# A Minnesota Management Plan for Invasive Species

MISAC
Minnesota Invasive Species Advisory Council

## May 24, 2022

An earlier version of this plan was developed by the Minnesota Invasive Species Advisory Council (MISAC) and completed on October 20, 2009. It was updated from 2020-2022 by a subcommittee of MISAC, with input and review by MISAC membership, tribal representatives and other invasive species partners throughout the state. The aquatic elements of version of the Minnesota State Management Plan for Invasive Species were approved by the Aquatic Nuisance Species Task Force in 2022.

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# Statements of Endorsement and Support

Participants in the development of the Minnesota Management Plan for Invasive Species agree that the elements, desired outcomes, strategies and actions outlined in the plan provide a structure that, if supported and advanced through individual or cooperative actions, will further the effective management of invasive species across all lands, waters and jurisdictions in Minnesota.

Supporting organizations of the original 2009 plan, as of October 20, 2009:

- Minnesota Association of County Agricultural Inspectors
- Minnesota Board of Water and Soil Resources
- Minnesota Department of Agriculture
- Minnesota Department of Natural Resources
- Minnesota Department of Transportation
- Minnesota Forestry Association
- Minnesota Nursery and Landscape Association
- National Park Service
- University of Minnesota Extension
- University of Minnesota Sea Grant Program
- U.S. Department of Agriculture-Animal and Plant Health Inspection Service-Plant Protection and Quarantine (Minnesota Office)
- U.S Fish and Wildlife Service (Great Lakes Region – Region 3)

Supporting organizations and individuals as of March 18, 2022:

- 1854 Treaty Authority
- Fond du Lac Band of Lake Superior Chippewa
- Grand Portage Band of Lake Superior Chippewa
- Lake Washington Improvement Association of Meeker County
- Meeker County
- Metropolitan Mosquito Control District
- Mille Lacs Band of Ojibwe Department of Natural Resources
- Minnesota Aquatic Invasive Species Research Center
- Minnesota Board of Water and Soil Resources
- Minnesota Invasive Terrestrial Plants and Pests Center
- Minnesota Department of Agriculture
- Minnesota Department of Natural Resources
- Minnesota Department of Natural Resources' Aquatic Invasive Species Advisory Committee
- Minnesota Department of Transportation
- Minnesota Nursery and Landscape Association
- National Park Service
- National Oceanic and Atmospheric Association
- Roseau County Commissioner John Horner
- Wild Rivers Conservancy
- University of Minnesota Sea Grant Program
- University of Minnesota Extension
- U.S. Fish and Wildlife Service, Interior Region 3 – Great Lakes

# Table of Contents

# Executive Summary

An invasive species is defined in state statutes as a nonnative species that (1) causes or may cause economic or environmental harm or harm to human health or (2) threatens or may threaten natural resources or the use of natural resources in the state (Minnesota Statutes 2021, section 84D.01, subdivision 9a; hereafter, all references to Minnesota Statutes or Minnesota Rules are to Minnesota Statutes 2021 and Minnesota Rules 2021, respectively, unless otherwise noted). Minnesota's natural resources, industries, agribusiness, recreation, stored products, structures and human health are threatened or harmed by hundreds of aquatic and terrestrial invasive species. If agencies, organizations, private individuals, businesses and visitors do not take necessary prevention steps, invasive species that are not yet present in Minnesota could be introduced and those that are already established in Minnesota could spread to new areas within the state. This plan is intended to cover the full range of invasive species, including aquatic and terrestrial animals, plants, microbes and pathogens. It is intended to address invasive species issues statewide and for connecting waters.

There are many pathways of introduction and spread of invasive species. Most introductions are the result of human activities. Some introductions, such as common carp, common and glossy buckthorns and purple loosestrife, were intentional and caused unexpected harm while other introductions were unintentional. Invasive species are often unknowingly introduced and spread by contaminated recreational watercraft, vehicles, ships, commercial goods, produce, wood, water and even clothing. Ballast water discharge from ships is a pathway of introduction for aquatic invasive species, yet improved management and technology has reduced this pathway significantly. Transportation of firewood is an example of a pathway for the introduction and spread of invasive pathogens like oak wilt and invasive insects such as emerald ash borer.

General approaches to address invasive species problems are often similar across the range of species and pathways of introduction and spread. While this offers efficiencies, there still are not sufficient resources, capacity, knowledge or need to treat all invasive species and situations in a similar manner. For many species, no tools exist to manage them once introduced, and for others, improved management tools are needed. There is a need to prioritize invasive species research, prevention, detection, responses, containment, control and management actions.

Climate change is also causing considerable challenges for invasive species management in Minnesota. Preserving climate resilient ecosystems and climate resilient invasive species management will hinge upon monitoring and prioritization of species and populations and application of the best available scientific information. As the global pool of species of concern changes with climate change, continued investment in approaches that reduce risk of harmful nonnative species establishment and impacts such as pathways analysis or managing for healthy and resilient ecosystems will be needed to complement species- or population-specific prioritization.

Within the state, there are numerous entities that have programs and regulatory authorities related to invasive species. The primary Minnesota state statutes related to invasive species include Minnesota Statutes, chapter 84D, Minnesota Statutes, chapter 18G, and Minnesota Statutes, sections 18.75 to 18.91. Federal and state agencies that regulate invasive species include the U.S. Department of Agriculture Animal and Plant Health Inspection Service (USDA APHIS), U.S. Coast Guard, U.S. Department of Homeland Security – Customs and Border Protection (CBP), U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA), U.S. Forest Service (USFS), Minnesota Department of Agriculture (MDA), Minnesota Department of Natural Resources (DNR), Minnesota Pollution Control Agency (MPCA). The Minnesota Ojibwe and Sioux tribes have government authority to protect reservation lands and Ceded Territories. There are also many other entities that manage invasive species in Minnesota, including soil and water conservation districts (SWCDs), counties, cities, townships, municipalities, and non-profit organizations.

The primary purpose of this voluntary plan is to provide a framework to coordinate and guide efforts to prevent the introduction, reduce the spread, and promote the management of invasive species within Minnesota. The aspirational goals of this state plan are to prevent the introduction and establishment of new terrestrial and aquatic invasive species, contain existing

populations of invasive species, and minimize the impacts of any remaining invasive species. Many other invasive species plans exist at the national, regional, state and local levels. This plan is intended to support and enhance those plans and not replace them.

Four Elements and their Desired Outcomes, Strategies, and Actions form the framework of the state plan. Each Element has multiple strategies to help attain desired outcomes for that Element. From 2020-2022, MISAC reviewed the 2009 plan and agreed that the foundational Elements, Outcomes, Strategies, and Actions are strong, high-level and timeless, and therefore remain largely unchanged from the original plan. The four major plan Elements and Desired Outcomes are:

- Element I. Prevention. Desired Outcome: New introductions of invasive species are prevented in Minnesota.
- Element II. Early Detection, Response and Containment. Desired Outcome: New invasive species populations are detected as early as possible and contained when deemed necessary.
- Element III. Management of Invasive Species. Desired Outcome: Reduce the impacts caused by invasive species to Minnesota's ecology, society and economy.
- Element IV. Leadership and Coordination. Desired Outcome: Collaborate with intrastate, interstate, national and international partners to help coordinate invasive species related efforts.

Participants involved in implementing the plan may be any entity in the state willing to do so. Key participants include MISAC, state, tribal, federal and county agencies that have assigned responsibilities related to invasive species. Local governmental and non-governmental entities, industry associations, businesses, volunteers and others are encouraged to partner to support implementation of the plan. Ideally, partners will determine which actions in the plan are appropriate for them to implement. The implementation tables in Section 4 identify strategies and actions for which activities are planned or currently being implemented. Approaches for monitoring and evaluating plan implementation are provided in Section 6.

This plan also identifies some specific priorities for action to help advance invasive species management in Minnesota over the next 10 years. Overall priorities include incorporating climate resiliency, preventing the introduction and spread of high-priority species, maintaining resources for research, investigating perspectives and implementation of genetic biocontrol agents, trade-pathway assessment and prevention, evaluation and improvement of outreach strategies, supporting public reporting of sightings, addressing gaps in authority and programs, increasing communication, coordination and collaboration and development of SMART (Specific, Measurable, Achievable, Relevant and Timely) metrics. Additional aquatic invasive species priorities include maintaining or increasing funding and supporting invasive species prevention and management in Minnesota border waters. Priorities specific to terrestrial invasive species include increasing overall funding, management on roadway, rail and utility rights-of-way, and assessing the effectiveness of regulatory enforcement.

# About This Plan

## What is MISAC?

The Minnesota Invasive Species Advisory Council's (MISAC) mission is "[t]o provide leadership to prevent the spread and reduce the harmful impacts of aquatic and terrestrial invasive species to Minnesota landscapes, economies, and the citizens of the State of Minnesota by promoting invasive species awareness, prevention, and management through research, education and regulation in cooperation with local, state, tribal, and federal partners."

The Council welcomes representation from the Minnesota Department of Agriculture, the Minnesota Department of Natural Resources, the USDA Animal and Plant Health Inspection Service, the University of Minnesota, county agricultural inspectors, the nursery and landscape industry, master gardeners, local, state, tribal and federal agencies, conservation and environmental groups, and other interested entities and individuals. New members will be invited to join the Council by the Council leadership based on recommendations from membership or self-nominations.

The purpose of [MISAC] is to provide communication, coordination, and integration among its member organizations to help develop and implement the Minnesota Statewide Invasive Species Management Plan by:

- Promoting communication and cooperation among the various organizations involved in invasive species prevention and management including ongoing discussions about the effectiveness of existing invasive species prevention and management efforts.
- Coordinating outreach on invasive species issues (such as development of educational materials like the annual MISAC invasive species calendar).
- Supporting statewide and multi-state education events and conferences related to invasive species issues.
- Supporting training events and field visits related to invasive species.
- Recognizing outstanding and noteworthy work related to invasive species activities and encouraging such work through the Carol Mortensen Award.
- Maintaining the MISAC website to help the public report sightings and locate invasive species resources.
- Advocating for invasive species research and effective management of the invasive species and pathways deemed to pose the greatest risk to the State of Minnesota.
- Reviewing this Minnesota invasive species management plan and making recommendations for changes as appropriate to ensure the plan is up to date and likely to lead to achievement of desired outcomes.
- Working on other projects related to invasive species issues that the Council deems appropriate.

These functions support, but do not supersede, the goals and responsibilities of individual member organizations.

This plan is largely voluntary and advisory. While it is fully expected that MISAC member organizations will assist in the implementation of this plan, MISAC has no authority to require or enforce implementation of this plan. MISAC itself has limited funding to implement plan elements. Thus, MISAC assumes no liability for failure to adequately carry out any portion of the plan. Further, MISAC itself is under no obligation to address current federal, state, or tribal requirements for invasive species management, nor is it obligated to modify the plan as those requirements change (while those requirements apply to some member organizations). Nevertheless, MISAC recognizes there is great value in having a shared plan among invasive species partners statewide and will evaluate implementation of the plan as described in Section 6.

*MISAC partners with member organizations to host invasive species training events, such as this workshop with Three Rivers Park District in 2015. (Photo: Laura Van Riper, DNR.)*

## How a Statewide Invasive Species Plan Can Help

The primary purpose of this plan is to provide a framework to coordinate and guide efforts to prevent the introduction, reduce the spread and impacts and promote appropriate management of populations of invasive species within Minnesota by state, federal, tribal, county, and local governments, as well as private and non-profit sectors. This statewide plan provides a means to identify the numerous partners, desired outcomes, strategies and future needs to address invasive species problems in Minnesota. Similar to MISAC's vision statement, the goal of implementing this state plan is to:

"Prevent the introduction and establishment of new terrestrial and aquatic invasive species, contain existing populations of invasive species and minimize the impacts of any remaining invasive species."

## Meeting State and Federal Requirements

MISAC developed and revised this plan with the intention of meeting certain state and federal requirements. Therefore, plan contents and format are guided in part by the following sources:

- Minnesota Statutes, section 84D.02 describes the plan requirements for the Minnesota Department of Natural Resources (DNR).
- Minnesota Statutes, section 18G.12 describes the plan requirements for the Minnesota Department of Agriculture (MDA).
- The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 as amended by the National Invasive Species Act of 1996; and
- Guidelines established by the national Aquatic Nuisance Species Task Force (ANSTF) describe the components that must be included in the plan so state and tribal governments are eligible for grants from the USFWS to implement the plan.

## Species Covered by the Plan

This plan is intended to cover aquatic and terrestrial invasive species.

## Geographic Area Covered by the Plan

This plan is intended to address invasive species issues throughout Minnesota and Minnesota's border waters (unless specified otherwise). All the water resources, native plant communities (such as forests and prairies), farmland, road corridors and other lands, whether federal, tribal, state, local or privately owned or managed, are subject to impacts from invasive species.

Minnesota has immense aquatic resources. It contains 11,842 lakes over 10 acres; 6,564 rivers totaling 69,200 miles in length and 9.3 million acres of wetlands (Figures 1 and 2). Total surface water area in Minnesota, including wetlands, is 13,136,357 acres. Minnesota is headwaters for three major watersheds: north to Hudson Bay in Canada (via the Red River basin), east to the Atlantic Ocean (via the Lake Superior/Great Lakes basin) and south to the Gulf of Mexico (via the Sioux River and Mississippi River basins). Prevention of invasive species movement between these basins is a priority of the state plan.

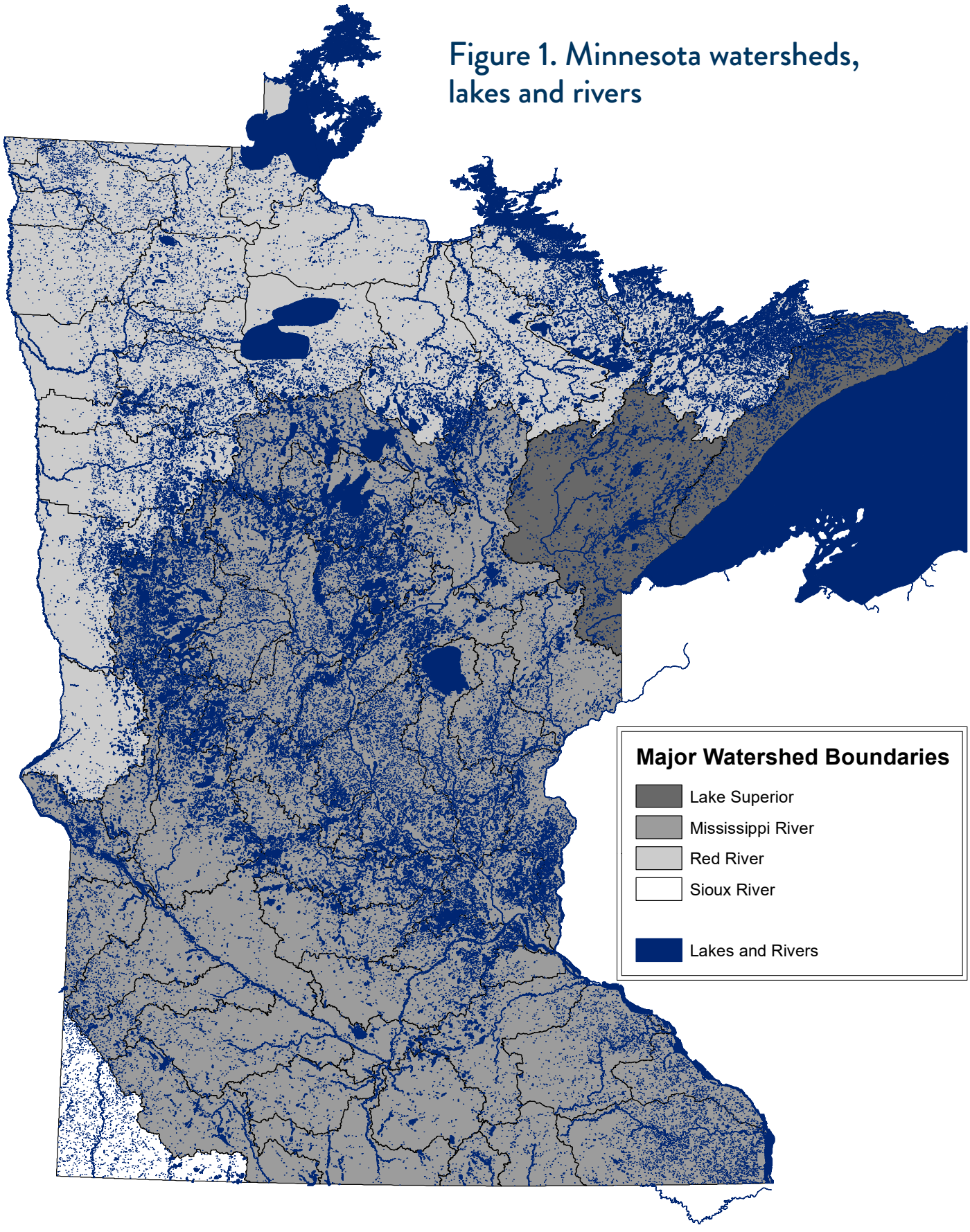
Minnesota also has vast agricultural, forest, prairie, grassland and other terrestrial resources (Figure 2). These include approximately 17.7 million acres of forests including the Chippewa National Forest, Superior National Forest, 4.2 million acres of state forests and 27 million acres of farmland.

The Minnesota plan shares its geographic coverage with the St. Croix National Scenic Riverway Comprehensive Interstate Management Plan for the Prevention and Control of Nonindigenous Aquatic Nuisance Species (St. Croix Plan). USFWS state-interstate plan implementation funding for implementation of this Minnesota plan will not occur within the geographic coverage of the above-mentioned St. Croix Plan, which has its own goals and objectives under which eligible entities may apply for funding for implementation.

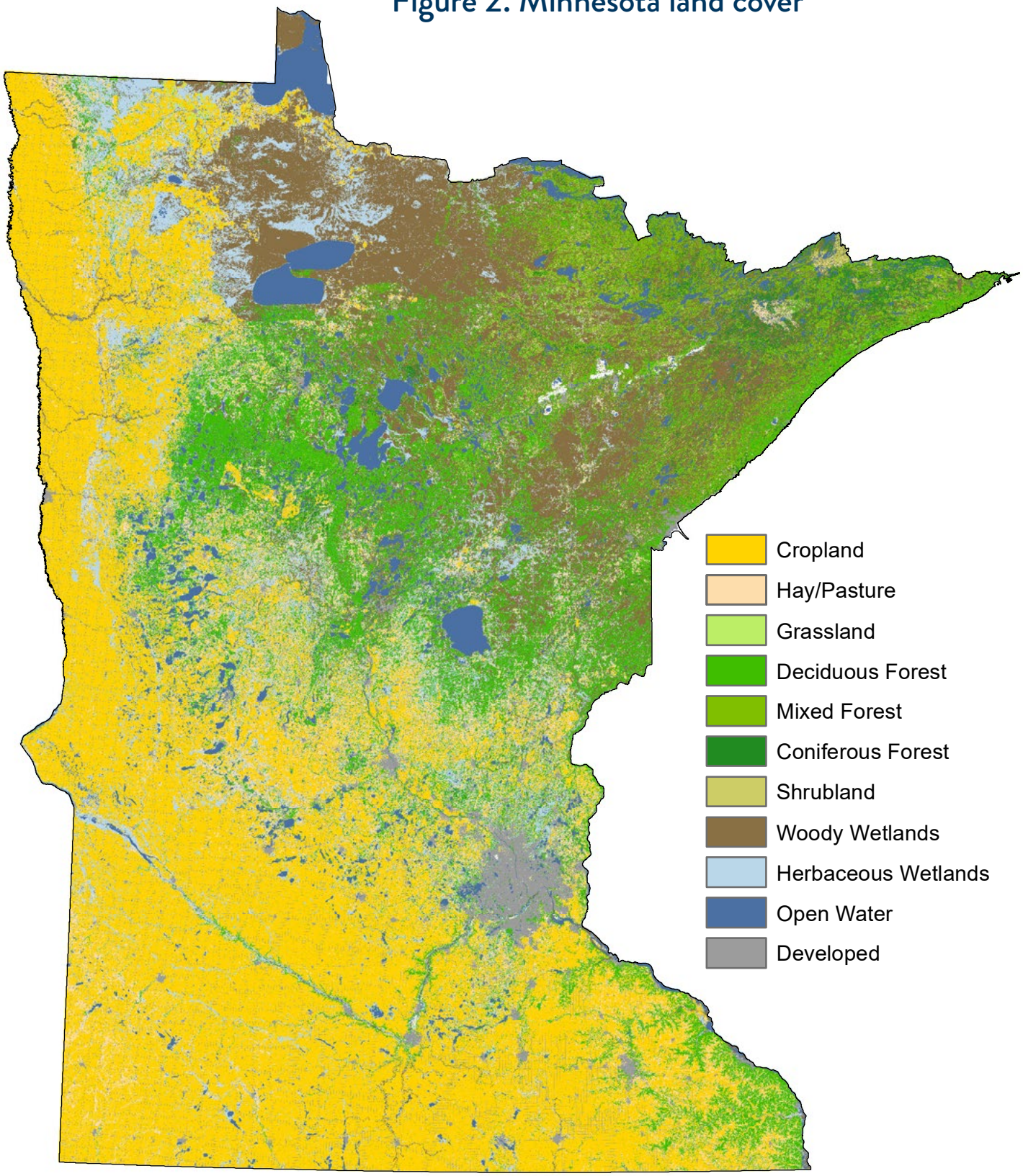
*Minnesota provides abundant opportunities for outdoor recreation, including hiking in Minnesota forests. (Photo: Laura Van Riper, DNR.)*

*Minnesota is bordered by the beautiful St. Croix River. (Photo: Laura Van Riper, DNR.)*

## Figure 1. Minnesota watersheds, lakes and rivers



## Figure 2. Minnesota land cover




*Data source: Karl Hillstrom. Minnesota Department of Agriculture.* Cropland Data Layer 2019, Minnesota. *February 2021.*

# Section 1. Introduction

An invasive species is defined in Minnesota statutes as a nonnative species that (1) causes or may cause economic or environmental harm or harm to human health or (2) threatens or may threaten natural resources or the use of natural resources in the state (Minnesota Statutes, section 84D.02, subdivision 9a). Many agencies, organizations, scientists and private individuals presently strive to prevent and slow introductions of invasive species, limit their spread and manage the populations already present in Minnesota and North America.

The Minnesota Invasive Species Advisory Council (MISAC), a diverse group with a common interest in addressing invasive species in Minnesota, was created in May 2001 in response to the Presidential Executive Order on invasive species (Executive Order 13112), the National Invasive Species Management Plan and Minnesota legislation that encouraged the state to plan and take action on invasive species. MISAC's mission statement and a list of member organizations can be found on the MISAC website.

Minnesota statutes require the Departments of Agriculture and Natural Resources to establish statewide programs for invasive species. Statutes also require them to prepare and maintain long-term invasive species management plans (see Meeting State and Federal Requirements). MISAC has taken a lead role to develop the plan.

*Wild parsnip is an example of an invasive species that is harmful to human health. Contact with its sap causes burns to the skin. (Photo: Laura Van Riper, DNR.)*

## 1a. How the Plan Will Be Implemented

Portions of this plan may be implemented by any entity in the state willing to do so. Often, state, federal, tribal or county agencies have assigned responsibilities related to invasive species. Local governmental and non-governmental entities, industry associations, businesses, volunteers and others are strongly encouraged to partner to support plan implementation. Ideally, participants will determine which plan actions are appropriate for them to implement. Further, invasive species prevention hinges upon consistent public participation in implementing best practices for prevention (e.g., removing vegetation from boat trailers and other equipment). The implementation tables in Section 4 provide a general summary of organizational roles for strategies and actions planned or currently being implemented.

## 1b. Essential Needs for Plan Implementation

This plan presents a holistic and comprehensive framework for invasive species management in Minnesota. The implementation tables highlight the plan actions identified in Section 4 for which current and planned efforts are underway. However, not all strategies and actions identified in this plan are being implemented at this time. Essential aspects for complete plan implementation include regulations, funding, management techniques, partnerships and public support.

State and federal regulations are critical for invasive species management and prevention. Among other things, the current regulatory frameworks allow state and federal agencies to classify organisms as invasive species, injurious wildlife or noxious weeds, inspect watercraft and administer a program for lake service providers. The statutory framework for invasive species management is robust. Some potential improvements to the invasive species regulatory framework are described in subsection 3d of this plan ("Gaps in Invasive Species Authorities, Funding and Program Implementation").

Reliable funding is also essential for plan implementation. There are several funding sources that support invasive species prevention and management. For aquatic invasive species efforts, major sources that sustain research and state and local management programs include boater registration fees, the Great Lakes Restoration Initiative (GLRI), and federal funds for state plan implementation. Local aquatic invasive species prevention aid funding is critical to local prevention efforts. Some funding sources for terrestrial invasive species work include the state's general fund and the Minnesota Game and Fish Fund's Heritage Enhancement Account. Additional state funding sources may support individual invasive species and habitat restoration projects through grants such as USFS Landscape Scale Restoration grants, the GLRI, Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR), Lessard-Sams Outdoor Heritage Council, Greater Minnesota Parks and Trails Commission, and the National Fish and Wildlife Foundation. These programs are evidence that Minnesotans greatly value natural resources and support investing in them. All these funding sources are important investments for invasive species management and must be either continuously supported or increased in some areas to support comprehensive invasive species management in the state. Consistent, long term and reliable invasive species funding would further improve the likelihood of this plan's success.

Managing invasive species populations can be very challenging; accordingly, effective management tools are necessary to address invasive species. Sound management of established populations must emphasize balance between invasive species removal and minimizing negative effects on ecosystems and non-target species. Development of selective management technologies can help alleviate some of the challenges associated with this. Yet, no effective management technologies or tools exist for many invasive species. Minnesota is fortunate to host two vitally important invasive species research centers at the University of Minnesota. The Minnesota Aquatic Invasive Species Research Center (MAISRC) and Minnesota Invasive Terrestrial Plants and Pests Center (MITPPC) are crucial resources for exploring new technologies and developing novel approaches for effective invasive species management.

Continued collaboration will allow partners to achieve common goals. Minnesota is fortunate to have dozens of organizations addressing invasive species issues. Organizations contributing to the implementation of this plan include federal, tribal, state, local, government agencies, non-profit and non-governmental organizations, academic researchers, University of Minnesota Extension (hereafter, Extension), and private entities. Communication, coordination and collaboration between the many partners provide increased capacity and efficiency in planning and implementing invasive species work. MISAC provides a central entity for connecting programs, projects and people. Continuing and increasing collaborations and coordination will further improve efficiency and solidarity in invasive species efforts.

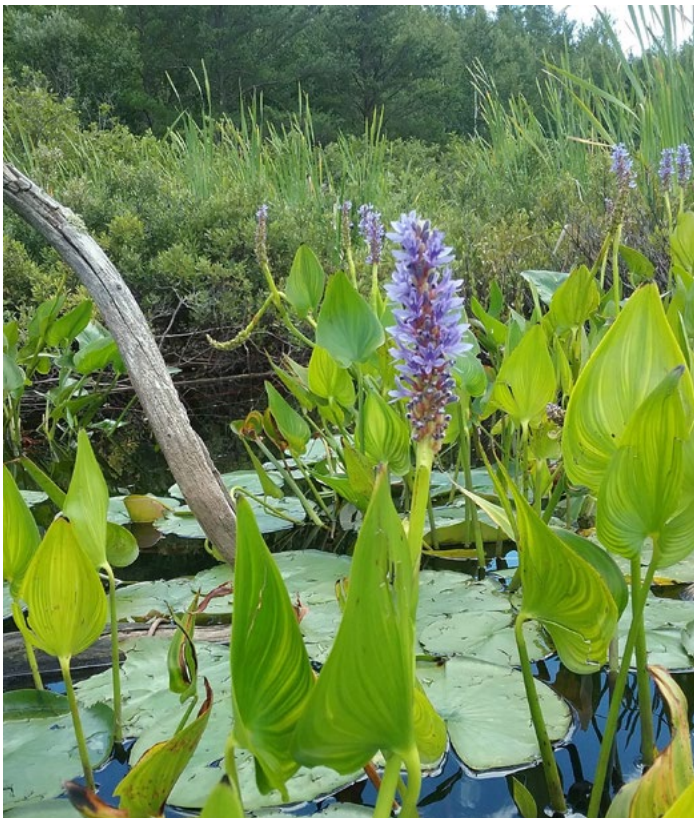
Finally, invasive species management in Minnesota depends on public support and consistent implementation of prevention practices. Transparency and coordinated, complementary communications highlighting management and prevention efforts are needed to inform Minnesotans on the important work that is being done. Communication strategies must convey success stories and the complexity of invasive species issues so that members of the public can understand the rationale for management decisions. Messaging must also continue to empower the public so they can do their part to help prevent the spread of invasive species and manage invasive species on their own property. Without public support, none of the other essential components for invasive species management described in this section would exist.


*Successful invasive species prevention and management hinges upon public participation. (Photo: Laura Van Riper, DNR.)*

## Considering Cultural Perspectives in Implementation

There are many diverse cultural perspectives in Minnesota and this plan recognizes that invasive species management may differ from one organization to another based on cultural values and beliefs. This plan is meant to serve as a guide to all Minnesotans but encourages a diversity of approaches as necessary to adapt to community-specific needs in addressing invasive species management. MISAC expects several independent interpretations of this plan, or operational plans, to emerge from communities and organizations based on their legal responsibilities and/or perspectives regarding invasive species management practices, definitions, data collection and recordings, enforcement, prevention, and other aspects of the plan.

