity, and expertise) are the next steps to inform conservation needs and actions.

DATA GAPS AND CONSERVATION RECOMMENDATIONS BY TAXONOMIC GROUP

Most of the data gaps reported by regional taxonomic experts for RSGCN taxa were climate and management related. These included:

- Emerging climate-related diseases/pests/pathogens and the alteration of native diseases/pests/pathogens.
- Ecological questions regarding the decoupling of food/nectar resources, host resources, phenological changes, and emerging competition from climate migrants.
- Habitat degradation, connectivity, and loss as amplified by climate change.

Several taxa were deemed to be data deficient for most species contained within those taxa, including:

- **Ephemeroptera, Plecoptera, and Trichoptera (EPT)** data-deficiency was driven by a lack of basic research needs on ecology, life history, and distribution before being able to answer questions related to changing landscapes, limiting factors, and threats.
- **Mussel** data deficiency was driven by information related to host-fish interactions and ecology.
- **Odonate** data deficiency was driven by unknown climate change impact data.

AQUATIC TAXA

Based on taxa expert and state wildlife agency comments, as well as cursory literature search, **conservation action recommendations to address threats to aquatic taxa** emerged:

- Fill data gaps for RSGCN species (see taxa summaries below).
- Conserve upstream habitats and develop best management practices (BMPs) for water and upland habitat corridors/connectivity.
- Use aquatic RSGCN as an indicator of large-scale aquatic and riparian quality and connectivity.
- Work with the Environmental Protection Agency (EPA) to evaluate existing water quality protocols and programs and collaborate/consult to incorporate RSGCN conservation (including assessment, research, sampling protocols, BMPs).

EPT

Ephemeroptera (Mayflies), Plecoptera (Caddisflies), and Trichoptera (Stoneflies), collectively referred to as EPT, are the most data-deficient taxa group evaluated, with basic information on distribution and ecology related to shifting stressors, habitat, or climate needed. Specific data deficiencies include diet, life history, specific habitat needs, predators, parasites, fecundity, dispersal corridors, phenotypic plasticity, and responses to individual pollutants for virtually all caddisfly species. Taxa experts stated that the common overarching threats to nearly every EPT species are aquatic pollution, modifications to the riparian corridor, and upstream habitat loss.

Conservation action recommendations for EPT include:

- Conserve upstream habitats.
- Use EPT as an indicators of large scale aquatic and riparian quality and connectivity.
- Work with the EPA to incorporate RSGCN conservation (including assessment, research, sampling protocols, and BMPs) into water quality protocols and programs.

FRESHWATER MUSSELS

Specific data deficiencies for freshwater mussels are indirect climate effects and species' ecology including habitat requirements, interactions with fish hosts, susceptibility to changes in water conditions, and potential interactions with pathogens and invasive competitors. Data also are needed on host fish population dynamics and physiological thresholds/cold water refugia, changing climate envelopes, and allowing for invasive species to alter host fish population dynamics.

Conservation action recommendations for mussels include:

- Continue to improve survey effort and standardization of methods across the region.
- Conserve terrestrial buffers and low intensity/open land use, maintaining open- to low-intensity land use within 100 meters of streams/rivers.

- Reduce chemical runoff from agriculture and mining; decrease mine, canal, pipeline, and high-density land use impacts near rivers and streams and associated riparian floodplains and wetlands
- Manage flow (especially during low precipitation periods) and habitat connectivity.
- Focus on a regional/watershed approach to species management, then on stream-specific populations.

ODONATES

Odonates are second only to EPT on data needs. Data deficiencies for RSGCN dragonflies and damselflies include interactions of climate on ecological relationships, climate and habitat degradation on physiology, and base knowledge on invasive species and ecology. More information is also needed on specific habitat components and vulnerabilities of wet seeps in forested areas and vulnerabilities associated with bogs and fens. Major threats to RSGCN odonates are habitat loss and degradation that compound continued population fragmentation or scattered populations.

