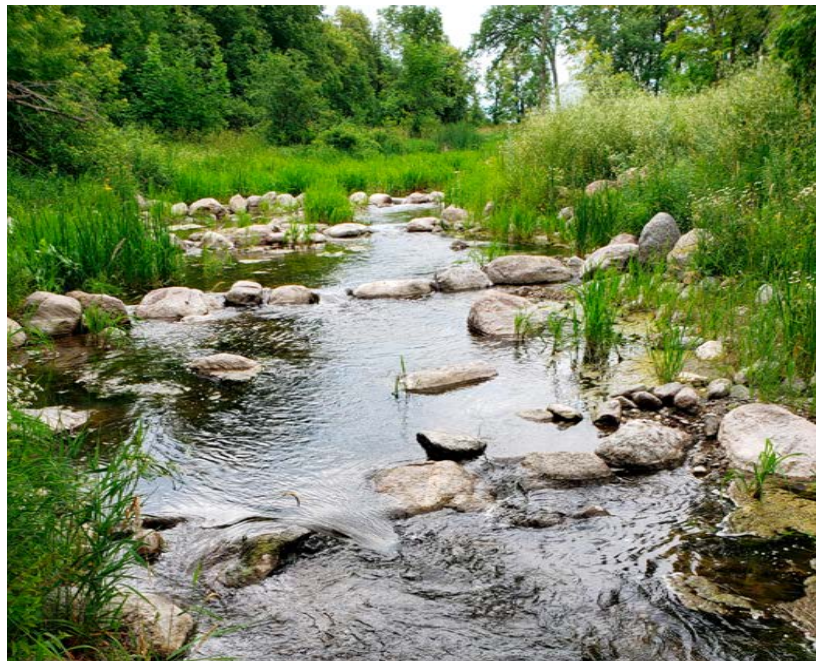


MINNESOTA'S WILDLIFE ACTION PLAN 2025-2035

CONSERVING HABITATS AND BIODIVERSITY

HABITAT



mn DEPARTMENT OF
NATURAL RESOURCES

NONGAME WILDLIFE PROGRAM

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Cover Photos: prescribed burn, Amy Westmark; Restoration project in Lost River enhances fish passage and aquatic habitat connectivity, Nicholas Kludt

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Chapter 3: Habitats

Overview

This Chapter explains the second goal of the Plan, to protect and enhance the resilience, function, and ability of habitats to support biodiversity, especially for Species in Greatest Conservation Need (SGCN). This chapter emphasizes the importance of habitat for SGCN and outlines five strategies to guide habitat conservation. We explain the context of how habitats were depicted across the Plan versions and our approach to creating an updated habitat spatial layer. A set of 15 detailed habitat sub-chapters, one for each habitat, follows.

Significance

Habitat conservation is arguably the most central pillar in recovering vulnerable wildlife. Habitat loss and degradation are repeatedly cited as the top reason for wildlife population declines. In the 2015 SWAP, 70% of the SGCN were classified as being affected by habitat-related stressors as a predominant factor (DNR, 2015). This also led the 2015 SWAP to be organized with the ‘habitat approach’ as the primary strategy for the Plan, a priority that is still relevant today. This makes habitat, and its conservation, the ‘heart’ of the Plan.

Historical Loss

Habitats are lost from an accumulation of past and present land use changes such as conversions to development or agriculture.

Many of the natural ecosystems in our state have sustained great losses. A compelling source of information regarding historic changes in Minnesota’s habitats come from a comparison of present day landcover to mapped native vegetation present during the Public Land Survey (1847 to 1907) (Marschner, 1974). A whole series of maps illustrate dramatic changes, especially in southern and

central Minnesota (Marschner, 1974; Wovcha et al., 1995). In the St. Croix River Valley and Anoka Sandplain, for example, less than 90,000 acres, (6% of the total area) remained in native habitat types when the survey of these two regions was completed in 1990 (Wovcha et al., 1995; Figure 3.1). In the 35 years since that survey, additional changes have likely occurred as well. Land use change in Minnesota can also be visually depicted through historical aerial photography (see [Minnesota Historical Aerial Photographs Online](#)).

For example, the historic loss of prairie throughout North America is well-recognized; indeed, tallgrass prairies are classified as critically endangered (the highest level of imperilment short of collapse), according to a recent publication by the International Union for the Conservation of Nature (IUCN) (Comer et al., 2022 2024). The prevalence of native, remnant prairies in Minnesota has dramatically declined from once covering over a third of the state (about 18 million acres; Marschner, 1974) to about 250,000 acres today, or about 1–2 percent of the historical area (DNR, 2018).

Ongoing Stress

Remaining natural lands are pressured by ongoing economic demands as well as effects such as pollution, invasive species, and changes in climate. These stressors are described carefully and methodically through the use of a threats lexicon (Salafsky et al., 2024). A structured lexicon better specifies the proximate causes of current-day ecological degradation and enables the targeting of conservation actions to ameliorate these threats. We call these “stressors” in this Plan and outline them in relation to SGCN and habitats (see stressor section of Chapter 2. Species in Greatest Conservation Need). It should be noted that some identified stressors might also be applied for conservation purposes, such as in ‘fire management.’

