What are Invasive Species?

Invasive species are nonindigenous plants, animals, algae, fungi or pathogens – disease causing organisms like viruses and bacteria – that threaten the diversity and survival of native species or the ecological stability of infested ecosystems, or commercial, agricultural or recreational activities dependent on these natural resources. They are a form of biological pollution.

The defining characteristic of invasive species is that they possess traits that allow them to outcompete native species, negatively altering the structure and dynamics of ecosystems. In novel environments, invasive species often lack natural population controls, such as pathogens and predators, that keep most species in check in their native range. Invasive plants may be more efficient at extracting nutrients from sediments to assist their growth, or their inherent faster growth rate may allow them to rise above and shade out other native plants. Also, invasive species tend to be opportunists that can quickly adapt to a wide variety of conditions. Due to these advantages, they often outcompete native species.

At least 52 aquatic non-native species are present in Vermont. While many of these species have not become invasive, a significant number have, including Eurasian watermilfoil, zebra mussels, water chestnut, and purple loosestrife. A portion of the state's lakes and rivers have been impacted by invasions of these exotic pests, but many more are still free of aquatic invasives.

Preventing new aquatic invasive species from being introduced to and established in Vermont is critical, not only to limit the future cost of managing invasive species but also to protect the integrity of Vermont's ecosystems. Programs aimed at preventing the spread or introduction of invasive species into Vermont are the best and least costly means of protection available.

How important are invasive species?

Based on the Watershed Management Division's evaluation, invasive species of aquatic, wetland, and riparian habitats are a highly-ranked stressor, the effects of which can be found throughout the state and severe in many waters where infestations occur. Where infestations of invasive species achieve moderate or high densities and are left unmanaged, severe long-term impacts to recreation and ecosystem function can be expected. Roughly 21% of Vermont lakes over 20 acres in size are affected by invasive species, although not all lakes support high density populations. Few systematic surveys have been carried out of riparian invasive species. However, field observations suggest that species such as purple loosestrife and common reed (which preferentially invade wetlands), and Japanese knotweed (which colonizes streambanks with alarming efficiency) are increasingly dominating Vermont's riparian zones, wetlands and watersheds. Small-bodied invasive animals, such as zebra mussels, Asian clams, and spiny waterflea, are found in limited Vermont waters, and have prompted increased efforts to ensure that these species are not spread further.

Effective management or preclusion of invasive species infestations promotes several surface water goals and objectives, including:

Objective A. ***Minimize Anthropogenic Nutrient and Organic pollution***

Invasive plant species outcompete native plants or animals resulting in major changes to surface waters, and are considered a form of biological pollution. Invasive species populations can reduce or eliminate swimming, fishing and boating opportunities in waters where moderate or dense infestations are present. Zebra mussel infestations have necessitated significant infrastructure modifications of water systems and fish hatchery facilities.

Objective B. ***Protect and Restore Aquatic, and Riparian Habitat***

Invasive species cause significant habitat shifts by replacing biologically diverse populations with mono-cultures, generally considered of lower habitat value. In lakes, invasive plants such as Eurasian watermilfoil can degrade spawning habitat for fishes and reduce overall habitat complexity. Along streambanks, Japanese knotweed outcompetes desirable species that provide diversity. Water chestnut infestations form a dense mat on the water surface, which can raise temperatures and lower dissolved oxygen content in affected areas, thereby limiting use by fish and other animals.

Specific causes and sources of invasive species

From a global perspective, overseas shipping and associated management of ballast-water has for years been the primary mechanism by which aquatic invasive species arrive in North America. This has eased in recent years due to federal regulations concerning ballast water. Many species also arrived in this country by way of the gardening or aquarium trades. For those species that are already in U.S. waters, and that occur in or threaten Vermont, recreational activities are largely responsible for spreading invasive species. People spread invasive aquatic plants by moving plant fragments on boats, trailers and other equipment. Microscopic organisms or their larval stages, such as zebra mussel veligers, are moved when water or sediment in boats, bait buckets, or gear is carried from one waterbody to another. The connectedness of waterways also allows spread; in Vermont, Lake Champlain is connected to both the Hudson River through the Champlain Canal, and the Great Lakes through the Richelieu and St Lawrence rivers. Occasional natural spread of certain invasive species has been attributed to distribution by wildlife.

Riparian invasive species are spread by a different set of activities. In addition to recreational spread, transportation infrastructure (roadside ditches and mowing) can promote the spread of species like common reed or purple loosestrife. Also, the removal of streambank vegetation creates excellent opportunities for Japanese knotweed to gain a foothold on streambanks, which then allows flooding and bank erosion to distribute root pieces downstream. More information on spread prevention is available here (http://dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives/).

Monitoring and assessment activities to track invasive species

Programs

- Surveys to monitor existing plant and animal infestations, or to detect new ones
- Aquatic plant surveys
- Vermont Invasive Patrollers (VIP) surveys
- Zebra mussel veliger and spiny waterflea monitoring (Lake Champlain and inland lakes)
- Crayfish monitoring (Biomonitoring and Aquatic Studies Program)
- Fish surveys (VT Dept. Fish and Wildlife and US Fish and Wildlife Service)
- Riparian species (US Forest Service (limited))
- Assessment of invasive species infestations as part of reporting to EPA and the public.

Key Strategies

- Expand the network of VIP programs.

- Discover new invasive species infestations early to maximize control options by monitoring for aquatic and riparian species of concern, including species not currently known in Vermont.
- Increase understanding of biological impacts of invasive species in riparian and wetland areas.

