Learn about:
Invasive Alien Species

Invasive Alien Species: Learning Materials for Nova Scotia Envirothon Participants 2016

Prepared by:

Dr. Peter Duinker, Stephanie Maasik and Carlisle Kent
School for Resource and Environmental Studies, Dalhousie University

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We hope you enjoy learning about urban forests using this format. If you encounter any difficulties or have questions about anything in this file, please contact either Dr. Peter Duinker (peter.duinker@dal.ca), or Stephanie Maasik, MREM Candidate (stephanie.maasik@dal.ca)

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What are Invasive Alien Species?

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- What are They?
- Impacts
- Pathways
- Good Invaders
- Roles and Responsibilities

Native species: occur naturally at a given location or in a particular ecosystem – not moved there by humans intentionally or unintentionally.

Invasive alien species: are a group of species that are introduced to an area, survive, and reproduce causing harm economically or environmentally within the new area.

Alien species: are non-native species. Some were introduced to Nova Scotia when Europeans first settled in the area in the 1600s and brought many new species that drastically changed the landscape.

Invasive species: threaten us or the environment.

Limited population control methods are in place to limit the extent of invasive alien species, allowing rapid increases in population numbers.

Source: MTRI, 2012

Impacts of Invasive Alien Species

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Environmental

- Disturb natural ecosystems by outcompeting native species and reducing local biodiversity
- Can cause extirpation or extinction of native species
- Introduce disease
- Alter natural processes and disturbance patterns
- Decrease food sources and impact food webs

Social

- Can cause the spread of disease
- Potential to increase allergies and irritations
- May reduce wellbeing
- May negatively impact recreational and tourism opportunities

Economic

- Changes to ecological services
- Reduces productivity in forestry, agriculture and fisheries
- Cause export and import restrictions
- Reduce property values
- Costly to prevent and manage
- Impacts to recreation and tourism

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Source: Environment Canada, 2013; Invasive Species Centre, 2015; MTRI, 2012; WWF, 2015

Pathways of Introduction

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Pathways: method in which invasive alien species are introduced or spread.

- Introductions can be both intentional (purposeful) or unintentional (accidental) and they can be "authorized" or "unauthorized" (illegal)

Secondary movement: occurs once a species has been introduced to a new area, and begins to spread to other locations nearby.

- This can occur through natural or human-assisted movement

Possible introduction pathways:

- Horticultural trade
- Gardening and landscaping
- Aquariums and the pet trade
- Transportation of animals and animal by-products
- Ballast water
- Recreational boating
- Transportation stowaways
- Intentional introduction (e.g. biocontrol)
- Illegal release (e.g. cultural release)

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Source: Environmental Protection Agency MTRI, 2012

What Makes a Good Invader?

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Characteristics of invasive species:

- Often generalists, able to adapt to different environments
- Tolerate a variety of habitat conditions
- Grow and reproduce quickly
- Compete aggressively for resources (water, food, habitat)
- Lack natural enemies or predators in the introduced ecosystem
- Low susceptibility to disease

- Not all alien species will be invasive
- **Naturalized species**: non-native species that do not become invasive, or have integrated into the ecosystem to such a degree that they are considered a natural part of the community
- Disturbed ecosystems may be more vulnerable to invasive species as they have empty niches
- "Healthier" ecosystems may be less vulnerable as native species may provide some level of protection (biotic resistance)

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Source: MTRI, 2012; US Forest Service, 2012

Roles and Responsibilities

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Governments: help prevent, detect, control, and monitor invasive alien species primarily through legislations, regulations, and policies. There are four levels:

- **International:** United Nations Environment Programme's Convention on Biological Diversity aids countries in building their own national strategies, and facilitates international collaboration
- **Federal:** National strategies, like Canada's Invasive Alien Species Strategy and the United States' Lacy Act, Animal Health Protection Act, and National Invasive Species Council. Federal government enhances coordination between different stakeholders and strengthens programs to respond to invasive alien species
- **Provincial:** Legislation, policies, and agencies to address invasive alien species within provincial boundaries, and collaboration with neighbouring provinces. Nova Scotia has the Biodiversity Program, a partnership between the province, municipalities, and other organizations.
- **Municipal:** May use by-laws, and most importantly plays important role in engaging the public in controlling these species. Frequently form partnerships with other levels of government and other organizations.

