Manitoba Maple

(*Acer negundo*)

Best Management Practices in Ontario

TORONTO

ONTARIO INVASIVE PLANT COUNCIL

Foreword

This Best Management Practices (BMPs) document provides guidance for managing Manitoba maple or Érable à Giguère (*Acer negundo*) when it is regarded as invasive in Ontario. Funding and leadership to produce this document was provided by the City of Toronto.

This BMP was developed by the Ontario Invasive Plant Council (OIPC) and its partners to facilitate invasive plant control initiatives by individuals and organizations concerned with the protection of biodiversity, agricultural lands, infrastructure, crops and species at risk in Ontario. This document also supports and advances the management of invasive species identified as a priority by the City of Toronto's Ravine Strategy and Biodiversity Strategy.

The intent of this document is to relay specific information relating to invasive plant control practices that leading professionals across Ontario have recommended. This document contains the most up-to-date, effective, and environmentally safe control practices known from research, experience, and literature available at this time. It complies with current provincial and federal legislation regarding pesticide usage, habitat disturbance, and species at risk protection. It is subject to change as legislation is updated or new research findings emerge. The information provided in this BMP is not to be considered legal advice. Interested parties are advised to refer to the applicable legislation to address specific circumstances.

Check the website of the OIPC (www.ontarioinvasiveplants.ca) for updates.

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For more information on invasive plants in Ontario, please visit the following websites:
www.ontarioinvasiveplants.ca, www.ontario.ca/page/invasive-species-ontario, www.invadingspecies.com, or www.invasivespeciescentre.ca

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Manitoba Maple.

Kemptville barn ruins with a sprawled-out Manitoba maple stand in Grenville County, Ontario.
Photo courtesy of: Frederick W Schueler, Fragile Inheritance Natural History.

Introduction

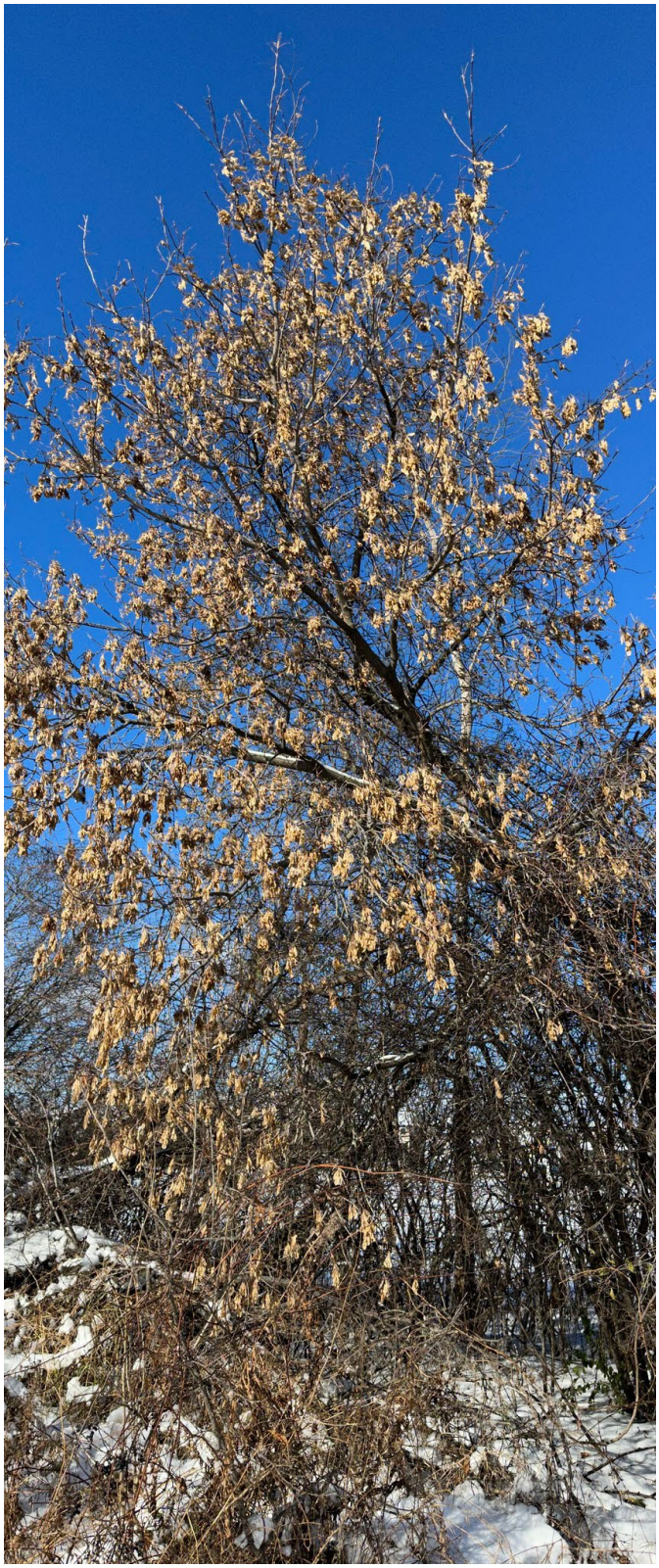
Manitoba maple is a fast-growing, short-lived dioecious, deciduous tree in the soapberry family (*Sapindaceae*). It has many common names that vary regionally, including box-elder, box-elder maple, ash-leaved maple, three-leaved maple, and western box-elder. Many of these names refer to its compound leaves, which resemble an elder or ash tree. Its scientific name "*negundo*" is in reference to the similarity of its leaves to the chaste tree of India, called "Negundi" in Sanskrit (Farrar 1995). The most accepted French name is Érable à Giguère, but there are others in use (Brouillet *et al.* 2022). The Ojibwe name is Adjagobi'muk. It is the only maple native to North America with compound (divided) leaves.

Manitoba Maple is native to parts of North America, including US states surrounding Ontario and the Canadian Prairies. Within Ontario however, its status as native or non-native is uncertain and a subject of controversy, due to the lack of certainty over its historical range prior to settlement. It may have been native to small parts of Ontario and naturalized beyond its range due to site alterations associated with human settlement (Lewis 2019). Regardless of its status, its many invasive characteristics have allowed it to thrive in Ontario's riparian and urban landscapes. It has been planted in many parts of North America outside of its native range as a shade and shelterbelt tree, due to its hardiness and fast-growing nature. It has adapted to the nutrient-rich and constantly changing conditions at the margins of streams (Schueler 1999). It grows rapidly in ravines and flood basins, tolerates periods of flooding or drought, as well as the often poor soil conditions in urban environments (Gomez *et al.*, 2008).

The female trees produce large annual seed crops. The winged seeds (called samaras) ripen and fall continuously over multiple seasons, promoting seed viability and long-distance spread by wildlife, wind, and water (Rosario 1988). Manitoba maple can establish in and dominate riparian areas, forest edges, as well as shade meadows and prairies, particularly in areas with poor soil or high disturbance. As urban trees, they present risks due to their rather weak branches that break easily during wind and ice storms. The tree usually develops a strong lean by mid-life or uproots completely and then resprouts, potentially damaging infrastructure or posing a health and safety risk. They can also host box-elder bugs (*Boisea trivittata*), a species regarded as a nuisance when abundant because it hibernates in buildings.

Despite its disadvantages as an urban landscape tree, it was planted by European horticulturalists as an ornamental throughout central and southern Europe beginning in the 17th century. Since then, it has colonized riparian, wetland, and disturbed habitats, where it dominates and displaces native vegetation, and has become a significant invader throughout southern and eastern Europe (Merceron *et al.*, 2016; *Nikoleava et al.*, 2020). While Manitoba maple has invasive characteristics, within its native range of North America it has a variety of important ecological relationships with native flora and fauna, and has a significant role in early successional reforesting communities. Many species of fungi rot its wood, providing shelter hollows for a variety of wildlife species. Although tolerant to changing conditions, it does require medium-high light exposure to establish, and as a result, tends to be more of a pioneer species in open landscapes and is not abundant in medium to late successional environments.

This document was developed to help guide the effective and consistent management of Manitoba maple populations across Ontario, in areas where it has become invasive or undesirable for other reasons.



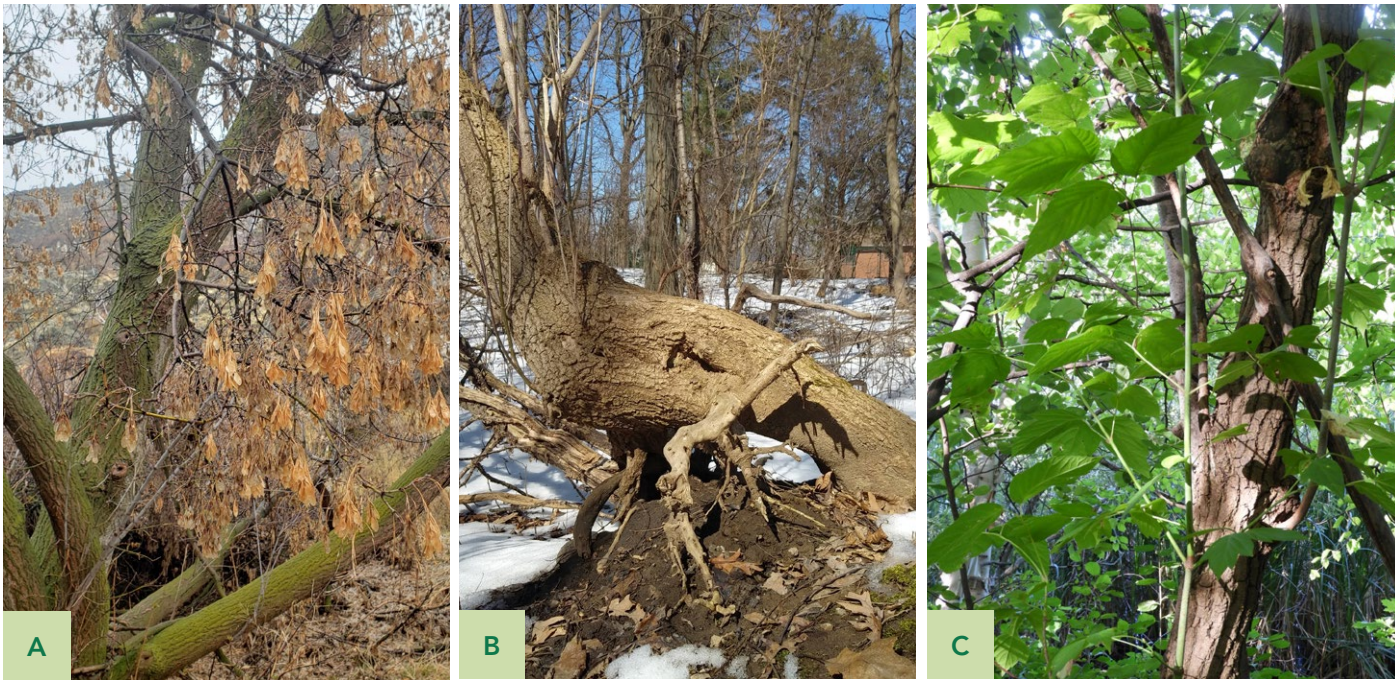
Manitoba maples retain their samaras in winter.

Photo courtesy of: Ray Snook, iNaturalist, Available: https://www.inaturalist.org/observations/142463122. Licensed under CC-BY-NC

Description

Shape and Size:

Manitoba maple is a small to medium-sized deciduous tree with an irregular appearance. In open habitats branches begin dividing at the base into a few long, spreading, crooked, irregularly branched limbs which support an uneven crown. In forest habitats the trunk is usually straighter, and branches divide higher up on the trunk, and are more frequently divided than in open areas. When it grows in an edge or shade habitat, it will often lean on one side to reach sunlight, sometimes uproot but continue to grow horizontally across the ground. This horizontal growth and weak branches predispose them to break, particularly during severe wind and ice storms. Mature height varies from 10-25 m, with a diameter at breast height (DBH) ranging from 60-120 cm. The trunk of mature trees is often hollowed out by rot. The main trunk tends to develop basal and branch sprouts.



