Voluntary Lexicon and Best Practice Recommendations for Midwest State Wildlife Action Plans

Developed by the Midwest SWAPs and Landscapes Team of the Midwest Landscape Initiative and Terwilliger Consulting, Inc.

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INTRODUCTION

One of the strengths of State Wildlife Action Plans (SWAPs) is the ability of states to exercise flexibility in designing and developing these plans, as long as the eight required elements are present. This flexibility is key to empowering each state to develop and create a document that works best for their constituents and partners. However, this flexibility can also result in data inconsistencies that make it more difficult to track SWAP elements consistently across space and time. Additionally, inconsistencies in data availability and formats complicate the process of developing databases and tools that would allow for greater accessibility and analysis of the vast information contained in SWAPs.

A lexicon can increase consistency, efficiency, and collaboration within and among Midwest SWAPs and other fish and wildlife diversity conservation efforts by sharing common language and best practices. Here we summarize key features of other regional SWAP lexicons and best practice efforts as voluntary guidance recommendations for each SWAP Element to support Midwest SWAP development and implementation.

The Association of Fish and Wildlife Agencies (AFWA) recommends that SWAPs follow best practices to "Adopt standard classification systems and taxonomy for [Species of Greatest Conservation Need] SGCN, habitats, mapping units, and other such methodologies and data sources" (AFWA 2012, p. ix). Several advances and updates in standardized classification systems, resources, and tools for SWAPs are now available, including the development of Midwest Regional Species of Greatest Conservation Need (RSGCN) and an associated database.

The recommendations contained in this document are designed to result in more simple and efficient data management processes within state agencies regarding their SWAP data, as well as to facilitate the future development of state and regional level data visualization and analysis tools that will improve the accessibility, usability, and collaborative capacity of SWAPs moving forward. As with all guidance and best practices documents developed by the Midwest Landscape Initiative (MLI), these

recommendations are voluntary and intended only to assist state wildlife agencies and their partners.

In 2021, the SWAP and Landscape Conservation Working Group of AFWA prepared the **Leading At-risk Fish and Wildlife Conservation: A Framework to Enhance Landscape-Scale and Cross-Boundary Conservation through Coordinated State Wildlife Action Plans** (AFWA 2021). The first Guiding Principle of this guidance recommends that states "Identify and apply regional and shared approaches for development, implementation and measuring [the] progress of SWAPs, to improve effectiveness, efficiency, cost-savings, and consistency" (AFWA 2021, p. 5).

Each Guiding Principle in the landscape report has specific Recommended Actions, associated outcomes, and a recommended implementation framework. Recommended Actions for Guiding Principle 1 include (AFWA 2021, p. 13):

- **1.1** Using clear and consistent criteria, identify priority species, habitats, landscapes, threats, and conservation actions for regional conservation.
- **1.2** Develop and use a common lexicon and classification system for species, habitats, threats, and conservation actions.
- **1.4** Promote the development of shared science, data, research, and monitoring protocols.
- **1.5** Use consistent metrics and reporting tools to evaluate conservation effectiveness.

MLI recommends the following best practices for Midwest SWAPs to implement this AFWA guidance.

Best Practice Recommendations: SWAP Element 1 – Species

AFWA Best Practices for SWAPs (2012, p. 10): "To increase consistency when comparing SGCN lists across states, use accepted or official taxonomic standards for plant and animal species."

Recommendations:

1.1. Use a recognized unique species identifier code in SGCN data management, preferably the Taxonomic Serial Numbers (TSN) of the Integrated Taxonomic Information System (ITIS). When a species does not have a TSN identifier code, check the Midwest RSGCN Database to see if a custom code has been created for the species (e.g., custom TSNID 164393a for the Hoosier Cavefish, *Amblyopsis hoosieri*). Custom codes should be generated through MLI for consistency across the region and to avoid duplication. To create a custom code, use the TSN identifier code for the genus (or species, when used for a subspecies) and then add a letter(s) at the end of the code (e.g., TSNID 208882a for the subspecies Southern Coal Skink, *Plestiodon anthracinus pluvialis*, where the TSNID 208882 is for the nominal species *P. anthracinus*). Additional data fields listing the ELCODE from Biotics (NatureServe) can be used to crosswalk species identifying codes, but ELCODE identifiers can change and must be updated periodically.