Non-Governmental Organizations: Public engagement and education, research, and coordination with other groups and governments.

Individual: Self-education, contributing to efforts, citizen science, not introducing.

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Source: Environment Canada, 2013

Smallmouth Bass
(*Micropterus dolomieu)*

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Smallmouth Bass

Chain Pickerel

Green Crab

How to identify:
- Robust body 23 to 38 cm in length, with spiny fin on back
- Colouration ranges from brown to green, with dark vertical blotchy bars on sides and several dark horizontal bars on head

Native alternative:
- White Perch (*Morone americana*), often incorrectly called the “Silver Bass”

Pathway:
- In 1942 the government authorized the release of Smallmouth Bass into Bunkers Lake in Yarmouth County
- Last authorized release took place in 1984

Habitat and impact:
- Prefers the rocky bottoms of well-shaded lakes and streams
- Threatening native fish communities in over half of the province’s primary watersheds
- Efficient predator of many native smaller fish, mammals, and amphibians
- Eats much of the food other native species rely on for survival

Stewardship actions:
- Keep all equipment, including fishing gear, boats, and buckets, clean when moving from bodies of water known to have Smallmouth Bass to avoid spread of fish or fish eggs
- It is illegal to use Smallmouth Bass as bait in Nova Scotia
- Be sure to report any sightings of the species in new locations


Credit: Engbretson Eric


Credit: Spencer Neuharth

Source: MTRI, 2012

Chain Pickerel
(*Esox niger)*

HOME

Smallmouth Bass

Chain Pickerel

Green Crab

How to identify:

- Long, narrow, torpedo-shaped, green body with a darker back and white belly. Often slimy to the touch
- Adults have chain-like patterns on sides
- Long snout filled with many large, sharp teeth. Tail fin is deeply forked
- Average length 38 to 51 cm

Native alternative:

- Speckled Trout and White Perch are popular native sport fish

Pathway:

- Introduced accidentally and illegally in the 1940s

Habitat and impact:

- Prefers shallow, vegetated waters
- Voracious predators of fish, insects, mice and snakes
- Chain pickerel transforms aquatic ecosystems and negatively impacts sports fishing

Management:

- Keep all equipment, including fishing gear, boats, and buckets, clean when moving from bodies of water known to have Chain Pickerel to avoid spread of fish or fish eggs
- It is illegal to use Chain Pickerel as bait in Nova Scotia
- Be sure to report any sightings of the species in new locations

Source: MTRI, 2012

Green Crab
(*Carcinus maenas*)

HOME

Smallmouth Bass

Chain Pickerel

Green Crab

How to identify:

- Upper shell (carapace) varies from mottled, green, red, yellow, to brown
- Five distinctive spines on either side of its eyes and three bumps between the eyes
- Hairy back legs that are pointed and slightly flattened
- Can be up to 10cm wide but usually less than 8cm

Pathway:

- Believed to have made its way up the east coast of the USA
- First documented in Nova Scotia in the 1950s, appearing in the Bay of Fundy

Habitat and impact:

- Shallow water, such as salt marshes and beaches, in both rocky and vegetated environments
- Voracious appetite for plants and animals, especially Eel Grass, soft-shell clams, oysters, quahogs, and mussels
- Predation and habitat destruction, especially Eel Grass beds (important habitats for native fish, invertebrates, and waterfowl)
- Highly negative impact on local biodiversity and shellfish fisheries

Management:

- Keep gear clean and do not transport water or vegetation when boating and fishing in Green Crab infested waters
- Do not release Green Crab bycatch
- Report sightings to Fisheries and Oceans Canada

Credit: Maritime Aquarium

Credit: CSIRO Marine Research

Source: MTRI, 2012

Common Burdock (*Arctium minus*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Biennial plant
- Bright, magenta flowers that closely resemble thistles, and large, rhubarb-like leaves
- Can grow up to 2 m high

Pathway:

- Pathway to Nova Scotia is not completely known
- Considered native to Europe and Asia
- Present in Canada for over 250 years

Habitat and impact:

- Found along human and animal paths and roadsides and in open areas in woods, as well as disturbed areas
- Produces around 15,000 seeds per plant, and easily self-distributes when disturbed by animals and birds, as they carry the seeds on their bodies
- Quickly spreads through suitable habitats
- Its large leaves cause extreme shad that inhibits the growth of other groundcover plants

Management:

- Best to remove the plants before they bloom to avoid the seeds dispersing
- The plant's roots can continue living for up to five years, so annual cutting is necessary
- Digging is not usually effective, as the root systems grow very deep

Credit: Alberto Salguero, 2005

Credit: David Antiss, 2009

Source: HRM, 2015

Goutweed
(*Aegopodium podagraria*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:
- Perennial herb
- Globe-like clusters of small white or cream flowers at the end of long stalks
- Can reach heights between 40 and 90 cm on average
- Extensive root system

Pathway:
- Native to Eurasia
- Found throughout Canada including Nova Scotia, for many years

Habitat and impact:
- Thrives in temperate climates
- Prefers moist soil conditions

Management:
- Often considered naturalized
- Relatively low concern in terms of invasiveness.

Credit: Franz Xaver

Source: HRM, 2015

Purple Loosestrife (*Lythrum salicaria*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Perennial herb
- Forms upright, stout, branched stems
- Leaves are simple, opposite or on whorls of 3, smooth, stalk-less, and downy
- Flowers are small, magenta and spiked with 5 to 7 petals, and bloom from July through September
- Small fruit capsules, about 6 mm in length, containing numerous dark seeds are produced
- Reaches heights from 50 to 150 cm

Pathway:

- Infamous invader from Europe, northern Africa and Asia
- Brought to North America several times for ornamental and medicinal purposes, and accidently in ship ballast

Habitat and impact:

- Primarily found in wetlands and human-disturbed wet areas like ditches
- Can prevent regeneration of native species

Management:

- Eradication is very difficult
- The use of biocontrol species, such as weevils and beetles seem to have slowed the spread


Credit: HRM


Credit: Liz West

Source: HRM, 2015; MTRI 2012

Wild Parsnip
(*Pastinaca sativa)*

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Large plant, growing up to 2m tall
- Compound leaves and many leaflets on a shared stem
- Small yellow flowers in umbrella-shaped clusters measuring 10-20 cm across, that bloom in June and July, sometimes as late as September
- Round flat seeds with wings
- Stems are 2-5cm thick, smooth with a few hairs, and hollow at nodes
- The roots are edible

Native alternative:

- Angelica (*Angelica sylvestris*)
- Queen Anne's Lace (*Daucus carota*)
- Cow's Parsnip (*Heracleum maximum*)

Pathway:

- Native to Eurasia
- Believed to have been introduced to North America for its edible roots. It
- Arrived in Nova Scotia in the 1940s

Habitat and impact:

- Tolerates many soil types (dry, moist, or wet)
- Habitats include meadows, riparian zones and forest edges, and roadsides and railway embankments
- Tends to grow in dense clumps and spreads quickly through seed dispersion, outcompeting native plants to reduce biodiversity
- Direct contact with the plant can cause photodermatitis, resulting in severe skin and eye problems, including blindness

Management:

- Mowing before the plant has gone to seed
- Pulling by hand should be avoided due to health risks – digging with gloves and tools recommended
- Covering the plant with a tarp for a full growing season in conjunction with digging or mowing can be effective in smothering growth of new plants


Credit: Joshua Mayer


Credit: Cbaile19

Source: HRM, 2015

Garlic Mustard
(*Alliaria petiolata*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Biennial herb
- In its first year, the plant is a rosette with kidney-shaped, lightly serrated leaves
- In the second year is characterized by an erect stem, and sharply serrated, alternate triangular leaves
- Small white regular flowers, appearing in clusters of four petals in a cross shape
- Blooms in the spring, and has fruit in an oblong seed pod up to 10 cm long
- Ranges in size from 60 to 105 cm
- When the stem or leaves are crushed, a garlic odour is released

Pathway:

- First appeared in around 1868 brought over from Europe
- Used for food and medicinal purposes

Habitat and impact:

- Prefers moist, shady soils found in the understories of forests
- Potential to prevent native regeneration
- Several published studies suggest Garlic Mustard produces allelopathic chemicals that suppress other plants' growth
- Currently the plant has only been found in one location in Annapolis Valley

Management:

- Report any sightings of Garlic Mustard to the Clean Annapolis River Project
- If found on your property, remove the plant
- If the plant has seeds, do not compost, rather dry and burn it or place it in the garbage for pick-up, to prevent further spread


Credit: Sansse


Credit: hspauldi

Source: Clean Annapolis River Project, 2013

Canada Thistle / Creeping Thistle (*Cirsium arvense*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canadian Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Herbaceous perennial
- Leaves are simple, alternate, lance-shaped, deeply lobed, spiny, and may clasp stem
- Flowers are generally rounded or umbrella shaped clusters, purple or pink in colour, and bloom June through October
- Small, dry, single seeded fruit, up to 4 cm in length, and feathery structure attached to the seed base
- Erect and branched stem that can grow 30 to 150 cm in height

Pathway:

- Accidently introduced in the early 1600s from Europe and Asia

Habitat and impact:

- Commonly found in waste areas, agricultural crops, fields, and meadows
- Can outcompete native plants, and may actually be allelopathic (produce chemicals that suppress the growth of other plants)
- Major agricultural weed

Management:

- Very difficult to eradicate due to its extensive root structure
- If found on your property, remove it quickly
- Dry and burn or put the plant in the garbage (do not compost)
- Hand cutting plants before they seed can help deplete the root stock


Credit: Daniel X. O'Neil


Credit: D. Gordon and E. Robertson

Source: Clean Annapolis River Project, 2013

Glossy Buckthorn (*Frangula alnus*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Single or multi-stemmed shrub or small tree, reaching heights of 6 m
- Leaves are oval-shaped with smooth edges, 3 to 7 cm long by 2.5 to 4 cm wide, with a glossy upper surface, and alternate along the stem
- Flowers are five-petalled star shaped, greenish-white, 3 to 5 mm wide, clustered in leaf axils, and bloom from May to June
- 6 to 10 mm red, non-edible berry-like fruit, that turns black when ripe
- Bark is blackish-brown and spotted with grey, and inner bark is yellow

Native alternative:

- Chokecherry (*Prunus virginiana*)
- Serviceberry (*Amelanchier spp.*)

Pathway:

- Introduced into North America as a hedge or ornamental plant late 1800s
- In Nova Scotia for the past 50 years

Habitat and impact:

- Wet to moist old fields, thickets of forest, shores and open wetlands
- Tolerant to acidic conditions, making it well adapted to invade many habitats Forms dense stands, which can replace wetland communities and take over tree understories, even eliminate tree seedlings

Interesting fact:

- Berries are poisonous to many animals, birds and other small mammals consume them, which helps spread the seeds several kilometers

Management:

- Promote the use of native or non-invasive alternative shrubs
- Smaller plants can be uprooted and larger plants trimmed to help limit spread
- Should not be composted as seeds can remain viable


