Goutweed

(*Aegopodium podagraria*)

Best Management Practices in Ontario

TORONTO

ONTARIO INVASIVE PLANT COUNCIL

Foreword

This Best Management Practices (BMP) document provides guidance for managing invasive goutweed (*Aegopodium podagraria*) in Ontario. Funding and leadership to produce this document was provided by the City of Toronto. BMPs are 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 have been recommended by leading professionals across Ontario. 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. The timing windows suggested will differ throughout Ontario and should be tailored to your region. Interested parties are advised to refer to the applicable legislation to address specific circumstances.

Check the website of the Ontario Invasive Plant Council (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.

Front and back cover photo courtesy of Diana Gora, Hamilton Conservation Authority.

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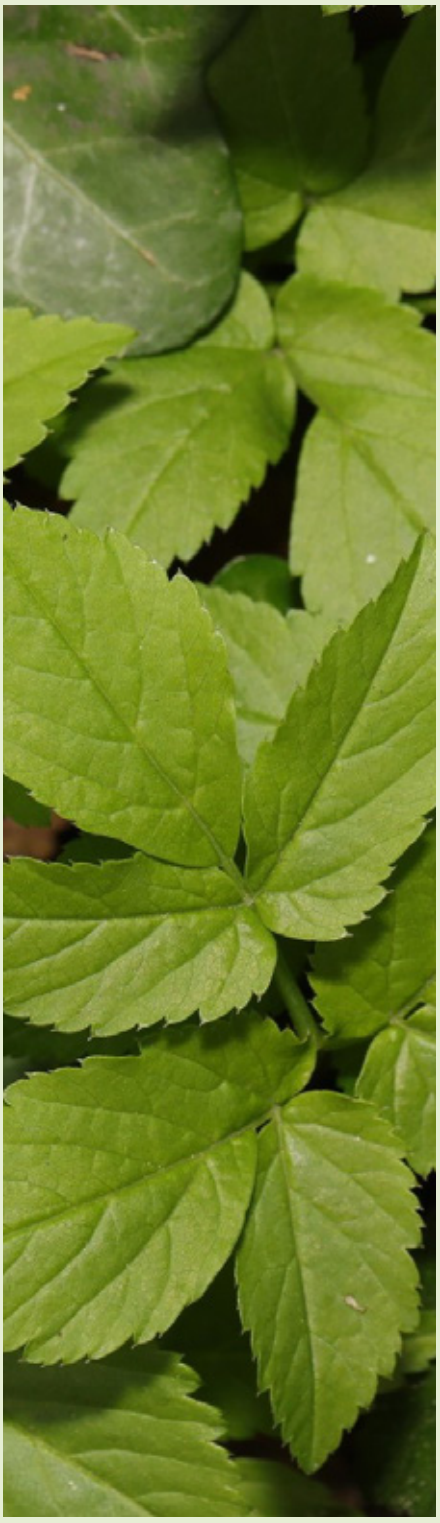


Goutweed.

Photo courtesy of Stephen James McWilliam, inaturalist.org/observations/73222977

Goutweed in spring.
Photo courtesy of Cathy Quinlan, Upper Thames River Conservation Authority.

Introduction

Goutweed (*Aegopodium podagraria*) is a herbaceous, perennial plant in the carrot/parsley family (Apiaceae). It is also known by a variety of other names including bishop's goutweed, ground elder goutwort, Herb-Gerard, English masterwort, aise-weed, dwarf weed, white-ash-herb, dog elder, and snow-on-the-mountain. Native to Europe and northern Asia, goutweed was brought to North America as an ornamental by early European settlers in the mid-1800s. It was considered to be well established in the United States by 1863, with records indicating it was locally abundant and becoming common in North America by the late 1960s. Records of goutweed in Canada date back to as early as 1902, but it is suspected to have been introduced prior to that date.

Labeled as one of the worst garden weeds in perennial gardens, goutweed has many characteristics that aid its survival and inhibit its control. This perennial plant is shade tolerant and able to grow in infertile soils but prefers nitrate rich habitats. There is evidence of a competitive ability over native species, and it is capable of invading closed-canopy forests where it inhibits native tree germination and growth. Goutweed regenerates and spreads vigorously through underground root systems called rhizomes that allow it to spread up to 70 cm per year. Together, these characteristics make it an aggressive invader in North America where it can form dense patches of vegetation that outcompete native species and persist over the long term.