1.2. Wherever possible, use accepted or official taxonomic standards.

1.3. SGCN can be listed at the species, subspecies, or population/variety level.

1.4. Coordinate with state Natural Heritage Programs to ensure that state heritage ranks and available Heritage data are up-to-date to allow assessment of species' risk of extinction or extirpation.

1.5. Use the Midwest RSGCN Database and list of RSGCN and Watchlist species in developing or revising lists of SGCN and to identify associated key habitats and threats. Proposed RSGCN and Proposed Watchlist species meet the criteria as RSGCN or Watchlist species but were not identified in previous Midwest SWAPs as SGCN and therefore could be considered during SGCN updates (Terwilliger et al. 2021).

1.6. Data should be provided in tabular/spreadsheet format for all SWAP data elements.

   a. To facilitate taxonomic reconciliation across state and regional boundaries, SGCN data management should include additional, separate data fields for taxonomic groups, genus, species, subspecies, and population or variety.
   b. Do not abbreviate a genus, species, or subspecies scientific names.
   c. Record scientific and common names in separate data fields.

d. Provide federal and state listing status, such as proposed, threatened or endangered, as well as S-Rank and G-Rank information, for each SGCN.
e. For federally listed species that use outdated taxonomy, include a Taxonomic Synonyms data field where the accepted taxonomy can be recorded or vice versa.
f. Where possible, associate habitats, threats, and actions with each SGCN in a relational database.

Additional Resources:

- NatureServe developed a conservation ranking methodology that can be used to assess species' risk of extinction or extirpation (AFWA 2012).
- AFWA *Best Practices for SWAPs* (AFWA 2012) recommend prioritizing SGCN with decision theory approaches, with the first prioritization step based on the immediacy and magnitude of threats. The Southeast Association of Fish and Wildlife Agencies (SEAFWA) *Recommendations to Improve the Identification, Assessment, and Prioritization of SGCN in the SEAFWA Region* offers a species prioritization method for SGCN (SEAFWA 2022).
- AFWA (2022a) offers guidance on identifying plant SGCN, and SEAFWA has identified Southeastern Plant RSGCN that may occur in the Midwest (Radcliffe et al., 2023).

Taxonomic Standards

- American Society of Mammalogists' Mammal Diversity Database (v.1.11, released April 2023)
- The Society for the Study of Amphibians and Reptiles (SSAR) Checklist of the Standard English Names of Amphibians and Reptiles
- The American Ornithologists' Union (AOU) Check-list of North American Birds
- The American Fisheries Society (AFS) Names of Fishes
- The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) PLANTS Database
- Freshwater Mollusk Conservation Society Scientific and Common Names of Freshwater Bivalves of the US and Canada
- For crayfish, see Crandall and DeGrave (2017) An Updated Classification of the Freshwater Crayfishes (Decapoda: Astacidea) of the World, with a Complete Species List

Best Practice Recommendations: SWAP Element 2 – Habitat

AFWA Best Practices for SWAPs (2012, p. 10): "Use a well-accepted hierarchical vegetation classification standard to classify land cover or habitats for SWAPs." Use standardized aquatic classification systems where available.

Recommendations:

2.1. Wherever possible, SWAP Key Habitats should be consistent with or translated to the United States National Vegetation Classification System (USNVC) for terrestrial systems (USNVC 2022). The MacGroup or Group levels will be most applicable to SWAP habitats. USNVC is mapped and represented spatially in LandFire. MLI has developed a map and associated habitat crosswalk tables for terrestrial habitats in the Midwest.