A) Manitoba maple has an uneven crown, with irregularly branched limbs that can grow more horizontally, giving it a sprawled-out appearance. B) Tree demonstrating horizontal growth as a result of being uprooted. C) The main trunk often develops basal and branch sprouts.

Photos courtesy of: a) iNaturalist, Available: https://www.inaturalist.org/observations/152896350. Licensed under CC-BY-NC. b) Iola Price. c) Paul Abell, iNaturalist. Available: https://www.inaturalist.org/observations/21216434. Licensed under CC-BY-NC.

Stem, Buds and Bark:

Twigs are stout, smooth, and hairless. Young twigs are green-purple and shiny with a white waxy coating that can be rubbed off. The terminal bud is egg-shaped, blunt, 3-8 mm long, with 2-3 pairs of brownish-green or purple scales, coated with fine white hairs. The lateral leaf buds are pressed against the twig, and located within the base of the leaf stalk, which is often not visible until the leaf falls off. The leaf scars are V-shaped, meeting each other around the twig. Young bark is smooth, light grayish-brown, mature bark darkens and becomes furrowed into narrow firm ridges.

Winter ID tip: Manitoba maple differs from other maples in retaining most of its keys throughout the winter. The buds aid in winter identification: terminal bud is egg-shaped and blunt, coated with fine hairs, and lateral leaf bud are pressed against the twig.

The twigs are coated with a white waxy coating that can be rubbed off, and the terminal bud is blunt and egg-shaped, coated with fine white hairs, and lateral leaf buds are pressed against the twig. These features can aid in winter identification.

Photo Courtesy of: iNaturalist, Available: https://www.inaturalist.org/observations/70610172. Licensed under CC-BY-NC

Mature bark darkens and becomes furrowed into narrow firm ridges.

Photo Courtesy of: iNaturalist, Available: https://www.inaturalist.org/observations/80972218. Licensed under CC-BY-NC

Leaves:

Manitoba maple is the only maple native to North America with compound leaves. Leaves are pinnately compound, with 3-9 toothed leaflets that are shallowly and irregularly lobed or coarsely toothed. Seedlings have only 3 leaflets, mature trees have more leaflets and more irregular margins. Leaflets are lanceolate to ovate or oblong, and 5-12 cm long. The upper surface of the leaf is light green, and the undersurface is grayish-green, and usually hairless. Leaves turn yellow or yellowish-green in the fall.

Leaves are pinnately compound, with 3-9 leaflets.

Photo Courtesy of: Robert Levy, iNaturalist, Available: https://www.inaturalist.org/observations/161130509. Licensed under CC-BY-NC

Flowers:

The tree is dioecious (each tree bears either male or female flowers). Flowers are small, yellow-green or green with five sepals and no petals. Both sexes begin to bloom in early spring at the same time, either before or with the leaves. Male flowers droop downward, somewhat resembling greenish tassels. There are 3-5 stamens at the tip of a slender, hairy stalk. Immature anthers (stamen tips) are often maroon-colored. Female flowers hang in drooping clusters of 6-12 at the tips of branches. The lime-green pistils are the most prominent part of the flower and most likely the best identification characteristic. Each has a long, two-parted style, and 3-5 sepals on a hairy stalk. Pollination occurs by wind.

Flowers are the main distinguishing feature between sexes. A) Male flowers on slender single stalks in loose clusters, B) female flowers are short stalked along a central axis in drooping clusters.

Photos Courtesy of: a) Andrew Hipp, iNaturalist, Available: https://www.inaturalist.org/observations/42041850. Licensed under CC-BY-NC
b) Sandy Woldenberg, iNaturalist, Available: https://www.inaturalist.org/observations/111992967. Licensed under CC-BY-NC

Fruits and Seeds:

The fruit on female trees is a green to pale brown pair of winged keys or samaras that are spread at an angle less than 45°, each key is 3-5 cm long. The seedcase is elongated, 2-3 times as long as it is broad, and wrinkled. Samaras grow in drooping clusters, ripen in the fall and are dispersed by wind, animals, and water. The seeds are prolific and fertile.

Fruits are winged samaras at a < 45°. Samaras hang in drooping clusters, starting as green and browning as they mature.

Photo Courtesy of: iNaturalist, Available: https://www.inaturalist.org/observations/15297892. Licensed under CC-BY-NC

Roots:

The root system is fibrous, shallow, and spreading. It can have a short taproot with stronger laterals in deeper soil. It sprouts readily from stumps and roots. Uprooted trees frequently resprout from the base and branches. This species tends to uproot more frequently than other maple species found in the same sites.

Manitoba maple tends to uproot more frequently than other maples. Here, a Manitoba maple has uprooted and fallen on a slope after a heavy winter storm. It has damaged trees around it but also created a canopy gap where other species can have a chance to grow into a canopy position. For this reason it is not a suitable species to grow where there is a chance of uprooting and creating slope or riverbank erosion.

Photo Courtesy of: Stephen Smith, Urban Forest Associates

Manitoba Maple Cultivars

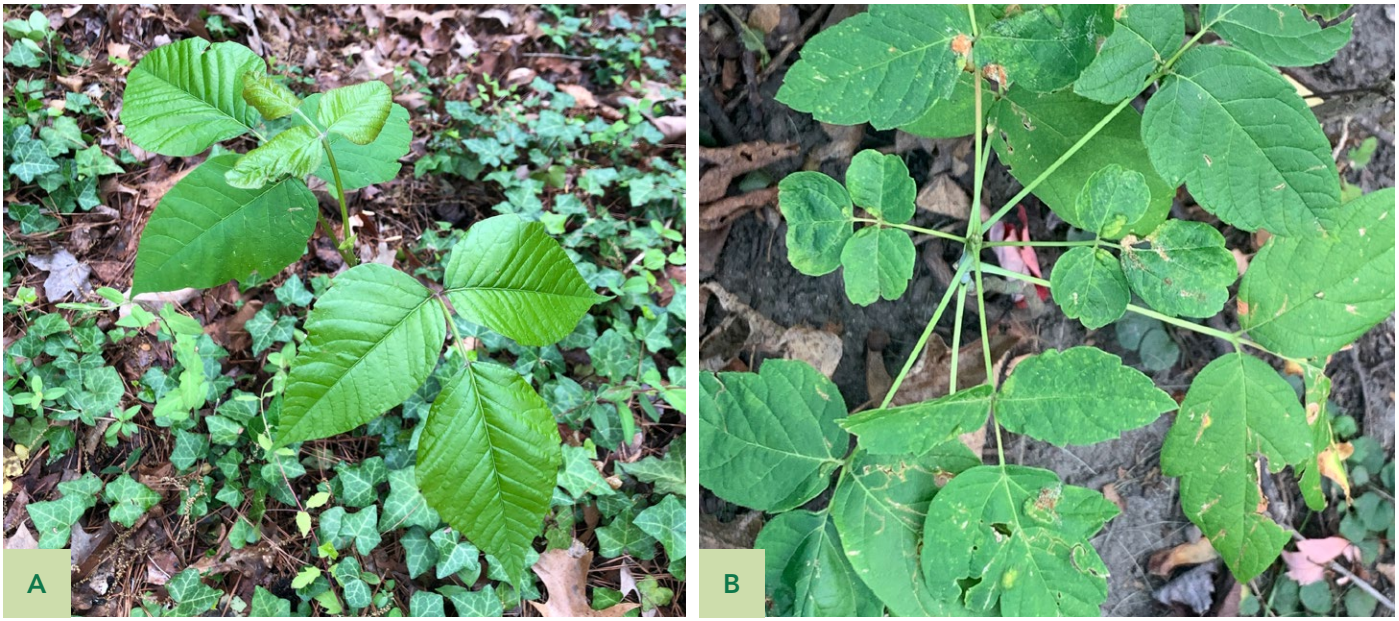
Despite its disadvantages as a landscape tree due to its brittle branches, it is a popular landscape tree in Europe, where ornamental cultivars are propagated by side grafts, whip and tongue grafts, or chip budding. Many varieties exist, with different leaf colors and variegated patterns or weeping branches. In Ontario, it is rarely planted, although the cultivar 'Sensation Box Elder' is sold in at least one Ontario nursery and the variety can be purchased online from Canadian websites.

Lookalikes

Manitoba maple is unique as the only maple native to North America with compound leaves. As a result, this species is more likely to be confused with a non-maple species, such as an ash or elderberry. Its resemblance to these species is why it is sometimes called box elder or ash-leaved maple. As young seedlings, the compound leaves are divided in three and it can be misidentified as the leaves of poison ivy. The bark may also resemble the bark of white mulberry (*Morus alba*).

Poison ivy (*Toxicodendron radicans*)

Manitoba maple seedlings and poison ivy both have compound leaves with three leaflets that are irregularly, coarsely toothed. However, poison ivy is a low spreading groundcover or colonial shrub up to 1 m tall with greenish white berries, and in the south a vine with hairy stems that can grow up trees. As Manitoba maple trees mature, they have more leaflets (5-9). In addition, Manitoba maple has an opposite branching pattern, while poison ivy has alternate branching or leaves that are borne in whorls of 3. Poison ivy leaves can have a shiny or waxy sheen, unlike Manitoba maple.



Comparison of poison ivy A) and Manitoba maple B) Manitoba maple has opposite branching pattern, poison ivy alternate branching. Poison ivy is usually a trailing vine with pale green leaves.

Photos courtesy of: a) Julie Pearce, iNaturalist, Available: https://www.inaturalist.org/observations/205275964. Licensed under CC-BY-NC

b) Vivien Ratcliffe, iNaturalist, Available: https://www.inaturalist.org/observations/182220585. Licensed under CC-BY-NC

Trees and Shrubs with Compound Leaves:

Ashes (*Fraxinus* spp.)

There are 4 native ash species in Canada, and they are distinguished from Manitoba maple by having regularly toothed, pinnately compound leaves with more numerous leaflets (5-11). Ash keys are single, 1-seeded, with a long terminal wing. Ashes don't have furry buds or white dust on the new growth.

Elderberries (*Sambucus* spp.)

There are 3 native tree-size elderberry species in Canada. They are mainly shrubs or small trees up to 10 m high. Like ash, they have more regularly toothed, pinnately compound leaves with more numerous leaflets (5-11). Flowers are in many-branched terminal clusters, and fruits are small and berry-like.

Maples (*Acer* spp.)

There are 10 native maple species in Canada and several non-native ornamental species. All except Manitoba maple have simple, palmately lobed leaves, and grow in opposite pairs along the stem. The fruit, called a winged samara or maple key, are borne in pairs, which only in Manitoba maple come together at an acute angle. Flowers are small with five petals and five sepals (except for Manitoba maple which lacks petals) and are arranged in clusters.

There are several non-native ornamental maple species that also have invasive tendencies:

- Sycamore maple (*A. pseudoplatanus*)
- Amur maple (*A. ginnala*)
- Hedge or Field maple (*A.campestre*)
- Norway maple (*A. platanoides*)

For more information on identifying native and non-native maple species, see Norway Maple (*Acer platanoides*): Best Management Practices in Ontario (OIPC)

Non-native ornamental maple species: A) Sycamore maple, B) Amur maple, C) Hedge or field maple, d) Norway maple

Photos courtesy of: a) John F Foster b) Ken Potter, iNaturalist, Available: https://www.inaturalist.org/observations/59309260. Licensed under CC-BY-NC c) Martin A. Prinz, iNaturalist, Available: https://www.inaturalist.org/observations/115864462. Licensed under CC-BY-NC d) Michael Pirrello, iNaturalist, Available: https://www.inaturalist.org/observations/174175954. Licensed under CC-BY-NC

Table 1: The main identification features of Manitoba Maple in comparison to three species that may appear similar (lookalikes). Key I.D. features that separate the lookalikes from Manitoba Maple are in **bold**.