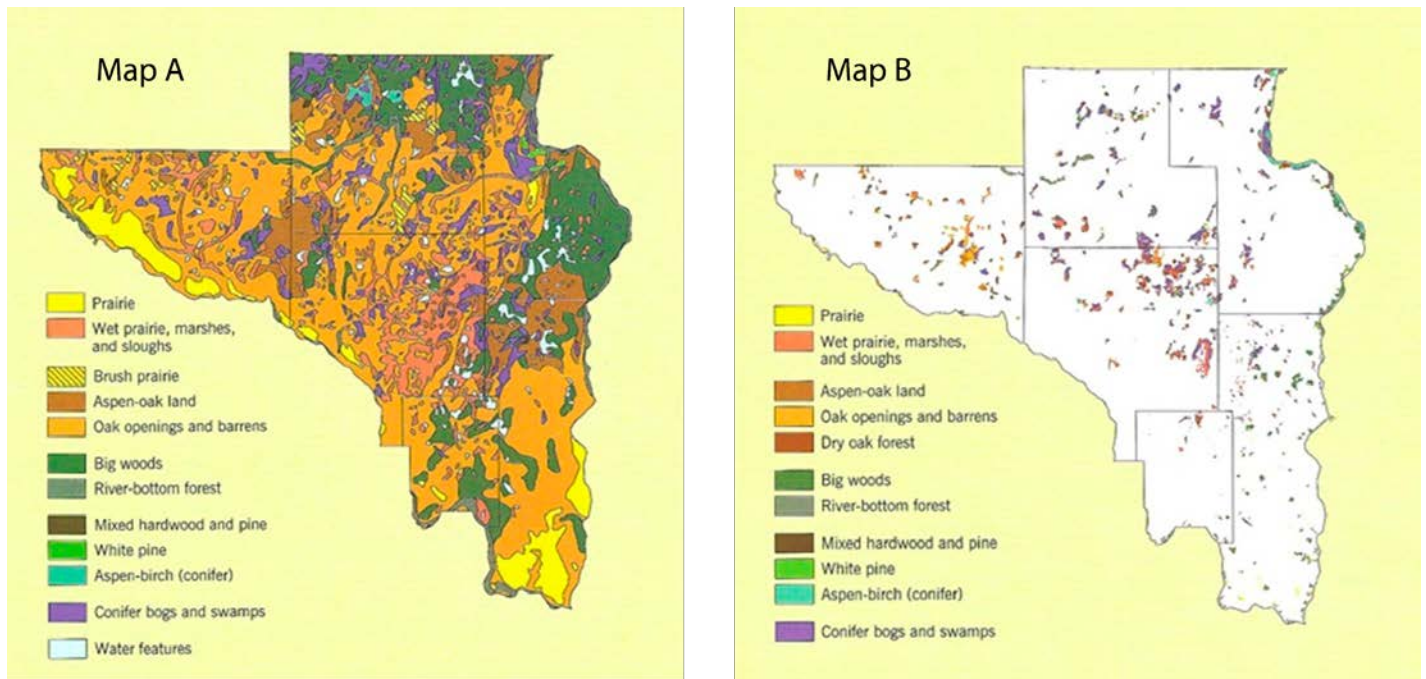


Figure 3.1. A comparison of landcover in the St. Croix – Anoka Sandplain region from the mid 1800's to 1990 (Wovcha et al., 1995). Map A depicts pre-settlement vegetation types and was compiled by FJ Marschner in 1929-30 (Marschner, 1974) using notes from the General Land Office surveys of the mid-1800's in constructing this map. Map B depicts the remaining native vegetation, as recorded by the Minnesota County Biological Survey between 1987 and 1990.

We take care to explain these nuances in the context of each habitat type. Climate change is pervasive throughout all habitat types and interacts with the other stressors. We discuss changes in temperature, precipitation, and hydrology (movement and distribution of water) within the stressors section for each habitat sub-chapter. Further background information and strategies for climate-smart management are presented in the Climate Adaptation section of Chapter 6. Implementation.

Habitat Conservation

In this chapter we outline five strategies to implement the Habitat Goal of the SWAP (see below). Habitat conservation that is meaningful at a landscape scale requires partnerships between land managers and collaborations across land ownership boundaries. Here is a current breakdown of Minnesota land uses according to the [Minnesota state land portfolio](#)

- 5.6 million acres (11%) are state-owned, DNR managed lands
- 3.8 million acres (7%) are federally owned lands
- 2.8 million acres (6%) are state-owned, county-administered tax-forfeited lands
- 0.7 million acres (2%) are tribal owned lands
- 0.3 million acres (1%) are county owned lands
- 25.4 million acres (45%) are in agricultural use (USDA, 2024)

42 million acres (75%) privately owned ([Private landowner information](#))

Building on the two Prior Plans

2005-2015 Tomorrow's Habitat for the Wild and Rare

Minnesota's original State Wildlife Action Plan, Tomorrow's Habitat for the Wild and Rare, identified significant loss and degradation of habitat as the principal management challenge for achieving its goal to stabilize and increase SGCN populations (DNR, 2005). The principal strategy for addressing this management challenge was the need to identify key SGCN habitats and focus management efforts on them. Habitat descriptions were subsequently provided for 16 key habitats in profiles of all 25 ecological subsections in Minnesota ([Ecological Classification System](#)). Each subsection profile included a matrix of SGCN use for all habitats that occurred in the subsection along with an assessment of which habitats were the most important to the greatest number of SGCN. Conservation actions to maintain and enhance the key habitats in each subsection were delineated.

Minnesota's Wildlife Action Plan 2015-2025

Minnesota's Wildlife Action Plan 2015-2025 identified a three-pronged approach to ensuring the long-term health and viability of Minnesota's wildlife, the first and most comprehensive being the habitat approach (DNR 2015). This Plan also presented a Wildlife Action Network to represent high-quality habitats for terrestrial and aquatic SGCN as well as movement corridors among them. To prioritize the implementation of on-the-ground conservation work with our partners, sites within the Wildlife Action Network were assigned priority rankings using five metrics including SGCN population viability and SGCN richness. These rankings were used in combination with a set of Conservation Focus Areas where resources, such as partners and/or funding, were available to address conservation needs through on the ground habitat restoration and management.