2.2. For both rivers and streams and lakes and ponds habitats, SWAP Key Habitats should use the classification systems and spatial map resources of the Resilient Rivers Explorer.

2.3. For wetland habitats, use the *Classification of Wetlands and Deepwater Habitats of the United States* (Federal Geographic Data Committee 2013, adapted from Cowardin et al. 1979), which classifies wetlands based on hydrology, vegetation, and substrate.

2.4. The Midwest RSGCN Database utilizes a coarse level of 20 habitat types for RSGCN and Watchlist species to facilitate regional and landscape-level data compilation and analysis (Terwilliger et al. 2021). The Northeast RSGCN Database (version 4.0) and Southeastern 2025 SGCN Database template use similar coarse regional habitat systems. Wherever possible, state-level habitat types should be cross-walked or linked to the Midwest RSGCN coarse habitats. Clearly define the classification system used for habitats to facilitate translation and cross-walking between classification systems at the regional or landscape scale.

2.5. If multiple levels of habitat classification are used, separate each classification level into different data fields or columns.

2.6. Where possible, associate species, threats, and actions with each habitat in a relational database.

2.7. Where possible, describe the condition of each habitat.

Additional Resources:

- Maberly et al. (2020) developed a thermal classification system for lakes.

- The *Northeast Lakes and Ponds Classification System* (Olivero Sheldon et al. 2016) may be applicable to the Midwest region, classifying lakes and ponds based on water temperature, depth, alkalinity, and trophic state.
- McManamay and DeRolph (2019), describes a stream classification system for the conterminous U.S. which classifies rivers and streams based on size, gradient, temperature, hydrology, valley confinement, and network bifurcation. McManamay et al. (2018) developed a stream classification system for riverine habitats east of the Mississippi River that includes anthropogenic habitat modifications along with the environmental variables of McManamay and DeRolph (2019). Both McManamay and DeRolph (2019) and McManamay et al. (2018) produced spatial distribution maps for each class variable for the conterminous U.S. or eastern U.S., respectively, which can inform the regional or national context for Midwest SWAPs.
- The US Stream Classification System categorizes rivers and streams based on size, gradient, hydrology, temperature, and valley confinement, with an online mapping platform hosted by the National Hydropower Asset Assessment Program of the US Department of Energy.
- The Minnesota shorelands and public waters classification system is based on the physical and biological characteristics of streams, rivers, lakes, wetlands, and shorelands.
- Habitat can be characterized through the use of standardized structural modifiers that define habitat attributes, such as:
    - The *Classification of Wetlands and Deepwater Habitats of the US* includes modifiers for water regime, water chemistry, and soil, plus special modifiers for habitats created or modified by humans or beavers (FGDC 2013).
    - The *Northeast Terrestrial Wildlife Habitat Classification System* includes structural modifiers for habitat systems, such as the presence of standing water, stand development age, canopy cover class, vegetation height, and presence of karst areas (Gawler et al. 2008).
    - The Midwest and Northeast RSGCN Databases include habitat modifier data fields to characterize habitat attributes used by RSGCN and Watchlist species.
    - The *Coastal and Marine Ecological Classification Standard* incorporates modifiers to characterize physicochemical, biogeographic, physical, spatial, temporal, biological, and anthropogenic attributes of lake, estuary, and marine habitats (FGDC 2012).
- AFWA *Best Practices for SWAPs* (AFWA 2012) recommend prioritizing ecosystems or habitats.
    - Comer et al. (2022) applied the IUCN Red List of Ecosystems risk assessment methodology to 655 terrestrial ecosystem types in North and Central America, identifying and mapping 219 ecosystems that are

critically endangered, endangered, or vulnerable and in need of priority conservation.
    - *The Standards and Guidelines for the Illinois Natural Areas Inventory* describes a methology to grade the quality of natural communities into very high quality, high quality, medium quality, low quality, and very severely disturbed quality (Illinois Department of Natural Resources 2023).
- The Midwest Conservation Blueprint can inform prioritization or ranking of lands and waters for conservation, or identification of Conservation Opportunity Areas, as recommended by AFWA (2012).