	Manitoba Maple (*Acer negundo*)	**Maples** (*Acer* spp.)	**Ashes** (*Fraxinus* spp.)	**Elderberries** (*Sambucus* spp.)
	 Photo courtesy of: iNaturalist, Available: https://www.inaturalist.org/observations/161031259. Licensed under CC-BY-NC	 Photo courtesy of: Joe Walewski, iNaturalist, Available: https://www.inaturalist.org/observations/3390894. Licensed under CC-BY-NC	 Photo courtesy of: Zack Harris, iNaturalist, Available: https://www.inaturalist.org/observations/31448008. Licensed under CC-BY-NC	 Photo courtesy of: Mathias Meurier, iNaturalist, Available: https://www.inaturalist.org/observations/90131759. Licensed under CC-BY-NC
Alternative Common Names	Box-elder, box-elder maple, ash-leaved maple, three-leaved maple, western box-elder	n/a	n/a	n/a
Accepted French Name	Érable à Giguère	Érables	Cendres	Sureau
Ojibwe Name	Adjagobi'muk	Ziinzibaakwadwaatig		
Habitat	Grows along lakeshores and stream banks and on sites that are seasonally flooded; disturbed sites, urban areas; thrives in open areas.	Variety of sites, some prefer wet sites, others grow mainly on uplands. Major component of many north temperate forests.	Variety of sites, best in moist rich soils. Some species occur in swamps or riparian habitats, others on poor, dry upland soils.	Moist, edge habitat, in full or light shade; Shrubs or small trees.
Bark	• Young bark is smooth and light grayish brown. • Older bark darkens and becomes furrowed into narrow firm ridges.	• Varies. Generally young bark is smooth. • Older bark becomes rougher textured and furrowed with age.	• Varies. Finely furrowed with firm ridges to scaly, scales can be rubbed off	• Rough, brownish

	Manitoba Maple (*Acer negundo*)	Maples (*Acer* spp.)	Ashes (*Fraxinus* spp.)	Elderberries (*Sambucus* spp.)
	 Photo courtesy of: iNaturalist, Available: https://www.inaturalist.org/observations/161031259. Licensed under CC-BY-NC	 Photo courtesy of: Joe Walewski, iNaturalist, Available: https://www.inaturalist.org/observations/3390894. Licensed under CC-BY-NC	 Photo courtesy of: Zack Harris, iNaturalist, Available: https://www.inaturalist.org/observations/31448008. Licensed under CC-BY-NC	 Photo courtesy of: Mathias Meurier, iNaturalist, Available: https://www.inaturalist.org/observations/90131759. Licensed under CC-BY-NC
Leaves	• Opposite pairs of **pinnately compound** leaves • **3-9 leaflets** • Leaflets shallowly and irregularly lobed or coarsely toothed. • Leaflets are lanceolate to ovate or oblong. • The upper surface of the leaf is light green, and the undersurface is grayish-green, and usually hairless.	• Opposite pairs of **simple leaves** • Palmately lobed with the number of lobes corresponding to the number of prominent veins. Lobes are toothed.	• Opposite pairs of **pinnately compound** leaves • **5-11 leaflets** • **Regularly toothed**	• Opposite pairs of **pinnately compound** leaves • **5-11 leaflets** • **Toothed,** base often uneven
Flowers	• Small, yellow-green or green. • 5 sepals, **no petals.** • Appear in early spring either before or with the leaves. • Male and female flowers on separate trees. Male flowers droop downwards resembling green tassels, with **3-5 stamens at the tip of a slender, hairy stalk.** Female flowers are in **drooping clusters of 6-12 at the tips of branches. The pistils are lime-green.**	• Small, green, yellow, orange, or red. • 5 sepals and 5 petals (no petals in some species). • Appear in early spring before or with the leaves. • Male and female flowers may be in the same cluster, in separate clusters, or on separate trees.	• Small • Flowers of native species lack petals; sepals are minute or missing. • **Borne in compact, many-flowered clusters, arranged laterally on twig, rarely at tip.** • Appear in early spring before the leaves. • Male and female flowers on the same or separate trees.	• Small, white • 5-lobed corolla, borne in **many-branched terminal clusters.** • Appear in summer. • Male and female flowers on the same tree.
Fruits	• Winged, green to pale brown **pair of samaras with angle between wings less than 45°**, each samara is 3-5 cm long. • Seedcase is wrinkled and 2-3 times as long as it is broad. • Samaras grow in drooping clusters • Remain on tree through fall and winter.	• Winged, in joined pairs on a **single stalk. Each fruit consists of a 1-seeded case and a long 1-sided wing.**	• Long terminal wing, single, 1-seeded. • Seeds borne in **large drooping lateral clusters.** • Remain on the tree through fall and winter.	• **Berry-like, round, with 3-5 hard seeds.**

Biology and Life Cycle

Female Manitoba maple trees can have high annual seed production.

Photo courtesy of: Kent Trulsson, iNaturalist, Available: https://www.inaturalist.org/observations/134817313. Licensed under CC-BY-NC

Manitoba maple is a small to medium-sized deciduous tree that is fast growing and short-lived. The typical lifespan is 60-75 years, rarely living to 100 years except under ideal growing conditions. Growth during the first 15-20 years is very rapid and can be as much as 1 meter or more in height and 2.5 cm DBH per year; resprouts from cut branches or stumps can grow 2-3 meters in 1 year under the right conditions, growing slower in poorer quality sites (Overton 1990). The tree can grow to diameters of 30 cm at breast height in 20 years under good growing conditions. At maturity, growth slows, and branches become weak and susceptible to breakage. Older trees greater than 60 cm DBH usually have extensive rot inside and visible fungal fruiting bodies.

Male and female flowers bloom at the same time, either with or just after the new leaves begin to emerge in mid-April and last until leaves are fully expanded in mid-May. The flowers are wind-pollinated but are also supplementally pollinated by bees (Medrzycki 2011). Male flowers release copious amounts of pollen into the wind from their drooping stamens to reach nearby female trees, after which the male flowers dry out and fall from the three. Wind-borne pollen adheres to the sticky surfaces of the female's lime-green pistils, and if fertilized, will produce winged samaras.

While Manitoba maple is almost strictly dioecious with rare observations of perfect flowers (CABI Invasive Species Compendium 2019), male and female trees vary in several traits. For example, female trees show higher water use than males, which may explain why females are more sensitive to drought and tend to be found in greater numbers on wetter sites, while males are concentrated on drier sites away from stream banks (Dawson *et al.* 2004). Females also have tougher leaves and are better defended against herbivory than males (Jing and Coley 1990).

Reproductive maturity varies depending on site conditions. It may be as short as five years in open areas with moderate soil conditions or more than 15 years in closed canopy forests (Medrzycki 2011). Seed production can be prolific, with female trees producing large annual seed crops beginning at 8-11 years (Overton 1990). Depending on light availability, females in more shaded environments produce five times fewer seeds than those in open areas (Medrzycki 2011). The paired, winged samaras are green, hanging from drooping racemes as they first emerge in June, and turn brown as the seeds begin to ripen in August. The seeds ripen over a long period and fall continuously (August – winter), providing an extended period with varying moisture and temperature conditions that likely promotes seed viability (Overton 1990). Seed germination in experimental conditions varies widely from 0-96% (Williams and Winstead 1972;

CABI Invasive Species Compendium 2019). Seeds overwinter and a period of cold stratification under snow facilitates germination in the spring (Kiseleva *et al.* 2020). Seed germination is best in disturbed and moist soils, in open or medium shade, and lowest in closed canopy forests (Sachse 1992). In cottonwood-willow stands in southern Illinois, it was found that seedlings will die after 1-2 years unless canopy gaps occur (Overton 1990). Therefore, Manitoba maple is usually found where it thrives in open, moist habitats.

Similar to other maple species, the seeds are double-winged samaras, which rotate like helicopter blades as they fall to the ground. They are mainly wind-dispersed, usually falling within 50 m of the tree, but may be carried longer distances if they fall into moving water bodies (e.g., nearby river or stream), or if lodged on transport vehicles (Medrzycki 2011). The samaras remain on the tree throughout winter, providing a winter food source for wildlife such as birds and squirrels, who also contribute to its spread.

Young and old. A) A young sapling growing in a residential backyard and B) A mature tree in an open field near Woodbine Park, Toronto. This tree demonstrates the product of rapid growth: crooked, irregularly branched limbs supporting an uneven crown.

Photos courtesy of: a) iNaturalist, Available: https://www.inaturalist.org/observations/117147224. Licensed under CC-BY-NC. b) Paul Abell, iNaturalist. Available: https://www.inaturalist.org/observations/35665139. Licensed under CC-BY-NC.

Vegetative reproduction can occur on trees that have been damaged. Exposed or damaged roots will produce new shoots, this can result from human cutting or natural disturbance (CABI Invasive Species Compendium 2019).

In the fall, leaves begin to change to yellow or yellow-green beginning in October, and all are lost by early November.

Seasonality for southern Ontario (based on iNaturalist sightings in Ontario):

Flowers: Mid April – mid May
Leaves: Mid April - October
Fruit/Seeds (samaras): June (immature), ripen from August - October (mature), and often persist on the tree through winter.

Diseases and Natural Enemies of Manitoba Maple

There are several insect pests and fungal diseases associated with Manitoba maple that contribute to defoliation, leaf wilting, root rotting, or seed loss, but do not impact the survival of a healthy individual tree.

Several leaf-feeding insects and insect borer pests contribute to defoliation, such as the pale-winged gray moth (*Iridopsis ephyraria*), rosy maple moth (*Anisota rubicunda*), fall cankerworm moth (*Alsophila pometaria*), white-triangle leafroller (*Clepsis persicana*), boxelder leafroller moth (*Caloptilia negundella*), and larger boxelder leafroller moth (*Archips negundana*). Insect borers include the boxelder twig borer moth (*Proteoteras willingana*), flat-headed apple tree borer (*Chrysobothris femorata*), and the Asian longhorned beetle (*Anophlopora glabripennis*). Boxelder bugs (*Boisea trivittata*) feed on female trees, including the leaves, fruits, and soft seeds (Overton 1990; Natural Resources Canada 2015; inaturalist). Several years of insect defoliation can kill mature or stressed trees, but this is not common.

Manitoba maple can become infected by root rot that affects the vascular system, most commonly caused by the *Phytophthora* fungus. The tree is also susceptible to verticillium wilt (*Verticillium albo-atrum*), as well as a stem canker caused by *Eutypella parasitica*, although these are not common. The fungus *Fusarium reticulatum* var. *negundinis* produces a red stain in the wood of living trees that is specific to Manitoba maple. This stain is associated with Cerambycid beetles and the galleries of other insects but does not damage the wood (Overton 1990). Common wood rotting fungi include Dryad's saddle (*Polyporus squamosus*) and *Hypsizygus tessulatus* (Stephen Smith, personal communication).

A stand of Manitoba maple in June defoliated by fall cankerworms. The understory is responding with abundant growth.

Photo courtesy of: Stephen Smith, Urban Forest Associates.

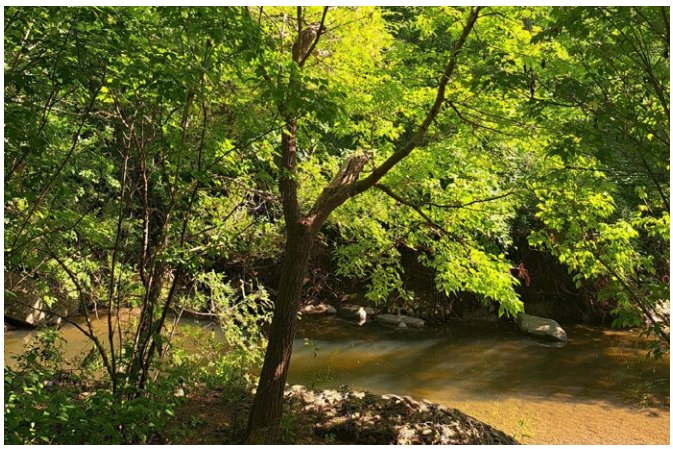
Habitat

A typical forest dominated by Manitoba maples. Trees are growing sideways with a lot of storm damage on them.