Credit: Calin Darabus

Source: MTRI, 2012

Japanese Knotweed (*Fallopia japonica*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Hollow-stemmed, bamboo-like herbaceous plant
- Leaves are smooth, oval-shaped, with points on the tips, and alternate on the stem
- Flowers are very small green-white in colour, found in linear clusters, and bloom in August and September
- Can reach about 3 m in height

Pathway:

- From eastern Asia
- Deliberately introduced to North America as an ornamental plant

Habitat and impact:

- Primarily found in human-disturbed sites
- May threaten riparian habitats
- Due to its ability to establish strong root systems and grow dense colonies, it crowds out other plants

Management:

- There are currently no effective measures to remove Japanese Knotweed once it has become established


Credit: Roger Kidd


Credit: Ancatdubh43

Source: HRM, 2015

Giant Hogweed (*Heracleum mantegazzianum*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Giant herbaceous plant (5 m in height)
- Dark green compound leaves, with many leaflets on a common stem and jagged, deeply grooved edges, 2.5 m in length – can have stiff, stubby hairs on the underside of leaves
- Flowers occur in large umbrella-shaped clusters, measuring up to 1.5 m in diameter, and bloom in June and July
- Large, flat, oval-shaped seeds
- Herbaceous stems (green, leaf-like, non-woody), ranges from 5-10 cm in diameter, hollow, covered with coarse hairs, and may have purple spots

Native alternative:

- Angelica, Queen Anne's Lace
- Cow Parsnip (smaller alternatives)

Pathway:

- Native to central Asia
- Introduced to North America in the 1900s as an ornamental plant

Habitat and impact:

- May threaten stream banks and other riparian areas as well as adjacent to roads and in vacant lots
- Potential to form a dense canopy in riparian areas causing stream bank erosion
- Can crowd out native vegetation
- Potential severe human health impacts as the sap can cause a severe rashes and even blindness in humans

Management:

- Due to the possible human health impacts, caution should be taken if Giant Hogweed is handled


Credit: Appaloosa


Credit: Derek Harper


Credit: HREM

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Source: HRM, 2015; MTRI, 2012

Norway Maple
(*Acer platanoides*)

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- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Large deciduous tree, up to 18 to 25 m tall
- Large crown
- Large, maple-shaped leaves, often with tar spots
- Leaf stem has milky sap
- Buds are round and flowers are greenish and bloom in the early spring
- Seeds look like a pair of green wings

Native alternative:

- Sugar Maple (*Acer saccharum*)
- Red Maple (*Acer rubrum*)

Pathway:

- Brought over to the United States in the 18th century
- More widespread in the 1940s as they were planted to replace White Elm dying of Dutch Elm Disease

Habitat and impact:

- Upland forests, concentrated in urban areas
- Create dense shade, grows competitive networks of shallow roots
- Releases toxic chemicals creating a harsh environment for other species and can reduce biodiversity in the area
- Can cause soil erosion due to lack of ground vegetation

Management:

- Promote the planting of native or non-invasive maple varieties


Credit: Mongo


Credit: Jonathan Billinger

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Source: MTRI, 2012

Scotch Pine / Scots Pine / Caledonian Pine (*Pinus sylvestris*)

HOME

- Common Burdock
- Goutweed
- Purple Loosestrife
- Wild Parsnip
- Garlic Mustard
- Canada Thistle
- Glossy Buckthorn
- Japanese Knotweed
- Giant Hogweed
- Norway Maple
- Scots Pine

How to identify:

- Large needle-leaved conifer, growing up to 25 m tall
- Blue-green, sharply pointed needles are in bundles of two, 4 to 6 cm in length
- Cones are 3 to 6 cm long
- Upper branches and trunk are characterized by yellowish bark

Native alternative:

- White Pine (*Pinus strobus*)
- Red Pine (*Pinus resinosa*)
- Jack Pine (*Pinus banksiana*)

