A Guide to Invasive Plant Species Planning, Identification and Management on Prince Edward Island, Canada (1st Edition)

Written by the PEI Invasive Species Council

This guide was funded by the PEI Forested Landscape Priority Place for Species at Risk to guide Islanders in monitoring and managing invasive plant species that threaten our environmental, economic, and social well-being.

Sketch by Beth Hoar

Prince Edward Island CANADA

Canada

PEI invasive species council

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Section 1: Introduction

This is the first edition of this guide. We look forward to any suggestions, comments, and feedback you may have as you go through to build and enhance future editions. This guide is meant for all Islanders interested in managing in invasive species, personally or professionally.

Section 1 – Table of Contents:

Garlic mustard, *Alliaria petiolate*, first year plants invading open woodland in Queens County, PEI.

Photo Credit: Green Thumb Photography

1.1: Who is the PEI Invasive Species Council (PEIISC)

The Prince Edward Island Invasive Species Council (PEIISC) is a non-profit group of individuals and organizations focused on the creation of a framework for the management of invasive species that threaten Prince Edward Island's environmental, economic, and social health.

Our council has representatives from federal, provincial, and municipal governments, University of Prince Edward Island, and the community at large who wish to create a framework for the management of invasive species that threaten Prince Edward Island's environmental, economic, and social health.

Our Roles:

a) Assemble the views of a broad range of experts from various levels of government, educational institutions, and the community at large on the management of invasive species.

b) Provide leadership, expertise, and advice on the management of invasive species on PEI.

c) Foster awareness and understanding of invasive species issues on PEI

d) Serve as a respected repository and source of credible information and resources on invasive species in PEI and disseminate this information effectively.

e) Identify gaps in existing knowledge required for effective planning and implementation of invasive species management on PEI.

f) Liaise and partner with other groups and agencies working on invasive species, including, but not limited to government, invasive species councils, and non-government organizations.

g) Identify potential funding opportunities to further the Committee's work

h) Encourage the public, governments, and industry to become active in the prevention, detection and where appropriate, the eradication of invasive species

Visit us our website to learn more about our team and to view a compendium of invasive species relevant to PEI: https://peiinvasives.com/

Chair – Beth Hoar, Retired Biologist/Urban Forester

2022 Staff from left to right: Kassidy (tech), Clay (tech), Erica (coordinator), Laura (tech)

1.2: What is an Invasive Species

According to the World Conservation Union, invasive species are the second leading causes of biodiversity loss globally, only after habitat loss. Limiting the success of invasive species on PEI is crucial in protecting the resiliency of natural ecosystems and the native species that have called this island home for millennia.

An invasive species is an organism that has all three of the following characteristics:

1. It is introduced from outside of its native range.
2. It spreads rapidly.
3. It is harmful to the economy, environment, or our social well-being.

An invasive species can be anything ranging from plants, insects, wildlife, to diseases. Not all introduced species become invasive once they are introduced, and if they do not meet all three characteristics they are known as “exotic species”. The effects of exotic species are mostly unknown until they are introduced, so if you are introducing exotic species to the landscape, it is important to do research on the species beforehand and monitor its spread.

Introduced species have not evolved with our native ecosystems and may outcompete native species due to:

- a lack of lack of natural controls in their new environment (eg. predators, competitors, disease, weather)
- or advantageous traits (e.g. broad habitat requirements, vine-like growth, enhanced seed dispersal, early leaf out).

View our priority list of invasive species in Appendix a or at:

https://peiinvasives.com/pei-invasive-species-plant-list/

Kassidy Matheson, Georgetown, 2021

Celastrus orbiculatus, *Asiatic bittersweet*

Kassidy Matheson, Murray Harbour, 2021

Rosa Multiflora, multiflora rose

1.3: How to Read this Guide

This guide is in it's first edition and will be built upon in future years. It currently contains 27 species. All high priority species on our priority plant list (Appendix A) are included, a select few others have been chosen. The PEIISC has firsthand experience with many of the species mentioned, but there are always new techniques and findings that influence our management decisions. We encourage users to use this guide as a starting point to their planning and reach out to us with any questions or feedback.

This guide works best as an electronic guide, sections link back and forth to one another to ease the reader's experience. Page numbers are included for those who prefer a printed version; however, we ask that you please consider the environment before you print. If at any point you wish to return to the section header, please click the title in the header.

Section four, five and six each have their own table of contents to help you navigate effectively. Species in these tables are listed alphabetically by their scientific name, which is followed by its common name. Species names are highlighted in each section guide with a color that correlates to their status on our plant's priority list:

Priority Species	Need to Understand Distribution
Horticultural	Ubiquitous

The Atlantic Canadian Conservation Data Center (AC CDC) provides the most up to date conservation status rankings for PEI. Throughout this guide you will see these statuses represented by a "S" ranking. Read more here: Species Ranks.

Health warnings are highlighted in section four and five by the diamond symbol on the left. This may not be all encompassing and we encourage you to always do further research yourselves.

This guide is complimented by a spreadsheet that organizes monitoring and management timings visually by timing of year. You are encouraged to view this spreadsheet on our website.

Get to know the sections:

Section 2: Why managing invasive species is important on PEI.

- A word on the current state of our forested lands, on our funder (Forested Landscape Priority Place for Species at Risk (PEI FLPP)) and examples of invasive species impacts on Species at Risk.

Section 3: Planning Guide

- Considerations when managing invasive species to reduce negative impacts, a word on tresspassing, permitting, the importance of monitoring, and understanding the stages of management.

Section 4: Identification

- Written features of the plant and comparisions to lookalike species.

Section 5: Management

- Best management practices to effectivley manage and grow me instead suggestions.

Section 6: Photo Guide

Section 7: Ecosystem Monitoring Lists

- To help narrow down what species you should be aware of when in certain habitats.

Section 2: Why Managing Invasive Species is Important on PEI

Invasive species threaten our ecological, economical, and social health.

- Ecologically they can have irreparable impacts on native ecosystems as they are a leading cause of biodiversity loss globally. Species at risk are particularly vulnerable to these pressures.
- Economically they can reduce harvest quantity, harvest quality, increase fire hazards and increase the need for pesticide applications.
- Socially they can reduce access to recreational areas, decrease property values, reduce access to culturally important species, damage infrastructure and cause bodily harm.

It is important we are aware of these pressures to mitigate these impacts. We appreciate, and want to conserve, our native biodiversity and species at risk as well as livelihoods and recreation areas. Prevention is the most cost effective and efficient way to mange invasive species. Government and organizations across PEI allocate many resources to preventing their establishment as the cost of long-term control is much higher and is less effective.

Section 2 – Table of Contents:

Sketch by Beth Hoar

2.1: The Wabanaki-Acadian Forest Region

Prince Edward Island is part of the Wabanaki-Acadian Forest Region (AFR), which is one of the eight distinct forest regions in Canada. It is located between the boreal and northern deciduous forests; it is a transitional forest featuring trees species from both the northern boreal and southern deciduous forests.

The World Wildlife Fund has recently classified the Wabanaki-Acadian Forest Region as endangered due to the extensive destruction of habitat that has occurred since European colonization. While some Wabanaki-Acadian tree species have been reduced in abundance, the forest still dominates the landscape, and no tree species has been eliminated. In PEI, our forested landscapes have faced dramatic changes that still impact it today.

- PEI's forests are fragmented. Forest fragmentation means forested patches are disconnected from each other. Forest disturbance can occur naturally, but the leading cause of fragmentation is a result of man-made disturbances like roads, housing, and agriculture. Forest plants that become exposed along these edges are subject to higher levels of light, winds, and temperatures. These microclimate shifts change the habitat suitability for certain species. Fragmented forests also endure increased pressure from invasive species, since invasives are usually better adapted to thrive in disturbed habitats.
- Boreal forest tree species are overrepresented in PEI forests. The Boreal Forest naturally experiences more frequent large-scale disturbances (e.g. fire) than the Wabanaki-Acadian Forest, resulting in boreal species being better adapted to these large-scale disturbances and less suited for our changing climate. These trees are less resilient than the historical Wabanaki-Acadian Forest mixed stands and are therefore weaker overall to wind, disease, and insects. As our climate changes these species are likely to be heavily affected and their collapse will leave gaps in our already fragmented landscape.
- Due to historic land use and management, our forests are relatively young. This younger forest makeup creates microclimates that are exposed to higher light conditions, temperatures, and lower air moisture. Historically our forests would be dominated by large patches of old growth species, as large-scale natural disturbances are rare in this region. These old-growth ecologically mature forests were excellent habitats for our native species, and many species have suffered with the sudden shifts of these habitats. Today less than 1% of old growth forests remain in the Wabanaki-Acadian Forest Region.

With these existing pressures, it is especially importance to prevent invasive species from establishing in the Wabanaki-Acadian Forest. Invasive species have their own set of pressures on a forest that compound existing issues and harm our ecological, social, and economic well-being. They:

- Result in the loss of culturally important medicine plants and food.
- Slow down tree growth, kill trees and reduce the quality of lumber and harvests. Forest pests destroy about 400,000 ha of forest every year in Canada, which is slightly less than half of the 930,000-ha harvested annually by the forest industry.
- Result in lost income, infrastructure damage, and recreational opportunities.
- Restrictions on and reductions in commercial activities and related income (sale of products, taxes, etc.) are other impacts produced by forest pests.

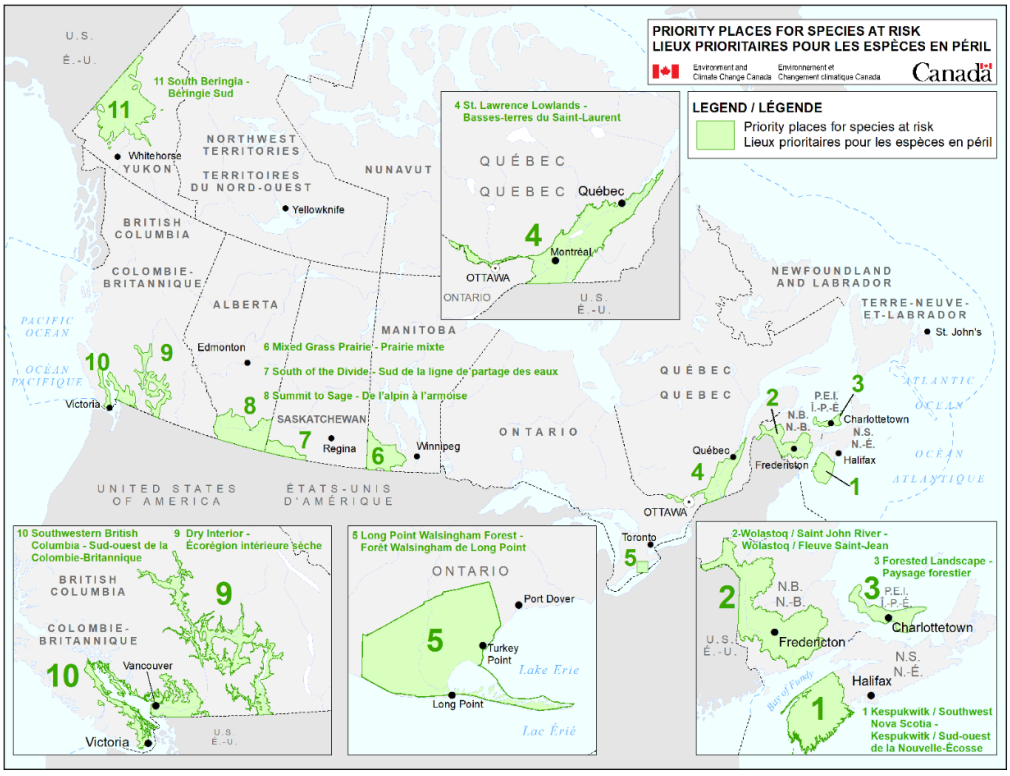
- Result in considerable investments being made towards regulatory controls, scientific monitoring of introduced pests, reforestation, sanitary measures, and, of course, prevention.
- Result in the loss of habitat for our native species.

Read more about the Wabanaki-Acadian Forest on Macphail Woods Ecological Forestry Project's website: https://macphailwoods.org/resources/the-wabanaki-acadian-forest

PEI Forested Landscape Priority Place for Species at Risk

The Forested Landscape Priority Place for Species at Risk (PEI FLPP) was established with the goal of streamlining Canada's approach to effectively conserving habitats for biodiversity and species at risk. This approach is multi-species and ecosystem-based focused. Work is collaborative, with an emphasis on implementation. There are 11 priority places identified in Canada. Priority places are one way that the Government of Canada is implementing the *Pan-Canadian approach to transforming species at risk conservation in Canada*. See the map below to view the priority places that have been identified by provincial, territorial and federal governments. A priority place is an area of high biodiversity value that is seen as a distinct place with a common ecological theme by the people who live and work there. PEI's forested landscape is one of the 11 chosen sites, and forested uplands, forested wetlands, riparian forests and coastal forests & krummholz were identified as forest conservation targets.

Invasive species can have dramatic effects on each of these forest conservation targets identified by the PEI FLPP. The PEIISC shares the goal of protecting these areas on PEI and is grateful to be a partner on this project.



Priority Places for Species at Risk in Canada, Government of Canada

How to Help?

Preserve

- Patches of forest are often connected through tracts of natural areas known as wildlife corridors. They provide animals the shelter they need to move between areas to find the resources necessary to their survival. Protecting these wildlife corridors on your land can help increase the success of vulnerable species.
- The provincial government and partner organizations (e.g. Island Nature Trust, Nature Conservancy of Canada, Ducks Unlimited) can assist you if you are interested in preserving your property using provincial legislation such as the *Natural Areas Protection Act* or the *Wildlife Conservation Act.*

Behaviour Changes

- Stay on trails, when possible, as many native plants are highly sensitive to trampling. Where trampling occurs, hardening and compaction of the soil may also inhibit the spread of root systems. Herbaceous, woody, and grass-like plants are particularly sensitive to trampling, and after being trampled are shown to have reduced size and height.
- Enter with clean clothing, shoes and gear, invasive species are excellent hitchhikers. Plants use several strategies to move to new areas. One such technique is known as phoresy, it is when a seed travels on the body of another, using adaptations such as hooks, barbs, and spines.
- Buy and burn local firewood to avoid transporting invasive insects and diseases over large distances. Visit our PEIISC Don't Move Firewood website to learn more and see a map of commercially available firewood on PEI.

Restore

- Promoting the growth of diverse native plant communities is an excellent way to improve the ecosystem resilience to an invasive species infestation. Collectively six species account for 82% of our Island's native tree diversity, red maple, *Acer rubrum,* white birch (paper birch), *Betula papyrifera,* black spruce, *Picea mariana,* white spruce, *Picea glauca,* trembling aspen, *Populus tremuloides,* balsam fir, *Abies balsamea*.

Increasing diversity in a forest by planting more uncommon native species:

8. Northern red oak, *Quercus rubra* (S3/S4)
9. Yellow birch, *Betula alleghaniensis* (S5)
10. American beech, *Fagus grandifolia* (S3/S4)
11. Eastern hemlock, *Tsuga canadensis* (S3)
12. Ironwood, *Ostrya virginiana* (S2)
13. Red pine, *Pinus resinosa* (S2)
14. White ash, *Fraxinus americana* (S2/S3)
15. Eastern larch (tamarack), *Larix laricina* (S5)
16. Eastern white pine, *Pinus strobus* (S3/S4)

1. Jack pine, Pinus banksiana (S2/S3)
2. Serviceberry spp., Amelanchier spp. (S1 – S4)
3. American elm, Ulmus americana (S3)
4. Large-toothed aspen, Populus grandidentata (S4/S5)
5. Grey birch, Betula populifolia (S5)
6. Stripped maple (moose maple), Acer pensylvanicum (S5)
7. Sugar maple, Acer saccharum (S5)

*17. Butternut, *Juglans cinerea*. It is debated by some whether this is a native species to PEI. The Atlantic Canadian Conservation Data Center lists it as "SNA". Regardless, it is not a harmful species, and it is federally "Endangered". It is threatened by butternut canker, a fungal disease present on the mainland. At this time, PEI forests seem to be a great place to protect this species as our province is considered free of this disease.

2.2: Species at Risk

Our island is home to a diverse community of native flora and fauna that have learned to coexist for millennia. The pressures on these species have dramatically increased in recent years as climate change, habitat loss, and invasive species have exerted themselves on our island. It is important to protect the species that suffer the worst from human influence to protect biodiversity.

All life is interconnected through a system that is intricate and beyond our complete understanding. Losing a species can have untold effects and alter how an entire ecosystem functions. Humans are part of these ecosystems, not separate. Our actions everyday impact these systems whether we are aware of our impact or not and we are impacted by these changes as well.

Have you heard of the windshield phenomenon? It has been observed by many that fewer dead insects accumulate on the windshields of people's cars since the early 2000s. This is attributed to a global decline in the abundance of insect populations caused by human activity. The loss of insects on a global scale is alarming, insects are an incredibly important part of our food web for which all life is dependent. Invasive plant species have contributed to their decline, and so it is important we manage invasive species to protect the integrity of the food web and species at risk.

> For example: An invasive plant species is introduced into your garden through wildflower seed. Birds eat the seeds of your plants, and this plant is deposited in their feces along a river. These seeds establish a population and spreads out of control. Invasive plants reduce the diversity, abundance, and taxonomic richness of terrestrial invertebrates at heavily invaded sites so now the river is no longer suitable habitat for insectivores. A number of PEI species at risk are insectivores including little brown myotis, *Myotis lucifugus*, northern myotis, *Myotis septentrionalis*, eastern wood-pewee, *Contopus virens*, common nighthawk, *Chordeiles minor*, and the olive-sided flycatcher, *Contopus cooperi*. These species will have to move elsewhere as they are susceptible to declines in invertebrate species.

For reasons like this example, invasive species are among the leading threats to native wildlife and species-at-risk on PEI. They displace native species, reduce local biodiversity, alter food-web structures and change how ecosystems respond to disturbance. A single invasive species can weaken these systems and make it easier for other invasives to move in and establish, this concept is called “invasive meltdown”.

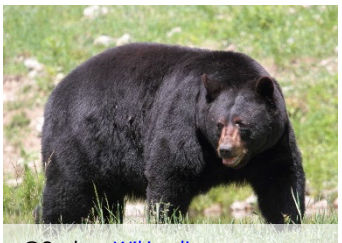
© Nathaniel Sharp, iNaturalist (left)

Common Nighthawk

Federally: Special Concern
Provincially: Critically Imperiled Breeding (S1B)

Species at risk can be regulated at a federal and provincial level in Canada. Currently there are 35 federally registered species at risk found on PEI. To view a current list of federally listed species view: Canadian Species at Risk Public Registry. On PEI, the Prince Edward Island Wildlife Conservation Act includes provisions for the protection of species at risk and their habitats.

1. **Species of Special Concern**
   - A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
2. **Threatened**
   - A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
3. **Endangered**
   - A wildlife species that is facing imminent extirpation or extinction.
4. **Extirpated**
   - A wildlife species that no longer exists in the wild in Canada but exists elsewhere in the wild. (Provincially, we could also say species were extirpated from P.E.I)
5. **Extinct**
   - A species that no longer exists.

Species of Concern	Threatened	Endangered	Extirpated (from PEI)
 @David McCorquodale, cc 4.0	 @Troy McMullin, lichenportal.org	 @Jason Headley, iNaturalist.org	 @Cephas, Wikipedia
Transverse lady beetle, *Coccinella transversoguttata*	wrinkled shingle lichen, *Pannaria lurida*	Little brown bat, *Myotis lucifugus*	North American black bear, *Ursus Americanus*

Examples: Invasive Species & Species at Risk on PEI

Mammal - Little brown bat, *Myotis lucifugus*

© Jason Headley, iNaturalist

Federal Status: Endangered, Summary

PEI Status: Critically Imperiled, S1

ID: Without handling the bat, identification based on external features is unlikely; we do not advise bats being handled. Golden brown fur, lighter underbelly. Juveniles appear darker. Has short ears (compared to other bats) and a fleshy sword like appendage called the tragus is distinctive.

Habitat: Summer maternity colonies primarily roost and raise their young in man-made structures (e.g. barns, church steeples and attics) but also in large tree cavities or under loose bark. Males live apart from females. Large standing dead trees make great bat habitat and bat presence has been shown to increase in forested areas with them present. In later summer – early fall bats swarm together at hibernacula. It is not uncommon to have species mix during this stage. In the fall and winter bats hibernate - they are true hibernators. Not much is known about bat hibernacula on PEI, but they have been known to use old wells and basements in PEI. It is considered likely that most PEI bats migrate to NB or NS to find hibernacula in natural caves and abandoned mines.

Invasive species impact: Changes in forest composition and an increase in insecticide use has impacted little brown bats; however, a single invasive species has severely affected populations across North America. A fungal pathogen that causes white nose syndrome was introduced accidentally from Europe. The syndrome affects bats by waking them up during the winter when they should be hibernating. These awakened bats burn additional energy reserves and end up starving or leaving the hibernacula in search of food but freezing to death. If they survive the winter, they do so with damaged wings and show scarring. It is estimated that hibernating bats declined in population by 90% from this pathogen between 2008 – 2018.

How can you help?

Plant trees to connect forested areas, avoid pesticide use, protect trees and snags, report old well sites to your local watershed group, and report bat sightings to the bat hotline: 1-833-434-2287 (BATS) and on iNaturalist.org. Bats are most likely to emerge at dusk to drink and hunt over water (aerial hawking).

Bats roost in the cavities of large trees, which have become rare in PEI. If you have large trees on your property, particularly specimens that are hallow inside, consider retaining these as wildlife trees.

Resource: Poster – Wild about Bats (Canada Wildlife Federation)

Bird (passerine) - Barn swallow, *Hirundo rustica*


© Ad Konings, iNaturalist (left), © Donna J. Parry, iNaturalist (right)

Federal Status: Special Concern, Summary

PEI Status: Imperiled Breeding, S2B

ID: Deeply forked tail helps you ID as a swallow. Dark blue iridescent head, shoulders and back. Rust colored throat and top of chest, fades to a white belly. When in flight you can see a white band on the tail (top and bottom view).

Habitat: "Before European colonization, Barn Swallows nested mostly in caves, holes, crevices and ledges in cliff faces. Following European settlement, they shifted largely to nesting in and on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts. Barn Swallows prefer various types of open habitats for foraging, including grassy fields, pastures, various kinds of agricultural crops, lake and river shorelines, cleared rights-of-way, cottage areas and farmyards, islands, wetlands, and subarctic tundra." (Government of Canada, 2011)

Invasive species impact: The exact cause of this species decline is unknown but modern farming techniques, declines in insect populations and climate change are all thought to contribute. In addition to these pressures, the barn swallow must compete with house sparrows, *Passer domesticus* for nest site selection. House sparrows are considered an invasive species in Canada, they were first imported from England in the 1850 and again in 1875 due to their known preference for eating caterpillars that fed on agriculture. Unfortunately, their population multiplied out of control. Their fiercely territorial nature has allowed them to take over habitats used by bluebirds, swallows, and other gentle, cavity nesting birds.

How can you help?

Avoid pesticide use. Allow swallows to set up a nest in your outbuildings remember, they have legal protections under Migratory Birds Convention Act. Encourage barn swallows to build a nest by installing "nest cups", they will eat the insects around your home! Make sure to first read about proper nest cup site selection, design, installation and more in this technical guide done by the Ontario Government: Creating Nesting Habitat for Bank Swallows.

If you have barn swallows nesting in/on your barn or structure, contact Island Nature Trust (INT). INT coordinates a Farmland Birds Conservation Program to assist Islanders in protecting and monitoring farmland birds at risk.

Fun fact: Barn swallows make around 1,000 trips back and forth building their nest.

Resource: Provide Nesting Habitat for Backyard Birds

Bird (waterfowl) - Barrow's goldeneye, *Bucephala islandica*

© Karen Steve Smith, iNaturalist (left), © Joanne Redwood, iNaturalist (right)
*Added common name of species to both images.

Federal Status: Special Concern, Summary

PEI Status: Imperiled Breeding, S2N

ID: Diving duck. Goldeneye wings make a characteristic whistling sound. Looks like a common golden eye, Bucephala clangula (S5). The beak of the barrow's is shorter. Distinguish between the males by observing the barrow's has a darker back and a black marking (spur) that extends from the shoulder of the wing down the side of the bird. The barrow's head is blue iridescent, the common's is green iridescent. The spot below the eye of the barrow's is more teardrop shaped (rather than oval). A female barrow's has a beak that is quite orange, and a dark brown head. A common female has a arrange/yellow tipped beak and has a lighter brown head.

Habitat: The eastern population of barrow's goldeneye breeds and nests in Quebec's boreal forest. They migrate to PEI for the non-breeding season and spend time in the coastal waters of the Saint Lawrence Gulf and the Saint Lawrence River/Estuary.

Invasive Species Impact: This species nests in tree cavities (often made by pileated woodpeckers and northern flickers) in remote woodlands near freshwater ponds. Forest harvesting is a threat to this species' breeding grounds. In the fall, winter and early spring large numbers of the population congregate in a few areas along the Saint Lawrence corridor. There has been a reduction in the quality of wintering habitat along the St. Lawrence corridor, stemming from contamination of the river's sediments. On top of all these existing pressures, goldeneyes are experiencing pressures from invasive species. European green crabs, *Carcinus maenas,* are reducing the presence of an important native plant to the Gulph region, eel grass, *Zostera marina.* These crabs are known around the world as ecosystem engineers, they are omnivorous and heavily reduce the populations of mollusks and invertebrates where they are introduced. These green crabs cause damage to the grass when they dig for prey in the sediment or while making burrows as green crab cut the roots of the eelgrass.

How can you help?

Never introduce a green crab (live or dead) to a new area. Support projects where green crabs are removed from natural areas, like this one done by Souris and Area Branch PEI Wildlife Federation.

Resource: Eel Grass Poster – Audubon Society

Fish - Atlantic salmon, *Salmo salar*

© Tom Clenche, iNaturalist (left), Edward Peter, United States Fish and Wildlife Service (right)
*Added lifecycle stage caption to both images.

Federal Status: Special Concern, Summary

PEI Status: Imperiled/Vulnerable Breeding and Non-breeding S2S3B,S2S3N

ID: Identification on Atlantic salmon must address its life cycle as they go through several distinct stages.

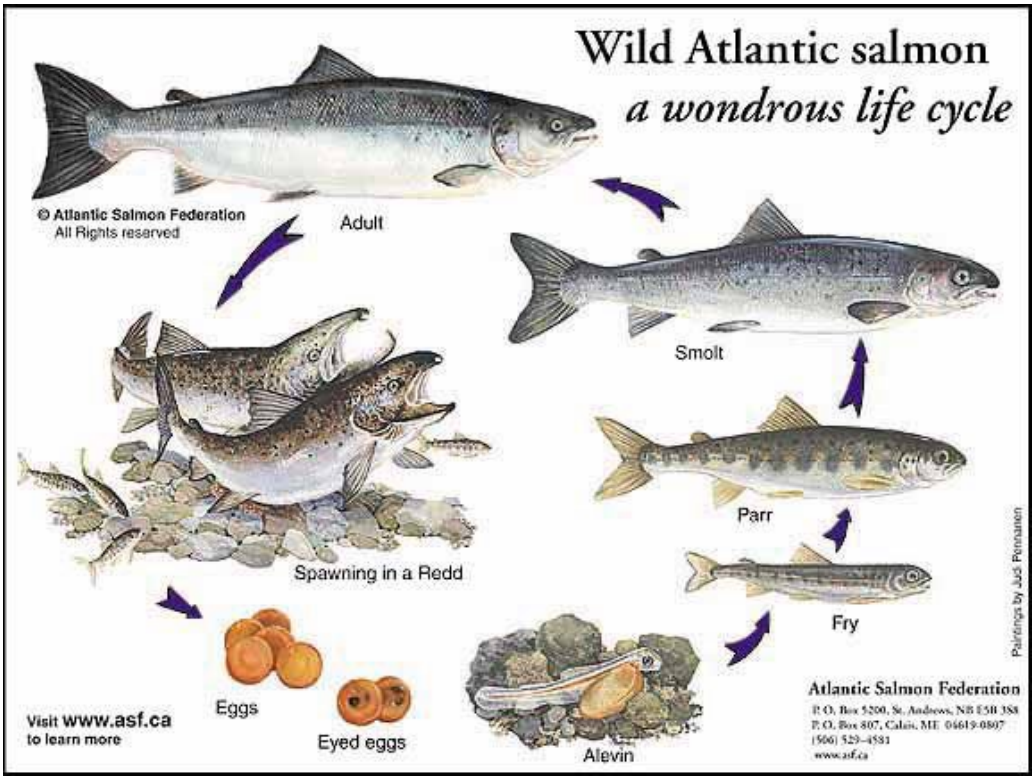


*Diagram by the Atlantic Salmon Federation

We suggest the following resources for those interested in learning more about the life cycle and stages of Atlantic Salmon.

- Government of Canada Life Cycle Poster
- Life Story by the Atlantic Salmon Federation

Habitat: A technical report from the Morell River Management Co-op Inc (1994) states that salmon returning from the ocean remain in pools until autumn when river levels rise, then migrate upstream to find suitable spawning areas. The females select a site with gravel/cobble and good flow so that incubating eggs have enough oxygen. The edge of a pool on the downward side of flow has been reported as a preferred spawning area. Parr use riffle and pool habitats before they migrate to the ocean. Availability of high-quality spawning and rearing habitats are critical (Morell River Management Co-op Inc, 1994).

Invasive species impacts: On PEI in freshwater habitats, Atlantic salmon can be impacted by Invasive Species through changes to riparian areas and through competition from non-native fish including the following species found in PEI: Rainbow Trout, Brown Trout, Goldfish and Brown Bullhead. Rainbow trout are more aggressive than Atlantic salmon and push them out of their ideal microhabitats, resulting in reduced genetic fitness (weight and length) (Aimee Lee S Houde., 2016). Brown trout compete with Atlantic salmon for habitat and food but also may be key predator to juvenile Atlantic Salmon during seaward migrations through estuary and coastal habitats (Fuller, 2022). Goldfish are popular ornamental fish that, when released into freshwater, can impact ecosystems and native fish populations. They significantly alter the habitat in which they live. Koi and goldfish feed on fish eggs, young fish, amphibians, invertebrates, and plants, stir up pond sediments reducing water quality and can spread disease to native wildlife. Invasive plants can also degrade fish habitat by increasing erosion, reducing shade and macroinvertebrate health (as is the case with glossy buckthorn, *Rhamnus frangula*). Some plants can even dry up systems by altering hydrological flow, yellow flag iris, *Iris pseudacorus.*

How can you help?