As mentioned above, federal and state agencies hold the authority to classify invasive species. However, in a meeting with tribal representation about the creation of this plan, it was expressed that not all communities believe management is necessary based only on a classification. Rather, invasive species are carefully monitored and only managed when they are directly having a negative or harmful impact in some way. Some communities are focused on the protection of native species, versus the elimination of those classified as invasive. Similarly, some native species may be subject to management efforts if they are having a negative impact on important resources. Such is true in the case of *ginoozhegoons*, also known as pickerelweed or moose ear *(Pontederia cordata)*, "invading" wild rice stands. This plan recognizes and supports this type of adaptation to the definition of an invasive species and the impacts these changes have on management and control efforts.



*Pickerelweed is native to Minnesota but can sometimes outcompete other important species. (Photo: Liz Anderson, Lake County SWCD.)*

It is also important to note that priority areas for management will likely differ due to differing cultural perspectives on management. For those focused on protection of important cultural resources, invasive species management becomes focused around measures to protect those resources. For example, whereas some agencies may look at accessibility, population size, or spread risk, a tribe may look at what is the greatest risk to a walleye fishery, wild rice lakes, a sugar bush or a blueberry stand. So though there is chance for overlap, it is also important to acknowledge the differences that occur in prioritization. This plan encourages collaboration and partnerships to address invasive species issues and in doing so

Pickerelweed is a native species that acts as a nuisance species in some Minnesota habitats. It does not, however, meet the definition of an aquatic nuisance species according to the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA as amended by NISA, 1996) and USFWS State and Interstate ANS Management Plan funding via NANPCA will not be used to fund activities related to this species.

acknowledges the differences that will need to be addressed as planning and implementation progresses. These differences also make for complementary and strengthened management.

### Tribal Consultation before Implementation

This section, except for the last paragraph which was authored by the DNR, was largely created by a tribal working group in Minnesota that had representation from many tribes and tribal authorities who gave input and guidance to how the consultative process should begin before conducting any sort of management or management planning. Including the Minnesota Chippewa Tribe, there are 12 distinct Indian tribes with elected or appointed tribal governments in Minnesota (Figure 3). Tribes that have negotiated treaties with the United States are sovereign nations. Tribal sovereignty refers to the right of American Indians and Alaska Natives to govern themselves. The U.S. Constitution recognizes Indian tribes as distinct governments and they have, with a few exceptions, the same powers as federal and state governments to regulate their internal affairs. Those tribes that ceded territory to the United States retain usufructuary rights, or property rights, and have a moral, ethical and legal interest in the co-management of those relationships and resources that extend throughout those territories ceded to the United States.

In order to protect, sustain and respect those relationships and resources, tribes will assert their shared interests with the state of Minnesota. To demonstrate respect for the unique legal relationship with tribes, state agencies are required to conduct meaningful consultation on matters of common interest to purposely achieve mutually beneficial solutions.

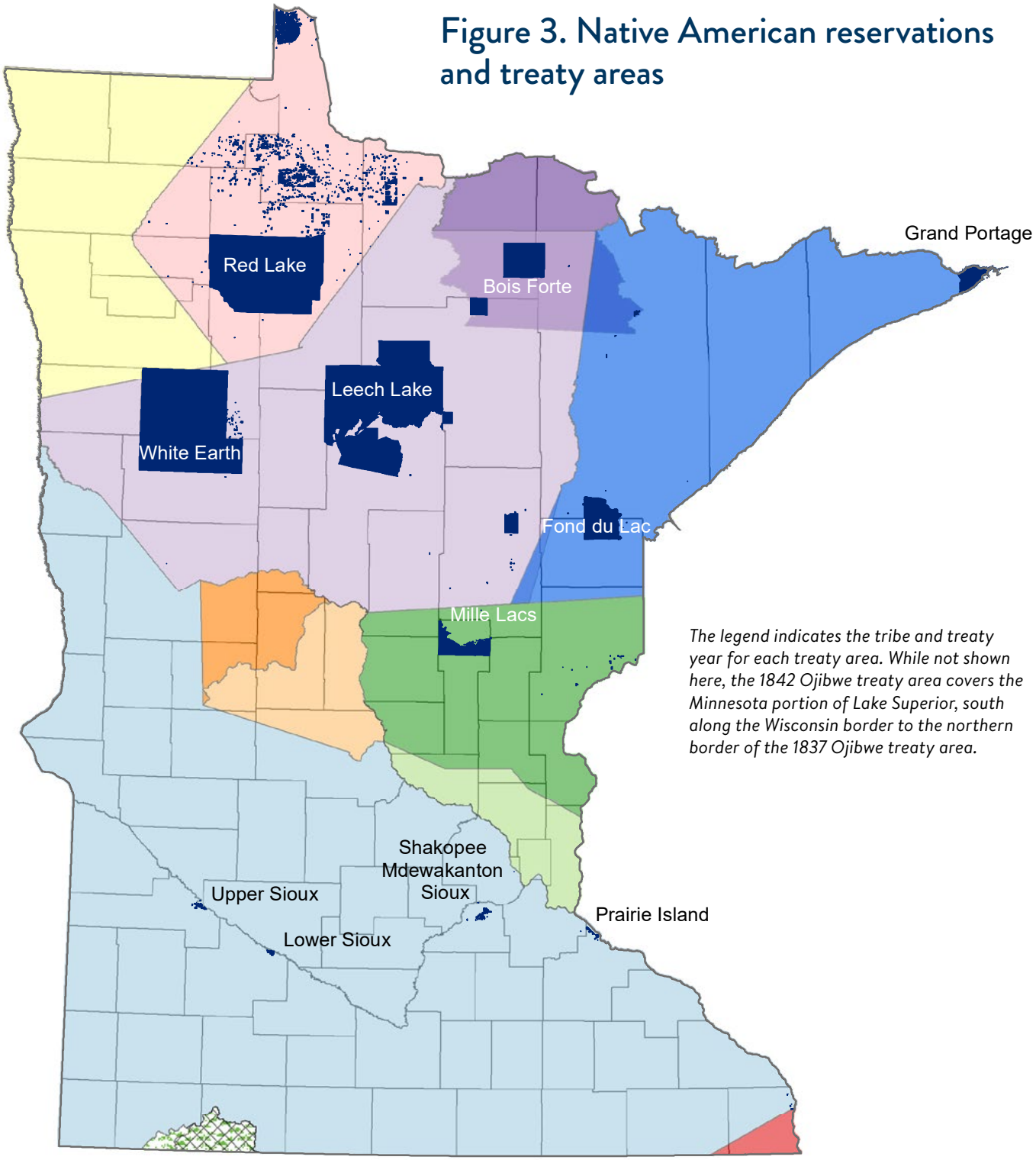
As it pertains to invasive species, tribal consultation is expected before any management activity, including prevention, surveillance, control, monitoring, etc., occurring on any tribally-owned land or within any reservation boundaries. Consultation should also occur before management activities occur in Ceded Territory areas with tribes whom have retained usufructuary rights, especially when a project or type of management has the potential to affect traditional harvest activities in some way. Consultation should also be initiated when management activities could interfere with tribal ordinances and laws or is in near proximity to reservation boundaries and tribal land or when the type of management used could interfere with cultural beliefs and practices, such as the use of biocontrol agents and herbicides. Some management approaches also have the potential to cause transboundary harm.

The above is not an exhaustive list of when consultation with tribal nations and entities is necessary, but rather a guide to starting the consultation process. This plan recognizes that there may be unique requirements for consultation and management practices for each sovereign nation and other tribal entities. It is the burden of the State of Minnesota and other organizations conducting this work in or near tribal areas to connect with the appropriate tribes and tribal entities for consultation before beginning invasive species management projects.

This plan also recognizes the important difference between consultation and notification. Consultation means the direct, interactive and collaborative involvement of tribes in management planning and development of regulatory policies on matters that have tribal implications. Consultation is the proactive, affirmative process of: (1) identifying and seeking input from appropriate Native American governing bodies, community groups and individuals and (2) considering their interests as a necessary and integral part of a Minnesota agency's decision-making process. There are often legal processes associated with consultation. Notification provides a period for comment, but does not replace any part of the consultation process, and should be utilized for updates of already approved projects or projects not requiring tribal consultation.

The Minnesota DNR recognizes existing treaty rights of tribes within Minnesota and wishes to establish a cooperative, government-to-government framework between the Tribes and the DNR that facilitates consistent and timely communication between the parties at the appropriate levels of government. Engagement can range from facilitating information flow in both directions between Tribal Nations and the DNR, technical cooperation, working together to create a mutually acceptable approach to an issue or formal government to government consultation. These different approaches and tools are used based on the objectives being considered by DNR and Tribal Nations.

## Figure 3. Native American reservations and treaty areas




*The legend indicates the tribe and treaty year for each treaty area. While not shown here, the 1842 Ojibwe treaty area covers the Minnesota portion of Lake Superior, south along the Wisconsin border to the northern border of the 1837 Ojibwe treaty area.*

# Section 2. Background, Issues and Problem Definition

## 2a. Problem Definition: What are Invasive Species and How Are They Managed?

Species that have been introduced or moved by human activities to a location where they do not naturally occur are termed "nonnative," "exotic," "alien," and "nonindigenous" (terminology varies in part due to the evolution of this relatively new discipline). It is important to recognize that all living beings move and migrate, and that nonnative species are not inherently “good” or “bad”. When nonnative species cause ecological, economic or human health problems, they are termed "invasive". This plan recognizes the challenges of species management in achieving a healthy and sustainable environment. Studies have suggested that 10% of imported species are introduced, 10% of those become established, and 10% of those established cause harm and become invasive (Williamson and Fitter 1996). Further, the likelihood of a given species establishing and displaying invasive behaviors is dependent on ecosystem properties (Strayer 2020). Determinations, discussions and decision-making can be highly complex. Formal species risk analyses and assessments aim to document species impacts as well as cultural and political considerations related to the species.

In Minnesota, there are many invasive species with unique life histories, numerous means of dispersal, varied feasibilities of control and various levels and impacts. Too many invasive species occur in the state to describe in detail their individual threats, pathways of introduction and spread, distributions and management responses (while these are described for a few species in subsection 3b). If agencies, organizations, private individuals, property owners, businesses and visitors do not take necessary prevention steps, invasive species that are not yet present in Minnesota could be introduced while those that are already established in Minnesota could spread to new areas within the state. Successful prevention of invasive species hinges upon individuals’ participation in the strategies and actions described in this plan.

Many pathways exist for introduction and spread of invasive species. Most introductions result from human activities. Many introductions are unintentional – invasive species are often unknowingly carried in or on vehicles, ships, commercial goods, produce, wood (e.g., pallets, firewood), water, soil and even clothing. Some introductions such as common carp *(Cyprinus carpio)*, common buckthorn *(Rhamnus cathartica)*, and purple loosestrife *(Lythrum salicaria)*, were intentional and are causing unexpected long-term harm. Managing pathways of introduction is an efficient way to prevent the introduction and spread of multiple invasive species. A detailed list of pathways for terrestrial and aquatic invasive species can be found in subsection 3b.

*Minnesotans and visitors enjoying outdoor activities can help prevent the introduction and spread of invasive species. (Photo: DNR.)*

*Movement of firewood can aid the spread of invasive insects like the emerald ash borer. (Photo: MDA.)*

International pathways can also bring invasive species from other countries directly into Minnesota. Potential introduction points include ports of entry, public mail facilities and commercial warehouses that import or handle foreign goods, dunnage holding areas, and container off-loading and unpacking locations where shipments are split up or repackaged. Other introductions can be associated with industry, educational and research institutions and the surrounding environs to their facilities including nurseries, home garden centers, greenhouses and plant trade groups, cut flower wholesalers, wood product facilities (e.g., mills, pallet recyclers, furniture, firewood dealers, mulch producers), zoos and botanical gardens, seed wholesalers, research institutions, aquarium fish and plant wholesalers and retailers, produce warehouses, flea markets, and farmers' markets. International travelers, including students and academic researchers, as well as luggage and items mailed from overseas may also be transporting invasive species. Internet sales can result in almost anything being shipped directly to the purchaser. People may intentionally smuggle specialty items (domestic or wild) seek species from other countries or introduce species unintentionally through contaminated materials.

## Managing Native and Nonnative Species

The Minnesota legal definition of invasive species includes only species that are not native and have negative impacts (Minnesota Statutes, section 84D.01, subdivision 9a). Sometimes native species or nonnative species that are not generally considered invasive need to be managed to achieve site-specific goals. For example, tribal resource managers dedicate significant resources toward controlling native pickerelweed in select waters or situations to protect wild rice. Eastern red cedar *(Juniperus virginiana)* is native to Minnesota, but lack of fire can allow it to invade prairies and reduce prairie species. Management actions at a given site may target invasive species, nonnative species or native species depending on the goals for the site. The fact that this plan focuses on nonnative invasive species does not preclude managers from managing native or nonnative species as fits their needs.

*Goldfish, likely released from aquaria, have become established in multiple lakes and ponds in the Twin Cities metropolitan area. (Photo: Doug Jensen, Minnesota Sea Grant.)*

*Common carp and purple loosestrife are examples of invasive species that were intentionally introduced to the United States. (Photos: DNR.)*

Further, there are several cryptogenic species (i.e., those that have not been determined as clearly native) in the state. This issue is most acute with pathogens and microbes. For example, the aquatic species didymo *(Didymosphenia geminata)* is considered a cryptogenic species. It is currently unclear if the population of didymo that is spreading around the Lake Superior basin is the same as populations that are invading waters in other U.S. states and therefore there is concern about its spread from Lake Superior to inland waters in Minnesota. Managers will need to use the most up-to-date information and their site-specific goals to make management decisions related to cryptogenic species.

*Didymo can form dense, slippery mats that alter stream conditions and smother invertebrates in the sediment. The origin of didymo in Lake Superior is not well understood. (Photo: Heidi Rantala, DNR.)*

## Approach

Despite the wide variety of invasive species, general approaches to their management and prevention are often similar. Because there are many federal, state, county, local, tribal, and private entities involved in addressing invasive species-related issues, using the framework established by this plan for all types of invasive species supports the use of cooperative, efficient and generally accepted and transparent approaches.

## Prioritization

While approaches are often similar among species, there are not sufficient resources, capacity, knowledge or need to treat all invasive species or situations the same. For some invasive species, there are no tools to manage them once established. For many invasive species, better, more selective management tools are needed to achieve management goals. There is a need to prioritize research, prevention, detection, containment, control and regulatory changes. It must be determined which species should receive high levels of attention in terms of resources allocated, research conducted and regulations established. Some species need little or no attention. Whether or not to invest in responses to individual nonnative species depends upon factors such as levels of risk or potential harm a species poses, its geographical distribution, authorities over the lands or waters and ability to control a species if it establishes in the state. These assessments and prioritization of efforts are key decisions in invasive species management.

## Climate Resiliency in Invasive Species Management

Climate change is causing additional challenges for invasive species management in Minnesota. The composition of native and nonnative species capable of surviving in the state, and localized regions of the state, will change with changes in climate (Simberloff 2000, Rahel and Olden 2008). Species ranges are already changing and will continue to do so (e.g., Cline et al. 2013). Established invasive species, including those deemed as potentially low risk, may pose new risks as invaded ecosystems change (Spear et al. 2021). Extreme weather events, such as floods, fires, and droughts, may have disproportionate effects on native species and favor dominance of nonnative and invasive

species (D'Antonio and Vitousek 1992). These are only a few of the potential interactions between climate change and invasive species threats.

Climate resilient invasive species management hinges upon increased monitoring, prioritizing species and populations and application of the best available scientific information. As the global pool of species of concern capable of establishing in Minnesota changes with a changing climate, Minnesota will need to increase investment in approaches that reduce risk of invasive species establishment and impacts (e.g., by addressing risks associated with pathways for invasive species or managing for healthy and resilient ecosystems) to complement species- and population-specific control prioritization.

Prevention continues to provide the best value for invasive species management. Science-based species risk assessments that include climate change factors are critical for preventing introduction or spread of invasive species not yet established in Minnesota or established only in parts of the state. Many organizations across the country and in Minnesota have risk assessment frameworks that incorporate climate change factors. Species risks may need to be reassessed every 5-10 years to account for changes in projected climate. As climatic changes shift the geographic areas that are suitable for any given species, risk assessments at regional, state and local scales should be used to inform species' regulatory classifications and local management strategies. Understanding suitability in Minnesota will likely require understanding and modeling ecosystem responses to climate change at this fine scale (Walsh et al. 2020). Regulatory agencies and industries will need ongoing collaboration to 1) identify species in trade that warrant risk assessment, as well as 2) industry practices and pathways that could lead to incidental movement of organisms. Industries, recreation and other human activities will likely change in adaptation to climate change, leading to new and unexpected pathways of invasive species transport. Collaboration with regulatory agencies will provide the necessary relationships to plan for and anticipate how adapting industry practices may change existing invasion pathways.

Nonnative species impacts are highly context dependent as populations interact with invaded ecosystems to produce adverse effects (Strayer 2020). As such, managing for healthy and resilient ecosystems may complement other strategies to reduce the impact of invasive species and the number of invasive populations on the landscape. Supporting healthy ecosystems may limit the cases of nonnative populations that would increase existing climate change-driven ecosystem degradation (Spear et al. 2021). Increasing investments in understanding ecosystem responses to climate change will also help inform predicted invasive species responses (Walsh et al. 2020).

The greatest implications of climate change for invasive species management will be the need to enhance early detection and response strategies and to use adaptive management (Rahel et al. 2008, Tausch 2008). Further investment in monitoring and detection technologies is needed to support early detection. Control activities are more likely to result in successful removal or control of invasive species if populations are detected early (e.g., Kujawa et al. 2017). Climate suitability models capable of projecting under future climates should be used to help professional and volunteer invasive species detectors determine which species to look for at local scales throughout the state.

Decisions about invasive species management at particular sites will become even more challenging for resource managers in the face of climate change. Managers will need to continue to reevaluate plans over time and adjust as needed (i.e., adaptive resource management), and they may find that species they previously managed are no longer management priorities. In some cases, ecosystems may become less suitable for a particular invasive species, or the species may be providing ecosystem services that are no longer being provided by native species. As a result, managers will need to carefully consider management outcomes and goals when developing management strategies for invasive populations.

It is particularly important to think of prioritization of invasive species management as it pertains to climate change and tribal communities. Prioritization of management should reflect the inability of tribes to move traditional harvest activities out of reservation and Ceded Territory boundaries. Since the tribes are sovereign nations and many today still practice hunting, fishing and gathering, the combination of climate change and invasive species could quickly diminish available resources and put these practices at risk of being lost. Many still use these practices for sustenance, and if the geographic area of available resources is changed because of invasive species and climate change, this could have devastating impacts to members of the tribal community.

### Acknowledgement of Harm Caused by Including Species Origin in Species Names

MISAC acknowledges that species names which include reference to a species' country of origin can have unintended negative impacts on people whose heritage includes those countries. Language characterizing invasive species as threats is often wrapped up with the species being nonnative to Minnesota or the United States. MISAC encourages the organizations involved in the implementation of this plan to be sensitive to this issue in their communications. MISAC and the scientific community should more broadly engage in discussion and analysis, and make changes accordingly that align with diversity, equity and inclusion goals.

## 2b. Invasive Species Threats to Minnesota

Not all invasive species pose the same degree of threat to the state. MISAC used a qualitative process to rate potential impacts from invasive species to human health, physical environment, ecological impacts, economies, and infrastructure. Several hundred species were evaluated, including those with self-sustaining populations in the state (established), those that have been found in the state but are not established (present, not established) and those not known to be here (not present). The most current ratings can be found on the MISAC website.

The process began by compiling multiple lists of species of concern. Panels of experts in 2007 and 2019-2020 provided qualitative assessments based on the best available science to determine the appropriate rating category for each species. In 2019-2020, there were seven panels, one for each group of species: aquatic plants, aquatic animals, aquatic pathogens, terrestrial plants, terrestrial animals, terrestrial pathogens, and terrestrial insects.

The goal of the 2019-2020 MISAC species ratings process project was to consolidate multiple invasive species lists into one location and provide information on levels of threat of the various species. The result provided an overview of the threats and status of invasive species to Minnesota as of 2019. The intent is that these educational and informational lists will be used by managers, policy makers, researchers, and other interested parties. The information can be used in multiple ways, such as:

- Examining how prevention efforts can prevent species that are threats to Minnesota, but not known to be present in the state, from being introduced to the state.
- Targeting species not known to be in the state for early detection efforts.
- Targeting species present, but not established in the state for management actions to prevent further spread.
- Researching impacts of species whose impacts are unknown.
- Encouraging mapping and reporting of species to better understand distribution.

Only a subset of rated species is listed in this plan. For aquatic species, overall threat ratings were assigned based on MAISRC's 2019-2020 Priority Species List, the Great Lakes and St. Lawrence Governors and Premiers "Least Wanted" Aquatic Invasive Species list (2019), MISAC member expertise and the MISAC species ratings. For terrestrial species, species rated with the potential for high ecological and economic impacts are listed. Species are listed in alphabetical order.

Species ratings will be revised periodically. It is very important that species ratings and assessments are based on the best available science to avoid unnecessary burdens on resource managers and industry. When possible, risk assessments and methods used should be made publicly available.

## Federal and Regional Species Threat Ratings

In addition to the MISAC ratings, other sources of information exist for ratings of species threats to Minnesota. The full MISAC ratings document includes the list of invasive species lists that were cross-referenced to develop the MISAC list. The Great Lakes Commission and Great Lakes Panel on Aquatic Nuisance Species are developing a risk assessment database that compiles risk assessments for a given species in one place (i.e., the National Oceanic and Atmospheric Administration's (NOAA) Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS)). The USFWS develops Ecological Risk Screening Summaries to evaluate species' potential invasiveness. The USDA APHIS Cooperative Agricultural Pest Surveys program aims to address international plant pest threats in cooperation with states. It is critical to note that MISAC's assessments are specific to Minnesota. Thus, it is possible that a species might be considered a high threat nationally, but a low threat to the state (e.g., insect pests of citrus crops), due to the lack of a suitable environment or hosts.

## Aquatic Invasive Species Threats

As indicated by the MISAC ratings of aquatic invasive species threats on the MISAC website, there are several species in the state that were rated as high threats to natural resources and their use. The species and overall threat ratings listed in the tables in this section were informed primarily by the MISAC species ratings process, which produced threat ratings for several impact areas (e.g., human health, ecological and economic impacts). The species listed here generally include those on MAISRC's 2019-2020 Priority Species List, the Great Lakes and St. Lawrence Governors and Premiers "Least Wanted" Aquatic Invasive Species list (2019) and/or those that MISAC species ratings process rated to have high ecological or economic impacts. MISAC member expertise was considered along with the MISAC species ratings to develop the overall threat rating. Species listed with a high threat rating might be prioritized for research, prevention, or control in the state. These species have variable distributions in the state. Many of them are designated as prohibited invasive species and in some cases the DNR lists water bodies as "infested" if doing so would reduce the risk of spread for those species.

To reduce the risk of spreading aquatic invasive species, activities like bait harvest and water use are managed differently in infested waters. EDDMapS provides the most accurate and up-to-date occurrence information for many of these species. More information about these species and their impacts can be found in the DNR's Guide to Aquatic Invasive Species. Note that the MISAC species ratings were completed in 2019 and invasive species status in Minnesota may change over time.

### Aquatic Animals

MISAC reviewed 75 aquatic animal species. Of the 75 species, 26 are established in Minnesota, 11 are present but not established, and 38 are not known to be present in Minnesota. Thirty-two species were rated as having potential for high ecological impacts and five had the potential for high economic impacts. Selected, high priority aquatic animals that present either high or moderate threats are listed in Table 1.

Impacts of aquatic invasive animals can include:

- predation on or displacement of native species
- destruction of native species habitat
- changes in water quality and clarity
- disease transmission to humans and animals

TABLE 1. AQUATIC ANIMALS THAT PRESENT HIGH OR MODERATE THREATS.

| Common name | Scientific name | Status in Minnesota | Overall Threat Rating |
|---|---|---|---|
| Bighead carp | *Hypophthalmichthys nobilis* | Not established | High |
| Black carp | *Mylopharyngodon piceus* | Not present | High |
| Chinese mystery snail | *Cipangopaludina chinensis malleata* | Established | High |
| Common carp | *Cyprinus carpio* | Established | High |
| Faucet snails | *Bithynia tentaculata* | Established | High |
| Golden mussel | *Limnoperna fortunei* | Not present | High |
| Goldfish | *Carassius auratus* | Established | High |
| Grass carp | *Ctenopharyngodon idella* | Not established | High |
| Killer shrimp | *Dikerogammarus villosus* | Not present | Moderate |
| Marbled crayfish | *Procambarus virginalis* | Not present | Moderate |
| New Zealand mudsnail | *Potamopyrgus antipodarum* | Not established | High |
| Northern snakehead | *Channa argus* | Not present | High |
| Quagga mussels | *Dreissena bugensis* | Established | High |
| Rainbow smelt | *Osmerus mordax* | Established | High |
| Red swamp crayfish | *Procambarus clarkii* | Not established | High |
| Round goby | *Neogobius melanostomus* | Established | High |
| Ruffe | *Gymnocephalus cernuus* | Established | High |
| Rusty crayfish | *Faxonius rusticus* | Established | High |
| Sea lamprey | *Petromyzon marinus* | Established | High |
| Silver carp | *Hypophthalmichthys molitrix* | Not established | High |
| Spiny water flea | *Bythotrephes longimanus* | Established | High |
| Tench | *Tinca tinca* | Not present | Moderate |
| Yabby | *Cherax destructor* | Not present | Moderate |
| Zander | *Sander lucioperca* | Not present | High |
| Zebra mussels | *Dreissena polymorpha* | Established | High |

*Ruffe were introduced into Lake Superior in the mid-1980s through ship ballast but have not been found in any inland Minnesota lakes as of 2022. (Photo: Doug Jensen, Minnesota Sea Grant.)*

*Rusty crayfish were likely introduced and spread through improper use and disposal of live bait. (Photo: Jeff Gunderson, Minnesota Sea Grant.)*

### Aquatic Microbes

MISAC reviewed 33 aquatic microbes. Of the 33 microbes, 11 are established in Minnesota, four are present but not established, and 18 are not known to be present in Minnesota. Six microbes were rated as having potential for high ecological impacts and six had the potential for high economic impacts. Selected, high priority aquatic microbes that present either high or moderate threats are listed in Table 2.

Impacts of aquatic invasive microbes can include:

- disease and death in native species
- forming dense mats that degrade habitats

*MAISRC is conducting research on the risks of fish pathogen introduction through live bait. Here, an employee from West Central Bait works to sort minnows by size. (Photo: Jeff Gunderson, Minnesota Sea Grant.)*

TABLE 2. AQUATIC MICROBES THAT PRESENT HIGH OR MODERATE THREATS.

| Common name | Scientific name | Status in Minnesota | Overall Threat Rating |
|---|---|---|---|
| Baitfish viruses | Multiple strains | Variable | High |
| Chytrid fungus | *Batrachochytrium dendrobatidis; Batrachochytrium salamandrivorans* | Not established | High |
| Didymo | *Didymosphenia geminata* | Established | High |
| Heterosporis | *Heterosporis sutherlandae* | Established | Moderate |
| Koi herpesvirus | Cyprinid Herpes Virus-3 | Established | Moderate |
| Rickettsia-like organisms | *Piscirickettsia* spp. | Not present | High |
| VHS | Viral hemorrhagic septicemia virus | Not established | High |

## Aquatic Plants

MISAC reviewed 45 aquatic plant species. Of the 45 species, 13 are established in Minnesota, five are present but not established, and 27 are not known to be present in Minnesota. Twenty-one species were rated as having potential for high ecological impacts and eight had the potential for high economic impacts. Selected, high priority aquatic plants that present either high or moderate threats are listed Table 3.

Impacts of aquatic invasive plants can include:

- Changing ecosystem processes such as hydrology and nutrient availability
- Displacing native plant and animal species
- Forming dense thickets that hinder recreation


*Yellow iris is commonly sold in the horticultural trade but can spread along shorelines and roadside ditches. (Photo: Paul Skawinski, University of Wisconsin Extension Lakes.)*

TABLE 3. AQUATIC PLANTS THAT PRESENT HIGH OR MODERATE THREATS.

| Common name | Scientific name | Status in Minnesota | Overall Threat Rating |
|---|---|---|---|
| Brazilian elodea | *Egeria densa* | Not established | Moderate |
| Curly-leaf pondweed | *Potamogeton crispus* | Established | High |
| Eurasian watermilfoil | *Myriophyllum spicatum* | Established | High |
| European frogbit | *Hydrocharis morsus-ranae* | Not present | High |
| Flowering rush | *Butomus umbellatus* | Established | High |
| Hybrid cattail | *Typha x glauca* | Established | High |
| Hydrilla | *Hydrilla verticillata* | Not present | High |
| Narrow-leaved cattail | *Typha angustifolia* | Established | High |
| Nonnative subspecies of common reed; nonnative *Phragmites* | *Phragmites australis* subsp. *australis* | Established | High |
| Oxygen weed | *Lagarosiphon major* | Not present | High |
| Parrot feather | *Myriophyllum aquaticum* | Not established | Moderate |
| Purple loosestrife | *Lythrum salicaria* | Established | High |
| Starry stonewort | *Nitellopsis obtusa* | Established | High |
| Water chestnut | *Trapa natans* | Not present | High |
| Water soldier | *Stratiotes aloides* | Not present | Moderate |
| Yellow floating heart | *Nymphoides peltata* | Not present | Moderate |
| Yellow iris | *Iris pseudacoris* | Established | Moderate |

## Terrestrial Invasive Species Threats

Terrestrial invasive species can impact Minnesota's economy, ecology and human health. This section summarizes the results of the MISAC species ratings and discusses some of the impacts the species can have. More detailed information on individual species can be found in the MISAC species ratings document and on DNR and MDA webpages. Note that the MISAC species ratings were completed in 2019 and species status in Minnesota may change over time.