Pathway:

- Used in the 1920s to reforest abandoned agricultural land
- Since then, the tree has been used as Christmas trees, and in landscaping and shelterbelts

Habitat and impact:

- Grows well in many soil conditions and moisture levels, and requires sunlight
- Thrives in open woodlands, wetlands, and barrens
- Major impacts come from outcompeting native species and modifying ecosystems

Management:

- Choose native or non-invasive alien pine species in your landscaping
- Encourage government, industry, and neighbours to choose native species to prevent the movement of Scotch Pine
- Pull out seedlings, cut down bigger trees, and burn cones on-site
- Report Scotch Pines to the Invasive Species Alliance of Nova Scotia


Credit: John Haslam


Credit: Jim Champion

Source: MTRI, 2012

Blacklegged Tick/ Deer Tick (*Ixodes scapularius)*

HOME

- Blacklegged Tick
- Brown Spruce Longhorn Beetle
- European Fire Ant
- Earthworm
- Coyote

How to identify:

- Dark brown to black colouration
- Smaller than dog or wood ticks (about 3 mm in length)
- No white markings on the large part of their bodies (contrary to other common ticks)

Pathway:

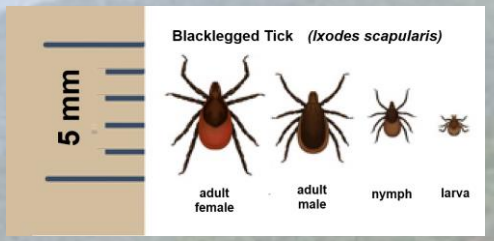
- Migrating birds tend to be a common transportation vector

Habitat and impact:

- Generally found in humid, wooded areas that are often also inhabited by their primary food sources (e.g. white-footed mice, deer, etc.)
- They search for a host from the tips of low-lying vegetation and shrubs, and generally attach near ground level
- Can crawl on host to find an appropriate location to feed
- Blacklegged ticks carry Lyme disease, which can be contracted by humans

Management:

- Bring possible Blacklegged Ticks to the Nova Scotia Museum in Halifax to help track the spread of the tick within the province



Credit: US Federal Government Center for Disease Control

Credit: Scot Bauer

Source: HRM, 2015

Brown Spruce Longhorn Beetle (*Tetropium fuscum*)

HOME

- Blacklegged Tick
- Brown Spruce Longhorn Beetle
- European Fire Ant
- Earthworm
- Coyote

How to identify:

- Adult beetles have flat bodies 8-18 mm in length
- Heads and necks ranging from dark brown to black, and red-brown antennae half the length of their bodies. Wing casings are brown
- Larvae are cream-coloured with segmented, semi-translucent tube-like bodies

Native alternative:

- Bark Beetle (*Tetropium cinnamopterum*)

Pathway:

- Native to northern and central Europe and to western Siberia
- Likely introduced to Nova Scotia on wooden packing material imported to Halifax
- First infestation was discovered in Point Pleasant Park in 1998

Habitat and impact:

- Larvae burrow into living spruce trees, forming extensive, irregular networks, which disrupts the tree's nutrient transport systems. This activity usually kills the host tree within 1-5 years
- Spruce trees are abundant across Canada, meaning the Brown Spruce Longhorn Beetle has significant potential to spread across the country

Management:

- Canadian Food Inspection Agency is responsible for monitoring and controlling Brown Spruce Longhorn Beetles
- Notify the Agency if you sight any occurrences
- Agency staff members will conduct targeted harvesting, removing host trees to grind or burn them

Credit: Natural Resources Canada

Credit: Kulac

Source: HRM, 2015

European Fire Ant (*Myrmica rubra*)

HOME

- Blacklegged Tick
- Brown Spruce Longhorn Beetle
- European Fire Ant
- Earthworm
- Coyote

How to identify:

- Reddish-brown colouration
- Working ants about 4 to 5 mm in length, and the queen is slightly larger
- Waist has 2 segments, including 2 backward pointing spines on the middle body section

Pathway:

- Likely brought over from Europe and Asia in potted plants, mulch or fill.

