

NB Envirothon Study Resources – Invasive Species

Prepared by the New Brunswick Invasive Species Council

Definitions

Invasive species: an organism (plant, animal, disease, or parasite) that has been accidentally or deliberately introduced into ecosystems beyond their native range and whose introduction or spread negatively impacts the environment, economy, and/or society including human health.

Characteristics of invasive species:

1. Species that is non-native to an area/ecosystem
2. Reproduces/spreads rapidly (making them difficult to manage)
3. Negatively impacts the environment, economy, and/or society including human health

Examples (further described below): emerald ash borer, hemlock woolly adelgid, Eurasian watermilfoil, Japanese knotweed, zebra mussels, jumping worms

Exotic: an organism (plant, animal, disease, or parasite) that has been accidentally or deliberately introduced into ecosystems beyond their native range but whose introduction does not necessarily negatively impact the environment, economy, and/or society including human health.

Characteristics of exotic species: a species that is non-native to an area/ecosystem

Examples: tomato plants

Pathways of Invasion

There are many “pathways of invasion” for invasive species, which are ways that an invasive species can be introduced to a new ecosystem naturally or through human activity, including:

- Spreading by wind, floating downstream, and animal dispersal (ex: birds eating seeds and dropping them elsewhere)
- Seeds and plant fragments stuck to hiking boot, tire treads (bikes, ATVs), pets (dogs, horses), recreational equipment, camping gear, and gardening equipment.
- Hitching rides on watercraft (boats, canoes, kayaks, paddleboards) and boat trailers
- Transportation in the ballast water of watercraft
- Movement of firewood, commercial wood imports, and inter-provincial and international shipping
- Introduction as a food source or a game species
- Introduction to get rid of another invasive species
- Release of unwanted pets (ex: rabbits, goldfish, red-eared sliders)
- Dumping of aquarium plants
- Pet and zoo escapees
- Being planted in gardens
- Relocation of infested soil and landscaping materials (ex: gravel)

Impacts of Invasive Species

The arrival and spread of invasive species to an area outside of their native range can cause negative impacts on the natural environment by out-competing native biodiversity and altering ecosystem functioning. Some examples of negative impacts to the environment include the increased predation of native species (alteration of predator/prey dynamics), reduction of resources and space for native species, the arrival of new diseases, and the reduced resiliency of affected ecosystems to withstand extreme climatic events resulting from climate change. They also have negative impacts on the economy, human health, and livelihoods through damage to infrastructure, reductions in agricultural or natural resource yields, decreased ecosystem services (ex: flood prevention), injuries to the public (ex: burns and blisters caused by contact with giant hogweed), and increasing the difficulty of participating in recreational activities (ex: Eurasian watermilfoil reduces fish habitat, impacting fishing opportunities). The economic impact of invasive species in Canada is significant and according to the Government of Canada, the damage from the introductions of invasive plant pests to agricultural crops and forestry alone is \$7.5 billion annually (Government of Canada, 2004).

Invasive Species and Climate Change

When it comes to invasive species, climate change will help to facilitate the introduction of new invasives as well as their spread across the landscape, which combined will reduce the resiliency of natural areas and urban areas as well as negatively impact biodiversity (International Union for Conservation of Nature, 2021). As the climate warms, invasive species that previously were not able to establish in new areas due to survival limitations based on the climate may now succeed and outcompete native species. These climatic changes can also bring the earlier arrival of spring, which can be advantageous to invasive species as they are able to sprout and establish earlier in comparison to native species, allowing them to outcompete native species and form monocultures. (North American Invasive Species Management Association, 2021). Climate change can also increase the frequency and intensity of extreme climatic events such as hurricanes and floods, which can help to transport invasive species to new areas that have been disturbed by these events. These introductions not only leave ecosystems vulnerable to future invasive species invasions, but they also reduce the ability for these areas to withstand the impacts of climate change overtime and the ecosystem services that they provide (ex: alteration of wetlands and floodplains by invasive species can reduce their ability to uptake water, which can increase flood levels during hurricanes).