Photo courtesy of: Stephen Smith, Urban Forest Associates.

Manitoba maple's wide geographic range indicates that it can grow under a variety of climatic conditions and habitat types, including swamps, flood-plain forests, fresh mesic deciduous forests, mesic to dry conifer forests, oak savannas, prairies, and grasslands (Rosario 1988). It is generally considered a pioneer species, establishing itself in early successional environments alongside other pioneering species such as cottonwood and willow (Maeglin and Ohman 1973; Overton 1990). It prefers full sun and moist, alluvial soils and is commonly found along the shores of lakes, rivers, streams, and low-lying flood plains, where its shallow root system can find abundant moisture. Manitoba maple is well adapted to the dynamic nature of these environments and can tolerate periods of drought as well as prolonged flooding (Hosner 1960). It is less tolerant to flooding than poplars and willows, but more tolerant than many other species from mesic forests (Medrzycki 2011). It can also tolerate poor soil conditions which allows it to establish in degraded urban environments, including along roadsides, pastures, and residential areas, where it is often called a 'weed tree'. Its ability to resprout vigorously and grow rapidly after being uprooted, pruned, cut, or topped contributes to its survival in close proximity to human disturbance. In eastern Ontario it grows in dense thickets around abandoned agricultural barns, which then seem to die back as the nutrients around the barns are exhausted (Scheuler, personal communication). In the Prairies, it has been planted for use as windbreaks and around homesteads (Medrzycki 2011). It is moderately shade-tolerant, although it usually fails to thrive in densely shaded, closed-canopy forests as seedlings need a canopy opening in the first few years of growth to ensure survival, and it often becomes replaced over the course of succession with more shade-tolerant species (Overton 1990; Saccone *et al.* 2010). There are also sex differences in habitat preference, with females growing better in wetter and more nutrient-rich conditions (Medrzycki 2011; Dawson and Ehleringer 1993; Ward *et al.* 2002).

This species will grow in a range of soil types from gravel to clay, but has a strong preference for well-drained soils, such as deep alluvial soils near streams, sandy loam, loam, or clay loam soils with a medium to rocky texture and a pH of 6.5 – 7.5. It can also appear in poor, dry sites and upland sites (Rosario 1988). It can grow quickly in very alkaline soils, cracks in pavement and building foundations where other species would not prosper.



Manitoba maple is well adapted to the dynamic nature of riparian habitats where it is often found.

Photo courtesy of: Paul Abell, iNaturalist.
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Pathways of Spread and Distribution in Ontario

Manitoba maple is the most widely distributed maple that is native to North America (Overton 1990; Rosario 1988). It ranges from northern Canada to Guatemala and is found in almost every state in the USA except for Alaska and Hawaii (Rosario 1988). Within Canada, its primary native range is considered the Prairie provinces, including the southern half of Manitoba, Saskatchewan, parts of eastern Alberta, and potentially small pockets of southwestern and northwestern Ontario (Farrar 1995; Lewis 2019). However, its natural range prior to human settlement is unclear, as it became more widespread due to land use changes and being planted as an ornamental species (Lewis 2019). It is considered naturalized in southern Quebec, New Brunswick, Nova Scotia, Prince Edward Island, Yukon, Northwest Territories, and British Columbia (Brouillet *et al.* 2010). The winged samaras are mainly wind-dispersed but can also be spread long distances by water, wildlife, and along transportation corridors.

It is now naturalized in many municipalities across Ontario, particularly urban areas in southern Ontario, and continues to spread throughout the province. Its populations extend from the eastern and western boundaries of the province, from Ottawa to Windsor. It may also be found in northern Ontario and northwestern Ontario including Kenora, Ontario (iNaturalist 2023). In the north, it is often closely associated with human habitation, not escaping far out into the wild from areas regularly occupied by humans. Although widespread in the province, its invasiveness is site specific, and appears at present to be most problematic in the Greater Toronto Area. In Europe, the species was imported as an ornamental tree, beginning in the seventeenth century, where earliest records indicate its presence in 1688 at the Fulham Garden in England (Medrzycki 2011). It became a popular tree due to its fast growth, and was planted as a road and park tree, for use as a windbreak and shelter-belt tree, and for nectar by beekeepers (Medrzycki 2011). It is now widespread in many urban centers and naturalized along riparian areas, where it can become invasive (Bottolier-Curtet 2012). It has also been introduced and become naturalized and/or invasive throughout much of the world, including South America, Australia, and New Zealand, most of Europe and parts of Asia (iNaturalist 2023).

For up-to-date distribution information, visit EDDMapS: www.eddmaps.org/ontario or http://inaturalist.ca.

Impacts

Example of Manitoba maple overtaking a spruce stand. Small spruce seedlings had been previously planted and will be outcompeted by incoming Manitoba maple seedlings.

Photo courtesy of: Stephen Smith, Urban Forest Associates.

Ecological:

Although Manitoba maple is native to parts of southwestern and northwestern Ontario, it is often considered to be weedy and shares many characteristics of an invasive species. Female trees produce large annual seed crops with high viability in ideal conditions. The seeds ripen and fall continuously over a long period (autumn to winter), promoting long-distance spread by wildlife who consume the seeds. It is fast-growing and adapted to the constantly changing conditions at the margins of streams. For this reason, it is very hardy and can tolerate prolonged periods of flooding or drought and poor soil conditions. Its range continues to expand in Ontario, following the path of degraded urbanized environments where it thrives.

Currently, it is a localized issue in Ontario, particularly throughout the Greater Toronto Area. Its fast growth and fast intake of water causes an angled growth habit and makes it prone to tip-ups and collapse. Trees will often lean to one side to reach sunlight, sometimes uproot, and keep growing horizontally at a 45˚ angle. This shades out more area of land where native species could grow, and contributes to erosion along riverbanks, due to its deep rooting system, which takes a lot of the riverbank with it when it uproots and falls into the river. Trees that fall into a river channel tend to impede water flow as they accumulate debris floating downstream, increasing water levels, and creating potential flooding hazards. Its angled growth habit creates issues along transportation corridors (i.e., trails, roadways), and requires continuous pruning. Due to its weak wood and irregular shape, it is also susceptible to wind and ice damage, which makes it a hazard tree around infrastructure such as residential buildings, water control structures (i.e., dams and dykes), and flight control structures. Seedlings are hardy and can be found growing through sidewalks cracks, along fence lines, and adjacent to people's houses. Dense sapling growth can also cause issues with sightlines, such as blocking road signs and trail edges, or create public safety concerns.

In natural areas, Manitoba maple can establish and dominate open habitats such as riparian areas, wetlands, meadows, and forest edges, especially after disturbance. Its weedy nature can displace early successional tree species, and it can form a dense canopy at maturity, accelerating succession of meadows and prairies into forest, and displacing understory species. It is mainly an edge threat from a forestry perspective, as it is particularly invasive along forest edges, fence lines, and hedgerows. Since the remaining forests of southern Ontario exist as forest fragments, these edge habitats provide opportunity for Manitoba maple to seed

into a neighboring forest or field, where seedlings grow quickly and outcompete many native early successional tree species, such as cottonwood. This impacts the success of forest restoration projects and threatens future forest succession in open habitats such as meadows and tallgrass prairies. In addition, in riparian areas dense monocultures of Manitoba maple grow quickly and displace other native floodplain species, even continuing to occupy space when they tip over and grow horizontally. The formation of dense canopy can in turn facilitate the growth of Manitoba maple seedlings by excluding herbaceous competitors in the understory and creating conditions favorable to Manitoba maple seedling germination growth (Saccone *et al.* 2010). This process of indirect facilitation may be a mechanism for the formation of dominant Manitoba maple stands. Disturbed forests dominated by Manitoba maple are often colonized by other invasive forest species like garlic mustard, urban avens, common buckthorn and euonymus species. These dominant Manitoba maple stands could also be potentially problematic for any accidental re-introduction of the Asian long-horned beetle (*Anoplophora glabripennis*) in Ontario, as Manitoba maple in addition to other maple species are preferred host trees. When Asian long-horned beetle was detected in the Mississauga area in 2013, survey efforts found two Norway maples and three Manitoba maple's to be heavily infested with Asian long-horned beetle exit holes (invasivespeciescentre.ca), underscoring the potential threat Manitoba maple monocultures could have on future invasions.

Much of the research on Manitoba maple and its invasive potential comes from studies in Europe, where it was introduced centuries earlier as a horticulture species and has since become invasive in many regions. Straigyte *et al.* (2015) found the invasive degree of Manitoba maple was very high in the cities of Riga, Latvia and Kaunas, Lithuania. Manitoba maple has had negative consequences for understory biodiversity in regions such as southern Europe, where for example it has been replacing white willow (*Salix alba*), a floodplain species occupying a similar niche. In a study of three riparian forests within the Adour-Garonne River basin in France, stands with Manitoba maple had lower plant species richness and biomass, and a decline in stinging nettle (*Urtica dioica*), the dominant species in white willow forest understories (Bottollier-Curtet *et al.* 2012). In southwestern France, Porte *et al.* (2011) found that Manitoba maple was able to grow in a variety of environments and adapt to changes in nutrient and light availability more efficiently than native species by allocating more resources to foliage (i.e., larger specific leaf area and total leaf area). The vegetative growth of Manitoba maple also contributes to its ability to dominate floodplain forests, as it is able to lean forward or fall down, remain rooted in the soil and form fast-growing secondary shoots, preventing the regeneration of poplars and willows (Medrzycki 2011).

Benefits to wildlife:

Despite its status in many urban areas as an invasive species, Manitoba maple provides a source of food and shelter to many native wildlife species. It is an important winter food source for birds, squirrels, and small mammals such as meadow voles, which debark the sprouts (Schueler 1999). White-tailed deer use it in the fall as a browse species of secondary importance (Rosario 1988). The increase in eastern populations of Evening Grosbeak (*Coccothraustes vespertinus*) has been attributed in part to the frequent planting of Manitoba maple since the early 1900s as windbreaks in the Prairies and as an ornamental tree (COSEWIC 2016). It may also have ecological value for some insectivorous birds. In the floodplain forests of southern Illinois researchers quantified a preference index (PI) for each bird species feeding on insects from different tree species. They found that 4 of 13 bird species had a positive PI for insects found on Manitoba maple including the Acadian Flycatcher (*Empidonax virescens*),

Prothonotary Warbler (*Protonotaria citrea*), Red-Eyed Vireo (*Vireo olivaceus*), Yellow-Billed Cuckoo (*Coccyzus americanus*) (Gabbe *et al.* 2002). In another study that examined foraging preferences of the Carolina Chickadee (*Poecile carolinensis*) in residential neighborhoods of Washington DC metropolitan area, it was found that Chickadee's strongly preferred foraging on native plants which had higher caterpillar biomass compared to non-native species. Chickadees also foraged on native *Acer* species (A. *negundo*, A. *rubrum*, A. *saccharinum*, A. *saccharum*) most frequently after native *Quercus* species, and preferred native *Acer* over non-native *Acer* species (A. *palmatum*, A. *campestre*, A. *ginnala*, and A. *platanoides*). Since Manitoba maple was included in the native *Acer* group, this indicates that it may provide a valuable food source for insectivorous birds feeding their young (Narango *et al.* 2017). The sprawling crown of Manitoba maple with many branches and nooks that cover the trunk also provides habitat for a variety of wildlife. Robins (*Turdus migratorius*) nest in the branches, and fly-eating white-face hornets (*Dolichovespula maculata*) paste grey nests among the branches.