### Terrestrial Animals (Not Including Insects)

The MISAC species ratings process reviewed 29 animal species. Of the 29 species, 13 are established in Minnesota, 5 are present but not established, and 11 are not known to be present in Minnesota. Eight species were rated as having the potential for high ecological impacts and ten species had the potential for high economic impacts (12 species total, Table 4).

Impacts of terrestrial invasive animals can include:

- Damage to crops, ornamental plants, or native plants
- Predation or displacement of native animal species
- Damage to soils, changing soil nutrient levels, increasing soil erosion
- Disease transmission to humans and animals

TABLE 4. TERRESTRIAL ANIMALS (NOT INCLUDING INSECTS) HAVING THE POTENTIAL FOR HIGH ECOLOGICAL AND ECONOMIC IMPACTS.

| Common name | Scientific name | Status in Minnesota | Ecological Impact Threat Rating | Economic Impact Threat Rating |
|---|---|---|---|---|
| Asian raccoon dogs | *Nyctereutes procyonoides* | Not present | High | Low |
| Black rats | *Rattus rattus* | Not present | Moderate | High |
| European rabbits | *Oryctolagus cuniculus* | Not established, present in captivity | High | High |
| European starlings | *Stunus vulgaris* | Established | High | High |
| European wild boar | *Sus scrofa* | Not present | High | High |
| House mice | *Mus musculus* | Established | Moderate | High |
| Jumping earthworms | *Amynthas* and *Metaphire* sp. | Established | High | Moderate |
| Multiple snail species | *Cernuella* sp., *Cernuella* virgata, *Cochlicella* spp., *Monacha* spp. | Not present | Moderate | High |
| Mute swans | *Cygnus olor* | Not established | High | Moderate |
| Norway rats | *Rattus norvegicus* | Established | Moderate | High |
| Nutria | *Mycocastor coypu* | Not present | High | Moderate |
| Other nonnative earthworms | Various | Established | High | Moderate |

### Terrestrial Insects

The MISAC species ratings process reviewed 84 insect species. Of the 84 species, 12 are established in Minnesota, 2 are present but not established, and 70 are not known to be present in Minnesota. Twelve species were rated to have the potential for high ecological impacts and 42 insect species were rated to have the potential for high economic impacts (of those 42, only those that are present in Minnesota or had high ecological threat ratings are listed in Table 5).

Impacts of terrestrial invasive insects can include:

- Damage to crops and ornamental plants
- Damage to native plants, including widespread death of tree species
- Disease transmission

*Here, a brown marmorated stink bug sits on the leaf of an amur maple tree. In Minnesota, amur maple may only be planted in areas where seedlings will be controlled or eradicated by mowing or other means. (Photo: MDA.)*

TABLE 5. TERRESTRIAL INSECTS HAVING THE POTENTIAL FOR HIGH ECOLOGICAL AND ECONOMIC IMPACTS.

| Common name | Scientific name | Status in Minnesota | Ecological Impact Threat Rating | Economic Impact Threat Rating |
|---|---|---|---|---|
| Asian longhorned beetle | *Anoplophora glabripennis* | Not established | High | High |
| Banded elm bark beetle | *Scolytus schevyrewi* | Established | High | Moderate |
| Brown marmorated stink bug | *Halyomorpha halys* | Established | Moderate | High |
| Citrus longhorned beetle | *Anoplophora chinensis* | Not established | High | High |
| Emerald ash borer | *Agrilus planipennis* | Established | High | High |
| European elm bark beetle | *Scolytus multistriatus* | Established | High | Moderate |
| Spongy moth | *Lymantria dispar* | Not established, present | Moderate | High |
| Japanese beetle | *Popillia japonica* | Established | Low | High |
| Japanese cedar longhorn beetle | *Callidiellum rufipenne* | Not established | High | High |
| Large pine weevil | *Hylobius abietis* | Not established | High | High |
| Mountain pine beetle | *Dendroctonus ponderosae* | Not established | High | High |
| Oak ambrosia beetle | *Platypus quercivorus* | Not established | High | High |
| Pine-tree lappet | *Dendrolimus pini* | Not established | High | High |
| Siberian silk moth | *Dendrolimus sibiricus* | Not established | High | High |
| Six-toothed spruce bark beetle | *Pityogenes chalcographus* | Not established | High | High |
| Soybean aphid | *Aphis glycines* | Established | Low | High |
| Spotted wing drosophila | Drosophila suzukii | Established | Low | High |

### Terrestrial Pathogens

The MISAC species ratings process reviewed 55 species. Of the 55 species, 13 are established in Minnesota, 9 are present but not established and 33 are not known to be present in Minnesota. Four species were rated with the potential to have high ecological impacts and six species were rated with the potential to have high economic impacts (10 species total, Table 6).

Impacts of terrestrial invasive pathogens can include:

- Damage to crops and ornamental plants
- Damage to native plants
- Death of native wildlife

### Terrestrial Plants

The MISAC species ratings process reviewed 282 terrestrial plant species and found that 142 are established in Minnesota, 67 are present but not established, 70 are not known to be present in Minnesota and three were listed as unknown as there was not clear enough information to make a determination. Forty-seven species were rated to have potential for high ecological impacts. Of those, 30 are considered established in Minnesota, seven present but not established, nine as not present, and one remains unknown. Seventeen species were rated to have the potential for high economic impacts. Of those, 13 are considered established in Minnesota, one present but not established, and two as not present. Due to the number of terrestrial plant species rated to have potential for high ecological and economic impacts, they are not listed here but can be found in the MISAC species ratings document.

TABLE 6. TERRESTRIAL PATHOGENS HAVING THE POTENTIAL FOR HIGH ECOLOGICAL AND ECONOMIC IMPACTS.

| Common name | Scientific name | Status in Minnesota | Ecological Impact Threat Rating | Economic Impact Threat Rating |
|---|---|---|---|---|
| Ash dieback | *Hymenoscyphus fraxineus* | Not present | High | Moderate |
| Bacterial wilt | *Ralstonia solanacearum* race 3 biovar 2 | Not present | None | High |
| Dutch elm disease | *Ophiostoma novo-ulmi* | Established | High | Low |
| Golden nematode | *Globodera rostochiensis* | Not present | Low | High |
| Late blight | *Phytophthora infestans* | Not established, present | None | High |
| Oak wilt | *Bretziella fagacearum* | Established | Moderate | High |
| Pale cyst nematode | *Globodera pallida* | Not present | Low | High |
| Root-knot nematode | *Meloidogyne minor* | Not present | None | High |
| White nose syndrome of bats | *Pseudogymnoascus destructans* | Established | High | Moderate |
| White pine blister rust | *Cronartium ribicola* | Established | High | Moderate |

The Noxious Weed Advisory Committee (NWAC) assesses plants that are potential threats and recommends regulation as appropriate through the MDA Noxious Weed List.

- Landowners are mandated to remove or kill plants on the Prohibited Noxious Weed – Eradicate List (species not widely found in Minnesota, but which have the potential to be highly damaging). Example eradicate list species include black swallowwort *(Cynanchum louiseae)*, common and cutleaf teasel *(Dispacus fullonum* and *D. lacinatus)*, Grecian foxglove *(Digitalis lanata)*, Oriental bittersweet *(Celastrus orbiculatus)* and Palmer amaranth *(Amaranthus palmeri)*.
- Examples of species on the Prohibited Noxious Weed – Control List (landowners must prevent seed spread off their site) include Canada thistle *(Cirsium arvense)*, Japanese knotweed *(Polygonum cuspidatum)*, leafy spurge *(Euphorbia esula)*, spotted knapweed *(Centaurea stoebe* ssp. *micranthos)* and wild parsnip *(Pastinaca sativa)*.
- Examples of species on the Restricted Noxious Weed List (sales and transportation of propagating parts are prohibited) include four nonnative bush honeysuckles *(Lonicera* species), common buckthorn, certain Japanese barberry cultivars and the parent species *(Berberis thunbergii)* and multiflora rose *(Rosa multiflora)*.

Impacts of terrestrial invasive plants can include:

- Limiting tree seedling establishment and regeneration of forests
- Reducing native plants and the wildlife that depend on those plants for food and cover
- Changing ecosystem processes such as promoting fires, changing nutrient availability in the soil or increasing erosion
- Reducing the availability of forage for grazing animals
- Forming dense thickets or tangles that are difficult to walk through
- Forming single-species stands that displace native wildflowers
- Producing sap or spines that can irritate human skin or are toxic
- Reducing crop yields
- Displacing cultural species used for sustenance and/or medicines
- Causing direct human harm through contact or ingestion
- Causing indirect human harm by creating habitats that result in increases in tick-carrying mammals and thus, possibly increasing the incidents of tick-borne diseases

*Here, technicians conduct spot spraying of common tansy and Canada thistle. (Photo: Tyler Kaspar, 1854 Treaty Authority.)*

# Section 3. Programs and Regulatory Authorities

There are numerous entities within the state that have programs and regulatory authorities related to invasive species. Some of these may exist under programs, or address categories of species, with different names: noxious weeds, agricultural pests, plant pests, and aquatic invasive species. There are also many other governmental and non-governmental entities that manage invasive species although they may not have legally assigned responsibilities, e.g., The Nature Conservancy, Lake Minnetonka Conservation District, and Minneapolis Parks and Recreation Board. The information below provides an overview of the various authorities, responsibilities of agencies, landowners and others. In addition, Appendix C lists many agencies and organizations involved in invasive species prevention and management.

## 3a. Regulations and Enforcement

The primary Minnesota state statutes related to invasive species include Minnesota Statutes, chapter 84D, Minnesota Statutes, chapter 18G, and Minnesota Statutes, sections 18.75 to 18.91. More information can be found on the respective DNR website pages related to aquatic and terrestrial invasive species laws and regulations.

Federal and state entities may regulate particular species and operate inspection programs. Before classifying nonnative species into regulatory categories, for purposes of restricting or allowing their importation, transportation, possession, sale and introduction, agencies generally conduct risk assessments and develop rationale for the classifications. Federal or state register notices and classification summaries are often prepared prior to classification of species. The involved agencies, such as the DNR, USFWS, MDA, and USDA APHIS can be contacted for this information. Agencies often do not have sufficient resources to conduct risk assessments for all species likely to be intentionally or unintentionally imported. Federal agencies that conduct inspections of shipments and other goods include U.S. CBP, USFWS and USDA APHIS.

Statewide entities implement further regulatory programs for invasive species prevention and management. The DNR operates a watercraft inspection program and has the authority to review and authorize or deny future introductions of unclassified nonnative species of wild animals and aquatic plants into the wild for beneficial purposes. The Minnesota Pollution Control Agency (MPCA) works with the U.S. Coast Guard and EPA and private entities for ballast water management. USDA APHIS requires a permit to move plant pests, soil or biological control agents across state lines and the MDA participates in that permitting process. The MDA regulates plant pests and terrestrial plants and works with the state's Noxious Weed Advisory Committee to assess and propose species for regulation. MDA also has programs for inspections and testing of nursery stock, seed and keeping new invasive pathogens out of the state. While not mandated to do so, MAISRC and MITPPC also frequently conduct species prioritization processes that can help inform prevention and management efforts.

*Minnesota DNR conservation officers have a K9 Unit to detect zebra mussels on water-related equipment. (Photo: DNR.)*

Each tribe has its own jurisdictions and codes related to enforcement that need to be considered. In some cases, tribal conservation officers have jurisdiction around the state to enforce state invasive species laws and other natural resources laws. Tribal codes only apply on tribal land and to band members but tribal conservation officers are recognized as authorities in the entire state and can enforce regulations with the general public. There is a reciprocal agreement that tribal and state conservation officers can both enforce laws on either territory. Some specific band members can request a conservation officer from their band rather than a state officer, and this sometimes applies across jurisdictional boundaries. State and tribal conservation officers often work together and collaboratively conduct enforcement and management.

A variety of regulations related to invasive species exist at federal, state, tribal and local levels and are administered by many agencies. An overview is provided in Table 7.

TABLE 7. KEY INVASIVE SPECIES AUTHORITIES.

| Topic | Agencies Involved | Type of Species | Key Legislation |
|---|---|---|---|
| Federally listed injurious wildlife | USFWS | animals (not including insects) | Title 18 of the Lacey Act (18 U.S.C. 42) |
| Prevention and control of invasive species in coastal inland waters; management of the ANSTF and the federal ANS program; reauthorization of the National Sea Grant College program | USFWS | Nonindigenous aquatic nuisance species | Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990;<br>National Invasive Species Act of 1996 |
| Protection of national wildlife refuges | USFWS | Aquatic and terrestrial invasive species | National Wildlife Refuge System Administration Act (16 U.S.C. sections 668dd-ee, regulated through 50 C.F.R.);<br>Refuge Manual Chapter 7 RM 8 |
| Federal and state ballast water management | U.S. Coast Guard, U.S. EPA, MPCA | Aquatic organisms | Minnesota Statutes, section 115;<br>EPA Vessel General Permit and USCG (33 C.F.R. 151.1500-151.1518 and 33 C.F.R. 151.2000-151.2080) until replaced by new regs under Vessel Incidental Discharge Act |
| Management of dams as they relate to fish passage and other environmental issues | U.S. Army Corps of Engineers | Aquatic organisms | Water Resources Development Act |
| Tribal codes | Tribes | Aquatic and terrestrial plants and animals | Each tribe has its own jurisdictions and codes related to enforcement that need to be considered, as described in the narrative above |
| State restricted species and watercraft inspection | DNR | Wild animals (not including insects) and aquatic plants | Minnesota Statutes, chapter 84D<br>Minnesota Statutes, section 17.457 |
| Federal regulations to restrict movement of various pests | USDA APHIS | Foreign plant pests and diseases | Federal Plant Protection Act (7 U.S.C. Chapter 104) |
| Federal noxious weeds | USDA APHIS | Aquatic and terrestrial plants | Federal Noxious Weed Law (7 C.F.R. part 360) |

| Topic | Agencies Involved | Type of Species | Key Legislation |
|---|---|---|---|
| State prohibited and restricted noxious weeds | MDA, counties, townships and municipalities | Terrestrial plants | Minnesota Noxious Weed Law (Minnesota Statutes, sections 18.75 to 18.91) |
| Terrestrial plant pests | MDA | Insects and other invertebrates, pathogens and plants | Minnesota Statutes, chapter 18G |
| Inspection of international shipments | U.S. CBP | Plant pests | Title 19 Code of Federal Regulations (19 C.F.R. section 12.31) |
| Prevention and control of invasive species in the National Forest System | USFS | Aquatic and terrestrial invasive species | Title 36 Code of Federal Regulations (36 C.F.R. section 222.8);<br>Consolidated Appropriations Resolution, 2003 (16 U.S.C. section 2104) |
| Protection of natural resources and control of invasive plants and animals | NPS | Invasive plants and animals | NPS Organic Act (16 U.S.C. section 1 et seq., P.L. 113-287, 128 Stat. 3094);<br>Consolidated Natural Resources Act of 2008 (16 U.S.C. section 1j, P.L. 113-287, 128 Stat. 3094);<br>General Authorities Act of 1970 (16 U.S.C. 1a-1; P.L. 113-296);<br>NPS Management Policies (2006) |
| Prohibited upstream travel beyond the Arcola High Bridge for the purpose of restricting aquatic invasive species movement | Saint Croix National Scenic Riverway | Zebra mussels and other aquatic invasive species | Title 36 Code of Federal Regulations (36 C.F.R. Sect 7.9c) |
| Control of invasive plants and animals | Federal (general) | Invasive plants and animals | Executive Order 13751: Safeguarding the Nation from the Impacts of Invasive Species (Dec. 2016) |

## 3b. Prevention, Monitoring, Responses, Management and Research

Many entities are involved in the detection, enforcement, and responses to new discoveries of invasive species in the state. The type of species and geographic location determine who has responsibilities for detection, control responses to keep the species from establishing or spreading if established, and management to reduce nuisance populations. In some situations, there is an overlap of responsibilities and often these situations can lead to cooperative efforts. Examples of the roles of participants in Minnesota are shown in Table 8.

*A DNR aquatic invasive species specialist inspects a boat lift for invasive species as it is taken out of the water for the season. (Photo: DNR.)*

### TABLE 8. EXAMPLE ROLES OF ORGANIZATIONS THAT PARTNER IN INVASIVE SPECIES WORK.

Organizational roles indicated include involvement with preventing introductions (P), monitoring (M), responding to new populations (R), controlling and managing established populations (C) and conducting, collaborating on or funding research studies (S). A "na" indicates that the organization does not have primary involvement with the associated taxonomic group.

| Organization Category | Organization | Aquatic Species | Wild Animals (Not including insects) | Plant Pests | Aquatic Plants | Terrestrial Plants | Area |
|---|---|---|---|---|---|---|---|
| Federal Agencies | USDA APHIS | na | na | P, M, R, C, S | na | P, M, R, S | Nationwide |
| Federal Agencies | USDA NRCS | na | na | na | na | P | Nationwide |
| Federal Agencies | U.S. CBP | na | na | P | na | P | Nationwide |
| Federal Agencies | U.S. Coast Guard | P, S (Ballast water) | na | na | na | na | Great Lakes |
| Federal Agencies | U.S. EPA Great Lakes National Program Office (GLNPO) | M | na | na | na | na | Great Lakes |
| Federal Agencies | USDA Forest Service | R, C | R, C | R, C, S | R, C | R, C, S | National forests and statewide |

| Organization Category | Organization | Aquatic Species | Wild Animals (Not including insects) | Plant Pests | Aquatic Plants | Terrestrial Plants | Area |
|---|---|---|---|---|---|---|---|
| Federal Agencies | USFWS | P, M, S | P, M, R, C | P, M, R, C | P, M, R, C, S | P, M, R, C | National Wildlife Refuges, Wetland Management Districts, Great Lakes Basin, and/or Statewide (areas vary depending on the activity) |
| Federal Agencies | USGS | S | S | | | S | Nationwide |
| Federal Agencies | CSMI | M | na | na | na | na | Great Lakes |
| Federal Agencies | U.S. Army Corps of Engineers | S | na | na | S | na | Nationwide |
| Regional Entities | Conservation Corps of Minnesota and Iowa | na | na | na | na | R, C | Minnesota and Iowa |
| Tribes | Bois Forte Band of Chippewa | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Fond du Lac Band of Lake Superior Chippewa | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Leech Lake Band of Ojibwe | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Lower Sioux Indian Community | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Mille Lacs Band of Ojibwe | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Minnesota Chippewa Tribe | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Prairie Island Indian Community | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Red Lake Nation | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Shakopee Mdewakanton Sioux Community | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Upper Sioux Community | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | White Earth Nation | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| Tribes | Grand Portage Band of Lake Superior Chippewa | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Reservations and Ceded Territories |
| State Entities | BWSR | na | na | M | na | P, M, R, C, S | Statewide |

| Organization Category | Organization | Aquatic Species | Wild Animals (Not including insects) | Plant Pests | Aquatic Plants | Terrestrial Plants | Area |
|---|---|---|---|---|---|---|---|
| State Entities | DNR | P, M, R, C, S | P, M, R, C, S | M, R, C, S | P, M, R, C, S | M, S | Statewide |
| State Entities | MDA | na | na | P, M, R, C, S | M (nursery inspection) | P, M, R, C, S | Statewide |
| State Entities | MnDOT | na | na | M | na | M, S | Statewide |
| State Entities | MAISRC | P, M, R, C, S | na | na | P, M, R, C, S | na | Statewide |
| State Entities | Minnesota Sea Grant | P, M, R, S | na | na | na | na | Statewide |
| State Entities | MITPPC | na | na | S | na | S | Statewide |
| State Entities | Universities | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Statewide |
| State Entities | Extension | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Statewide |
| Non-Governmental Entities | Lake associations | P, M, R, C | na | na | P, M, R, C | na | Portions of public waters |
| NGOs | Landowners | na | na | M | na | M, R, C | Their lands |
| NGOs | Non-profit organizations | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Statewide |
| NGOs | Riparian landowners | M | na | M | M, R, C | M, R, C | Portions of public waters |
| Local Government Entities | Government landowner (inc. counties, cities, townships and municipalities) | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | P, M, R, C, S | Their lands |

While not comprehensive, the following describes some of the fundamental ways in which partner organizations contribute to invasive species prevention and management in Minnesota, as well as a few recent projects of note. Programs and projects outlined in this section will change over time.

## Prevention

### Education and Outreach

Successful prevention of invasive species introduction and spread is only possible through public participation in prevention behaviors (e.g., cleaning boots, inspecting watercraft, not releasing pets or plants). Therefore, public education and outreach is critical. Most organizations involved in invasive species prevention conduct public education and outreach efforts. State agencies and others disseminate information about invasive species to the public through social media, newsletters, news releases, billboards, special events, personal communication and other methods. Major educational campaigns supported by plan partners include Stop Aquatic Hitchhikers!™, PlayCleanGo™, and Habitattitude™. The Minnesota DNR has begun to lead efforts related to community-based social marketing, a research-based method for encouraging adoption of beneficial aquatic invasive species prevention behaviors that has involved literature review, surveys, focus groups, community asset mapping and local pilot projects. Some additional education and outreach efforts are mentioned in the following tables describing pathways and prevention strategies.

*Invasive species partners often host educational booths at events, such as this Minnesota Sea Grant booth at "Take A Kid Fishing Day" on Lake Vermillion in 2013. (Photo: Doug Jensen, Minnesota Sea Grant.)*

STOP AQUATIC HITCHHIKERS!™
Be A Good Steward.
Clean. Drain. Dry.
StopAquaticHitchhikers.org

HABITATTITUDE™
PROTECT OUR ENVIRONMENT
www.habitattitude.net

Play Clean Go
STOP INVASIVE SPECIES IN YOUR TRACKS.
PlayCleanGo.org

## Prevention Strategies for Aquatic Invasive Species Pathways

Table 9 includes pathways for aquatic invasive species and examples of approaches used in Minnesota to interrupt these pathways. Pathway-specific invasive species educational materials are available on the DNR and MDA websites for most of these pathways.

### TABLE 9. PATHWAYS FOR AQUATIC INVASIVE SPECIES AND EXAMPLES OF APPROACHES USED IN MINNESOTA TO INTERRUPT THESE PATHWAYS.

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Boats and equipment:** Movement of aquatic invasive species on boats and equipment via public roads.<br><br>Examples: Zebra and quagga mussels, starry stonewort, Eurasian watermilfoil | A person may not place water-related equipment, including boats, into Minnesota waters if aquatic plants or invasive species are attached and must comply with aquatic invasive species inspection requirements (Minnesota Statutes, sections 84D.10 and 84D.105). Minnesota's watercraft inspection program aims to prevent the spread of invasive species within Minnesota through boater education, watercraft inspections and watercraft decontaminations at public water accesses. Authorized inspectors work at accesses throughout Minnesota and have legal authority to require inspections of any water-related equipment when entering or exiting waters of the state. Inspections are recorded via a mobile application and include information such as the last water body visited and the next planned trip. Authorized inspectors educate boaters at public water accesses during inspections by teaching inspection techniques and informing boaters about invasive species laws. The current DNR policy is to staff inspectors at high-use infested water accesses, with a primary focus on zebra mussels, spiny water flea, starry stonewort, and Eurasian watermilfoil.<br><br>Additional information about Minnesota invasive species laws and penalties are posted using signs at some accesses with additional information provided in the state boating and fishing regulations. When not busy with inspections, DNR inspection staff use rakes to help keep accesses clear of vegetation that has floated into the area. Minnesota DNR delegates its inspection authority to over 60 local government units, which gives them legal authority to run inspection programs. These partnerships allow for a large number of watercraft to be inspected annually (Figure 4), with over 600,000 watercraft inspections during the 2020 season. That same year, there were 820,051 registered boaters in Minnesota. In 2021, 95% of incoming watercraft inspected were found to be following all aquatic invasive species laws.<br><br>Public water access points remain open on infested water bodies and are not the only vector for invasive species spread. In some circumstances accesses may be closed for not more than seven days during the open water season for control or eradication purposes (Minnesota Statutes, section 84D.02, subdivision 3(7)). |
| **Transfer of infested water:** Transport or diversion of water from infested waters.<br><br>Examples: Zebra and quagga mussels, spiny water flea | Transportation or diversion of water from infested waters requires a permit from the DNR (Minnesota Rules, part 6216.0500). The DNR issued 10-13 infested waters permits in 2019 and 2020, respectively. |

*Watercraft inspectors conduct education, inspections and decontaminations at public water accesses. (Photo: DNR.)*