SWAP Habitat Goal

Protect and enhance the resilience, function, and ability of habitats to support biodiversity, especially for SGCN

Habitat Strategies

1. **Protect**, buffer, and connect high quality habitats to optimize biodiversity, SGCN, and landscape benefits, particularly across the Conservation Action Network.
2. **Restore**, enhance, and maintain lands and waters to benefit SGCN, biodiversity, and ecosystem resilience
3. **Collaborate** with conservation partners and landowners to enhance conservation delivery, particularly in the Conservation Action Network and Conservation Opportunity Areas
4. **Monitor** SGCN, native plant communities, habitats, and ecosystems for changes through time including responses to stressors, natural disturbances, conservation actions, and climatic conditions.
5. **Connect** to develop, innovate, incentivize, and disseminate evidence-based habitat management practices to benefit SGCN



Strategy 1. Protect, buffer, and connect high quality habitats to optimize biodiversity, SGCN, and landscape benefits, particularly across the Conservation Action Network.

This strategy articulates the need to protect remaining areas of quality habitat, such as remnant prairie, old growth forest, or lakes of biological significance. In addition, areas around those core areas also need safeguarding to provide SGCN access to all habitat needs throughout their annual cycle and allow for range shifts in response to potential environmental or climate related changes, thus creating a more ecologically resilient landscape. The Conservation Action Network (CAN) is a mapped resource representing important areas to the SWAP, including core areas of high biodiversity (high numbers of SGCN), highest quality habitats, and buffers and corridors to further protect and connect them. The CAN is intended to guide and prioritize conservation actions given limited resources (see Conservation Action Network section in Chapter 6: Implementation).



Photo: Restoration project in Lost River enhances fish passage and aquatic habitat connectivity, Nicholas Kludt



Strategy 2. Restore, enhance, and maintain lands and waters to benefit SGCN, biodiversity, and ecosystem resilience

This strategy emphasizes the need to actively manage lands, often layered upon protected lands, but also can be implemented anywhere, by any land manager or private landowner who seeks to improve the ecological function of their property. Restoration projects can be dramatic, such as a prairie reconstruction where a crop field is planted and tended into prairie over time, or they can be more subtle, such as by the dedicated application of conservation practices like prescribed fire or conservation grazing. Enhancement is done by augmenting plant communities that are already present, such as by re-seeding, planting seedlings, or removing invasive species. Maintenance management is critical for many habitats, particularly those dependent on disturbance, such as fire-dependent forests, woodlands, savanna, and prairie. Invasive species management can also be an ongoing maintenance need vitally important to the function of many of our habitats, both terrestrial and aquatic.



Photo: prescribed burn, Amy Westmark



Strategy 3. Collaborate with conservation partners and landowners to enhance conservation delivery, particularly in the Conservation Action Network and Conservation Opportunity Areas

This strategy calls attention to our need to work together, in broad partnerships, for ecosystem change. As detailed in the stressor sections of the various habitat sub-chapters, the extent to which our environments are affected by human activities, both past and present, require special attention to protecting, restoring, enhancing, and maintaining the habitats we have left, and optimizing their conditions to support species in need. The implementation of habitat conservation practices with a full set of partners, including private landowners, protected area managers, working land managers, and Tribes, enables us to collectively address the scale of stressors on the landscape.

This Plan relies on actions undertaken every year by numerous entities throughout the state. The role of the DNR is to facilitate partnerships with a broad array of entities so that we are working in concert. Collective actions when coordinated across entities such as municipalities, soil and watershed conservation districts, private landowners, Tribes, other state agencies, national agencies, educational institutions, and non-profit organizations will have the most impact. Most of work we do is in partnerships.

The Conservation Action Network can be used in a planning context to focus attention on core areas of high biodiversity, the highest quality habitats, and buffers and corridors protect and connect them. You can find more about the CAN in the Conservation Action Network section of Chapter 6. Implementation.

Conservation Opportunity Areas (COAs) are places where on-the-ground conservation actions are concentrated to benefit SGCN and

their habitats. COAs build on the Conservation Action Network. The COAs are prioritized areas delineated specifically for partnerships to focus efforts together on habitat conservation projects designed to benefit SGCN. For more information, please see the Conservation Opportunity Areas section in Chapter 6. Implementation.

It should be noted that collaboration as an approach truly applies to all actions in the Plan, as all conservation actions would benefit by broader implementation by a greater number of entities in more locations.



Photo: Biologists and Producers on Field Tour at Hole in the Mountain Wildlife Management Area, T.J. Boettcher



Strategy 4. Monitor SGCN, native plant communities, habitats, and ecosystems for

changes through time including responses to natural disturbances, conservation actions, and climatic conditions

This strategy highlights the importance of scientific information to inform our conservation actions. We need baseline information about our natural communities to learn about changes that may be happening in the systems such as in response to changing climatic factors. Well-designed monitoring projects provide insights about the effects of conservation actions as distinguished from natural changes that are happening in the system. Layered on this we need a sound understanding of whether the conservation actions create persistent change (effectiveness monitoring) and whether SGCN are responding positively to those changes as desired (response monitoring). Greater research into the threats that cause ecosystem change can also help to direct conservation efforts. Also refer to Chapter 5: Monitoring and Research for a comprehensive assessment of monitoring and research needs and approaches.



Photo: monitoring native plant community



Strategy 5. Connect to develop, innovate, incentivize, and disseminate evidence-based

habitat management practices to benefit SGCN

The SWAP puts science into action. However, sometimes there is a deficit in knowing what to do to help particular SGCN on their road to recovery. And, as much as we know about managing healthy ecosystems, we are still learning more each year about practices that are most effective and how in turn these conservation practices may help SGCN. Indeed, there is still a great unfulfilled demand for information to guide conservation efforts by habitat managers and landowners throughout the state.

In some cases, research or investigations are needed to develop the management guidelines, avoidance measures, or habitat best management practices. More studies about the effectiveness of our conservation practices, in learning whether or how species are reacting to our management actions, are essential (see Chapter 5: Monitoring and Research).

In other cases, there may be good knowledge of conservation actions coming out of the research community or become known through applied conservation practice that requires translation into easily applied materials and resources. There is a huge opportunity to investigate, collate, and write up habitat management guidance for more SGCN.