Conservation action recommendations for odonates include:

- protect river, lake, riparian, shoreline, and wetland habitat
- protect wetlands from ag runoff that could impact water quality
- protect shorelines from trampling by cattle that could impact shoreline vegetation
- control human disturbance

CRAYFISH

Data deficiencies for RSGCN crayfish are related to climate effects on ecological relationships, habitat degradation on physiology and base knowledge on invasive species, distributions and ecology.

Conservation action recommendations for crayfish include:

- Address displacement of native species by invasive crayfish (*Faxonius hylas*).
- Address the drought-induced reduction of small and intermittent streams.
- Manage and conserve riparian habitats.
- Develop regional "BMPs" designed to reduce silt and fine sediments to streams, manage water tables, and address warming temperatures (from climate or runoff/anthropogenic sources, changes in stream hydrology, or loss in forest cover).

FRESHWATER FISH

Data deficiency and uncertainty exists for RSGCN fish on the pace, type, and magnitude of climate impacts.

Conservation action recommendations for freshwater fish include:

- Develop standardized surveys for population trends, habitat preferences, and food source availability.
- Develop and implement/standardize BMPs in riparian areas region-wide.
- Evaluate and incorporate RSGCN species into stocking strategies for sportfish.
- Ensure diverse instream habitats.
- Maintain base streamflows.
- Address key threats of water management (exacerbated by climate change) including culverts, drainage in agricultural environments, withdrawal of groundwater, and removal of forest.
- Address the need for additional resources and capacity needed for conservation.

TERRESTRIAL TAXA

MAMMALS

MLI requested a threat analysis for RSGCN mammals by family and specific threat assemblage information for species of RSGCN migratory bats. Results indicate that 75% of shrew species, 100% of rabbit species, and more than 50% of rodents are in need of more detailed threat assemblage information and non-habitat related data, specifically small mammal ecology (including bats), especially climate change and refugia; population cycles/population dynamics; and diseases, pests, and pathogens. Species with additional information needed include both rabbit species, the pygmy shrew, Elliot's Short-tailed Shrew and the Long-tailed or Rock Shrew, pocket gophers, voles, ground squirrels, and mice species.

One key finding for RSGCN mammals is that climate change exacerbates overall habitat loss and degradation as well as invasive species in grasslands and forest cover.

Based on taxa expert and state wildlife agency comments, as well as cursory literature search, **conservation action recommendations to address threats to RSGCN mammals** emerged:

- Fill data gaps on most taxa. Develop a coordinated effort on distribution/abundance information particularly in riparian corridors at landscape/watershed levels.
- Develop a regional communication strategy and BMPs for cave vulnerabilities (stable temperatures, human encroachment).
- Conduct a forest health analysis for specific habitat structural components (such as down and dead woody debris and large tracts of forest).

- Collaborate regionally to leverage conservation efforts for large mammals and climate connectivity/refugia as major ongoing active management activities include maintaining connectivity, vegetative control, and protecting climate refugia.
- Work with the MAFWA furbearer team and state agencies through Pittman-Robertson funds to leverage and coordinate this work across state lines.
- Develop a proactive approach to address climate migration to cooler caves in bat populations (reducing the potential to spread disease).
- Monitor distributions and seasonal movement patterns to identify responses to climate change.
- Monitor and protect bat hibernacula.
- Address management barriers that include competing demands on managers, lack of resources, and uncertainty of the pace, type, and magnitude of climate impacts.

RSGCN SHREWS AND RABBITS

For the RSGCN **shrews and rabbits**, agriculture, invasive species, and habitat loss from development were the top three threats cited.

Conservation action recommendations for shrews and rabbits include:

- Maintain early successional habitat (White-tailed Jackrabbit) and riparian and wetland habitats with adequate cover requirements (Swamp Rabbit).
- Develop methods to census these nocturnal species.
- Assess abundance, distribution, and trends.
- Improve understanding of jackrabbit ecology, including habitat associations and selection.