- Before getting a new pet, do research into what a commitment it will be. If you need to rehome a pet, don't release them into natural systems, it is cruel to the environment and the animal. Consider returning it from where you purchased, rehoming (the PEI Humane Society will even take fish), or, if all else fails, have a veterinarian humanely euthanize the animal.
- Don't introduce fish to new waterways for sport fishing. If you are using live bait, dispose of it by dumping it on land at least 30m from the waters edge, in your waste bin or freeze them for use another day.
- Introduce native plants to your garden and avoid exotic plants unless you have done research specifically on its growth habits and consulted PEIISC's priority plant list.
- Clean, drain and dry your boat to avoid bringing invasives to new areas!
- Learn to identify Atlantic salmon from other salmonids in PEI streams. Keep up to date with PEI's angling information on fishing regulations around Atlantic salmon on PEI.
- Support watershed organizations doing important work to protect salmonid breeding habitat on PEI. Visit the Watershed Alliance to learn which organization your area is managed by.

Resources:

- A Renewed Conservation Strategy for Atlantic Salmon in Prince Edward Island
- The Salmon Hub by The Atlantic Salmon Conservation Foundation
- Invasive Species in Our Waters Activity Book (Canadian Council on Invasive Species)

Fish Plate Credit: Knepp, Timothy, United States Fish and Wildlife Service.

Insect (bumble bees)

Yellow-banded bumble bee, *Bombus terricola*

Suckley's cuckoo bumble bee, *Bombus suckleyi*

Gypsy cuckoo bumble bee, *Bombus bohemicus*

© Liz Osborn, iNaturalist (left), © Cory Sheffield, iNaturalist (middle), © Erland Refling Nielsen, iNaturalist (right)
*Added common name of species to all three images.

Yellow-banded bumble bee
Federal: Special Concern, Assessment
PEI Status: Vulnerable, S3

Suckley's cuckoo bumble bee
Federal: Threatened, Assessment
PEI Status: Possibly Extirpated, SH

Gypsy cuckoo bumble bee
Federal: Endangered, Summary
PEI Status: Critically Imperiled Uncertain, S1?

ID: Bumble bees are large, fuzzy insects with short, stubby wings that usually are clear with black veins. Take many photos when trying to ID a bumble bee as they tend to curl and hide ID features! Sexes look different from one another, the easiest way to differentiate between is by counting the segments in the antennae (12 in females, 13 in males).

The yellow-banded bumble bee females have stingers (males don't) and a pronounced structure called a pollen basket on their hind legs (only female bumble bees collect pollen, all worker bees are female). When this basket is empty, they are shiny. When the basket is full, it is even more visible, as seen in the top left picture. Yellow-banded bumble bee females can be queens or workers, they look similar but differ in size with the queen being larger at 19-21 mm, and a worker at 10- 15 mm. They have black heads, their thorax is yellow on its front part which extends to the second or third section of its abdomen, and the rest is mostly black except for the fifth abdominal segment which has brown fringes. Males are smaller, 13-15 mm, look similar but can have a few yellow hairs on face and they have less yellow on their thorax.

Cuckoo bumble bees, like the Suckley's or Gypsy, are nest parasites. They do not produce a social colony of their own and rely on social bee species to raise their young. Since they have no workers or hive to provide for, they do not have pollen baskets. Suckley's cuckoo bumble bee females are 15–25 mm and have black faces and heads, sometimes with some yellow hairs on top. Their thorax is typically yellow on both the front (anterior– before the wings) and back (posterior-behind the wings) half and they have a distinctive bar of black hairs across where the wings meet, this line of black hairs can extend vertically at varied lengths to the back end of the thorax. Their abdomen is mostly black with some yellow fringes separating the segments, this makes them look black with yellow stripes. Males have a similar color pattern but have more yellow on the abdomen and are 15-22mm. Gypsy cuckoo bumble bee females are 17 - 18mm and have black faces and heads, occasionally with a few yellow hairs on top. Their front part of their thorax (anterior – before the wings) is typically yellow and varies from yellow to black on

the remaining half. This species is often mistaken for other species, the hairs on the back end of the abdomen are usually white or at least white tipped in the middle of the fourth segment. Males are 12-16mm and have a similar colour pattern, except for the white hairs on abdomen. They may be confused for other species and if so, may require a specimen to be examined by an expert.

Habitat: "Yellow-banded Bumble Bee is a habitat generalist within open coniferous, deciduous and mixed-wood forests, wet and dry meadows and prairie grasslands, meadows bordering riparian zones, and along roadsides, in taiga adjacent to wooded areas, urban parks, gardens and agricultural areas, subalpine habitats and more isolated natural areas. Like other bumble bees, the Yellow-banded Bumble Bee is a generalist pollen forager and has been collected from a wide variety of plant species. Queens overwinter, typically by burrowing in loose soil or rotting trees (Benton 2006). Yellow-banded Bumble Bees nest underground (Laverty and Harder 1988), often in abandoned rodent burrows located at depths of 15 to 45 cm with downward sloping entrances (Hobbs 1968; Plath 1927). Nest sites have been located in old fields (Harder1986)." (Government of Canada, 2015). The Suckley's and Gypsy cuckoo bumble bees both use yellow-banded bumble bees as a host species and so can be found wherever they can be. They are presumed to over winter the same way as well.

Invasive Species Impact: Native bumble bee species across Canada are in decline, including yellow-banded bumble bees which was once considered the most widespread native bumble bee in North America. Many things are contributing to their decline: habitat loss, pesticide use, disease, and competition from non-native bees. The introduction of the Common Eastern Bumble Bee, *Bombus impatiens,* to Atlantic Canada and BC for pollination services has impacted native bees. It is possible it has resulted in competition for nesting habitat and resources but most impactfully it has increased the frequency of native pathogens across the yellow-banded bumble bee's range. This pathogen spillover is considered to have a major threat on populations. The increased use of insecticides to control invasive insects can have a direct impact on the health of bees as some are lethal depending on the chemical and concentration. "Various life history traits of the Yellow-banded Bumble Bee (such as large body size, early emergence and long colony cycle) may make it more vulnerable to accumulation of pesticides in the colony compared to other species at local scales." (Government of Canada, 2015). Cuckoo bumble bees are impacted by the decline of these factors as well as the decline of their host species.

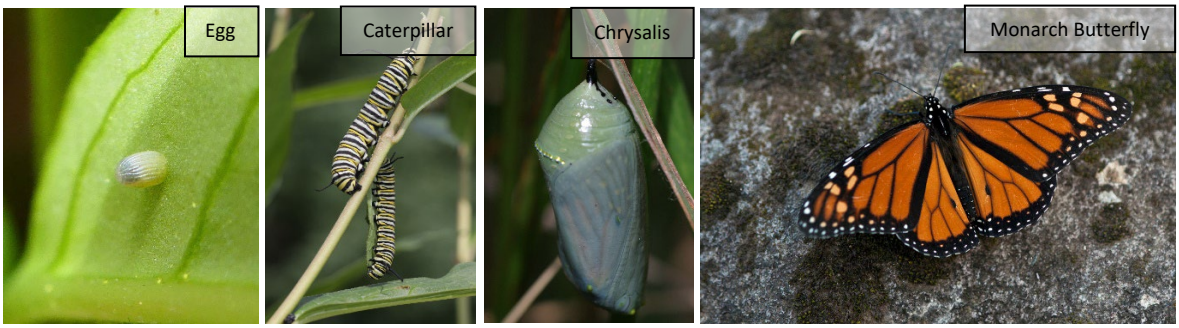
How can you help?

Avoid pesticides, do not introduce unproven biocontrol agents, welcome bumble bees to your landscape and plant native species! Do not plant wildflower seed mixes, these mixes are often full of invasive species that decrease suitable habitat for native species and increase the need for pesticide use.

Resources:

- Selecting Plants for Pollinators A Guide for Gardeners, Farmers, and Land Managers In the Prince Edward Island Ecoregion (Pollinator Partnership Canada)
- Bumble Bee Watch (Wildlife Preservation Canada, The Xerces Society for Invertebrate Conservation, Faculty of Environmental Studies, York University)
- Garden Habitat Certification (Canadian Wildlife Federation)

Insect (butterfly) - Monarch, *Danaus plexippus*



© Green Thumb Photography

Federal Status: Endangered, Summary

PEI Status: Critically Imperiled Non-breeding, S1B

ID: The monarch has four life stages: eggs, caterpillar, chrysalis, and butterfly. As a butterfly, it is large with predominantly orange wings. It is outlined by a black border that has two rows of white spots. At this stage it can be confused with another native species, the Viceroy (native species, S4). The black line that cuts through the hind wings of a viceroy is a helpful differentiating feature. The monarch caterpillar is distinctive, with white, yellow, and black-bands and two large black filaments. The chrysalis is green and gold but turns translucent when the monarch approaches emergence. The eggs are very small, 1mm long. They have a blunt base and a pointed top.

Habitat: Monarchs migrate thousands of kilometres from their southern wintering grounds to its northern range, arriving in PEI as early as May/June. Several generations will be born, breed and die here over the summer (summer generations have a shorter life span than the migrating generation) before they make their way south again. Milkweeds are the only source of food for caterpillars, on PEI we have one native species of milkweed. Swamp Milkweed, *Asclepias incarnata*, it is ranked as an imperilled species in our province. Swamp milkweed can be found in marshes, swamps, and other open wet sites, including gardens where people are intentionally creating habitat for monarchs.

Invasive Species Impact: Monarchs are particularly vulnerable in their wintering grounds as they are concentrated in large numbers and threatened by deforestation. In their breeding grounds, here in North America, herbicides and the decline in milkweeds is a significant threat facing monarchs. Unfortunately, finding the already elusive milkweed is made even harder for monarchs because of an invasive species known as the dog-strangling vine, *Vincetoxicum nigrum* and *Vincetoxicun rossicum.* Monarchs have been known to accidentally lay their eggs on these species, mistaking it for milkweed. This mistake results in their young dying as it is not a viable food source for caterpillars. We are lucky to have had no reports of this plant yet on PEI, but it is in neighbouring provinces.

How can you help?

Plant our native swamp milkweed, plant native wildflowers, and avoid pesticide use.

Resource: Planting for Butterflies (Canada Wildlife Federation)

Insect (lady beetle) - transverse lady beetle, *Coccinella transversoguttata*

© Jason Headley, iNaturalist (left), © rsealy, iNaturalist (right)

Federal Status: Special Concern, Summary

PEI Status: Possibly Extirpated, SH

ID: "Transverse Lady Beetles are small, round beetles (5.0 to 7.8 mm) that are native to North America. Adults have orange to red wing covers with black markings, consisting of a black band and four elongate spots, which distinguish them from other species." (Government of Canada, 2016).

Habitat: "Transverse lady beetles are habitat generalists, primarily feeding on aphids and occurring across a wide range of habitats. This lady beetle inhabits agricultural areas, suburban gardens, parks, coniferous forests, deciduous forests, prairie grasslands, meadows, riparian areas, and other natural areas." (Government of Canada, 2016). "Overwintering adults tend to aggregate in well ventilated microhabitats such as under stones, rock crevices, in grass tussocks, in leaf litter, or in tree bark (Hodek and Honěk 1996; Hodek et al. 2012). Larvae tend to be located in habitat with an abundance of prey." (Government of Canada, 2016)

Invasive Species Impact: Transverse lady beetles were once the most common and widespread lady beetles in North America and played an important role in aphid control. The exact cause of their widespread decline is unknown; however, habitat loss, pesticide use, and the introduction of invasive lady beetles may have contributed to the decline. The multicolored Asian lady beetle, *Harmonia axyridis*, is an invasive lady beetle species that predates on, competes with, and introduces disease to our native lady beetles. It was purposefully introduced in the 60's by the U.S government who intended to use them to control agricultural pests. Unfortunately, its population became uncontrollable, it is present in PEI and has established a widespread population. On top of harming our native lady beetles, it has been known to negatively impact fruit crops and invade homes seasonally.

How can you help?

Avoid pesticide use, transverse beetle habitat is closely related to availability of food sources. Identify lady beetles in your garden and report any sightings on iNaturalist (this species has not been reported in PEI for many years).

Resource: Webinar: How to Nature Journal Bugs! (Nature Journaling with Marley Peifer)

Plant (herbaceous) - beach pinweed, *Lechea maritima*


© Colin Chapman-Lam, iNaturalist (left), © Larry Chen, iNaturalist (right)

Federal Status: Special Concern, Summary

PEI Status: Imperiled, S2

ID: A herbaceous perennial, its branches grow along the ground. It is densely leaved along the stem, with dull green leaves that are whorled. Each plant has 4-5 erect, heavily branched, flower stalks that are 20 -35cm tall. They flower mid-late summer but are inconspicuous. Each flower has 3 short-lived reddish-brown petals. It looks similar to narrowleaf pinweed, *Lechea intermedia.* Can be differentiated as *L. maritima* has smooth seeds and dense white hairs on the underside of its basal leaves.

Habitat: "Beach Pinweed is found only in coastal maritime sand dunes that are stabilized (largely covered by vegetation). It is usually found in sand in open, dry habitats." (Government of Canada, 2008). "Beach Pinweed is frequently found in association with beach heather, a low shrub that forms locally dominant and sometimes extensive patches. Beach Pinweed is also found locally in open jack pine-red pine woodland on old dunes, but these populations are small and are limited to the most open woodland." (Government of Canada, 2008)

Invasive Species Impact: Heavy storm activity resulting from climate change is likely to have a serious negative impact on beach pinweed. Recreational activity has also impacted this species as it is an inconspicuous species that could be trampled by those walking in dunes or operating all terrain vehicles. As small, pocketed populations of this plant exist in our province it is important for the future of beach pinweed we prevent invasive species from outcompeting them and contribute to it's decline. Species like Japanese knotweed can establish in dunes and contribute to erosion since their annual stems die back after the growing season and expose the shoreline to winter conditions. White sweet clover, *Melilotus albus*, is another dune invader that threatens beach pinweed habitat. Stable dunes full of native species will help prevent increased pressures felt by this species.

How can you help?
Stay out of dune systems, always walk along trails to reach the beach.

Resource: Management Plan for the Beach Pinweed (Lechea maritima) in Canada (Government of Canada)

Lichen - Wrinkled shingle lichen, *Pannaria lurida*

© Colin Chapman-Lam, iNaturalist (left), © laurenaarts, iNaturalist (middle), © Dwayne Sabine, iNaturalist (right)

Federal Status: Threatened, Summary

PEI Status: Critically Imperiled, S1

ID: The Wrinkled Shingle Lichen, Pannaria lurida, is a leafy lichen forming patches or rosettes that can be up to 10 cm across. It almost always grows on the trunks of deciduous trees. The upper surface is brownish grey and wrinkled.

Habitat: "The Wrinkled Shingle Lichen in Nova Scotia and New Brunswick colonizes mature deciduous trees, most often Red Maple that grow near, but not usually within, imperfectly drained habitats. Hence, this lichen is found on trees close to the edge of treed swamps or floodplains. The only occurrence on Prince Edward Island was on Cedar while the ones in Newfoundland are on White Spruce growing in an unusual habitat on cliffs close to the sea." (Government of Canada, 2016).

Invasive Species Impact: The deforestation of large deciduous trees with rough bark is a serious threat to this species due to a loss of its host, as well as changes in microclimates. A reduction in the frequency of rain events due to climate change is another pressure on this species. Invasive species can add to these pressures by increasing deforestation and microclimate shifts. The Asian longhorned beetle, *Anoplophora glabripennis*, is an invasive insect that can lead to large-scale, rapid deforestation. *A. glabripennis,* favours maple species which is one of the main species colonized by the wrinkled shingle lichen. Luckily for this lichen, it has been eradicated from Canada. Invasive plant species like Asiatic bittersweet, *Celastrus orbiculatus*, can create dramatic shifts in forested microclimates. Once this woody vine gets a foothold in edge habitat, it spreads outward into the forest killing and toppling large trees under its weight. It works continuously in waves, opening the canopy and increasing light conditions.

How can you help?

Preserve native species on your property and monitor trees for pests, familiarize yourself with the identification of this species so that you can help report sightings.

Resource: Why is lichen important? (Video: Ecosapien)

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Section 3: Planning Guide

Section 3 – Table of Contents:

Staff out monitoring for invasive species using PEIISC surveying sheets.

Staff mapping yellow flag iris patches for benthic mat installation.

3.1: Planning for Wildlife, Native Plants and Species at Risk

Invasive species management can be conducted year-round; however, it is important to always consider how specific management timings can impact native species. The best management strategies use a combination of techniques based on the species being managed and the environment in which they are being managed. For a complete listing of species at risk on PEI to watch for and consider in planning visit: https://naturepei.ca/species-at-risk-on-pei/sar_list/. This list of considerations is not exhaustive, we encourage any suggestions for future editions of this guide.

Birds - Am I disturbing nests?

- General nesting season on PEI runs from mid-April to late-August. Under the Migratory Birds Convention Act, the nests of all migratory bird species are protected when they contain a live bird or a viable egg (so generally during the nesting period).
- See "Nesting Periods" website: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html)
- Walk on cleared ground when possible to avoid trampling ground nesting birds.
- Avoid disturbing plant species known to be popular hosts for nesting birds. Consider the specific plant species you will be removing, it's best to remove favored species outside of the nesting season or chose control methods that are not invasive, like girdling.
    - Multiflora rose, blackthorn, buckthorn, and even giant hogweed are known as popular nesting hosts. If you must conduct work, walk the site first carefully and flag any areas to avoid and work slowly.
- Some birds nest in grasslands, which include agricultural fields like hay fields. One such species is the bobolink, *Dolichonyx oryzivorus*. This species arrives as early as May, it is important if you are going to manage invasive species in nesting habitat to leave their young time to fledge. An appropriate time to conduct this type of management would be mid-July.
    - The bobolink is a species at risk that is listed federally as a species of special concern. On PEI it is considered to be an imperiled breeding population (S2B).
    - The Island Nature Trust has an excellent video summarizing the challenges faced by the bobolink on PEI which can be found here: Bobolink – A Migratory Marvel and they also have an excellent factsheet as well: Bobolink Factsheet.

Fish

Will the work I do impact fish?

- Vegetated streamside (riparian) zones are important components of healthy fish habitat. These areas improve water quality by minimizing sediment and chemical run-off from reaching the river, stabilize banks minimizing erosion, shade the river helping to maintain healthy water temperatures and provide food sources for aquatic ecosystems.
- If you are working within the legislated 15m buffer zone of a watercourse, stream or wetland, a permit is required to complete any work (see section 3.3 for permit information). Given the importance of these habitats, we recommend that you reach out to your local watershed group (www.peiwatershedalliance.org) and the PEI invasive species council for guidance and support.

- Minimize actions that deposit sediment into the waterway or cause bank erosion. Silt can clog fish gills, smother fish eggs and harm macroinvertebrate populations as well as negatively change habitat conditions such as filling pools and widening streams.
- Be mindful that water flows downstream and for considerable distances so work in the vicinity of a watercourse can impact fish habitat.
- In riparian zones, prioritize invasive species management techniques that encourage bank stabilization and reduce erosion. Many types of invasive plant species are responsible for increased erosion rates but with responsible management we can return siltation rates to natural levels.
- Be mindful when walking in streams to avoid fish spawning and juvenile habitats. It is important to avoid walking in streams during certain periods to protect species such as Atlantic Salmon and Brook Trout and their eggs and alevin to ensure population stability.
    - Brook trout spawn in rivers with good flow, and shallow loose gravel. Redds are saucer shaped in appearance. In the warmer months those that stay in freshwater take refuge in spring fed ponds where waters are cooler.
        - Brook trout life cycle in substrate: Can begin spawning as October to late December. From November to January, eggs incubate in redds (fish nests). These eggs begin to hatch in late February into early March and hatch into alevin, which are small trout with an attached yolk sac. They stay in the substrate until fully absorbing their yolk sacs. In June and July, the young have emerged and are swimming around in the stream.
    - Atlantic salmon spawn in rivers with good flow, with gravel or cobble. A redd is usually a square meter in size or larger and are elongated.
        - Atlantic salmon life cycle in substrate: Once water levels rise in the fall Atlantic salmon enter streams. In late October to early November, they lay their eggs. The eggs hatch into alevin in the spring and remain in substrate for 2-6 weeks until they have absorbed their yolk sac. They typically emerge from the substrate as fry in late May to early June.
- Avoid removing all vegetative cover at once - even if it is a monoculture of invasive species. Work strategically in patches and re-plant each year with native fast-growing species. This is important as vegetation provides the cover needed to protect water temperatures from direct sunlight and aquatic life from predation. Riparian zones also act as wildlife corridors in our fragmented landscape and so wildlife cover should be carefully considered. This might mean that invasive species management might take a few more years to accomplish desired goals.
- Don't release non-native species into local waterways including fish, invertebrates, vegetation, and substrate. Be mindful when moving between systems to not move invasives and non-native species.

Native Plants

- Will the work I do have a negative impact on native plant species?
    - It is important to preserve native plant species whenever possible. The presence of native plants increases the likelihood of long-term control efforts at a management site. Consider they population density at the site before starting, determine if it is a monoculture or if there are native plants interspersed. Determining this will help you decide on choosing a selective or non-selective approach.
        - A selective approach is something that carefully targets just the invasive species present and does not directly negatively affect the other species present.

Selective Example: Digging the roots of an invasive plant out by hand.

- A non-selective approach is a more aggressive choice that kills all species in the target area. It is usually best to decide against this strategy unless it is a monoculture. Native species at risk must never be destroyed.

  Non-selective Example: Tarping invasive species.

- Walk the management site before management begins and flag any rare plant species to ensure they are not disturbed in the management process.

3.2: Trespassing on PEI

The PEIISC recommends that you survey and manage only the properties that you have permission for. On PEI, people can access forested places for any reason provided there is no posted signage indicating that the land is private property, no fence, and you have not been given verbal notice to stay away. This access is yours to enjoy if you do not engage in disorderly conduct, disturb the property owner's privacy, or operate a motor vehicle unreasonably while on the unmarked property. While legally you may be able to access a forested area, you may not be welcomed there. It is important to be aware of provincial trespassing laws while surveying. Even if you are within your rights, it is always a good idea to ask for permission to survey where possible. You should also note that in some areas, municipal bylaws may have different regulations from provincial laws. Municipal bylaws may outline a stricter set of rules for property access. Respecting privacy and asking first before entering a privately owned area is the best course of action.

If you know that you are on private property, it is your responsibility to limit any disturbance caused by your presence. Never undertake management here without the express permission of the landowner.

For the most up to date information, review applicable provincial legislation here: Trespass To Property Act (princeedwardisland.ca)

3.3: Permitting on PEI

This list of permits is not exhaustive and may not be sufficient for the type of work you are undergoing. The permits listed below are the two most commonly associated with invasive species work and used by the PEIISC.

To read more about "Environmental Management and Protection Permits" visit this provincial page: https://www.princeedwardisland.ca/en/topic/environmental-management-and-protection-permits

1. Watercourse, Wetland and Buffer Zone Activity Permit

In PEI, you will need an activity permit if you wish to conduct work in a watercourse, wetland, or 15 m buffer zone on or near your property. Unauthorized changes made to a watercourse, wetland or buffer zone may result in damage to the environment, water quality, infrastructure, and property.

Apply for a permit here: https://www.princeedwardisland.ca/en/service/apply-for-a-watercourse-wetland-and-buffer-zone-activity-permit

** Watershed groups receive a blanket permit each year so that they can work on a select list of pre-approved invasive species along a buffer zone. If you work for a watershed, it is important to understand each year what species you have the right to remove and which you need to apply for a "Watercourse, Wetland and Buffer Zone Activity Permit" for. The PEI Watershed Alliance issue's this permit to watershed groups each year and is the contact for any questions or suggestions relating to this.

2. Special Waste Disposal Permit

If you are disposing of more than a half-tonne trucks worth of invasive species, it is important you receive a special waste disposal permit. Upon receiving it you will be directed to the appropriate disposal facility.

This permit can be issued for a one-time use or seasonal use. This permit number will be requested at the disposal facility. If you are a conservation organization and would like to learn more about this permit, please reach out to us at the PEIISC as there may be existing permits that cover your work.

Apply for a permit here: https://www.princeedwardisland.ca/en/information/environment-water-and-climate-change/special-waste-disposal-permit#:~:text=%2425%20is%20the%20fee%20for,HST%20is%20not%20required

*To learn more about disposal please visit Island Waste Management Cooperation's website at IWMC.pe.ca and use the disposal guide and typing in "Invasive Species".

3.4: Monitoring

Monitoring: To observe and check the progress or quality of something over a period of time.

Monitoring for invasive species is essential work that helps us understand distribution and make appropriate management decisions. Information gathered will help drives important future project work that promotes a resilient ecosystem. Monitoring can be done opportunistically or strategically, both types of surveying have their benefits and are worth implementing in your annual plans.

Systematic monitoring can be done by anyone but is most often done by groups that have an obligation to detect invasive species, they are usually focused on high priority target areas (PEIISC, CFIA, Parks Canada, etc.).

- Pros: Is repeatable and done over a period of time so that invasives that may the area will be caught quickly. Appropriate time will be set aside for details that may help get a fuller picture.
- Cons: Needs to be planned for and requires dedicated time set aside.

If you plan to conduct systematic monitoring the PEIISC would love to hear from you and share our protocols and **data sheets** for your interest. Please contact us to find out more if you are interested.

Opportunistic monitoring is done when individuals or organizations come upon invasive species when they are conducting other work (recreationalists, watershed groups during stream clearing, etc.). Individuals who report invasive species are known as “Citizen Scientists” they are given this title as the reports they submit is important in the research of invasive species.

- Pros: Covers a larger area, can be done year-round.
- Cons: Is not repeated the same way each year to check the sites progress overtime. Reporters may be distracted and not thinking about it or find the time in their activities.

The PEIISC encourages the sharing of invasive species data so we can all benefit from its collection. We are in the process of gathering data from conservation organizations and combining it with PEIISC data. We expect to soon have it all data entered and visible on a public data base called EDDMapS (read more about this platform in the next section).

If you are part of a conservation organization that gathers data throughout the season using your own format (besides EDDMapS), please consider sharing your sightings with us. We can keep reports confidential when necessary and we will gladly accept data in any format, whether its is a few entries via email, a shape file or a spreadsheet formatted in your own way. If you do not currently have a method in which you organize your sightings, reach out to us to get a copy of the spreadsheet we use for our bulk data uploads.

3.5: How to Report Sightings

Understanding how invasive species are distributed across the land helps islanders make effective management decisions. It is important to have an early detection and rapid response to new invaders and strategic on-going plan for those that are well established. Public reporting of sightings is crucial to these efforts, so much so that those who make reports are known as “Citizen Scientists”.

The PEIISC accepts reports in any format. We always ask that you provide three simple details to us when doing so: the name of the species, its location, and photos for confirmation.

We accept these reports through email and Facebook messages and especially encourage doing so when you have questions or special concerns about an invasive you would like to discuss with our team.

In general, we encourage citizen scientists to make reports on EDDMapS, which is a public reporting tool and database that stands for “Early Detection and Distribution Mapping System”. It is available online and through app stores, with more features available online (ie: distribution maps). Every report made to this platform is verified before our staff before being published. EDDMapS also takes in data from other reporting systems like iNaturalist, so we don’t miss out on any important sightings. If you prefer to use iNaturalist that is an excellent choice as well, your reports will periodically be transferred over to EDDMapS if they have reached the status of “research grade” (an iNaturalist rating). Visit EDDMapS.org to learn more or download the app today.

Photographing Plants for Identification

It is always important to attach an image when making a report so that the PEIISC can positively identify your sighting. Plant identification can be tricky, our staff and council members are experienced and will be able to identify most images sent along; however, it is always helpful to have several photos when identifying. While we have some suggestions to consider, we encourage you to not let these suggestions hold you back from submitting your report as even one photo can be enough. **Be careful handling unknown plants, some may have secretions that may result in skin reactions with even minimal contact.**

- The plant (as a whole)
- The inflorescence (flower structure) or fruit
- The stem and/or bark
- The leaves (ideally the front and backside & placement along stem)
- The surrounding area
- Roots

woodland angelica, *Angelica sylvestris* photos

3.6: Management Stages

There are four stages of management*:* prevention, eradication, containment, and long-term control. If an invasive species introduction is caught early and the appropriate management actions are taken in a timely manner, eradication efforts are possible, and it is an efficient use of resources. However, management decisions become more complicated as time goes on.

The "Invasion Curve" in Figure 1 explores the rate of economic return in relation to time a species goes unmanaged. Cost increases and goals shift as the species becomes established. Long-term control efforts are costly on an economical, environmental, and social scale. The importance of preventing and catching invasive species early cannot be overstated, especially in a province that depends so heavily on natural resources.

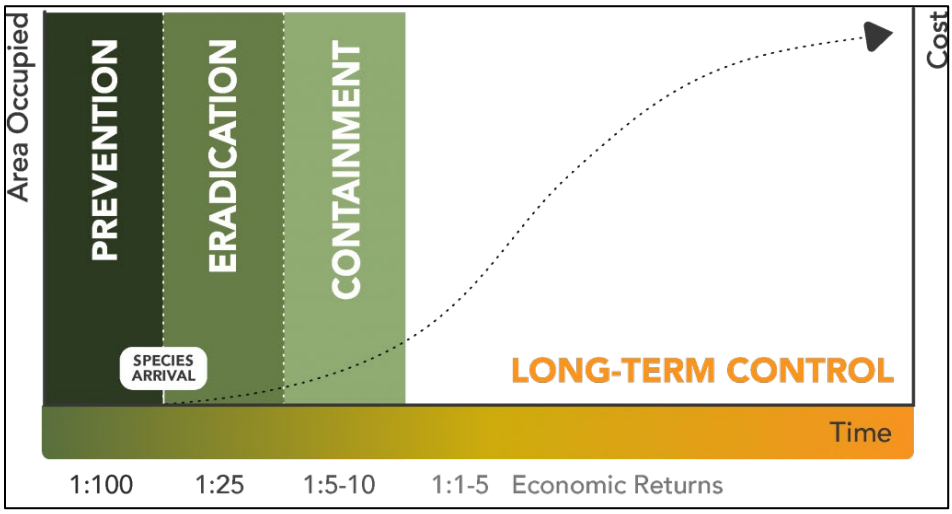

Photo Credit: The Invasive Species Center https://www.invasivespeciescentre.ca/learn/invasion-curve/

Figure 1. Invasion Curve

Prevention: Public awareness is the goal. Invasive species can be introduced by humans both accidentally and intentionally. Raising awareness around important behaviour change campaigns is the most cost-effective solution. There are five main behaviour change campaigns in Canada, they are known as take-action programs: "Be Plant Wise", "Play, Clean, Go", "Clean, Drain, Dry", "Buy Local, Burn Local", and "Don't let it loose".

- To read more about how you can make changes to prevent invasive species introductions please visit the "Take Action Programs" on the Canadian Council on Invasive Species page: https://canadainvasives.ca/programs/
- If you are an organization interested in promoting these "Take Action Programs", please reach out to us to express your interest and we will send along a maritime partner toolkit!

Eradication: Removing a species population in its entirety is the goal. This can usually be done if a species is localized.

Containment: Reducing further spread. If a species has established a population that is unlikely to be eradicated, the goal shifts next to containing the species to prevent further harm.