Sometimes existing and emerging resources just need better communications to put them into the hands of more practitioners. Examples include the Landowner Guides to Woodlands, Native Plant Classification guides, and climate adaptation resources. Workshops, field trips, and engaging webinars may work well for engaging managers, with one-pagers and webpages to provide the materials. Sometimes it is a matter of spreading the word, such as when new research or threats assessments or



Photo: Sharing information about managing habitat for pollinators at Whitewater State Park, Alison Cariveau

best management practices become available. This is a parallel strategy to Strategy 3 in Chapter 2: Species in Greatest Conservation Need and overlaps also with some of the strategies and actions in Chapter 4: Public Engagement.

Conservation Actions

Strategies are implemented by conservation actions, which are described in the habitat sub-chapters. These potential conservation actions are grouped under the five strategies and are related to stressors they address with icons (see also Stressors and Actions section in Chapter 2. Species in Greatest Conservation Need). Some actions are widely employed as best practices while others may be more novel.

Habitat Definition

The term ‘habitat’ can be used in several ways and warrants clarification (Krausman and Morrison 2016; Hall et al. 1997). Specifically, habitat may be defined as, “the resources and conditions present in an area that produce occupancy, which may include survival and reproduction, by a given organism” (Krausman and Morrison 2016). In contrast to this definition that is organism-specific, ‘habitat type,’ can be defined to mean, “type of vegetation association in an area or to the potential for vegetation to reach a specified climate stage” (Krausman and Morrison 2016 based on Daubenmire 1968).

In this Plan, we use the term ‘habitat’ broadly, like the ‘habitat types’ defined above. We take this approach because with over 1,000 Species in Greatest Conservation Need, it is not practical to discuss the specific habitat requirements of each species. Indeed, by adding plants as SGCN, we emphasize the importance of biodiversity and a broad conservation approach. And, when we manage natural communities for values such as ecosystem health or function, including the support of biodiversity, we are also providing habitat for animals that live in that community.

To analyze conservation needs and actions for the different types of habitat types present in our state, we created a set of 15 habitat types (see list below and Figure 3.2). For most terrestrial types we used ecological systems to group native plant communities into habitat types such as ‘prairies and other grasslands.’ For aquatic systems we followed hydrological classifications to define types such as ‘rivers and streams.’ Other habitats were inherently more specific, such as ‘caves’ and ‘cliffs, talus, and rock outcrops.’ In another case, we created a grouping based on non-natural landcover types, classified as ‘urban and other developed lands.’

These groupings are only meant for organizational purposes and do not replace the specificity of native plant community descriptions. In addition, the full array of specific habitat requirements, particular conditions, or micro-habitats needed by particular SGCN are not easily depicted at a statewide scale or in these sub-chapters. Rather, we provide a list of animal SGCN that use the habitat in [Appendix D](#) and a list of plant SGCN that use the habitat in [Appendix E](#) and briefly highlight a subset to illustrate use of the habitats in the sub-chapters. For more detailed information about species' habitat requirements, we recommend referencing the DNR's webpages for [Animals](#), [Plants](#), and the [Rare Species Guide](#) or other external resources cited in the SGCN species group sub-chapters in Chapter 2. Species in Greatest Conservation Need.

Primary Habitat Types

1. Prairie and Other Grasslands
2. Savanna
3. Upland Conifer Forest and Woodlands
4. Upland Deciduous Forests and Woodlands
5. Mesic Hardwood Forest
6. Deciduous Wet Forest
7. Coniferous Forest Wetland
8. Riparian and Floodplain Forest
9. Non-forested Wetlands
10. Rivers and Streams
11. Lakes
12. Vernal Pools
13. Cliff, Talus, and Rock Outcrop
14. Caves
15. Urban and Other Developed Lands

Habitat Map Methods

Overview

For the 2025-2035 SWAP we recognized the need for an updated habitat map of Minnesota that was accurate at a site-level scale and provided full coverage of the state. There was also a need to provide accurate representation of anthropogenically (human) modified habitats such as agriculture, and developed areas as SGCN are sometimes found in these locations. There are examples of layers that cover the entire state including the Crop Data Layer and Midwest Terrestrial Habitat layer. These layers are remotely sensed and often lose accuracy as map resolution is increased. Because they cover such broad areas, it is infeasible to ground-truth every cover-type. Other layers, such as the Native Plant Communities, National Wetland Inventory, and Lake Morphology layers are more accurate but lack comprehensive coverage. Due to these inherent strengths and weaknesses, it became apparent that the best course of action was to combine several layers into one, leveraging the accuracy from some and the coverage of others. Thus, the SWAP Habitat Map (Figure 3.2) was created by combining six different GIS layers. These layers consisted of the DNR Native Plant Communities (NPC), Stream Routes with Strahler Stream Order, Shallow Lakes Identified by DNR Wildlife, Lake Basin Morphology, National Wetland Inventory for Minnesota (NWI), and Midwest Terrestrial Habitat System (MWTHS) layers