Shrew threat data are primarily driven by the North American Least Shrew, with loss and degradation of suitable habitat due to development, intensive farming, and pesticide application. Long-term drought is a threat in prairie and dry woodland habitats prone to moisture stress. Management activities that promote long-term site desiccation or habitat conversion are harmful in prairie and dry woodlands. Native prairie conversion drives threats to other shrew species. Impacts from forest and range management activities, such as prescribed burning and livestock grazing, need assessment and evaluation.

Key threats to RSGCN rabbits (Swamp Rabbit and White-tailed Jackrabbit) include loss of habitat (due to draining of swampy areas, clearing of floodplains, and damming of rivers and deforestation) for Swamp Rabbits and habitat loss and degradation of shrub steppe and grasslands (due to historic unsustainable grazing practices and invasion of exotic plants) for jackrabbits.

RSGCN CARNIVORES

Key threats for RSGCN carnivores (Eastern Spotted Skunk, Plains Spotted Skunk, and Prairie Gray Fox) include mortality from collisions with vehicles; habitat loss from urbanization, intensive agriculture, or overgrazing (especially riparian areas); harvesting for fur; pesticides; and pathogenic diseases including canine distemper (fox), canine parvovirus (fox) and rabies (all).

Conservation action recommendations for carnivores include:

- Maintain or restore native prairie and control invasive plants. Restore or maintain prairie areas with a diverse mixture of native warm-season grasses and forbs or with a mix of wildlife-friendly cool-season grasses.
- Implement a patch burn grazing system or prescribed grazing system on native prairie or other wildlife-friendly grasslands to manage for greater plant diversity and heterogeneous stands of vegetation.
- Support rabies transmission and reservoir research ([Velasco-Villa 2023](#)).

RSGCN RODENTS

Rodent threat data are driven by data available for the Allegheny Woodrat. cursory threat information on pocket mice included conversion of sandy soil habitat for agricultural use. Herbicide and pesticide use on agricultural land may also be a threat to mouse and vole RSGCN. Allegheny Woodrat threats include invasive species, biological resource use, climate change, and mining.

Conservation action recommendations for rodents include:

- Monitor populations of Plains Pocket Mice, which are often isolated by areas of unsuitable habitat making genetic flow unlikely. Conduct long-term monitoring of both vegetation and small mammal composition.
- Protect habitat from human disturbance. Impacts of human development, including the introduction of cats and dogs and soil compaction from foot and vehicular traffic, can eliminate populations of Plains Pocket Mice.
- Maintain early successional habitat, as an increase in trees and thick ground vegetation attracts meadow voles and drives out plains pocket mice. When prescribed burning or discing, subdivide the area to avoid disturbing all potential habitat in any one year. Support an increase in hayfields, meadows, and fencerows for shrew habitat.
- Support Allegheny Woodrat research. No single factor has been identified to explain the decline of Allegheny woodrat populations. American chestnut may have been an important food source until the chestnut blight, and more recent Spongy Moth infestations affected acorn production. The raccoon roundworm parasite, Great Horned Owls, and porcupines (which may preempt favorable den sites) may affect populations.
- Maintain rocky outcropping and critical core habitat land protection for Allegheny Woodrats. Timbering, road building, utility lines, ridge-top telecommunications towers

and wind farms, and conversion of land to agricultural or residential use have all affected forests surrounding rock habitat and created barriers that reduce the woodrat's ability to travel between rock patches, increasing isolation and reducing recolonization.

RSGCN BATS

The top three most frequently reported threats to bats are pollution, invasive species and disease (pathogens), and climate change. In comments from taxa experts and from NatureServe, threats to RSGCN bats also include water impoundments, roosts vulnerable to disturbance and/or destruction (e.g., removal of lekking trees, recreational caving or mine exploration, mine reclamation, renewed mining in historic districts, mine sealing, and bridge conversion), pesticide use, white-nose syndrome (WNS), and mortality caused by wind turbines. Indiana Myotis, Northern Long-eared Bat, and Little Brown Myotis had similar threat assemblages, with pollution (pesticide use), pathogens (WNS), natural system modifications (habitat loss and roost site loss), climate change, and mining the top five most cited threats. The species with little information reported or are lesser-known are Fringe-tailed and Gray Myotis.