Best Practice Recommendations: SWAP Element 3 – Threats

AFWA Best Practices for SWAPs (2012): Use a hierarchical threats classification system to describe threats, incorporate climate change as a criteria to select and prioritize SGCN, and follow the recommendations in AFWA's *Voluntary Guidance for States to Incorporate Climate Change into SWAPs and Other Management Plans* (AFWA 2022b).

Recommendations:

3.1. Wherever possible, use the Unified Classification of Direct Threats, version 3.3, of the International Union for Conservation of Nature (IUCN) and Conservation Measures Partnership (CMP) to Level 2 (IUCN and CMP 2022).
3.2. For Level 3 direct threats, consider the regional application of the IUCN and CMP direct threats classification scheme as incorporated in the Midwest RSGCN Database, originally developed by the Quebec Conservation Data Centre (Lamarre et al. 2021) and recommended in the Northeast Lexicon by the Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTC) of the Northeast Association of Fish and Wildlife Agencies (NEAFWA; Crisfield and NEFWDTC 2022).
3.3. If multiple levels of threat classification are used, separate each classification level into different data fields or columns.
3.4. Consider ranking or prioritizing threats to illustrate relative importance.
3.5. Where possible, associate species, habitats, and actions with each threat in a relational database.

Additional Resources:

- Threats can be characterized by identifying their immediacy, spatial extent or scope, severity, certainty, or threat trend, as recommended by the Northeast Lexicon and/or Southeast SGCN Recommendation Report (SEAFWA 2022).
- AFWA *Best Practices for SWAPs* (AFWA 2012) recommends development and/or use of climate change vulnerability assessments for SGCN and their prioritization. The Northeast Climate Adaptation Science Center (NECASC) *A Regional Synthesis of Climate Data to Inform the 2025 State Wildlife Action Plans in the Northeast U.S.* includes an inventory of climate change vulnerability assessments as of 2023 for Northeast RSGCN, some of which may be Midwest SGCN (Staundinger et al. 2024).
- The *Voluntary Guidance for States to Incorporate Climate Change into SWAPs and Other Management Plans* (AFWA 2022b) offers recommendations for incorporating climate change threats into SWAPs.

- The Midwest Climate Adaptation Science Center offers numerous resources, reports, and fact sheets summarizing the latest research on the impacts of climate change to Midwest species and habitats.
- Staudinger et al. (2015) offers a synthesis of climate change information for Midwest and Northeast SWAPs as of 2015.

Best Practice Recommendations: SWAP Element 4 – Actions

AFWA Best Practices for SWAPs (2012, p. 14): "Use a hierarchical or tiered system to prioritize conservation actions."

Recommendations

4.1. Wherever possible, use the CMP Conservation Actions Classification, version 2.0, to Level 2 (CMP 2016).
4.2. For standardized Level 3 conservation action categories, consider the regional application of the beta version of Level 3 actions in the CMP actions classification scheme developed by the Quebec Conservation Data Centre and recommended in the Northeast Lexicon by the NEFWDTC of NEAFWA (Crisfield and NEFWDTC 2022).
4.3. If multiple levels of action classification are used, separate each classification level into different data fields/columns.
4.4. Where possible, associate species, habitats, and threats with each action in a relational database.
4.5. Consider ranking or prioritizing actions to illustrate relative importance (AFWA 2012).

Additional Resources:

- Conservation actions can be characterized by location, urgency or priority, likelihood or probability of success, target location(s), performance metric(s), and/or benefits to SGCN, groups of SGCN, and/or habitats as recommended by the Northeast Lexicon (Crisfield and NEFWDTC 2022) and/or Southeastern SGCN Database User Guide (SEAFWA 2023).
- The *Open Standards for the Practice of Conservation*, or *Conservation Standards*, developed by the Conservation Measures Partnership is an open-source set of best conservation practices and principles for planning, monitoring, and management (CMP 2020).
- Consider connecting conservation actions to regulatory mitigation programs (AFWA 2012).
- Conservation Evidence offers a searchable database of the documented effectiveness of conservation actions, with synopses for individual taxonomic groups, habitats, and types of management.