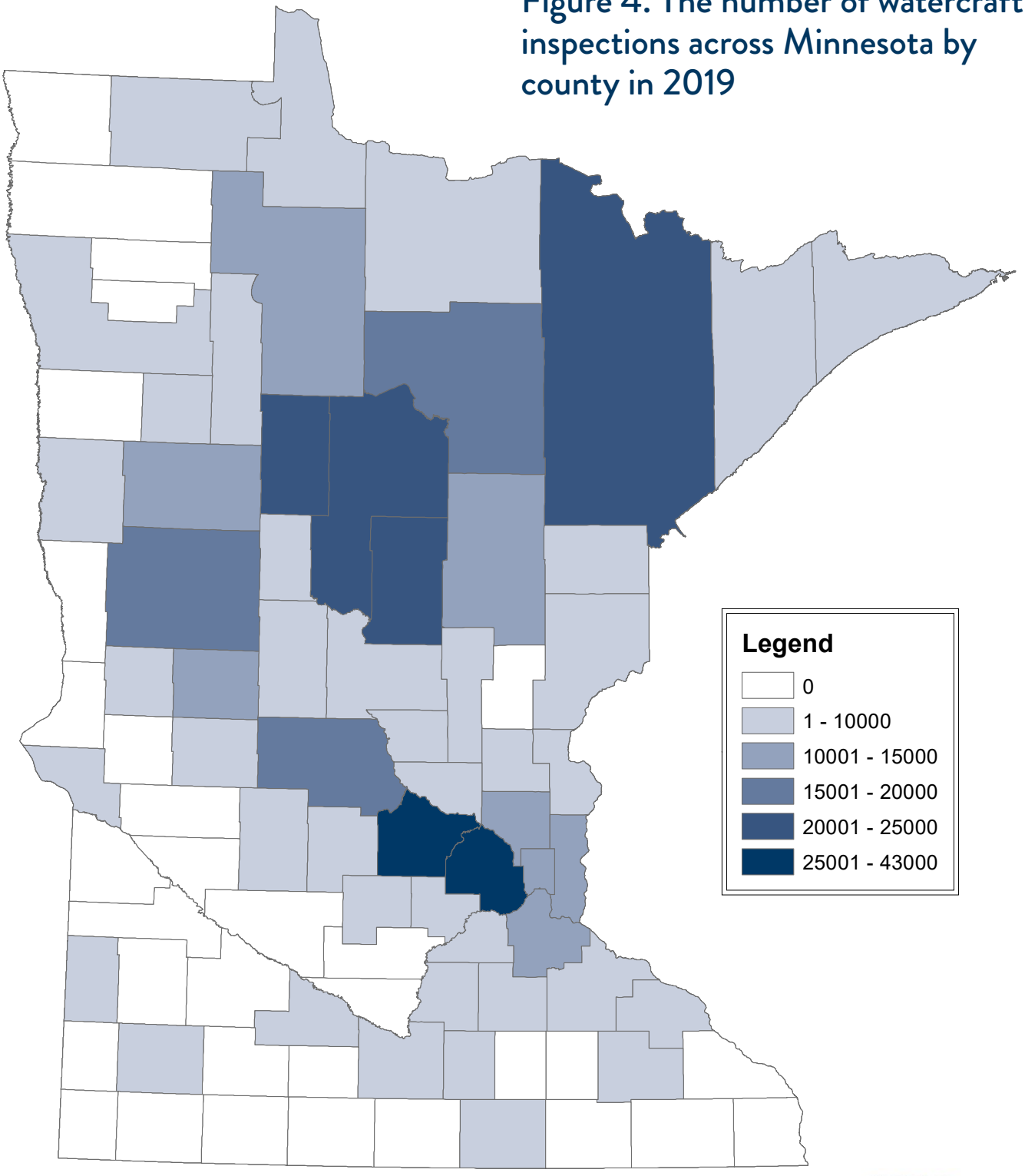
| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Lake service providers:** Movement of equipment by lake service providers (i.e., individuals or businesses that decontaminate, install, move or rent water-related equipment) and commercial, government, tribal, and research equipment such as commercial nets, boats, and waders.<br><br>Examples: Zebra and quagga mussels | On average, there were 1,016 permitted lake service provider businesses and 3,092 certified lake service provider employees in 2019-2020. These individuals receive invasive species prevention training before conducting work involving decontamination, installation removal, or rental of water-related equipment. State agencies, the invasive species research centers and many others have mandatory invasive species prevention standards in place. |
| **Waterfowl hunters, anglers, recreational divers, and seaplanes:** Organisms hitchhiking on waterfowl hunter, angler and recreational diving equipment and seaplanes.<br><br>Examples: Spiny water flea, invasive *Phragmites*, starry stonewort | There were about 526,409 licensed hunters and 1,404,726 licensed anglers in Minnesota from 2018-2019 on average. Invasive species laws are described in Minnesota's fishing regulations. Invasive species prevention is also briefly discussed in the DNR's hunter safety and "learn to hunt" and "learn to fish" programs. There is an opportunity to provide additional invasive species education to recreational divers and seaplane owners.<br><br>  <br>*Waterfowl hunters can help prevent the spread of invasive species by cleaning mud and plant propagules off their gear and following all aquatic invasive species laws. (Photo: DNR.)* |
| **Connected waters:** Downstream or upstream spread from infested waters to previously uninfested waters<br><br>Examples: Zebra and quagga mussels, invasive carp, sea lamprey | Multiple approaches are being used to prevent invasive carp from moving upstream in the Upper Mississippi River basin. These include contracted commercial fishing, collaboration with partners to remove invasive carp from Pool 8 using the Modified Unified Method and tracking invasive carp to detect and respond to upstream movement. Also see Connecting Water Bodies. |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Ballast water:** The introduction of new aquatic invasive species via ballast water.<br><br>Examples: Zebra and quagga mussels, didymo | The MPCA permits vessel owners that are 1) required to obtain the EPA's vessel general permit and 2) wish to transit the Minnesota waters of Lake Superior. Beyond following the requirements in Minnesota Statutes, section 115 and Minnesota's 401 certification of the vessel general permit, permit conditions require vessel owners to either install ballast water treatment systems by a certain date or describe why installation of such systems is not feasible. On average, approximately 800 vessel arrivals occur in the Port of Duluth-Superior each season. Of these arrivals, more than 700 are lakers (vessels traveling only within the Great Lakes) and fewer than 100 are salties (oceangoing vessels). According to a 2018 Martin Associates study, the Port of Duluth-Superior supports more than 7,880 jobs and generates $1.4 billion in business revenues, plus $240 million in federal and state tax revenue. These economic figures do not include jobs and revenue associated with vessels visiting ports in Two Harbors and Silver Bay, which saw annual averages of 302 and 115 vessels from 2018-2020. While MPCA's permitting program will end with the recently promulgated national Vessel Incidental Discharge Act, MPCA has been working closely with the EPA and other Great Lakes states to address invasive species concerns. |
| **Importation of products:** Intentional or unintentional (e.g., via packaging material or along with other organisms) movement of invasive species into the U.S.<br><br>Examples: Zebra mussels, Chinese mitten crab *(Eriocheir sinensis)* | USFWS has federal regulatory authority over amphibians, fish, crustaceans, mollusks, and their offspring or gametes that are injurious to the interests of human beings, agriculture, horticulture, forestry, wildlife or wildlife resources of the United States. Species that are federally listed as injurious wildlife cannot be imported into the United States without a permit and are subject to inspection by the USFWS Office of Law Enforcement. Office of Law Enforcement personnel are stationed at international ports of entry, inspecting commercial shipments of wildlife and wildlife parts as well as monitoring international passenger traffic in cooperation with U.S. CBP. |
| **Live bait:** Preventing potential introductions through the trade and use of live bait.<br><br>Examples: Baitfish viruses, faucet snail (if inadvertently transported with harvested minnows or leeches from infested waters), rusty crayfish (if harvested and transported to an uninfested water body) | Regulations prohibit importation of live minnows or leeches, harvest of bait from infested waters and disposal of minnows, earthworms, leeches and other species into the environment. Commercial minnow dealers and bait retailers must be licensed and minnow dealers are required to complete aquatic invasive species prevention training. There were 311 and 963 licensed minnow dealers and minnow retailers in 2021, respectively. In 2013, Minnesota baitfish sales were worth $2.4 million (Gunderson 2019). Disease testing or preservation of some minnows is required before they can be used in Minnesota waters. Several counties and cities conducted local-scale projects in 2021 to encourage proper bait disposal. MAISRC is conducting research on the risks of fish pathogen introduction through live bait.<br><br>  <br>*Always dump bait container water, replacing it with tap or bottled water prior to traveling. (Photo: DNR.)* |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Aquaria:** Aquarium releases and escapes.<br><br>Examples: Goldfish, red swamp crayfish, hydrilla<br><br>  <br>*Trading with other hobbyists provides an alternative to dumping aquaria. (Image: Minnesota Sea Grant.)* | There are approximately 59 aquarium sellers in the state and an unknown number of sellers online. The Pet Industry Joint Advisory Council (PIJAC) estimated the value of pet sales overall at $38.5 million (PIJAC and PLC 2015). Beyond public reports of prohibited species, there is little regulation of aquarium sellers with respect to invasive species. In the mid-2010s, Hennepin and Dakota counties hired a contractor to investigate the availability of invasive species in aquarium and water garden retail stores. In 2021, Hennepin County supported revisits and education to those retailers. Around the same time, the DNR supported a study assessing the availability of invasive species at pet stores and seafood markets throughout the state and conducted outreach to stores via mail, phone, and store visits (through a federal state-interstate ANS management plan implementation grant and GLRI funding; Dindorf et al. 2021). |
| **Water gardening:** Releases and escapes of aquatic species used in water gardening.<br><br>Examples: Water chestnut, European frogbit, common carp | The number of businesses selling water garden plants in Minnesota and online is unknown. The MDA inspects and certifies nurseries in the state. Nursery stock (which includes cold hardy, perennial aquatic plants) is annually inspected for noxious weeds, insect pests, and plant diseases. The number of businesses selling aquatic plants is not tracked.<br><br>  <br>*Water gardeners can help prevent the introduction and spread of invasive species by ensuring pond plants and animals cannot reach natural waters. (Photo: Tina Fitzgerald, DNR.)* |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Live food:** Release of aquatic invasive species purchased from food markets.<br><br>Examples: Red swamp crayfish, northern snakehead, invasive carp | Beyond public reports of prohibited species, there is little regulation of live food sellers with respect to invasive species. While it is not known how many markets and restaurants sell or use live seafood, nine markets are known to do so. In 2021, the DNR supported a study assessing the availability of invasive species at pet stores and seafood markets throughout the state (through a federal state-interstate ANS management plan implementation grant; Dindorf et al. 2021). From 2019-2021, concerted efforts were made at the state and regional levels to educate distributors regarding importation of invasive crayfish.<br><br>  <br>*The Louisiana crawfish or red swamp crayfish commonly used in crawfish boils is a prohibited invasive species in Minnesota. (Photo: Tina Fitzgerald, DNR.)* |
| **Classroom and laboratory organisms:** Release of classroom and laboratory study organisms.<br><br>Examples: Red swamp crayfish, Brazilian elodea | Further invasive species outreach to Minnesota's schools is needed. The DNR has partnered with a biological supplier and the Minnesota Science Teachers Association to distribute information to schools about invasive crayfish and other invasive species. The Minnesota and Oregon Sea Grant programs collaborated on a study of the use of live organisms in classrooms and educators' perspectives on disposal options. Sea Grant also developed the Adopt a Habitattitude™ curriculum to educate students about invasive species and problems associated with release of organisms. |

## Figure 4. The number of watercraft inspections across Minnesota by county in 2019




Source: 2019 Watercraft Inspection Survey Application.
NOTE: Paper surveys, or digital surveys without GPS information are not included on this map.

DEPARTMENT OF NATURAL RESOURCES

*(Map created by Marielle Mateo, 2019.)*

### *Connecting Water Bodies*

Minnesota is the headwaters of the Great Lakes, the origin of the Mississippi River, and the headwaters of Hudson Bay. There are natural and human-made connections among Minnesota water bodies to each other and to outside waters that provide invasion routes into and out of the state. Precipitation patterns can create periodic connections between waters as well. For example, the Cedar River is a potential route for the spread of invasive carp, at least during certain hydrologic conditions. Intensive multi-state programs are in place to prevent invasive species movement upstream or inland through these connecting waters.

Ballast water management efforts and the sea lamprey control program are examples of management efforts that reduce impacts posed by invasive species in Lake Superior. The Minnesota DNR has an invasive fish monitoring and capture program on the Mississippi River as well as river and stream monitoring crews statewide. State and local watercraft inspection programs provide further defenses to prevent species movement elsewhere in the state. More information on specific initiatives is provided in subsection 3c.

*Lake Superior is vital to Minnesota's economy and connects Minnesota to the Great Lakes, which can also provide passage for invasive species. (Photo: Laura Van Riper, DNR.)*

*The Minnesota DNR has an invasive fish monitoring and capture program on the Mississippi River. (Photo: Laura Van Riper, DNR.)*

## Prevention Strategies for Terrestrial Invasive Species Pathways

Table 10 focuses on some of the most critical pathways that can contribute to the introduction and spread of terrestrial invasive species both into and within Minnesota, as well as prevention strategies.

### TABLE 10. PATHWAYS FOR TERRESTRIAL INVASIVE SPECIES AND EXAMPLES OF APPROACHES USED IN MINNESOTA TO INTERRUPT THESE PATHWAYS.

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Firewood:** When untreated firewood is moved, insects and pathogens can also be spread.<br><br>Examples: Emerald ash borer, Asian longhorn beetle, spongy moth, oak wilt and Dutch elm disease<br><br>  <br>*Movement of firewood can spread invasive species. (Photo: DNR.)* | The MDA has regulatory authority under Minnesota Statutes, chapter 18G to restrict the movement of products which may transport a plant pest. The MDA currently has quarantines passed under the authority of 18G which restrict the movement of wood into and within the state related to emerald ash borer, spongy moth and mountain pine beetle. Minnesota Statutes, chapter 18G also authorizes the MDA to certify products that meet standards set by the department. Under this authority the MDA runs a firewood certification program to certify business that heat treat firewood to prevent the spread of invasive animals. The MDA participates in the national "Slow the Spread" program for spongy moth to help reduce its rate of spread into Minnesota.<br><br>The DNR has rules on what types of wood may be used for firewood in state parks to reduce spread of these species.<br><br>The "Don't move firewood" public outreach campaign encourages people to burn firewood where they buy it or purchase firewood certified by MDA which has been treated to kill insects and pathogens. Multiple organizations such as MDA, DNR, USFS and others promote this message. Not moving firewood is also promoted in the PlayCleanGo™ campaign. |
| **Importation of products:** Packing material used to move products through trade pose a risk for the introduction of invasive insects and animals. Solid wood packing material, wooden spools, and pallets are often constructed of poor-quality wood or recently cut trees that may have been previously colonized by insects and may include bark. Invasive animals may be present in nursery stock, packaging materials, or as contaminants in other purchases such as composting worms or floral arrangements.<br><br>Examples: Red bay ambrosia beetle (*Xyleborus glabratus*), Sirex wood wasp, emerald ash borer, jumping worms (*Amynthas* and *Metaphire* spp.) and nonnative frogs | USDA APHIS has rules around international and state to state importation of organisms. Under the authority of the Plant Protection and Honeybee Acts, a Plant Protection and Quarantine (PPQ) 526 permit is required for the importation, interstate movement and environmental release of plant pests (plant feeding insects, mites, snails, slugs, and plant pathogenic bacteria, viruses, fungi, etc.), biological control organisms of plant pests and weeds, bees, parasitic plants, and Federally listed noxious weeds. Packing materials made of wood, including pallets, dunnage, bracing, etc., are regulated under ISPM 15, an international standard recognized across the globe. This standard requires all solid wood packing material (SWPM) be treated by a certified entity and stamped to show country, entity, and treatment. Materials found to be imported with non-compliant SWPM are rejected and returned to their country of origin.<br><br>USFWS has federal regulatory authority over mammals, birds, amphibians, reptiles, and their offspring or gametes that are injurious to the interests of human beings, agriculture, horticulture, forestry, wildlife or wildlife resources of the United States. Species that are federally listed as injurious wildlife cannot be imported into the United States without a permit and are subject to inspection by the USFWS Office of Law Enforcement. Office of Law Enforcement personnel are stationed at international ports of entry, inspecting commercial shipments of wildlife and wildlife parts as well as monitoring international passenger traffic in cooperation with U.S. CBP.<br><br>Outreach from federal and state agencies encourages people to report products that contain organisms that are not supposed to be present. |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Nursery and floriculture industry:** Contaminated plant nursery stock (trees, landscape plants, etc.) and cut flowers can act as vehicles to transport many invasive insects and pathogens. Pathogens move on infected plants, plant parts used for propagation, soil and artificial growing media in the nursery trade. Infected plants may not have symptoms of disease when shipped.<br><br>Examples: Thrips (*Thrips* species), hemlock woolly adelgid (*Adelges tsugae*), spongy moth, sudden oak death (*Phytophthora ramorum*) and the plant pathogen *Ralstonia solanacearum* Race 3 Biovar 2 | Under the authority of Minnesota Statutes, chapter 18H, the MDA regulates the production and sale of nursery stock. All nursery stock produced or sold in Minnesota must be certified as free of damaging insects, pathogens or weeds. State to state movement of nursery stock is coordinated through the National Plant Board which is comprised of representatives from all 50 states. Each state must manage a program for certification of nursery stock. Similarly, nursery stock produced in other countries must be inspected to satisfy USDA import requirements. |
| **Natural dispersal:** Some organisms arrived in the U.S. or Minnesota through purposeful introduction by humans or inadvertently through other pathways on this list, and once they arrived, they spread further through wind, water currents, other organisms, and their own mobility.<br><br>Examples: Spotted wing drosophila, mute swans, garlic mustard | The MDA's Noxious Weed Law requires efforts to be made to prevent the spread of certain invasive plants by preventing maturation of seeds and reproductive parts. If the seeds are not allowed to mature, then they cannot be spread further by birds, wind, water, etc.<br><br>Federal programs on species such as Eurasian swine have worked to reduce their populations so that they cannot spread on their own to new places. |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Movement on vehicles and equipment:** Vehicles, construction equipment, landscaping tools, and items stored outside can transport insects, plants, and animals. Invasive insects and snails can lay their eggs on many common household items such as outdoor furniture, grills, toys, and house plants. Adult insects can hitchhike through an open vehicle window, truck trailer, all-terrain vehicles or recreational vehicles. Animals, animal egg cases, seeds, or viable plant fragments can be present in mud or soil on vehicles and equipment.<br><br>Examples: Brown marmorated stink bug, spotted lanternfly (*Lycorma delicatula*), giant African snail (*Achatina fulica*), earthworms, nonnative knotweeds (*Polygonum* spp.), wild parsnip and spotted knapweed | MDA provides significant outreach prevent the spread of noxious weeds and invasive plants. Pathways of spread are also examined for high priority species through the Noxious Weed and Seed Programs where enforcement and regulatory penalties are assessed when violations occur. The Noxious and Invasive Weed Program encourages cleaning of vehicles and equipment operating in areas with known noxious weed and invasive plant populations.<br><br>Similarly, under Minnesota Statutes, chapter 18G, the MDA implements regulations regarding the movement of spongy moth egg cases on materials. MDA has quarantined counties (Lake and Cook as of 2022) which requires that people inspect outdoor materials and vehicles before moving them from quarantined areas.<br><br>The DNR's internal policy, Operational Order 113, directs DNR staff to prevent the spread of invasive species, including through equipment. The DNR provides equipment cleaning guidance to its staff, contractors, and permittees. In addition, guidance is shared on the public webpage and other agencies, local governments, and others are encouraged to make sure their staff and contractors clean equipment to prevent the spread of invasive species.<br><br>The outreach campaign PlayCleanGo™ focuses on the importance of recreationists cleaning their gear. The campaign has international presence. Many organizations in Minnesota are PlayCleanGo™ partners and spread this message through boot brush kiosks, signage, websites, presentations, social media, and other opportunities.<br><br>  <br>*If not properly cleaned, construction equipment can contribute to the spread of invasive species. (Photo: DNR.)* |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Agricultural products:** Fruits, vegetables, hay and forage, and seeds can all spread invasive insects and plants farther than natural dispersal. Hay and forage for livestock and horses can contain invasive plant seeds. Infected agricultural products can transport pathogens especially if products are disposed of prior to processing or are used improperly. Purchased seeds may be mislabeled or contaminated, such that invasive plants may be unintentionally planted. Cultivated nursery stock can also contain seeds of invasive plants.<br><br>Examples: Khapra beetle (*Trogoderma granarium*), fire ant (*Solenopsis invicta*), basil downy mildew (*Peronospora belbahrii*), the garlic pathogen *Ditylenchus dipsaci*, Palmer amaranth | In addition to providing outreach to agricultural producers, consumers, processors and manufacturers regarding the many pathways that invasive species can be transported into and within the state, MDA regulates the sale and transport of harmful plant pests, invasive species, noxious weeds, seeds and screenings through Minnesota Statutes, sections 18.75 – 18.91 (Noxious Weed Law), chapter 18G (Plant Protection and Export Certification), chapter 18H (Nursery Law), chapter 18J (Inspection and Enforcement), sections 21.71 – 21.78 (Screenings Act) and sections 21.80 – 21.92 (Seed Law). MDA also encourages the use of certified hay and forage through Minnesota Crop Improvement Association. |
| **Mulch, compost, wood chips, and soil:** These products are moved for landscaping and gardening and can carry invasive insects, earthworms, pathogens, and seeds. Earthworms, earthworm egg cases, and some invasive plant seeds can remain viable if composting material is not properly treated. When people come to a central compost site and collect compost and bring it home, they may spread invasive species throughout the area.<br><br>Examples: Swede midge (*Contarinia nasturtii*), emerald ash borer, jumping worms, cyst nematodes, soybean sudden death syndrome (*Fusarium virguliforme*), and garlic mustard | Under the emerald ash borer quarantine, the MDA has requirements for grinding ash trees to an appropriate size to kill emerald ash borer before leaving quarantined areas. For organisms that are not regulated, like Swede midge, the MDA may partner with Extension or agency partners to provide guidance to prevent spread.<br><br>DNR and MDA have worked to encourage yard waste sites to follow the process for further reducing pathogens to ensure compost is hot enough for a long enough period to kill worms and weed seeds. Yard waste sites are not legally required to follow this process while commercial compost facilities are required to follow it.<br><br>Multiple organizations are reaching out to vendors to share the best practices to prevent the spread of jumping worms and other invasive species in their products.<br><br>Multiple organizations do outreach to homeowners and gardeners about invasive species prevention and this pathway. |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Holiday greenery and crafts:** Decorative agricultural products including Christmas trees, wreaths, boughs, cut vines, shrubs, and plants with colorful fruits and seeds can carry invasive insects and pathogens or include invasive plants. When hung outside or disposed of improperly, birds can spread the berries into natural areas. Infected plant material used in holiday décor, such as holiday wreaths and straw or corn leaf crafts, can harbor plant pathogens.<br><br>Examples: Elongate hemlock scale (*Fiorinia externa*), spongy moth, oriental bittersweet, boxwood blight (*Cylindrocladium buxicola*) | MDA regulates the sale of harmful plant pests, invasive species, noxious weeds, seeds and screenings through Minnesota Statutes, sections 18.75 – 18.91 (Noxious Weed Law), chapter 18G (Plant Protection and Export Certification), chapter 18H (Nursery Law), chapter 18J (Inspection and Enforcement), sections 21.71 – 21.78 (Screenings Act) and sections 21.80 – 21.92 (Seed Law). The agency also provides education and outreach statewide to the nursery and floriculture industry to prevent the use of invasive plants. MDA offers best management practices and guidance on the disposal of holiday greenery.<br><br>USDA APHIS also regulates, educates and enters into compliance agreements with producers in this pathway to prevent spongy moth spread.<br><br>Organizations do timely outreach messages around the holidays; for example, the MISAC invasive species calendar December topic has focused on this pathway. |
| **Intentional introductions and escapes:** Sources of introductions and escapes can include the pet trade, pets, zoos, pet food source, or as fauna "improvement." Intentional introductions occur when animals are purposefully released to a free-living state. Animals may have been introduced for enjoyment, food, hunting, pets, or other reasons. Animals may also be intentionally introduced to a confined environment, but then escape and spread.<br><br>Examples: European starling, hogs (*Sus scrofa* and subspecies), mute swans, red-eared slider turtles *(Trachemys scripta elegans)* | The DNR regulates some mammal, bird, and reptile species as prohibited invasive species or regulated invasive species to reduce their chances of introduction to a free living state in Minnesota.<br><br>APHIS monitors online retailers to ensure pests such as the Giant African Land Snail are not being traded into or throughout the US. When detected, they use enforcement tools provided by the Plant Protection Act to mitigate impacts.<br><br>Organizations use outreach campaigns such as Habitattitude promote responsible pet ownership and alternatives to releasing pets into the wild when the owner no longer wishes to care for them. |
| **Bait release:** When unwanted live bait is released or the bait's packing material is discarded, invasive species may inadvertently be introduced into an area. Earthworms purchased for fishing bait, such as invasive European nightcrawlers (*Lumbricus terrestris*) may even be contaminated with other worm species.<br><br>Examples: jumping worms, nightcrawlers | Organizations have consistent messaging regarding throwing unused bait in the trash. Several counties and cities conducted local-scale projects in 2021 to encourage proper bait disposal. |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Movement on people:** Hikers and other recreationists can transport seeds and other propagating parts of plants that stick to boots, clothing, gear and pets. Small seeds are easily spread in mud stuck in boot treads. Seeds with burs or hooks can attach to clothing and pets.<br><br>Examples: garlic mustard (*Alliaria petiolata*), common burdock (*Arctium minus*), European stickseed (*Lappula squarrosa*) | The DNR's internal Operational Order 113 directs DNR staff to prevent the spread of invasive species, including by making sure they are not spread on staff boots.<br><br>The DNR launched a branded outreach campaign PlayCleanGo™: Stop Invasive Species in Your Tracks" in 2012 to address the link between human behaviors and the accidental spread of terrestrial invasive species. Focusing initially on trail users but expanding to bikers, cavers, and others, PlayCleanGo™ encourages responsible recreation through cleaning footwear and gear. Some of the concepts of PlayCleanGo™ were modeled off the successful strategies of the Stop Aquatic Hitchhikers!™ campaign. PlayCleanGo™ provides turnkey outreach materials to allow smaller organizations to expand their reach and influence across property lines. The flexible branding also saves organizations time and money by allowing them to customize the messaging to apply to their specific audiences. The PlayCleanGo™ campaign has spread far beyond Minnesota's borders – to other states as well as Canada and Mexico. In 2019, the North American Invasive Species Management Association (NAISMA) took over management of the now international campaign. Boot brush stations and educational signage with the PlayCleanGo™ message can be found at trailheads across ownerships in Minnesota and many different partners share PlayCleanGo™ messaging on social media and in outreach publications.<br><br>  <br>*A boot brush can be used to scrape mud and potentially invasive plant propagules from boot treads prior to moving locations. (Photo: DNR.)* |
| **Intentional planting:** Ornamental plants intentionally planted in gardens can escape into natural areas and become invasive. Seeds of invasive plants can be purchased via the internet or through other growers and planted intentionally. Invasive plants may also be intentionally planted for biofuels.<br><br>Example: winged burning bush (*Euonymus alatus*) | The MDA has the Noxious Weed Advisory Committee which reviews species through a risk assessment process and may recommend regulation of some species. The MDA noxious weed lists species prohibited from sale.<br><br>The Minnesota Seed Law (Minnesota Statutes, sections 21.80-21.92) provides a process for listing restricted and prohibited noxious weed seeds through the Seed Program Advisory Group to limit the sale of seed that is contaminated with invasive, harmful weeds. Prohibited noxious weed seeds are not legal for sale in the state.<br><br>Organizations such as the Midwest Invasive Plant Network have created apps and brochures on non-invasive ornamental alternative plants. The DNR lists non-invasive alternative plants on the webpages for invasive terrestrial plants. |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Gravel and soil movement:** These products can contain seeds of invasive plants, which are spread when gravel and soil is transported for construction and other purposes. Places where gravel and soil are stored (like gravel pits and piles) are prime habitats for invasive plants. When these materials are transported, the invasive seeds can be introduced to new areas.<br><br>Examples: spotted knapweed and common tansy (*Tanacetum vulgare*) | USDA APHIS regulates all international movement of soil and some domestic movement depending on the presence of actionable pests, such as pale cyst nematode or *Phytophthora ramorum* in the area exporting the soil.<br><br>The DNR regularly treats state gravel pits to make them less likely to spread invasive plants. DNR projects also use weed free gravel when possible.<br><br>Becker county has a weed free gravel program where the county agricultural inspector works with gravel pit companies and certifies pits that meet specific criteria.<br><br>  <br>*Movement of gravel and soil can spread invasive plant propagules. (Photo: DNR.)* |
| **Mowing and snow plowing:** These activities can spread invasive plants along roadsides and rights-of-way. Mowing along roadsides and rights-of-way, can spread invasive species along the mowed corridor if mowing occurs while invasive plants are in seed. Snow plowing can spread invasive plants if seed heads are moved along with snow along roadsides.<br><br>Examples: wild parsnip and Queen Anne's lace (*Daucus carota*) | The Minnesota Department of Transportation (MnDOT) Office of Environmental Stewardship consults on future transportation projects to protect natural resources, areas of high cultural and resource value, and prevent further spread of noxious weeds along Minnesota's roadsides. They created a guide to Minnesota's noxious weeds which has calendars stating when mowing should be avoided to prevent the spread of seeds.<br><br>  <br>*Japanese hops, present in this southeast Minnesota ditch, is an example of an invasive species that could be spread through roadside mowing. (Photo: Dave Hanson, MnDOT.)* |

| Pathway | Pathway Information and Prevention Efforts |
|---|---|
| **Seed screenings:** Seed screenings are the by-products produced from cleaning seed to prepare it for sale to farmers for planting. Screenings can be sold as animal feed. Screenings have been found to include weed seed and can be a source of seed spread.<br><br>Example: Palmer amaranth | MDA is working to implement inspection and regulation of the sale and movement of screenings through the Screenings Law (Minnesota Statutes, sections 21.71-21.75). This statute is outdated however, and the Department is working with partners to improve it. The Noxious and Invasive Weed, Seed and Feed Units work together to prevent contaminated seeds from being spread in Minnesota. |
| **Infested seeds:** Some plant pathogens can be carried on or within seeds produced by an infected plant. Infected seeds often have no symptoms of disease.<br><br>Examples: tomato brown rugose fruit virus and bacterial canker of tomato (*Clavibacter michiganensis* subsp. *michiganensis*) | The MDA conducts annual disease surveys across the state to look for diseases. Some of these diseases are carried on or within infected seeds. |

## Early Detection, Response and Containment

### Strategies for Detection

There are many entities involved in invasive species surveillance, from state agencies to volunteers. The DNR has numerous annual monitoring efforts in lakes, rivers and wetlands, including coordinated monitoring specifically for aquatic invasive species. A more complete list of the DNR's aquatic monitoring is provided in the Minnesota Early Detection and Response Plan for Aquatic Invasive Species. The University of Minnesota Extension's AIS Detectors Program trains interested volunteers in aquatic invasive species identification, detection, reporting and beyond. Lake association members are also important partners for education and detection. The MDA has numerous annual monitoring efforts for terrestrial plant pests on urban, forest and agricultural lands. The MDA, DNR and partners conduct trainings in species identification and publicize reporting mechanisms, such as the Early Detection and Distribution Mapping System (EDDMapS) and app and the MDA's report a pest website. There are extensive networks of partners including other state agencies (such as MnDOT and Minnesota Board of Water and Soil Resources (BWSR)), county agricultural inspectors, local governments, nursery inspectors, cooperative weed management areas (CWMAs), master gardeners, master naturalists, volunteers and others.

### Invasive Species Reporting and Mapping

It is valuable to have consistent ways to report invasive species and share invasive species location and management information. There are many benefits to sharing invasive species information among agencies and organizations, including:

- Having a central source of information to make information easy to find and avoid lost information if someone retires or changes positions
- Access to data helps managers plan land and water management activities
- When new species are found, the information can be quickly shared allowing for early detection and response activities
- Statewide policy makers can use statewide data to inform decisions and policy recommendations
- Location data provides information on cold hardiness of various species in Minnesota
- The spread of species over time can be documented and the information used to inform prevention activities

In recognition of the importance of sharing information, many Minnesota agencies and organizations use databases such as EDDMapS and the U.S. Geological Survey Nonindigenous Aquatic Species database (USGS NAS) for compiling and sharing invasive species distribution information.

Minnesota state agencies encourage the use of EDDMapS for making reports. The Minnesota Departments of Agriculture, Natural Resources, and Transportation and other organizations have staff who receive notices when reports are made into EDDMapS and verify reports for accuracy. In addition to reports made directly to EDDMapS, EDDMapS also pulls in information from a number of other databases such as the Midwest Invasive Species Information Network, USDA PLANTS, USGS NAS, NOAA GLANSIS and iNaturalist. The program Invasive Species Management Tracking System (ISMTrack) was developed for tracking invasive species management. ISMTrack is integrated with EDDMapS. ISMTrack can help evaluate effectiveness of management over time for specific invasive species populations. While sharing data through EDDMapS is encouraged, organizations may use a variety of methods for managing their invasive species occurrence data. Reports of invasive species can always be made directly to agencies if the reporter does not want to go through EDDMapS. The DNR is also committed to sharing aquatic invasive species reports with the USGS NAS database. Organizations, local or tribal governments may keep their occurrence information in their own GIS database or other types of databases. They may choose not to share those data with EDDMapS but use other methods to share data with state agencies.

The state plan supports open communication between partners and collaboration to continue to find ways to share invasive species information that is useful for planning prevention, management, outreach and research. By reporting, verifying, mapping and sharing invasive population location information, Minnesota can develop more robust invasive species plans and actions.

## Management of Invasive Species

### Aquatic Invasive Species Management

The DNR collaborates with national, state, and local organizations to manage aquatic invasive species to mitigate the economic, social and environmental harm caused by those species and to help prevent their spread to new areas. Work has been done on zebra mussels, Eurasian watermilfoil, curly-leaf pondweed, flowering rush, starry stonewort, and purple loosestrife. Collaboration has included support for research into the efficacy of treatment methods and field tests of new control methods, financial assistance with control efforts, and technical assistance to local cooperators from DNR Invasive Species Specialists.