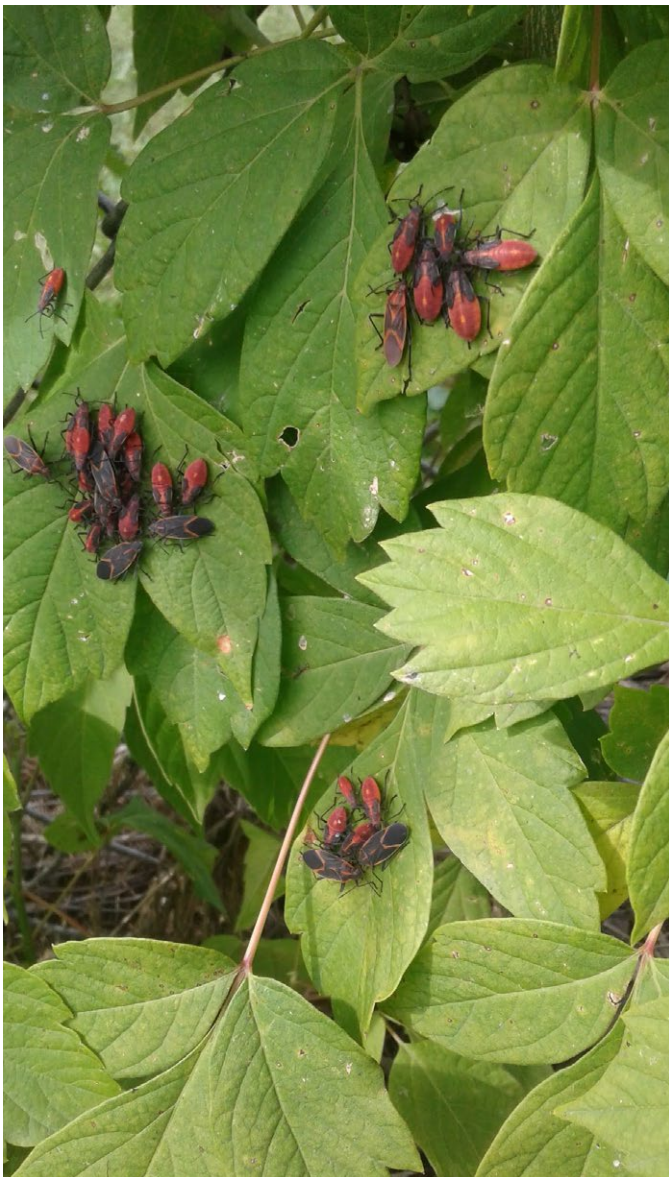
Societal:

Both male and female trees can be a nuisance on urban streets. Females drop significant numbers of seeds on cars and streets from the summer onwards. In some cities female trees are prohibited because they also attract box-elder bugs (*Boisea trivittata*).

The box-elder bug prefers feeding on Manitoba maple and will over-winter on or near dwellings adjacent to a tree. They may enter houses in large numbers in the fall or early spring when they begin looking for egg-laying sites and although harmless, can often be a nuisance. They may stain walls and curtains with brown faecal material and produce a foul odor when crushed (Vail *et al.* 2002; CABI Invasive Species Compendium 2019).

Male trees release a considerable amount of pollen early in the spring, causing seasonal allergies in many people. Manitoba maple has the most allergenic pollen of any other maple species in North America. It is wind-pollinated, and the peak allergy season for Manitoba maple typically occurs in late April and early May when it is in full flower (Pollenlibrary.com 2023).

Manitoba maple has brittle branches that often break during storms, and it falls over easily due to its rapid growth and short lifespan caused by weaker trunks. Falling trees and limbs can cause property damage, injury risk, and financial losses (*Rosario* 1988).



Female trees attract box-elder bugs (*Boisea trivittata*).

Photo courtesy of: Ethan Bass, iNaturalist, Available: https://www.inaturalist.org/observations/73447964. Licensed under CC-BY-NC

Economic:

Injured wood develops an attractive red stain.

Photo courtesy of: Fred Scheuler, Fragile Inheritance Natural History.

Manitoba maple wood has been used for making boxes and crates, as wood fiber in fiberboards, less expensive furniture, and decorative pieces such as turned items (bowls, stem-ware, pens), as the injured wood develops an attractive red stain. However, it is of low commercial value in North America due to the undesirable characteristics of its wood, which is light, close-grained and soft (Rosario 1988), and because the tree rarely grows large enough, rot-free or straight enough to use for timber. The wood makes good firewood when split and dried. The wood has also been used for a variety of purposes by Indigenous peoples, including making bowls, dishes, drums, pipe stems and prayer sticks. Manitoba maple was also identified as the material used in the oldest extant wood flutes, discovered in 1931 in Northeastern Arizona and dated to 620-670 CE (iNaturalist 2023).

Historical evidence indicates that Prairie settlers tapped this tree to make maple syrup (Blouin 1992). The sap of Manitoba maple is reported as unique, pleasant-tasting, and sweet, comparable to other maple species commonly tapped for syrup (sugar, red, silver maple) (Blouin 1992; Kort and Michaels 1997). However, its sap flow is considerably lower than the other species, and it takes colder nights to draw a steady flow from a tap than other maple species require (Schueler 1999). Nonetheless, a small-scale industry of Manitoba maple syrup has been developed in the Prairie provinces (Kort and Michaels 1997).

Pen made from Manitoba maple wood.

Photo courtesy of: Stephen Smith, Urban Forest Associates.

Agriculture:

The foliage of Manitoba maple has poor nutritional value for livestock (Rosario 1988).

The seeds of Manitoba maple contain a toxic metabolite called hypoglycin A, which can cause a highly lethal pasture myopathy in horses. The cause of seasonal pasture myopathy (SPM) in North America was not known until fairly recently. Grazing horses are particularly affected in the fall when concentration of this metabolite is highest in the seeds. Symptoms include stiffness, difficulty walking or standing, dark urine and eventually rapid breathing and immobility (Valberg *et al.* 2013).

Applicable Legislation

(Last Updated – July 2024)

Regulatory Tools – Manitoba maple:

Manitoba maple is not a regulated species. **See Table 2 for details.**

Depending on the location, timing of work, and the type of management activities (e.g., mechanical/manual or chemical), permits, approvals or authorizations may be required from municipal, provincial or federal agencies before invasive plant control can be initiated. Individuals undertaking control activities for Manitoba maple are responsible for ensuring that these are obtained and complying with any applicable legislation. Please note that this is only for general guidance and is not intended as legal advice.

Additionally, if protected species or habitats are present, an assessment of the potential effects of the control project and authorization could be required. Depending on the species and its location, applications should be directed to the appropriate authorities.

While not an exhaustive list of permits or rules that may apply to invasive plant species management, the following examples are provided for consideration:

Table 2: Legislation pertaining to Manitoba maple management.

Legislation & Regulating Body	Purpose	Application to Manitoba Maple Management
PROVINCIAL		
Invasive Species Act, Ontario Regulation *354/16* Ministry of Natural Resources (MNR) Applicable to Terrestrial and Aquatic Environments	Prevent the Introduction and Spread of Invasive Species	Manitoba Maple is not regulated under the *Invasive Species Act* (ISA), 2015. For more information, visit: https://www.ontario.ca/page/managing-invasive-species-ontario
Endangered Species Act Ministry of Environment Conservation and Parks (MECP) Applicable to Terrestrial and Aquatic Environments	Protection of Endangered and Threatened Species and their Habitat	The *Endangered Species Act* (ESA) prohibits the killing, harming, and harassing of species at risk (SAR) classified as extirpated, endangered or threatened, as well as damage and destruction of the habitat of endangered and threatened SAR. Management activities that may adversely impact protected SAR or habitat, such as herbicide application or mechanical removal, may proceed in accordance with an ESA authorization (permit or agreement) or regulatory exemption. For the full list of SAR in Ontario and for information on permit requirements consult: http://ontario.ca/page/how-get-endangered-species-act-permit-or-authorization

Legislation & Regulating Body	Purpose	Application to Manitoba Maple Management
***Pesticides Act* & Regulation 63/09** Ministry of Environment Conservation and Parks (MECP) Applicable to Terrestrial and Aquatic Environments	Regulation of Pesticide Use in Ontario	The *Pesticides Act* and Ontario Regulation 63/09 govern the sale, use, transportation, storage and disposal of pesticides in Ontario including license and permit requirements. Most invasive species control projects will require a licensed exterminator. Only pesticides registered under the federal *Pest Control Products Act* by the Pest Management Regulatory Agency (PMRA) can be used in Ontario. **The pesticide label is a legal document that must be followed exactly.** Exterminations on land are subject to the cosmetic pesticide ban. Other than certain biopesticides and low-risk pesticides on Ontario's "Allowable List", pesticides can only be used in accordance with an exception (e.g., agriculture, forestry, public health and safety, natural resources and other legislation) to the cosmetic pesticide ban. The licensed exterminator in charge can provide guidance regarding how the exceptions to the cosmetic pesticide ban apply to the specific extermination and any requirements that must be met to perform work under the exception. For more information on these exceptions and the rules with respect to pesticide use visit: https://www.ontario.ca/laws/regulation/090063
FEDERAL		
Fisheries Act* and *Species at Risk Act Applicable to Aquatic Environments	Protection of Fish and Fish Habitat *Fisheries Act*: Protection of Fish and Fish Habitat *Species At Risk Act*: Protection of aquatic species at risk	The *Fisheries Act* (and in some cases the *Species at Risk Act* [SARA]) applies when a proposed work, undertaking or activity in fish-bearing water results or is likely to result in: • The death of fish (by means other than fishing); • The harmful alteration, disruption or destruction of fish habitat; • The deposit of a deleterious substance (e.g., herbicides) in water frequented by fish; • Impacts to species listed as aquatic species at risk under *Species at Risk Act* (SARA) or any part of their critical habitat. If there is risk of harm to fish or their habitat, authorization from DFO is required prior to undertaking any projects to avoid and mitigate impacts. The use of herbicides may be authorized to prevent the introduction or spread of, or to control aquatic invasive plants that may cause harm to fish, fish habitat or use of fish. To remain in compliance with the Fisheries Act and the SARA consult the guidance found at the following websites: Projects near water - http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html Permitting - http://www.dfo-mpo.gc.ca/species-especes/sara-lep/permits-permis/index-eng.html

Legislation & Regulating Body	Purpose	Application to Manitoba Maple Management
Species at Risk Act Environment and Climate Change Canada (ECCC) Applicable to Terrestrial Environments	Protection and Recovery of Species at Risk and their Habitats	For most extirpated, endangered and threatened species, the *Species at Risk Act* (SARA) applies automatically only on federal lands. This includes National Parks, National Wildlife Areas, and other protected heritage areas administered by Parks Canada. For control activities on federal lands that may affect non-aquatic species listed on Schedule 1 of SARA, or which contravene SARA's general or critical habitat prohibitions, permits may be required. For more information, consult: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/permits-agreements-exceptions/permits-agreements-information.html
***Migratory Birds Convention Act* & Regulations** Environment and Climate Change Canada (ECCC) – Canadian Wildlife Service (CWS) Applicable to Terrestrial and Aquatic Environments	Protection of Migratory Birds, and their Nests and Eggs	When undertaking your project, you should take precautions to avoid harming migratory birds, nests and eggs. This includes: • Understanding how migratory birds and their nests are legally protected • Consider species activity timelines (i.e. active nesting season) • Planning your activity ahead of time, evaluate if the activity may cause harm to migratory birds, and determine what measures can be taken to avoid causing this harm • Develop and implement preventative and mitigation measures, such as beneficial management practices. For more information please visit: https://www.canada.ca/en/environment-climate-change/services/migratory-birds-legal-protection/convention-act-regulations.html
Pest Control Products Act Pest Management Regulatory Agency (PMRA), Health Canada Applicable to Terrestrial and Aquatic Environments	Regulation of Pest Control Products in Canada	Before a pesticide can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCPA) by the Pest Management Regulatory Agency (PMRA) of Canada. The pesticide label is a legal document. Follow all label directions – and ensure you have the most current label and are aware of any re-evaluation decisions. Visit the PMRA's product label search site at https://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php

Municipal

Under the *Building Code Act* (1992), municipalities may pass bylaws to address the presence of invasive plants. Municipalities may enact bylaws to control plants when there is a risk of negative impact to human health and safety.