Best Practice Recommendations: SWAP Element 5 – Monitoring

AFWA Best Practices for SWAPs (2012, p. ix): "Use widely-accepted monitoring protocols designed to make the resulting data as useful as possible to conservation and science. Assess populations, habitats, and project effectiveness at multiple scales, and collaborate with existing monitoring programs and regional associations. Participate in existing research and conservation alliances, and regional agency associations. Consider staffing and funding when determining priorities for long-term monitoring programs, and consult with partners to evaluate needs. Develop new citizen science programs as appropriate to augment monitoring capacity."

Recommendations:

5.1. Clearly identify *existing* monitoring programs and associate them with habitats and/or species.

5.2. Clearly identify and describe *needed* monitoring programs and associate them with habitats and/or species.

5.3. Wherever available, incorporate standardized monitoring protocols at the species level for SGCN.

5.4. Collaborate with existing regional, national, or international monitoring programs. The *Northeast Regional Conservation Synthesis*, Chapter 5 on Monitoring, describes international and national monitoring programs plus public species databases relevant to SWAPs (TCI and NEFWDTC 2023), including:

- a. Motus Wildlife Tracking System
- b. North American Bat Monitoring Program
- c. Native Bee Inventory and Monitoring Program
- d. North American Breeding Bird Survey
- e. Great Lakes Observing System (GLOS)
- f. Great Lakes Acoustic Telemetry Observation System (GLATOS)

5.5. Collaborate with existing community or citizen science projects and programs, using established protocols and methods where available, to enhance monitoring capacity and to engage the public in SWAP development and implementation. Searchable directories of projects are available at scistarter.org and citizenscience.gov. Appendix A provides a list of existing international, national, and regional databases of community science and non-governmental organization monitoring programs. Midwest community science monitoring program examples include:

- a. Wisconsin Aquatic and Terrestrial Resources Inventory
- b. Great Lakes Worm Watch
- c. Nebraska Lost Ladybug Project

d. Nebraska Monarch and Regal Fritillary Survey
e. Missouri Bumble Bee Atlas project
f. Lakes of Missouri Volunteer Program
g. Chronolog Environmental Monitoring Project at Indiana Dunes State and National Parks

Additional Resources:

- Consider the use of performance indicators, as recommended by AFWA (AFWA 2011, 2012). Examples of existing performance indicators to assess habitat condition in the Midwest include:
    - The Great Lakes Restoration Initiative (GLRI) monitors several performance measures for conservation projects it funds, which are described in an Action Plan that is updated every five years (GLRI 2019). Current performance indicators include acres of habitat protected, restored, or enhanced; miles of aquatic connectivity established; miles of shorelines and riparian corridors restored or protected; acres of habitat controlled for invasive species; measures to reduce non-point source pollution; and number of species significantly protected or population recovery promoted.
    - The Environmental Protection Agency (EPA) monitors climate change indicators for wildlfires, stream temperature, streamflow, lake ice, lake temperature, Great Lakes ice cover, Great Lakes water levels, and more.
    - The EPA monitors standardized environmental indicators and issues periodic national assessments on the condition of wetlands, rivers and streams, lakes, and coastal areas (including the Great Lakes).
    - The Upper Mississippi River Restoration Program partnership of federal and state agencies monitors the ecological status and trends of the Upper Mississippi and Illinois Rivers with indicators for fish, aquatic vegetation, water quality, invertebrates, land cover, bathymetry, and other metrics.
    - Iowa has developed a Multiple Species Inventory and Monitoring (MSIM) program which uses a randomized sampling design to select representative habitats, from which statewide inferences can be made about wildlife in Iowa. An associated MSIM Technical Manual describes standardized monitoring protocols for multiple taxa and habitats (Iowa Department of Natural Resources 2016).
    - Iowa has developed *Fish Habitat Indicators for the Assessment of Wadeable, Warmwater Streams* that correlates environmental indicators of the physical stream habitat with a Fish Index of Biotic Integrity as part of the state's stream bioassessment program (Wilton 2015), with associated standardized operating procedures for monitoring the indicators (Iowa Department of Natural Resources 2015).