Examples of invasive species in Atlantic Canada

Emerald Ash Borer

The emerald ash borer (*Agrilus planipennis*) is a small emerald-colored wood-boring beetle that has caused the deaths of millions of ash trees across Canada and the United States since it was first detected in 2002. Originating from Eastern Asia, this forest pest exclusively targets ash trees, including the three species found in New Brunswick: black, white, and green ash. The emerald ash borer (EAB) causes the most damage during the larval stage, when the hatched eggs have become larvae and chew through the cambium layer of the tree that is



1. An adult emerald ash borer. Photo by Debbie Miller, USDA Forest Service, Bugwood.org.

responsible for transporting water and nutrients. Unfortunately, ash trees have a 99% mortality rate 8-10 years after they have become infested with EAB. The loss of ash trees from forest and riparian ecosystems changes the forest structure and functioning, which leads to a loss of habitat for native wildlife, increased ground temperature due to reduced forest canopy cover, and can allow other invasive species to establish. In urban environments, ash trees serve as windbreaks and regulate temperature by providing shelter and shade, and their root structures and leaves can mitigate water runoff and intercept urban pollution. Ash trees are also a culturally significant species for many Indigenous peoples across Canada that use them to make traditional baskets and snowshoes. The loss of ash trees can also have a significant economic impact; as of 2012, the Canadian Food Inspection Agency has already spent over \$30 million to manage the invasion of EAB (Ontario Ministry of Natural Resources, 2012). Although the adults move naturally by flying up to a few kilometers each year, they are commonly spread to new areas through the movement of infested firewood and wood products.

Hemlock Woolly Adelgid

The hemlock woolly adelgid (*Adelges tsugae*) is a small aphid-like insect that was first detected and eradicated in Canada in 2012, and more recently was discovered in southwestern Nova Scotia in 2017. Outside of its native range of Japan, HWA attacks and kills hemlock and some spruce tree species, including the eastern hemlock (*Tsuga canadensis*) that is found throughout the Maritime provinces. The insects feed on hemlock trees by inserting their mouthparts at the base of needles on hemlock twigs to extract nutrients and sap, which leads to the death of a tree in as little as 4-15 years. In infested tree stands, the “woolly” egg sacs can be easily spotted along the new growth twigs of the trees along with premature shoot and needle dieback, thinning tree crown, and discoloration of the foliage. The loss of hemlock trees can have significant negative impacts, including altering the forest structure, reducing habitat and food sources for wildlife, reducing shading of streams in riparian areas which can impact fish habitat, increasing erosion and sedimentation along riverbanks, and increasing presence of invasive species in the newly disturbed areas. Hemlock woolly adelgid can be spread to new areas through the movement of infested firewood and wood products.



2. Hemlock woolly adelgid on tree. Photo by Steven Katovich, Bugwood.org.

Eurasian Watermilfoil

Eurasian watermilfoil (*Myriophyllum spicatum*) is an invasive aquatic plant species native to Europe, Asia, and Northern Africa that was introduced to North America in the 19th century via infested ballast water or the aquarium trade. It has now become widely distributed across the continent, including throughout the Wolastoq River/ St. John River basin in New Brunswick. Although this aggressive perennial plant can reproduce by seed, it is most often spread through fragmentation, which occurs when a single piece of the plant's stem with a node is separated from the main stem by human activity (ex: disturbance by a boat propeller) or through the plant auto-fragmenting. A single plant fragment that is transported to a new waterbody can take root and form a new colony, which highlights the importance removing plant fragments from recreational equipment to



3. Eurasian watermilfoil. Photo by Alison Fox, University of Florida, Bugwood.org.

prevent spreading invasive aquatic plants to other waterbodies. The dense mats of tangled stems formed by Eurasian watermilfoil negatively impacts waterbodies by outcompeting native plant species which reduces plant biodiversity and oxygen levels in the waterbodies and slows waterflow which increases algae blooms and creates ideal habitat for mosquitos. The presence of Eurasian watermilfoil stands can also hinder recreational activities like swimming and boating, as well as severely reduce the value of properties located on infested waterbodies.

Invasive Phragmites

Invasive phragmites (*Phragmites australis ssp. australis*) is a type of perennial reed grass that was transported to North America from Eurasia and is commonly found in wetlands, field edges, and along shorelines. Although invasive phragmites has a closely related native subspecies, it can be distinguished from the native counterpart by the dense stands that it forms (up to 200 stems/m²), the lack of other plant species mixed into the stands, its dense seedhead, and that it can reach heights of up to 5 meters. Identified by Agriculture and Agrifood Canada as the nation's "worst" invasive plant species, this aggressive plant



4. Invasive phragmites patch. Photo by NBISC.

forms dense patches that reduces plant biodiversity by outcompeting native vegetation, reduces habitat and food sources for wildlife, alters wetlands by lowering water levels, and is a fire hazard along roadsides. Invasive phragmites can be introduced to new areas through the accidental spread of seeds and root structure pieces that have become stuck to clothing, pets, vehicles, and equipment (ex: mowers and tools) that have not been cleaned after encountering the plant as well as the deliberate introduction into gardens.