### Invasive Aquatic Plant Management (IAPM) Permits

The DNR's goal of invasive plant management is to minimize harmful effects caused by invasive plants while also protecting the natural resources and their use in the state. Most management of invasive aquatic plants that involves mechanical removal methods and all management of aquatic plants that involve the application of herbicides to public waters requires a permit from the DNR. Permits may be issued to property owners, lake organizations and local governments. The DNR has an online permitting system called MPARS where applicants can apply for an IAPM permit. Commonly managed aquatic plants are Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), and flowering rush (*Butomus umbellatus*). Invasive species specialists review IAPM permits requests and provide technical assistance to permit applicants, or potential applicants, providing guidance on best management approaches for their situation. In 2020, the DNR issued 344 IAPM permits statewide. Most of the management of invasive aquatic plants is initiated by local organizations (e.g., lake associations, local citizen groups, and local units of government) using this permitting process. When funds are available, the DNR provides grant funding to help offset the costs of this management.

*Eurasian watermilfoil and flowering rush are some commonly managed aquatic invasive plants in Minnesota. (Left photo: MAISRC; Right photo: Peter Dziuk.)*

### Terrestrial Invasive Species Management

State agencies collaborate with national, state, and local organizations to manage terrestrial invasive species to mitigate the economic, social, and environmental harm caused by those species and to help prevent their spread to new areas. Work has been done on leafy spurge, wild parsnip, buckthorn, Japanese hops (*Humulus japonicus*), jumping worms, emerald ash borer, spongy moth and many others. Collaboration has included support for research into the efficacy of treatment methods and field tests of new control methods, financial assistance with control efforts, and technical assistance to local cooperators from agency specialists. BWSR administers a grant program to support CWMAs.

Multiple approaches are used by the MDA to deal with pests. Early detection surveys are conducted and if a pest is of regulatory concern but not widespread, MDA will try to eradicate or contain the population. An example of this is the MDA's spongy moth treatment program where detection surveys are used to locate spongy moth and inform treatment. If the pest is widely established, MDA uses an integrated approach to manage pest populations. The MDA spongy moth program and emerald ash borer programs respond to reports and implement statewide strategies to contain and slow the spread of these insects. The MDA Noxious Weed Program has obtained grants to focus on early detection species on the Prohibited – Eradicate Noxious Weed List and focused management has been done for species including Grecian foxglove, Dalmatian toadflax (*Linaria dalmatica*), and Oriental bittersweet.

The Minnesota Department of Transportation (MnDOT) manages approximately 175,000 acres of roadside vegetation across Minnesota. This vegetation plays an important role in the safety and aesthetics of Minnesota roadsides. MnDOT uses a variety of methods, often in combination, to achieve effective vegetation control including biological control, chemical application, mechanical and cultural manipulation and prescribed fire. Healthy roadside vegetation is necessary for preventing weeds, controlling erosion, protecting water quality and keeping roadways safe.

MnDOT's Office of Environmental Stewardship oversees implementation of integrative roadside vegetation management with help from local district offices and consults on future transportation projects to protect natural resources, areas of high cultural and resource value, and prevent further spread of noxious weeds along Minnesota's roadsides. Goals of MnDOT's noxious weed management program are prevention, control, and containment in an efficient and environmentally responsible manner.

*Grecian foxglove has been found along Highway 95 north of Stillwater. (Photo: Dave Hanson, MnDOT.)*

*Prescribed fire is one of many tools in the toolbox for managing terrestrial invasive plants. (Photo: DNR.)*


*Volunteers can play an important role in managing invasive species, like these volunteers who participated in a garlic mustard pull in Ely. (Photo: Tyler Kaspar, 1854 Treaty Authority.)*

## Leadership and Coordination

Minnesota continues to be a leader in emerging invasive species topics. The invasive species research centers, MAISRC and MITPPC, support cutting-edge research on novel control strategies, public perspectives on invasive species, and many other topics. The DNR hosted a workshop in 2019 to begin discussions about genetic biological control of invasive species, including current research and existing regulatory frameworks. The University of Minnesota Extension Forestry has been collaborating with national partners to address issues associated with the names of some invasive species as related to diversity, equity and inclusion.

Along with MISAC, there are many networks connecting organizations and individuals involved in invasive species prevention and management within and beyond Minnesota. Annual funding since 2014 from the state to county and local government organizations has greatly helped increase their capacity for invasive species efforts. The DNR's Statewide Aquatic Invasive Species Advisory Committee (SAISAC) is composed of individuals from various stakeholder and partner groups to provide recommendations for improving the DNR's invasive species program, other organizations' invasive species activities and promote shared understanding among participating entities. Lake associations, lake improvement districts, coalitions of lake associations, Minnesota Lakes and Rivers Advocates, and cooperative invasive species management areas (CISMAs) also provide significant local leadership, time, and monetary investments toward managing invasive species.

## Recent Efforts Addressing Selected High-Profile Species

This section summarizes substantial prevention, management, and research efforts that are currently underway in Minnesota related to selected high profile, high threat invasive species representing various taxonomic groups. Given the many species listed in subsection 2b, this section is intended to provide an understanding of some of the greatest challenges Minnesota is facing and how they are being addressed. It is not intended to comprehensively describe all current, high profile invasive species management efforts.

### Aquatic Invasive Species

#### *Invasive carp*

Minnesota works with state, regional and national level partners on invasive carp prevention and management. Appendix D lists invasive carp plans the DNR operates under. Multiple approaches are being used to prevent invasive carp from moving upstream in the Upper Mississippi River basin. These include contracted commercial fishing, collaboration with partners to remove invasive carp from Pool 8 using the Modified Unified Method (a concentrated netting and herding technique; Figure 5) and tracking invasive carp to detect and respond to upstream movement. Eighty-three and 69 invasive carps (silver, bighead, hybrid, and grass carp) were harvested from Minnesota waters in 2020 and 2021, respectively, the vast majority from Mississippi River Pool 8.

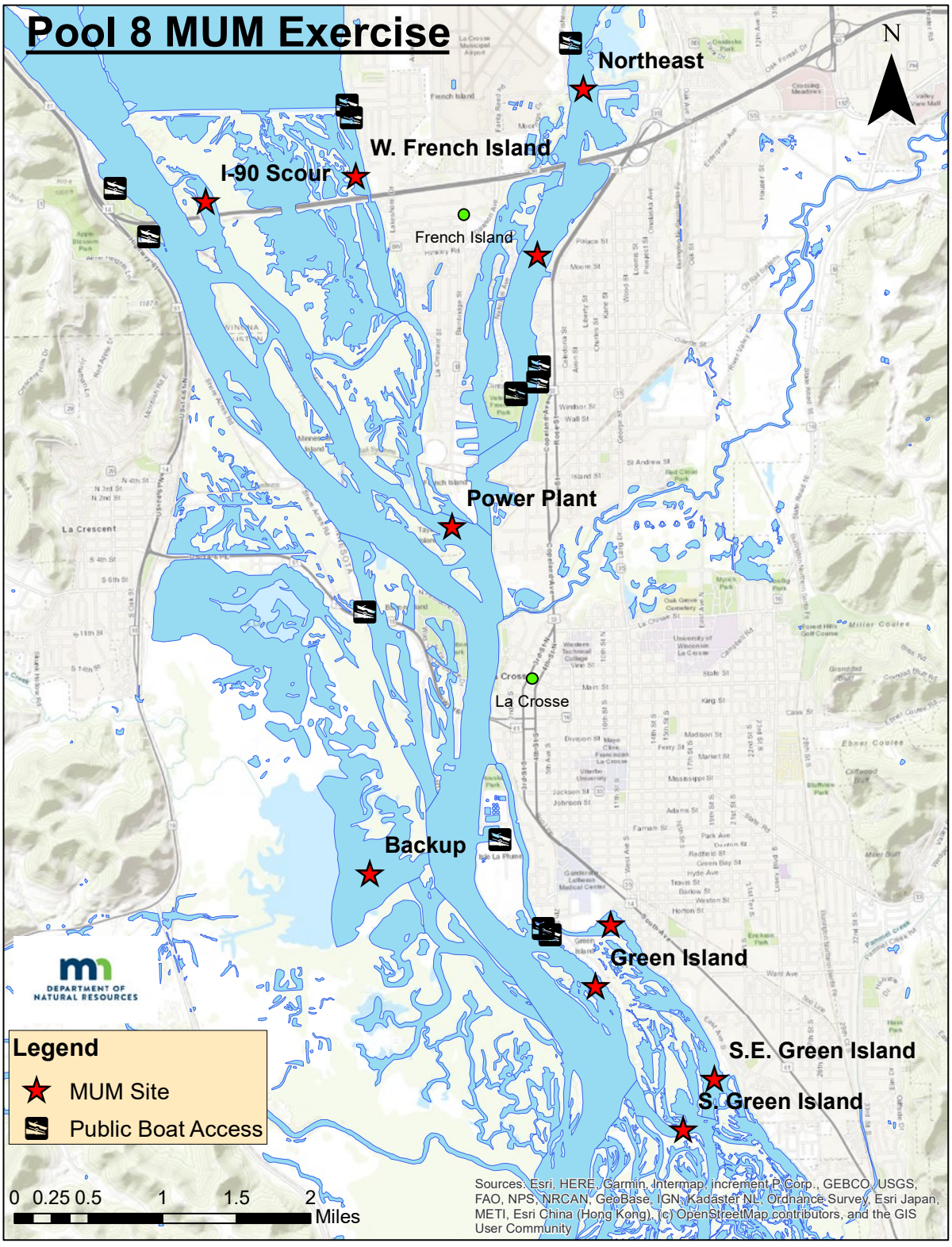
Research at MAISRC includes projects on all species of invasive carps, including common, silver, bighead, grass and black carps. Because the primary pathway of spread for silver and bighead carps is through upstream movement in large river systems, much focus has been placed on physical, acoustic, and air curtain barriers to block their movement through lock and dam infrastructure. Past studies have shown that sound, coupled with a bubble net blocks most, but not all upstream movement of these carp species. Current research efforts are examining whether periodic additions of carbon dioxide to a bubble net could increase the efficacy of a sound and bubble curtain.

Common carp are well-established in Minnesota but have severe impacts, making them a high priority for research. Their life history in Minnesota, habitat use patterns and social dynamics have been studied extensively to develop and refine more effective removal tactics. Resulting from many years of research, managers can now implement a lake or watershed-scale integrated pest management approach to common carp and ongoing studies are working to automate systems, reduce costs and improve efficacy.

*The Modified Unified Method, a concentrated fish netting and herding technique, was employed to capture invasive carp in the Mississippi River in 2020 and 2021. (Photo: DNR.)*

## Figure 5. Sampling sites for the spring 2021 Modified Unified Method exercise

During this exercise, 31 silver carp were removed from the Mississippi River Pool 8.




*(Created by Carli Wagner, 2021.)*

### *Zebra mussels*

Zebra mussels have been studied intensively at MAISRC, with multiple lines of research into genetics, impacts, pathways, prevention, and chemical-based control methods spanning multiple projects over many years. Researchers have established that veligers can survive for multiple days in residual water in recreational boats and in drained ballast tanks from wake boats. Other projects have used genetic relationships between lakes and boater movement data to inform risk, prioritize inspection efforts, and increase the efficacy of decontamination methods. Now that the zebra mussel genome has been mapped, researchers are using those insights to explore gene targets for RNA-interference, which could be a species-specific biopesticides for zebra mussels. Copper-based control of existing populations has been studied since 2016, scaling up projects in scope and complexity each year. Current research teams are exploring the relationship of water chemistry to copper toxicity to further refine and optimize the treatments, while reducing non-target impacts even more.

### *Spiny water flea*

Research into this predatory zooplankton by MAISRC has focused on its impact to aquatic food webs, means of overland spread, and invasion history. A recent study of Minnesota's nine "large walleye lakes" found that first-year walleye in spiny water flea infested lakes were 12% smaller going into their first winter. Multiple other projects have documented large-scale, cascading impacts of spiny water fleas due to their high rates of predation, their relative inedibility to zooplanktivores, and rapid reproductive rate. An emerging research issue appears to be the limited detectability of this species. A paleolimnology study of Minnesota lakes with well-established spiny water flea populations suggested that spiny water fleas have been present for many decades before they were first reported (Branstrator et al. 2017). This research, as well as another Minnesota-based project which found that spiny water fleas are easily entangled on and transported by recreational fishing gear, lend support for a current MAISRC-led outreach project (StopSpiny.org) to educate boaters and anglers about this species and how to prevent further spread.

*Zebra mussels can attach to and kill native mussels, which are some of the most threatened freshwater species worldwide. (Photo: DNR.)*

*Spiny water fleas prey on important food sources for native fishes. (Photo: Jeff Gunderson, Minnesota Sea Grant.)*

***Starry stonewort***

Starry stonewort is a macro alga that looks similar to native aquatic plants and can form dense mats, which can interfere with use of a lake and compete with native plants. It was initially found in Minnesota in 2015 in Lake Koronis in Stearns County. Because starry stonewort has a very limited distribution in state, the DNR has helped fund and implement rapid responses to new discoveries of small starry stonewort populations. In lakes where starry stonewort is widespread, the DNR has collaborated with state and national researchers and local partners to examine the impacts of the species and the best methods to manage the plant while minimizing non-target damage.

The impact to Minnesota lakes, as well as which lakes are at-risk of starry stonewort invasion because of habitat suitability and boater movement networks have been studied and modeled by multiple MAISRC research teams. Both experimental approaches and a recent meta-analysis of treatment outcomes have shown that existing management options for controlling established starry stonewort populations may be effective at reducing biomass and nuisance impacts but do not lead to long-term population reductions, primarily because the reproductive structures (bulbils) are left intact or are further spread due to these methods. However, aggressive hand-removal of small, isolated populations has shown promise for possible eradication of this species. All research findings lend support for the annual MAISRC/Extension-led, statewide, early detection volunteer effort to survey at-risk lakes for starry stonewort called Starry Trek which has to date identified nearly 25% of confirmed populations.

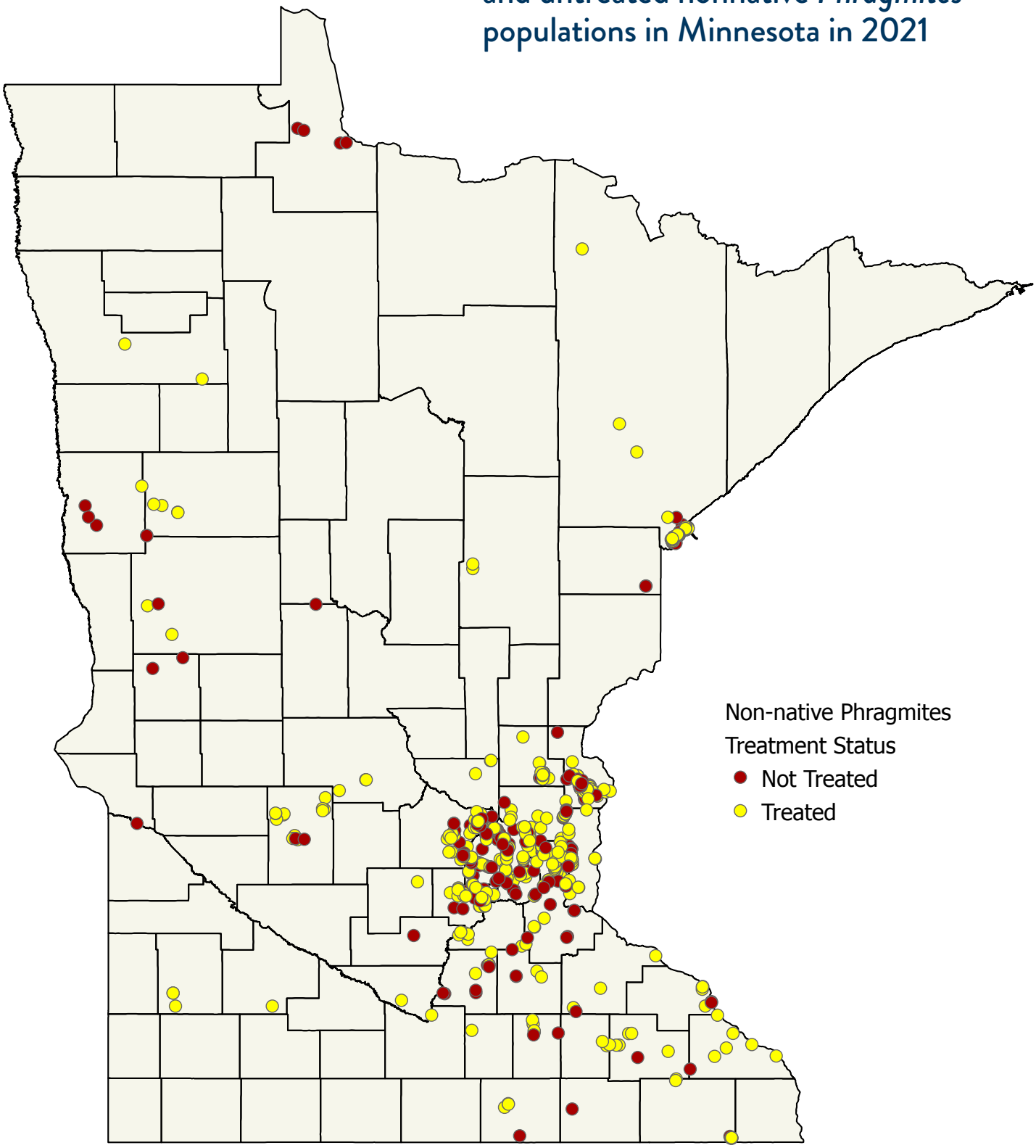
*Starry stonewort can be identified by its distinctive star-shaped bulbils and thin, bright green branchlets. (Left photo: DNR; Right photo: MAISRC.)*

### *Nonnative Phragmites*

In 2020 and 2021, state agencies and the University of Minnesota began coordinating a statewide response to nonnative *Phragmites*. In the years prior, the University of Minnesota/MAISRC conducted fundamental surveillance work. Nonnative *Phragmites* was largely concentrated around the Twin Cities metropolitan area into Chisago County and around the city of Duluth, with only sporadic populations found elsewhere in the state. Recognizing the relatively low abundance and limited distribution of the invasive grass, the DNR used GLRI funding to hire a contractor to conduct control of populations statewide and support coordination by the University of Minnesota. Several counties and local partners in the Twin Cities metropolitan area and Chisago County also leveraged funds to support control (Figure 6). In the Duluth area, the Great Lakes Indian Fish and Wildlife Commission and Community Action Duluth's Stream Corps began leading control efforts around the St. Louis River estuary in 2013. As of 2021, very little nonnative *Phragmites* had been found at small sites in that area for at least two years. With continued pressure and coordination, control efforts aim to reverse the spread of nonnative *Phragmites* and prevent it from transforming lakeshores, wetlands and roadside ditches as in eastern Wisconsin and states further east. Also in 2021, the MDA reclassified nonnative *Phragmites* as a noxious weed on the control list, requiring control on public and private properties. Alternatives to the use of nonnative *Phragmites* for biosolids dewatering at 16 Minnesota wastewater treatment facilities are being researched by the University of Minnesota.

*Nonnative Phragmites is less widespread in Minnesota than in states to the east. (Photo: MAISRC.)*

## Figure 6. Map of verified, treated and untreated nonnative *Phragmites* populations in Minnesota in 2021




*(Created by Julia Bohnen, January 2022.)*

## Terrestrial Invasive Species

### *Jumping worms*

Jumping worm prevention and control efforts span many organizations. In 2015, MISAC wrote a letter to the commissioners of the MDA, DNR and MPCA drawing attention to the negative impacts of jumping worms and lack of clarity around which agency has regulatory authority for earthworms. The agencies determined that the DNR would be the regulatory lead. A multi-organization team, including state agencies, researchers, and the Minnesota Nursery and Landscape Association (MNLA), developed a classification summary for jumping worms, documenting the potential impacts of jumping worms and jumping worm regulations.

The University of Minnesota and the DNR created webpages providing information on the impacts of jumping worms, how to identify and report jumping worms, how to prevent the spread of jumping worms and the lack of known management techniques. The DNR and MPCA also reached out to yard waste sites to encourage them to follow the process for further reducing pathogens in their composting processes to get the compost hot enough to kill jumping worms and their cocoons (egg cases) to prevent further spread. In 2020, MITPPC funded a multi-year research project to study management actions and create best management practices for jumping worms in Minnesota. Researchers are also studying potential management options and enlisting community scientists to learn more about the distribution of jumping worms and how jumping worms are spreading in Minnesota. University of Minnesota Extension and Master Gardeners developed and distributed guidance on how to reduce the spread of jumping worms through informal plant sales. The MNLA developed best management practices on the management of jumping worms for its membership, including a handout for distribution by MDA nursery inspectors. MNLA is also working with the MDA and other state agencies to help facilitate the management of jumping worms reported by MNLA members. Together, these and other MISAC partner organizations are helping to spread the word and improve jumping worm prevention and management guidance.

*Jumping worms can dramatically alter soils, which can kill plants and increase erosion. (Photo: University of Wisconsin – Madison Arboretum.)*

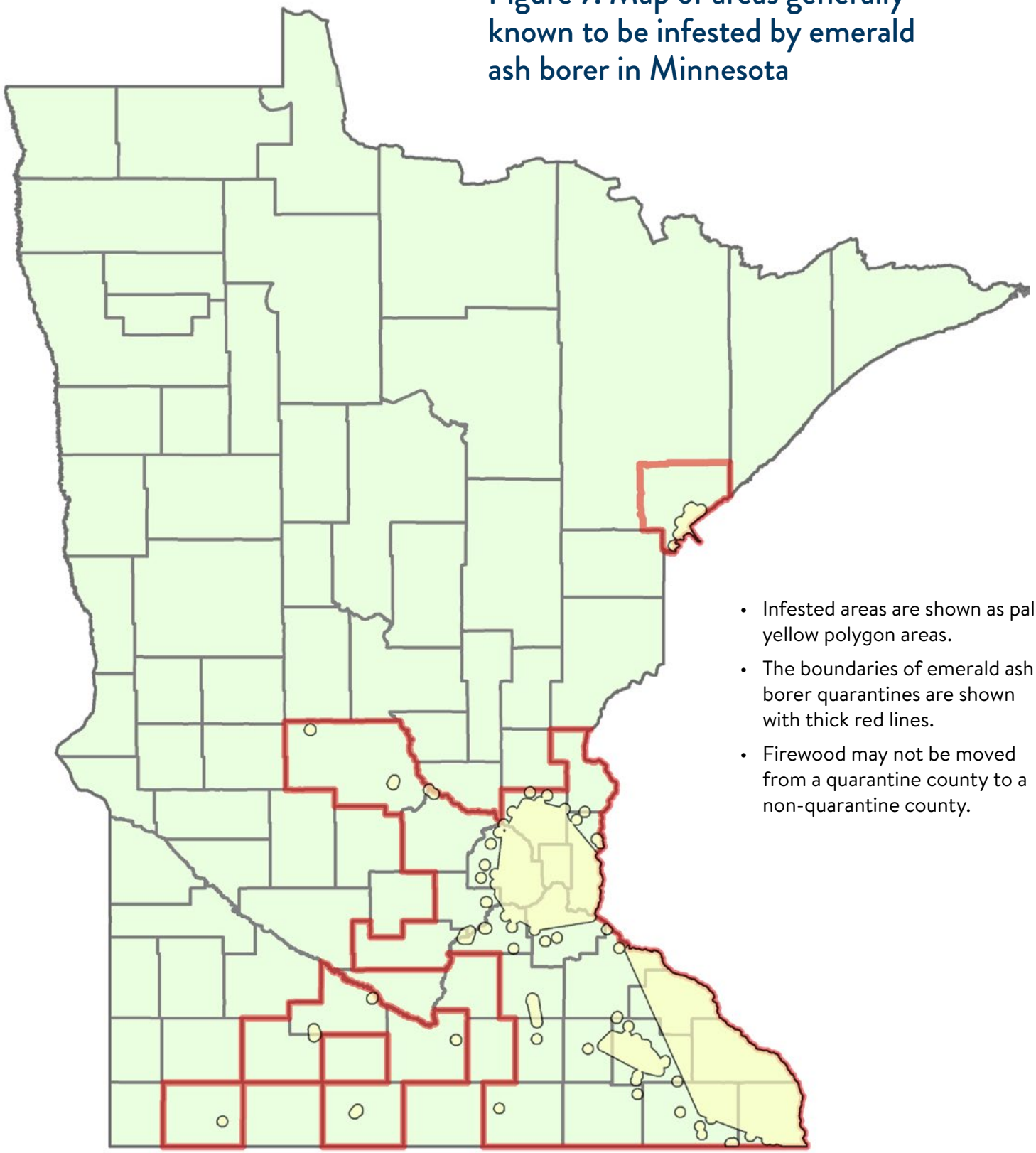
***Emerald ash borer***

Emerald ash borer was first discovered in Minnesota in 2009. As of February 2022, it has been found in 30 Minnesota counties. Emerald ash borer is considered one of the most destructive forest pests to be introduced to North America. In Minnesota, the most substantial impacts to date have been to cities, townships and municipalities, although there is great concern for the vast stands of black ash found in Minnesota's northern forests. The MDA has led efforts to find new areas of infestation. Although multiple survey tactics have been used over the years, outreach and responding to citizen reports has been the most effective and the MDA supports that effort through an online reporting system. The MDA is also responsible for limiting movement of EAB by regulating the movement of ash material and firewood from infested areas (Figure 7). The county-level spread rate of EAB in Minnesota has been about 1/3 of the national average. However, as EAB populations increase the ability of cities and counties to utilize or dispose of wood is becoming a greater concern for the MPCA. In 2021, EAB was deregulated at the federal level but the MDA took steps to maintain regulations in Minnesota given that most communities and forest black ash were not yet affected. The DNR has led efforts to help communities prepare for and respond to EAB through awarding grants for planning and tree inventory, removal and replacement. The MDA assists with community efforts funding by the USFS by providing technical support to communities for detection, monitoring and management. The MDA has also led efforts to introduce parasitic wasps as a biological control for EAB and a contributing management tactic. Research by the University of Minnesota has covered the cold tolerance of EAB and associated biocontrol agents, efficacy of biocontrol as a management tactic, impact of chemical control on both EAB populations and non-target organisms, efficacy of surveillance tactics and potential impact of EAB-associated fungi on ash trees. Key issues for Minnesota going forward are: continuing to slow the spread, finding funds for community management efforts, identifying ways to utilize increasing amounts of ash wood and fostering market opportunities that will lead to greater management opportunities for northern ash forests.

*MITPPC is investigating fungi associated with infestations of Emerald ash borer to determine effects on tree health and potential for control of the invasive insect. (Photo: MITPPC.)*

*Minnesota municipalities are working to remove ash trees affected by emerald ash borer. (Photo: Laura Van Riper, DNR.)*

## Figure 7. Map of areas generally known to be infested by emerald ash borer in Minnesota



- Infested areas are shown as pale yellow polygon areas.
- The boundaries of emerald ash borer quarantines are shown with thick red lines.
- Firewood may not be moved from a quarantine county to a non-quarantine county.

*(Created by Jonathan Osthus, MDA, November 2021.)*

***Palmer amaranth***

Palmer amaranth, a fast-growing, challenging-to-control noxious weed that significantly reduces crop yields, was first found in Minnesota in September 2016 in conservation plantings sown with Palmer amaranth-contaminated seed mixes. The MDA designated Palmer amaranth as a Prohibited Noxious Weed in 2015 and listed it as a Noxious Weed Seed in 2016 by emergency order. A genetic test to identify Palmer amaranth was simultaneously developed by multiple laboratories, providing a tool to limit its spread as a contaminant in seed. Seed companies adopted genetic testing methods for labeling seed for sale, thus reducing introductions via the seed pathway. Additionally, MDA determined that manure spread on crop fields from contaminated screenings fed to livestock resulted in new infestations. Limiting spread via these and other potential pathways was critical to successfully reducing the impact of Palmer amaranth. MDA, University of Minnesota Extension, Conservation Corps of Minnesota and Iowa, farmers, and other partners are working to eradicate these infestations before they can spread. In 2016, 35 sites were sown with Palmer amaranth–contaminated seed mixes. Palmer amaranth was found at eight (23%) of these sites. Management with intensive scouting, torching, prescribed burning, and herbicide application was implemented in 2016 and 2017. By 2018, no Palmer amaranth was found at any of these sites. Similar success to newer infestations in 2018, 2019, and 2020 was achieved using the same methods" (quoted text from Yu et al. 2021). Efforts to identify and close pathways for Palmer amaranth are expected to continue.

*MITPPC research pinpointed genetic markers common to Palmer amaranth strains across the globe, supporting efficient testing for contamination by seeds of this invasive species. (Photo: MITPPC.)*

*Palmer amaranth. (Photo: Shane Blair, MDA.)*

***Common buckthorn***

Common buckthorn is a small tree or shrub that can overtake forest understories and cause a myriad of ecological impacts. Infestations reduce species diversity, inhibit overstory tree regeneration, facilitate earthworm invasions and may alter stream communities. It is also an overwintering host for soybean aphid and oat crown rust which are important crop pests. The species is regulated as a Restricted Noxious Weed by the MDA.


*Common buckthorn forms dense stands that dominate forest understory. (Photo: MDA.)*

Outreach efforts related to common buckthorn are many. University of Minnesota Extension created a video series on buckthorn identification, its relationship to soybean aphid, and management tools and techniques. MnDOT includes buckthorn in Minnesota Noxious Weeds, a widely utilized identification and management guide. Many local organizations hold workshops and conduct other outreach about buckthorn identification and control.