Conservation action recommendations for bats include:

- Regional **winter detection/rapid response to WNS in non-migratory bat** species:
 - Build gates to avoid disturbance in caves and abandoned mines where bats spend the winter.
 - Treat hibernation areas to kill fungal spores when bats are not present.
- Migratory and non-migratory bat species **forest management practices**:
 - Incorporate regional opportunities and plans to evaluate forest management practices (e.g., [Lake States Forest Management Bat Habitat Conservation Plan](#) and the [Ohio Bat Conservation Plan](#)) and monitoring research consortiums such as the [Midwest Bat Hub](#).
 - Identify roosting sites and minimize disturbance/tree cutting within specific radii.
 - Plan conservation of migratory bats at a geographically and politically broad scope and protect a variety of different roost sites, including those used for mating, migration, and maternity, as well as foraging habitats around critical roost sites and migratory and stopover habitats.
- Manage **wind turbines** to avoid / minimize peak bat fatalities that occur in late summer and fall and are heavily concentrated in long-distance migrants such as species of *Lasiurus*. The number of bat fatalities at wind farms could be reduced substantially by temporarily stopping turbines at night at certain times of the year and under certain climatic conditions ([Fleming 2019](#)).
- Explore **conservation finance** mechanisms such as the [Bat Conservation Bank of Indiana](#) created by The Nature Conservancy Indiana Chapter.

- Support **cooperative geopolitical approaches** for migratory bats that mirror migratory bird treaties ([López-Hoffman et al. 2017](#)).

BIRDS

Regional conservation should focus on the unique avian needs the region fills for both resident and neotropical migrant full life cycles.

Conservation action recommendations for birds include:

- Monitor nest occurrence and productivity, causes of nest loss, habitat utilization in urban areas, predation and nest parasitization changes, basic ecology of secretive marsh/grassland birds, effects of grassland stressors and management on nesting and brood-rearing, and annual variations in nesting colony locations.
- Address barriers to conservation, including loss of natural flow regimes and competing uses of rivers (e.g. nesting along the Missouri River competes with other reservoir uses, such as irrigation, flood control and recreation); water pollution affecting prey fish; nesting location success/fidelity; multiple uses of many grouse nesting areas; and livestock grazing, especially during droughts.
- Support partners (e.g., [Southern Wings](#)) in full life cycle conservation planning.

HERPTOFAUNA

Herpetofauna represents one of the most diverse taxonomic groups in terms of threats, management actions, and sources of uncertainty. MLI requested a threat analysis for RSGCN reptiles and amphibians by family and specific threat assemblage information for **short-distance migratory herpetofauna RSGCN**. For the purposes of this report, we defined short-distance migratory herpetofauna as any species that moves between juxtaposed habitat types, regardless of the distance covered. For example, moving between habitat types for brumation in winter and laying eggs in summer, or needing different habitat types for different life stages.

This report summarizes the results of the data gap and threat analysis. It is a compilation of data acquired from taxa expert solicitation and cursory research from NatureServe and other publicly available websites to fill some key data gaps. This is not an exhaustive list of all data available. One key finding is that climate amplifies nearly all stressors for RSGCN herpetofauna, including emerging diseases like Ranavirus and Chytrid, habitat fragmentation (especially the vulnerability of ephemeral pools and grasslands), and thermal refugia.