- Example: In urban areas there are many horticultural plants that are considered invasive once they escape into natural areas. It is prudent to survey these natural edges to prevent establishment in natural areas.

Long-term control: Eradication is unlikely to impossible, and we instead focus on limiting populations and protecting remaining resources.

- Example: Japanese Knotweed is a species on PEI that is at this management stage. It is an invasive species with an enormous impact and is certainly worth controlling areas that are most vulnerable. The reality is resources are limited, work must be based on the individual or organizational priorities. Conservation organizations must prioritize work in sensitive natural areas, whereas landowners may decide to prioritize management to protect their infrastructure.

Upcoming: Edition 2

In the second edition of this guide, this planning section will be built upon and include information on biosecurity, personal safety, site recovery, tools, and how to develop a field management plan. If you have any other suggestions you would like to see covered, please reach out to us.

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Section 4: Identification Guide

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- *Acer pseudoplatanus,* sycamore maple
  - Type: Large deciduous tree grows 12 – 18m tall.
  - **Bloom: June.**
  - Inflorescence: Yellow-green small flowers grow in white dangling clusters.
  - Fruit: During **September – October the green-pink samara** (two-winged seeds) grows in dangling clusters up to 7.5cm long. An individual samara is 2.5cm long.
  - Leaves: Leaves unfurl in the early spring and are thick and leathery. They are 7.5-15 cm wide, 3-5 palmately lobed, have coarsely toothed leaf margins and are dark green on the upper side and light green on the underside (can sometimes be purple on underside).
  - Stem: Its grey bark is smooth when young, it becomes furrowed greyish pink bark at maturity.
  - Root: Widespread, strongly branched root system. The roots can grow to have a radius of 30 feet and about 2 feet under the soil. These shallow and fast-growing root systems can cause damage to buildings, underground pipes, septic systems, and pavement.
  - Habitat: Grows in abandoned fields, early successional forest edge, open disturbed areas, pastures, roadsides, vacant lots, yards and/or gardens.
  - Lookalike: Red maple, *Acer Rubrum*, (Native, S5) leaves have less side veins, and the blooms appear before leaves on the tree come. The samara of red maple is bright red whereas sycamore samara are green-pink.
  - Management Guide: *Acer pseudoplatanus*, sycamore maple, page 53
  - Photo Guide: *Acer pseudoplatanus*, sycamore maple**,** page 85

Horses who eat seeds or seedlings can develop Equine atypical myopathy, a fatal disease.

- *Aegopodium podagraria,* goutweed
  - Type: Perennial herbaceous groundcover. In it's second year it flowers 1m above the basal rosette.
  - Bloom: May – June.
  - Inflorescence: Not always produced, especially in shaded conditions. Flat-topped umbel 6-12cm wide, made up of tiny five petaled flowers that are typically white but can be pink.
  - Fruit: Oval, flattened, 4mm long, ribbed, splits into 2 seeds.
  - Leaves: Basal compound leaf divided into groups of three, known as triternate leaflets. They are often **irregularly lobbed, and one or two of the leaflets is described as mitten-like**. Many people are familiar with the variegated form that has blueish green leaves with white edges, but it is important to know that the "wild" variety has dark green leaves with no variegation. Leaves can begin to yellow in August but may stay green for several months following.
  - Stem: Green erect stems are hairless, hollow, ridged and branched. At the base of the stem there is a sheath that the leaf stalk.
  - Root: Branching white fleshy rhizomes make up and extensive underground system. They break easy when damaged, giving rise to new plants. Smell like carrots.
  - Habitat: Grows in gardens, fields, roadsides and invades all types of forests.

- Lookalike: Goutweed belongs to the carrot family and may be confused with umbellifer species like queen anne's lace, *Daucus carota*. The leaf structure can help distinguish between the two as flowering Queen Anne's Lace leaves are "feathery". The leaves may be confused with Yellow Archangel, *Lamium galeobdolon*, as it also is a variegated ground cover. Yellow Archangel has simple leaves that are oppositely arranged, and the edges of the leaves are green, the center of the leaf is white, and the inner portion of the leaf is green.
- Management Guide: *Aegopodium podagraria*, goutweed, page 54
- Photo Guide: *Aegopodium podagraria*, goutweed, page 86

- *Alliaria petiolata, garlic mustard*
  - Type: Biennial herbaceous plant that has a first and second-year plant.
    i. First year plant is a low growing rosette with kidney shaped leaves that have scalloped edges.
    ii. Second-year flowering plant grows 1m tall with white umbel flowers.
  - **Bloom: Late-April – May**
  - Inflorescence: Flowers are small and white with 4 petals and grow in clusters at the top of leafy stems. Occasionally may **bloom twice July - August**
  - Fruit: Second year plant's seed capsules sometimes are still standing at the start of next growing system.
  - Leaves: First and second-year leaves are both simple, however, are shaped differently from one another. **Leaves smell strongly of garlic** which helps in identification. **First year leaves persist into winter and are visible when the snow melts before other plants emerge.** First year rosettes have kidney shaped leaves that have scalloped edges. Second-year leaves are arranged oppositely on stalks, coarsely toothed and are triangular to heart-shaped.
  - Stem: Usually single-stemmed but if broken can have multiple.
  - Root: Slender, white, taproot, with a distinctive "s" curve at the top of the root, just below the root crown.
  - Habitat: Grows in moist to dry forest habitats, forest edges, floodplains, and along roadsides and disturbed lands.
  - Lookalike: First year plants look like Creeping Charlie aka Ground Ivy, *Glechoma hederacea*. Ground Ivy is from the mint family and does not smell of garlic. Its leaves are less veined than Garlic Mustard and are more scalloped around the edges. Second year flowering plants look like Queen Anne's Lace, *Daucus carota*, or Aegopodium podagraria, goutweed, however the leaves are very different and smell of garlic.
  - Management Guide: *Alliaria petiolata*, garlic mustard, page 54
  - Photo Guide: *Alliaria petiolata*, garlic mustard, page 87

- *Angelica sylvestris*, woodland angelica

Phototoxic Sap

  - Type: Monocarpic (flowers once and then dies) herbaceous annual, biennial, or perennial that has a first- and reproductive -year plant.
    i. First year plant is a large rosette.
    ii. Reproductive year plant has an umbel and grows up to 2m (6.5') tall.
  - **Bloom: June – September**

- Inflorescence: Hemispherical umbels are made up of many white flowers that can be lilac tinged.
- Fruit: Oval, flat, thin-winged, brown, 4–5 mm fruit that splits apart to release a single seed when ripe. Turns brown when ripe. Seed heads persist Late August – December.
- Leaves: Compounded leaves are composed of numerous small leaflets (between three and five on each branch) and they are 2-3 times pinnately compounded. The terminal leaflet is often unlobed.
- Stems: Green or purple can have furrows, ridges, and minute hairs (hardly visible to the naked eye). The hairs on the stem can be a key ID feature.
- Root: Thick taproot that is less established in it's first year.
- Habitat: Grows in disturbed roadside habitats, forest edges and open moist areas.
- Lookalike: Looks like two native species that are of concern on PEI: Seaside Angelica, *Angelica lucida* (S2), and Purple-stemmed Angelica, *Angelica atropurpurea* (S3). Purple-stemmed Angelica and Woodland Angelica look most alike as both can have purple stems and they grow in the same habitat. Purple-stemmed Angelica has spherical umbels, but the key ID feature comes down to whether the stems and petioles have tiny hairs. Purple-stemmed Angelica are 100% hairless (glabrous), while Woodland Angelica plants have tiny hairs that can be very small and sometimes only found on the petioles. Shiny leaves and a plant found near the shore would indicate seaside angelica. It is also a shorter plant. For help in identification, contact the PEIISC if you are unsure.
- Management Guide: *Angelica sylvestris*, woodland angelica, page 55
- Photo Guide: *Angelica sylvestris*, woodland angelica, page 88

- *Anthriscus sylvestris,* wild chervil
  - Type: Herbaceous biennial or short-lived monocarpic perennial.
    i. First year plant is a rosette of fern-like leaves.
    ii. Reproductive year plant has an umbel and grows on average 1 meter (3-4') tall but can grow up to 1.8 meters (6').
  - Bloom: May – June
  - Inflorescence: Flat compound 3-inch-wide umbels of small white flowers, each with 5 petals.
  - Fruit: Seeds are shiny and black, elongated oval shape, about 6 mm long and are in pairs joined with small antenna-like structures at the top. Form in July.
  - Leaves: Alternate leaves are shiny and dark green, finely divided and fern-like 2-3 times pinnately compound with sharply pointed segments and sparse hairs.
  - Stems: Green hollow stems are deeply furrowed, covered in fine hairs near the base and becomes more glabrous towards the apex of the stem.
  - Root: Thick taproot can grow up to 2 meters long.
  - Habitat: Grows in rich moist soils, streambanks, grasslands, open woodlands, and moderately disturbed areas.
  - Lookalike: Looks like Queen Anne's lace, *Daucus carota*, but Queen Anne's blooms much later than chervil. The umbels of Queen Anne's lace have bracts below them whereas chervil does not, and the leaves of chervil are more fern-like.

Phototoxic Sap

- Management Guide: *Anthriscus sylvestris,* wild chervil, page 57
- Photo Guide: *Anthriscus sylvestris,* wild chervil, page 89

- *Butomus umbellatus*, flowering rush
  - Type: Aquatic perennial that can grow as an emergent plant (0.3-1.5 m), a submerged plant (3m) or even a terrestrial plant in moist soil.
  - **Bloom: May - September**
  - Inflorescence: Only emergent and terrestrial plants produce flowers. 20-50 flowers form an umbel, are showy pink and formed of 3 petals and 3 petaloid sepals (resemble a petal). They are 2-3cm across.
  - Fruit: Brownish purple, tear dropped shaped fruit split at maturity, releasing many floating seeds.
  - Leaves: Leaf blades are basal, emerging from rhizomes. They are grass-like and are triangular in cross-section. They are 1m tall and .5-1cm wide.
  - Stem: Flowering stem is round and rises above the leaves.
  - Root: Extensive submerged root systems of thick rhizomes. Rhizomes (an umbels) form pea sized "bulbils" that resemble onion bulbs, they detach and propagate new plants downstream.
  - Habitat: Grows in freshwater wetlands and other riparian habitats.
  - Lookalike: When it's not in flower it can be commonly confused with native sedges.
  - Management Guide: *Butomus umbellatus,* flowering rush, page 58
  - Photo Guide: *Butomus umbellatus*, flowering rush, page 90

- *Celastrus orbiculatus,* Asiatic bittersweet
  - Type: Perennial dioecious (male and female flowers are found on separate plants) **woody vine** capable of climbing up surrounding vegetation to 18m. Sometimes can have perfect flowers that produce both male and female plants.
  - Bloom: May – June
  - Inflorescence: Flowers are not very noticeable, they are small, pale yellow and grow along the leaf axils.
  - Fruit: Produces bright red berries that begin their growth as small green fruit with a short stem-like feature at the end where the flower once grew. As the fruit matures, the berry will enlarge, and its outer capsule turns from green to yellow. In late summer and early fall, the capsule will dry and split apart, revealing the mature red berry within. Berries persist into the winter after the leaves die back (on female plants).
  - Leaves: **Leaves are alternately arranged, roundish, with finely toothed edges. These can be quite variable even on the same plant.**
  - Stem: Twigs are light brown and have distinct round leaf scars. Older stems are silvery brown, and the trunk is often finely scaly.
  - Root: Deep extensive root systems are orange and run horizontally over large distances and sends up sprouts (even in young plants).
  - Habitat: Grows almost everywhere. In roadsides, hedgerows, woodlands, forest edges, and grasslands.
  - Lookalike: American bittersweet, *Celastrus scandens.* looks similar but the flowers & berries grow in different places along the stem. Asiatic bittersweet's grow along the leaf

Caution: Vine is often attached to dead branches that could injure workers. Do not trip or pull on vine.

axil whereas the American bittersweet has them growing in clusters at the terminal end of the branch.

- Management Guide: *Celastrus orbiculatus*, Asiatic bittersweet, page 60
- Photo Guide: *Celastrus orbiculatus*, Asiatic bittersweet, page 91

- *Centaurea nigra,* black knapweed
  - Type: Perennial herbaceous plant that has a first and second-year plant.
    I. First year: A basal rosette with simple elliptical broad leaves that have stalks, shallow lobes and veins on the underside that are raised and ridged. Hairs give the leaves a green-grey appearance. Occasionally the basal leaves are toothed and lobed.
    II. Second year: Flowering stems are openly branched at the middle. 30-150 cm (.3 - 1.5m) tall.
  - **Bloom: June - October**
  - Inflorescence: Its flowers are purple with a base that is oval and covered with stiff blackish-brown bracts (this gives it its name).
  - Fruit: Fruit is a small, dry, one-seeded fruit that does not open to release the seed (achene). They are tan, hairy, 2-3 mm long, and often have a dark pappus. One plant can produce 18,000 achenes.
  - Leaves: Alternate simple leaves are lance shaped and decrease in size moving up the stem. They can be slightly toothed or smooth along the margins.
  - Stem: One to many branching stems covered in hairs.
  - Root: Plants have a woody taproot and a woody root crown.
  - Habitat: Grows in disturbed, well drained soils with full sun. Invades roadsides, agricultural land, open forests, travel corridors and orchards.
  - Lookalike: The flowers may look like a thistle sp., *Cirsium sp.*, however the base of the flower heads does not have the characteristic brown bracts; the leaves are quite different as thistle leaves are sharp!
  - Management Guide: *Centaurea nigra*, black knapweed, page 61
  - Photo Guide: *Centaurea nigra*, black knapweed, page 92

- *Cytisus scoparius*, scotch broom
  - Type: Perennial shrub that grows 3m tall.
  - **Bloom: May – July.**
  - Inflorescence: Begins blooming before leaves form. Yellow pea-like flowers have five petals, are 2.5cm long, solitary or in pairs along the upper stems.
  - Fruit: Seed capsules are very distinguishable; they look like **flat hairy peas** turning green then brown/black as the season progresses. When seeds are brown/black, they explode on touch and **burst outward**. Each pod contains 3-12 seeds.
  - Leaves: Leaves are ovate, 5-30mm long and alternate along the stem. They are simple or, near base of plant, trifoliate. Upper surface is glabrous (hairless), underside have hairs that range from sparse to dense.
  - Stem: **Dark green stems persist into winter and have distinctive leaf scars** on the stem. They are responsible for half the plants photosynthesis. They are heavily branched, and

All parts of this plant are extremely poisonous to humans, horses, and livestock.

the bark at the base of these stems is greenish brown. Young stems have hairs whereas older stems are hairless and can also be leafless. The stems are shallow grooved and are five angled (often star shape in cross -section). Leaves fall off in the winter or wither on the plant.

- Root: Taproot with nodulated roots that are nitrogen fixing.
- Habitat: Grows in open areas, in ditches, meadows and yards. Has grown successfully in dunes in its native range.
- Lookalike: Spanish broom, *Spartium junceum,* a similar plant has flowers growing at the ends of the branches instead of along them.
- Management Guide: *Cytisus scoparius*, scotch broom, page 62
- Photo Guide: *Cytisus scoparius*, scotch broom, page 93

- *Echinocystis lobata, w*ild cucumber
  - Type: Annual herbaceous vine that grows 7 – 9m tall. Plant is monecious, meaning both male and female parts occur on the same plant.
  - **Bloom: July – September**
  - Inflorescence: Male flowers grow in a 30 – 40cm long raceme along the upper leaf axils of the vine. Each flower is 1.5 – 2cm wide and has 6 greenish-white petals. A solitary female flower is located at the base of the male cluster.
  - Fruit: Produces **prickly, oval-shaped fruit** that is 5cm long and releases the plant's seed once it reaches maturity. Seeds are spread through hydrostatic pressure, expelling the seeds at over 11.5m/sec. Contain 1-6 seeds. As the fruit ripens, it dries into a paper-like husk which opens at the bottom. The nickname "lace plant" comes from this stage.
  - Leaves: 5 deep lobes with a heart-shaped base. Each leaf is paired with a long curly tendril.
  - Stem: This climbing vine has soft, hairless, fleshy, and grooved stems. This vine uses tendrils to climb leaves, branches, and stems of neighbouring species. The tendrils are reactive and once they contact something, they curl around it. **Tendrils are 3 pronged**.
  - Root: Unbranched, shallow, tan roots 4-15cm long.
  - Habitat: Grows along trails, in fields, on the edges of forests and in riparian zones.
  - Lookalike: Virgin's bower, *Clematis virginiana*, is a native PEI vine with white flowers. Be careful not to damage this species if you encounter it. Other invasive vines know to be on PEI include Celastrus orbiculatus, Asiatic bittersweet, *Solanum dulcamara*, bittersweet nightshade, and Virginia creeper, *Parthenocissus quinquefolia, P. vitacea*.
  - Management Guide: *Echinocystis lobata*, wild cucumber, page 62
  - Photo Guide: *Echinocystis lobata,* wild cucumber, page 94

- *Elodea canadensis,* Canada waterweed
  - Type: Submerged aquatic perennial, stems grow an average of 1.2 – 2.5m long.
  - **Bloom: June – August.**
  - Inflorescence: Occasionally blooms, small white flowers grow at the end of the stem at the top of the water. Flowers are 4mm broad.

- Fruit: An ovoid capsule about 6 mm long containing several seeds that ripen below the water's surface.
- Leaves: Simple leaves are oblong, green, translucent, and in **whorls of 3 (occasionally 4) around the stem.**
- Stem: Herbaceous branched, slender stems are 1-2mm thick, and can grow up to 6m long. Form dense mats in shallow stagnant waters.
- Root: Roots are shallow (only about 15cm deep but up to 50cm long) anddevelop along the stems and stolons
- Habitat: Grows in slow-moving fresh or brackish water. Thrives in nutrient poorwaters as temperatures begin to warm.
- Lookalike: Nuttall's waterweed, *Elodea Nuttalli*, is a critically imperilled native species (S1) to PEI that looks very similar. Canada Waterweed's leaves are wider, they are 1.5-4mm whereas Nuttall's leaves are usually less than 1.5mm.
- Hydrilla verticillata is another submergent invasive. Its leaves have visible serrations, whereas Canada waterweed's leaves must be magnified to see the serrations. Hydrilla also have 3-8 leaves whorled around the stem.
- Management Guide: *Elodea canadensis*, Canada waterweed, page 63
- Photo Guide: *Elodea canadensis*, Canada waterweed, page 95

- *Euphorbia cyparissias*, cypress spurge

Sap is an extreme irritant, can result in blindness if eye contact. May be toxic to grazers.

- Type: Perennial herbaceous clumping plant that grows to 10 – 40cm (.1 - .4m).
- **Bloom: Late-May – September**
- Inflorescence: Flowers in its first year. Can produce more than one flower crop per season. Flowers and bracts are greenish yellow and turn purple-red as they mature. The plant is monoecious (separate male & female flowers on each plant). Both the male and female flowers lack sepals and petals. Each umbel supports many cyathia (cup-shaped structures) of tiny, inconspicuous flowers, subtended by heart-shaped, greenish-yellow bracts.
- Fruit: Can produce more than one seed crop per season. Fruits form inside round capsules about 4mm long with three chambers, each containing a single seed. Seeds are forcefully ejected from seed capsules by explosive dehiscence of the fruit, each is 2.5mm long.
- Leaves: Leaves are simple, small, linear-shaped, and whorled around the stem. They are 1 – 3cm long and 1 – 3mm wide. Contain a milky sap that is an extreme irritant.
- Stem: Stems are usually unbranched on the lower stem. Often have short, widely spreading, non-flowering, leafy branches on the upper stem. Contain a milky sap that is an extreme irritant.
- Root: Extensive underground root system that spreads via lateral roots. These have buds which can send up new above-ground growth.
- Habitat: Grows in open, disturbed areas such as pastures, abandoned fields, ditches, and coastal areas.
- Lookalike: Leafy spurge, *Euphorbia esula*. Cypress spurge is shorter and less robust than leafy spurge, and has a higher number of leaves that are smaller in size.
- Management Guide: *Euphorbia cyparissias*, cypress spurge, page 64
- Photo Guide: *Euphorbia cyparissias*, cypress spurge, page 96

- *Euphorbia esula,* leafy spurge

Sap is an extreme irritant, can result in blindness if eye contact. May be toxic to grazers.

  - Type: Perennial herbaceous plant up to 1m tall one of the first to emerge in the spring.
  - **Bloom: Early-May – November**
  - Inflorescence: Does not flower in its first year. Flowers and bracts are greenish-yellow and turn purple-red as they mature. The plants are monoecious (separate male & female flowers on each plant). Both the male and female flowers lack sepals and petals. Each umbel supports many cyathia (cup-shaped structures) of tiny, inconspicuous flowers, subtended by heart-shaped, greenish-yellow bracts.
  - Fruit: Fruits form inside round capsules about 4mm long with three chambers, each containing a single, smooth seed. Seeds are forcefully ejected from seed capsules by explosive dehiscence of the fruit. Seeds are 2.1-3mm long, oval-shaped, and slightly flattened.
  - Leaves: Emerge soon after snow melt. Simple leaves are linear-shaped and whorled around the stem. They are 2.5 – 10 cm long and 3mm to 8mm wide.
  - Stem: Smooth and bluish green erect branching stems with a woody base.
  - Root: Extensive root systems that spread horizontally and vertically; vertical roots can be over 4m deep. There are over 300 underground adventitious pinkish buds can be found on these long roots.
  - Habitat: Grows in open, disturbed areas such as pastures, abandoned fields, ditches and coastal areas.
  - Lookalike: Cypress spurge, *Euphorbia cyparissias*, can be confused with leafy spurge but the latter is taller and has fewer leaves that are wider.
  - Management Guide: *Euphorbia esula*, leafy spurge, page 65
  - Photo Guide: *Euphorbia esula*, leafy spurge**,** page 97

- *Fallopia japonica*, Japanese knotweed
  - Type: Perennial semi-woody plant that grows up to 2.5m tall and appears shrub like.
  - **Bloom: August - September**
  - Inflorescence: Small, white-green flowers bloom along branching panicles near the end of the stem.
  - Fruit: Seeds are small, winged, white, shiny and triangular.
  - Leaves: Alternate and grow along a red petiole (leaf stem) in a zig-zag pattern. They are round to triangular, have smooth edges and a distinctive narrow tip. They are 10-17 cm long and 7-10 cm wide. Spring foliage is tinted red.
  - Stem: **Stems are distinctive. They are multi-branching, stout, hollow, and green but often mottled with a purplish red. They are swollen at the joints. Stems are annual (they** die back and emerge each year). Dead stems can accumulate and increase the risk of fire.
  - Root: Japanese Knotweed has a large underground root system made of rhizomes that makes up 2/3 of its total mass. Rhizomes are dark brown and have a bright orange interior. They can extend to over 2m deep and over 18m horizontally. Strong roots can penetrate infrastructure including foundations, pavement, and pipes.

- Habitat: Grows in a wide range of habitats including riparian areas, dunes, wetlands, roadsides, ditches, urban environments, forest edges, and disturbed forested areas.
- Lookalike: There are three species of knotweed that look alike on PEI. Japanese knotweed may be confused with giant knotweed, *Fallopia sachalinensis,* or bohemian knotweed, *Fallopia x bohemica*. Giant knotweed stems are light green and are not typically mottled, and leaves are much larger (15-40 cm long, 10-28 cm wide). Bohemian knotweed has a reddish-brown stem, can have leaves of varied sizes (up to 25cm long and up to 20 cm wide). Bohemian knotweed can be hard to differentiate, even for experts. If you are unsure, please contact with us.
- Management Guide: *Fallopia japonica*, Japanese knotweed, page 67
- Photo Guide: *Fallopia japonica*, Japanese knotweed, page 98

- *Heracleum mantegazzianum,* giant hogweed

Phototoxic Sap

- Type: Monocarpic (flowers once and then dies) herbaceous biennial or perennial that has a first and reproductive -year plant.
    i. First year plant is a large rosette.
    ii. Reproductive year plant grows up to 5.5m (18') tall.
- **Bloom: June – July**
- Inflorescence: Large flat-topped umbel (1.5m in diameter) made up of thousands of small white flowers.
- Fruit: The fruit is a 1cm dry, flattened, oval, two-winged fruit that splits apart to release a single seed when ripe.
- Leaves: Compound leaf has three leaflets and is deeply lobed, has sharply jagged edges (1.5 meters wide).
- Stem: **Raised red bumps** on stem are a key ID feature, **stiff hairs** along the nodes and the base of petioles help in ID.
- Root: Large taproot which develops extensively during its first season of growth.
- Habitat: Grows along roadsides, along streambanks and in disturbed areas.
- Lookalike: Cow parsnip, *Heracleum maximum*, is often confused for giant hogweed. They can be of a similar size, but the stem of cow parsnip never has raised bumps (this is a key ID feature), and the hairs are much softer looking on cow parsnip. The leaves of giant hogweed are hairless and very deeply lobed with jagged edges (1.5 meters wide) whereas cow parsnip leaves are smaller (60-75cm wide), less lobed, less jagged, and covered in soft hairs.
- Management Guide: *Heracleum mantegazzianum*, giant hogweed, page 68
- Photo Guide: *Heracleum mantegazzianum*, giant hogweed, page 99

- *Impatiens parviflora,* small-flowered jewelweed
    - Type: Annual herbaceous plant grows up to 90cm (.9m) tall.
    - **Bloom: May – September**
    - Inflorescence: Flowers are pale yellow, cone shaped (some say helmet shaped) and often have red speckles found in its "throat".

- Fruit: Seed capsules are linear-oblong, 1-2.5cm long and are pale green at maturity. Seeds are forcefully ejected from seed capsules by explosive dehiscence of the fruit. Avoid walking through them when ripe as seed capsules will explode when touched.
- Leaves: Simple, alternate, pointed and sharply serrated with the serrations directed toward the leaf tip.
- Stem: Single-stemmed or branched, translucent, and hairless.
- Root: Small, shallow and translucent root system.
- Habitat: Grows well under a variety of light and moisture levels. This plant can dominate the forest floor, forming large, uniform stands that displace native species, and negatively impact forest regeneration.
- Lookalike: Spotted jewelweed, *Impatiens capensis*, is a native species that looks similar. Both plants have similarly shaped flowers, can reach heights between 30 – 90cm tall, and have leaves that are alternately arranged. Small-flowered jewelweed differs as it has a bright orange flower with red speckles all over, and its leaves are rounded at the tips.
- Management Guide: *Impatiens parviflora*, small-flowered jewelweed, page 70
- Photo Guide: *Impatiens parviflora*, small-flowered jewelweed, page 100

- *Impatiens glandulifera,* Himalayan balsam
  - Type: Annual herbaceous plant that grows to 2m tall.
  - **Bloom: June – October**
  - Inflorescence: Distinct cone-shaped irregular pink or white flowers with a sac structure. Some refer to the shape as helmet or hooded shaped.
  - Fruit: **Seeds are forcefully ejected from seed capsules** by explosive dehiscence of the fruit. Seeds can be ejected **up to 7m from the parent plant**. Capsules are 1.5-3cm long and have five chambers containing up to 16 seeds each. Fruits form during Late August – October. As the plants reach maturity, avoid walking amongst them as the capsules will explode when disturbed, facilitating dispersal.
  - Leaves: Simple leaves are either opposite or whorled. They are long, slender, sharply toothed, have a prominent reddish mid vein are 5–20 centimetres long, are shiny, and are dark green.
  - Stem: **Straight, red, bamboo-like stems** are hollow, glabrous (hairless) and ridged. In shaded conditions the stems do not grow as tall, are much less pigmented, and translucent.
  - Root: Shallow, reddish pink, extending only 10 - 15cm into the soil. Will produce roots at the nodes if the plant is toppled over and touching soil.
  - Habitat: Grows in disturbed areas, forest edge, riparian areas and can be found in wet forests.
  - Lookalike: Spotted jewelweed, *Impatiens capensis*, has a similarly shaped flower and explosive fruit capsules, but its flower is yellow-orange, and the leaves are alternate.
  - Management Guide: *Impatiens glandulifera*, Himalayan balsam, page 71
  - Photo Guide: *Impatiens glandulifera*, himalayan balsam, page 101

Irritating Resin in Sap

- *Iris pseudacorus,* yellow flag iris
  - Type: Emergent aquatic perennial (can survive in drought conditions) grows 90-150 cm (.9 – 1.5m).
  - **Bloom: June**
  - Inflorescence: Flower is a robust, three-petaled, pale to vibrant yellow iris that is about 8cm wide. The downward facing sepals have brown veins and a brown ring. Each plant stem has 4-12 flowers.
  - Fruit: Seed pods are shaped like small green bananas. They are 3-sided, 3.5-8.5cm long and dry to brown. When they split, they release an average of 120 seeds each. Seeds are corky, 4-7cm long, brown when ripe and have an air pocket that allows them to float.
  - Leaves: Basal leaves are sword shaped and look a lot like cattail leaves, except it has a **distinct raised midrib**. It forms dense stands.
  - Stem: Stout leafless stems that can have 1-3 branches. Each branch can produce 1-3 showy flowers.
  - Root: Fleshy roots are 10-30cm long and have thick, pink, branching, tuberous rhizomes that form dense mats. One root system can have over 100 flowering plants connected by rhizomes. Walking over a large system like this is like walking on a floating bog. Roots can remain viable after being dry for several months.
  - Habitat: Grows in fresh, brackish, or salt water. Found in marshes, ponds, streams, ditches, and gardens.
  - Lookalike: Cattails', *Typha spp.*, leaves look similar early in the growing season when no flowers or seed pods are present. The iris leaves are more robust, fan-like at the base and have a raised midrib. There is no native iris present on PEI that the yellow flag Iris is likely to be confused with when it is in bloom, although there are several ornamental species. There are two native irises, and it can be difficult when flowers are not in bloom to tell them apart: our native blue flag iris, *Iris versicolour,* and beach head iris, *Iris hookeri* (respectively: imperiled/vulnerable). Yellow flag iris leaves are yellowish-green, have a yellow tint at the base, and often have a more prominent midrib compared with blue flag iris leaves, which are often purplish at the base. The blue flag iris has seed pods that are 3.5-6cm in length, while yellow flag iris' grow up to 8cm. The beach head iris has seed pods that are 2-4cm in length (much smaller than yellow flag iris).
  - Management Guide: *Iris pseudacorus*, yellow flag iris, page 72
  - Photo Guide: *Iris pseudacorus*, yellow flag iris, page 102

- *Lythrum salicaria,* purple loosestrife
  - Type: Perennial herbaceous plant grows .5 -3m tall.
  - **Bloom: July – September**
  - Inflorescence: Large spikes (10-40cm long) of many small purple-pinkish flowers. Each flower has 5 petals (rarely 6 or 7) and are 1-2cm wide.
  - Fruit: A stem can typically produce about 1,000 dark brown, egg-shaped capsules. They are approximately 2-3 mm in length and contain many small seeds (over 100 per capsule). A mature plant can produce over 2.5 million seeds.