There is research underway in Minnesota, supported by MITPPC, that aims to improve buckthorn management. Researchers are demonstrating that buckthorn is stunted and dies under dense shade (3% light or less). Planting native species to provide that shade seems to be a critical element to prevent buckthorn from overtaking restored sites. Citizen science is being used to evaluate the robustness of the approach across the state. Benefits and costs of using goats to restore buckthorn invaded sites are being investigated. Further research is demonstrating the competitive advantage of buckthorn over other tree species under future weather conditions.

Minnesota is also implementing some significant control and restoration efforts. A Tactical Invasive Species Management: Regional Prioritization Plan 2020 identified areas for buckthorn treatment where infestation levels are low. Buckthorn control in these priority areas of the Lake Superior Basin will be funded by a GLRI grant. Counties, townships, municipalities, and tribes can apply for grants through MDA and BWSR programs as funding permits. A wide range of management techniques are used that include mechanical removal, prescribed fire, targeted grazing, forestry mowing, herbicide application (foliar, cut stump and basal bark) treatments. Conservation Corps of Minnesota and Iowa is involved with many of these efforts in partnership with state and local governments. DNR Forestry may require buckthorn removal as a condition of a timber sale to prepare sites for new tree plantings/recruitment. Some restoration projects involving buckthorn removal are funded through the Outdoor Heritage Fund as recommended by the Lessard-Sams Outdoor Heritage Council. The Natural Resource Conservation Service funds some buckthorn removal followed by restoration on private lands.

*The fruit, leaf shape and venation are some of the distinguishing characteristics of common buckthorn. (Photo: Laura Van Riper, DNR.)*

***Oak wilt***

Oak wilt is a nonnative, fatal oak disease that has been spreading slowly northward in Minnesota since the 1940s. It can be devastating in forests that are mostly oak. The disease currently covers an estimated 35 percent of the state's red oak range and is common in central, east central, and southeast Minnesota.

*Progressive leaf discoloration caused by oak wilt. (Photo: DNR.)*

To slow the spread of oak wilt northward into uninfected forests, the DNR forest health program prioritizes early disease detection, outreach efforts, and management at two strategic locations: the northern half of Pine County and all of Morrison County. Oak wilt was not confirmed in these areas until 2015. The forest health staff use airplanes and aerial photographs to conduct surveys for early disease detection. Potential oak wilt detections are verified from the ground by various partners (DNR Forestry, county forestry and SWCD staff). Site visits are coordinated with an interactive web map developed in 2021. Such surveys resulted in the two northernmost oak wilt detections in Morrison County in 2019 and 2020. In 2020, forest health partnered with the University of Minnesota Extension to develop oak wilt identification and reporting materials for Extension's Invasive Species Citizen Science project for the Brainerd area.

Substantial oak wilt control efforts are underway. In 2020, the DNR forest health program published a detailed oak wilt control guide for natural resources managers. The DNR has used its forest stewardship cost share incentives program to assist four property owners in Pine and Morrison counties to control oak wilt in recent years. Federal oak wilt suppression grants have helped the DNR control many oak wilt pockets in St. Croix State Park. DNR forest health staff helped write and provide support for two grants that Morrison County SWCD received from the Environment and Natural Resources Trust Fund for oak wilt control on private land in Morrison County and areas to the north. DNR provides on-site guidance on oak wilt control that many landowners have carried out without outside financial assistance. Finally, the DNR forest health program is evaluating a potential technique for oak wilt control in woodland settings on four sites; final results are anticipated by 2027. More details on oak wilt control efforts can be found in the DNR Forest Health 2020 Annual Report.

*MITPPC researchers are investigating the efficacy of hyperspectral imaging for detection of oak wilt. (Photo: MITPPC.)*

## 3c. Interstate and International Collaborations

Minnesota is bordered by Wisconsin, Iowa, North Dakota, South Dakota, and the Canadian provinces of Manitoba and Ontario. The biennial Upper Midwest Invasive Species Conference is a major information-sharing opportunity encompassing aquatic and terrestrial invasive species issues. The tribes in the Great Lakes region work across state lines. The Great Lakes Indian Fish and Wildlife Commission represents 11 Ojibwe tribes who have treaty-reserved rights to hunt, fish and gather within the 1836, 1837, 1842 and 1854 Ceded Territories of Michigan, Wisconsin and Minnesota. The DNR, Minnesota Sea Grant and partners often plan cooperative prevention and containment efforts that make use of the national Stop Aquatic Hitchhikers!™, PlayCleanGo™, and Habitattitude™ campaigns. These states often consult with Minnesota as they develop their aquatic invasive species programs and activities (e.g., regulations, signage, watercraft inspection, assessments) in part because Minnesota DNR and Minnesota Sea Grant have had active invasive species programs since 1991.

Personal communications and formal groups support interstate aquatic invasive species collaborations. Staff at the Minnesota DNR, MDA, Minnesota Sea Grant and other Minnesota-based invasive species organizations regularly communicate with program staff in neighboring states regarding specific issues.

- Minnesota Sea Grant regularly attends ANSTF bi-annual meetings and connects with the National Invasive Species Council (NISC).
- DNR staff, Minnesota Sea Grant, MAISRC staff and others participate in meetings of the Great Lakes and Mississippi River Basin Panels on Aquatic Nuisance Species, the 100th Meridian Initiative focused on preventing westward spread from North Dakota to Texas, the Mississippi River Asian Carp Team, and the Great Lakes Fishery Commission.
- Watercraft inspection staff at the DNR participate in the Decontamination Think-Tank subpanel of the Western Regional Panel on Aquatic Nuisance Species and the Great Lakes Landing Blitz.
- Minnesota invasive species professionals also participate in regional collaborative groups, including the:
  - Invasive Mussel Collaborative
  - Starry Stonewort Collaborative
  - Invasive Crayfish Collaborative
  - Hydrilla Collaborative
  - New Zealand Mudsnail Collaborative
  - Habitattitude™ Collaborative
  - Western Lake Superior Aquatic Invasive Species Work Group, and
  - Great Lakes Phragmites Collaborative.
- Staff from the DNR's Fisheries Division attend Great Lakes Fishery Commission meetings and periodic border water meetings with managers from Wisconsin, Iowa, Minnesota and the Dakotas.
- There are several partnerships are in place for protection of the Boundary Waters Canoe Area Wilderness and the Rainy-Lake of the Woods watershed. Several Minnesota entities participate in the Rainy-Lake of the Woods Watershed Partnership and host the Rainy-Lake of the Woods Watershed Forum. North St. Louis County SWCD and the National Park Service work in partnership on watercraft inspection and decontamination. The Boundary Waters Canoe Area Wilderness Coalition supports outreach and additional efforts.
- Regional and national symposiums also provide opportunities for knowledge sharing and collaboration.

*The Boundary Waters Canoe Area Wilderness is treasured by many Minnesotans and visitors. (Photo: Liz Anderson, Lake County SWCD.)*

The ANS Interstate Management Plan for the St. Croix National Scenic Riverway was approved by the ANSTF in 1992. Since then, Minnesota, Wisconsin, the Great Lakes Indian Fish and Wildlife Commission and the Wild Rivers Conservancy of the St. Croix and Namekagon, the official non-profit friends group of the St. Croix National Scenic Riverway have worked together to implement the interstate plan and address aquatic nuisance species in the St. Croix Riverway. A large part of this plan is to prevent and control the spread of Zebra mussels in the riverway as well as other threatening ANS such as invasive carp. Collaboration efforts with the Minnesota and Wisconsin state ANS plans have occurred with monitoring and managing of these threats in and along the riverway. The key activities continue to be: information and education, boat inspections, access management, research, and monitoring, as outlined in the 2002 St. Croix River Zebra Mussel Action Plan. As a bordering riverway to both Minnesota and Wisconsin, it is important to continue collaboration and complement efforts between the ANS interstate plan for the St. Croix National Scenic Riverway and the Minnesota state ANS plan.

Under the binational Great Lakes Water Quality Agreement as amended in 2012, Annex 6 was formed to address aquatic invasive species early detection and response, implement ballast water discharge programs, prevent spread of aquatic invasive species, assess effectiveness of aquatic invasive species prevention programs and develop and evaluate technology to improve effectiveness of control, eradication and detection efforts and assess habitat requirements and impacts. Priorities are based on evaluation of the State of the Lakes, with input from the Great Lakes Executive Committee, participants at the Great Lakes Public Forum and recommendations of the International Joint Commission. Several Minnesota participants represent federal, state, tribal, advocacy, regional bodies, and conservation groups.

Terrestrial invasive species managers in Minnesota also coordinate with neighboring states through personal communications and collaborative efforts. Collaborations with the Wisconsin Department of Natural Resources and researchers at the University of Wisconsin – Madison are critical to aid prevention efforts, as these partners have valuable information on terrestrial invasive species that are advancing westward. Regional coordination groups include the Midwest Invasive Plant Network and the Woody Invasives of the Great Lakes Collaborative. National groups include the National Plant Board and regional subgroups, National Plant Diagnostic Network and the Forest Health Cooperative between the USFS and state forest health specialists.

## 3d. Gaps in Invasive Species Authorities, Funding and Program Implementation

Regulation is an important aspect of invasive species management. As we continue working to improve management and prevention efforts, gaps in the regulatory framework should also be assessed and addressed. This section describes gaps in state authority, funding and program implementation that impede invasive species prevention and management in Minnesota (as of 2022).

### Aquatic Invasive Species Gaps

#### Enforcement of Interstate Species Transport Regulations

States' lists of prohibited invasive species, regulatory classifications and capacity for enforcement are inconsistent across states, which can lead to gaps in enforcement between the state and federal agencies. For example, grass carp, a prohibited invasive species in Minnesota, are available in Iowa hardware and gardening stores for weed and algae control in ponds. In addition, a 2017 D.C. Circuit court decision determined that the federal injurious wildlife regulation, 18 U.S.C. section 42(a)(1), does not prohibit transport of injurious wildlife between states within the continental United States. Federal wildlife law enforcement may be able to assist with detection and response to interstate transport of species prohibited by states but the responsibility falls heavily on state law enforcement. The Great Lakes jurisdictions, with support of regional coordinating bodies, have made significant progress toward harmonizing prohibited species lists across the region where possible to address this gap. Regulatory changes to improve detection of and response to illegal activities, increased funding and capacity for law enforcement or building relationships between industry and law enforcement personnel could support enforcement of interstate species transport regulations.

### Local Aquatic Invasive Species Prevention Aid Reporting

Minnesota's Local Aquatic Invasive Species Prevention Aid provides $10 million annually to Minnesota counties and has been extremely valuable in supporting local-level prevention efforts. Minnesota Statutes, section 477A.19 states, "The county must establish, by resolution or through adoption of a plan, guidelines for the use of the proceeds" to help guide their aquatic invasive species prevention and management efforts. Each local entity receiving these funds must submit guidelines to the DNR at the end of each calendar year. Currently, DNR staff aid local entities and annually request basic reporting metrics from them on a voluntary basis. While most of these entities voluntarily report on the important work they are accomplishing, data could be improved by all counties reporting on the same metrics on an annual basis. Requiring some basic and reasonable metrics (e.g., spending, number of staff and partnerships, people engaged, watercraft inspected) would support the development of statewide summaries and evaluation of efforts, which in turn would demonstrate the overall impact of these funds.

### Standards for Decontamination Stations

The current statutory definition of a decontamination station is not sufficient to ensure that all decontamination stations in Minnesota will effectively decontaminate watercraft and water-related equipment. The definition states, "Decontaminate means to wash, drain, dry, or thermally or otherwise treat water-related equipment in order to remove or destroy aquatic invasive species…" (Minnesota Statutes, section 84D.01, subdivision 3a). The DNR has authority to require certain standards for decontamination stations at public water accesses. It is assumed that most locally managed decontamination stations likely meet minimum standards, though there are instances of off-site decontamination stations not meeting minimum standards. This can create confusion for members of the public who may think their equipment has been decontaminated to DNR standards when in actuality, the decontamination was not sufficiently effective to prevent the movement of some aquatic invasive species. Modifying the statutory definition of a decontamination station to expand DNR oversight of minimum standards and operation by a trained inspector would help alleviate this issue.

*Boaters can have courtesy decontaminations done at dozens of locations around the state. (Photo: DNR.)*

### Lake Service Providers

The lake service provider program educates and regulates businesses involved in the decontamination, installation, removal, and rental of water-related equipment. However, not all categories of businesses that transport watercraft and water-related equipment are clearly covered under the statutory definition of a lake service provider (Minnesota Statutes, section 84D.01, subdivision 15a). For example, the current statute does not explicitly include fishing guides or contractors conducting shoreline restorations. There is also a lack of capacity for program staff to ensure compliance with program requirements. Modifying the statutory definition of a lake service provider to encompass additional businesses and increasing funding or time dedicated toward validation would further prevent the spread of invasive species through movement of watercraft and water-related equipment. Statutory modification to differentiate between different types of lake service providers (e.g., those working with equipment that remains in one water body and those moving equipment between water bodies) would also help remove undue regulations and improve implementation of the lake service provider program.

*Lake service providers play an important role in preventing the introduction and spread of invasive species. (Photo: DNR.)*

## Terrestrial Invasive Species Gaps

### Funding for Terrestrial Invasive Species Management

Terrestrial invasive species management is underfunded when compared to the funding available for aquatic invasive species management. Boater registration fees, recreational taxes and other licensing fees provide dedicated funding for aquatic invasive species research and management in Minnesota. There currently are no dedicated funding systems in place for terrestrial invasive species management, making funding intermittent and hard to obtain on a case-by-case basis. Western states such as Montana and Wyoming have established dedicated funding mechanisms for noxious weeds and invasive plants through pesticide registration fees and establishment of trust funds through vehicle licensing fees. These fees provide a significant amount of funding for enforcement and management programs in both states. The Minnesota legislature could adopt similar funding mechanisms or other new, creative funding mechanisms to provide a source of dedicated funding for terrestrial invasive species management in Minnesota.

Additionally, state and tribal entities with plans approved by the ANSTF are eligible for federal funds specifically for aquatic invasive species projects and the GLRI largely supports aquatic invasive species projects as well. Parallel federal or user-fee-based funding sources for terrestrial invasive species management are lacking. The state legislature also allocates $10 million annually in local aquatic invasive species prevention aid, for which there is no terrestrial invasive species equivalent. Equipment, supply or resource user fees, legislative allocation and support from the federal level are all possible approaches for providing the dedicated, long-term funding needed to improve terrestrial invasive species management.

Plant identification can be challenging. Establishing a team of federal and/or state botanists who could officially identify plants would be helpful, especially for newly introduced species that may be unfamiliar to many people.

### Funding for Control of Priority Species on Private Lands

There is a lack of funding for control of invasive species on private lands. For example, county agricultural inspectors have the authority to require control of noxious weeds on all public and private lands in the state, but do not receive dedicated funds to complete the work. Enforcement and management are difficult to achieve without funding to support these local efforts. Dedicated funding is needed to support local control of priority species on private lands, especially to prevent spread and protect ecologically significant areas. Each county prioritizes differently, where some have very robust noxious weed programs that have strong partnerships between local, state and federal agencies and some only respond to complaints.

### State Agency Authority for Various Taxa

While regulatory authority for some taxa is clearly defined in statutes, there are certain taxa for which regulatory authority remains unclear. The DNR has regulatory authority over aquatic plants, aquatic animals and terrestrial wild animals. The MDA has authority over terrestrial plants and plant pests. However, there are many taxa that do not fall into these categories. Jumping worms, for example, are a relatively new invasive earthworm species in Minnesota with the potential to cause devastating effects on forest health and gardens as well as negative effects on the economy. They are currently not regulated by the DNR, MDA or the MPCA. Discussions between the three agencies determined that jumping worms would be most appropriately regulated by the DNR. The DNR is currently seeking to classify jumping worms as prohibited invasive species under Minnesota

Statutes, chapter 84D, though the rulemaking process will determine whether jumping worms are regulated in this way. Overall, additional clarity is needed to determine the agencies' authority over taxa that are not included in the categories listed above.

### Disposal and Waste Management of Noxious Weeds and Invasive Species

Disposal of noxious weeds and other invasive plant species is often difficult because people are often not willing or able to keep the materials on site after treatment. The material may contain invasive plant seeds or roots or rhizome fragments from which plants may re-sprout. People need disposal options that minimize the chance of spreading the species to new sites. It is illegal to dispose of noxious weeds or any yard waste into the solid waste stream (e.g., landfill or incinerator) in Minnesota. Other states allow noxious weeds to be disposed of in the trash if they are identified as noxious weeds to prevent them from being spread in compost. In Minnesota, landowners are advised to either keep dead plant material on site or to take them to a yard waste facility that is equipped to handle them. Yard waste sites are not mandated to follow the processes to kill weed seeds, so landowners must call yard waste sites to find out their composting processes, otherwise other homeowners may bring home invasive plant seeds when they pick up finished compost.

In addition to yard waste sites potentially receiving weed seeds, they may also receive yard waste material (such as leaf litter) that contains invasive jumping worms or plants with plant pathogens. If the compost is not heated according to the process for further reducing pathogens or if finished compost is kept adjacent to unfinished compost, the finished compost can be contaminated with jumping worms or other invasive species or pathogens.

The MPCA has authority for managing yard waste sites, which are not mandated to maintain compost at temperatures high enough to reduce the risk of pathogen transmission and survival of jumping worm eggs, noxious weeds and weed seeds. If all yard waste sites followed the process for further reducing pathogens, it would reduce the risk of invasive species spreading through this pathway. The MPCA is also able to work closely with facilities when invasive plants are causing an issue in composting operations. For example, MPCA offers permits for limited exemptions to the prohibition on plants in the solid waste stream for specific species situations such as Japanese knotweed interfering with a facility's composting operations or poison hemlock due to its long-lasting chemicals. While keeping invasive materials on site and not moving them should continue to be promoted as the best option, it is important to recognize that it is not always feasible or that people may not realize that the materials they are bringing to the yard waste site contain invasive species. Additional coordination and cooperation in improving yard waste disposal is needed, including increasing the number of yard waste facilities that follow the process for further reducing pathogens.

Managing noxious weeds via landfill or incineration may not completely prevent the spread of the weeds. Trash vehicles make frequent stops, have different mechanisms for compacting waste and often deliver waste to intermediary locations (e.g., transfer stations) before it reaches a landfill or incinerator. Additionally, landfills and incinerators are not designed to devitalize weed seeds or propagating parts. Leachate (liquids managed from landfills) may be land applied or processed at a wastewater treatment plant (that may then land apply biosolids). The purpose of exploring options for disposal of invasive species material beyond keeping them on site is to reduce risk of spread and make it easier for the public to have confidence that they are not spreading invasive species when they bring yard waste to a yard waste site or when they bring compost home.

Jumping worms may also be present in soil in addition to being present in yard waste. Some yard waste sites and businesses accept soil. Jumping worms in soil can be more challenging to manage than in yard waste because there can be less organic matter and the soil is not put through the high heat composting process that yard waste can go through. Agencies and industry are working to continue to refine and provide guidance on this issue. For sites with infested soil, the best option is to keep the soil onsite if possible. For jumping worm infested soil that must be removed from a site, soil without plant material is not restricted from disposal in a landfill the way yard waste is. Jumping worm infested soil can be disposed of in a landfill if the landfill will accept it.

*Yard waste sites may pose risks of pathogen and jumping worm transmission. (Photo: Laura Van Riper, DNR.)*

### Harmonizing Noxious Weed and Seed Regulations

The MDA noxious weed and seed regulations are not currently aligned. For example, it was illegal to sell wild carrot but legal to sell its seeds. This allowed wild carrot to continue to be included in seed mixes for sale. While the MDA is currently working to harmonize weed and seed regulations, it is likely to take several years to address all inconsistencies.

## Aquatic and Terrestrial Invasive Species Gaps

### Assessing the Effectiveness of Prevention, Response, and Other Management Actions

While some funding opportunities exist for invasive species management, including prevention and response, in the state, little funding exists to evaluate the effectiveness of the activities. Some funding sources go so far as to exclude assessment as an allowable activity. To complicate matters, when such assessments are conducted, they are often performed by individuals with a vested interest in the outcome (e.g., to receive future funding). This problem affects invasive species management nationally, regionally, and locally. The national Entomological Society of America has recommended that independent committees, specifically Invasive Pest Intervention Networks, be created to review data meant to demonstrate the effectiveness of a management activity. Minnesota could be an early adopter of the approach for more than invasive insects.

### Emerging Invasive Species Control Technologies

Continued discussions are needed between researchers and federal, tribal, state, and local entities to understand the potential risks and benefits of emerging invasive species control technologies. For example, researchers are currently developing "genetic biocontrol" technologies (here, genetic biocontrol is a general term that may refer to the use of many different approaches to modify the genes or gene expression of an organism) for the purpose of managing populations of invasive species. In 2019, the DNR hosted a workshop to discuss selected research projects and federal regulatory frameworks for genetic biocontrol. Other emerging technologies include using pathogens, new chemical controls, and applying traditional control methods in new ways such as pesticide application by drones.

### Determining Responsibility for Overlapping Jurisdictions

It can be difficult to determine which agencies are responsible for management of noxious weeds, plant pests, and other invasive species. In some situations, the state, counties and cities may have overlapping authorities. Counties, townships, and cities are mandated by law to manage noxious weeds in the state. However, responsibility between the state and cities can be unclear for other plant pests such as emerald ash borer. Ongoing discussions between agencies are needed to clarify responsibilities for management implementation.

# Section 4. Elements, Desired Outcomes, Strategies and Actions

This chapter presents four elements of the state plan, and for each element, their:

- Desired Outcomes (representing what the plan will seek to accomplish),
- Strategies (describing the approach to attain desired outcomes), and
- Actions (describing the work that is being done or will be done when more resources are available).

These four levels, Elements, Desired Outcomes, Strategies and Actions, form the framework of the state plan.

The first three elements address separate phases of invasive species responses, and the fourth element addresses coordination at multiple levels. The plan was built by starting with one element, developing the statement of desired outcome and brief narrative about the element, then adding strategies, and finally adding actions. The context provided earlier in this plan (e.g., climate resiliency, species threats, existing programs and authorities, etc.) should be considered in implementing plan actions.

As described earlier, any entity in the state may be a partner in implementing this plan. The implementation tables identify strategies and actions for which activities are planned or currently being implemented, as well as respective lead and cooperating organizations. The placement of lead and cooperating organizations is meant to give a general summary of organizational efforts for a given action. In some cases, the lead and cooperating organizations are likely to change over time. Additionally, lead organizations often depend on jurisdiction. Tribes have management authority and lead invasive species management on their respective reservations. Tribal agencies may also be lead or cooperating organizations in Ceded Territories or elsewhere.

The implementation tables provide the following information for each action:

- **Strategy** – The plan strategy under which the respective action falls
- **Action Number** – Identifies each action in the table by a three-character identifier (e.g., I.2.d.)
- **Action** – A description of the action
- **Aquatic Lead Organization(s)** – The organization(s) currently or planning to implement the respective action for aquatic invasive species
- **Terrestrial Lead Organization(s)** – The organization(s) currently or planning to implement the respective action for terrestrial invasive species
- **Cooperating Organization(s)** – The organization(s) that are essential to or may support implementation of the implementation of the respective action for aquatic or terrestrial invasive species

## Element I. Prevention

**Desired outcome:** New introductions of invasive species are prevented in Minnesota.

The most effective strategy in invasive species management is to prevent their introduction and establishment. Prevention of invasive species not yet present in Minnesota must be a high priority. Preventive measures typically offer the most cost-effective means to minimize or eliminate environmental, societal and economic impacts. Prevention relies on a diverse set of tools and methods, including research, risk assessment, inspections, outreach, regulations and enforcement. Managing existing natural areas and other lands to decrease their susceptibility to invasion by invasive species (e.g., maximizing diversity and reducing disturbance) may also constitute an element of prevention. Management should focus on maintaining resilient systems that can slow the establishment, spread and dominance of invasive species. This could lead to a basic shift from focusing solely on control after establishment, by adding management of the site to limit invasion or prevent establishment as a part of the whole management package.

## Element I Strategies

1. **Understand Risks** – Improve understanding of the potential risks associated with the introduction of nonnative species and their pathways of spread.
2. **Coordination** – Improve ability of responsible agencies to communicate, cooperate and collaborate on priority prevention strategies for species and pathways.
3. **State Regulations** – Review state regulations to optimize legal authority for preventing import and introduction of invasive species, while recognizing that regulations reflect unique agency approaches and needs.
4. **Tribal, State and Local Regulations** – Establish new and maintain, revise or improve existing regulations that address pathways of spread in the state per Element I – Strategy 3.
5. **Federal Regulations** – Seek and support more comprehensive and improved federal and international regulations regarding invasive species.
6. **Federal and State Inspections and Enforcement** – Continue inspections, enforcement of invasive species regulations and quarantines by state and federal agencies.
7. **Local Enforcement** – Seek and support enforcement efforts by local jurisdictions and agencies (e.g., county sheriffs and county agriculture inspectors) to enforce state regulations.
8. **Prevention Research and Technology** – Improve technological options and strategic approaches, and work to implement appropriate standards that will help prevent introductions of invasive species (e.g., innovative ballast water management technology and technology for barriers in waterways; alternatives to linking watersheds).
9. **Public Awareness** – Conduct effective outreach programs targeting people and pathways that could potentially introduce invasive species into the state. Inform people and businesses of actions they can take to prevent the spread of invasive species and comply with state regulations. Also, inform the public and specific stakeholders as invasive species are found in new locations.
10. **Regional Approaches** – Seek interjurisdictional and watershed-wide cooperation and approaches to prevent introductions of potentially invasive species into watersheds that include Minnesota (e.g., invasive carp in other states; barriers in Illinois waterways).
11. **Manage for Prevention** – Manage ecosystems in ways that reduce invasion potential (e.g., replanting native species in areas that have been cleared to reestablish and restore plant communities).
12. **Funding** – Seek or provide funding and partners from federal, state, tribal and local resources to increase total funds available for invasive species prevention.
13. **Evaluation** – Evaluate effectiveness of prevention and containment outreach strategies targeting specific audience pathways.