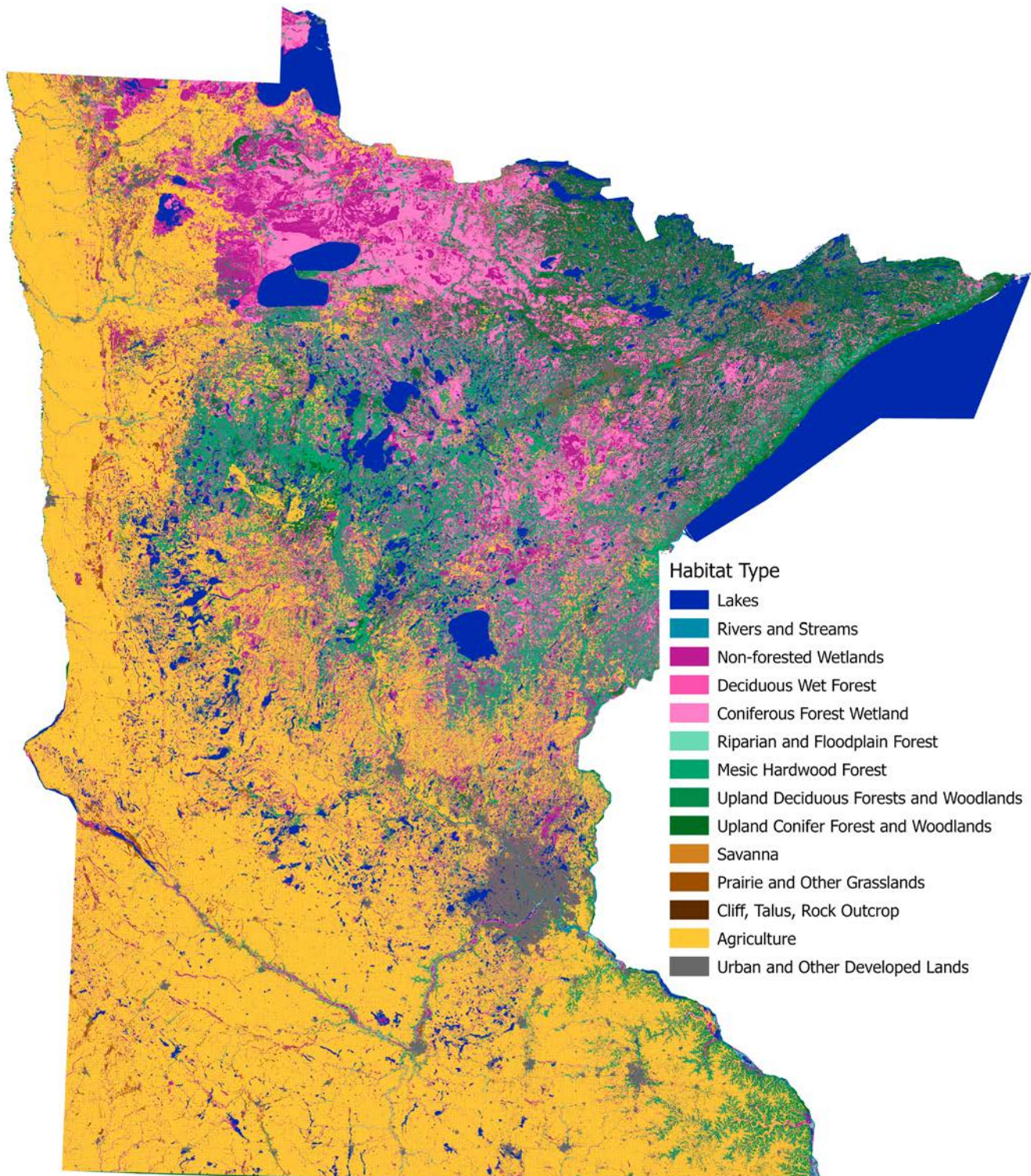


Figure 3.2. Map depicting Minnesota's 2025-2035 Wildlife Action Plan Habitat Layer, depicting each of the primary habitat types described by sub-chapters, except for caves which are not depicted here. Also, Agriculture is not one of the SWAP Habitats but is included in this map as a prominent landcover type.