- Leaves: Leaves can be opposite (most common) but can be found whorled or even alternate. They are simple lance shaped leaves with smooth edges, fine hairs, and they are sessile (attached directly to the stem).
- Stem: Annual stems emerge from a perennial root stalk, shoot emergence and seed germination occurs as early as late April. Square stems (4-6 sides) are green when young and red and woody as they age. Mature plants can have 30-50 flowering stems.
- Root: Root crown can be connected to many stems and expands each year to accommodate the new stems reaching a maximum diameter of 20cm. Large woody taproot with fibrous short rhizomes that spread rapidly and form dense mats. When flooded, it produces "aerenchyma", a tissue that allows roots to exchange gases while submerged in water.
- Habitat: Grows in ditches, marshes, swamps, pond/stream edges, uplands, and meadows.
- Lookalike: Fireweed, *Chamaenerion angustifolium*, is a native species on PEI that also has vertical purple flowers on it's stem. Fireweed flowers are lighter in colour and its flowers are in a raceme, meaning its flowers come off the stem in evenly sized stalks whereas purple loosestrife's flowers grow directly off the stem in a spike. Fireweed flowers are larger, 2-3cm and have four petals, whereas purple loosestrife flowers are 1-2cm and have 5 or more.
- Management Guide: *Lythrum salicaria*, purple loosestrife, page 73
- Photo Guide: *Lythrum salicaria*, purple loosestrife, page 103

- *Pastinaca sativa,* wild parsnip

Phototoxic Sap & is toxic to humans and livestock if ingested.

- Type: Monocarpic (flowers once and then dies) herbaceous biennial or short-lived perennial that has a first and reproductive-year plant.
    i. Non-reproductive year plant: A basal rosette with leaves similar to the mature plant but the cluster of leaves grows directly from the ground.
    ii. Reproductive year plant: Umbel flowers and grow .5 – 1.5m tall.
- **Bloom: July** (sources vary and consider bloom from June – October)
- Inflorescence: Umbel made up of small, yellow, 5-petaled flowers.
- Fruit: Fruits are dry, smooth, slightly winged and flattened on back. Fruits each contain two seeds. Plants often have blooms and seeds at the same time.
- Leaves: Alternate compound leaves along the stem are made of 5-15 leaflets, and they can be once or twice pinnately compound (the latter having 2-5 pairs of leaflets). Leaflets are mitten-shaped, with coarse serrated edges and the terminal leaflet is three lobed. Leaves on the upper stem have a shorter petiole or sometimes no petiole (leaf stalk attached to base of leaf and stem).
- Stem: A single light green stem deeply grooved and mostly hairless, 2.5-5 cm thick, and hollow except at the nodes. A sheath attached to the stem covers the petioles.
- Root: Long taproot that smells distinctively of parsnip.
- Habitat: Grows best in disturbed sites. Can be found in roadsides, old fields, travel corridors, vacant lots, beaches, semi-shaded forests & riverbanks. Can sometimes even be found invading swampy lowlands and cultivated fields.

- Lookalike: Queen anne's lace, *Daucus carota*, common valerian, *Valeriana officinalis*, or possibly Angelica spp. but none of these other umbellifers have yellow flowers.
- Management Guide: *Pastinaca sativa*, wild parsnip, page 74
- Photo Guide: *Pastinaca sativa*, wild parsnip, page 104

- *Phragmites australis ssp. australis,* common reed grass
  - Type: Aquatic emergent perennial grows 1 – 6m tall.
  - **Bloom: July – September**
  - Inflorescence: The heavily branched inflorescence is described a dense oblong panicle, meaning clusters of flowers, known as spikelets, are attached to branches rather than to the main stem. Individual flowers are purple in colour and the branches are slightly flattened. These panicles droop to one side and cause the entire stem to lean.
  - Fruit: Seed heads are large, dense, and grey/tan in colour. They look fluffy due to the long narrow bristles attached to each seed. Seeds are 2 to 3 mm long, if you include the bristles, they are about 8mm long. Present from September – November.
  - Leaves: Arranged alternately the leaf blades are 20—60cm long, 4cm wide, blue-green, hairless, and tapered with a pointed tip. Leaves are attached to the stem by a tight-fitting sheath, the leaves drop off the plant in the late summer, but the sheath remains on the stem and turns tan.
  - Stem: **Annual unbranched stems and dead standing stems from last years growth are typically present**. Living stems are tan on their lower portions and green at the top. They are rigid, ribbed, rough textured, hollow and have many nodes.
  - Root: Dense network of stout rhizomes grow horizontally at 3cm wide and vertically at 1.5cm wide. They can be as deep as 1.5m. As a stand ages, rhizomes can make many clones. Under optimal conditions a rhizome can expand 3m each year. Roots are 2-4mm wide and extend down to 4m. Also has above ground stolons that can establish clones, individual stolons can extend up to 10m and support up to 70 stems.
  - Habitat: Grows in ditches, and wetlands including fresh and brackish water. Does well in disturbed and pristine sites.
  - Lookalike: *Phragmites australis ssp. americanus* is a native phragmites to PEI. The invasive subspecies grows in dense stands and crowds out other species whereas the native species is scattered and mixed. The lower stems of the invasive variety are tan or beige-coloured whereas the native species lower stems are red. Leaves on the native variety are yellowish-green and grow more on one side of the stem rather than alternate, the seed head is also much less dense. It can be hard to ID between, genetic testing may be necessary. The PEIISC has done some genetic testing on PEI populations and found two invasive varieties and many more native varieties.
  - Management Guide: *Phragmites australis ssp. australis*, common reed grass , page 76
  - Photo Guide: *Phragmites australis ssp. australis*, common reed grass, page 105

- *Prunus spinosa,* blackthorn
  - Type: Small perennial deciduous shrub that grows 6-7m tall.
  - **Bloom: March – April**

- Inflorescence: White, **showy flowers appear before its leaves emerge.**
- Fruit: Deep blue fruit called **sloes from August – November**.
- Leaves: Alternate simple leaves with toothed edge, pointed at the tip and tapered at the base.
- Bark & Stems: Stems and bark are very dark and smooth, and as the shrub ages it gets even darker. Pointed and thornlike spur shoots found along the stems give this plant its name.
- Root: Plants are shallow-rooted and of a suckering habit.
- Habitat: Grows best in moist, well drained soils and full sun. Invades urban or disturbed areas, forest edges, forests, meadows, and fields.
- Lookalike: May be confused with Hawthorn, *Crataegus spp.,* as both have "thorns" however blackthorn flowers much sooner, and its bark is smooth and dark. The fruit of the hawthorn are called haws (not sloe's) and are red when ripe.
- Management Guide: *Prunus spinosa*, blackthorn, page 77
- Photo Guide: *Prunus spinosa*, blackthorn, page 106

- *Rhamnus cathartica,* common buckthorn

Poisonous Berries

- Type: Large perennial deciduous shrub grows to 5 – 8m tall. Plant is diecious, meaning this plant has either male or female parts (not both).
- **Bloom: Mid-May – Early June**
- Inflorescence: Tiny, four-petaled yellow-green flowers grow in clusters along the leaf axil.
- Fruit: **Green berries called drupes** replace flowers and ripen, turning black, from July – September. Drupes grow in clusters along the leaf axil and tend to **ripen all at the same time.**
- Leaves: Simple, elliptical-oval shaped leaves are opposite or sub-opposite (almost opposite) along the stem. They have **finely toothed edges and are often slightly wavy**. They emerge early in the spring and remain late into the fall (turn yellow in the fall).
- Stem: Young stems are dark reddish-brown, with **prominent white lenticles**. At maturity, the main stem's branches are a grey-brown and the main stem is dark and scaly. On mature plants there are many twigs that have small thorn-like tips, which are generally located at the end of the twig.
- Root: Has a root crown and lateral roots that are extensive but shallow. Lateral root extension varies greatly depending on site conditions, the longest recording being 5.6m and the greatest depth being 1.2m. In sites that have a high moisture content the roots were much shallower and longer, sites that were heavily shaded produced shorter roots.
- Habitat: Grows in the light shade of deciduous woodlands, establishes in openings, roadsides, ravines, riverbanks, disturbed forest edges, open disturbed areas like abandoned fields. It is shade and drought tolerant. Commonly found in urban environments.
- Lookalike: Glossy buckthorn, *Rhamnus frangula*, is a similar looking species that is also invasive and known to be present on PEI. Glossy buckthorn differs in that it does not

have toothed leaves, and the end of its branch has no thorn. The drupes of common buckthorn grow in smaller groups s along the leaf axil. The veins on the glossy buckthorn leaves extend straight towards the edges of the leaf (a similar pattern to fish bones), whereas common buckthorn leaf veins are more curved and end nearer the tip of the leaf.

- Management Guide: *Rhamnus cathartica*, common buckthorn, page 78
- Photo Guide: *Rhamnus cathartica*, common buckthorn, page 107

- *Rhamnus frangula,* glossy buckthorn
  - Alternative Scientific Name: *Frangula alnus*
  - Type: Large perennial deciduous shrub grows to 4.5 – 6m tall. Plant is monecious, meaning both male and female parts occur on the same plant. One glossy buckthorn plant can start a whole colony by itself.

Poisonous Berries

  - **Bloom: May – June** (is possible to find from July to September)
  - Inflorescence: Flowers are tiny, star shaped, pale yellow-green, and arise along the leaf axil on younger branches.
  - Fruit: Green **berries** called drupes replace the flowers beginning in July. As they ripen, they turn red and then black. **The clusters of drupes are produced from July – September** and persist into the winter. Drupes tend to **mature at different times along the stem.**
  - Leaves: Alternate leaves are elliptical to egg shaped. They have **smooth edges that are often wavy**, and the top side of the leaf is shiny. The veins on the glossy buckthorn leaves extend straight towards the edges of the leaf in a similar pattern to fish bones. Leaves emerge early in the spring and remain late into the fall (turn yellow in the fall).
  - Stem: Young stems are dark reddish-brown, **with prominent white lenticles (white spots)**. At maturity the main stems are brown to dark grey, spotted bark that may develop shallow fissures due to lenticels. Twigs are light grey-brown and have no thorn, despite its name.
  - Root: Shallow, red, extensive root system, with a root crown and lateral roots.
  - Habitat: Grows in wetter, less shaded, and more acidic soils than some other buckthorns, it is especially aggressive in alkaline bogs and swamps. Can be found in bogs, marshes, fens, wetlands, along riverbanks, forests, abandoned farmland and roadsides. Commonly found in urban environments.
  - Lookalike: *Rhamnus cathartica*, common buckthorn, is a similar looking species which is also invasive and known to be present on PEI. Common buckthorn has slightly toothed opposite leaves and the end of its branch has a thorn, despite its name glossy Buckthorn does not have any thorns. The drupes of common buckthorn grow in larger groups along the axil. The veins on the glossy buckthorn extend straight towards the edges of the leaf (a similar pattern to fish bones), whereas common buckthorn leaf veins are more curved and end nearer the tip of the leaf.
  - Management Guide: *Rhamnus frangula,* glossy buckthorn, page 80
  - Photo Guide: *Rhamnus frangula,* glossy buckthorn, page 108

- *Rosa multiflora,* multiflora rose
  - Type: Rambling (long flexible stems that can climb) or sprawling perennial shrub can grow up to 5m tall.
  - **Bloom: May – July.**
  - Inflorescence: Flowers are white, grow in clusters and are fragrant.
  - Fruit: Rosehips are small, deep red, balloon shaped, found in terminal clusters and persist into winter after leaves have died back.
  - Leaves: Compound leaves are alternate along the stem and divided into 5-11 sharply toothed leaflets. **Fringes** at the base of the leaf stalk help distinguish this plant from other roses.
  - Stem: Branches, known as **canes**, form wide arches that can be over 2 meters in height. When these canes touch the ground, they form shallow roots and this is how they spread, it is a process called "cane layering". These long flexible canes are able to climb trees or even structures. Canes sometimes have curved, backwards faced thorns that are found in pairs; however, are sometimes they are thornless (this is less common). Canes are woody and are green to red in color.
  - Root: Shallow roots extending from a root crown for extensive systems.
  - Habitat: Grows in roadsides, fields, forests, stream banks, wetlands, and coastal sand dunes.
  - Lookalike: PEI's native roses are much smaller, have pink flowers and do not have the fringe at the base of the leaf stalk. Multiflora rose's small, clustered, balloon-shaped rosehips are distinguishable from the large, rounded rosehips of native species which grow more singularly and distributed on the plant.
  - Management Guide: *Rosa multiflora*, multiflora rose, page 81
  - Photo Guide: *Rosa multiflora*, multiflora rose, page 109

- *Solanum dulcamara,* bittersweet nightshade
  - Type: Perennial semi-woody vine grows up to 7m.
  - **Bloom: May – September.**
  - Inflorescence: Flowers are blue-violet, star-shaped, with protruding yellow anthers.
  - Fruit: **Berries are egg-shaped and mature at different times on the same plant**.
  - Unripe are green, then orange, and ripe berries are a bright red. They remain into the fall after leaves have died back. Each berry contains an average of 30 – 60 yellow-colored, small, flattened seeds.
  - Leaves: Dark green, often with one or two small ear-like lobes near the base, 1 to 4 inches long.
  - Stem: The stem is hollow, green to gray-brown, and grows up to 3cm in diameter. The base of the stem is woody and furrowed. Creeping stems root at nodes.
  - Root: Taproot with rhizomes just below the surface soil. These rhizomes give rise to new top growth regularly.
  - Habitat: Grows in hedgerows, forest edges, riparian zones and in forest understories.

Poisonous Berries

- Lookalike: Bittersweet nightshade belongs to the potato family and so you may be familiar with it's flower structure. Other invasive vines know to be on PEI include Asiatic bittersweet*, Celastrus orbiculatus,* wild cucumber, *Echinocystis lobata*, and Virginia creeper, *Parthenocissus quinquefolia.*
- Management Guide: *Solanum dulcamara*, bittersweet nightshade, page 82
- Photo Guide: *Solanum dulcamara*, bittersweet nightshade, page 110

- *Valeriana officinalis,* common valerian
  - Type: Herbaceous perennial plant that has a non-reproductive (one year of above ground development) and reproductive year plant (second year of above ground development). This plant produces daughter plants from runners and therefore it does not have a finite lifespan.
    i. Non-reproductive year: A basal rosette with compound pinnate leaves.
    ii. Reproductive year: Has umbel-like flowers and grows 0.5 – 5.5m tall.
  - **Bloom: June – July**
  - Inflorescence: Flowers are white or pale pink, forming in tight clusters at the top of the plant in 2-5 umbrella-shaped umbels, fragrant – very sweet smelling.
  - Fruit: The fruit is small, and lance shaped, measuring 3-5 mm long and contains many seeds. Seeds are dry ovate, ridged, 1mm wide at the base but tapering to .5mm at the tip. These seeds can be to 2 mm long and have a feathery pappus for wind dispersal. Plants can also occasionally make bulbils (small outgrowths that lead to the production of whole new plants) in their leaf axils.
  - Leaves: Compound leaves are opposite, have 5-12 pairs of leaflets, and are irregularly toothed. The underside of the leaves, the edges and leaf stems are hairy.
  - Stem: Unbranched, thick, fleshy, green or red/purple and ridged.
  - Root: Stolons (runner/above ground stem) and rhizomes (underground stem) that are small, white, fleshy and have a pungent odour.
  - Habitat: Grows in moist soils, along stream banks, in wet meadows, fens, and roadside ditches.
  - Lookalike: Angelica sp. (native & invasive varieties) may be confused with valerian; however, the stem of valerian is ridged, and the leaves of valerian are opposite whereas Angelica leaves are alternate. Bulbous water hemlock *Cicuta bulbifera* (native) may also be mistaken for valerian because of its flower but this hemlock's leaves are alternate, very narrow, and hairless.
  - Management Guide: *Valeriana officinalis*, common valerian, page 83
  - Photo Guide: *Valeriana officinalis*, common valerian, page 111

Section 5: Management Guide

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- *Acer pseudoplatanus*, sycamore maple

Horses who eat seeds or seedlings can develop Equine atypical myopathy, a fatal disease.

- Reproduction: Spreads only by seed. Can produce 10,000 – 170,000 seeds. There is a high mortality of seedlings in first year and so it is important to distinguish between seedlings and saplings older than one year when planning management. Seed bank is not very persistent, some reports say 2-3 years with most germinating the following growing season.
- Human Pathway: Sycamore maple is a native of central and southern Eurasia. It was originally imported to North America in the 1870s as a horticultural tree for planting in urban areas. The tree has been present in the wild in North America since the early 1900's. It was planted by cities and gardeners for a fast-growing shade tree and its tolerance to wind and salt.
- Natural Dispersal: Winged seeds dispersed by wind, capable of travelling up to 4km. Strongest dispersal 200m around the mother plant.
- Management Timing: This fast-growing tree is a prolific seeder and so it would be ideal if large seed producing trees would be managed in the spring and early summer before seed formation and shading out of native species. It is important to avoid cutting large trees during the nesting season, if you must manage mature trees during this period girdling is an option. Girdling is effective however it will not prevent the first year's seed production and possibly a few subsequent years. Hand pulling seedlings and young saplings if effective if the entire root is removed. It can occur almost year-round, except when the ground is frozen as this may cause the roots to snap, also snow will obscure the view. It is easiest when soils are moist.
- Young Seedlings or Saplings:
    i. Hand pulling or digging is effective, an effort should be made to remove the entire root. Many seedlings will not survive into the second year, time is best spent focusing on saplings. You may need an extractigator for saplings with more extensive root systems. Do not remove large saplings in the nesting season.
- Large Trees:
    i. Cutting large tress down is effective as it prevents seed dispersal. It is important to grind the stump or returning to the site to cut new shoots as they arise. Do not cut trees down during the nesting season, April – August.
    ii. Girdling the tree is effective. It is most effective the spring and can be done during the nesting season as it is minimally invasive. It will need to be revisited to remove any suckers growing below the girdling line.
- Grow Me Instead:
    i. *Red maple, *Acer Rubrum* (A moderate to fast growing maple. Moderate to low salt tolerance. Does well in a wide variety of sites but prefers moist well drained soils.).
    ii. *Red oak, *Quercus rubra* (PEI's provincial tree. A moderate to fast growing tree. High salt tolerance. Does best in full sun conditions and is moderate to low shade tolerant).
- Identification Guide: *Acer pseudoplatanus,* sycamore maple, page 35
- Photo Guide: *Acer pseudoplatanus*, sycamore maple, page 85

*Grow Me Instead options with an asterisk indicate the plant is available in the MacPhail Woods Ecological Forestry Center's 2023 Nursery Catalogue.

- *Aegopodium podagraria*, goutweed
  - Reproduction: Spreads by seed and by branching network of rhizomes (primary method of spread) that allow it to grow aggressively away from plantings. The non-variegated leaf is said to spread faster in shady conditions. It can produce viable seedlings but it's rare. The number of seeds per plant is unknown but assume to be low and seed bank duration is unstudied as well. Root fragments can remain viable in soil for over to 4 years.
  - Human Pathway: Root fragments and rhizomes transported in soil can colonize a new site.
  - Natural Dispersal: Wind disperses these seeds over short distances.
  - Management Timing: Begin management early in the season. If you are mowing, begin in April when leaves emerge. If you are tarping, begin in May after the plant has used some energy to send up leaves. If you are planning on digging, do so in June or July when the plant is at its maximum growth stage and has depleted many of its carbohydrates.
  - Small Infestations:
    i. Hand pulling can be effective if done with persistence and consistency. It is important to remove all root fragments possible. This is best done in June-July but can be done anytime during the growing season and works best in moist soil (after a rain). Using a sifter of some kind would be ideal, anything found under 60cm (.6m) is unlikely to regenerate. Hand pulling will not extract rhizomes in their entirety and so it is important to keep at this for several years.
  - Large Infestations:
    i. Tarping is the most effective means of control, the best time of year to do so is in May after all the leaves have grown up. Cut the leaves before tarping. Waiting for the leaves to come up helps expend energy from the root system as goutweed uses a lot of its carbohydrates to put its leaves up. Tarping the species directly afterward will help prevent regrowth.
    ii. Mowing may help slow the spread but is unlikely to eradicate it. Begin mowing in April to a deck height of 2.5cm as this will remove the leaves.
  - Grow Me Instead:
    i. *Herb robert*, Geranium robertianum* (S4. Creeping groundcover with a purple flower that blooms from May – September. Grows well in gardens and forests).
  - Identification Guide: *Aegopodium podagraria,* goutweed, page 35
  - Photo Guide: *Aegopodium podagraria*, goutweed, page 86

- *Alliaria petiolata*, garlic mustard
  - Reproduction: Spreads only by seed. One plant can produce thousands of shiny black seeds that can spread several metres from the parent plant, they typically split from the pod in July – August but can remain standing into the winter. Seed bank remains viable for up to 10 years.

- Human Pathway: Travels very easily on the groves of footwear, it is thought to be one of the main sources of long-distance spread.
- Natural Dispersal: Seeds are moved about by animals and humans, and in some cases water.
- Management Timing: First year plants can be managed year-round, they are evergreen and are therefore obvious year round. Second year plants should be removed before they go to seed (July), the best time is just after they flower (May – June) as it will reduce the number of times needed to return and cut. Will need to cut a few times as flowers bloom at different times. Since it is a biennial, do not focus any energy on removing second year plants if they have gone to seed. When working in the area ensure you thoroughly clean your shoes as these seeds readily hitch a ride in grooves.
- First Year Rosettes:
    i. Hand pull removing the entire root "S" shaped root from the soil. Stirrup hoes can be a useful tool that speeds this process along. Choose stirrup hoes with a curve in the metal so that it digs below the surface of the soil. Cutting garlic mustard rosettes rarely leads to mortality because they can produce new shoots.
- Second Year Mature Plants:
    i. Small Infestations: Pulling is effective, removing the entire root when possible.
    ii. Larger Infestations: Cutting adult plants at ground level just after it flowers has been shown to be effective in killing the plant as re-sprouting shoots will die in a few weeks. Cutting is preferred as it minimizes soil disturbance and therefore reduces seed germination. May need to be repeated more than once if the flowers do not bloom at the same time.
- Burning is not an effective control method for Garlic Mustard.
- Fun Fact: Young plants are edible, however older plants have a bitter flavour and contain cyanide and so they must be cooked thoroughly before consumption.
- Grow Me Instead:
    i. *Ostrich fern, *Matteuccia struthiopteris*. (S4. A showy ground cover that spreads readily and is a great choice for replanting a garlic mustard sites as it is able to compete with new growth. Does best along in shaded streams and is a great choice in shaded gardens).
- Identification Guide: *Alliaria petiolata, garlic mustard*, page 36
- Photo Guide: *Alliaria petiolata*, garlic mustard, page 87

- *Angelica sylvestris*, woodland angelica

Phototoxic Sap

- Reproduction: Spreads only by seed. Unknown seedbank viability, some reports say it lacks a persistent seedbank.
- Human Pathway: Believed to have originated in Syria and is found throughout Eurasia. The plant is thought to have been introduced to North America as a culinary herb by early French settlers in the 17th or 18th century. It may have been brought to PEI as a hitchhiker on a motor vehicle or even intentionally planted. Can be accidentally spread now across PEI on vehicles, lawn mowers, farm equipment or even snowplows.

*Grow Me Instead options with an asterisk indicate the plant is available in the MacPhail Woods Ecological Forestry Center's 2023 Nursery Catalogue.

- Natural Dispersal: No resource was found specifically for this species; however, it has a seed shape like others in the family which are designed to float along waterways and disperse by wind over hard surfaces like hard packed snow.
- PERSONAL PROTECTIVE EQUIPMENT: Due to the phototoxic sap within woodland angelica, you must take precautions to protect yourself against burns. Protective clothing should be worn, including a non-absorbent coverall (Tyvek), waterproof gloves, eye protection, face shield, non-absorbent long pants and shirt, and rubber boots. You may also want to tape joints in clothing to ensure it does not ride up and expose skin during management. Apply sunscreen before management. If exposed to sap, immediately cover the area from sunlight and for several days after. Flush the area with cold water ASAP and wash it off with soap. If exposure results in a burn, see a physician for further advice. It is important to provide safety protocols to staff beforehand and ensure that regular water breaks are possible. If you plan on managing this species, please contact us for a copy of our staff's safety protocols.
- Management Timing: Targeting management early in the season will make the roots easier to manage. It is important to at least complete management of the flowering plants by August as that is when seed set begins, this will need to be repeated.
- Small-Medium Infestations:

  Flowering Plants are Highest Priority:

  i. Since this species is monocarpic (flowers once and dies) the plants that go to flower this year will not return in future years. Cut these plants to ground level just after it flowers to discourage re-flowering. Discard the flower heads safely, umbels mature at different times (the middle first) and can continue to mature even after they are cut from stem. If you are late and seeds are already present, it is important to take the time to cut the flower heads off and bag them for disposal off site. Putting the bag over the seed head before cutting is a good technique. Flowering stems that are cut should be monitored for regrowth as sometimes flower heads can regrow.
  ii. Digging reproductive year plants is effective, however, is more labour intensive than letting the plants go to flower and cutting them at the base. If the plants are in an area out of your continuous control, like on a roadside, we would recommend digging them as improper management timings can worsen your problem. We have observed Angelica flowering just below the roadside's brush cutters height, possibly having adapted to repeated cutting too early in the season.

  Immature Plants are a Secondary Priority:

  iii. Digging is effective to remove non-reproductive year plants from future seeding populations. Do so with a shovel, avoid hand pulling as squeezing the stems may expose sap, increasing the possibility of exposure. Dig into the ground .5 - 1.5' from the base of the plant. Dig straight down, burying the shovel head and place your foot on the shovel. Use your weight to wiggle the shovel back and forth, this will loosen the plant and indicate where needs to be dug next. Once adequately loosened the plant can be pulled out and bagged. This is easiest in the spring when root systems are not as well developed and the soil is moist,

timing this after a rain is a beneficial strategy later in the season. Removing the entire taproot is the most effective, however, if a significant section of the taproot is severed from the base, it is unlikely to resprout (a spade is an effective tool for this).

iv. Tarping may be combined with these methods to impact viability of the seed bank and reduce the frequency of management.

- Large Infestations:
    i. Mowing is effective however there is the risk of spreading root fragments around (these will start new plants) and the machinery should be cleaned before transferring to new areas. The timing is crucial as your problem can worsen if done at the wrong time.
        - Mowing is most effective just after mature plants have bloomed and before seed set. Doing it at this time will allow for most of the plant's energy to be put into its aboveground parts and so the roots will be at their weakest, meaning less aggressive regrowth. We have observed Angelica flowering close to the ground, just below the height of the roadside's brush cutter, possibly having adapted to repeated cutting too early in the season. Once you have cut the plant, monitor the site for any signs of re-flowering and mow again once/if the plant produces flowers.
        - Cutting "too early" in the season is not a concern if you will consistently mow the area to ground level for the whole length of the growing season.

    If this method is not combined with others it will need to be kept up on for the duration of the seed banks viability which is a minimum of 5 years (restarting the 5-year window if at any point the plant was allowed to have gone to seed).
- Whipper snipping is not encouraged as this process splashes the sap around and creates a significant hazard to those undergoing management.
- Do not burn as sap may become airborne and be harmful.
- Reminder: It is important to avoid the sap of this species when working. Avoid stepping on the plants when walking through it, instead part them and step in between. Most burns from this family are experienced on the legs as it is easy to forget this when working. Take care when bagging this plant to not flick any sap onto your face, ensure your face shield is on during this step.
- Additional Fact: Pollinators love this species and may ignore surrounding native species.
- Grow Me Instead:
    i. *Common boneset, *Eupatorium perfoliatum* (S3/S4. Wildflower grows to 1.5 meters and has beautiful white flowers that bloom from August – September. Grows along the margins of streams, in wetlands and ditches.).
- Identification Guide: *Angelica sylvestris*, woodland angelica, page 36
- Photo Guide: *Angelica sylvestris*, woodland angelica, page 88

- *Anthriscus sylvestris,* wild chervil
    - Reproduction: Spreads by seed (primarily) and vegetatively with new plants sprouting from lateral buds that form at the top of the taproot. Each plant can produce 800 – 10,000 seeds, the seed bank viability is unknown.

Phototoxic Sap

- Human Pathway: Thought to have been introduced through wildflower seed mixes. Seeds are often dispersed on agricultural equipment, and traffic corridors.
- Natural Dispersal: Seeds disperse by wind and birds slowly disperse seeds.
- PERSONAL PROTECTIVE EQUIPMENT: Due to the phototoxic sap within wild parsnip, you must take precautions to protect yourself against burns. Protective clothing should be worn, including a non-absorbent coverall (Tyvek), waterproof gloves, eye protection, face shield, non-absorbent long pants and shirt, and rubber boots. You may also want to tape joints in clothing to ensure it does not ride up and expose skin during management. Apply sunscreen before management. If exposed to sap, immediately cover the area from sunlight and for several days after. Flush the area with cold water ASAP and wash it off with soap. If exposure results in a burn, see a physician for further advice. It is important to provide safety protocols to staff beforehand and ensure that regular water breaks are possible. If you plan on managing this species, please contact us for a copy of our staff's safety protocols.
- Management Timing: Management should begin before June as the seeds can begin to form in later part of the month.
- Small Infestations: Tarping is effective on small populations.
    i. Immature Plants: Hand pulling or digging up rosettes is effective.
    ii. Mature Plants: Digging up and removing the root crown is effective in preventing regrowth.
- Large Infestations:
    i. Repeated mowing of large populations before the plant goes to seed will starve the population and eventually kill it – however consistent efforts are necessary. Aim to mow 3 – 6 times during the growing season and ensure your equipment is clean before mowing in new areas. Do not use a whipper snipper, sap is dangerous and should not be splashed around. Avoid the area after mowing until the sap at the site has time to dry up.
    ii. Livestock can graze on young plants and be an effective method of control.
    iii. Where appropriate, tilling multiple times over two years followed by sowing the infested areas with competitive perennials can provide long term results. Tilling is effective because it brings the root to the surface and dries it out, however without replanting it is not effective.
- Grow Me Instead:
    i. White meadowsweet, *Spiraea alba* (S5. Shrub. Grows .5 – 2 meters tall. Delicate looking white flowers bloom in mid to late summer. Grows in disturbed sites, old pastures and alongside streams or ponds.).
- Identification Guide: *Anthriscus sylvestris,* wild chervil, page 37
- Management Guide: *Anthriscus sylvestris,* wild chervil, page 89

- *Butomus umbellatus,* flowering rush
    - Reproduction: Spreads by seed (rarely), budding (bulbils) and rhizome fragmentation (primarily). Small bulbils detach from rhizomes and umbels. Some plants don't produce flowers but those that do produce an average of 200 seeds. Seed bank viability unknown.