    - The Illinois Biological Stream Rating System evaluates and ranks stream health based on biological diversity, integrity indices, and biological significance using data from multiple taxonomic groups, with a formal designation of Biologically Significant Streams (Illinois Department of Natural Resources 2008).
    - The Lower Mississippi Alluvial Valley Joint Venture (LMVJV) Forest Resource Conservation Working Group developed guidance for *Restoration, Management and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat*, which describes priority wildlife species and habitat conservation objectives along with recommended forest inventory and breeding bird monitoring indicators for assessing forest habitat condition (LMVJV Forest Resource Conservation Working Group 2007).
- AFWA *Best Practices for SWAPs* (AFWA 2012) recommends use of effectiveness measures. Examples of effectiveness measures to monitor conservation actions in the Midwest include:
    - The Great Lakes Restoration Initiative, for example, provides annual reports on measures of progress monitored by the program.
    - The Dam Removal Information Portal maintained by the United States Geological Survey monitors dam removals and associated scientific studies on the effectiveness of dam removals is another example of a national performance monitoring resource.

Best Practice Recommendations: SWAP Element 6 – Plan Revisions

Recommendations:

7.1. Clearly state the planned cycle of major and minor revisions (every 5 years, 10 years) and the next planned year of revision (i.e., 2035).

Additional Resources:

- USFWS and AFWA (2017) offers guidance on SWAP reviews and revisions.

Best Practice Recommendations: SWAP Element 7 – Partner Coordination

AFWA Best Practices for SWAPs (2012, p. 30): "Working with partners can elevate conservation to the broader landscape scale, which avoids imposing political boundaries on natural systems. Individual states can better leverage scarce resources (e.g., staff, time, money) and avoid duplication of effort by finding complementary roles and actions with partners."

Recommendations:

7.1. Include a list of partners involved in the development and implementation of the SWAP in tabular format, including the type of involvement.

Additional Resources:

- Consider identifying opportunities to engage existing regional partnerships such as the Midwest Landscape Initiative, Joint Ventures, JV8 Central Grasslands Conservation Initiative, Fish Habitat Partnerships, Great Lakes Restoration Initiative, Great Lakes Fishery Commission, Great Lakes Indian Fish and Wildlife Commission, Upper Mississippi River Conservation Committee, Center for Pollinator Conservation, National Bobwhite and Grassland Initiative, Working Lands for Wildlife Initiatives, Midwest Partners in Amphibian and Reptile Conservation, watershed alliances, and many others.
- Consider identifying overlapping priority or focal species with partner organizations (AFWA 2012).
- State Forest Action Plans are comprehensively revised every ten years, with the most recent revisions completed in 2020. These plans and a regional summary report prepared by the U.S. Forest Service (USFS 2022) identify state and regional priorities for forest habitat and management relevant to SWAPs.
- *Perspectives on and Voluntary Guidance for Improving Tribal Engagement in State Wildlife Action Plans* (Schmidt et al. 2023) offers recommendations on how to engage tribal partners in SWAP revisions and implementation.

Best Practice Recommendations: SWAP Element 8 – Public Participation

AFWA Best Practices for SWAPs (2012, p. 37): "Develop and implement a public participation process that identifies key constituent groups / audiences, identifies involvement goals appropriate to each audience, and defines involvement strategies that will be effective at getting information to, and gathering feedback from, affected groups."