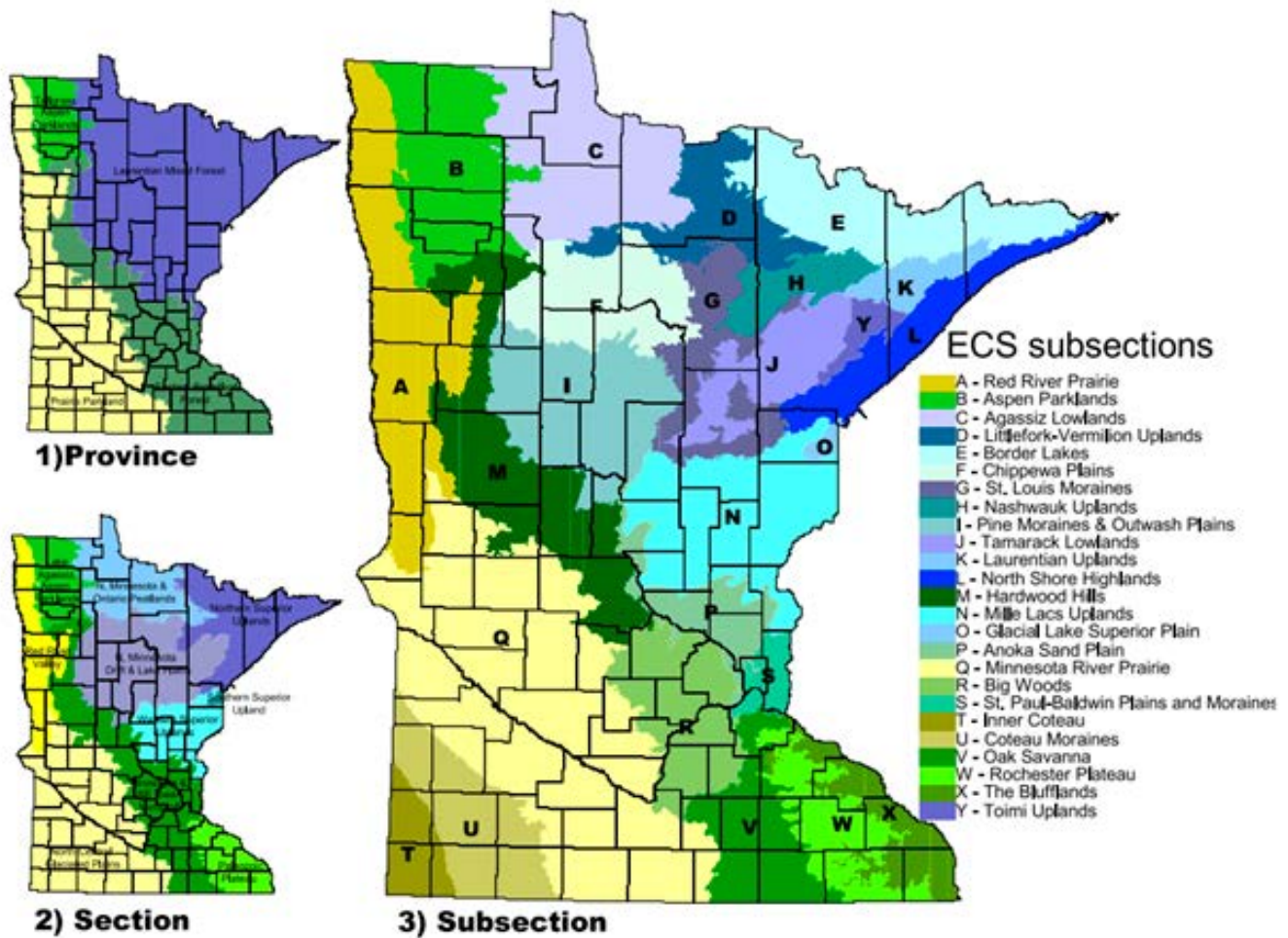


Figure 3.3. Minnesota Ecological Provinces, Sections, and Subsections.

Table 3.1 Minnesota’s Native Plant Community Classification Hierarchy.

Classification Level	Dominant Factors	Example
System Group	Vegetation structure & hydrology	Upland Forest & Woodland Systems
Ecological System	Ecological Processes	Fire-Dependent Forest/ Woodland
Floristic Region	Climate & paleohistory	Central
NPC Class	Local environmental conditions	Central Dry Pine Woodland
NPC Type	Canopy dominants, substrate, or finer environmental conditions	Jack Pine-(Yarrow) Woodland
NPC Subtype	Finer distinctions in canopy dominants, substrate, or environmental conditions	Ericaceous Shrub

Component Descriptions

Minnesota Ecological Classification System

We use [Minnesota's Ecological Classification System \(ECS\)](#) to describe the geography of where habitats occur. This system was developed by the Minnesota Department of Natural Resources and the U.S. Forest Service for ecological mapping and landscape classification. This hierarchical ecological land classification system is used to identify, describe, and map areas of land with uniform ecological features. The ECS system uses associations of biotic and environmental factors, including climate, geology, topography, soils, hydrology, and vegetation. There are eight levels of ECS units in the United States. Map units for six of these levels occur in Minnesota: Provinces, Sections, Subsections, Land Type Associations, Land Types, and Land Type Phases.

Within the SWAP we reference the 4 Provinces, 13 Sections, and 25 Subsections in Minnesota (see Figure 3.3). Provinces are units of land defined using major climate zones, native vegetation, and biomes such as prairies, deciduous forests, or boreal forests. There are four Provinces in Minnesota. Sections are units within Provinces that are defined by origin of glacial deposits, regional elevation, distribution of plants, and regional climate. Minnesota has 10 sections. Subsections are units within the Sections that are defined using glacial deposition processes, surface bedrock formations, local climate, topographic relief and the distribution of plants, especially trees. Minnesota has 25 subsections.

Native Plant Communities

The DNR's [Native Plant Community Classification](#) hierarchy (Table 3.1) further divides plant communities into systems, classes, and types. The DNR's classification is intended to provide a framework and common language for improving our ability to manage vegetation, survey natural areas for biodiversity conservation, identify research needs, and promote study and appreciation of

native vegetation in Minnesota. Three levels of this classification system can be found in the final habitat layer: System Groups, Native Plant Community Classes, and Native Plant Community Types. System Groups, the highest level, were created to allow development of manageable field keys for lower levels of the classification. System groups were formed by combining lower levels of the classification along major physiognomic and hydrologic splits in vegetation. The system level most closely matches the Habitat Chapters within the SWAP, and the Classes and Types are then further used to describe the habitats where SGCN are found. Native Plant Community Classes are units of vegetation that generally have uniform soil texture, soil moisture, soil nutrients, topography, and disturbance regimes. For wooded vegetation, native plant community classes were developed by emphasizing understory vegetation more than canopy trees, under the hypothesis that in much of Minnesota understory plants are often more strongly tied to local habitat conditions (such as levels of nutrients and moisture) than are canopy trees. Native Plant Community Types are defined by dominant canopy trees, variation in substrate, or fine-scale differences in environmental factors such as moisture or nutrients. Type distinctions were also made to describe geographic patterns within a class.

The [DNR Native Plant Communities layer](#) was desirable for a few reasons: 1) The NPC hierarchy is a system widely used across the state by both internal and external partners, and 2) the geographic extent of NPC's are highly accurate because many of them have been identified and mapped on site. Due to these strengths, it was ranked as the highest importance for the final layer; however, it does have a few caveats: 1) It only covers around 10% of the total land area of the state, 2) it only includes terrestrial or emergent wetland plant communities, and 3) it does not classify human-modified plant communities or land cover.

Streams with Strahler Stream Order

To incorporate rivers and streams into the habitat layer, components from two layers were combined into one. The attributes associated with the [Stream Routes with Strahler Stream Order layer](#) were desirable because streams and rivers could be categorized into different sizes. This layer also included the Kittle number designated by the DNR Fisheries Stream Survey database meaning future attributes could be added based on this unique identifier. While this layer had the desirable attributes, it could not be used alone due to it being a line feature which meant it did not capture the spatial extent of the rivers and streams. For this reason, another layer was needed that represented the shape and size of rivers and streams as closely as possible. The NWI layer meets this need as its polygons outline the shapes of rivers and streams but lacked attributes that classified them into different sizes. To merge the two layers into one, all polygons categorized as “Riverine Systems” in the Circ39 Class attribute of the NWI layer were selected and exported as their own layer. Then a 500-foot buffer was added around the Stream Route layer and then clipped using the exported Riverine layer. In this way, a new feature class was created that followed the shape of the riverine polygons from the NWI layer while maintaining the attributes of the Stream Routes. Finally, a new attribute field was created to categorize the stream order sizes. Streams with stream orders from 1-4 were classified as “small,” 4-6 as “medium-large,” and 7-8 as “large.”