- Human Pathway: Flowering rush is an ornamental which is sold in nurseries and online as a water garden plant.
- Natural Dispersal: Water movement is the main way the vegetative structures are transported to new areas.
- Management Timing: If cutting the rush below the water level, we recommend starting in the spring and continuing throughout the summer into the fall. Digging up the plant when the water levels drop is ideal, late July-August.
- Small Infestations:
    i. Cutting flowering rush below the waters surface can be an effective method of controlling the spread but not a technique for eradication. Care must be taken to dispose of all plant parts. This is best started in the spring and continues throughout the summer into the fall. Take care not to disturb the roots, if done too roughly it may encourage the bulbils to break off the root.
    ii. Digging can be an effective on isolated plants, preventing populations from establishing - it may be possible to eradicate if extreme care is taken. Avoid disturbing plant when in water as plant the rhizome is likely to fragment and/or dislodged bulbils can start new plants. This is best done when water levels are low, end of July. Using a pitchfork and getting underneath that with hands can be effective, use filters/screening nets to prevent materials from spreading downstream.
    iii. Benthic barriers may be a solution in long term control, but it will take much longer than other aquatic species, some reports say after five years there was still viable materials. Maintaining a benthic barrier for long term durations like this may not be feasible for most organizations/environments.
    iv. If your management plan is not ready to be put into place this year, it would still be wise to dedicate a day to removing seed heads if the form to reduce the spread (August – September). Do not trample roots while doing so s you will loosen bulbils.
- Methods such as raking or pulling which disturb the root system, but do not remove it, are not recommended control strategies.
- Control of this species is especially difficult, there is currently no known solution for a large patch although research continues. It should not be allowed to establish. The PEIISC is not away of any established populations on PEI, please report any sightings.
- Grow Me Instead:
    i. *Blue vervain, *Verbena hastata* (S1. Wildflower grows to 1.5 meters and has beautiful purple flowers which bloom August – September. Grows on water edges and can handle flooding. Also does well in gardens and in meadows.).
    ii. Sweet gale, *Myrica gale* (S5. Although this shrub does not have showy flowers, its smell is warm and fragrant, making it a wonderful addition to any garden. Grows in wet soils and does well with its roots submerged.).
- Identification Guide: *Butomus umbellatus*, flowering rush, page 38
- Photo Guide: *Butomus umbellatus*, flowering rush, page 90

- *Celastrus orbiculatus*, Asiatic bittersweet

Caution: Vine is often attached to dead branches that could injure workers. Do not trip or pull on vine.

  - Reproduction: Spreads by seed and vegetatively by spreading underground roots that form new stems. Seed bank is short lived, studies show that most seeds established after the first year and subsequent two years had no appreciable germination. Can begin producing seeds at 2 years of age.
  - Human Pathway: Asiatic bittersweet is native to China, Japan and Korea. It was introduced into the North America around 1860 as an ornamental plant. Some admire these vines around Christmas and make wreaths from them due to the red berries.
  - Natural Dispersal: Bittersweet fruit is eaten by birds and small mammals. It is a nutritious food source eaten in late winter. The seed is retained in the gut of birds for a long time, aiding in long-distance dispersal of the species (reports say can spread over 1km away).
  - Management Timing: Preventing seed dispersal is important in preventing the spread of this species over long distances, ideally management will have begun before berries formed (August – November, persist until February). The female plants with berries will be easy to identify from November – February as many other plants will have died back and the red will be obvious against the white snow. Marking these plants for future priorities during management will help control long distance spread from the infested site.
  - Small Infestations:
    i. Hand Pulling up root systems can be effective. Cut the vine at eye level and follow the stem downwards to the root system (which spreads horizontally) and hand pull gently so that all the root fragments are removed. Do not try and untangle the part above eye level, this can be left on the tree and will loosen overtime, pulling is hazardous.
    ii. Tarping can be effective. Cut the vine at eye level and again at ground level then tarp area the root system extends – it extends further than you may initially think. If you are unsure as to how far to tarp, follow a few outer roots to gather an idea.
    iii. If it is too late in the season to pull roots or tarp due to snow, the fruit can still be removed from the plant to prevent further spread. Take the time to mark this plant for future years priority.
  - Large Infestations:
    i. Must be tackled using a combination of methods. The PEIISC recognizes that herbicides can be effective in managing this plant on a large scale but does not currently offer advice in that regard. If the need arises, we remind all land managers to follow provincial and federal regulations as well as directions on the product labels.
  - Although cutting the plant will temporarily protect trees it is not a permanent solution, the roots will resprout from any remaining stumps and roots. Repeated cutting over many growing seasons is required to control Asiatic bittersweet. If it is not done consistently, it is likely to increase the population's size.
  - Reminder: Care must be taken when walking while managing this plant as the likelihood of tripping with tools increases as the roots can be quite extensive. Workers must also

avoid pulling on the upper growth of the vines as they are often wound tightly around dead limbs on trees.

- Grow Me Instead:
    i. *Virgin's bower, *Clematis virginiana* (S4. Vine. Showy white flowers bloom in August. Does well in full sun and in moist soils).
- Identification Guide: *Celastrus orbiculatus,* Asiatic bittersweet, page 38
- Photo Guide: *Celastrus orbiculatus*, Asiatic bittersweet, page 91

- *Centaurea nigra*, black knapweed
    - Reproduction: Primarily reproducing from seeds but can also regenerate from stem and root fragments. Seeds are viable for at least 5 years (some report 8) and typically begin to form in August. Each plant can individually produce 1,800 seeds per growing season.
    - Human Pathway: Introduced from Europe as an ornamental plant as well as in ships' ballast it now spreads commonly through machinery, hay, and soil movement.
    - Natural Dispersal: Seeds are spread by wind, water, and attaching to animals (phoresy).
    - PERSONAL PROTECTIVE EQUIPMENT: Knapweed can cause skin irritation; it is important to wear gloves and cover your skin with appropriate field clothing when managing.
    - Management Timing: When at all possible, hand pulling/digging of Black Knapweed should be done early in the growing season before flowering occurs. If mowing, this should begin just before the plant reaches the flowering stage. Allowing the plant to bolt before cutting will reduced the likelihood of resprouting. Prioritize outlying less established populations first unless in sensitive ecosystems.
    - Small infestations:
        i. Hand-pull and dig to remove the plants root system. It is always best to try and remove the entire taproot but if it cannot be removed, it should be cut with a spade 3cm below the soil surface to remove at least the root crown.
    - Large infestations:
        i. Mowing can be effective; although it will not eradicate a population in the short term, it can prevent further spread if undertaken before the plant goes to seed. This process will need to be repeated monthly throughout the growing season as flowering stems may regrow. Black Knapweed seeds can persist in the soil for 5-8 years, it is important the plants do not seed themselves. If these efforts are consistent, this may deplete the root systems of its energy.
    - Reminder: When removing second year plants, remember to look around the base of larger plants for the basal first-year rosettes.
    - Additional Facts: Allelopathic, meaning it can alter soil chemistry and large sites may need to have its soil remediated to encourage a healthy soil for re-establishing native species. Dead plant material may increase the risk of forest fires.
    - Grow Me Instead:
        i. *Blue-eyed grass, *Sisyrinchium montanum* (S5. Grass. Grows up to 35 cm. Deep violet flowers bloom from May – July. Grows in meadows, roadsides, moist disturbed sites, gardens and occasionally in open woodlands and shorelines.).
    - Identification Guide: *Centaurea nigra,* black knapweed, page 39
    - Photo Guide: *Centaurea nigra*, black knapweed, page 92

- *Cytisus scoparius*, scotch broom

All parts of this plant are extremely poisonous to humans, horses, and livestock.

- Reproduction: Spreads mainly by seed but also through lateral bud growth. Each plant has thousands of seed pods, each pod has about 5-12 seeds there are about 18,000 seeds on a plant. Long lived seed bank, minimum of 5 years but some reports say 30 to 80 years. Starts producing seeds after 3 years, a plant can live up to 17 years.
- Human Pathway: Native to Europe, from Ireland to west-central Ukraine and from southern Spain to southern Sweden. Introduced to North America as an ornamental it is now a garden escapee. Can travel on footwear, vehicles, livestock, and soil movement.
- Natural Dispersal: Seedpods dry, they split and spiral, expelling seeds up to 5 metres. Large seeds can float and disperse down waterways. Ants have been known to transport seeds.
- Management Timing: Management should be undertaken before the plant goes to seed when the strategy allows. It is especially important to get outlier species (aka satellite populations) removed before seed set. Seeds form in late July - November.
    i. Small- Medium Infestations: Should be pulled, removing as much of the as possible. This will be labour intensive. We recommend bringing an extractigator along if possible (the PEIISC has one to lend for this purpose, email for more info).
    ii. Large Infestations: For large sized infestations use chainsaws, brush cutters, and loppers to cut plants to ground level. Cutting in the spring or early summer will result in poor control. This is most effective (80% mortality) in the dry season which is late July to early September. It is important to consider the explosive seed pods will be developing during this time. While it is normally best to avoid exploding seed pods completely, the dry weather reduces the likelihood of plants from resprouting. Older plants are likely to resprout, some sources say that 20% over the age of 5 will resprout, whereas 50% of young growth will resprout. If undergoing management during this time. take special care to avoid spreading mature seed pods to un-infested areas.
    Cutting down mature shrubs over 2" in diameter is effective but mowing young, green plants is not and will result in a dense carpet of short broom plants. If cutting plants under 2" in diameter check back regularly for regrowth.
        - Tarping increases the success of a project and when combined with cutting can result in control in 2 years of application, may take longer.
- Grow Me Instead:
    i. *Bush honeysuckle, *Diervilla lonicera* (S4. Shrub. Grows up to 1 meter tall. Yellow flowers bloom late-June – July. Grows along roadsides, old fields, and in open forests.).
- Identification Guide: *Cytisus scoparius*, scotch broom, page 39
- Photo Guide: *Cytisus scoparius*, scotch broom, page 93

- *Echinocystis lobata*, wild cucumber
    - Reproduction: Spreads only by seed. 1-6 seeds explode from spiky fruit capsule due to hydrostatic pressure, expelling the seeds at over 11.5m/sec. Spreads only by seed, plant

is monecious - meaning both male and female parts occur on the same plant (fruit form on all mature plants). Seed banks are considered persistent, but details are unknown.

- Human Pathway: Native to many parts of the US and Canada, this species is considered invasive in PEI. Gardeners unfamiliar with the status of PEI's native flora may be tempted to grow this species, and seeds can be purchased online.
- Natural Dispersal: Seeds can float and travel to new areas through watercourses. Birds and rodents also disperse seeds.
- Management Timing: This species is best managed before seed pods form, which is typically in September. It is best to start management early in the spring to prevent the vines from weighing down native vegetation and reducing its ability to collect nutrients and light.
- Young Plants:
    i. Stirrup hoe in the spring once most of the germination has taken place. Return to the site throughout the season as soil disturbance may increase germination.
    ii. Hand pulling can be effective if the site is not conducive to using a stirrup hoe. Return to the site throughout the season as soil disturbance may increase germination.
- Mature Flowering Plants:
    i. Cutting can be effective. Although less ideal than managing early in the spring it is possible to manage sites found late in the season by cutting the vines. Cut the stems at eye level (so you can see what has been cut), follow the growth to the roots, and pull. Leave the upper portion of the plant behind, it is not worth untangling unless it is aesthetically important to you. If there are flowers or seeds present it is important to bag and properly dispose of them.
- Large Sites:
    i. If the site is open and the plants are not climbing, mowing is an effective option.
- If management is done before the plant goes to seed, the plant materials can be left behind at the site if the roots are suspended away from soil. If the seeds have developed it is important to remove seed pods as unripe seeds can ripen even off a dead plant. In this case, bag them immediately to avoid spreading them to new areas.
- Grow Me Instead:
    i. *Virgin's bower, *Clematis virginiana* (S4. Vine. Showy white flowers bloom in August. Does well in full sun and in moist soils).
- Identification Guide: *Echinocystis lobata, w*ild cucumber, page 40
- Photo Guide: *Echinocystis lobata,* wild cucumber, page 94

- *Elodea canadensis*, Canada waterweed
    - Reproduction: Spreads vegetatively, primarily by fragmentation but also by budding. Buds known as Turions are short, dormant, and are capable of turning into their own plants. They develop then break off to float around the water body before they sink to the bottom. Here, they overwinter and produce new plants in spring. Canada waterweed does sometimes (rarely) produce seeds, seed bank viability unknown.
    - Human Pathway: Canada waterweed is native to other Canadian provinces, including the rest of the maritime region. It can be spread through recreational boating activities

when caught in propellers or trailers if the gear is not cleaned between uses. It is a common plant in aquariums and therefore can be introduced to systems when people dump their fish tanks into natural systems.

- Natural Dispersal Method: Overwintering buds and fragments of the brittle branches are easily detached by waves, currents, foraging animals, and boat traffic.
- Management Timing:
    i. Installing benthic mats has proven to provide effective control in just three weeks. This may be the best solution for managing this species as it results in lower fragmentation than other methods. This is a non-selective approach and will harm all it covers.
    ii. Mechanically removing the biomass of the plant can be done using several means. These include chains, dredging or specialized boat equipment. It is important to place filters downstream that will capture any of the brittle fragments that snap off. This method offers short term relief. All materials should be removed from the water once broken from bottom. This is best done in May, before peak biomass which occurs in July. This method may provide 8 – 10 weeks of control.
- Shade can help control many aquatic submergent species. It is advisable to plant trees around the infested area to provide shade long term and prevent reestablishment. In the short term, a floating sheet of opaque material has been shown to be effective as well as non-toxic dyes or colorants. Dyes and colorants prevent or reduce aquatic plant growth by limiting sunlight penetration.
- When possible, increasing waterflow rates can help prevent this plant from establishing again, as it prefers stagnant waters.
- Grow Me Instead:
    i. Common hornwort, *Ceratophyllum demersum* (S4. Submergent freshwater aquatic.).
- Identification Guide: *Elodea canadensis,* Canada waterweed, page 40
- Photo Guide: *Elodea canadensis*, Canada waterweed, page 95

- *Euphorbia cyparissias*, cypress spurge

Sap is an extreme irritant, can result in blindness if eye contact. May be toxic to grazers.

- Reproduction: Spreads by seed, horizontal roots, and fragments. Some populations don't produce seeds but those that do produce from 30-900 seeds per plant. Seeds remain viable for up to 20 years. The plant can produce more than one seed crop per season. Roots can form new genetically identical plants by creeping rhizomes. Root fragments of almost any size can start new plants.
- Human Pathway: Cypress spurge is a Eurasian native likely introduced to North America in the early 1800s as an ornamental garden plant. It was traditionally planted in graveyards. Over the past century, the plant has spread through ornamental planting, movement of contaminated hay, and being carried on dirty farm equipment. It may also be transferred on footwear.
- Natural Dispersal: Seeds are forcefully ejected from seed capsules by explosive dehiscence, travelling up to 5m from parent plant. Seeds also spread by wind, insects, and birds. Seeds contain an oily substance that is attractive to ants. Spring flooding has been reported to increase spread in Ontario. Some reports say birds help spread the seeds, but these reports are not conclusive.

- PERSONAL PROTECTIVE EQUIPMENT: It is important to wear protective equipment to avoid exposure to the irritating latex sap. Gloves and eye protection will be necessary, along with boots, long pants, and a long sleeve shirt.
- Management Timing: Wild cucumber reproduces primarily by seed. Its prolific seed production and long seed bank viability means management should be undertaken before the plant goes to seed. This plant can produce more than one seed crop per season. An Ontario-based study found that seed production began in the third week of June and continued until early fall.
- Small Infestations:
    i. Hand-pulling can be effective. This method is labour-intensive and will require repeated visits (monthly) to pull any new plants coming up. The roots grow very deep and are likely to fragment. Therefore, it will be necessary to dig out any root fragments left in the soil after pulling. It is important to dispose of these safely to prevent spread.
    ii. Tarping the affected area can effectively reduce plant health and seed viability when combined with cutting or digging beforehand, although there are currently no resources that study effectiveness for this species.
- Large Infestations:
    i. Tilling is an effective control measure. This must be repeated every two weeks during the growing season. In late summer and autumn this regiment can be reduced to every three weeks. Clean equipment before transporting it to new location to prevent unintentional spread.
    ii. Mowing is effective in reducing seed production and aboveground growth. However, it is unlikely to be a permanent solution unless it is paired with other control measures as it does address the roots. Some sources do not recommend it as a technique since it can have a stimulating effect on the growth of cypress spurge. If mowing, it is best to do so at least every two weeks.
    iii. Grazing by goats and sheep is an effective control measure for this species if the animals are fenced in. Grazing is not a final solution as a portion of the seeds consumed remain viable in the feces of the animal and the roots are not damaged. The animals prefer to eat young shoots. Any other grazers can become ill from consuming this species and it can burn their hooves/legs. Hay infested with this species poses a health risk to cattle. If you plan on using the goats or sheep for meat, you may want to do some further research into the tumor-promoting properties of this plant. There is some concern that livestock who eat this plant may pass this along to humans.
- Effects of controlled burns are not well documented for this species, caution because of irritant sap is recommended as some can become aerosolized.
- Grow Me Instead:
    i. *Seaside goldenrod, *Solidago sempervirens* (S4/S5. Wildflower grows to 2 meters tall. Showy yellow flowers bloom July – September. Adapted to many sites including disturbed areas, brackish shorelines, marshes, coastal dunes.).
- Identification Guide: *Euphorbia cyparissias*, cypress spurge, page 41
- Photo Guide: *Euphorbia cyparissias*, cypress spurge, page 96

- *Euphorbia esula*, leafy spurge
    - Reproduction: Spreads by seed, adventitious buds on roots and root fragments. Approximately 140 seeds are produced per plant and the seeds are viable for up to 8

Sap is an extreme irritant, can result in blindness if eye contact. May be

*Grow Me Instead options with an asterisk indicate the plant is available in the MacPhail Woods Ecological Forestry Center's 2023 Nursery Catalogue.

years. Despite this longevity, studies have found that 99% of seeds germinate in the first two years. The seeds can be ejected 4.6m or more when the mature capsule explodes. Seeds have a sticky coating that allows it to attach to animals. Peak germination is late May – June. Extensive root systems that spread horizontally and vertically. Over 300 underground adventitious buds can be found on these long roots. Vegetative growth is the primary hardship of management. At 15 days old the plant has an average of 5 new root buds.

- Human Pathway: Leafy spurge is a Eurasian native that was first introduced to North America in 1826 (Massachusetts). It is believed to have had multiple introductions by way of ship ballast discard, contaminated agricultural shipments, and as an ornamental plant. The movement of contaminated or infested soil and attaching to the undersides of vehicles are examples of unintentional dispersal.
- Natural Dispersal: Seeds are forcefully ejected from seed capsules by explosive dehiscence, travelling up to 5m from parent plant. Seeds are also dispersed by water (rivers and streams), wind, ants, and birds. Frost breakage of roots with adventitious root buds lead to further spread.
- PERSONAL PROTECTIVE EQUIPMENT: It is important to wear protective equipment to avoid exposure to the irritating latex sap. Gloves and eye protection will be necessary, along with boots, long pants, and a long sleeve shirt.
- Management Timing: This plant's prolific seed production means management should be undertaken before the plant goes to seed. The seeds are dispersed 20-30 days after flowering. Some plants flower in early May, so seeds can be present in early June. Seeds and flowers are produced continuously throughout the growing season. They can both be found into November, although most seeds are dispersed by mid-September.
- Small Infestations:
    i. Hand-pulling can be effective before the plant goes to seed. This method is labour-intensive and will require repeat pulling every two weeks due to the boom in vegetative growth stimulated by the disturbance. As the roots grow very deep, they are likely to fragment. It will be necessary to dig out any root fragments left in the soil after pulling. It is important to dispose of these fragments safely.
    ii. Tarping the affected area can effectively reduce plant health and seed viability when combined with cutting or digging beforehand, although there are currently no resources to support the effectiveness of tarping for this species.
- Large Infestations:
    i. Tilling is an effective means of control. This would need to be repeated every two weeks during the growing season. In late summer and autumn this can be reduced to every three weeks. Two years, tilling will greatly reduce the adventitious buds. Aboveground growth and roots will be stressed.
    ii. Mowing is effective in reducing seed production and aboveground growth. It is unlikely to be a permanent solution unless paired with other techniques. If you mow, do so every two weeks.
    iii. Grazing by sheep or goats is effective at controlling the spread of this species if the animals are fenced in. Grazing is not a final solution as a portion of the seeds consumed remain viable in the feces of the animal. The animals prefer to eat young shoots. Any other grazers can become ill from consuming this species and it can burn their hooves/legs. Hay infested with this species poses a health risk to cattle. *If you plan on using the goats or sheep for meat, you may want to do

some further research into the tumor-promoting properties of this plant. There is some concern that livestock who eat this plant may pass this along to humans.

iv. Burning and then introducing certain grasses to compete can reduce population sizes. If burning, note that the oils in this plant are very flammable and caution should be exercised. Burning is also effective when paired with biological controls, but burns must occur in a way that has little impact on the lifecycle of the biological control agent.

- Additional Facts:
  i. To date, no single control method will eradicate leafy spurge. When control measures are combined, eradication may be possible (including use of biological controls and herbicide applications).
  ii. Horses in pastures with this plant have been reported to have burns around their hooves, especially if the plants were mowed and the sap was exposed.
- Grow Me Instead:
  i. *Seaside goldenrod, *Solidago sempervirens* (S4/S5. Wildflower grows to 2 meters tall. Showy yellow flowers bloom July – September. Adapted to many sites including disturbed areas, brackish shorelines, marshes, coastal dunes.).
- Identification Guide: *Euphorbia esula,* leafy spurge, page 42
- Photo Guide: *Euphorbia esula*, leafy spurge, page 97

- *Fallopia japonica*, Japanese knotweed
  - Reproduction: Spreads vegetatively, most are clones of original individuals that were introduced. Rhizome fragments weighing as little as 0.7g are capable of regenerating into a new plant, even in water. Japanese knotweed produces seeds, but they are considered almost entirely non-viable. Therefore, the seed bank is irrelevant for this species. It is important to confidently ID Japanese knotweed from other knotweeds on PEI, as these have seeds viable for 15yrs.
  - Human Pathway: Japanese knotweed was originally imported from Japan to North America as an ornamental garden plant. It was admired as a quick growing privacy "shrub" and for its bamboo-like stems. It is now commonly found in urban areas. It is transported mainly through soil movement and on equipment that may transport plant parts.
  - Natural Dispersal: Seeds are spread by wind and water but are not viable.
  - Management Timing: Tarping is best done in the spring. This will allow the sun to bake the material throughout the whole growing season. The tarp should certainly be in place before the plant flowers as it starts to send nutrients back to the roots at this stage. Cutting, when done alone, is not an ideal method should begin in April and continue until regular frost. Large scale excavation can be done any time.
  - Small – Medium Infestations:
    i. The best mechanical approach is tarping. It can be an effective approach to eradication if maintained. Cut stems to ground level, taking care not to disturb the roots, then tarp the area. Doing so in the spring will allow the sun to bake the roots over the warmest months. We recommend a minimum 5-year plan to keep the tarp in place. Each year that a new shoot emerges through/past the

tarp, it restarts the 5-year plan until there has been 5 years with no new growth around the edges or center. Local success has been achieved within 10 years of initial control efforts with consistent effort. This plant is well known to puncture through tarping materials, so the tarp should be checked on regularly and patched. It is important to plan for maintenance as the edges will require additional tarping as the plant extends outward looking for light.

ii. Cutting may help reduce the spread of this species in some instances but is not an option to eradicate a patch. A local firsthand account of a small patch being cut was reported to take 18 years of consistent efforts before success. If your only option is to cut (for example its in your neighbour's yard who won't allow management) be sure to do so at least twice a month (preferably more) and ensure the plant does not grow above 6". Begin this in April and continue until frost. Do not leave cut parts of the stem behind in the soil as they can take root, clean your equipment carefully. This method is best combined with another as it is likely to be ineffective for eradication, if done inconsistently can actually increase the spread of the plant. Take care to not leave fragments behind in the soil as stems can produce roots and start new plants.

- Large Infestations:
  i. Sites that require full-scale management can be remediated by using an excavator to dig up at least 2m of soil, creating a pile of infested soil. Then, dig the hole even deeper, stopping at somewhere over 5m, creating a pile of "clean" soil. Bury the infested soil beneath the "clean" soil. Be sure to clean up all stems and fragments, monitor the site for any regrowth.
- **Do not try and dig this plant out** unless you have a very small patch, and you have a plan for the soil dug up. Root fragments are likely to break off during digging, and each will be able to start a new plant. Movement or improper disposal of the soil can simply relocate the infestation, making it someone else's problem.
- Grow Me Instead:
  i. Wild raisin, *Viburnum cassinoides* (S5. Makes a great privacy fence, grows up to 4 meters tall. Large, white, umbrella-shaped clusters of flowers bloom late-June – July. In September, the berries give way to green, white, pink, and dark purples berries. Prefers shady moist sites but does well in almost any condition and is flood tolerant.).
- Identification Guide: *Fallopia japonica*, Japanese knotweed, page 42
- Photo Guide: *Fallopia japonica*, Japanese knotweed, page 98

*Grow Me Instead options with an asterisk indicate the plant is available in the MacPhail Woods Ecological Forestry Center's 2023 Nursery Catalogue.

- *Heracleum mantegazzianum*, giant hogweed
  - Reproduction: Spreads only by seed. Abundant seed production, with anywhere from 50,000 – 120,000 seeds per individual. Seed bank remains viable for up to 5 years, by the third year only .1% of seeds remain viable.
  - Human Pathway: A garden escapee admired for its tall stature and large inflorescence.

Phototoxic Sap

- Natural Dispersal: Winged seeds can spread an average of 10m by wind or float along water, remaining viable for up to 3 days.
- PERSONAL PROTECTIVE EQUIPMENT: Due to the phototoxic sap within Giant Hogweed, you must take precautions to protect yourself against burns. Protective clothing should be worn, including a non-absorbent coverall (Tyvek), waterproof gloves, eye protection, face shield, non-absorbent long pants and shirt, and rubber boots. You may also want to tape joints in clothing to ensure it does not ride up and expose skin during management. Apply sunscreen before management. If exposed to sap, immediately cover the area from sunlight and for several days after. Flush the area with cold water ASAP and wash it off with soap. If burns occur, see a physician for further advice. It is important to provide safety protocols to staff beforehand and ensure that regular water breaks are possible. There is an increased risk of heat stroke and heat exhaustion when working in PPE. If you plan on managing this species, please contact us for a copy of our staff's safety protocols.
- Management Timing: Begin management early in the season when plants are at their smallest, preferably May to early June before flowers form. This is an optimal time for management as temperatures are lower than the July – August heat and the protective gear can be quite exhausting.
- Young Seedlings:
    i. Seedlings should be dug early in the season when the ground is moist and the plants easy to pull. A stirrup hoe may aid in this process if plant density is high. Ensure they are bagged, removed from the site, and properly disposed of.
- Medium Non-flowering Plants:
    i. Digging and removing the root is effective. If a large portion of the root including the root ball is removed, the plant is unlikely to resprout. Use a shovel to dig into the ground .5-1.5' from the base of the plant. Dig straight down, burying the shovel head and place your foot on the shovel. Use your weight to wiggle the shovel back and forth. This will loosen the plant and indicate where needs to be dug next. Once adequately loosened, the plant can be pulled out and bagged. *Keep in mind digging flowering plants is not a priority. This plant is monocarpic and so will die after it flowers. Cut flowering plants down to ground level and dig out medium sized plants.
- Flowering/fruiting Plants:
    i. Cut flower heads off of the stem and bag them. A hogweed plant has multiple umbels, that mature into seeds at different times. It is important to never leave these behind as they can mature into seeds even once cut. If there are already seeds present, we recommend putting the clear bag over the seed head before cutting from plant to prevent dropping any. Close the bag around the stem below the seed head to ensure all seeds are captured, then clip it. This plant is monocarpic and so the year it goes to flower is its last year of life.
- Mowing or whipper snipping is not encouraged as this can spread the toxic sap around and create a significant hazard to the manager and anyone in the area. Mowing also leaves the root behind, meaning the plant is likely to resprout.
- Do not burn as the toxic sap may become airborne.

- If you plan on managing this species, please reach out to us at the PEIISC for further advice including the safety protocols followed by our experienced staff .
- Reminder: It is important to avoid the sap of this species when working. Avoid stepping on the plants when walking through them, instead part them and step in between. Most burns from this family are experienced on the legs as it is easy to forget this when working. Wrists and any other gaps in PPE for sap to enter are additional commonly burned areas. Take care when bagging this plant to not flick any sap onto your face! Ensure your face shield is on during this step.
- Grow Me Instead:
    i. Common elderberry, *Sambucus canadensis* (S4/S5. Shrub. Grows to 4 meters tall. Flat white flower clusters bloom in early-July – August. Fruit ripens from August to September and are dark purple. Does best in moist soils and is flood tolerant. It is often found in damp roadsides, open woodlands, old fields, and streambanks.).
- Identification Guide: *Heracleum mantegazzianum,* giant hogweed, page 43
- Photo Guide: *Heracleum mantegazzianum*, giant hogweed, page 99

*Grow Me Instead options with an asterisk indicate the plant is available in the MacPhail Woods Ecological Forestry Center's 2023 Nursery Catalogue.

- *Impatiens parviflora*, small-flowered jewelweed
    - Reproduction: Spreads only by seed. Produces an average of 1,000 – 2,000 seeds per plant, but production can be as high as 10,000 in some cases. Unknown seed bank viability but it is thought to be short-lived.
    - Human Pathway: Seeds travel with mud and dirt on footwear and vehicles. It can also be transported unintentionally on harvested logs and planted intentionally as an ornamental ground cover.
    - Natural Dispersal: Seeds are forcefully ejected from seed capsules by explosive dehiscence and travel up to 3.4m from parent plant. Seeds can float and move downstream. Birds have been reported to disperse seeds as well.
    - Management Timing: Management can be undertaken until the plant goes to seed which is in July. This plant is an annual, so there is no benefit to removing the plant once it has produced seeds as the seeds readily disperse once touched.
    - Small-Medium Infestation:
        i. Hand-pulling is effective. Shallow roots make it easy to pull from moist soil. This method is effective for larger patches but time consuming. If resources allow, it is possible to use this approach on any size patch. This approach is ideal because it is selective and minimizes damage to surrounding vegetation, which should be protected to compete with this the jewelweed. Hand-pulling should be done before seed pods form in August to avoid dispersing seeds and furthering spread.
    - Large Infestation:
        i. There are no published studies on the effects of mowing/cutting this species. Evidence suggests that this treatment could be effective, as this is an annual plant that spreads only by seed. A whipper snipper could be effective in forested areas. It is important to survey the site before starting to identify any rare or ecologically

significant species and mark them with flagging tape. Leave as many native species as possible to compete with the balsam. Cutting will need to be repeated throughout the growing season. Visit the site monthly to repeat controls and prevent seed formation.