Municipalities are also responsible for enforcing tree-cutting bylaws. Depending on the location within Ontario and the type of property, the number of trees that can be felled varies. Land managers are responsible for ensuring they acquire all necessary permits if exceeding the annual tree removal limits. Check with your local municipality to determine if there are further restrictions around Manitoba maple in your community.

Invasive Plant Management Planning

Management Considerations

It is important to determine the goals and priorities of your restoration project when deciding to control Manitoba maple. Manitoba maple might be removed if it is posing a health and safety hazard, infrastructure risk, or impeding goals for restoration at a site. Trees might also be managed as part of site preparation for an area being considered for restoration or new tree planting. For example, if there is a seed source adjacent to an open planting zone, the trees should be removed before planting. An ideal control plan should incorporate Integrated Pest Management (IPM) principles. This entails integrating existing knowledge about the invasive plant (i.e., its biology and life cycle), its surrounding environment and combining more than one control measure to be successful.

Once it has been decided to manage Manitoba maple and/or other invasive plants at a site, a control plan can be developed integrating information on infestation size, site accessibility, and potential for spread. This approach should also consider site specific conditions such as native plant richness and diversity and wildlife usage including species at risk. Conducting a detailed inventory of each site before starting control efforts is strongly recommended to ensure that proper methods and wildlife timing windows are used to mitigate potential negative impacts on native plant species and wildlife.

Mapping

If you are planning a restoration project on your property, conducting an ecological survey is a beneficial way to document current and future distributions of invasive and weedy plants that might be present. Conservation authorities or municipalities which manage large land areas may hire internal staff or contractors, or have qualified volunteers conduct ecological surveys. However, private landowners with smaller properties may be able to conduct their own surveys or hire a contractor. Survey the entire property to determine whether there might be populations of Manitoba maple that are locally dominant, in addition to other invasive species that might be impacting your goals for restoration at a site.

For detailed information on mapping techniques consult the Landowners Guide for Managing and Controlling Invasive Plants in Ontario.

Landscape Level Management

A more detailed management strategy is likely to be needed if Manitoba maple as well as multiple invasive plant species have established on your site. A strategic, landscape-level approach to management should be undertaken which aids in bringing together partners, landowners and land managers. This approach is designed to work towards common and shared goals that consider both site-level needs in conjunction with wider landscape considerations. It makes it easier to use resources efficiently, coordinate management activities and accomplish strategic goals. Failure to consider a broader landscape context by only focusing on individual or local challenges, may increase management costs, be more labour intensive and may not produce desired results across larger areas. Effective management of invasive plant populations requires repeat treatments and the combination of control methods (i.e., cut stump and herbicide use). Determining the land use objective and desired plant community is important because it is not always realistic, especially for larger populations, to eliminate the entire infestation at once. From here, develop an appropriate IPM strategy.

Setting Priorities

Establishing your highest priority locations for control prior to management will help to determine your best course of action. Therefore, when developing a management strategy, it is important to consider the following to help inform control decisions:

1. Protect federally, provincially, and regionally rare species and communities by removing invasive plants and ensuring rare species are not negatively impacted by control efforts. You are responsible for ensuring that your project follows provincial, federal, and municipal laws, including the provincial *Endangered Species Act*, 2007 (ESA) and federal *Species at Risk Act* (SARA). For species-specific information consult: https://www.ontario.ca/page/species-risk-ontario
2. Ensure all landowners have been identified and consulted before control takes place.
3. **Contain:** If you have limited resources, try to remove the outlying populations of invasive plants first (isolated plants or satellite populations), to prevent further spread. Protect areas where invasive plants are absent or just appearing. When action is taken early it can significantly reduce the cost of control. Where resources are limited, consider only removing female Manitoba maple trees (which serve as seed sources), particularly along fence lines and hedgerows, which can seed into a neighboring forest or field.
4. **Work inward:** If you have more resources, working from the outlying or satellite populations inward into larger, "core" populations of invasive plants and reducing the quantity of seeds can prevent spread into uninfested areas. In many cases, resource limitations may prohibit the immediate removal of entire core populations. Under these circumstances, core areas should be prioritized and addressed strategically.
5. **Consider sensitive ecological areas:** Concentrate on preventive strategies in high-priority ecological areas or areas where invasive plants are going to cause the most problems in terms of spread, such as the most productive or sensitive part of an ecosystem, along a creek, near species at risk, or a high-quality natural area. Pay special attention to disturbed sites which can be quickly colonized by invasive plants. Reduce the spread of invasive plants by following the Clean Equipment Protocol and removing invasive plant material from boots, clothing, and animal fur.
6. **Logistics and costs:** Review the different control options and costs with consideration to surrounding water, habitat, time of year, and type of land use (i.e., high-traffic recreational areas, agriculture, etc.).
7. Consider dedicating a certain time each year to control efforts and make it a joint effort with neighbouring landowners and/or land managers.
8. Begin to assess whether regeneration or restoration is appropriate, and if seeding or planting of native plants is needed to help jump-start natural succession and increase biodiversity in the area.
9. Follow-up monitoring is crucial to remove new invasive plants or address resprouts that may emerge after initial control efforts.

Prioritizing within a Control Area

(This section is modified from *The Landowners Guide to Managing and Controlling Invasive Plants*, published by Credit Valley Conservation).

1. Focus on large blocks of un-invaded areas and keep them free of invaders.
2. Control small, younger, outlier (satellite) populations first.
3. Reverse the invasion, expand the cleared area outward and ensure that un-invaded areas are kept free of invasive plants (with regular monitoring).

This flow chart can help land managers choose where to first focus control efforts if controlling satellite populations due to limited resources:

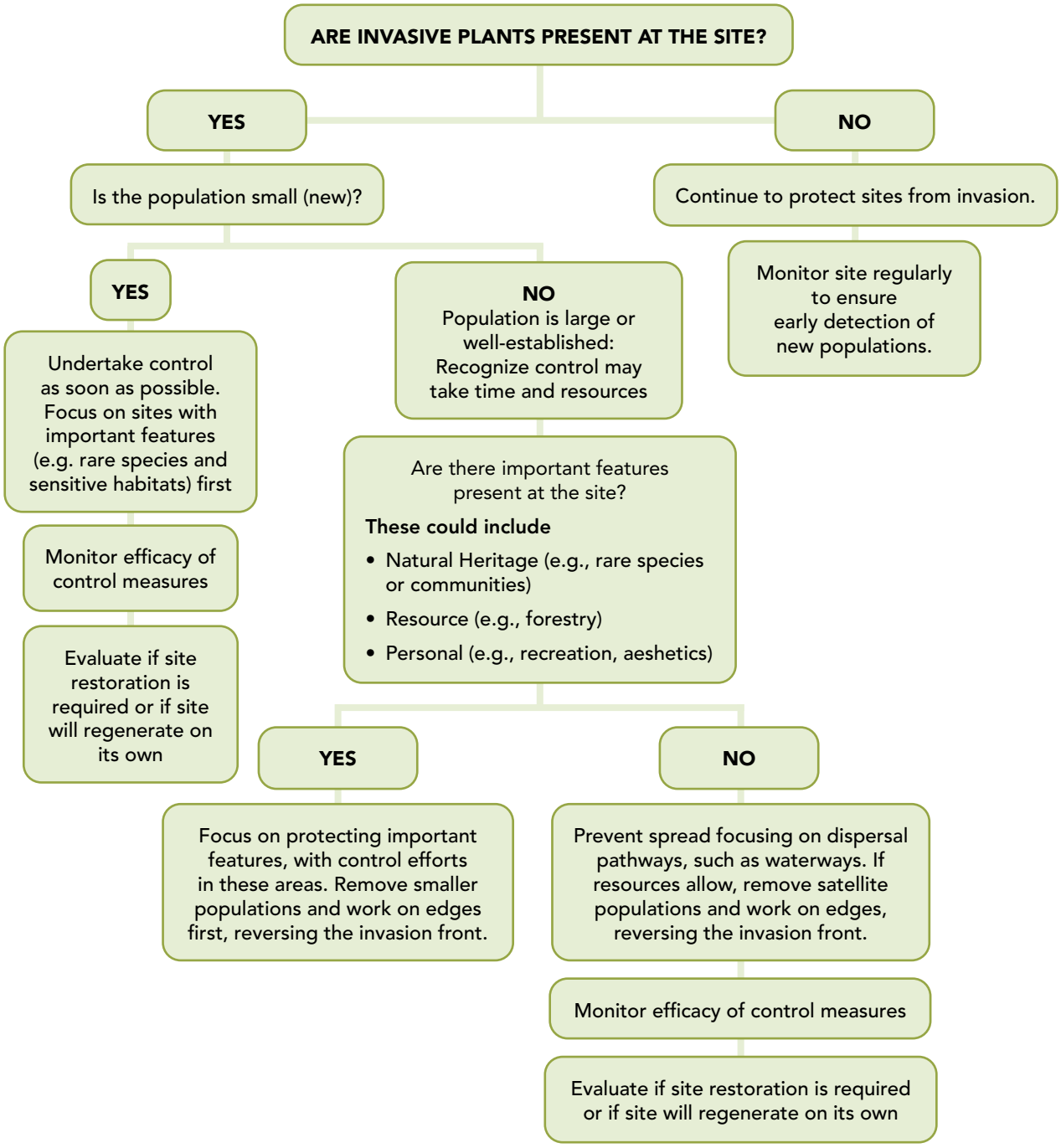


Figure 1: How to prioritize restoration sites for effective control of invasive plants

Long-term Management and Monitoring

A long-term management and monitoring plan should be developed prior to control efforts to help prevent the re-establishment of Manitoba maple. Established stands of Manitoba maple will likely need annual management because the stumps sprout vigorously. Monitoring after the initial control measures will enable the assessment of effectiveness determine the need for follow-up treatments. Ongoing management is essential to the success of a control project because after removal a site is at risk of reinvasion from nearby populations or other invasive plants.

Manitoba maple is an early succession, pioneer species that grows best in open habitats. Over time, this species will become replaced by shade-tolerant climax forest trees. A long-term management plan should consider restoration strategies that will encourage the establishment of climax forest trees.

Monitoring can be simple or complex ranging from taking photos or performing visual assessment to conducting extensive vegetation surveys.

For detailed information on monitoring consult the Landowners Guide for Managing and Controlling Invasive Plants in Ontario.

After Management: Assessing Regeneration vs. Restoration

Consider the following factors:

1. **Level of disturbance at the site:**
    - Was this a heavily invaded site (e.g., was much disturbance caused during control measures)?
    - Will it continue to be disturbed (e.g., through urban management activities or recreational use)?
2. **Biology of the invasive species removed:**
    - Is there a seed bank to consider?
    - Are there seed banks from other invasive plants in the area?
3. **Re-invasion risk:**
    - Are there invasive species nearby that could re-invade the site from nearby trails, watercourses or other pathways of introduction?
4. **Existing native vegetation:**
    - Will any native vegetation that still exists on the site regenerate quickly?
    - Does the existing native vegetation need help? Are there enough native trees to close the canopy and suppress the growth of Manitoba maple? Species with specific habitat requirements or reproductive strategies resulting in low fecundity, including species at risk, may require re-introduction. The majority of plant species should be able to recover naturally, especially if healthy populations exist adjacent to the controlled area.