Technical assistance and implementation programs to address invasive species

Programs

- Aquatic Invasive Species Program to provide technical assistance and on-site visits to support the development and implementation of waterbody-specific, long-range control and spread prevention projects
- Water Chestnut Management Program (statewide) to reduce and prevent further spread of this species in Vermont
- Eurasian watermilfoil control efforts in high priority waters (e.g. Hinkum Pond)
- Implement the Rapid Response Action Plan for Invasive Aquatic Plants and Animals throughout Vermont (e.g., Halls Lake Variable-leaved watermilfoil, Lake Bomoseen Asian clam, Lakes Memphremagog and Derby starry stonewort)

Key Strategies

- Continue annual water chestnut program to ensure recently achieved milestones, especially in Lake Champlain, continue and are not lost.
- Maintain readiness to implement rapid response protocols when necessary.
- Maintain knowledge of current available control methods and regional issues through coordination with peers in New England and nationally. Support research to increase technical knowledge of spread prevention protocols.
- Emphasize spread prevention as the most cost-effective and successful strategy.
- Integrate invasive species spread prevention into all ANR field programs. Ensure that protocols are current, field staff are trained and field staff practice effective spread prevention techniques.
- Coordinate invasive species prevention and control plans within a region or basin for greatest effectiveness.
- Clarify environmental review process to ensure invasive “watch list” species are not utilized in projects undergoing state review.
- Develop best management practices for invasive species to ensure the highest level of control success and to minimize the use of pesticides.

Regulatory programs to address invasive species

Programs

- Aquatic Nuisance Control Permit Program (10 V.S.A. §1455): regulates the use of mechanical, biological, physical and chemical nuisance control activities in Vermont waters

- Aquatic Species Transport Law of aquatic plants and aquatic nuisance species (10 V.S.A. §1454) prohibits the transport of *all* aquatic plants or aquatic plant parts, zebra mussels *(Dreissena polymorpha*), quagga mussels *(Dreissena bugensis*), or other aquatic species identified by the Secretary by rule to or from any Vermont waters on the outside of a vehicle boat, personal watercraft, trailer or other equipment
- The Vermont Use of Public Water Rules, Section 4.1 authorizes the Secretary of the Agency of Natural Resources to identify areas of public waters as temporarily closed to all persons, vessels or both to prevent, control or contain the spread of aquatic nuisance infestations
- Noxious Weeds Quarantine Rule (AAFM #3) regulates the importation, movement, sale, procession, cultivation and/or distribution of certain plants known to adversely impact the economy, environment, or human or animal health. The rule provides penalties for violations.
- Rule regulating the introduction of any live fish to Vermont waters (10 V.S.A §4605)
- Baitfish Rule: Places restrictions on the purchase of baitfish and the movement of baitfish between waters of the State (10 V.S.A. §122)

Key Strategies

- Ensure prohibited aquatic nuisance species under 10 V.S.A. §1454 reflect current species of concern.
- Ensure invasive species spread prevention measures are integrated into Watershed Management Division permit programs.
- Implement **t**he Aquatic Nuisance Control Permit program with consistency and accuracy to ensure quality projects and the meeting of statutory criteria.
- Work with enforcement staff from State Police Auxiliary, Fish and Wildlife Wardens and Border Patrol to ensure knowledgeable and effective enforcement of the Transport Law.
- Work with AAFM to implement Noxious Weeds Quarantine Rule #3.

Coordinate funding programs to address invasive species

Programs

- Aquatic Nuisance Control Grants-in-aid grants provides funding to municipalities for eligible spread prevention programs and nuisance (for native and non-native species) control activities
- Lake Champlain Basin Program grant program for certain aquatic invasive species projects
- US Army Corps of Engineers
- Local initiatives raise funds to support lake-specific control and spread prevention projects

Key Strategies

- Prioritize spread prevention programs, such as public access area greeter programs, based on risk of spread. Support programs at infested lakes.
- Evaluate funding options to meet statewide invasive species spread prevention and control project needs.

Information and education programs to address invasive species

Programs

- Vermont Invasive Patrollers (VIPs) monitor a local waterbody for new introductions of invasive species while also learning about native aquatic plants and animals and their habitats
- The Vermont Public Access Greeter Program and the Lake Champlain Basin Program's Lake Steward Program trains "greeters" to educate boaters, anglers and other recreationists about invasive species, encourage adoption of spread prevention methods, and offer courtesy boat and equipment inspections
- *Roving Aquatic Invasives Decontamination and Education Resource* (RAIDER) Program provides staffed, aquatic invasive species decontamination units at high-priority public access areas as educational and spread prevention tools
- Aquatic invasive species signs are posted and maintained at public boat access points to remind users to practice "Clean, Drain, Dry" spread prevention measures
- Aquatic Invasive Species website, educational materials, and distribution maps are available to provide up-to-date information on aquatic invasive species management, status and distribution
- Wise on Weeds, The Nature Conservancy (for riparian species)
- VT Better Backroads Program workshops

Key Strategies

- Maintain and grow a complete network of VIP programs.
- Establish a complete network of access area greeter programs regardless of local sponsorship.
- Evaluate funding options to support and expand the RAIDER initiative.
- Expand education and outreach coordination with Department of Fish and Wildlife to reach common audiences such as anglers, day users, and out-of-state users.
- Expand audiences that receive invasive species information.
- Expand existing programs to include all taxa, when appropriate.
- Encourage non-regulatory approaches to prevention such as voluntary codes of conduct for road crews and contractors.