- Grow Me Instead:
    i. *Small enchanter's nightshade, *Circaea alpina* (S5. Wildflower that forms colonies. Grows 10-30cm tall. White slender flowers bloom June – September. Does best in moist shady conditions and can be found in shady woodlands and forested wetlands.).
    ii. *Hairy sweet cicely, *Osmorhiza claytonii* (S2/S3. Wildflower that makes an excellent forest ground cover. Grows up to 1 meter tall. White umbel shaped flowers bloom May – June. Does best with dappled sunlight or moderate shade and can be found in rich deciduous or mixed woodlands with.).
    iii. *Yellow violet, *Viola pubescens* (S2/S3. Wildflower that makes an excellent forest ground cover. Grows up to .5 meters tall. Yellow flowers bloom April – May. Does best in dry deciduous woodlands.).
- Identification Guide: *Impatiens parviflora,* small-flowered jewelweed, page 43
- Photo Guide: *Impatiens parviflora*, small-flowered jewelweed, page 100

- *Impatiens glandulifera*, Himalayan balsam
    - Reproduction: Spreads by seed which remain viable for 1.5 years.
    - Human Pathway: Native to the foothills of the Himalayas, this plant was introduced to North America as an ornamental species. This plant is still used as an ornamental and is considered a garden escapee. It can spread to new areas through contaminated soil. Beekeepers have been known to intentionally plant this species for its high nectar content.
    - Natural Dispersal: Seeds spread 7m (23') from the parent plant through explosive dehiscence. Long distance natural spread is often due to movement of seeds through waterways. Seeds can even germinate under water. Small rodents may also contribute to the seed spread.
    - Management Timing: As an annual that spreads only by seed it is imperative that the plant is managed before it goes to seed (usually mid-August).
    - Small-medium Populations:
        i. Hand-pulling is effective, and not very strenuous. The process may be time consuming when populations are large. Return to site to pull plants later in season as well since soil disturbance may increase seed germination rates.
    - Large Populations:
        i. Cut/mow the stems below the first node and monitor the site for regrowth. Remove plants from the soil as nodes can sprout roots.
    - Additional Fact: It is an annual that plant dies back in the winter and leaves banks exposed, increasing erosion.
    - Grow Me Instead:
        i. *Spotted joe-pye Weed, *Eupotorium maculatum* (S5. Wildflower. Showy purple flowers bloom July – September and are admired by pollinators for its high nectar content. Prefers full sun to partial shade and in wet soils. Can be found in

wetland, streamsides, swamps, ditches, but can become drought tolerant once established.).

- Identification Guide: *Impatiens glandulifera,* himalayan balsam, page 44
- Photo Guide: *Impatiens glandulifera*, himalayan balsam, page 101

- *Iris pseudacorus*, yellow flag iris

Irritating Resin in Sap

- Reproduction: Spreads by floating seeds and vegetatively by rhizomes. Unknown seed bank viability. The rhizomatous growth is said to extend an average of 25cm (10") per year.
- Human Pathway: Native to Europe, Western Asia, and Northwest Africa, it was introduced to North America in the early 1900s as an ornamental garden flower. It is still planted today and is considered a garden escapee.
- Natural Dispersal: Dispersed through water, the seeds of this iris can float for months and establish downstream. Escapes from gardens in surface runoff during snow melts.
- PERSONAL PROTECTIVE EQUIPMENT: Wear gloves and a long sleeve shirt as resin found in the sap can cause skin irritation in some people.
- Management Timing: Manage before seeds form as management when seeds are present will increase the potential for long distance dispersal. Seeds form in July - August.
- Small infestations:
    i. Digging can be an effective control measure. Remove as much of the plant as possible including the roots. Roots left in the ground will give rise to new plants as this root system is persistent. This practice is most effective when the plant is not in water as root fragments can float away downstream and re-establish. If you must dig in water, try to implement some kind of straining system to catch debris. This would be best implemented in gardens or seasonally dry wetlands.
    ii. Repeated cutting below the water's surface may help eradicate a population and will prevent seed set. This is best started as soon as leaves emerge in spring and continued throughout the growing season. Over time, this can deplete the rhizomes' energy reserves.
- Large infestations:
    i. Tarping is effective. Cut the plants down to the soil level and cover the area with a tarp. After installing a tarp/benthic mat, it is very important to use a spade to cut around the edges of the mat. This is so that if there are any roots extending this far, they are no longer connected to plants under the tarp.
    ii. Installing a benthic barrier over submerged or seasonally flooded sites in wetlands or ponds is very effective. After installing a benthic mat, it is very important to use a spade to cut around the edges of the mat. This is so that if there are any roots extending this far, they are no longer connected to plants under the mat. This may be effective in as little as one season. Check the readiness of the site by removing the tarp and examining the rhizomes – they should be mushy and brown.
    iii. Mowing repeatedly may eventually result in eradication of yellow flag iris as it prevents photosynthesis, gradually depleting the energy stored in the rhizomes which is necessary for plant growth. The roots of this iris have plenty of nutrient reserves, so this will take years to deplete. Still, mowing impedes the plant from producing seeds, depleting the seed bank, so this at least prevents long-distance

dispersal. Mowing should occur before plants go to seed. Equipment must be thoroughly cleaned before moving from site.

- Last minute efforts:
    i. If you did not get a chance to perform any of the above management during the growing season, it is still highly recommended that you cut any developed seed pods off the plants to prevent the population from spreading. This is especially true near waterways, as the seeds of this iris can float for months and establish downstream.
- Grow Me Instead:
    - *Blue flag iris, *Iris versicolor* (S5. Wildflower. Grows to 80cm. Large showy deep blue to violet flowers bloom in June – July. A hardy native iris that does well in gardens and is great for pollinators in wetlands if it does escape).
- Identification Guide: *Iris pseudacorus,* yellow flag iris, page 45
- Photo Guide: *Iris pseudacorus*, yellow flag iris, page 102

*Grow Me Instead options with an asterisk indicate the plant is available in the MacPhail Woods Ecological Forestry Center's 2023 Nursery Catalogue.

- *Lythrum salicaria*, purple loosestrife
    - Reproduction: Spreads by seed and vegetatively. Prolific seed producer, one plant can produce 2.7 million tiny seeds. Unknown seedbank viability, some reports 2-3 years however some sources indicate it could be up to 20 years.
    - Human Pathway: Arrived in eastern North America in the early 1800s. Introduced as garden alternatives, on sheep, raw wool and also accidentally through seeds present in the ballast holds of ships. Today this plant is often shared by gardeners, spread through soil movement, in "wildflower" seed mixes, footwear and on vehicles/boats.
    - Natural Dispersal: Seed travel by wind, on animals or water. It has been known to spread through waterfowl that visit infested wetlands.
    - Management Timing: This species produces millions of seeds and so it is important to perform management before they are formed, which can begin as early as mid-July. Digging should begin in May, June and up to mid-July before seed set. Doing so after seed set, will still prevent future years from seeding but it will reset the duration of management at your site and will contribute to its spread. If digging, keep in mind multiple visits in a season is important as some may seed late.
    - This is best done early in the season before seed set. Annual stems emerge as early as late April and so leaves should be visible at this point for an ID.
    - Small infestations:
        i. Digging is considered the most effective way to control purple loosestrife, but it is also the most labor intensive. When digging, try to remove as much of the taproot as possible to reduce re-growth. Digging plants disturbs the soil and may promote the germination of seeds from the soil seed bank, root fragments left behind can also start new plants due to adventitious buds.
    - Large Infestations:

i. Cutting the aboveground growth is a temporary measure to prevent plants from going to seed. Cut after the plant has been in flower for 3 weeks, which should be ahead of seed production. Stem fragments must be disposed of properly as they can start new plants, check on the site as it may need to be repeated if it flowers again.

ii. Biological Control. There are no natural predators in North America to keep this species under control, therefore extensive research has been done on biological control agents which specifically target and feed on purple loosestrife. Ducks Unlimited has successfully released the two species of *Galerucella* beetles on PEI. Both the adult and the larvae of these beetle's forage on purple loosestrife plants causing severe damage and often killing the plant.

- Additional Fact: Purple loosestrife is controlled plant under the PEI Weed Control Act and cannot be propagated, sold, or traded.
- Grow Me Instead:
  i. *Swamp milkweed, *Asclepias incarnata* (S2. Imperiled. Wildflower. Showy purple flowers bloom in July. Does best in a wet soils in full sun, does well in gardens. Sole food source for monarchs). Due to its rarity on PEI, do not collect seed from wild plants.
- Identification Guide: *Lythrum salicaria,* purple loosestrife, page 45
- Photo Guide: *Lythrum salicaria*, purple loosestrife, page 103

- *Pastinaca sativa*, wild parsnip

Phototoxic Sap & Ingestion is toxic to humans and livestock.

- Reproduction: Spreads only by seed, prevention of seed production is a crucial goal when managing this species. Seed bank remains viable for up to 5 years.
- Human Pathway: Likely brought to North America by European settlers as a food source. Today it is a garden escapee, as it remains admired as an ornamental and medicinal herb. Mowing at improper times can cause the seeds of this plant to spread over far distances as its seeds can hitch a ride on machinery. It commonly grows along travel corridors and can hitch a ride on vehicles (farm equipment, cars, all terrain vehicles). It can be transported accidentally in soils.
- Natural Dispersal: Spreads aggressively, most often 2-5 meters from the parent plant. The umbels of the plant may snap off and act as tumble weeds and wind may push some of these far from parent plant. If growing near waterways, the seeds are also dispersed downstream as the seeds of this plant can float.
- PERSONAL PROTECTIVE EQUIPMENT: Due to the phototoxic sap within wild parsnip, you must take precautions to protect yourself against burns. Protective clothing should be worn, including a non-absorbent coverall (Tyvek), waterproof gloves, eye protection, face shield, non-absorbent long pants and shirt, and rubber boots. You may also want to tape joints in clothing to ensure it does not ride up and expose skin during management. Apply sunscreen before management, in case of accidental exposure. If exposed to sap, immediately cover the area from sunlight and for several days after. Flush the area with cold water ASAP and wash it off with soap. If burns occur, see a physician for further advice. It is important to review safety protocols beforehand. If you plan on managing this species, please contact us for a copy of PEIISC safety protocols.

- Management Timing: Seeds form mid-summer however unless disturbed do not normally break free from the parent plant until autumn. It is best to undergo management before seeds form. Doing so in the spring is effective as the taproot is at its most manageable size and the soils are moist which make it easier to remove the roots. Wearing the protective gear listed above can be quite cumbersome on hot days, increasing the risk of heat exhaustion. When possible, it is best to plan for days with less humidity and sunlight – a breeze is always nice too, but no rain as it compromises the personal protective equipment.
- Small-Medium Infestations:

  Flowering Plants are Highest Priority:

  i. Since this species is monocarpic (flowers once and dies) the plants that go to flower this year will not return in future years. Cut these plants to ground level just after it flowers and discard the material, this reduces the risk of sap exposure during and after management. If there are a few plants, and the area has no foot traffic, you may choose to just cut the flowering head to reduce the amount of material removed from the site. If you are late and seeds are present, it is important to take the time to cut the flower heads off and bag them for disposal off site (even if they don't seem ripened as they may continue to mature off the stem) and then cut to ground level. Flowering stems that are cut should be monitored for regrowth as sometimes flower heads can regrow.
  ii. Digging is effective however is more labour intensive than letting the plants go to flower and cutting them at the base. If the plants are in an area out of your continuous control, like on a roadside, we would recommend digging them as improper timing of management activities (such as mowing, brush-cutters) may spread viable seed.

  Immature Plants are a Secondary Priority:

  iii. Digging is effective to remove non-reproductive year plants. Use a shovel to dig, as it is important to avoid hand pulling which results in an increased exposure to sap. This is easiest in moist soil, timing this after a rain is beneficial. Removing the entire taproot is the most effective, however if a significant section of the taproot is severed it is unlikely to resprout (a spade is an effective tool for this).
  iv. Tarping may be combined with these methods to impact viability of the seed bank and reduce the frequency of management. It can be removed after one full growing season and then replanted with native species.
- Large Infestations:
  i. Mowing is effective if it is done before seed set. The timing is crucial as your problem can worsen if done at the wrong time.
     - Mowing is most effective just after mature plants have bloomed and before seed set. Doing it at this time will allow for most of the plant's energy to be put into its aboveground parts and so the roots will be at their weakest, meaning less aggressive regrowth. Monitor the site for any signs of re-flowering and mow again once/if the plant produces flowers.

        - Cutting “too early” in the season is not a concern if you consistently mow the area to ground level for the whole length of the growing season.

    If this method is not combined with others it will need to be kept up on for the duration of the seed banks viability which is a minimum of 5 years (restart the 5-year window if the plant was allowed to go to seed).

- Whipper snipping is not encouraged as this process splashes the sap around and creates a significant hazard to those undergoing management activities.
- A field burn is not an effective management strategy on its own and it will aerosolize the saps toxins and cause health risks over long distances.
- Reminder: It is important to avoid the sap of this species when working. Avoid stepping on the plants when walking through them. Instead part the plants and step in between them. Most burns from this family are experienced on the legs as it is easy to forget this when working. Take care when bagging this plant to not flick any sap onto your face, ensure your face shield is on during this step.
- Additional Facts: Burning to dispose of plant material is not a recommended method of disposal as this may aerosolize the toxins and cause health risks over long distances.
- Grow Me Instead:
    i. *Yellow cone flower, *Rudbeckia laciniata* (S2, imperiled. Wildflower. Grow up to 2 meters tall. Yellow flowers bloom from July – August and attracts a wide range of pollinators and is a great food source for finches. Grows in full sun to part shade, requires protection from the wind. Can be found in old fields and roadsides. Due to its rarity on PEI, do not collect seed from wild plants).
- Identification Guide: *Pastinaca sativa,* wild parsnip, page 46
- Photo Guide: *Pastinaca sativa*, wild parsnip, page 104

- *Phragmites australis ssp. australis*, common reed grass
    - Reproduction: New infestations can result from phragmites seed or rhizome fragments. Seed viability varies greatly year to year and the duration of viability is unknown, there are about 1,000 seeds per inflorescence. Stand expansion is predominantly by vegetative reproduction through the production and fragmentation of underground rhizomes (1-3m) and above ground stolons.
    - Human Pathway: Common reed grass (*Phragmites australis ssp. australis*) is an invasive perennial grass that is native to Eurasia. It is not known for certain how it was moved to North America, but it likely arrived on the Atlantic coast accidentally via ballast materials in the late 1700s – early 1800s. Today it is known to spread through the mud on boots, vehicles, boats, and construction equipment. Roads increase habitat connectivity for this species and therefore have a high likelihood of invasion. They are sometimes collected by decorators for autumn bouquets. Seeds stick to clothing easily.
    - Natural Dispersal: Wind, water and animals all contribute to the long distance spread of this species.
    - Management Timing: It is important to manage this species before it goes to seed which is usually around mid-August. Optimal management begins in April and May when the plant has the least amount of plant material present, during this period cutting should be done if in standing water and repeated through the growing season. If on dry land,

spading should be started during this timeframe and repeated through the growing season. If you miss this window, you should wait until August to spade because doing so earlier will not provide any additional benefits and will be a waste of labour. By this time the cutting window has passed but if the plant is in standing water, you can remove seed heads to prevent the spread.

- Small-Medium Infestations:
    i. Spading is effective at removing photosynthetic parts of the plants, therefore starving rhizomes of their nutrients. It can be done on dry land or in water and although labour intensive, it not expensive. This is ideally done a few times throughout the growing season as shoots arise. If resources are limited, it can be effective if done once and, in this case, perform management when the plant reaches its peak height, and the seed head is beginning to emerge. It is important to note that spading is different than digging, as digging can worsen your infestation. When spading, you are severing the underground root system from it's above ground stem. The spade enters the soil at a 45-degree angle and severs the root, the stem is then hand pulled as this minimizes soil disturbance.
- Large Infestations in Year-round Submerged Sites:
    i. Cutting Phragmites stems below the waters surface is effective if it is possible to cut the stem to at least 15cm below the waterline. The more water above the cut stem, the more effective management will be. Cut stems need to be removed and if there are seed heads present it is important to remove them and bag them first before starting.
- Additional Fact: Nicknamed: "**Canada's Worst Invasive**" certainly is true for wetlands.
- Grow Me Instead:
    i. Bluejoint reed grass, *Calamagrostis canadensis* (S5. Grass. Grows up to 2 meters tall. This grass forms dense stands with tufted plumes that make a great transition from garden to natural landscape. Can be found in wet meadows, open woods, and along streambanks.).
    ii. *Tall cordgrass, *Spartina pectinata* (alternative latin name: *Sporobolus michauxianus*) (S5. Grass. Readily available. Grows over 2 meters tall, useful for stabilizing banks, it turns a beautiful gold in the fall. Does best in brackish salt marshes, river and lake shores, fields, and disturbed habitats.).
- Identification Guide: *Phragmites australis ssp. australis,* common reed grass, page 47
- Photo Guide: *Phragmites australis ssp. australis*, common reed grass, page 105

- *Prunus spinosa*, blackthorn
    - Reproduction: Spreads by seed, seed bank viability unreported. Once a shrub is established it spreads vegetatively from its parent plant by forming a new stem and root system from an adventitious bud off its roots (suckering). These suckering plants can lead to impenetrable thickets.

- Human Pathway: Intentional plantings. Used as a "cattle-proof" hedgerow, food (gin/jellies), wood (walking sticks) and used commonly as a rootstock for other prunus & fruit species.
- Natural Dispersal: Seeds consumed by wildlife and spread to new areas.
- PERSONAL PROTECTIVE EQUIPMENT: Due to the sharp "thorns" covering the plant, proper PPE such as safety glasses and thick gloves should be worn.
- Management Timing: Best undertaken outside of the nesting season to protect nesting birds as blackthorn is a popular nesting choice due to the thorns and density. Nesting season runs from May – August on PEI for most species.
- Management: Buckthorn will require considerable labour to remove as cutting the tree down with a saw will not kill the tree as the roots will continue to sucker and the stem will resprout.
    i. Digging and removing the bulk of the root if an effective option to completely eradicate the plant. Using an extractigator toll will help effectively pull up the roots.
    ii. Girdling may be effective; invasive species with similar biology can be controlled by this technique. Girdling involves cutting a two-inch ring around circumference of the tree's phloem (inner bark) but leaving the xylem (sapwood) intact. There are yet to be any available sources describing the efficacy of girdling this species. The tree should be revisited several times throughout each growing season to remove any new shoots below the girdling mark (leave anything above as it will be draining the resources of the tree). If the tree is cut instead of girdled it will need to be visited many more times throughout the season as it is likely to sprout more, anecdotal reports online say buckthorn is very resistant to cutting.
- Fun Fact: Blackthorn wood is valuable; it is a favourite material in the production of traditional Irish walking sticks. The fruits, called sloes, can be collected, and used to produce an alcoholic beverage known as sloe gin or autumnal sloe (do not eat them raw as they contain trace amounts of cyanide).
- Grow Me Instead:
    i. *Hawthorn, *Crataegus spp.* (S1-S4. Shrub. Showy white flowers bloom May – June. and produce red fruit called haws. Does well in sunny areas, and often planted as hedgerow or in gardens. Thorns provide safe habitats for nesting birds. Sensitive to salt.).
- Identification Guide: *Prunus spinosa,* blackthorn, page 47
- Photo Guide: *Prunus spinosa*, blackthorn, page 106

- *Rhamnus cathartica*, common buckthorn

Poisonous Berries

- Reproduction: Spreads by seed only. It is a diecious species, meaning a plant has either male or female parts (this means berries, known as drupes, will only form on female mature plants). Female plants begin to produce seeds at about 5 years, the fruit contain 3-4 seeds each. Seed bank is viable for an average of six years.
- Human Pathway: It was introduced to North America in the 1880s as an ornamental shrub and was widely planted for fencerows and windbreaks in agricultural fields.
- Natural Dispersal: Birds and other wildlife eat the fruit and disperse the seeds as it is a diuretic.

- Management Timing: Management for this species is best done in the spring, the plant produces leaves earlier than native plants and so this will help you avoid trampling native species. It also reduces competition for the light and nutrients needed for healthy native plants. Managing this species before it goes to seed helps support long term management and getting started in the spring gives you lots of time.
- Large Shrubs: Shrubs over 1" in diameter and over a meter in height
    i. Priority should be removing large buckthorn shrubs as these individuals will be most likely to go to seed, causing further spread. If plants are in fruit prioritize the female plants.
    ii. Large shrubs can be girdled as they may be too hard to pull out even with tools like an extractigator. Girdling involves cutting a two-inch ring around circumference of the tree's phloem (inner bark) but leaving the xylem (sapwood) intact. Girdling, if done correctly, causes less resprouting that cutting and kills the tree quickly. Only cut resprouting that occurs below the girdled line.
    iii. Cutting causes buckthorn to resprout vigorously, with reports of up to 100 stems per plant. New shoots will need to be continuously pruned as a shoot can produce fruit in 1-3 years. Cutting will at least prevent them from going to seed in the short term, but it will require dedicated, consistent maintenance and so should be avoided.
- Small/Medium Shrubs:
    i. Secondary priority should be pulling young shrubs. Plants are less than 1 inch in diameter and about a metre in height should be manageable. These can be pulled by hand, dug out or pulled with an "extractigator" which is a tool that pries the root from the ground and was designed for buckthorn removal.
        - Small seedlings and young shrubs can be loosened with shovel around the base and then easily pulled by hand.
        - Medium sized shrubs may require the bulk of the root crown to be cut out with the help of a spade. This is done by cutting a circle 1-2ft around the shrub's trunk while another person rocks the shrub back and forth to show what remains to be cut. An axe or hand saw (one you don't mind getting dirty) can be useful to cut free the main portion of crown once it is exposed. Regeneration is unlikely if the bulk of the root crown is removed.
- Reminder: If the plant has berries, it is important to remove the branches with berries first and bag them up before pulling the main stem out. If ripened, the berries will fall easily off the branch, you could lay a tarp out under the tree to catch falling berries or spend time picking them up. Collecting them is worthwhile as the extra work will save you future years of management. Always make sure to tap disturbed soils back into place and plant native species to discourage the further establishment of invaders.
- Grow Me Instead:
    i. *Grey birch, *Betula populifolia* (S5. Shrub. A pioneer species, that helps establish an area for other species. Grows 15 meters tall. Does well on nutrient depleted soils.)
- Identification Guide: *Rhamnus cathartica, c*ommon buckthorn, page 48

- Photo Guide: *Rhamnus cathartica*, common buckthorn, page 107

- *Rhamnus frangula,* glossy buckthorn
  - Alternative Scientific Name: *Frangula alnus*
  - Reproduction: Spreads by seed only. Is a monecious species, meaning both male and female parts occur on the same plant (this means berries will form on all mature plants). Plants begin to produce fruit at 3 or 4 years, each containing 3-4 seeds each. Seed bank is viable for an average of six years.

Poisonous Berries

  - Human Pathway: Glossy buckthorn was introduced from Europe as an ornamental shrub in the 1700 - 1800's and is not commonly sold today.
  - Natural Dispersal: Wildlife eat the fruit and disperse the seeds. Birds in particular are a major dispersal vector.
  - Large Shrubs: Shrubs over 1" in diameter and over a meter in height (multistems)
    i. Priority should be removing large buckthorn shrubs as these individuals will be most likely to go to seed, causing further spread.
    ii. Large shrubs can be girdled as they may be too hard to pull out even with tools like an extractigator. Girdling involves cutting a two-inch ring around circumference of the tree's phloem (inner bark) but leaving the xylem (sapwood) intact. Girdling, if done correctly, causes less resprouting that cutting and kills the tree quickly. Only cut sprouts that occurs below the girdled line.
    iii. Cutting causes buckthorn to resprout vigorously, with reports of up to 100 stems per plant. New shoots will need to be continuously pruned as a shoot can produce fruit in 1-3 years. Cutting will at least prevent them from going to seed in the short term, but it will require dedicated, consistent maintenance and so should be avoided.
  - Small/Medium Shrubs:
    i. Secondary priority should be pulling young shrubs. Plants are less than 1 inch in diameter and about a metre in height should be manageable. These can be pulled by hand, shovelled out or pulled with an "extractigator" which is a tool that pries the root from the ground and was designed for Buckthorn removal.
      - Small seedlings and young shrubs can be loosened with shovel around the base and then easily pulled by hand.
      - Medium sized shrubs may require the bulk of the root crown to be cut out with the help of a spade. This is done by cutting a circle 1-2ft around the shrub's trunk while another person rocks the shrub back and forth to show what remains to be cut. An axe or hand saw (one you don't mind getting dirty) can be useful to cut free the main portion of crown once it is exposed. Regeneration is unlikely if the bulk of the root crown is removed.
  - Reminder: If the plant has berries, it is important to remove the branches with berries first and bag them up before pulling the main stem out. If ripened, the berries will fall easily off the branch, you could lay a tarp out under the tree to catch falling berries or spend time picking them up. Collecting them is worthwhile as the extra work will save you future years of management. Always make sure to tap disturbed soils back into place and plant native species to discourage the further establishment of invaders.

- Grow Me Instead:
    i. *Grey birch, *Betula populifolia* (S5. Shrub. A pioneer species, that helps establish an area for other species. Grows 15 meters tall. Does well on nutrient depleted soils.)
- Identification Guide: *Rhamnus frangula,* glossy buckthorn, page 49
- Photo Guide: *Rhamnus frangula,* glossy buckthorn, page 108

- *Rosa multiflora*, multiflora rose
    - Reproduction: Spreads by seed and vegetatively. Seeds are known as rosehips; a plant can produce 500,000 seeds per year, have a viability of 90% and can remain in the seed bank for 10 – 20 years. Vegetatively the plant spreads through nodes along the stolons, and through canes layering, which is when a portion of the cane touches the ground and forms a shallow root system, generating new shoots.
    - Human Pathway: Introduced to North America in the 1700, 1800's it has been used as a living fence, in wildlife plantings, planted to prevent soil erosion and is still used today as a rootstock for roses more susceptible to cold climates (although the latter does not increase spread). Today it has been reported to be used as crash barriers along highways and most commonly as an ornamental.
    - Natural Dispersal: Dispersed mainly by birds and other animals that consume rosehips.
    - PERSONAL PROTECTIVE EQUIPMENT: Thick full body clothing that can withstand tears from the thorns, protective eye wear and gloves are recommended.
    - Management Timing: Avoid intensive managing practices (digging/cutting) of this species during nesting season (April – August) as it is a site favored by many birds for nesting. It is best to complete management before seed set as the fruit is readily spread by birds. The nesting season can be a time to target seedlings or small shrubs that are guaranteed to be nest free.
    - Small Infestations:
        i. Hand Pulling small patches of seedlings is effective. If they are particularly dense a stirrup hoe may be effective.
        ii. Digging up medium-large plants is effective. Use a shovel, spades, axes and extractigator.
            - Small seedlings and young shrubs can be loosened with shovel around the base and then easily pulled by hand.
            - Medium sized shrubs may require the bulk of the root crown to be cut out with the help of a spade. This is done by using the spade to cut a circle 1-2ft around the shrub's trunk while another person rocks the shrub back and forth to show what remains to be cut. An axe or hand saw (one you don't mind getting dirty) can be useful to cut free the main portion of crown once it is exposed. Regeneration is unlikely if the bulk of the root crown is removed.
    - Large thickets:
        i. Cutting or mowing large outbreaks will cause vigorous resprouting. If this technique is not combined with other methods, it will likely be ineffective in eradication but will help in preventing further spread by seed. If you must, cut or mow in the spring or early summer and continue monthly until the end of the

growing season. It is important to be consistent in your efforts or you may worsen your problem.

- Grow Me Instead:
    i. *Northern bayberry, *Morella pensylvanica* (S5. Semi-evergreen shrub. Grows up to 2 meters tall. Although this shrub does not have showy flowers, its smell is wonderfully fragrant up close or when the leaves are crushed. Great option for planting a long roadside due to its salt tolerance and nitrogen fixing roots).
    ii. *Native roses, like the Shining Rose, *Rosa nitida (S4)*, and Virginia Rose, *Rosa virginiana (S5)* (Shrub. Both have showy pink flowers and area great choice for native pollinators, they bloom from July – August. R nitida thrives wet soils including bogs and R. virginiana thrives in a wider range and is salt tolerant.).
- Identification Guide: *Rosa multiflora,* multiflora rose, page 50
- Photo Guide: *Rosa multiflora*, multiflora rose, page 109

- *Solanum dulcamara*, bittersweet nightshade

Poisonous Berries

- Reproduction: Reproduces by seed and vegetatively through rhizomes and by creeping stems that root at the node. Each berry contains an average of 30 – 60 yellow-colored, flattened seeds. Seed bank persistence is unknown but thought to be short lived, some laboratory reports say that most germinate in the first two years. Root & rhizome fragments can start new plants.
- Human Pathway: Brought to North America as an ornamental vine but is known as a weed to many gardeners today.
- Natural Dispersal: Seed dispersal typically occurs through birds who seem tolerant, if not entirely resistant, to the bitter taste.
- PERSONAL PROTECTIVE EQUIPMENT: Gloves are important to wear as the berries are poisonous.
- Management Timing: Management should begin early in the season before flowers form, as preventing the seeds from developing is ideal. If there is a large infestation along a stream edge it can best to wait until June-July to avoid sedimentation affecting salmonid spawning.
    i. Pulling/Digging the roots is effective. It is important to avoid snapping the plant as fragments can start new plants. Pat the soil down afterwards to prevent establishment. Return several times throughout the season to prevent new shoots from returning to flower.
    ii. Tarping large infestations can be effective. Cut the plants down to ground level and tarp the area, check the site regularly for regrowth and after two years evaluate if the tarp is still needed. Applying a tarp early in the growing season will be most effective.
    iii. If it is impossible to dig the area because of rocky terrain (ie: pavement) repeated cutting will be effective, cut more than 5 times per growing season.
- Mowing has been found to be ineffective and likely to increase the spread plant parts.
- Grow Me Instead:

    i. *Virgin's bower, *Clematis virginiana* (S4. Vine. Showy white flowers bloom in August. Does best in full sun and in moist soils; however, established plants can tolerate dry conditions).
- Identification Guide: *Solanum dulcamara,* bittersweet nightshade, page 50
- Photo Guide: *Solanum dulcamara*, bittersweet nightshade, page 110

- *Valeriana officinalis*, common valerian
  - Reproduction: Spreads vigorously by self-seeding and vegetatively by aerial stolon's (also known as runners) and through nodes in the rhizomes. Seeds bank does not exist in the soil over long periods, some reports suggest 2-3 years. Plants can also reproduce via bulbils (small outgrowths that lead to the production of whole new plants), these are produced in their leaf axils.
  - Human Pathway: Garden escapee, admired as an ornamental and medicinal herb.
  - Natural Dispersal: Seeds are wind dispersed.
  - Management Timing: Control should be undertaken before the plant goes to seed (which happens in mid-July - mid-August). If managing common valerian after seeds appear, carefully clip and bag seed heads before beginning to prevent dispersal.
  - Small Infestations:
    i. Hand-pull, roots are shallow. Care should be taken to ensure that the entire root is pulled up with the plant, as it will regrow from roots left behind. The plant is delicate, and so pulling should be done very carefully to avoid leaving behind the root.
  - Larger Infestations:
    i. Can be mowed as this prevents seed formation but it does not kill the plants or reduce their numbers as runners will continue to spread and seedlings may be too low to mow and will be unaffected by this treatment.
  - Fun Fact: The roots of this plant has been made into teas that promote relaxation and treating insomnia.
  - Grow Me Instead:
    i. Tall meadow rue, *Thalictrum pubescens* (S5. Wildflower. One of our tallest, it grows up to 2.5 meters. Showy delicate white flowers bloom from July – August. Grow along rivers, in wet woods, ditches, fens and damp meadows.).
  - Identification Guide: *Valeriana officinalis, c*ommon valerian, page 51
  - Photo Guide: *Valeriana officinalis*, common valerian, page 111

Section 6: Photo Guide

Section 6 – Table of Contents:

Acer pseudoplatanus, sycamore maple

- Identification Guide, page 35 or Management Guide, page 53.
- Abandoned fields, early successional forest edge, open disturbed areas, pastures, roadsides, vacant lots, yards and/or gardens.