If you answered **Yes** to most of the questions under 1 to 3, it is most likely that (a) the site will be re-invaded before it has a chance to regenerate on its own or (b) that invasive plants will continue to invade and be present among the native species so that annual control of invasive plants may be required. Restoration will be needed to reduce the risk of re-invasion. If you answered **Yes** to the questions under 4, your site may have a lower risk of invasion but could still require some restoration measures to help re-establish native vegetation.

Control Measures

A forest being restored to natural vegetation with native plantings after thinning and girdling the Manitoba maples.

Photo courtesy of: Stephen Smith, Urban Forest Associates.

The decision to control Manitoba maple will be site specific and depend on your project goals and priorities. A management plan should consider which situations it may be best to leave Manitoba maple in place or when to apply control measures.

In some situations, it may be best to leave trees in place, such as intact deciduous forests with high native species richness where this species is not known to thrive, or where other more aggressive invasive plants are being prioritized (i.e., buckthorn, dog strangling-vine), or where removal along riverbanks could contribute to bank destabilization. Unlike most non-native invasive species, Manitoba maple provides some benefits as a source of refuge and food for a variety of wildlife species. Control, however, may be necessary in some environments, where it can become a hazard tree due to its fast growth and poor form, resulting in its branches leaning or breaking during wind and ice storms. This can pose risks to infrastructure, such as residential buildings, flight control structures, dams and dikes, and cause potential flooding hazards. Dense growth can also cause sightline issues, blocking road signs and trail edges. In natural areas, it may be removed if it is becoming locally dominant and impeding goals for site naturalization or reforestation efforts (i.e., oak regeneration), or interfering with other habitat objectives. For example, if trees are growing in open areas such as tallgrass prairie, Manitoba maple might be removed along with other woody vegetation in order to encourage native species to establish and grow. It is good practice to focus on removing seed source trees such as those growing along fencerows, windbreaks, or woodland edges where it could seed into a high-quality deciduous forest, or where it has established in forest gaps within a tree canopy. Alternatively, consider focusing on removal of mature female trees with high seed production.

This species is often found in sensitive, wet habitats such as riparian areas and wetlands, where chemical control may not be suitable. In these cases, it may be best to pull young seedlings and girdle older specimens, leaving dead standing trees in place. Consider that Manitoba maple sprouts vigorously from root stumps, therefore cutting the stump is not effective unless followed up with chemical treatment. Note that it may take many years of retreatment to successfully eradicate Manitoba maple from a treated area. Due to its heavy seed production, it is also recommended to remove seedlings from the understory for at least two years after girdling or cutting and chemical treatment. Seedlings and smaller plants may be pulled by hand or with a weed wrench, or foliar sprayed over larger areas.

In urban areas, consider site factors such as root depth, height, soil conditions, proximity to road allowances, interference with overhead wires, etc. It is recommended that felled wood or mulch is used on site where appropriate, or precautions are taken to prevent seed spread if taken off site. Once removed, consider native species alternatives that can be planted in place of Manitoba maple that would also be suitable to the site.

Size classes for woody tree species:
DBH = Diameter at Breast Height
Based on the Regional Municipality of York size class guidelines for tree species:
Juvenile tree (0 - 12 cm DBH)
Intermediate tree (13 – 50 cm DBH)
Mature tree (> 50 cm DBH)

Treatment of seedlings and small saplings on the forest floor:
Manual: hand-pulling or repeat mowing of seedlings/small saplings (for smaller populations).
Chemical: foliar spray with a glyphosate-based herbicide or basal bark with a triclopyr-based herbicide (for larger populations or larger saplings).

Manual

Pulling and Digging:

Seedlings and small saplings can be hand-pulled from moist soil. Larger saplings can be pulled or dug using equipment such as a weed wrench or shovel (generally for trees less than 5 cm DBH). The pulled tree can be overturned, roots left to dry on site, and disposed or left on site. Try to limit soil disturbance, and pat down soil that has been disturbed after removal. Pulling or digging can be time consuming and impractical for areas with large seedling populations.

Girdling:

Girdling involves completely removing the outer layer of bark from around a stem. Girdling can be very effective on trees greater than 5 cm DBH if the cut is deep enough to sever the sapwood (the layer beneath the cambium). A study in southwestern France found girdling alone to be an effective control method for Manitoba maple growing in riparian forests, with higher mortality rates two years after treatment compared to cutting the stump or applying juglone after cutting (Merceron *et al.* 2016). This could be due to Manitoba maple having a small root-to-shoot ratio, and therefore few below-ground reserves allowing girdling to effectively exhaust the tree and lead to tree death. However, girdling alone is best in dense shade, as girdling will often initiate vigorous sprouting from below the girdling cut, particularly in open sunny areas where they have more resources to resprout.

To girdle: Cut two parallel rings around the entire circumference at the lower 30 cm of the tree's trunk. If the sapwood layer is severed, the tree will no longer be able to translocate nutrients and everything above the girdle will immediately die (over several days). Below the girdling cut, girdling will often initiate vigorous sprouting and the sprouts will grow quickly, unless the stump is in dense shade. Monitor over this period: Repeat girdling over several seasons and/or follow up herbicide treatment of the sprouts if necessary (see chemical control section). Larger trees (> 25 cm DBH) may take several years to die.

A tree is dead when the wood is grey and the canopy no longer produces leaves and re-sprouting does not occur. Within a year the bark between the two cuts should fall off. If it is not possible to cut deep enough to sever the sapwood the cambium should be fully removed at 5 to 7.5 cm width to keep it from growing back together. Girdling can be performed using a chainsaw or manual tool such as a girdling knife and can be done any time of year, although if combined with herbicide application, should not be performed in the spring.

Size:	• Any infestation size. • For older, larger trees with a diameter of 5 cm DBH and up to 30 cm DBH.
Goal:	• Eradication
Timing (season):	• Any season; can be performed in spring or early summer when root resources are lowest and when the cambium is active and moist, or mid-summer onwards. If combining with herbicide application, it should not be performed in the spring as heavy sap flow will reduce herbicide efficacy.
Treatment Frequency:	• Continue to repeat girdling over several years to exhaust below-ground systems and eventually kill the tree. Follow-up with herbicide treatment if resprouting or healing occurs.
Best Practices:	• Recommended in sensitive habitats, such as wetlands and riparian areas, as well as in dry and resource-poor environments. • Girdling is recommended following natural disturbances (i.e., windstorms, flooding) that lead to canopy openings, as seedlings respond with rapid growth in response to increased light. • Repeat girdling for a few years if healing develops over 2-3 years. **Post treatment:** • Minimize regeneration of Manitoba maple by removing all seedlings and juvenile individuals for at least two years after the removal of adult trees and facilitate the establishment of native tree species. • Dying trees that have been mechanically girdled and treated do not make viable seed. If in a steep ravine or natural area where it will not become a hazard tree, girdled trees can be left to stand and fall harmlessly. Dead trees will become wildlife habitat or food and will eventually rot on site, adding to soil. If the tree poses a hazard and/or it is decided to cut, the material can be left to rot on site where it has dropped, or alternatively logs can be chipped and used as mulch.
Advantages:	• Manitoba maple is frequently found in sensitive habitat such as wetlands and riparian areas where herbicides may not be appropriate or available. Girdling alone is appropriate for these sensitive habitats and can be repeated as many times as necessary to prevent the plant from re-sprouting. Depending on the habitat, targeted spot treatment with herbicide can also be combined with girdling.
Disadvantages:	• Time consuming; may require repeat girdling
Ideal for:	• Environmentally sensitive habitats, or in restoration sites • Girdling is effective in wet and nutrient-rich ecosystems but can also be applied in dry and resource-poor environments. • Steep slopes where trees can be left to stand or rot. • **Note: Girdling should only be done in areas where it is safe to do so. In some areas (such as on trails, or in residential backyards), dead standing trees can pose a safety risk.*

*Recommendations from Merceron *et al.* 2016

Cut Stump:

Stump cutting involves cutting at the base of the stem near the soil surface to sever the connection between the photosynthesizing parts of the plant and the roots. However, cutting the trunk on its own is an ineffective method of control for Manitoba maple, as the species responds by vigorous resprouting and suckering (Nikolaeva *et al.* 2020; Merceron 2016) unless it is growing in deep shade. If stump cutting, follow up with an herbicide treatment is necessary to effectively kill the tree for best results.

To cut: Wearing protective clothing, hard hat, gloves, and safety glasses (**Note:* Personal protective equipment will depend on the equipment being used), cut the tree down or re-cut the stump until live wood is reached. Cut the stump horizontally above the root flair, as close to the ground as possible.

Monitor cut stumps for resprouts and suckers so that herbicide can be applied, or the resprouts can be frequently cut back.

Size:	• Any infestation size. • For older, larger trees with a diameter of 5 cm DBH and up to 30 cm DBH.
Goal:	• Eradication
Timing (season):	• Mid-summer onwards, most effective in late summer and early fall, although cutting prior to seed production can help prevent seed spread. Not effective in spring during heavy sap flow if followed up with herbicide application.
Treatment Frequency:	• Follow up with herbicide treatment to address resprouts and suckering from the root system.
Best Practices:	• See Chemical Control section for advice on herbicide application following a stump cut.
Advantages:	• Selective. Effective at killing whole tree. Less disturbance to soil.
Disadvantages:	• Labour-intensive. • Can open canopy gaps, stimulating seedling growth.
Ideal for:	• If leaving dead standing trees is not suitable to the site or the tree needs to be cut for health and safety reasons. • Environmentally sensitive habitats, or in restoration sites. Steep slopes where dead stumps can be left to rot.

Cultural

Solarization:

If chemical control is not feasible, juvenile cut stumps can be covered to prevent light from reaching the stump, which will eventually kill the roots. A variety of materials (and some creativity) can be used, such as a heavy black plastic sheet or bag tied with strong non-decomposable string or cable ties around the stump, or a dark tarp over the stump held down with weights, or even a soup can covering the stump. This method can be effective for small to medium scale projects, such as on a stewardship site. It is a suitable option on steep slopes or areas where erosion is a problem, as stumps can be left in place, and will also prevent disturbance to soil without the need for uprooting. This method will require frequent returns to monitor the site, to ensure the covered material has not been tampered with (via humans or wildlife) or damaged.

Chemical

The management of pesticides is a joint responsibility of the federal and provincial governments. The federal government, through the Pest Management Regulatory Agency (PMRA), is responsible for approving the registration of pesticides across Canada under the *Pest Control Products Act*. Ontario regulates the sale, use, storage, transportation and disposal of pesticides including issuing licenses and permits under the *Pesticides Act* and Ontario Regulation 63/09. Federally registered pesticide products are assigned one of four product class designations (i.e., Manufacturing, Restricted, Commercial or Domestic). The class of pesticides determines who can sell or use the pesticides products as well as what restrictions are placed on its use (e.g., requires a license and/or permit). Most invasive species control programs using a pesticide will require an appropriately licensed exterminator.

The use of pesticides on land is subject to the cosmetic pesticide ban. Other than certain biopesticides and low-risk pesticides on Ontario's "Allowable List", pesticides can only be used if the use is permitted under an exception to the ban. Depending on the specifics of the extermination, invasive plant control may be permitted in accordance with exceptions for forestry, agriculture, public health and safety (e.g., plants poisonous to humans by touch and plants that affect public works and other buildings and structures) and compliance with other legislation (e.g., control of noxious weeds where required by the *Weed Control Act*). There is also an exception for the management, protection, establishment or restoration of a natural resource that may be considered if other exceptions do not apply. The requirements that must be met for pesticide use under each exception are set out in Ontario Regulation 63/09 and may include conditions such as certification in integrated pest management, a letter from the relevant Ministry (MNR or MECP) and/or others. The appropriately licensed exterminator in charge can provide guidance on requirements that apply to the specific extermination under consideration.