Recommendations:

8.1. Provide a list of public participation approaches/events in tabular format.

Additional Resources:

- The Northeast Regional Conservation Synthesis for 2025 State Wildlife Action Plans summarizes the state of knowledge and available resources for public engagement. Chapter 8 of the synthesis describes resources for shifting public fish and wildlife values, outdoor recreation planning and management, public health initiatives like One Health, education and outreach, citizen science, and diversity, equity, inclusion, and justice (TCI and NEFWDTC 2023).
- State Comprehensive Outdoor Recreation Plans are revised every five years and offer information on engaging and managing public outdoor recreation relevant to SWAPs.

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Appendix A. Numerous non-governmental and community science databases are publicly available online that contain inventory, monitoring, and status information on fish and wildlife resources of the Midwest (adapted from TCI and NEFWDTC 2023).

Informational Database	Location and Description
Discover Life	https://www.discoverlife.org/ International database and encyclopedia of plant and animal species observations and profiles for more than 1.4 million species with 822,000+ known distribution maps.
FishBase	https://www.fishbase.se/search.php International database of 35,000+ fish species profiles with taxonomy, location, conservation status, habitat, biological use, protection status, trophic ecology, life history, identification keys, citations, and imagery.
Global Biodiversity Information Facility (GBIF)	https://www.gbif.us/ National species database for animals, plants, and fossils in the US and its Territories. More than 825 million observation records with taxonomy, occurrence status, location, date, issues and flags, source dataset, and publisher (e.g., USGS, NatureServe, NOAA). Previously known as the Biodiversity Information Serving Our Nation (BISON) database.
Global Invasive Species Database	http://www.iucngisd.org/gisd/ International database of invasive species with species profiles that include taxonomy, species description, native distribution, alien distribution, impacts, life cycle stages, reproduction, spread pathways, management techniques, references, and photographs.

Informational Database	Location and Description
iNaturalist	https://www.inaturalist.org/ Public observations of animal and plant species across the world, which are searchable by name or location with information on the seasonality, number, life stage, and sex of observations. Includes more than 411,000 species and 125 million observations contributed by 5.9 million people.
Invasive and Exotic Species of North America	https://invasive.org Database of invasive and exotic species profiles that include taxonomy, origin, life cycle, distribution, imagery, and invasive listing sources. Includes plants, insects, pathogens, and other species.
ITIS	https://www.itis.gov/ Integrated Taxonomic Information System (ITIS) is the authoritative taxonomic information source on animals, plants, fungi, and microbes of North America and the world and is the taxonomic reference standard for RSGCN and the national SGCN database maintained by the USGS.
IUCN Red List of Threatened Species	https://www.iucnredlist.org/ International Union for Conservation of Nature (IUCN) maintains a Red List of Threatened Species with comprehensive information on the global extinction risk status of animal, fungus, and plant species. Information on more than 153,000 species includes taxonomy, conservation status, status assessments, geographic range, population trends, habitat and ecology, threats, use and trade, and needed conservation actions.

Informational Database	Location and Description
NatureServe Explorer	https://www.natureserve.org/ NatureServe Explorer includes detailed information on the taxonomy, distribution, conservation status, ecology, life history, population, management and monitoring needs, threats, habitat, and biological research needs of more than 100,000 species of plants, animals, and ecosystems.
AmphibiaWeb	https://amphibiaweb.org/ AmphibiaWeb includes nearly 8600 amphibian species profiles from around the world that are searchable by species, location, taxa, or photograph. Species profiles in the database include taxonomy, distribution, reasons for decline, and conservation status.
Amphibian Disease Portal	https://amphibiandisease.org/ International database monitoring the distribution of amphibian pathogens *Batrachochytrium dendrobatidis* (Bd) and *B. salamandrivorans* (Bsal).
Birds of the World	https://birdsoftheworld.org/bow/home International database of birds across the world with comprehensive life history profiles searchable by species or family. Includes identification, taxonomy, systematics, distribution, habitat, movements and migration, diet and foraging, sounds and vocal behavior, behavior, breeding, demography and populations, conservation and management, priorities for future research, and photographs. Integrated with eBird database.
eBird	https://ebird.org Public observations of bird species across the world, which are searchable by species name or location in a database that includes species maps, photographs, and sounds.