Most goutweed infestations are a result of the intentional planting in gardens and planters. Goutweed has successfully escaped cultivation and become established in natural areas because of its extensive rhizomes. Goutweed is still extremely popular in the horticultural trade and is still sold commercially at garden centers across North America. Its popularity is largely due to its adaptability and versatility, its low maintenance requirements, its tolerance to drought, and its ability to spread. It is also widely known by some gardeners to be highly invasive and hard to remove, with many experienced gardeners recommending against the use of it. The ongoing availability and popularity of goutweed as an ornamental groundcover will likely contribute to the ongoing establishment of goutweed in natural areas throughout North America.

Description

Leaves:

Leaves are compound and ternate.

Photo courtesy of Katherine Baird.

The leaves are compound and divided into 3 groups of 3 leaflets each (ternate). The separation of leaflets is often incomplete, appearing irregularly lobed or "mitten-like". Each leaflet is somewhat oval and has coarsely to finely-toothed margins. Most of the leaves are basal, with the leafstalks (petioles) attaching directly to the rhizomes. Larger plants may have a few leaves per plant, arranged alternately along the stem. Basal and lower leaves are larger and are about 3 – 8 cm long with long petioles. The lower leaves are doubly compound and divided again (twice ternate), totaling up to 9 leaflets per leaf. The upper leaves resemble the lower leaves but are smaller and will usually only have 3 leaflets (ternate) per leaf. The leaves are mostly hairless and medium green in colour, but the leaves of the variegated type are blue-green in colour and have creamy white margins.

Leaves of the variegated type are blue-green and have creamy white margins.

Photo courtesy of Diana Gora, Hamilton Conservation Authority.

Size and Stem:

Goutweed is a herbaceous, perennial plant. The flowering stems are erect, hairless, hollow, and can grow anywhere from 0.4 m to 1 m tall. The upper stems can be branched but this is not always the case.

Flowers:

The white flowers are arranged in flat-topped umbels which are 6 – 12 cm across. Umbels are umbrella-shaped clusters of short-stalked flowers, a typical feature of plants in the carrot family. Umbels of goutweed lack bracts (modified leaves under the flower). Each umbel is borne on a long, leafy stem and is made up of 10 – 20 umbellets. Each umbellet can have 15 – 25 rays (individual flowers). The individual flowers are small, about 3 mm across, and have five petals. The flowers typically bloom from June to August but can be seen as early as May in some areas. Flowers are uncommon on plants in densely shaded areas.

Individual flowers are white, small and have five petals.

Photo courtesy of Diana Gora, Hamilton Conservation Authority.

Each flower produces a tiny schizocarp (fruit).

Photo courtesy of: Robert H. Wardell, inaturalist.org/observations/53825549

The flowers are arranged in umbels.

Photo courtesy of: George Lx, inaturalist.org/observations/49127199

The fruit ripens and turns brown in late summer.

Photo courtesy of: Robert H. Wardell, inaturalist.org/observations/56109835

Fruit and Seeds:

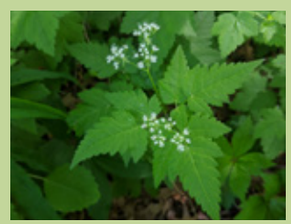
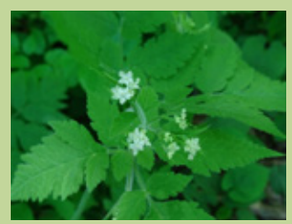
Each flower produces a tiny, brown fruit or seed called a schizocarp. This fruit is about 3 – 4 mm long, oblong to ovoid in shape, and laterally flattened. The fruit ripens in late summer (mid-July to September) and splits into two sections called mericarps, with each containing one seed. The number of seeds produced per plant is unknown, but it is assumed to be low.

Roots:

Goutweed has an extensive underground root system of branching, white rhizomes. The rhizomes break easily and when damaged, give off a characteristic carrot-like odor. New plants can grow from broken rhizome fragments and a fragment can remain viable in the soil for more than four years. The plant can spread up to 70 cm per year by its rhizomes.