Herbicide Selection and Application

Pesticide applications can be an effective method for Manitoba maple management when used as part of an integrated pest management program and in consideration of the species biology and site-specific information. Pesticides must be applied in accordance with the federal *Pest Control Products Act*, the Ontario *Pesticides Act*, Ontario Regulation 63/09 and all label directions. Most invasive species control programs using a pesticide will require an appropriately licensed exterminator. The availability of pesticides to control Manitoba maple may change over time, as may the label directions on how to use the pesticide.

Before using any pesticide, ensure you have the most current label. Pesticide labels can be accessed using the PMRA's label search tool, which can be found by searching "PMRA label search" in any major search engine. Always read and follow all directions on the label. The label is a legal document that must be followed exactly, including any applicable buffer zones. Using a pesticide to treat a species not listed on the label, or in a manner other than specified on the label violates the *Pest Control Products Act* and may incur penalties.

Chemical Control and Manitoba Maple:

See manual control section for instructions on girdling or cutting.

Several methods of chemical application may be used on young and mature trees, including basal bark, girdling, and cut stump. These methods are most effective with a triclopyr-based product. Small seedlings or saplings can be foliar sprayed with a glyphosate-based product.

**Note: Always refer to the specific directions listed on the pesticide label for the product you will be using. Visit the Pest Management Regulatory Agency's product label search site at* http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php

Table 3. Herbicides effective at controlling Manitoba maple.

Herbicide	Application/Timing	Herbicide Class	Benefits	Cautions
Triclopyr	• Apply to bark, girdled trunk, or cut stump from mid-summer onwards. Avoid using during heavy sap flow in spring. • Apply with a backpack or canister sprayer.	• Commercial • Only licensed professionals may apply this herbicide.	• Fast acting (3-5 days). Can be used for both basal and cut stump treatments.	• Observe required buffer zones. • Non-selective, avoid contact with non-target broadleaf weeds and woody plants.
Glyphosate	• Apply as a foliar spray to seedlings or saplings or for cut stump. • Apply with a backpack or canister sprayer.	• Commercial • Only licensed professionals may apply this herbicide.	• Low rate of persistence in the environment, low toxicity.	• Observe required buffer zones. Non-selective, avoid contact with non-target plants. Avoid application if heavy rain is forecasted.

Foliar Spray of Small Seedlings or Saplings:

For large numbers of seedlings or if manual methods are not feasible, seedlings and saplings (typically less than 2 cm DBH or less than 2 m in height) can be foliar sprayed using a backpack or canister sprayer with a glyphosate-based herbicide.

Basal Bark:

Size:	• Small to medium sized infestations. • Best for younger trees with a diameter of 2 cm DBH and up to 20 cm DBH. • *Note: Rarely get 100% kill above 10 cm DBH.
Goal:	• Eradication.
Timing (season):	• Best mid-summer onwards including winter, except when snow or water prevents spraying at the desired height above ground level. Most effective in late summer and early fall when the sap of the tree flows towards the roots. Not effective in spring when sap is flowing upwards.
Treatment frequency:	• Has a strong tendency to resprout, therefore may need to re-apply to sprouts over multiple seasons. • Monitor site to evaluate effectiveness of treatment. • Follow-up to cut stump treatment.
Best Practices:	• Triclopyr-based products are used for basal bark treatments because the products can penetrate bark. • Basal bark treatments work best on young actively growing stems, with best results on stems < 8 cm DBH. Spray herbicide 30-50 cm above ground level. Wet bark thoroughly but not to the point of runoff. With sufficient volume, the treated zone should widen to encircle the entire stem circumference within 30 minutes. • For stems less than 8 cm DBH, spray a band 5 cm wide on one side of each stem. • For stems 8-20 cm DBH, spray a band 5 cm wide on two sides of each stem. • Basal bark application to leave dead standing (via backpack sprayer to tree trunks with triclopyr)
Advantages:	• Selective, less soil disturbance.
Disadvantages:	• Can open canopy gaps, stimulating seedling growth (note this may be advantageous if you want space for new plantings).
Ideal For:	• Natural areas such as deciduous forests. Environmentally sensitive habitats or in restoration sites. Steep slopes where trees can be left on site to stand or rot. • Can be used as a follow-up to cut stump treatment to help manage any resprouts that have generated.

Girdling with Herbicide Application:

If the tree has responded to girdling by vigorous resprouting, follow up application of a triclopyr-based herbicide may be necessary. Using a backpack or canister sprayer with a wand, apply herbicide to the girdled portion of the tree, ideally to a freshly cut section. Herbicide can be applied from mid-summer onwards but is most effective in late summer and early fall. Not effective in spring during heavy sap flow.

Cut Stump with Herbicide Application:

Follow up cut stumping with a herbicide application using a triclopyr-based or glyphosate-based herbicide. Apply herbicide to the cambium layer of the cut stump surface using a backpack or canister sprayer with a wand to kill the root system and prevent regrowth. An advantage of triclopyr products is that the cut does not have to be fresh allowing for flexibility in herbicide application, and herbicide can be applied even in freezing conditions, as long as it is above –10°C. A glyphosate-based herbicide can also be used, but it needs to be applied to a fresh cut and is not suitable for winter use. Basal bark treatment can be used as a follow-up to cut stump treatment to help manage any resprouts that have generated.

Disposal

In natural areas

In natural areas where it will not become a hazard tree, Manitoba maple can be killed and left to stand on site and rot, to become a refuge and food source for wildlife, adding nutrients to soil. In terms of cost effectiveness and time, it is generally better to leave biomass on site. Limbs or small branches can also be piled and used as wildlife habitat, burned on site (check with your municipality for burn permits), or chipped. Pulled seedlings can be turned upside down to let the roots dry, and can then disposed of or left on the ground. Manitoba maples do not root from cut branches lying on the ground or buried so there is no risk of re-rooting.

In public spaces, and urban areas

If aesthetics are a concern, material can be collected and removed from the site or left in piles out of the way for wildlife habitat, or wood can be used as firewood. Non-viable plant material without seeds can be brought to a municipal compost yard.

Restoration

Following control measures, consider restoring the site to encourage the re-establishment of native plant species. Consider the following restoration practices:

Mulching:

Mulch can be created from the chipped material of felled Manitoba maple trees. Avoid heavy mulching in natural areas. Covering a forest floor with a thick layer of mulch (> 5 cm) in a natural area can do more harm by changing nutrient composition of the soil and smothering desirable ground vegetation, such as spring ephemerals and native tree or shrub seedlings. Urban sites (i.e., urban parks) may be more appropriate. Mulch can be used to cover an area immediately after invasive species control (e.g., manual or chemical control), which may help to prevent re-colonization by other invaders and helps to reduce soil compaction by people and pets.

Seeding:

Broadcasting seeds of native plant species immediately after management activities may be most suitable to less urbanized sites where wildlife species have more food sources available. Otherwise, seeds may be quickly eaten by wildlife. Seeding may be useful to prevent the establishment of new invasive species. This can give desirable native species the chance to establish themselves. Seeding should only be done after management activities are completed to prevent new native plants from being damaged or killed. It is best to spread seeds from local native plants into the area.

Planting:

Once Manitoba maple has been removed, consider restoring the site by replanting with site-appropriate native species that can help out-compete invasive seedlings. Wait until all management is completed if doing a large stock (e.g., potted) re-planting to ensure newly planted stock is not damaged or killed due to ongoing management. When planting after control, consider space and light availability (i.e., have any trees recently been removed that have created a canopy gap?). These environmental changes should be considered when choosing plant species for restoration, as they will affect the growing and soil conditions. Plants should be appropriate for the area being replanted. Generally, a selection of fast and slow growing species is ideal, with a diverse mix of native groundcover, shrubs, and trees that are well-suited to the growing conditions on site.

See the "**Long-term Management and Monitoring**" on page 27

A typical forest of Manitoba maple in a highly degraded urban site. Growing on very disturbed ground and with abundant garbage.

Photo courtesy of: Stephen Smith, Urban Forest Associates.

Preventing the Spread

Prevention and early detection are the most effective tool for controlling the spread of invasive plant species and everyone can help by following these suggestions:

☑ Watch for it.

Learn to recognize invasive plants and then monitor property boundaries, forested areas, fence lines, and trails. Early detection of invasive plants can make it easier and less expensive to remove or control them.

☑ Stop the spread.

Inspect, clean, and remove mud, seeds and plant parts from clothing, pets (including horses), vehicles (including bicycles, trucks, ATVs, etc.) and equipment such as mowers and tools. Clean vehicles and equipment in an area away from natural areas where plant seeds or parts are not likely to spread (e.g., wash vehicles in a driveway or at a car wash) before travelling to a new area. See the Clean Equipment Protocol for more details. The winged samaras of Manitoba maple can be spread long distances by transportation corridors, wildlife or water currents.

☑ Keep it natural.

Try to avoid disturbing soil and never remove native plants from natural areas. This leaves the soil bare and vulnerable to invasive species.

☑ Use native species

Try to use local native species in your garden. Encourage local garden centres and nurseries to sell non-invasive or native plants. The Grow Me Instead guide lists alternative species to plant instead of invasive species. For more information on alternative species to plant instead of invasive species, consult the Grow Me Instead guide at https://www.ontarioinvasiveplants.ca/resources/grow-me-instead/.

Additional Resources

Woody Invasives of the Great Lakes Collaborative
http://woodyinvasives.org

Toronto Street Tree Guide: Growing Toronto's Tree Canopy
https://www.toronto.ca/wp-content/uploads/2021/05/9765-Street-Tree-Brochure.pdf

Neighbourwoods©, a community-based tree inventory, monitoring, and stewardship planning program
http://neighbourwoods.org/index.html

Best Management Practices Series from the OIPC

Autumn Olive
Black Locust
Buckthorn
Dog-strangling Vine
Erect Hedge-parsley
Eurasian Water-milfoil
European Black Alder
European Frog-bit
Flowering Rush
Garlic Mustard
Giant Hogweed
Goutweed
Invasive Honeysuckles
Japanese Barberry
Manitoba Maple
Multiflora Rose
Norway Maple
Purple Loosestrife
Reed Canary Grass
Scots Pine
Spotted Knapweed
White Mulberry
White Sweet Clover
Wild Parsnip
Yellow Iris

Technical Bulletin Series from the OIPC

Autumn Olive
Black Locust
Buckthorn
Dog-strangling Vine
Erect Hedge-parsley
Eurasian Water-milfoil
European Black Alder
European Frog-bit
Flowering Rush
Garlic Mustard
Giant Hogweed
Goutweed
Invasive Honeysuckles
Invasive Phragmites
Japanese Knotweed
Multiflora Rose
Norway Maple
Purple Loosestrife
Reed Canary Grass
Scots Pine
Spotted Knapweed
White Mulberry
White Sweet Clover
Wild Parsnip
Yellow Iris

Additional Publications from the Ontario Invasive Plant Council

A Landowner's Guide to Managing and Controlling Invasive Plants in Ontario

A Quick Reference Guide to Invasive Plant Species

Clean Equipment Protocol for Industry

Creating an Invasive Plant Management Strategy: A Framework for Ontario Municipalities

Grow Me Instead! Beautiful Non-Invasive Plants for Your Garden, a Guide for Southern Ontario, Edition 3, 2020 (EN)

Grow Me Instead! Beautiful Non-Invasive Plants for Your Garden, a Guide for Southern Ontario, Summer 2017 (EN, FR)

Grow Me Instead! Beautiful Non-Invasive Plants for Your Garden, a Guide for Northern Ontario

Invasive Aquatic Plant Species: A Quick Reference Guide

Invasive Terrestrial Plant Species: A Quick Reference Guide

The Landowners Guide to Controlling Invasive Woodland Plants

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