Japanese Knotweed

Japanese knotweed (*Fallopia japonica*) is an aggressive perennial plant native to eastern Asia that was introduced to North America in the 1890's for ornamental gardening and erosion control. Often mistaken for bamboo, this semi-wooden plant can grow up to 3 meters tall and can be identified by its distinct large, ovate leaves with a flat base, and round, reddish-purple smooth stem that resembles bamboo. Japanese knotweed is fast-growing and forms dense monocultures, which takes over natural spaces and is very difficult to control. In the environment, Japanese knotweed outcompetes native plant species for space and resources which reduces local plant diversity and provides little benefit to local wildlife. Controlling the plant is difficult since the vigorous rhizomes and root system can grow a new plant if a 1-inch root segment is left in soil and is strong enough to break through. Japanese knotweed is commonly introduced to new areas through the accidental spread of plant fragments that have become stuck to clothing, pets, vehicles, and equipment (ex: mowers and tools) and well as the relocation of infested soil and landscaping materials.



5. Japanese knotweed. Photo by Tom Heutte, USDA Forest Service, Bugwood.org.

Zebra Mussels

Zebra mussels (*Dreissena polymorpha*) are small invasive freshwater mussels from southwestern Europe (specifically the Black and Caspian Seas) that first arrived in the Great Lakes in the 1980s through infested ballast water that was discharged from ships. They are not currently found in Atlantic Canada, but in 2022 an established population was found in Lac Témiscouata, Québec, which flows into New Brunswick’s Madawaska River and Wolastoq (St. John) River. These invasive mussels range in size from a few millimeters to 4 cm, and per their name have a dark “zig-zag” pattern that resembles the stripping pattern on zebras. Zebra mussels can colonize in densities of up to 700,000 individuals per m² on solid surfaces such as boats, docks, rocks, plants, and native mussels. Since they are filter feeders, large populations of these mussels can over-filter waterbodies, which depletes native species’ food sources like plankton, altering food webs, and creates clear water conditions that allow sunlight to penetrate deeper, increasing the presence of toxic algae blooms and aquatic invasive plants. Since they are capable of heavily colonizing on various surfaces, they can clog vital infrastructure such water intake pipes and can be a health hazard for recreational users as they risk cutting themselves on the razor-sharp shells that litter beaches and waterbodies. While zebra mussels can move throughout a waterbody by free-floating during their veliger life stage, they are often introduced to new waterbodies through accidental transportation by recreational boating equipment like boats, canoes, kayaks, and fishing gear.



6. Zebra mussels. Photo by Dave Britton, US Fish and Wildlife Service.

Jumping Worms

The name “jumping worms” is a catch-all term for 16 species of pheretimoid (“jumping”) worms recorded in North America, including the three most invasive species of jumping worms which are: *Amynta agrestis*, *Amynta tokioensis*, and *Metaphire hilgenforfi*. Originally from east and southeast Asia, they were first found in North America in the 1900s and have spread across Canada through the movement of adults or eggs resulting from human activities including the transportation of cargo or goods, movement of potting soil or plants, and being used as fishing bait. They were first discovered in New Brunswick in 2021, and since then they have also been found in the soil of a houseplant in Nova Scotia. The name “jumping worm” comes from their aggressive thrashing and wiggling, as they “flick” their tail and move quickly through soil and break up material, causing a coffee-grind like appearance in impacted soils. While New Brunswick is home to other non-native earthworm species, jumping worms have a greater negative impact on the environment by changing the structure and nutrient composition of the soil as they consume the top layer of organic material, which reduces plant growth and forest productivity, altering food web and the species composition in forest environments, and creating disturbed areas that increase opportunities for other invasive species introductions.



7. A jumping worm. Photo by NBISC

References

Canadian Food Inspection Agency. (2008). *Invasive Alien Plants in Canada*. Ottawa, Ontario: CFIA.

Government of Canada. (2004). *An Invasive Alien Species Strategy for Canada*. Ontario, Canada:
Government of Canada.

International Union for Conservation of Nature. (2021). *Invasive Alien Species and Climate Change*.
Gland: International Union for Conservation of Nature. Retrieved from
https://www.iucn.org/sites/default/files/2022-04/ias_and_climate_change_issues_brief_2021.pdf

North American Invasive Species Management Association. (2021). *Climate Change and Invasive Species*.
Retrieved from NISAW - National Invasive Species Awareness Week:
<https://www.nisaw.org/climatechange/>

Ontario Ministry of Natural Resources. (2012). *Ontario Invasive Species Strategic Plan*. Toronto, Ontario:
Queen's Printer for Ontario. Retrieved from <https://www.ontario.ca/page/invasive-species-strategic-plan-2012>