Based on taxa expert and state wildlife agency comments, as well as cursory literature search, **conservation action recommendations for RSGCN reptiles and amphibians** include:

- Maintain ephemeral ponds, reduce/stop erosion and habitat encroachment, maintain water tables, and keep sand areas open.
- Manage farm runoff and subsidized predators (raccoons).
- Minimize human disturbance, including road/recreational trail mortality, collection for the pet trade, and mortality caused from humans and pets.
- Educate the public not to harm, kill, or collect animals.
- Collaborate with the Midwest Partners for Amphibian and Reptile Conservation and other partners to develop and/or utilize regional communication platforms about fragmented populations, behavioral/population changes, and conservation efforts that can be leveraged at regional, national, and international scales.

RSGCN FROGS AND TOADS

The most frequently reported threats to frogs and toads are natural system modifications (wetland loss or withdrawal of surface water), invasive and problematic species, pathogens and genes (*Batrachochytrium dendrobatidis* or Bd), pollution, climate change, and agriculture and aquaculture. Northern Leopard Frog, Fowler's Toad, and Wood Frogs had the most diverse and frequently reported threat categories. Threat assemblages for these three species are very similar, with invasive and problematic species (fungal pathogens), pollution (pesticide use) and/or agriculture associated with pollution, habitat loss, and roads most frequently reported.

Habitat destruction, degradation, and fragmentation (secondary effect of habitat destruction and degradation) are among the most serious listed causes of current and future amphibian population declines. Freshwater systems face significant reductions in biodiversity, which can be linked to overexploitation, water pollution, flow modification, destruction or degradation of habitat, and invasion by exotic species. Corridors and wetland complexes may be particularly critical for Blanchard's Cricket Frogs. Habitat fragmentation eliminates recolonization opportunities; this may be one of the chief reasons for the disappearance of some populations.

Conservation action recommendations for frogs and toads include:

- Protect naturally occurring vernal pools and wetlands.
- Support research on effective locally-occurring probiotics for fighting Bd and Bsal.
- Support practices that decrease nutrient runoff or excess nutrient loads of nitrogen and phosphorus and pesticides.

RSGCN SALAMANDERS, NEWTS, HELLBENDERS AND MUDPUPPIES

All salamander species except Black Mountain Salamanders, Cumberland Plateau Salamanders, Kentucky Spring Salamanders, Yellow-spotted Woodland Salamander, all hellbender species, and Common Mudpuppy are short-distance migrants. Migration is frequently between

breeding vernal pools or wetlands and non-breeding uplands, with many species migrating en masse, triggered by the first rains of spring nights.

The most frequently reported threats to RSGCN salamander, newt, hellbender and mudpuppy species are pollution, biological resource use, invasive and problematic species, pathogens and genes, natural system modifications, and climate change. Threats also include draining wetlands, channelizing streams, removing temporary woodland ponds and sloughs, mortality from road traffic, nutrient loads, and habitat loss, alteration, and fragmentation.

Threat assemblages for the Eastern Hellbender, Common Mudpuppy, and Green Salamanders differ but share invasive and problematic species (fungal pathogens), pollution (pesticide/herbicide and nutrient loads) and/or agriculture associated with pollution, habitat loss, and roads as the most frequently reported threats. Almost all RSGCN amphibians are susceptible to *Batrachochytrium dendrobatidis* or *Bd*.

Conservation action recommendations for salamanders, newts, mudpuppies and hellbenders include:

- Reduce impacts of transportation maintenance, including through support of research, BMP development, and use of alternative materials for road maintenance.

RSGCN SNAKES AND LIZARDS

The most frequently reported threats for RSGCN snakes and lizards are natural system modifications, pollution, invasive and problematic species, pathogens and genes, biological resource use, and climate change. Threats also include draining wetlands, channelizing streams, removing temporary woodland ponds and sloughs, clearing forests, mortality from road traffic, and habitat loss, alteration, and fragmentation.

The Slender Glass Lizard and Northern Prairie Skink have the least reported and least diverse threat assemblage, which includes natural system modifications, transportation and service corridors, and pollution. Both of these species are under-reported and in need of more robust research programs for Midwest populations. This may indicate a data deficiency for these species.