*While ballast water has resulted in the introduction of many aquatic invasive species, vessels exchanging their ballast water between water bodies greatly reduced the rate of species introductions through this pathway. (Photo: Minnesota Sea Grant.)*

## ELEMENT I ACTIONS AND IMPLEMENTATION TABLE

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| 1. Understand Risks | I.1.a. | Identify nonnative species of concern, evaluate and rate their level of risk and classify those species. Include state and local climate suitability factors in species risk assessments and update them periodically. | DNR, USFWS, USDA APHIS | MDA, USFWS, USDA APHIS | MISAC, Universities, NWAC, regional entities |
| | I.1.b. | Support, fund and coordinate efforts that enable the responsible agencies to identify, evaluate, rate and classify invasive species. | DNR | MDA | NWAC, MISAC, Universities, EPA/GLRI |
| | I.1.c. | Identify pathways of introduction, evaluate their level of risk and rate the relative level of risk of pathways on a continuing basis. | DNR | MDA, DNR | Universities, regional entities |
| | I.1.d. | Support, fund, and coordinate efforts that will identify, evaluate and rate pathways. | DNR, Minnesota Legislature | MDA, Minnesota Legislature | Universities, regional entities, EPA/GLRI |
| 2. Coordination | I.2.a. | Distribute lists of species classified as invasive (in state and federal regulations) and their likely pathways of introduction to agencies in the state responsible for inspection and detection. | DNR | MDA | USFWS, USDA APHIS, DNR (for terrestrial) |
| | I.2.b. | Monitor ports of entry and conduct inspections for prohibited and regulated invasive species. | USFWS, USDA APHIS, port authorities | USFWS, USDA APHIS | N/A |
| | I.2.c. | Train staff about invasive species and evaluate effectiveness of inspection efforts. | USFWS, USDA APHIS, Extension | USFWS, USDA APHIS, MDA, Extension | N/A |
| | I.2.d. | State agencies with invasive species responsibilities monitor federal and regional inspection and detection efforts and coordinate and cooperate on those efforts. | DNR, tribal agencies, Extension | MDA, tribal agencies, Extension | N/A |
| | 1.2.e. | Determine roles for county, local agencies and non-governmental entities to assist in prevention and inspection efforts. | County and local entities, Extension | County and local entities, Extension | DNR, MDA, Minnesota Sea Grant, universities, tribal agencies, SAISAC |
| | 1.2.f. | Coordinate with appropriate tribes and tribal organizations when conducting prevention activities within or near reservation and Ceded Territory boundaries. | All partners | All partners | N/A |
| 3. State Regulations | 1.3.a. | Ensure that enforcement authority is clear and appropriate. | DNR and tribal, federal, and local agencies | MDA and tribal, federal, and local agencies | N/A |
| | I.3.b. | Review existing regulations to identify gaps and needs. | DNR | MDA, DNR | Tribal and federal agencies, NWAC |
| | 1.3.c. | Explore the need for new approaches or change in legal approach. | DNR and tribal, federal, and local agencies | DNR and tribal, federal, and local agencies | SAISAC, NWAC |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued) 3. State Regulations | I.3.d. | Adopt enforceable and effective rules, permits or other approaches as appropriate within each responsible agency to augment statutory approach. | DNR | MDA, DNR | Tribal and federal agencies, Minnesota legislature |
| | I.3.e. | Seek state law changes through the state legislative process if the need is identified by Actions a, b or c above. | DNR | MDA | MISAC, Minnesota Legislature |
| 4. Tribal, State and Local Regulations | I.4. | Establish new and maintain, revise or improve existing regulations that address pathways of spread in the state per Element I – Strategy 3. | DNR, tribal and local agencies | MDA, tribal and local agencies | Federal agencies |
| 5. Federal Regulations | I.5.a. | State and non-governmental entities pursue and support passage of more comprehensive federal regulations through congressional action or by responding to proposed federal rulemaking. | DNR, federal and regional entities | MDA, federal and regional entities | Universities, tribal agencies, Extension |
| | I.5.b. | Modify commodity entry standards as appropriate based on pathway assessment and communicate standards to the U.S. CBP. | DNR, federal and regional entities | MDA, federal and regional entities | Universities, Extension |
| 6. Federal and State Inspections and Enforcement | I.6.a. | Use the MDA inspection and enforcement provisions (Minnesota Statutes, chapter 18J) to provide enforcement authority for plant pests consistent with agricultural statutes and programs. | N/A | MDA | N/A |
| | I.6.b. | Monitor markets for prohibited products and when found, investigate to determine and close source. | USDA APHIS | MDA, USDA APHIS | N/A |
| | I.6.c. | Collaborate with foreign cooperators in offshore mitigation of pests. | USFWS, USDA APHIS | USFWS, USDA APHIS | N/A |
| | I.6.d. | Investigate and trace incidents when invasive species are found in interstate shipments and take appropriate safeguarding measures. | DNR, USFWS, USDA APHIS | MDA, USFWS, USDA APHIS | N/A |
| | I.6.e. | Use DNR conservation officers, tribal conservation officers and other state, federal and local officers and agents to enforce Minnesota Statutes, chapter 84D, Minnesota Rules, part 6216 and other applicable state and federal regulations according to statewide invasive species enforcement plans. | DNR, USFWS, USDA APHIS, tribal agencies | DNR, USFWS, USDA APHIS, tribal agencies | Local entities |
| | I.6.f. | Facilitate development and implementation of invasive species prevention self-assessment (i.e., Hazard Analysis and Critical Control Points (HACCP) plans by business, industries, agencies, contractors, researchers and others. | Extension, Minnesota Sea Grant | Extension, Minnesota Sea Grant | DNR, MDA, industries |
| | I.6.g. | Assess and improve process and authority for response to online sales and sales from out-of-state sellers. | DNR, USFWS, USDA APHIS | MDA, USFWS, USDA APHIS | N/A |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued) 6. Federal and State Inspections and Enforcement | I.6.h. | Support development of certification programs for industries and activities that are pathways for invasive species (such as fund weed-free forage and gravel pit certification). | None | Counties | None |
| | I.6.i. | Clarify inspection authorities of each agency or jurisdiction to allow for cross-agency inspections. | DNR, USFWS, USDA APHIS | MDA, USFWS, USDA APHIS | N/A |
| | I.6.j. | Train federal, tribal and state enforcement officers and highway patrol officers to facilitate cooperative enforcement efforts | DNR, USFWS, USDA APHIS, tribal agencies | DNR, USFWS, USDA APHIS, tribal agencies | N/A |
| 7. Local Enforcement | I.7.a. | Identify likely local jurisdictions and pursue cooperative efforts (e.g., DNR to contact lake associations and county sheriffs and MDA to contact county agricultural inspectors). | DNR | MDA | Local entities, lake associations, county agricultural inspectors |
| | 1.7.b. | Use peace officers from various jurisdictions or agencies to enforce state regulations (e.g., Minnesota Statutes, section 84D.13) and conduct training where appropriate. | DNR | N/A | USFWS, USDA APHIS |
| | 1.7.c. | Establish a memorandum of understanding between MDA, USDA APHIS, DNR and other entities regarding enforcement related to illegal invasive plant sales. | DNR | MDA, USDA APHIS | USFWS |
| 8. Prevention Research and Technology | I.8.a. | Conduct, fund or support research to develop new technologies to prevent or reduce the risks of new introductions of invasive species. | MAISRC, DNR, Minnesota Legislature | MITPPC, MDA, Minnesota Legislature | Tribal agencies, Universities, local entities, EPA/GLRI |
| | I.8.b. | Support the evaluation of novel approaches and available technology to prevent or reduce the risks of new introductions of invasive species. | MAISRC | MITPPC | Universities, DNR, MDA, tribal agencies, local entities |
| | I.8.c. | Support use of best available technologies that could prevent introduction of invasive species (e.g., development of technological standards). | MAISRC | MITPPC | Universities, DNR, MDA, tribal agencies |
| | I.8.d. | Encourage manufacturers to develop and market vehicles and equipment (e.g., mowers, watercraft) designed to minimize spread. | DNR | N/A | N/A |
| | I.8.e. | Adopt research protocols that will minimize potential introduction and spread of invasive species through research and other scientific activities such as water quality and biological sampling (e.g., using recommendations as provided in the ANSTF's Research Evaluation Protocol). | MAISRC, Extension | MITPPC, Extension | Universities |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued) 8. Prevention Research and Technology | 1.8.f. | Support research on aquatic invasive species transport and erosion resulting from enhanced-wake watercraft. | Universities | N/A | DNR |
| 9. Public Awareness | 1.9.a. | Use existing invasive species education resources and outreach activities or develop specific messages and actions (such as the ANSTF national guidelines for recreation, water gardening and classroom study) for priority audiences (e.g., commercial horticultural trade, recreational boaters, construction companies, biological supply houses, the pet trade especially in aquatic organisms, pet and water garden hobbyists, anglers, firewood sales and forest products industry). | DNR, universities, Extension | MDA, universities, DNR, Extension | Local entities, tribal agencies |
| | 1.9.b. | Integrate proven behavior change strategies into invasive species programs. | DNR, local entities | N/A | N/A |
| | 1.9.c. | Participate in state, regional and national evaluation efforts to determine the effectiveness of outreach efforts to priority audiences. Use the assessment information to improve outreach plans and actions. | DNR, universities, Extension | MDA, universities, DNR, Extension | Local entities |
| | 1.9.d. | Observe and support Invasive Species Month and National Invasive Species Awareness Week. | None | None | All partners |
| | 1.9.e. | Develop and distribute invasive species identification materials. | DNR, universities, Extension | MDA, universities, DNR, Extension | For distribution, all partners |
| | 1.9.f. | Encourage businesses to adopt voluntary codes of conduct designed to limit the use and distribution of invasive plant species throughout the nation. | N/A | MDA | DNR, universities, industries |
| | 1.9.g. | Encourage the use of native ornamental plants in landscapes and water gardens at state, county and municipal buildings, rest areas and parks. | DNR, local entities | MDA, local entities | MnDOT |
| | 1.9.h. | Support pet and plant rehoming events (e.g., Habitattitude surrender events, Minnesota Aquarium Society auctions). | Minnesota Sea Grant, Minnesota Aquarium Society | Minnesota Herpetological Society | None |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued) 9. Public Awareness | I.9.i. | Support P-12, non-formal youth education through use of lesson plans and curricula, trunks, kits and online resources aligned with state education standards (e.g., working with the Minnesota Environmental Education Board and the Minnesota Science Teachers Association), as well as through special events (e.g., county fairs, water festivals, River Quest, Forestry Days). | Extension, Minnesota Sea Grant | Extension, Minnesota Sea Grant | All partners |
| | I.9.j. | Support education through public aquaria, zoos, environmental learning centers and special events. | Minnesota Sea Grant, public aquaria, zoos and environmental learning centers | Public aquaria, zoos and environmental learning centers | None |
| | I.9.k. | Support the national Don't Pack a Pest Program for Academic Traveler's effort. | Minnesota Sea Grant, Extension | Extension | None |
| | I.9.l. | Conduct watercraft inspections at public water accesses with priority given to infested waters, waters with high boater activity, proximity to existing populations of invasive species and where there are local sponsors. | DNR, local entities, tribal agencies | N/A | N/A |
| | I.9.m. | Provide presentations, training and assistance to lake associations, public land user groups (e.g., ATV clubs) and other organizations interested in setting up access awareness and other events. | DNR, Minnesota Sea Grant, county staff | MDA | Local entities, Extension, non-profits |
| | I.9.n. | Encourage, use and support local awareness events and private access awareness activity throughout the state. | DNR, Minnesota Sea Grant, Extension, lake associations | MDA, Extension | Local entities, non-profits |
| | I.9.o. | Develop communication plans and prepare, distribute and use various media (e.g., radio and TV ads, print resources, newsletters, web, social media) and signs according to the plans. | DNR, MAISRC, Extension, Minnesota Sea Grant | MDA, MITPPC, Extension | Local entities |
| | I.9.p. | Publicize new invasive species discoveries through news releases and other media to raise awareness aimed at preventing and containing spread. | DNR, Minnesota Sea Grant | MDA, DNR | Local entities, Extension |
| | I.9.q. | Provide notice of locations and waters containing populations of high-priority species. | DNR | MDA | Local entities, lake associations |
| | I.9.r. | Emphasize the required 21-day dry time for docks and lifts in educational materials. | DNR | N/A | Local entities, lake associations |
| | I.9.s. | Continue having staff at state-level institutions to help educate local entities on invasive species. | DNR | MDA, BWSR, MnDOT | N/A |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| 10. Regional Approaches | I.10.a. | Establish, support and participate in international, national, interstate, watershed-based coalitions (e.g., Great Lakes and Mississippi River Basin Panels) and collaborative groups to develop regional prevention approaches regarding invasive species. | DNR, tribal agencies, universities | MDA, tribal agencies, universities, DNR | N/A |
| 11. Manage for Prevention | I.11.a. | Minimize disturbance of native plant and animal communities, re-establish native vegetation and maintain diverse native plant and animal populations to reduce the potential for invasive species to establish. [Recognizing that the DNR Fisheries Division allows lakeshore landowners to control aquatic plants via a permit program when necessary.] | DNR, USFWS, tribal agencies | MDA, BWSR, tribal agencies | Universities |
| 12. Funding | I.12.a. | Seek or provide additional funds to implement unfunded actions in the Statewide Management Plan for Invasive Species (i.e., development of certification and HACCP programs for industry pathways). | DNR, Minnesota Legislature | MDA, Minnesota Legislature | All partners |
| | I.12.b. | Maintain partnerships with agencies, academic institutions, non-government organizations, counties, local communities and others to seek and leverage funds from appropriate sources. | N/A | N/A | All partners |
| | I.12.c. | Assess implementation of additional fees to support invasive species prevention and management. | None | None | None |
| 13. Evaluation | I.13. & I.13.a. | Evaluate the effectiveness of outreach strategies; Seek funding for evaluation of prevention and containment strategies targeting specific pathways using qualitative and quantitative assessments | DNR, MAISRC, Minnesota Sea Grant, universities, Extension | MDA, MITPPC, universities, Extension | Federal agencies |

## Element II. Early Detection, Response and Containment

**Desired Outcome:** New invasive species populations are detected as early as possible and contained when deemed necessary.

Early detection and response are sometimes considered the "second line of defense" after prevention. It is a critical component of any effective invasive species management program. When new invasive species populations are detected and the population is still small, a prompt and coordinated eradication and containment response can reduce the potential establishment, spread and harmful impacts of a species. This action results in lower cost and less resource damage than implementing a long-term control program after a species is established. Early detection of new populations requires vigilance and regular monitoring.

### Element II Strategies

#### Detection of New Invasive Species Populations

1. **Detection** – Detect new invasive species populations as early as possible and encourage reporting of high-priority nonnative species within Minnesota.
2. **Database** – Maintain an inventory of locations of high-priority invasive species within Minnesota.
3. **Prioritize Detection** – Prioritize invasive species and their geographic locations for allocation of available resources.
4. **Detection Research and Technology** – Develop new, practical tools for early detection and identification of invasive species.

#### Response to Newly Detected Populations

5. **Develop Response Plan** – Develop general and, where needed, species-specific response plans outlining the actions required following the first detection of invasive species that are not known to occur in the state or in boundary areas of the state.
6. **Implement Response Plans** – Reduce the potential for establishment of a reproducing population through targeted treatment efforts when acceptable treatment options exist.
7. **Response Research and Technology** – Develop new tools for use in response efforts.

#### Containment

8. **Enforcement** – Enforce federal, tribal, state, county and local regulations aimed at containment.
9. **Funding** – Seek funding and partners from federal, state, tribal, county and local sources to increase total funds available for invasive species containment.
10. **Prioritize Containment** – Allocate resources to minimize potential spread based on the prioritization of species and pathways of spread.
11. **Monitor Spread** – Monitor the spread of invasive species within Minnesota and connected lands and waters.
12. **Evaluate Cost Effectiveness** – While incorporating cultural and ecosystem health impacts, evaluate the cost effectiveness of actions that have been taken to prevent the spread of invasive species within Minnesota.
13. **Risk Reduction** – Take actions that help minimize risk of pathways transporting invasive species.
14. **Containment Research and Technology** – Develop new scientific tools for containing invasive species.

## ELEMENT II ACTIONS AND IMPLEMENTATION TABLE

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| 1. Detection | II.1.a. | Identify people and agencies that might observe invasive species. | DNR, universities, Extension | MDA, universities, Extension | All partners |
| | II.1.b. | Raise awareness of priority species of concern by developing and distributing information about how to recognize, collect and report various invasive species (e.g., reporting card, list of priority species, ID cards) to people identified in Action a. | DNR, universities, Minnesota Sea Grant, Extension | MDA, DNR, universities, Extension | For distribution, all partners |
| | II.1.c. | Refine and conduct outreach about processes for reporting suspected invasive species sightings and agency verification of these reports (e.g., EDDMapS, USGS NAS, NOAA GLANSIS, Report a Pest and alternative methods). | DNR, Extension | MDA, DNR, Extension | Universities, non-profits, lake associations |
| | II.1.d. | Investigate reports of new nonnative species as soon as possible. | DNR, tribal agencies, Minnesota Sea Grant | MDA, tribal agencies, Extension | N/A |
| | II.1.e. | Develop memorandums of understanding between responsible agencies, such as the DNR, MDA, Minnesota Sea Grant, Extension, tribes, USDA APHIS, U.S. National Park Service and others regarding monitoring and detection, as needed. | All partners, where necessary | All partners, where necessary | N/A |
| | II.1.f. | Establish partnerships between existing field surveys for reporting suspected new sightings or presence of invasive species (such as the DNR county biological survey, river surveys, fisheries surveys, and shallow lake surveys; DNR and MPCA index of biological integrity surveys; MDA pest surveys, Cooperative Agricultural Pest Surveys, Forest Pest First Detectors, Starry Trek, Aquatic Invasive Species Detectors and Trackers, monitoring by local government units, CSMI). | DNR, federal agencies, universities | MDA, DNR, federal agencies, universities | Local entities, lake associations, volunteers, private contractors |
| | II.1.g. | Conduct field surveys for priority invasive species and monitor invasive species populations. | DNR, federal agencies, tribal agencies, universities, local entities, Extension | MDA, tribal agencies, universities, local entities, Extension | Private contractors |
| | II.1.h. | Provide and seek funding for survey, outreach and monitoring when appropriate. | DNR, universities, local entities, Extension | MDA, universities, local entities, Extension | Federal agencies, private contractors |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued) 1. Detection | II.1.i. | When feasible, use eDNA, remote sensing, drones and other technologies to detect new populations of invasive species. | DNR, universities, federal and local agencies | MDA, universities, federal and local agencies | N/A |
| | II.1.j. | Establish new or use existing citizen and community science volunteer monitoring networks (e.g., Aquatic Invasive Species Detectors and Trackers) for early detection of terrestrial and aquatic invasive species. | DNR, universities, U.S. EPA GLNPO | MDA, universities, Extension | Volunteers, lake associations, local entities |
| 2. Database | II.2.a. | Maintain databases of known locations of priority invasive species (such as those mentioned in Invasive Species Reporting and Mapping). | DNR, federal and tribal agencies | MDA, DNR, federal and tribal agencies | N/A |
| | II.2.b. | Adopt state data collection standards to facilitate intrastate sharing of invasive species sightings and presence data and allow Minnesota's data to be integrated into regional or national data centers of invasive species information. | DNR, federal agencies | MDA | Federal and regional entities, universities, non-profits |
| 3. Prioritize Detection | II.3.a. | Given known pathways and species biology, identify high-risk areas for invasive species introductions, establishment and spread, and focus detection efforts in these areas (e.g., popular recreational water bodies or recreational trails, degraded or disturbed systems, urban areas, ports, shipping and receiving terminals, campgrounds, mills). | DNR, tribal agencies, universities | MDA, tribal agencies, universities | All partners conducting surveillance |
| 4. Detection Research and Technology | II.4.a. | Promote development of molecular and genetic technologies for identification and detection of invasive species (e.g., genetic fingerprinting, eDNA). | Universities, Extension | Universities, Extension | DNA, MDA, businesses |
| 5. Develop Response Plans | II.5.a. | Develop response plans that incorporate the elements of communication and outreach, management, monitoring, and funding. | DNR, counties, Extension | MDA, Extension | Tribal agencies, regional entities |
| | II.5.b. | Ensure that training is provided to applicable employees regarding the response plan. | DNR, counties, Extension | MDA, Extension | Tribal agencies, regional entities |
| | II.5.c. | Identify species for response efforts and prioritize and select species for response plan development. | Local entities | Local entities | DNR, MDA, tribal agencies and regional entities |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued) 5. Develop Response Plans | II.5.d. | Inform the public about response plans that might employ methods that may have significant non-target impacts. | DNR, local entities | MDA, local entities | Tribal and federal agencies, lake associations |
| | II.5.e. | Engage with tribes in planning response efforts, as described in the section Tribal Consultation before Implementation. | All partners | All partners | N/A |
| | II.5.f. | Review and revise response plans periodically. | DNR, counties | MDA | Tribal agencies, regional and local entities |
| 6. Implement Response Plans | II.6.a. | Implement quarantines allowed by law or other containment measures to prevent movement of material that may promote the spread of the invasive species. | DNR | MDA | Tribal and federal agencies |
| | II.6.b. | Evaluate and implement the use of chemical, biological and/or mechanical methods to eradicate recently detected and isolated invasive species populations. | DNR, federal agencies, universities | MDA | Local entities, Tribal agencies, private contractors |
| | II.6.c. | Monitor eradication efforts through field survey or other means to evaluate eradication success. | DNR, federal agencies, universities | MDA | Local entities, Tribal agencies, private contractors |
| 7. Response Research and Technology | II.7.a. | Encourage, support and conduct research projects to develop new tools to use in response. | MAISRC, universities, businesses | MITPPC, universities | DNR, MDA, federal agencies |
| 8. Enforcement | II.8.a. | Monitor locations and activities operating under permit to ensure proper safeguards are utilized in activities that present high risk of spreading invasive species. | DNR | MDA | Federal agencies |
| | II.8.b. | Enforce state, tribal, county and federal laws and ordinances intended to contain invasive species. | DNR Enforcement Division, tribal conservation officers | MDA, tribal conservation officers | Federal and local enforcement officials |
| 9. Funding | II.9.a. | Seek additional funds to implement unfunded actions in the Statewide Management Plan for Invasive Species (i.e., actions related to firefighting, evaluating cost effectiveness). | All partners | All partners | All partners |
| | II.9.b. | Maintain partnerships with agencies, academic institutions, non-governmental organizations and others to seek funds from appropriate sources. | All partners | All partners | All partners |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| 10. Prioritize Containment | II.10. | Develop and refine prioritization tools such as modeling with multi-criteria decision analysis. | All partners | All partners | All partners |
| 11. Monitor Spread | II.11. | Monitor the spread of invasive species within Minnesota and connected lands and waters. | DNR, tribal agencies, Extension | MDA, tribal agencies, Extension | Local entities, universities |
| 12. Evaluate Cost Effectiveness | II.12. | While incorporating cultural and ecosystem health impacts, evaluate the cost effectiveness of actions that have been taken to prevent the spread of invasive species within Minnesota. | All partners | All partners | All partners |
| 13. Risk Reduction | II.13.a. | Clear aquatic plant fragments from public water access ramps to help reduce aquatic plants clinging to watercraft and trailers exiting water bodies. | Watercraft inspectors | N/A | DNR, local entities |
| | II.13.b. | Develop and support the use of best management practices to prevent the spread of invasive species on construction equipment and recreational vehicles, as part of actions I.6.f and I.9.a. | DNR | MnDOT | Local entities |
| | II.13.c. | Evaluate the use of dry hydrants in the state and inform firefighting entities (fire departments, forest fire fighting agencies) about the risks of transporting water from infested waters via dry hydrants, planes and other methods. | DNR | N/A | Local entities |
| | II.13.d. | Develop and train firefighters in processes related to forest fire fighting and the use of infested waters. | DNR | N/A | Local entities |
| | II.13.e. | Work with roadside vegetation managers to time mowing to prevent invasive plant spread. | N/A | MnDOT | County highway authorities |
| 14. Containment Research and Technology | II.14.a. | Encourage, support and conduct research projects to develop new tools to use for containment of invasive species (e.g., fish barriers, toxic bait for invasive carp). | MAISRC, universities | MITPPC, universities | DNR, MDA, federal and tribal agencies, local entities |

## Element III. Management of Invasive Species

**Desired Outcome:** Reduce the impacts caused by invasive species to Minnesota's ecology, society and economy.

Management of invasive species is necessary to reduce harmful impacts. Because there are numerous invasive species in the state, management must be prioritized for programmatic, species-specific and site-specific activities to effectively use available resources. Prioritization must be dynamic and flexible so that decisions can be made using the best available scientific information. Risk assessments can also be used to help set priorities. Priority setting will occur at different hierarchical levels (e.g., spatial, agency, taxonomic) as appropriate. When setting management priorities, the species characteristics, impacts of the invasive species, and the costs and benefits of management must be considered. Some management tools are limited or have low efficacy. In these situations, more research is needed for better management.

### Element III Strategies

1. **Prioritize** – Establish processes to prioritize species and populations for which control and research is needed and prioritize areas where management is most useful.
2. **Develop and Refine Integrated Pest Management (IPM) Plans** – Develop and revise IPM plans for high-priority invasive species.
3. **Implement IPM Plans** – Use IPM to manage populations of invasive species when feasible, such as when management tools are available and they can be implemented with acceptable results.
4. **Coordination and Communication** – Coordinate, facilitate and review control efforts among federal, tribal, state and local units of government, non-governmental organizations and landowners to improve efficiency and effectiveness of management efforts and to ensure compliance with applicable laws.
5. **Management Research and Technology** – Coordinate, conduct, review, fund and support research to improve management options.
6. **Evaluation** – Periodically evaluate long-term and short-term success of control methods for the purpose of improving management practices.
7. **Funding** – Ensure sufficient funding and other resources are available for invasive species management in Minnesota from federal, state, tribal, county and local sources.
8. **Rehabilitation and Restoration** – Integrate rehabilitation and restoration into eradication and management efforts.

ELEMENT III ACTIONS AND IMPLEMENTATION TABLE

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| 1. Prioritize | III.1.a. | Develop and use risk assessment models, including climate change factors, to evaluate which species should be managed and where (e.g., the NOAA GLANSIS Risk Assessment Clearinghouse). | DNR | MDA | Universities |
| | III.1.b. | Use existing or establish criteria for setting priorities such as legal requirements, current technology, costs and threats determined by risk assessments. | DNR | MDA | Universities |
| 2. Develop and Refine IPM Plans | III.2.a. | Develop and revise IPM plans for high-priority invasive species and when available refer to national and regional invasive species management plans for strategies and actions. | DNR | MDA | Universities, tribal and federal agencies |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued) 2. Develop and Refine IPM Plans | III.2.b. | Continue to monitor findings of national and international research on invasive species control through research conferences (e.g., the Upper Midwest Invasive Species Conference), publications and other venues. | DNR, universities | MDA, universities | Tribal and federal agencies |
| 3. Implement IPM Plans | III.3.a. | Use IPM to control high-priority invasive species (as identified in the species management or IPM plans, if they have been written). | DNR | MDA | Local entities, lake associations, tribal and federal agencies |
| | III.3.b. | Develop and implement site management plans (e.g., private forest management plans). Include climate change considerations in plan development. | DNR, tribal agencies, local entities | MDA, tribal agencies, local entities | Private contractors, private landowners |
| 4. Coordination and Communication | III.4.a. | Consult with and listen to the needs of tribes, local units of government and Minnesotans to foster two-way communication regarding local concerns about invasive species. | DNR | MDA | Local entities, lake associations, tribal agencies |
| | III.4.b. | Provide technical advice to federal, state, tribal and local units of government, and non-governmental organizations who are managing invasive species (e.g., presenting lectures for various groups, attending meetings at different agencies, producing articles, newsletters, news releases, mass and social media about effective management of invasive species). | DNR, Minnesota Sea Grant, universities | Universities, MDA, DNR | Federal, tribal and local government and non-governmental entities |
| | III.4. c. | Use landscape and watershed approaches for management of high-priority invasive species that include various levels of government and non-governmental entities (e.g., CISMAs). | DNR, local entities and coalitions | MDA, local entities | Tribal agencies, regional entities |
| | III.4.d. | Technical experts will maintain contact with researchers and managers working on management of invasive species within and beyond Minnesota. | DNR, universities, Minnesota Sea Grant, tribal agencies, Extension | MDA, DNR, universities, tribal agencies, Extension | Regional and local entities, federal agencies |
| | III.4.e. | Consult national and regional management plans for strategies, actions and information when developing state or local management plans and activities. | DNR, Minnesota Sea Grant | MDA | Regional entities, tribal and federal agencies |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued) 4. Coordination and Communication | III.4.f. | Engage with tribes regarding control projects as described in the section Tribal Consultation before Implementation (in some cases, this may include utilizing herbicides in rights-of-way, which can disrupt tribal harvest activities and also harm native plants that are significant to tribes). | All partners | All partners | N/A |
| 5. Management Research and Technology | III.5.a. | Provide logistical support and technical assistance to researchers working on invasive species in Minnesota. | DNR, Minnesota Sea Grant | MDA | Universities, tribal agencies, local entities, non-profits |
| | III.5.b. | Conduct, fund and support experiments to test the efficacy of existing control methods and develop new potential control methods (preferably selective methods that minimize harm to non-target species). | MAISRC, universities | MITPPC, universities | DNR, MDA, tribal agencies, EPA/ GLRI |
| | III.5.c. | Provide funding for research on high-priority species (e.g., population genetics work, reproductive ecology) to create more effective control methods. | DNR, Minnesota Legislature | Minnesota legislature | GLRI, LCCMR and other funding sources |
| | III.5.d. | Seek and leverage funding for research related to management of priority invasive species (e.g., biocontrol, studies of impacts). | MAISRC, Minnesota Sea Grant, universities | MITPPC, universities | DNR, MDA, tribal agencies, local entities |
| 6. Evaluation | III.6.a. | Monitor the effects of control methods on both target and non-target species. | DNR, local entities, universities | DNR, local entities, universities | Tribal and federal agencies, private contractors |
| | III.6.b. | Determine which invasive species can be managed effectively. | DNR, universities | MDA, universities | Tribal and federal agencies |
| | III.6.c. | Conduct cost-benefit analyses at local, regional and state scales to determine if the benefits (e.g., environmental, economic, recreational, cultural) of control outweigh costs. | DNR, MAISRC, Minnesota Sea Grant | MDA | Any partner conducting control activities |
| 7. Funding | III.7.a. | Identify appropriate sources and seek funding and cooperation for management work. | DNR, Minnesota Sea Grant | MDA | Tribal agencies, local entities |
| | III.7.b. | Seek perpetual funding for management projects. | DNR | MDA | Tribal agencies |
| | III.7.c. | Work with local, county, conservation, environmental, business and non-governmental organizations that may be willing and able to assist in funding invasive species prevention and control efforts. | Non-profits, local entities | Non-profits, local entities | N/A |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| 8. Rehabilitation and Restoration | III.8.a. | Conduct research to determine and overcome problems that may occur in restoration efforts (e.g., some invasive species change soil characteristics that inhibit reestablishment of native plants). | Universities, Minnesota Sea Grant | Universities | DNR, MDA |
| | III.8.b. | Use research and other means to increase information and the knowledge base about native species, plant resistance, the role of intact ecosystems, restoration ecology, disturbance ecology and invasive species and climate change interactions. | Universities | Universities | DNR, MDA |
| | III.8.c. | Develop appropriate guidance documents on effective rehabilitation and restoration practices for resource managers. Include climate change considerations. | Universities | Universities | DNR, MDA |
| | III.8.d. | Implement proven rehabilitation and restoration techniques in environments where invasive species have been managed. | DNR, tribal agencies | MDA, tribal agencies | Local entities, non-profits |
| | III.8.e. | Ensure that any restoration seed mixes used do not contain invasive plant seeds. | N/A | BWSR | Private entities |
| | III.8.f. | Improve access to native plants and seeds for restoration and other purposes. | Private entities | Private entities | Local entities and hobby organizations |

## Element IV. Leadership and Coordination

**Desired Outcome:** Collaborate with intrastate, interstate, national and international partners to help coordinate invasive species related efforts.

Invasive species management activities need to be coordinated at all levels to help avoid duplication, leverage resources, and to share knowledge and expertise. It is the responsibility of participating entities to determine with whom it may be appropriate to coordinate and cooperate. Participating entities are encouraged to contact MISAC members or the MISAC website for information about collaboration and coordination ideas and opportunities.

### Element IV Strategies

#### Intrastate Coordination Strategies

1. **Facilitate Coordination** – Continue to facilitate statewide coordination and cooperation on invasive species — including the review of information concerning the current status, management and spread of invasive species into and within Minnesota.
2. **Communication** – Communicate, conduct outreach to raise awareness targeting preventative actions and coordinate activity concerning species of concern with appropriate federal, state, tribal, county, university, nongovernmental organizations, industry, and other stakeholders.
3. **Local** – Foster the development and participation of local partnerships (e.g., SWCDs, CWMAs, CISMAs, Coalitions of Lake Associations, individual lake associations, counties, municipalities, community groups) to address invasive species using landscape and watershed approaches.