Informational Database	Location and Description
Audubon Christmas Bird Count	https://www.audubon.org/conservation/science/christmas-bird-count Database of December bird observations across the US and Canada since 1900 with location, species counts, weather conditions, sponsoring organization, and participants.
Audubon Great Backyard Bird Count	https://birdcount.org Public global observation counts of birds conducted annually in February across four days since 1998, with data integrated into eBird since 2013.
Project FeederWatch	https://feederwatch.org/ Database and maps of public bird observations at bird feeders between November 1 and April 30 across the US and Canada since the mid-1970s.
Botanical Information and Ecology Network (BIEN)	https://bien.nceas.ucsb.edu/bien/ International database of georeferenced plant locations, plot inventories and surveys, species geographic distribution maps, plant traits, species-level phylogeny, and cross-continent, continent, and country-level species lists with more than 464,000 species.
BugGuide	https://bugguide.net/node/view/15740 Database of insects, spiders, and related species with identification keys, imagery, taxonomy, and species profiles with information on range, habitat, season, food, and citations.
Bumble Bee Watch	https://www.bumblebeewatch.org/ Database of 122,000+ observations of bumble bees and their nests across North America with verified identification of species, location, conservation status, observation date, and related information.

Informational Database	Location and Description
Butterflies and Moths of North America (BAMONA)	https://www.butterfliesandmoths.org/ International database of Lepidoptera observations across North America with regional species checklists, taxonomy, and species profiles for more than 7000 species with distribution maps, identification, life history, flight, caterpillar hosts, adult food, habitat, conservation status, management needs, verified sightings, and imagery.
eButterfly	https://www.e-butterfly.org/#/ Database of butterfly 491,000+ observations across North and Central America for 1,250+ species with species profiles including weekly frequency of observations, taxonomy, distribution, imagery, and citations.
North American Butterfly Association Butterfly Count	https://www.naba.org/butter_counts.html International database of butterfly observations since 1993 across 400+ 15-mile count circles in North America.
Land Snails and Slugs of the Mid-Atlantic and Northeastern US	https://www.carnegiemnh.org/science/mollusks/index.html Database of known terrestrial snails and slugs of the Northeast and Mid-Atlantic regions with imagery, taxonomy, and species profiles.
Atlas of Common Freshwater Macroinvertebrates of Eastern North America	https://www.macroinvertebrates.org/#/ Database of freshwater macroinvertebrate species for eastern North America with identification keys, diagnostic characteristics, high resolution imagery, genus overview, habitat, pollution tolerance, feeding habits, movements, and distribution. Integrated with the PocketMacros app.
Mayfly Central	https://www.entm.purdue.edu/mayfly/ Database of Ephemeroptera (mayfly) species across North America, including records for 573 species in the US organized by taxonomy.

Informational Database	Location and Description
Freshwater Mussel Host Database	https://mollusk.inhs.illinois.edu/57-2/ Database of more than 2700 known host interdependent relationships for freshwater mussels searchable by mussel or host species or family with location, data source, and natural or lab evidence for the relationship.
Nature's Notebook	https://www.usanpn.org/natures_notebook National database of 500,000+ phenology records for plants and animals tracking seasonal changes, with featured campaigns to track nectar sources for pollinators, the emergence of mayflies, flowers for bats, insect pests, and non-native invasive plants.
Odonata Central	https://www.odonatacentral.org/#/ Database of Odonata (dragonflies and damselflies) observations in the Western Hemisphere including species, location, date, level of confidence in identification, and imagery with more than 300,000 records.