Read more on our website

1

Large deciduous tree grows 12 – 18m tall.

2

Its grey bark is smooth when young.

3

At maturity its bark becomes furrowed and greyish pink.

4

Leaves are 7.5-15 cm wide, 3-5 palmately lobed, have coarsely toothed leaf margins and are dark green on the upper side and light green on the underside. Yellow-green small flowers grow in white dangling clusters.

5

During September – October the green-pink samara (two-winged seeds) grows in dangling clusters up to 7.5cm long. An individual samara is 2.5cm long.

Photo Credit: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org (1-3), Green Thumb Photography (4-5).

Aegopodium podagraria, goutweed

- Identification Guide, page 35 or Management Guide, page 54.
- Gardens, fields, roadsides and invades all types of forests.

Variegated form of this Perennial herbaceous groundcover this plant has blueish green leaves with white edges.

Compound leaf divided into groups of three, known as triternate. Often one or two of the leaflets are irregularly lobbed, described as mitten-like.

Tiny five petaled flowers, typically white and sometimes pink, make up a flat-topped umbel that sits above the basal leaves.

Branching white fleshy rhizomes make up and extensive underground system. They break easy when damaged, giving rise to new plants. Smell like carrots.

The “wild” variety has dark green leaves with no variegation. Flat-topped umbels 6-12cm wide can be seen in this photo but it is important to note flowers are not always produced, especially in shaded conditions.

Photo Credit: Kassidy Matheson (1,2), Green Thumb Photography (3), Leslie J. Mehrhoff, University of Connecticut, Bugwood.org (3-5)

Alliaria petiolata, garlic mustard

- Identification Guide, page 36 or Management Guide, page 54.
- Moist to dry forest habitats, forest edges, floodplains, and along roadsides and disturbed lands.

Read more on our website

Second-year flowering plants, grow up to 1m tall, smell of garlic.

Flowers are small and white with 4 petals and grow in clusters at the top of leafy stems in an umbel.

Second-year leaves are arranged oppositely on stalks, coarsely toothed and are triangular to heart-shaped.

Fist year leaves persist into winter and are visible when the snow melts before other plants emerge.

First year rosette has kidney shaped leaves that have scalloped edges.

Slender, white, taproot, with a distinctive "s" curve at the top of the root, just below the root crown.

Photo Credit: Green Thumb Photography (1,3), Chris Evans, University of Illinois, Bugwood.org (2) , Kassidy Matheson (4-6).

Angelica sylvestris, woodland angelica

- Identification Guide, page 36 or Management Guide, page 55.
- Disturbed roadside habitats, forest edges and open moist areas.

Read more on our website

Reproductive year plant can grow 2m (6.5') tall and have green or purple stems.

Hemispherical umbels are made up of many white flowers (can be lilac tinged).

Green or purple stem can have furrows, ridges, and minute hairs (hardly visible to the naked eye).

Compounded leaves are composed of numerous small leaflets (between three and five on each branch) and they are 2-3 times pinnately compounded.

Leaflets are ovate with toothed edges, sometimes lobed but the terminal leaf usually unlobed.

Oval, flat-backed, thin-winged, brown, 4–5 mm fruit that splits apart to release a single seed when ripe. Turns brown when ripe. Seed heads persist Late August – December.

Photo Credit: Kassidy Matheson (1,3,4,6), Green Thumb Photography (2,5)

Anthriscus sylvestris, wild chervil

- Identification Guide, page 37 or Management Guide, page 57.
- Rich moist soils, streambanks, grasslands, open woodlands, and moderately disturbed areas.

Reproductive year plant has a white umbel. It grows on average 1 meter tall but can grow up to 1.8 meters.

Alternate leaves, shiny, dark green, finely divided and fern-like, 2-3 times pinnately compound with sharply pointed segments.

Green, hollow, deeply furrowed, covered in fine hairs near the base becoming more glabrous towards the apex. May have some purple.

Flat compound 3-inch-wide umbels of small white flowers, each with 5 petals.

Seeds are shiny and black, elongated oval shape, about 6 mm long and are in pairs joined with small antenna-like structures at the top. Form in July.

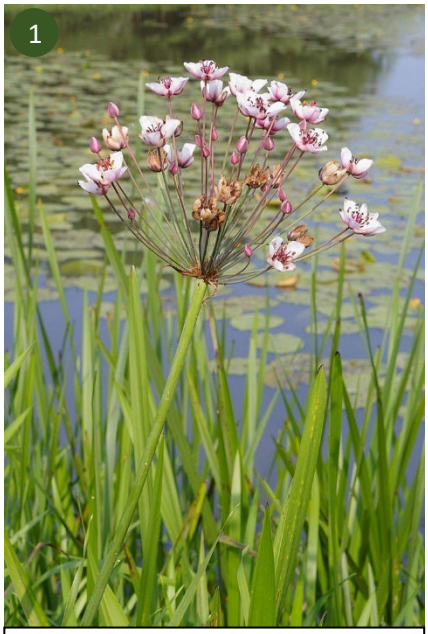
Thick taproot can grow up to 2 meters long.

Photo Credit: Green Thumb Photography (1 - 6)

Butomus umbellatus, flowering rush

- Identification Guide, page 38 or Management Guide, page 58.
- Grows in freshwater wetlands and other riparian habitats.

Read more on our website



Grows as an emergent species (0.3-1.5 m), a submerged species (3m) or even a terrestrial species in moist soil.

Showy pink umbels of 20-50 flowers, each 2-3cm across. Each flower has 3 petals and 3 petaloid sepals (resemble a petal).

Brownish purple, tear dropped shaped fruit split at maturity, releasing many floating seeds.

Thick rhizomes form pea sized “bulbils” that resemble onion bulbs. They detach and propagate new plants downstream.

Submerged form has longer, flatter, limp leaf blades that grow up to 3m. Does not flower.

Photo Credit: Christian Fischer via Wikimedia Commons (1,2), Peter M. Dziuk (3), Jennifer Andreas, Washington State University, Bugwood.org (4), Minnesota Department of Natural Resources (5)

Celastrus orbiculatus, Asiatic bittersweet

- Identification Guide, page 38 or Management Guide, page 60.
- Found almost everywhere. In roadsides, hedgerows, woodlands, forest edges, and grasslands.

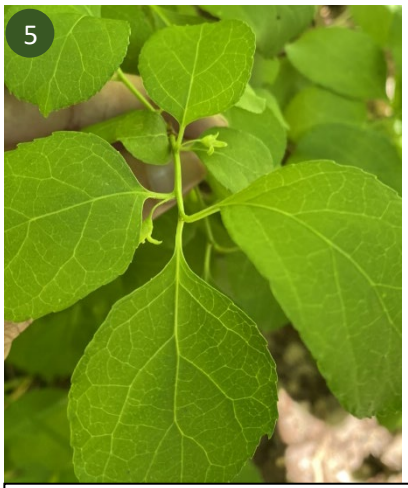
Read more on our website

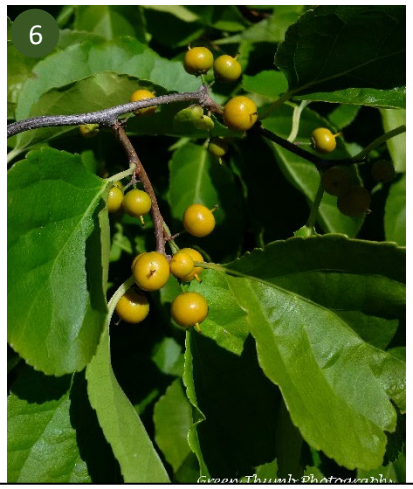
Perennial woody vine capable of climbing up to 18m.

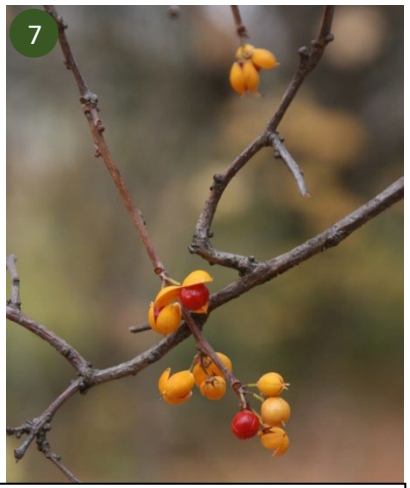
Twigs are light brown, older stems are silvery brown, and older stems and trunks are scaly.

Deep extensive root systems are orange and run horizontally over large distances.

A smaller vine girdling another larger vine.







Left: Inconspicuous yellow flowers grow along the leaf axil. Middle: Small green fruit with a short stem-like feature at the end where the flower once grew. Right: As the fruit matures, the berry will enlarge, and its outer capsule turns from green to yellow. In late summer and early fall, the capsule will dry and split apart, revealing the mature red berry within.

Photo Credit: Kassidy Matheson (1-5), Green Thumb Photography (6), Chris Evans, University of Illinois, Bugwood.org (7)

Centaurea nigra, black knapweed

- Identification Guide, page 39 or Management Guide, page 61.
- Disturbed, well drained soils with full sun. Is known to invades roadsides, agricultural land, open forests, travel corridors and orchards.

Read more on our website

First year rosette.

Second year flowering plants.

First year rosettes root system. Roots have a woody root crown and a woody taproot.

Second year flower is purple with a base that is oval and covered with stiff blackish-brown bracts.

Photo Credit: Green Thumb Photography (1,2,4), Kassidy Matheson (3)

Cytisus scoparius, scotch broom

- Identification Guide, page 39 or Management Guide, page 62.
- Open areas, in ditches, meadows, yards and, in its native range, dunes.

Read more on our website

Perennial evergreen shrub grows 3m tall, blooms May – July.

Yellow peal-like flowers have five petals, are 2.5cm long, solitary or in pairs along the upper stems.

Seed capsules look like flat hairy peas. Unripe pods are green and explode 3-12 seeds when black.

Stems have shallow grooves, stem is five angled. Young stems have hairs whereas older stems are hairless.

Leaves are ovate, 5-30mm long and alternate along the stem. They are simple or, near base of plant, trifoliate.

Photo Credit: Kassidy Matheson (1), Green Thumb Photography (2-5).

Echinocystis lobata, wild cucumber

- Identification Guide, page 40 or Management Guide, page 62.
- Along trails, in fields, on the edges of forests and in riparian zones.

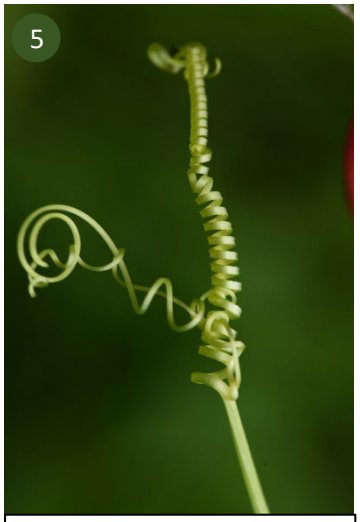
Read more on our website

Annual herbaceous climbing vine grows 7 – 9m tall. Blooms from July – September. Male flowers grow in a raceme along the upper leaf axils of the vine, and solitary female flower is located at the base of the male cluster.

Each flower 1.5 – 2cm wide and has 6 greenish-white petals.

Prickly, oval-shaped, 5cm fruit uses hydrostatic pressure to release 1-6 seeds.

5 deep lobes and a heart-shaped base.



Each leaf is paired with a long, curly, 3 forked tendril.

Fruit ripens and dries into a paper like husk that has an opening at the bottom. The nickname “lace plant” comes from this stage.

Photo Credit: Green Thumb Photography (1-5), Kassidy Matheson (6)

Elodea canadensis, Canada waterweed

- Identification Guide, page 4040 or Management Guide, page 63.
- Slow moving fresh or brackish water. Thrives in nutrient poor waters as temperatures begin to warm.

Read more on our website

Simple leaves are oblong, green, translucent, and in whorls of 3 (occasionally 4) around the stem. Slender stems are 1-2mm thick.

Herbaceous branched stems, can grow up to 6m long, forming dense mats in shallow stagnant waters.

Aquatic submerged perennial, stems grow an average of 1.2 – 2.5m long.

Occasionally blooms, small white flowers grow at the top of the water. Blooms June-August.

Photo Credit: Green Thumb Photography (1,3), Kassidy Matheson (2), Photo by Christian Fischer via Wikimedia Commons (4)

Euphorbia cyparissias, cypress spurge

- Identification Guide, page 41 or Management Guide, page 64.
- Open, disturbed areas such as pastures, abandoned fields, ditches and coastal areas.

Read more on our website

Plants are arranged in clumps and grows 10 – 40cm (.1 - .4m) tall.

Extensive underground root system that spreads via lateral roots. These lateral roots have buds which can send up new above ground growth.

Simple leaves are small, linear-shaped, and whorled around the stem. They are 1 – 3cm long and 1 – 3 mm wide.

Flowers and bracts are greenish yellow, has male and female flowers on the same plant.

Bracts turn purple-red as the plant matures. Fruit capsules are typically 3 mm in diameter, they contain 3 seeds each and explode seeds outwards.

Photo Credit: Green Thumb Photography (1,3), Leslie J. Mehrhoff, University of Connecticut, Bugwood.org (2), Photo via Wikimedia Commons (4), Richard A. Casagrande, University of Rhode Island, Bugwood.org (5)

Euphorbia esula, leafy spurge

- Identification Guide, page 42 or Management Guide, page 65.
- Open, disturbed areas such as pastures, abandoned fields, ditches and coastal areas.

Read more on our website

Second-year mature plants form dense stands grow up to 1m tall.

Flowers and bracts are greenish yellow, has male and female flowers on the same plant.

Fruits form inside round capsules about 4mm long with three chambers, each containing a single, smooth seed. Seeds are forcefully ejected by explosive dehiscence.

Has a milky, latex-like sap that flows through all parts of the plant; sap may be irritating to the skin, eyes, and digestive tract of humans and other animals.

Photo Credit: Green Thumb Photography (1-4)

Fallopia japonica, Japanese knotweed

- Identification Guide, page 42 or Management Guide, page 67.
- Wide range of habitats including riparian areas, dunes, wetlands, roadsides, ditches, urban environments, and forest edges or disturbed forested areas.

Read more on our website

1

Perennial semi-woody plant grows up to 2.5m tall and appears shrub like.

2

Stems are distinctive. They are multi-branching, stout, hollow and green but often mottled with a purplish red.

3

Rhizomes are dark brown and have a bright orange interior.

4

Small, white-green flowers bloom along branching panicles near the end of the stem.

Seeds are small, winged, white, shiny and are triangular.

6

Leaves are alternate along a zigzag patterned red stem, round to triangular, smooth edged and have a distinctive narrow tip.

Photo Credit: Green Thumb Photography (1,4 edited – top right picture cropped and faded edges, 6), Kassidy Matheson (2-3), Chris Evans, University of Illinois (5).

Heracleum mantegazzianum, giant hogweed

- Identification Guide, page 43 or Management Guide, page 68.
- Found along roadsides, along streambanks and in disturbed areas.

Read more on our website

A reproductive year flowering plant growing up to 5.5m (18') tall, amongst many non-reproductive year plants.

Large flat-topped umbel (1.5m in diameter) made up of thousands of small white flowers.

Compound leaf has three leaflets and is deeply lobed, has sharply jagged edges (1.5 meters wide).

Raised red bumps on stem, and stiff hairs along the node where petiole & sheath extend.

The fruit is a 1cm dry, flattened, oval, two-winged fruit that splits apart to release a single seed when ripe. Turns a dark brown later in the season.

Photo Credit: Kassidy Matheson (1,4,5), Green Thumb Photography (2,3)

Impatiens parviflora, small-flowered jewelweed

- Identification Guide, page 43 or Management Guide, page 70.
- Grows in a variety of light and moisture conditions. This plant can dominate the forest floor, forming large, uniform stands and displacing native species, while also impacting forest regeneration.

Annual herbaceous plant acts as a ground cover, grows up to 90cm (.9m) tall.

Simple, alternate, pointed and sharply serrated with the teeth directed forward.

Flowers are pale yellow, cone shaped (some say helmet shaped) and often have red speckles found in its “throat”.

Small, shallow translucent root system. Single stemmed or branched, translucent-light green, hairless stem.

Left: Seed capsules are linear-oblong, 1-2.5cm long and are pale green at maturity.

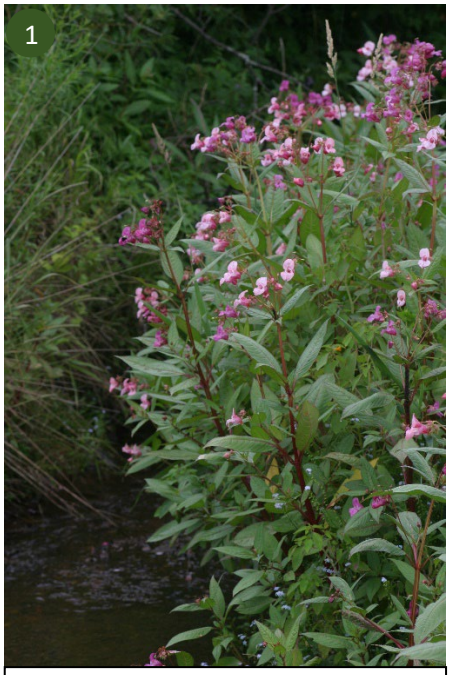
Right: Five outer walls coil to forcefully eject seeds from the capsules, known as explosive dehiscence. Releases 1-5 oblong seeds per capsule, they have longitudinal ridges.

Photo Credit: Kassidy Matheson (1,2,4), Green Thumb Photography (3,5)

Impatiens glandulifera, Himalayan balsam

- Identification Guide, page 44 or Management Guide, page 71.
- Disturbed areas, edge habitat, riparian areas and can be found in wet forests.

Read more on our website



Annual herbaceous plant can grow 2m tall.

Distinct pink or white flower has a sac structure; some refer to the shape as helmet shaped.

Fruit expels seeds through explosive dehiscence. Capsules are 1.5-3cm long, have five chambers and up to 16 seeds each and 800 – 2,500 per plant.

Roots are shallow, red-pink, and extend only 10 - 15 centimetres into the soil. Will produce roots at the nodes of the plant is toppled over ad touching soil.

Simple leaves are opposite or whorled and are long, slender, and sharply toothed.

Prominent reddish mid vein, 5–20 centimetres long, shiny, and dark green.

Red bamboo-like straight stem is hollow and glabrous (hairless), ridged, and normally red-tinged.

Photo Credit: Green Thumb Photography (1-4, 6-8), Kassidy Matheson (5)

Iris pseudacorus, yellow flag iris

- Identification Guide, page 45 or Management Guide, page 72.
- Fresh, brackish, or salt water. Found in marshes, ponds, streams, ditches, and gardens.

Read more on our website

Monoculture at edge of the pond. Aquatic emergent perennial that grows 90-150 cm (.9 – 1.5m). Leaves are basal, stems are leafless.

Three-petaled, yellow iris, 8cm wide. Downward facing sepals have brown veins and a brown ring. Each plant stem has 4-12 flowers. Bloom: June.

Seed pods are shaped like small green bananas, they are 3-sided, 3.5-8.5cm long. Formed: July-August. Leaves have a distinct midrib which is observable in this photo.

Fleshy roots are 10-30cm long and have branching thick, pink, tuberous rhizomes that form dense mats. One root system can have over 100 flowering plants connected by rhizomes.

Seed pods dry to a black/brown when ripe and split to release an average of 120 seeds each. Seeds are corky, 4-7cm long, brown, and have an air pocket that allows them to float.

Photo Credit: Kassidy Matheson (1), Green Thumb Photography (2), Leslie J. Mehrhoff, University of Connecticut, Bugwood.org (3-5)

Lythrum salicaria, purple loosestrife

- Identification Guide, page 45 or Management Guide, page 73.
- Ditches, marshes, swamps, pond/stream edges, uplands, and meadows.

Read more on our website

1

Pictured: An established population growing in upland habitat. It is likely to outcompete the native species present through its rapid growth, reducing sunlight and water availability.

2

3

Perennial herbaceous plant, 0.5-3m tall, can grow as a single stem or in clumps. Large flower spikes (10-40 cm long) have many small purple-pinkish flowers, each has 5 petals (sometimes 6-7).

4

Annual stems are square and have 4-6 sides. They are green when young and turn red and woody as they age. Mature plants can have 30-50 flowering stems.

Leaves can be opposite (most common) but can be found whorled or even alternate. They are simple lance shaped leaves with smooth edges, fine hairs, and they are attached right to the stem.

5

1,000 dark brown, egg-shaped capsules per plant. Capsules are approximately 2-3 mm in length and contain many small seeds (83 – 130 each).

Photo Credit: Green Thumb Photography (1-4), Rob Routledge, Sault College, Bugwood.org (4), Leslie J. Mehrhoff, University of Connecticut, Bugwood.org (5)

Pastinaca sativa, wild parsnip

- Identification Guide, page 46 or Management Guide, page 74.
- Does best in disturbed sites. Can be found in roadsides, old fields, travel corridors, vacant lots, beaches, semi-shaded forests & riverbanks. Can sometimes even be found invading swampy lowlands and cultivated fields.

Read more on our website

Patch of reproductive year wild parsnip plants.

Yellow, 5-petaled flowers form an umbel.

Umbel of fruits are dry, smooth, slightly winged and flattened on back. Fruits each contain two seeds.

A basal rosette of leaves growing directly from the ground.

Long taproot that smells distinctively of parsnip.

A single, light green, stem is deeply grooved and smooth (a few hairs) Pictured: an alternate leaf's petiole is covered by a sheath.

Pictured: Once pinnate leaf made up of 5-15 leaflets, terminal leaflet is three lobed.
Leaves can also be twice pinnate with 2-5 pairs of leaflets.

Photo Credit: Green Thumb Photography (1 – 7)

Phragmites australis ssp. australis, common reed grass

- Identification Guide, page 47 or Management Guide, page 76.
- Ditches and wetlands including fresh or brackish water & disturbed or pristine sites.

Read more on our website

1

Tall plants in seed growing in ditch along highway. Can reach 6m tall at maturity.

2

Arranged alternately the leaf blades are 20—60cm long, 4cm wide, blue-green, hairless, and tapered with a pointed tip.

3

Leaves are attached to the stem by a tight-fitting sheath. Unbranched stems are rigid, ribbed, hollow and have many nodes.

4

Dense oblong panicle causes a droop to one side of the stem, causing a lean. The flowers are attached to branches rather than to the main stem, each branch has spikelets (clusters of flowers) that are usually purple or golden in colour.

5

Large, dense, grey/tan colored seed heads look fluffy due to the long narrow bristles attached to each seed.

Photo Credit:
Kassidy Matheson (1), Peter M Dziuk, www.minnesotawildflowers.info (2), Katy Chayka, www.minnesotawildflowers.info (3), David Dickenson, www.naturescene.net (4), Green Thumb Photography (5)

Prunus spinosa, blackthorn

- Identification Guide, page 47 or Management Guide, page 77.
- Invades urban/disturbed areas, forest edges, forests, meadows, and fields.

Read more on our website

White, showy flowers bloom in March – April and emerge before its leaves emerge.

Blue fruit are known as sloes.

Pointed and thornlike spur shoots along the stems are thorn like and give this plant its name.

Leaves are alternate, simple, have toothed edges and are pointed at the tip and tapered at the base.

Large thicket of Blackthorn.

Left: Pointed and thornlike spur shoots after the leaves have died back. Right: Bark darkens as tree matures.

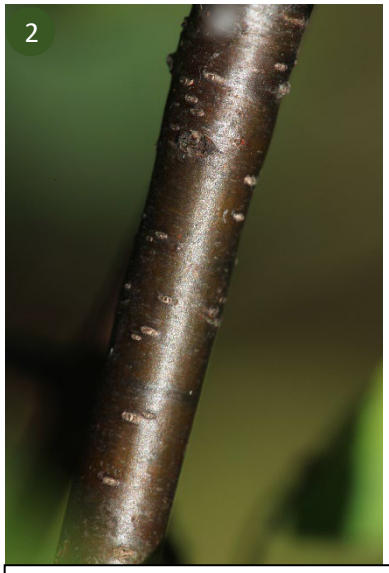
Photo Credit: Opiola Jerzy via Wikimedia Commons (1), Kristian Peters via Wikimedia Commons (2), David Carmichael (3-5).

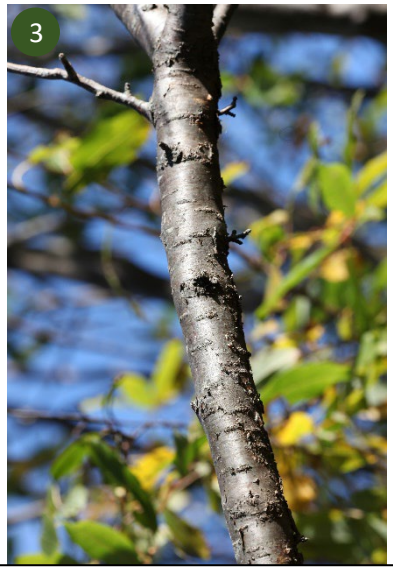
Rhamnus cathartica, common buckthorn

- Identification Guide, page 48 or Management Guide, page 78.
- Grows in the light shade of deciduous woodlands, establishes in forest openings, roadsides, ravines, riverbanks, disturbed forest edges, open disturbed areas like abandoned fields. It is shade and drought tolerant. Commonly found in urban environments.

Read more on our website

Large perennial deciduous shrub grows 5 – 8m tall.





Branches and young shoots are reddish-brown, hairless and have prominent white lenticles. Main stem's bark is a grey-brown and becomes darker and scaly as it matures.

Fruit known as drupes are green before they ripen and turn black, they are usually ripe from August – September. Drupes grown in clusters along the leaf axils and tend to ripen all at the same time.

Small thorn-like tips are generally located at the end of the twig and found on mature shrubs.

Simple, oppositely arranged, elliptical-oval shaped, finely toothed, often wavy edged leaves have veins extending to tip.

Photo Credit: Green Thumb Photography (1-7)

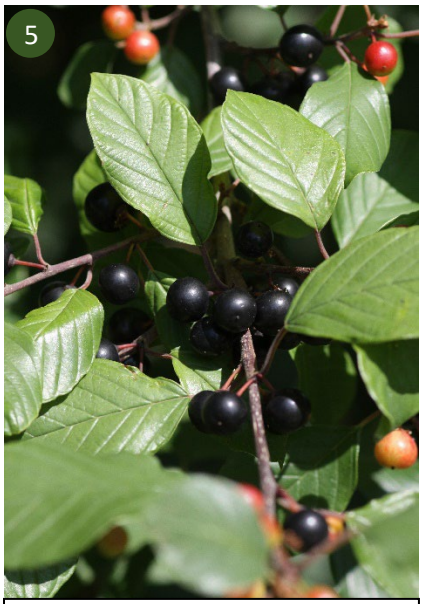
Rhamnus frangula, glossy buckthorn

- Identification Guide, page 49 or Management Guide, page 80.
- Grows in wetter, less shaded, and more acidic soils than some other buckthorns, it is especially aggressive in alkaline bogs and swamps. Can be found in bogs, marshes, fens, wetlands, along riverbanks, forests, abandoned farmland and roadsides.

Read more on our website

Large perennial deciduous shrub grows 4.5 – 6m tall.

Young stems are dark reddish-brown, with prominent white lenticles. At maturity the main stems are grey-brown to dark grey, spotted bark that may develop shallow fissures due to lenticels. Twigs are light grey-brown



Simple, alternately arranged, elliptical-egg shaped, smooth edged, often wavy, shiny topped leaves have veins extending to edge.

Shallow, red, extensive root system, with a root crown and lateral roots.

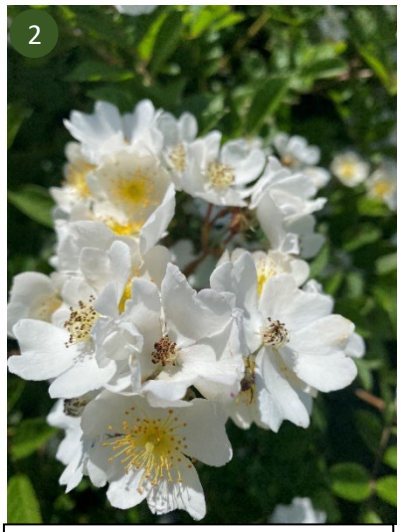
Photo Credit: Green Thumb Photography (1,2,5,6), Leslie J. Mehrhoff, University of Connecticut, Bugwood.org (3), Chris Evans, University of Illinois, Bugwood.org (4)

Rosa multiflora, multiflora rose

- Identification Guide, page 50 or Management Guide, page 81.
- Roadsides, fields, forests, stream banks, wetlands, and coastal sand dunes.

Read more on our website

Perennial climbing shrub grows up to 5m tall, blooms May-June.



Flowers are white, grow in clusters and are fragrant.

Compound leaves are alternate along the stem and divided into 5-11 sharply toothed leaflets.

Branches, known as canes, form wide arches that can be over 2 meters in height. When these stems touch the ground, they form shallow roots and this is how they spread, it is a process called “cane layering”.

Fringes at the base of the leaf stalk help distinguish this plant from other roses. Branches sometimes have backwards faced thorns however sometimes they are thornless.

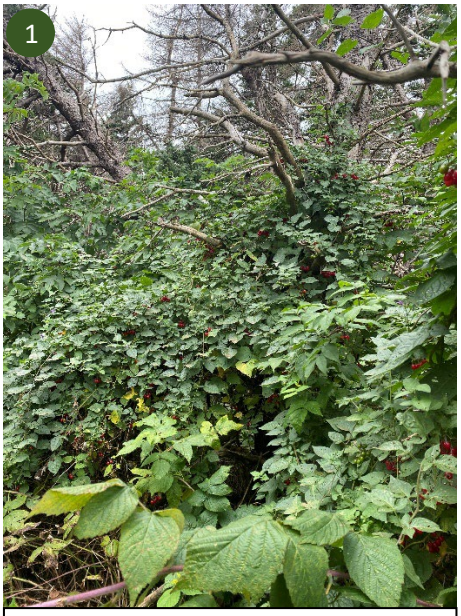
Rosehips are small, deep red, balloon shaped and persist into winter after leaves have died back.