#### Interstate Coordination Strategies

4. **Regional Entities** – Participate in regional invasive species panels, boards and events to facilitate interstate cooperation and coordination (e.g., Mississippi River Basin Panel on ANS, Great Lakes Panel on ANS, Great Lakes Sea Grant Network, Midwest Invasive Plant Network, Western Lake Superior Aquatic Invasive Species Work Group, Great Lakes Aquatic Invasive Species Landing Blitz).
5. **Neighboring States and Provinces** – Maintain ongoing communication and collaboration with entities in neighboring states, border organizations, tribes and provinces.

#### Multi-level, National, and International Coordination Strategies

6. **Support diversity, equity and inclusion** – Engage in discussion and analysis, and make changes accordingly that align with diversity, equity and inclusion goals.
7. **National Entities** – Participate in national invasive species panels, boards and events to facilitate national cooperation and coordination (e.g., NISC, ANSTF, Federal Interagency Committee for the Management of Noxious and Exotic Weeds, North American Invasive Species Management Association).
8. **International Entities** – Work with appropriate entities to coordinate with international entities (e.g., State Department, International Joint Commission, Great Lakes Panel on Aquatic Nuisance Species, Rainy-Lake of the Woods Watershed Partnership, Lake Superior Partnership Management Committee, USDA APHIS and U.S. CBP, Canadian natural resource agencies).

## ELEMENT IV ACTIONS AND IMPLEMENTATION TABLE

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| 1. Facilitate Coordination | IV.1.a. | MISAC should work cooperatively to: provide leadership to prevent the spread and reduce the harmful impacts of invasive species to Minnesota landscapes, economies, and Minnesotans by promoting invasive species awareness, prevention, and management through research, education and regulation in cooperation with local, state, tribal, and federal partners. | MISAC | MISAC | MISAC member organizations and partners |
| 2. Communication | IV.2.a. | Appropriately engage with tribes in invasive species projects, as described in the section on Tribal Consultation before Implementation. | All partners | All partners | N/A |
| | IV.2.b. | Establish, maintain, and promote listservs for those interested in invasive species issues in the state. Promote and use existing regional listservs as appropriate. | DNR, MAISRC, Extension | MDA, MITPPC, Extension | Regional entities |
| | IV.2.c. | Establish, maintain, and promote a statewide MISAC website to facilitate education and coordination. | MISAC | MISAC | MISAC members |
| | IV.2.d. | Make implementation information and quadrennial reports on accomplishments (as described in Section 6) available for all entities by posting on the MISAC website. | MISAC | MISAC | MISAC members |
| | IV.2.e. | Facilitate networking through MISAC and other partnerships in the state. | MISAC, Extension | MISAC, Extension | DNR, MDA, Minnesota Sea Grant MAISRC, MITPPC, SAISAC |
| | IV.2.f. | Support and host statewide or regional conferences in Minnesota on invasive species (e.g., Upper Midwest Invasive Species Conference and field tours). | Minnesota Sea Grant, DNR, regional entities, businesses, MAISRC | MDA, regional entities, Extension, MITPPC | All partners |
| | IV.2.g. | Hold annual or biennial meetings between tribal and state entities, and between county and state entities. | DNR, tribal agencies, counties | DNR, tribal agencies, counties | N/A |
| | IV.2.h. | Compile, highlight and share information about existing restoration and rehabilitation successes around the U.S. | Unknown | Unknown | Unknown |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| (continued)<br>2. Communication | IV.2.i. | Compile, highlight and share information about existing prevention, outreach, control and eradication research and successes from around the U.S. | Unknown | Unknown | Unknown |
| 3. Local | IV.3.a. | Seek input from local entities to develop local partnerships. | DNR, Minnesota Sea Grant, Extension | MDA, Extension | Local entities, tribal agencies, SAISAC |
| | IV.3.b. | Establish and support existing CISMAs, County Coalitions of Lake Associations and other local and community-based partnerships and coalitions to address invasive species. | Local entities, Minnesota Sea Grant, CWMAs, CISMAs | Local entities, Extension | State agencies, tribal agencies, universities, volunteers, lake associations, Minnesota Legislature |
| | IV.3.c. | Provide grants that encourage involvement in prevention and management of invasive species at local levels. | DNR, Extension | BWSR, Extension | LCCMR and other funding sources |
| 4. Regional Entities | IV.4.a. | Work collaboratively in response to new and existing invasive species populations along border lands and waters. | DNR, Minnesota Sea Grant, tribal agencies, regional and federal entities, non-profits | MDA, tribal agencies, regional and federal entities, non-profits | Universities |
| | IV.4.b. | Collaborate through an MOU to co-host the Upper Midwest Invasive Species Conference by MISAC, Midwest Invasive Plant Network and Invasive Plants Association of Wisconsin (IPAW). | MISAC, MIPN, IPAW | MISAC, MIPN, IPAW | MISAC member organizations and partners |
| | IV.4.c. | Survey MISAC members to find out who participates in which groups. Encourage MISAC members to share updates from those groups at MISAC meetings. | MISAC | MISAC | N/A |
| | IV.4.d. | Determine if there are regional groups that are missing representation from Minnesota and work to provide Minnesota representatives to those groups. | MISAC | MISAC | All partners |
| 5. Neighboring States and Provinces | IV.5.a. | MISAC can develop and maintain a list of key contacts in neighboring areas for ease of providing contacts. | MISAC | MISAC | Neighboring jurisdictions |
| | IV.5.b. | MISAC can invite representatives from neighboring jurisdictions to attend meetings and introduce themselves and their programs. | MISAC | MISAC | Neighboring jurisdictions |

| Strategy | Action No. | Action | Aquatic Lead Organization(s) | Terrestrial Lead Organization(s) | Cooperating Organization(s) |
|---|---|---|---|---|---|
| 6. Support Diversity, Equity and Inclusion | IV.6.a. | Review memberships in MISAC and other committees and invite additional people to make membership more diverse. | MISAC, SAISAC | MISAC | All partners |
| | IV.6.b. | Foster communication and discussion of diversity, equity, and inclusion through conference sessions, webinars, or other means. | MISAC | MISAC | Unknown |
| | IV.6.c. | When designing new outreach materials, review them with a lens of supporting diversity, equity, and inclusion. | Unknown | Unknown | All partners |
| | IV.6.d. | Incentivize diversity, equity, and inclusion training, action steps, and evaluation within each organization. | All partners | All partners | N/A |
| | IV.6.e. | Co-create and deliver programs and projects with diverse partners, such as tribal and BIPOC-led organizations. | Unknown | Unknown | Unknown |
| | IV.6.f. | Work to better understand indigenous knowledges and integrate them into invasive species management when appropriate. | Unknown | Unknown | Unknown |
| 7. National Entities | IV.7.a | Survey MISAC members to find out who participates in which groups. Encourage MISAC members to share updates from those groups at MISAC meetings. | MISAC | MISAC | N/A |
| | IV.7.b. | Determine if there are national groups that are missing representation from Minnesota and work to provide Minnesota representatives to those groups. | MISAC | MISAC | All partners |
| 8. International Entities | IV.8.a | Survey MISAC members to find out who participates in which groups. Encourage MISAC members to share updates from those groups at MISAC meetings. | MISAC | MISAC | N/A |
| | IV.8.b. | Determine if there are international groups that are missing representation from Minnesota and work to provide Minnesota representatives to those groups. | MISAC | MISAC | All partners |

# Section 5. Priorities for Action

The elements, desired outcomes, strategies and actions outlined in this plan provide a comprehensive framework for implementation. The following identifies select priorities for action to help advance invasive species management in Minnesota over the next 10 years. Developed by MISAC for the purposes of this plan, it was modified based on follow-up input from partners and stakeholders. Priorities are not organized in any particular order within each category.

## Priorities for Aquatic and Terrestrial Invasive Species Management

- Integrate climate resiliency into all aspects of invasive species management (see subsection 2a).
- Prevent the spread of high-priority species within the state, such as starry stonewort, zebra and quagga mussels, nonnative *Phragmites*, jumping worms, emerald ash borer, and others (subsections 2b and 3b).
- Preserve Minnesota's leadership in invasive species research by supporting development of new detection and management technologies and funding for invasive species research.
- Continue discussions between researchers and federal, tribal, state, and local entities to understand the potential risks and benefits of emerging invasive species control technologies. In particular, better understand public and particularly tribal opinions of and potential regulatory structure for implementing genetic biocontrol agents.
- Assess risks posed by trade pathways for invasive species and increase prevention and enforcement as appropriate.
- Evaluate the effectiveness of invasive species outreach strategies and promote strategies that result in positive invasive species prevention behaviors (e.g., cleaning boots, inspecting watercraft, avoiding release of pets or plants).
- Bolster programs to support public reporting of suspected invasive species populations, including citizen and community science and education related to reporting processes, such as the use of EDDMapS.
- Increase opportunities for communication, outreach, coordination and collaboration between organizations involved in invasive species management in Minnesota.
- Address the gaps identified in subsection 3d. Gaps in Invasive Species Authorities, Funding and Program Implementation.
- Within participating partner organizations or across coalitions of partner organizations, develop SMART (specific, measurable, actionable, relevant, and time-bound) metrics to determine if respective efforts to implement aspects of this plan are achieving desired outcomes with respect to preventing or mitigating impacts from invasive species. (Note: Participating organizations' individual projects will be better suited to application of SMART metrics than the high-level strategies and actions outlined in this plan. MISAC encourages participating organizations to develop and report on SMART metrics.)

## Priorities Specific to Aquatic Invasive Species Management

- Maintain or increase funding for aquatic invasive species prevention, outreach, research, surveillance and management of existing populations.
- Continue to support invasive species management efforts in Minnesota border waters, such as sea lamprey control in Lake Superior and invasive carp prevention.

## Priorities Specific to Terrestrial Invasive Species Management

- Increase funding for terrestrial invasive species prevention, surveillance and management of existing populations.
- Strengthen requirements for and coordination related to invasive species management on roadway, rail and utility rights-of-way.
- Assess the effectiveness of enforcement of terrestrial invasive species laws in the state.

# Section 6. Program Monitoring and Evaluation

MISAC recognizes the importance of monitoring and evaluating plan implementation and will promote adoption and implementation of the plan by partners. Partners contributing to the implementation of this plan are strongly encouraged to build reporting on implementation of this plan into their regular organizational reporting processes. For example, the DNR prepares an annual report on invasive species and submits reports to USFWS regarding accomplishments using federal grants to implement state aquatic invasive species related actions. Minnesota Sea Grant also submits annual reports concerning responses to aquatic invasive species to the National Sea Grant College Program and Planning, Implementation and Evaluation Resources System. While MISAC has taken a lead role in developing this plan, the council is the sum of its parts. As with all aspects of plan implementation, evaluation hinges largely upon partner participation.

MISAC expects this plan to be taken into consideration when invasive species work is undertaken in Minnesota. To support the long-term goals of the plan, MISAC strongly encourages partners to adopt principles and practices that allow for an objective assessment of the performance of the plan. MISAC embraces principles of integrity, accountability, and transparency. Based on these principles, MISAC encourages widespread sharing of reports and supporting data that relate to the implementation of elements of the plan. MISAC will be a clearinghouse for these reports. MISAC also encourages independent assessments of performance of member organizations and, upon request, will offer recommendations for improvements to those organizations.

MISAC will facilitate a quadrennial evaluation process through a survey and will regularly address plan implementation. Partner organizations will be asked to complete a survey that will allow them to identify which strategies and actions from the plan they are implementing and provide additional information as desired. This review is primarily intended to evaluate the degree of engagement on different components of the plan (i.e., who is doing what). MISAC leadership will compile and present the survey findings and/or request that partners give brief presentations about their efforts particularly as they relate to the plan Priorities for Action, followed by a broad discussion about plan implementation and necessary updates or amendments to the plan. A summary of findings from the quadrennial evaluation process will be posted to the MISAC website.

Beyond the quadrennial evaluation process, a subcommittee of MISAC will thoroughly review the plan and consider updating it ten years following approval of the plan by the ANSTF. The plan will remain in effect until it is superseded.

# Glossary of Terms

**Aquatic Plant** – a plant, including algae and submerged, floating leafed, floating, or emergent plants, that naturally grows in water, saturated soils, or seasonally saturated soils (Minnesota Statutes, section 84D.01).

**Aquatic Invasive Species** – for the purposes of this plan, the term aquatic invasive species will be synonymous with aquatic nuisance species.

**Aquatic Nuisance Species** – a nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural or recreational activities dependent on such waters (National Invasive Species Act of 1996).

**Classify** – the act of determining the appropriate category or classification in which a nonnative species fits.

**Communication** – for the purposes of this plan, the term communication will be used when referring to distribution and sharing information among many entities, such as interagency communication. (The term outreach will be used to refer to efforts to inform the specific audiences about invasive species to raise public awareness.)

**Community Science** – engages members of the community to identify and/or support research by collecting and analyzing data, interpreting results, making new discoveries, and developing new technologies or applications.

**Contain/Containment** – attempt to stop the spread of invasive species from an area where the species is present to other areas.

**Control**

1) to employ chemical, physical, biological or other approaches to reduce the abundance of an invasive species.

2) in the context of the state noxious weed law, control means to destroy the above ground growth of noxious weeds by a lawful method that prevents the maturation and spread of noxious weed propagating parts from one area to another (Minnesota Statutes, section 18.77, subd. 3).

**Cooperative Weed Management Area/Cooperative Invasive Species Management Area** – partnership of federal, state and local government agencies, tribes, individuals, and various other interested groups that manage noxious weeds or invasive plants in a defined area.

**Designate** – the process of officially declaring the regulatory status of a nonnative species that has been classified.

**Eradicate** – to eliminate a population of an invasive species from a specific area.

**Establish** – the process of an invasive species population persisting and reproducing in a given area.

**Genetic Biocontrol** – a general term that may refer to the use of many different approaches to modify genes or gene expression of an organism for the purpose of managing populations of invasive species.

**Injurious** – high risk species that may cause harm to interests of the United States (as determined by the U.S. Fish and Wildlife Service; USFWS 2022).

**Inspection** – the act of looking for invasive species that may be introduced via a pathway on its way into the state, at the location of its first point of entry (e.g., customs agents at an airport).

**Integrated Pest Management** – the use of a combination of approaches, incorporating the judicious application of ecological principles, management techniques, cultural and biological controls, and chemical methods, to keep pests below levels where they do economic damage (Minnesota Statutes, section 17.114, subd. 2b).

**Intentional Introduction** – an introduction made deliberately by humans, involving the purposeful movement of a species outside of its natural range and dispersal potential. Such introductions may be authorized or unauthorized. (The International Union for the Conservation of Nature and Natural Resources – Species Survival Commission – Invasive Species Specialist Group 2000).

**Introduction** – the intentional or unintentional escape, release, dissemination or placement of a species into an ecosystem as a result of human activity (Executive Order 13112).

**Invasive Species** – an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).

**Invasive Species** – a nonnative species that: causes or may cause economic or environmental harm or harm to human health; or threatens or may threaten natural resources or the use of natural resources in the state (Minnesota Statutes, section 84D.01).

**Lake Service Providers** – a "service provider" is defined in state statute as an individual who or entity that: (1) decontaminates, installs, or removes water-related equipment or structures into or from waters of the state for hire or as a service provided as a benefit of membership in a yacht club, boat club, marina, or similar organization; or (2) rents or leases water-related equipment that will be used in, placed into, or removed from waters of the state (Minnesota Statutes, section 84D.01).

**Native Species** – species naturally present and reproducing within this state or that naturally expands from its historic range into this state (Minnesota Statutes, section 84D.01).

**Nonnative Species / Exotic Species / Introduced Species** – a species occurring outside its natural range that is not native.

**Noxious Weed** – in the context of the state noxious weed law, "noxious weed" means an annual, biennial, or perennial plant that the commissioner designates to be injurious to public health, the environment, public roads, crops, livestock or other property (Minnesota Statutes, section 18.77, subd. 8).

**Outreach** – an engagement process that in the context of invasive species uses knowledge and research to raise awareness to inform public audiences about how to prevent, slow and minimize impacts.

**Pathogen** – a disease producing organism or biotic agent.

**Pathway** – means by which species are transported from one location to another. Natural pathways include wind, currents, and other forms of dispersal in which a specific species has developed morphological and behavioral characteristics to employ. Man-made pathways are those that are enhanced or created by human activity. These are characteristically of two types. The first type is intentional, which is the result of a deliberate action to translocate an organism. The second type of man-made pathway are those that unintentionally move organisms (e.g., ballast water discharge, soil associated with the trade of nursery stock). In these and countless other unintentional pathways, the movement of species is an indirect byproduct of our activities (NISC website).

**Plant Pest** – includes, but is not limited to, an invasive species or any pest of plants, agricultural commodities, horticultural products, nursery stock, or non-cultivated plants by organisms such as insects, snails, nematodes, fungi, viruses, bacterium, microorganisms, mycoplasma-like organisms, weeds, plants and parasitic plants (Minnesota Statutes, chapter 18G).

**Prohibited Invasive Species** – an invasive species that has been designated as a prohibited invasive species in a rule adopted by the commissioner [of Natural Resources] under section 84D.12 (Minnesota Statutes, section 84D.01).

**Prohibited Noxious Weed** – plants designated by the commissioner as a prohibited noxious weed are injurious to public health, the environment, public roads, crops, livestock and other property. Plants in this category must be controlled in all locations statewide unless other laws apply.

**Quarantine** – an enforced isolation or restriction of free movement of plants, plant material, animals, animal products, or any article or material in order to treat, control or eradicate a plant pest (Minnesota Statutes, chapter 18G).

**Response** – actions intended to eliminate or control the establishment or perpetuation of reproducing populations.

**Regulated Invasive Species** – an invasive species that has been designated as a regulated exotic species in a rule adopted by the commissioner [of Natural Resources] under section 84D.12 (Minnesota Statutes, section 84D.01).

**Field Survey** – the act of looking for invasive species in the environment beyond the original point of entry (e.g., looking for Eurasian watermilfoil in a lake, placing insect traps near a warehouse).

**Unregulated Nonnative Species** – a nonnative species that has been designated as an unregulated nonnative species in a rule adopted by the commissioner under section 84D.12 (Minnesota Statutes, section 84D.01).

**Vector** – a biological pathway for a disease or parasite (i.e., an organism that transmits pathogens to various hosts) and is not completely synonymous with the much broader definition of a pathway (USDA 2022).

# Glossary of Acronyms and Abbreviations

| Acronym | Definition |
|---|---|
| ANS | Aquatic nuisance species |
| ANSTF | Aquatic Nuisance Species Task Force |
| BWSR | Minnesota Board of Water and Soil Resources |
| CBP | U.S. Department of Homeland Security – Customs and Border Protection |
| CISMA | Cooperative invasive species management area |
| CSMI | Environment and Climate Change Canada's Cooperative Science and Monitoring Initiative |
| CWMA | Cooperative Weed Management Area |
| DNR | Minnesota Department of Natural Resources |
| EDDMapS | Early Detection and Distribution Mapping System |
| Extension | University of Minnesota Extension |
| GLANSIS | Great Lakes Aquatic Nonindigenous Species Information System |
| GLRI | Great Lakes Restoration Initiative |
| IAPM | Invasive aquatic plant management |
| IPM | Integrated pest management |
| ISMTrack | Invasive Species Management Tracking System |
| LCCMR | Legislative-Citizen Commission on Minnesota Resources |
| MAISRC | Minnesota Aquatic Invasive Species Research Center |
| MDA | Minnesota Department of Agriculture |
| MnDOT | Minnesota Department of Transportation |
| MISAC | Minnesota Invasive Species Advisory Council |
| MITPPC | Minnesota Invasive Terrestrial Plants and Pests Center |
| MPCA | Minnesota Pollution Control Agency |
| NISC | National Invasive Species Council |
| NOAA | National Oceanic and Atmospheric Administration |
| NWAC | Noxious Weed Advisory Committee |
| SAISAC | DNR's Statewide Aquatic Invasive Species Advisory Committee |
| SWCD | Soil and Water Conservation District |
| EPA | U.S. Environmental Protection Agency |
| EPA GLNPO | U.S. Environmental Protection Agency Great Lakes National Program Office |
| USDA | U.S. Department of Agriculture |
| USDA APHIS | USDA-Animal Plant Health Inspection Service |
| USFS | U.S. Forest Service |
| USFWS | U.S. Fish and Wildlife Service |
| USGS NAS | U.S. Geological Survey Nonindigenous Aquatic Species Database |

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# Appendix B. Plan Development and Review

Distinct subcommittees of MISAC, in 2005-2009 and 2020-2022, respectively, developed and updated this plan with review and input from MISAC members and invasive species partners and stakeholders. Members from each subcommittee are listed below. The timeline below summarizes key milestones in plan development and revision. With an approved plan, the state and tribes (through subgrants from state agencies) are eligible to apply for grants from USFWS to implement aquatic portions of the plan. Only a single state agency can request funding from USFWS for implementation of the aquatic portions of the plan through the State and Interstate ANS Management Plan Grant Program.

- 2005: Development of the original plan formally began. A workshop sponsored by the University of Minnesota Sea Grant Program (Minnesota Sea Grant) through a grant from the Great Lakes Commission was held for MISAC members and other potential partners to review a draft.
- 2009: A second draft was made available for public comment, a meeting was held to broaden tribal review and participation and the plan was further revised and finalized. The plan was submitted to the ANSTF for technical review and was approved during its fall meeting, November 5, 2009.
- 2019: MISAC completed an update of its species ratings assessment.
- January 2020: The second MISAC subcommittee discussed potential plan revisions. ANSTF confirmed that updating the species ratings would require re-approval of the plan by the ANSTF.
- Summer 2020: Tribal representatives, beyond those already participating as part of MISAC, were invited to participate in the plan update.
- September 2020: Plan revision began.
- March 2021: A draft of the update plan was distributed for review by tribal representatives and partner and stakeholder organizations. Reviewers were invited to submit their feedback through a survey and/or direct comments on the draft plan.
- May 2021-March 2022: The MISAC plan subcommittee revised the plan to address comments received and submitted it for review by the ANSTF.
- May 2022: The plan was approved by the ANSTF at its spring meeting on May 24, 2022.

## Plan Development Subcommittee (2005-2009)

The following individuals were involved in numerous meetings to develop the draft plan prior to holding a workshop to involve numerous other individuals and entities in the plan development. This list reflects committee members' respective organizations and titles in 2009; some may have since changed affiliations or roles.

Val Cervenka, MDA Invasive Species Coordinator

Kevin Connors, USDA APHIS Plant Protection and Quarantine

Meredith Cornett, The Nature Conservancy

Tony Cortilet, MDA

Collie Graddick, MDA

Mike Hoff, USFWS – Region 3 Aquatic Nuisance Species Coordinator

Bob Jacobson, MnDOT and BWSR

Doug Jensen, Minnesota Sea Grant

Alan Jones, DNR Forest Health Supervisor

Terry McDill, MDA Invasive Species Unit Supervisor and MISAC Co-chair

Nick Palaia/Kelly Hogan, USFWS – Region 3 Assist. Refuge Supervisor

Jay Rendall, DNR Invasive Species Program and MISAC Co-chair

Luke Skinner, DNR Invasive Species Program

Rob Venette, U.S. Forest Service

## Plan Revision Subcommittee, Contributions and Reviewers (2020-2022)

The following individuals provided recommended revisions to the plan, determined the plan update process and drafted plan revisions. Chelsey Blanke coordinated the plan update on behalf of the DNR and MISAC.

Angie Ambourn, MDA

Kelly Applegate, Mille Lacs Band of Ojibwe Department of Natural Resources

Chelsey Blanke, DNR Invasive Species Program

James Calkins, Minnesota Nursery and Landscape Association

Doug Jensen, Minnesota Sea Grant

Marian Shaffer, National Park Service

Tyler Kaspar, 1854 Treaty Authority

Alexandra (Sascha) Lodge, DNR Forestry

Cori Mattke, MAISRC

Katie Sickmann, Wild Rivers Conservancy

Kelsey Taylor, Fond du Lac Band of Lake Superior Chippewa

Laura Van Riper, DNR Invasive Species Program

Krishna Woerheide, Grand Portage Band of Lake Superior Chippewa

The climate resiliency section was drafted by Chelsey Blanke and Jake Walsh (DNR). Charlie Lippert (Mille Lacs Band of Ojibwe) and Adam Doll (DNR) assisted in developing updated maps. Many organizations provided content and comments on earlier drafts of the updated plan.

# Appendix C. Federal, Tribal, State, Local and Non-Governmental Partners

## Federal Agencies

- National Oceanic and Atmospheric Administration
- National Park Service
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture
- U.S. Coast Guard
- U.S. Environmental Protection Agency – Great Lakes Program Office
- U.S. Fish and Wildlife Service
    - Co-chair: Aquatic Nuisance Species Task Force
- U.S. Forest Service
- U.S. Geological Survey
- U.S. Department of Homeland Security – Customs and Border Protection

## Regional Entities

- Conservation Corps of Minnesota & Iowa
- Great Lakes Panel on Aquatic Nuisance Species
- Great Lakes Water Quality Agreement Annex 6
- Lake Superior Partnership
- Mississippi River Basin Panel on Aquatic Nuisance Species

## Tribes

- Bois Forte Band of Chippewa
- Fond du Lac Band of Lake Superior Chippewa
- Grand Portage Band of Lake Superior Chippewa
- Leech Lake Band of Ojibwe
- Lower Sioux Indian Community
- Mille Lacs Band of Ojibwe
- Minnesota Chippewa Tribe
- Prairie Island Indian Community
- Red Lake Nation
- Shakopee Mdewakanton Sioux Community
- Upper Sioux Community
- White Earth Nation

## Tribal Organizations

- 1854 Treaty Authority
- Great Lakes Indian Fish and Wildlife Commission

## State Entities

- Minnesota Board of Water and Soil Resources
- Minnesota Department of Agriculture
- Minnesota Department of Natural Resources
- Minnesota Department of Transportation
- Minnesota Pollution Control Agency
- Minnesota Aquatic Invasive Species Research Center
- Minnesota Invasive Terrestrial Plants and Pests Center
- University of Minnesota
- University of Minnesota Extension
- University of Minnesota Sea Grant Program

## Non-Governmental Entities

- Aquatic Invasive Species Detectors Program
- Conservation Minnesota
- Local Coalitions including Cooperative Invasive Species Management Areas, Cooperative Weed Management Areas and County Coalitions of Lake Associations
- Minnesota Association of County Agricultural Inspectors
- Minnesota Coalition of Lake Associations
- Minnesota Lakes and Rivers Advocates
- Minnesota Master Naturalist Program
- Minnesota Nursery and Landscape Association
- Minnesota Traditions
- Wild Rivers Conservancy
- The Nature Conservancy
- Wildlife Forever

## Local Government Entities

- Cities
- Counties
- Duluth Seaway Port Authority
- Lake Organizations
- Mississippi River Headwaters Board
- Soil and Water Conservation Districts
- Three Rivers Park District
- Watershed districts and watershed management organizations

# Appendix D. Relation to Other Invasive Species Plans

Other invasive species plans exist at the international, national, tribal, regional, state and local levels. This plan is intended to complement those plans and not replace them. This plan can also provide a framework for county, tribal and other entities developing their own invasive species plans. For example, state and local management plans may be developed for high-priority species, individual infested water bodies or management areas, or priority pathways or activities. To maximize cooperation and coordination, it is beneficial for those developing plans to refer to plans previously developed for larger geographic areas, such as national, regional or state plans. Links to relevant international, national, regional and state invasive species plans and are listed below.

## Aquatic and Terrestrial Species Plans

- U.S. Department of the Interior's Invasive Species Strategic Plan
- GLRI Action Plans I-III
- 1854 Treaty Authority Invasive Species Management Plan
- Fond du Lac Band of Lake Superior Chippewa Management Plan for Aquatic and Terrestrial Invasive Species

## Aquatic Invasive Species Plans

### International

- Lake Superior Lakewide Action and Management Plan 2015-2019
- Lake Superior Aquatic Invasive Species Complete Prevention Plan
- Lake Superior Climate Change Impacts and Adaptation
- Great Lakes Commission Interstate Early Detection and Rapid Response Surveillance Framework

### National

- Aquatic Nuisance Species Task Force Strategic Plan
- Management and control plan for bighead, black, grass, and silver carps in the United States

### Interstate

- Upper Mississippi River Basin Asian Carp Control Strategy Framework
- St. Croix National Scenic Riverway Comprehensive Interstate Management Plan for the Prevention and Control of Nonindigenous Aquatic Nuisance Species (under revision)
- St. Croix River Basin Aquatic Invasive Species Strategic Plan

### State

- Minnesota Early Detection and Response Plan for Aquatic Invasive Species
- Minnesota Invasive Carp Action Plan (The national invasive carp plan referenced above was used to develop the Minnesota carp plan.)

The neighboring states of Wisconsin, Iowa, and South Dakota have management plans for aquatic invasive species. The DNR, Minnesota Sea Grant and USFWS – Region 3 aquatic invasive species staff interact with program coordinators from these states regularly. More information about collaborative efforts with neighboring states can be found in subsection 3c.

## Terrestrial Invasive Species Plans

### State

- Minnesota State Forest Action Plan
- State of Minnesota Tactical Invasive Species Management Regional Prioritization Plan 2020
- Emerald Ash Borer in Minnesota. Minnesota State Agency Report 2019

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