Habitat and impact:

- Found in moist environments, including decaying logs, soil, potted plants, under rocks and debris
- Nests can spread through colony budding, where a group including the queen move to a new nest nearby, or through human transport
- The ants defend their territory and will sting humans and pests within their foraging area

Management:

- Currently no known methods to eradicate ant colonies
- Populations can be controlled through removal of nests, reducing habitat, and killing queens when they are identified

Credit: Thompson Rivers University

Credit: HRM

Source: HRM, 2015; MTRI, 2012

Earthworm (*Lumbricus terrestris*)

HOME

- Blacklegged Tick
- Brown Spruce Longhorn Beetle
- European Fire Ant
- Earthworm
- Coyote

How to identify:

- Fleshy, pink, or red, with tube-like, segmented bodies
- Range in size from several millimeters to many centimeters

Pathway:

- As earthworms are so ubiquitous, their pathway is not definitively known
- May have been transported in soil or other organic matter, for example, in ornamental plants

Habitat and impact:

- Found throughout Canada, extending as far as the North's territories
- Inhabits soils, ingesting and mixing organic matter
- Native forest soils dramatically change with the removal of leaf litter, resulting in newly exposed mineral soil
- May be detrimental to tree seedlings, ferns and other ground fauna, and perhaps water quality

Management:

- There are currently no methods to control earthworm populations where they are already present
- In order to prevent accidental transmissions and new infestations, take care when transporting soil or organic material

Credit: S Shepherd

Credit: Luis Daniel and Carbia Cabeza

Source: Ontario's Invading Species Awareness Program, n.d.

Coyote
(*Canis latrans*)

HOME

- Blacklegged Tick
- Brown Spruce Longhorn Beetle
- European Fire Ant
- Earthworm
- Coyote

How to identify:

- Closely resemble their relatives: wolves and foxes
- Bushy tails, flat foreheads with forward-facing eyes, large pointed ears, and a long, slender muzzle
- Thick fur, generally a mixed tawny and grey
- Similar in size to a medium-sized dog

Pathway:

- Native to North America, though not to Nova Scotia
- Replaced grey wolves gradually, increasing their range across the continent and into Nova Scotia

Habitat and impact:

- Various habitats throughout the province
- Prey on smaller animals, and present a non-native threat to biodiversity, as well as some nuisance to farmers
- However, their impact does not appear to be catastrophic, and they have been deemed an invasive species of “least concern” on the International Union for Conservation of Nature’s list of invasive species

Management:

- As with all wild animals, it is important to limit their reliance on humans
- Farmers and other Nova Scotians with small, domesticated animals such as rabbits and chickens should take care to use appropriate safeguards, such as fences and dogs

Credit: Mario Massone

Credit: Rebecca Richardson

Source: Canadian Geographic, n.d.; Newfoundland and Labrador; 2015

Beech Scale Insect
(*Cryptococcus fagisuga)*

HOME

- Beech Scale Insect
- White Nose Fungus
- Elm Fungus

Malady: Insect and ascomycete fungi causing Beech Bark Disease

How to identify:
- Disfigured beech trees with severe crater- or target-shaped scars in bark
- Spots of white, cottony secretion on bark
- Beech Scale insect is very small (1 mm)
- Usually covered in a waxy secretion resembling cotton
- Fungi cannot be seen by the naked eye

Pathway:
- Insect and fungi are believed to have arrived in North America on a European Beech that planted in the Halifax Public Gardens in 1890

Habitat and impact:
- Insects burrow into the trees' bark, fungi then infect the damaged trees
- Impacts vast majority of American Beech trees in the Acadian forest
- Infected trees weaken and often die, or if they persist it is often by root suckering, which can result in very shrubby forest stands, which are both economically and ecologically unproductive
- Estimated that only 1% of American Beech in Nova Scotia are healthy - this small group is believed to have developed genetic resistance