Shallow Lakes

For shallow lakes, the [Shallow Lakes Identified by DNR Wildlife layer](#) was used. The layer was developed to help natural resource managers identify these bodies of water for habitat restoration and enhancement. To qualify as a shallow lake, the body of water must be 50 acres or greater in size and have a maximum depth of 15 feet or less. Some lakes have an “undefined” depth and may be deeper than 15 feet but were still included.

Lake Basin Morphology

To capture deeper lakes, the [Lake Basin Morphology layer](#) was used. This layer describes the physical form and morphology of lakes in Minnesota. Like the Shallow Lakes layer, it contains an attribute called “DOWLKNUM” which is a unique identifier for each lake in Minnesota. This number enables the sharing of data and attributes from different layers that also have the “DOWLKNUM” attribute field. Any lakes that were not captured by the Shallow Lakes or Lake Basin Morphology layer were captured by the National Wetland Inventory Layer.

National Wetland Inventory

The [NWI Layer](#) was used to capture any lakes, rivers, or wetlands in Minnesota not mapped by the previous layers. Administered by the United States Fish and Wildlife Service, the [National Wetland Inventory data](#) provides detailed information on abundance, characteristics, and distribution of American wetland and deepwater habitats, as well as changes in these habitats through time. This information is provided through two resources: the Wetland Geospatial Dataset and Wetlands Status and Trends report. Within the NWI layer, several attribute fields were used to crosswalk wetland types with habitats: the Cowardin codes, the Simplified Plant Community Classification (SPCC), and the Circular 39 fields (similar but slightly different than the SPCC; see Table 3.2). The relationship between these two classification systems is an approximation. Riverine types (R2ABH, R2EM2F, R2EM2H, R2UBF, R2UBH, R2USA, R2USC, R3UBH, R4SBA, R4SBC) were related to the Rivers habitat. For more detail, please refer to the [Minnesota Wetland Inventory: User Guide and Summary Statistics](#) (Kloiber et al. 2019).

Midwest Terrestrial Habitat System

The Midwest Association of Fish and Wildlife Agencies (MAFWA) passed a resolution to endorse the [Midwest Landscape Initiative](#) (MLI) to help meet the need for landscape-level conservation planning in the Midwest.

MLI created a regional terrestrial habitat system that provided common descriptions for natural habitats within the Midwest, thus providing a common naming convention that could be used to help coordinate conservation planning across state lines. The data used to create this map was initially modelled from the [LANDFIRE](#) Consortium using artificial intelligence and remote sensing. NatureServe then assigned the natural systems to their

appropriate National Vegetation Classification (NVC). The [Midwest Terrestrial Habitat System 2025 Update](#) (MWTHS) incorporates three levels of classification; groups, macrogroups, and divisions. It also crosswalks the NVC groups with each state’s unique heritage vegetation classes. This layer is a large component of the SWAP Habitat layer because it fills many of the spatial gaps left by the previous layers.

Table 3.2. Table cross-walking National Wetland Inventory (NWI) types to Plan habitat sub-chapters, the simplified plant community classification (SPCC) and Cowardin codes (based on table in Kloiber et al. 2019).

Chapter	SPCC	Cowardin code
Conifer Forest Wetland	Coniferous Bog	PFO2Dq, PFO4Dq
Conifer Forest Wetland	Coniferous Wetland	PFO2D, PFO4D
Non-forested Wetland	Deep Marsh	PEM2G, L2EM2G, L2EM2H, PEM2H, R2EM2G, R2EM2H
Deciduous Wet Forest	Hardwood Wetland	PFO1A, PFO1C, PFO1D
Lakes	Non-Vegetated Aquatic Community	L1UBH, L2RSC, L2USA, L2USC, PUSA, PUSC, R2UBF, R2UBG, R2UBH, R2USA, R2USC, R3UBG, R4SBA, R4SBC, L2UBF, L2UBG, L2UBH, PUBF, PUBG, PUBH
Non-forested Wetland	Open Bog	PEM1Dq, PSS1Dq, PSS2Dq, PSS3Dq, PSS4Dq
Non-forested Wetland	Seasonally Flooded/Saturated Emergent Wetland	PEM1A, PEM1D
Non-forested Wetland	Shallow Marsh	L2EM2F, PEM1C, PEM1F, PEM2F, R2EM2F
Non-forested Wetland	Shallow Open Water Community	L1ABH, L2ABF, L2ABG, L2ABH, PABH, R2ABG, R2ABH, PABF, PABG
Non-forested Wetland	Shrub Wetland	PSS1A, PSS1C, PSS1D, PSS1F, PSS2D, PSS3D, PSS4D
Deciduous Wet Forest	Artificially Flooded Hardwood Wetland	PFO1K
Lakes	Artificially Flooded Non-Vegetated Aquatic Community	L1UBK, PUSK, L2UBK, PUBK
Non-forested Wetland	Artificially Flooded Shallow Marsh	PEM1K
Non-forested Wetland	Artificially Flooded Shallow Open Water Community	L2ABK, PABK
Non-forested Wetland	Artificially Flooded Deep Marsh	L2EM2K, PEM2K
Non-forested Wetland	Artificially Flooded Shrub Wetland	PSS1K, PSS3K

Habitat Map Compilation

To merge the individual component layers, the Union tool was utilized in ArcGIS Pro. However, before the individual component layers could be combined, each layer needed to be prepared. For the Union to work, all layers needed to be vectors. Fortunately, the MWTHS was the only layer that needed to be converted from a raster to a vector. The next step was to reduce the amount of attribute fields in each layer keeping only those relevant to habitats. Taking this step reduced the overall data size of the final layer which increased processing speeds. An additional field was created for each layer prior to the Union that assigned each

instance in the attribute table to one of the SWAP habitat chapters.