Eastern Hog-Nosed Snake, Eastern Massasauga, and Timber Rattlesnake threat assemblages are very similar, with invasive and problematic species (feral cats), pollution (pesticide use) and/or agriculture associated with pollution, habitat loss, and roads cited. Habitat destruction of prairies and pastures, glades, and fens affects many of the RSGCN snake species, especially the loss of areas formerly dominated by prairie and grassland.

Conservation action recommendations for snakes and lizards include:

- Identify and conserve complexes of multiple habitat types used by RSGCN species seasonally or through their life history (e.g., Eastern Massasauga may use grasslands for summer habitat, wetlands for winter habitat, and subterranean habitat for hibernacula).
- Protect and manage remaining populations and habitat crucial for conservation of snakes and lizards in the Midwest.
- Maintain or restore large, suitable wetland complexes and minimize habitat fragmentation (e.g., due to roads or development).
- Manage wetland habitats to include open conditions with adequate cover (e.g., downed woody debris) and suitable hibernacula.
- Practice herptile-friendly habitat management and apply Priority Amphibian and Reptile Conservation Areas (PARCA) and other BMPs.
- Conduct management activities such as prescribed burning and mowing during the inactive season.
- Inform public education to help facilitate proper identification, raise public awareness, and discourage illegal persecution, harassment, and collection.

RSGCN TURTLES

The most frequently reported threats to RSGCN turtles are natural system modifications, pollution, invasive and problematic species, pathogens and genes, biological resource use, and climate change. Threats also include draining wetlands; channelizing streams; removing temporary woodland ponds and sloughs; clearing forests; habitat loss, alteration, and fragmentation; mortality from road traffic; urban predators such as raccoons and introduced species; and the collection of wild turtles for the commercial pet trade and overseas markets.

Conservation action recommendations for turtles include:

- Support turtle-friendly habitat management (e.g., PARCA, best practices developed for [Northeast turtles](#)).
- Develop and implement compatible prescribed burn management guidelines that incorporate RSGCN turtle needs.
- Encourage urban lighting reduction by providing information on wildlife impacts; support practices, policies, or education that decreases urban lighting.
- Encourage the use of BMPs in transportation projects to reduce mortality and habitat connectivity impacts (e.g., [New Hampshire Department of Environmental Services 2023](#)).
- Reduce illegal turtle trade or collection; support policies, research and/or education that decreases wildlife trade.

POLLINATORS: LEPIDOPTERA AND BEES

Data deficiencies for RSGCN Lepidoptera and bees include indirect climate effects, host plant population dynamics and phenological changes, altered habitat from changing fire regimes and development, and invasive plant migration causing habitat degradation and endangerment of pollen-dependent hosts. Fine-scale habitat components, including soil and host plant phenology, were mentioned by taxonomic experts as uncertain stressors. A suite of fine-scale habitat components plus high-site fidelity and small home ranges outside of migration uniquely separate the lepidoptera and bee threats/limiting factors from other taxa groups.

Basic information on distribution, ecology, changing climate envelopes, population reaction from fire management or succession, and fragmented populations was cited as lacking. Stressors related to both long and short distance migration/connectivity were mentioned for Lepidoptera as well as birds and herpetofauna.

Key threat assemblages for pollinator RSGCN include vegetation succession, invasive / non-native terrestrial plants, and herbicides and pesticides.

Conservation action recommendations for lepidopterans and bees include:

- Encourage conservation of pollinators through education and community programs.
- Conduct surveys, monitoring, and research of bee RSGCN, including tracking of commercial bumble bee placement in states with extant *Bombus affinis* populations.
- Conserve habitat for RSGCN habitat specialist pollinators, including composite specialists, sand obligates, grasslands with abundant floral resources spring through fall, areas rich in legume species, grassland/savanna with *Dalea* plant species, gravelly/sandy habitats, and older glacier habitats.
- Coordinate regional high-quality prairie remnant-dependent pollinator conservation.
- Address the need for additional resources and capacity for management to protect and increase habitat with floral resources throughout the season.
- Work with EPA and other partners to reduce the use of harmful pesticides.
- Work with the Natural Resources Conservation Service and other partners to encourage pollinator friendly habitat management.