Photo Credit: Green Thumb Photography (1,3,4,5), Kassidy Matheson (2,6)

Solanum dulcamara, bittersweet nightshade

- Identification Guide, page 50 or Management Guide, page 82.
- Hedgerows, forest edges, riparian zones and in forest understories.

Read more on our website



Perennial semi-woody vine grows up to 7m.

Alternate leaves are dark green, often with one or two small ear-like lobes at their base, 1 to 4 inches long.

The stem is hollow, green to gray-brown, and grows up to 3cm in diameter. The base of the stem is woody and furrowed.

Flowers are blue-violet, star-shaped, with protruding yellow anthers. Blooms May – September.

Berries are egg-shaped and mature at different times on the same plant. Unripe are green, then orange, and ripe berries are a bright red.

Photo Credit: Kassidy Matheson (1), Green Thumb Photography (2,4,5), Mary Ellen Harte, Bugwood.org (3)

Valeriana officinalis, common valerian

- Read More: Identification Guide, page 51 or Management Guide, page 83.
- Does well in moist soils. Along stream banks, in wet meadows, fens, and roadside ditches.

Read more on our website

Monoculture of reproductive year Common Valerian.

Flowers are white or pale pink, forming in tight clusters at the top of the plant in 2-5 umbrella-shaped umbels, fragrant – very sweet smelling.

First year basal rosette of pinnate leaves.

Fruit is small (0.1 inch) and contains many powdery seeds. Seeds form in mid-July and dispersed by mid-August.

Stem is unbranched, Grows to 1.5 – 5ft tall. Stem is thick, fleshy, green or red/purple and ridged.

Roots are fibrous; small, white, fleshy rhizomes have a pungent odour

Compound leaves are opposite, have 5-12 pairs of leaflets, and are irregularly toothed. The underside of the leaves, the edges and leaf stems are hairy.

Photo Credit: Green Thumb Photography (1,2, 4-7), Leslie J. Mehrhoff, University of Connecticut, Bugwood.org (3)

Main Table of Contents (Click to Return)

Section 7: Ecosystem Monitoring Lists

Invasive species can thrive in a wide variety of habitats. Knowing what species to anticipate finding in a particular ecosystem may help keep an individuals attention focused on identifying the most likely threats. In this section there are four broad ecosystem descriptions and a list of what to monitor for in each.

Section 7 – Table of Contents:

7.1: Roadsides & Fields – Checklist

Present in my area?	**Common Name**	**Bloom Period & Photo Guide Link**
	sycamore maple	June (mature trees) | Photo Guide pg. 85
	goutweed	May – June (occasionally) | Photo Guide pg. 86
	garlic mustard	late-April – May (second year) | Photo Guide pg. 87
	woodland angelica	June – September (reproductive-year) |Photo Guide pg. 88
	wild chervil	May – June (reproductive-year) |Photo Guide pg. 89
	Asiatic bittersweet	May – June (inconspicuous) |Photo Guide pg. 91
	black knapweed	June – October (second year) |Photo Guide pg. 92
	scotch broom	May – July (starts in third year) |Photo Guide pg. 93
	wild cucumber	July – September |Photo Guide pg. 94
	cypress spurge	late-May – September |Photo Guide pg. 96
	leafy spurge	early-May – November |Photo Guide pg. 97
	Japanese knotweed	August – September |Photo Guide pg. 98
	giant hogweed	June – July (reproductive-year) |Photo Guide pg. 99
	Himalayan balsam	June – October |Photo Guide pg. 101
	yellow flag iris	June |Photo Guide pg. 102
	purple loosestrife	July – September |Photo Guide pg. 103
	wild parsnip	June – October (reproductive-year) |Photo Guide pg. 104
	common reed grass	July – September |Photo Guide pg. 105
	blackthorn	March – April |Photo Guide pg. 106
	common buckthorn	mid-May – early-June (starts in fourth year) |Photo Guide pg. 107
	glossy buckthorn	May – June (can start in second year)|Photo Guide pg. 108
	multiflora rose	May – July |Photo Guide pg. 109
	bittersweet nightshade	May – September |Photo Guide pg. 110
	common valerian	June – July (second-year) |Photo Guide pg. 111

7.2: Pond & Riparian – Checklist

Present in my area?	**Common Name**	**Bloom Period & Photo Guide Link**
	goutweed	May – June (occasionally) | Photo Guide pg. 86
	garlic mustard	late-April – May (second year) | Photo Guide pg. 87
	woodland angelica	June – September (reproductive-year) |Photo Guide pg. 88
	flowering rush	May – September (not submergent) |Photo Guide pg. 90
	Asiatic bittersweet	May – June (inconspicuous) |Photo Guide pg. 91
	scotch broom	May – July (starts in third year) |Photo Guide pg. 93
	wild cucumber	July – September |Photo Guide pg. 94
	Canada waterweed	June – August (occasionally) | Photo Guide pg. 95
	Japanese knotweed	August – September |Photo Guide pg. 98
	giant hogweed	June – July (reproductive-year) |Photo Guide pg. 99
	small-flowered jewelweed	May – September |Photo Guide pg. 100
	Himalayan balsam	June – October |Photo Guide pg. 101
	yellow flag iris	June |Photo Guide pg. 102
	purple loosestrife	July – September |Photo Guide pg. 103
	wild parsnip	June – October (reproductive-year) |Photo Guide pg. 104
	common reed grass	July – September |Photo Guide pg. 105
	common buckthorn	mid-May – early-June (starts in fourth year) |Photo Guide pg. 107
	glossy buckthorn	May – June (can start in second year)|Photo Guide pg. 108
	multiflora rose	May – July |Photo Guide pg. 109
	bittersweet nightshade	May – September |Photo Guide pg. 110
	common valerian	June – July (second-year) |Photo Guide pg. 111

7.3: Beaches, Dunes & Bogs - Checklist

Present in my area?	**Common Name**	**Bloom Period & Photo Guide Link**
	Asiatic bittersweet	May – June (inconspicuous) |Photo Guide pg. 91
	cypress spurge	late-May – September |Photo Guide pg. 96
	leafy spurge	early-May – November |Photo Guide pg. 97
	Japanese knotweed	August – September |Photo Guide pg. 98
	purple loosestrife	July – September |Photo Guide pg. 103
	wild parsnip	June – October (reproductive-year) |Photo Guide pg. 104
	glossy buckthorn	May – June (can start in second year)|Photo Guide pg. 108
	multiflora rose	May – July |Photo Guide pg. 109

7.4: Forest - Checklist

Present in my area?	**Common Name**	**Bloom Period & Photo Guide Link**
	sycamore maple	June (mature trees) | Photo Guide pg. 85
	goutweed	May – June (occasionally) | Photo Guide pg. 86
	garlic mustard	late-April – May (second year) | Photo Guide pg. 87
	Asiatic bittersweet	May – June (inconspicuous) |Photo Guide pg. 91
	black knapweed	June – October (second year) |Photo Guide pg. 92
	wild cucumber	July – September |Photo Guide pg. 94
	Japanese knotweed	August – September |Photo Guide pg. 98
	small-flowered jewelweed	May – September |Photo Guide pg. 100
	Himalayan balsam	June – October |Photo Guide pg. 101
	wild parsnip	June – October (reproductive-year) |Photo Guide pg. 104
	blackthorn	March – April |Photo Guide pg. 106
	common buckthorn	mid-May – early-June (starts in fourth year) |Photo Guide pg. 107
	glossy buckthorn	May – June (can start in second year) |Photo Guide pg. 108
	multiflora rose	May – July |Photo Guide pg. 109
	bittersweet nightshade	May – September |Photo Guide pg. 110

Section 8: Glossary

Achenes: *A small, dry one-seeded fruit that does not open to release the seed.*

Adventitious buds: *Buds that occur in unusual places on a plant i.e. on: roots, trunk or leaves.*

Aerenchyma: *A term given to spongy plant tissues that form spaces/air channels in the leaves, stems, and roots of salt tolerant plants.*

Allelopathy: *Is the production of biochemicals that inhibit the growth of other plants.*

Alternate Arrangement: *Refers to the leaf placement along a stem. In this case, leaves grow in subsequent order along the stem.*

Annual: *A plant that completes its life cycle in one growing season and then dies.*

Anther: *The pollen producing part of the plant. Is the male reproductive organ of a flower, it is part of the stamen. They can be found on imperfect male flowers or on perfect flowers.*

Aquatic: *A plant that lives in water. There are three categories: submergent, emergent or free floating.*

Basal: *Refers to the leaf placement on the plant. It is the lowest growing leaf on the stem.*

Benthic mat: *Also known as a benthic barrier or weed mat. A mat that sits at the bottom of a body of water to prevent the growth of aquatic weeds.*

Biennial: *A plant that completes its life cycle in two growing seasons and the dies. It is common for many biennials to flower and fruit in their second year.*

Biomass: *Material that comes from living organisms.*

Brackish: *A slightly salty mixture of water where the ocean and freshwater meet.*

Bracts: *A leaf that is directly under a flower, usually looks very different than other leaves. Can be modified to have a different shape, color and texture.*

Bulbils: *A small plant shaped like a bulb that is reproduced vegetatively from the axil of a leaf or in place of a flower.*

Clumping Plant: *A compact plant that forms in a mound or thicket.*

Compound Leaf: *A leaf consisting of two or more units called leaflets.*

Cyathium (plural cyathia): *A specialized false flower that forms an inflorescence. It is made of small, cup-shaped bracts.*

Deciduous: *A tree or shrub that sheds its leaves annually. Usually referring to broad-leaved trees however some can have needle like leaves and loose them (eastern tamarack, Larix laricina).*

Dioecious: *A plant that has male and female organs on different individuals.*

Drupes: *A fruit consisting of one or more hard seeds that are surrounded by a fleshy covering.*

Early Successional Forest: *The early stages of a forest after a major disturbance. Species that characterize this type of forest could include, ferns, grasses, raspberries, pin cherry's, white birch, grey birch, and eastern tamarack. These species enjoy high light conditions, temperatures, and lower moisture levels. Today's Wabanaki- Acadian Forest Region is overrepresented by this stage of succession.*

Elliptical Leaf: *Oval shaped leaf that tapers at the ends.*

Eradicate: *One of the stages of controlling invasives, this stage means to eliminate a population of a species. This may not always be possible on a province wide scale; it depends on the stage of invasion. If a species is reported early and a rapid response is had, it may be possible. Subsequent management stages would be containment or long-term control which are more expensive and ongoing.*

Evergreen: *A tree or shrub that retains green leaves annually, typical of coniferous species.*

Explosive Dehiscence: *A form of seed dispersal that involves its explosive release from mechanisms within a capsule. It allows the parent plant to spread outwards without the aid of animals.*

Extractigator: *A tool that helps pull out stubborn woody branching roots. It acts like a lever, leveraging your weight/strength against the ground.*

Floodplain: *Is the area adjacent to a body of water that extends from the banks of the "usual" water levels to the valley walls. Floodplains are usually low-lying and made up of species that tolerate flood conditions as this area experiences flooding during heavy rains, snow melts and/or storm events. The soils in these areas a nutrient rich as they contain sediment deposited by the waters.*

Flower Spike: *Group of flowers arranged along the main stem with no petioles (sessile). It looks similar to a raceme but is different because of its lack of petioles.*

Germination: *The act of a seed beginning to develop as it undergoes physical and chemical changes.*

Girdling: *Girdling involves cutting a two-inch ring around circumference of the tree's phloem (inner bark) but leaving the xylem (sapwood) intact. This technique allows the roots to nourish the top but prevents the top from sending nourishment back to the roots, which then die out. Always cut new shoots that arise below the girdling line.*

Glabrous: *A hairless plant part.*

Haw: *The round, red fruit of a hawthorn.*

Herbaceous: *A vascular plant that has no woody stems above ground, their stems are flexible and usually green.*

Hydrostatic pressure: *A pressure that exerts itself on the cell walls of a plant, showing when a plant disperses seed shoot out from the plants fruit capsule.*

Leaf Axil: *The upper angle formed between a leaf or leaf stalk (petiole) and the stem from where they arise.*

Leaf Scar: *A marked area of a trunk, stem, or branch where a leaf once was attached. These are often unique looking and can help in the identification of closely related species.*

Leaf Sheath: *A tube shaped structure at the base of the leaf's petiole which protects the leaf and stem where they meet.*

Leaf Variegation: *Pattern of different colored zones on a leaf, often green and white but can be a wide range of colors.*

Leaf Vein: *The vascular structure of broadleaved leaves that extends from the petiole into the leaf to transport water and nutrients. These patterns can often aid in identification.*

Leaflets: *A single division of a compound leaf (a small "leaf" that makes up the actual leaf).*

Lenticel: *A raised pore along a woody stem (sometimes on fruits) that allows the plant to exchange gasses. These are often distinctive and can be arranged in patterns that help in identification.*

Linear Leaf: *A long and narrow leaf shape (length is usually 12 times the width).*

Lobe: *A rounded segment of a leaf, separated by adjacent segments by clefts extending halfway or less to the middle of a leaf.*

Monocarpic: *Is a plant that flowers/fruits and then dies. Monocarpic perennials may live many years until they flower and die.*

Nodulated Roots: *Root nodules are found on the roots of plants, primarily legumes, that form a symbiosis with nitrogen-fixing bacteria.*

Opposite Arrangement: *Refers to the leaf placement along a stem. In this case, leaves are borne two at a time across from one another along a stem. *See definition for "sub-opposite".*

Ovate Leaf: *An egg-shaped leaf, with the widest part of the leaf occurring towards the base of the leaf.*

Panicle: *Is a branched raceme, each branch has its own raceme.*

Perennial: *A plant that lives more than two years.*

Perfect Flower: *A flower with male and female parts: sepals, petals, pistils and stamens it is a complete flower.*

Petiole: *The stalk of a leaf.*

Phototoxic Sap: *A toxic sap resulting in a response elicited after the initial exposure of skin to certain chemicals and subsequent exposure to light. Can result in rashes or burns as the chemical composition varies.*

Photosynthesis: *A process in which plants user sunlight, water, and carbon dioxide to oxygen and energy in the form of sugar.*

Pinnately Compound: *A leaf divided into smaller leaflets, with those leaflets arranged on either side of the leaf's central stalk (known as rachis). *Can be twice pinnately compound which means the pinnate leaf are themselves pinnate, also known as bipinnate.*

Propagate: *To increase a plant through vegetative or sexual reproduction.*

Raceme: *A flower cluster with many flowers attached to a main stem with short equal length stalks.*

Rachis: *A main axis of a compound structure.*

Rhizome: *An underground horizontal part of a plant that is often categorized as part of a plants root system, despite it being not a root and actually a modified stem.*

Riparian Area: "*The strip of moisture-loving vegetation growing along the edge of a natural water body. The exact boundary of the riparian area is often difficult to determine because it is a zone of transition between the water body and the upland vegetation."* (Government of Canada, 2020)

Roots Buds: *These are considered adventitious buds, can sprout new plants.*

Rosette: *A whorled arrangement of leaves emerging from a central point of a plant, usually at the base of a plant.*

Runner (stolon): *A slender stem that grows horizontally outward from the plant above ground. It gives rise to new root systems and vegetative growth at nodes.*

Samara: *A winged achene, commonly referred to as helicopter seeds. Many species produce these fruits, most are likely familiar with maples doing so but other examples include true ash trees, tree of haven, Ailanthus altissima, and some species of elm.*

Satellite Populations: *A smaller population of invasive species in comparison to a large source patch (aka outlier species).*

Scalloped Edges: *The edges of a leaf margin having rounded indentations.*

Seed Bank: *The soil seed bank is the natural storage of seeds, often dormant, within the soil of most ecosystems. To know how long a seed remains viable there must be trials kept in the lab and in natural environments, not all plants have been studied to this depth. Seeds in a seed bank often experience higher germination after disturbance.*

Seed Bristles: *A dry, stiff, often colorless plant hair that forms part of a spikelet.*

Simple Leaf: *A leaf not divided into secondary units, no leaflets.*

Sloe: *A small acidic fruit of the blackthorn.*

Soil Remediation: *Returning the soil to a form of ecological stability. Invasives with allelopathic abilities have altered soil microbial communities, limiting plant growth for other species you may want to establish at the site. It is important to consider when replanting a site for the success of your plantings. A soil amendment is a material applied to the soil to improve its quality; certain treatments may mitigate the allelopathy of invasive plants. Here is an interesting article done on biochar to get started in your research: "Biochar mitigation of allelopathic effects in three invasive plants: evidence from seed germination trials".*

Spikelet: *Surrounded by two bracts at its base the spikelets form a compound inflorescence, common in grasses. Each spikelet contains one or more florets (small flowers) along it's rachilla (secondary rachis).*

Stirrup Hoe: *A tool that helps making weeding of seedlings and young plants much easier, is used while standing. It has a "U" shaped blade that digs under the surface of the soil to pull out a root as a whole.*

Stolons (runner): *A slender stem that grows horizontally outward from the plant above ground. It gives rise to new root systems and vegetative growth at nodes.*

Submergent: *Submerged plants an aquatic plant that is rooted. They have limp stems and most of their vegetative mass is below the water surface, although small portions may stick above the water like flowers.*

Sub-opposite: *A leaf arrangement where the plants leaves are not perfectly opposite from one another along a stem; however, they are not far enough apart to be considered alternate.*

Suckering (epicormic sprouting): *Plant suckers are vigorous vertical growth originating from the root system or lower main stem of a plant. This can happen naturally or after it has been damaged or stressed. A more scientific term is epicormic sprouting as these suckers are also known as epicormic shoots since they grow from an epicormic bud, which lies underneath the bark of a trunk, stem, or branch of a plant.*

Taproot: *A plants main or primary root. Normally is downward growing and has an extending root system.*

Tendril: *A threadlike structure used by climbing plants to coil around other surfaces for support.*

Terminal Branch: *Apex of the stem where the terminal bud is located, an undeveloped portion of the embryonic shoot. Plants with these buds will concentrate their resources to allow this bud to grow and develop adding height to a plant.*

Terrestrial Plant: *A plant that grows on land. Other types include aquatic, epiphytic (living on trees) and lithotrophic (living on rocks).*

Toothed Leaf: *Refers to serrations along a leaf's margin. Toothed serrations often look like a saw blade, with the pointed end facing the apex of the leaf.*

Translucent: *Leaves and stems may become translucent (allowing light but not detailed shapes) when it has lost a significant amount of chlorophyll which give plants their green appearance. Insufficient exposure to light stops chlorophyl from working at peak performance.*

Triternate Leaf: *Is compounded three times. Trifoliate leaves (a leaf with three leaflets) are compound each with three leaves themselves making the structure biternate, the biternate leaf is also compounded making it triternate. It's helpful to look at a diagram when discussing compound leaf structures.*

Turion: *A type of bud found on certain aquatic plants that is capable of growing into a complete plant as it contains store nutrients. It detaches from the parent plant and remains dormant until growing conditions allow it to emerge.*

Umbel: *A flower cluster in which stalks of nearly equal length spring from a common center from the main stem. They can be flat topped or have a curved shape that can be hemispherical or spherical. Picture it shaped like an umbrella.*

Unfurl: *When something that is curled up or wrapped tightly unfolds.*

Vegetative Fragmentation: *A very common method of vegetative reproduction in plants, it can happen naturally and through human interference. It is a major consideration when planning the management activities of invasive species, as often there is a possibility of increasing the plants spread if improper techniques are chosen – not all plants can be dug out effectively!*

Whorled: *Refers to the leaf placement along a stem. In this case, it means having three or more leaves originating from the same point on a stem.*

Appendix

Appendix A: PEIISC Priority Plant List (Two Pages)

PEI IS Plant List - Priority Reporting List for Spotter's Network, August 16, 2021
This is an informational list only (not intended for legislation or enforcement purposes).
This is an ongoing project and will be updated on a regular basis as new information becomes available.

Common Names	Scientific names	Plant Description	Priority Spotter's Network	Refer to legend at bottom of table for category description. Habitat									Invasiveness	Distribution	Immediacy	Controllability
				Aq	WeF	WeS	Wo	GM	*D	U	Ag	H	Du	RO	RW				
Black knapweed	*Centaurea nigra*	Herbaceous plant	1, priority								x					?	1	1	?
Blackthorn	*Prunus spinosa*	Shrub	1, priority				x	x	x			x				?	1	2	?
Canada waterweed	*Elodea canadensis*	Herbaceous plant	1, priority	x												2	1	3	3
Common valerian	*Valeriana officinalis*	Herbaceous plant	1, priority									x				1	1	2	3
Cypress spurge	*Euphorbia cyparissias*	Herbaceous plant	1, priority				x	x	x							1	1	2	3
Flowering rush	*Butomus umbellatus*	Herbaceous plant	1, priority		x	x										2	1	2	3
Garlic mustard	*Alliaria petiolata*	Herbaceous plant	1, priority		x		x	x	x					x		2	1	2	3
Giant hogweed	*Heracleum mantegazzianum*	Herbaceous plant	1, priority		x		x	x	x					x		2	1	2	3
Himalayan balsam	*Impatiens glandulifera*	Herbaceous plant	1, priority		x			x	x					x		2	1	2	3
Leafy spurge	*Euphorbia esula*	Herbaceous plant	1, priority				x	x	x		x					2	1	2	3
Oriental bittersweet	*Celastrus orbiculatus*	Vine	1, priority		x	x	x	x	x		x		x	x	x	2	1	2	3
Scotch broom	*Cytisus scoparius; Sarothamnus scoparius*	Shrub	1, priority				x	x	x			x	x			2	1	2	3
Sycamore maple	*Acer pseudoplatanus*	Tree	1, priority					x	x			x	x			1	1	2	3
Wild parsnip	*Pastinaca sativa*	Herbaceous plant	1, priority				x	x	x		x					1	1	2	3
Woodland angelica	*Angelica sylvestris*	Herbaceous plant	1, priority				x	x	x							1	1	2	2
Yellow flag iris	*Iris pseudacorus*	Herbaceous plant	1, priority		x		x	x	x				x			1	1	2	3
Angel's Trumpet	*Datura innoxia*	Vine	2, not present				x	x	x							?	?	?	?
Dog strangling vine	*Vincetoxicum nigrum*	Herbaceous plant	2, not present				x	x	x		x					2	1	1	?
Eurasian water milfoil	*Myriophyllum spicatum*	Herbaceous plant	2, not present	x												2	1	1	?
European frog-bit	*Hydrocharis morsus-ranae*	Herbaceous plant	2, not present	x												2	1	1	?
False Cleavers Bedstraw	*Galium spurium*	Herbaceous plant	2, not present								x						1	1	?
Kochia	*Kochia scoparia*	Herbaceous plant	2, not present																
Kudzu	*Pueraria lobata*	Vine	2, not present				x	x	x					x		2	1	1	?
Palmer Amaranthe	*Amaranthus palmeri*	Herbaceous plant	2, not present								x								
Tall water hemp	*Amaranthus Tuberculatus*	Herbaceous plant	2, not present								x								
Yellow floating heart	*Nymphoides peltata*	Herbaceous plant	2, not present	x					x							2	1	1	?
Yellow nut sedge	*Cyperus esculentus*	Herbaceous plant	2, not present	x					x		x					1	1	1	?
Wild chervil	*Anthriscus sylvestris*	Herbaceous plant	3, need to know distribution													1	1	1	?
Valvetleaf	*Ahuthia theophrasti*	Herbaceous plant	3, need to know distribution													1	1	1	1/?
Mugwort	*Artemisia vulgaris*	Herbaceous plant	3, need to know distribution								x					1	1	2	?
Common buckthorn	*Rhamnus cathartica*	Shrub	3, need to know distribution								x			x	x	2	1	2	3
Common reed grass	*Phragmites australis ssp. australis*	Herbaceous plant	3, need to know distribution		x		x	x	x		x					?	?	?	?
Common tansy	*Tanacetum vulgare*	Herbaceous plant	3, need to know distribution				x	x	x		x					2	2	3	2
Glossy buckthorn	*Frangula alnus; Rhamnus frangula*	Shrub	3, need to know distribution		x		x	x	x		x			x	x	2	2	3	1
Marsh hedge-nettle	*Stachys palustris*	Herbaceous plant	3, need to know distribution		x			x	x		x					2	1	2	3
Soapwort (Bouncing bet)	*Saponaria officinalis*	Herbaceous plant	3, need to know distribution				x	x	x		x					2	1	2	3
Virginia creeper	*Parthenocissus quinquefolia, P. vitacea*	Vine	3, need to know distribution				x	x	x				x			3	3	3	3
Wild cucumber	*Echinocystis lobata*	Herbaceous plant	3, need to know distribution		x		x	x	x							2	2	3	3
Bugleweed	*Ajuga spp.*	Herbaceous plant	4, horticultural			x	x	x	x							2	2	2	2
Creeping bellflower	*Campanula rapunculoides*	Herbaceous plant	4, horticultural				x	x	x							1	1	2	2
European high-bush cranberry	*Viburnum opulus*	Herbaceous plant	4, horticultural											x		1	1	2	3
False spirea	*Sorbaria sorbifolia*	Shrub	4, horticultural				x	x	x							1	1	2	3
Goutweed (var. & non-var.)	*Aegopodium podagraria*	Herbaceous plant	4, horticultural				x	x	x							2	2	2	2
Lady's mantle	*Alchemilla mollis*	Herbaceous plant	4, horticultural													1	1	2	2
Lily-of-the-valley	*Convallaria majalis*	Herbaceous plant	4, horticultural				x									1	1	2	2
Moneywort	*Lysimachia nummularia*	Herbaceous plant	4, horticultural													1	1	2	2
Multiflora rose	*Rosa multiflora*	Shrub	4, horticultural				x	x	x							1	1	2	2
Nodding star-of-Bethlehem	*Ornithogalum nutans*	Herbaceous plant	4, horticultural													1	1	2	2
Periwinkle	*Vinca minor*	Herbaceous plant	4, horticultural			x		x	x		x	x				2	2	2	3
Salt cedar	*Tamarix spp.*	Shrub	4, horticultural	x					x		x	x	x			?	1	2	3
Sedum spp.	*Sedum herbstfreude*	Herbaceous plant	4, horticultural	x		x	x	x	x		x	x	?			?	?	?	?
Small-flowered touch-me-not	*Impatiens parviflora*	Herbaceous plant	4, horticultural						x		x	?	x	x	x	2	1	2	2
Purple loosestrife	*Lythrum salicaria*	Herbaceous plant	5, restricted		x		x	x	x			x	x			2	3	3	2
Bittersweet Nightshade	*Solanum dulcamara*	Herbaceous plant	6, ubiquitous		x		x	x	x			x		x		1	1	2	1
Canada thistle	*Cirsium arvense*	Herbaceous plant	6, ubiquitous				x	x	x		x					2	1	3	1
Coltsfoot	*Tussilago farfara*	Herbaceous plant	6, ubiquitous				x	x	x							?	?	3	1
Common hawkweed	*Hieracium lachenalii*	Herbaceous plant	6, ubiquitous				x	x	x					x		2	2	3	1
Common oregano	*Origanum vulgare*	Herbaceous plant	6, ubiquitous					x	x							1	1	3	1
Common speedwell	*Veronica officinalis*	Herbaceous plant	6, ubiquitous				x	x	x							2	1	3	1
Creeping buttercup	*Ranunculus repens*	Herbaceous plant	6, ubiquitous							x				x		2	2	3	1
Creeping charlie	*Glechoma hederacea*	Herbaceous plant	6, ubiquitous				x	x	x		x			x	x	2	2	3	1
Dame's rocket	*Hesperis matronalis*	Herbaceous plant	6, ubiquitous								x					2	2	3	1
Dandelion	*Taraxacum officinale*	Herbaceous plant	6, ubiquitous				x	x	x		x					2	2	3	1
European mountain ash	*Sorbus aucuparia*	Tree	6, ubiquitous				x	x	x							2	2	3	1
Japanese knotweed	*Fallopia japonica Polygonum aspidatum*	Herbaceous plant	6, ubiquitous				x	x	x							2	2	3	1
Lupine, Lupin	*Lupinus polyphyllus*	Herbaceous plant	6, ubiquitous				x	x	x		x			x		2	1	3	1
Manitoba maple	*Acer negundo*	Tree	6, ubiquitous				x	x	x					x		1	1	3	1
Norway maple	*Acer platanoides*	Tree	6, ubiquitous		x		x	x	x						x	2	1	2	2
Ox-eye daisy	*Leucanthemum vulgare*	Herbaceous plant	6, ubiquitous				x	x	x		x					2	1	3	1
Queen anne's lace/Wild carrot	*Daucus carcota*	Herbaceous plant	6, ubiquitous				x	x	x		x		x			2	1	3	1
Reed canarygrass	*Phalaris arundinacea*	Herbaceous plant	6, ubiquitous	x			x	x	x		x					2	2	3	2

Scots pine, Scotch pine	*Pinus sylvestris*	Tree	6, ubiquitous				x	x	x	x		x	x			1	3	2	3
Silver (White) poplar	*Populus alba*	Tree	6, ubiquitous					x	x	x		x		x		1	3	2	1
Smooth bedstraw	*Galium mollugo*	Herbaceous plant	6, ubiquitous					x	x	x	x					2	3	3	1
Tansy ragwort	*Senecio jacobaea*	Herbaceous plant	6, ubiquitous					x	x	x	x	x				1	2	2	3
Thyme	*Thymus vulgaris*	Herbaceous plant	6, ubiquitous						x	x		x				2	3	2	1
Water lily	*Nymphaea odorata (exotic)*	Herbaceous plant	6, ubiquitous	x						x		x				2	3	2	2
White sweet clover	*Melilotus albus, M. alba*	Herbaceous plant	6, ubiquitous					x	x		x		x			2	3	3	1

Legend

Habitat
Aq - Aquatic
WeF - Wetland/Meadow, fresh water
WeS - Wetland, salt water
Wo - Woodland
GM - Grassland/Meadow
U - Urban
D* - Disturbed areas
Ag - Agricultural land
H - Horticulture (garden escape)
Du - Dunes
RO - Open Riparian zone
RW - Wooded Riparian zone

Invasiveness
1. Highly
2. Very highly

Distribution
0. Not present
1. Localized
2. Moderate spread
3. Widespread
? = Unknown at present

Immediacy
1. Potential risk
2. Watch for spread
3. Immediate threat

Controllablity
1. Unmanagible
2. Prevent further spread
3. Potential for eradication

*Disturbed areas include: roadside, waste areas, hedgerows, woodland edges, abandoned homesteads

Priority Level	Explanation
1. Priority	Priority species are not yet widespread in PEI and
2. Not present	These species are not yet present in PEI but may
3. Need to know distribution	These species are known to be present in PEI
4. Horticultural	These species originated from horticultural
5. Restricted	These species are regulated in PEI and cannot
6. Ubiquitous	These species have become naturalized in PEI

Appendix

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