Management:
- Allow healthy American Beech trees on your property to disperse their seeds and root suckers
- Use local wood products to avoid potential transmission of timber-born insects and pests
- Encourage industry and government to choose local wood products

Credit: US Department of Agriculture Forest Service

Source: MTRI, 2012

White Nose Fungus (*Geomyces destructans*)

HOME

Beech Scale Insect

White Nose Fungus

Elm Fungus

Malady: Fungus causing White Nose Syndrome in bats

How to identify:
- White fungus growing on bat's snout, ears, and wings
- From afar, infected bats can be identified if they are flying in the winter or during the day
- Aside from the visible fungus, symptoms include extreme loss of body fat, wing damage, and scarring

Pathway:
- Fungus may have originated in Europe First found in North America in New York state in 2006
- Since then it rapidly spread from colony to colony

Habitat and impact:
- Native bat species are the Little Brown (*Myotis lucifugus*), the Northern Long-eared (*Myotis septentrionalis*) and the Tricolored (*Perimyotis subflavus*)
- Fungus grows best in cold temperatures, especially targeting overwintering bats in caves and other hibernacula
- Bats are woken up mid-winter by the fungal attack, and starve to death due to excessive activity
- Over 5.5 million bats have been affected in North America, with mortality rates up to 90%

Management:
- When travelling, keep your belongings free of spores and seeds by cleaning thoroughly
- Avoid entering bat hibernacula (e.g., caves) or handling bats
- Immediately report odd bat behaviour such as day- or winter-flying, or dead or dying bats to Nova Scotia Department of Natural Resources

Credit: Marvin Moriarty

Source: MTRI, 2012

Hylurgopinus, Scotylus, and *Ophiostoma* spp.

HOME

Beech Scale Insect

White Nose Fungus

Elm Fungus

Malady: Insect and fungus responsible for Dutch Elm Disease

How to identify:

- Dead or dying White Elm trees
- Early signs of infestation include:
  - Significant leaf wilting in early summer
  - Brown leaves attached to the tree for some time
  - The tree dying from the fungal infection within one to two years
- Very small boring holes
- Reddish-brown or black beetles about 2 to 3 mm long
- Networks of beetle feeding galleries, and brown staining under the bark

Pathway:

- Likely brought to North America from in wooden crates made of elm wood
- First found in Liverpool in 1969

Habitat and impact:

- Most common in floodplains and along cultivated fields
- Most White Elm in Nova Scotia have been wiped out from the beetle/fungus combination
- Elm bark beetles feed on the bark, allowing ascomycote (sac) microfungi to infest
- Beetles reproduce and spread the fungi to other elm trees

Interesting fact:

- Fungi was not actually brought over from the Netherlands
- Named after a Dutch phytopathologist that first identified it in 1921

Management:

- Use local wood products to limit the potential introduction of other species

Source: MTRI, 2012

More Resources

- Mersey Tobeatic Research Institute – Invasive Alien Species in Nova Scotia: Identification and Information Guide

http://www.merseytobeatic.ca/userfiles/file/projects/Human%20Dimension/Invasive%20Alien%20Species/Invasive%20Alien%20Species%20Guide%20(web).pdf

- Halifax Regional Municipality – Invasive Species: Invasive Species on Municipal Radar

https://www.halifax.ca/energy-environment/environment/InvasiveSpecies.php

- Clean Annapolis River Project – Invasive Alien Plants in the Annapolis Valley

http://www.annapolisriver.ca/alienplants.php

- Invasive Species Alliance of Nova Scotia

http://www.invasivespeciesns.ca/

- Environment Canada – Where Are Invasive Species Found in Canada

https://www.ec.gc.ca/eee-ias/default.asp?lang=En&n=805A5D5C-1

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