OVERARCHING RECOMMENDATIONS

The priority data gaps and threats identified above inform priority conservation for key taxa groups and habitats and are highlighted as recommendations for Midwest regional action:

1. **Prioritize and fill key taxa specific data gaps** including:

- a. Aquatic invertebrate data gaps (EPT, Crayfish, Mussels, and Odonates particularly). Specifically, most aspects of EPT ecology and distribution, mussel ecology with host fish, and Odonate and crayfish ecology.
 - b. Small mammal distributions regionwide, small mammal communities in grasslands, and key threats (encourage BMPs including the compatible use of prescribed burns and exacerbating impacts on response of invasive species).
 - c. Bat movement, thermal refugia, and disease ecology. Large scale connectivity and leveraging conservation efforts with climate refugia for other species/taxa.
 - d. Climate change impacts to most taxa.
2. **Management specific:**
- a. Coordinate efforts on large and small-distance migratory assemblages including opportunities on prairie remnants, migratory butterflies, and grassland-obligate bird species; herpetofauna that migrate to very different habitat-types seasonally; fish assemblages; and thermal refugia.
 - b. Apply outreach (e.g., bee and butterfly) conservation success stories to be scaled for herpetofauna and other taxa communication-specific threats.
 - c. Leverage multiple conservation goals across taxa groups using large-scale, climate-smart connectivity.
 - d. Identify management activities for prelisting/recovery efforts (e.g., Endangered Species Act Section 4(d), Species Status Assessment (SSA) capacity).
 - e. Develop regional protocols and BMPs to address multiple taxa that share the same habitats and threats to leverage resources.
3. **Fill data gaps in the Midwest RSGCN database** to improve analysis of species conservation need via habitat and threats, including more detailed threat analyses/threat assemblages.
4. **Design effective, climate-informed actions** using RSGCN species and habitats along with their known threat information.
5. **Develop/strengthen partnerships to be informed by these priorities in ecoregions within the Midwest**, such as Great Lakes states, prairie remnant states, and climate corridor regions, using a consortium of taxa-experts, climate experts, and social scientists.

6. **Identify key regional indicators to monitor** in concert with the Midwest Conservation Blueprint (e.g., riparian and aquatic habitat condition and connectivity).
7. **Identify opportunities to collaborate with neighboring states on shared RSGCN for funding opportunities in context with the Midwest Conservation Blueprint.** Indiana and Illinois have the highest number of RSGCN occurring in their states, with 179 RSGCN occurring in both states and presenting an opportunity for collaboration between the neighboring states. Those two states have the highest number of Lepidoptera RSGCN and EPT RSGCN, which could prioritize taxa for collaboration. The Ohio River states share many freshwater mussel RSGCN and present a similar collaboration opportunity.
8. **Use the RSGCN database fully and incorporate into more Midwest programs/projects.** The RSGCN list can be sorted and filtered to prioritize species for customized use by MLI, MAFWA, and their partners. The deferral categories and USFWS workplan species also indicate the need for follow up and coordination across regions and their conservation priorities.
9. **Develop a method to track conservation status changes over time within the RSGCN process with taxa expert confirmation.**
10. **Further develop a prioritization system for species** based on gaps in available data/knowledge, the number of workplans/programs the species is listed under, known threat levels, and ecological or ecological service roles.
11. **Collaborate/consult with sister federal agencies to incorporate RSGCN, At-Risk Species, and SGCN into their programs.** Specifically, explore the water quality assessments and monitoring programs of the EPA and United States Geological Survey to enhance these aquatic priority species.
12. **Bridge the gap between ARS and prelisting and listing.** Improve collaboration between USFWS Ecological Services and At-Risk Species Programs and state fish and wildlife agencies to enhance the capacity for SSAs, leads, prelisting, and recovery to bridge the gap for these priority species within USFWS.

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