Once all the layers were prepared, they were merged via the Union tool and ranked based on their importance to the final layer. Ranking the layers ensured that the more accurate ones were visible when they overlapped with other layers. Once the final layer was created, another attribute field, called SWAP Habitats was created. Then, the associated SWAP Habitat chapters for each polygon were calculated for this field based on the SWAP Habitat Chapters from the component layers. This ranked Union is conceptualized in Figure 3.4.

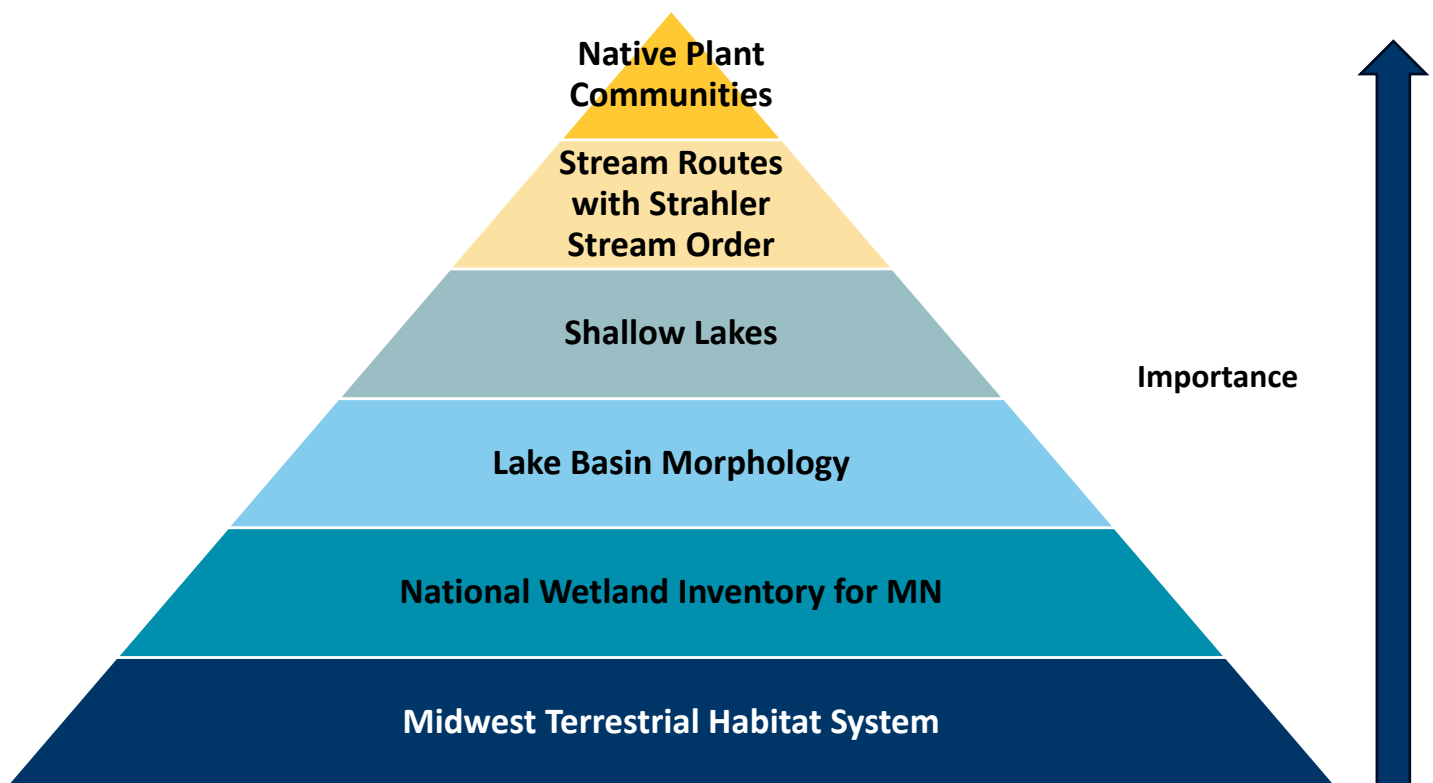


Figure 3.4. Conceptualization of the ranking of the individual component layers that make up the final habitat layer.

Habitat Sub-chapters

Habitat sub-chapters will follow for each of the 15 habitat types, with the following sections.

General Description

Here we describe general characteristics of the habitat type and any major sub-types. We reference the Minnesota Ecological Systems and Native Plant Community Classes and any other sources used to compile the habitat type in the habitat layer.

Conservation Context

This section briefly summarizes information about past and present extent and condition of habitat type.

Species in Greatest Conservation Need

We give a summary of the number of SGCN species that are associated with this habitat type and descriptions of representative SGCN from various species groups.

Primary Stressors in this Habitat

The primary stressors that may negatively affect the habitat are described. Each stressor is depicted by an 'icon' to help the reader connect content from stressors to actions.

Priority Habitat Conservation Strategies

The five conservation strategies for the Habitat Goal are shared in each habitat sub-chapter.

Conservation Actions

Conservation actions are listed under the most pertinent strategy that they implement and tagged with icons to signify the stressor(s) they address. Frequently a conservation action can

address more than one stressor. In those cases, the conservation action is identified by multiple stressor icons. Some actions are widely in practice while others may be more novel.

Case Studies

Throughout the sub-chapters we highlight case studies and key partnerships and provide links to important resources pertinent to the habitat. Case studies feature examples of conservation projects that effectively address one or more of the stressors. These give a brief summary of the project as well as links to read additional information. The case studies and key partnerships described are not an exhaustive list, but rather a set of examples to help readers engage in conservation actions.

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