Lookalikes

Goutweed resembles several native and non-native members of the carrot family (Apiaceae) including wild carrot (Daucus carota), Canada honewort (*Cryptotaenia canadensis*), smooth sweet cicely (*Osmorhiza longistylis*), hairy sweet cicely (*Osmorhiza claytonii*), and golden alexanders (*Zizia aurea*). Goutweed can be distinguished from these other species by the presence of rhizomes, the absence of flowering bracts, the shape of the leaves, the absence of hair on the stems, and the colour of the flowers. For example, smooth sweet cicely and hairy sweet cicely resemble goutweed; however, these two species have dense hairs on the stem and leaves, have more fern-like leaves, have an anise (licorice) smell, and do not share the same dense growth habit as goutweed. Table 1. The main identification features of goutweed in comparison to five species that may appear similar (lookalikes). Key I.D. features that separate the lookalikes from goutweed are in bold.

	Goutweed *(Aegopodium podagraria)*	**Wild Carrot** (*Daucus carota*)	**Canada Honewort** *(Cryptotaenia canadensis)*	**Smooth Sweet Cicely** (*Osmorhiza longistylis*)	**Hairy Sweet Cicely** (*Osmorhiza claytonii*)	**Golden Alexanders** (*Zizia aurea*)
	 Photo courtesy of: Lee Merrill, Credit Valley Conservation	 Photo courtesy of: inaturalist.org/observations/78564782	 Photo courtesy of: Katherine Baird	 Photo courtesy of: George Pauly, inaturalist.org/observations/25882543	 Photo courtesy of: Reuven Martin, inaturalist.org/observations/26635481	 Photo courtesy of: inaturalist.org/observations/24347282
Alternative Common Names	• bishop's goutweed, ground elder	• Queen Anne's lace	• Japanese parsley, white chervil, wild chervil	• anise-root, long-style sweet cicely, long-style sweetroot	• bland sweet cicely, Clayton's sweet cicely, Claton's sweetroot, sweet javril, woolly sweet cicely	• common alexanders, golden meadowparsnip, golden zizia
Accepted French Name	• égopode podagraire	• carotte sauvage	• cryptoténie du Canada	• osmorhize à long style	• osmorhize de Clayton	• zizia doré
Native Range	• Europe and Asia	• Europe and Asia	• Eastern North America	• Eastern North America	• Eastern North America	• Eastern North America
Habitat	• Old fields, woods, forests, meadows, pastures, roadsides, riparian areas	• Pastures, old fields, roadsides, meadows	• Forests, wooded areas, woodlands, shaded fence rows	• Moist woods and thickets	• Moist woods and forests	• Fields and open areas, wet areas
Size & Stem	• 0.4 – 0.9 m	• 0.3 – 1 m	• 0.3 – 0.9 m	• 0.6 – 0.9 m	• 0.3 – 0.9 m	• 0.6 – 0.9 m

	Goutweed *(Aegopodium podagraria)*	Wild Carrot (*Daucus carota*)	Canada Honewort *(Cryptotaenia canadensis)*	Smooth Sweet Cicely (*Osmorhiza longistylis*)	Hairy Sweet Cicely (*Osmorhiza claytonii*)	Golden Alexanders (*Zizia aurea*)
	 Photo courtesy of: Lee Merrill, Credit Valley Conservation	 Photo courtesy of: inaturalist.org/observations/78564782	 Photo courtesy of: Katherine Baird	 Photo courtesy of: George Pauly, inaturalist.org/observations/25882543	 Photo courtesy of: Reuven Martin, inaturalist.org/observations/26635481	 Photo courtesy of: inaturalist.org/observations/24347282
Leaves	• **Solid green** or **blue-green** • Leaves are alternate and **hairless** • Margins are **coarsely to finely toothed** • Divided into **3 groups of 3 leaflets** (ternate), and the **lower leaves are divided again** (twice ternate) • Variegated type has **white margins** • Sometimes "mitten-like"	• **Light to medium** green • Leaves are alternate and **lower surfaces may have hairs** • Margins are **feathery (fern-like)** • Divided into **3 leaflets**, larger leaves have more divisions	• **Medium to dark** green • Leaves are alternate and **hairless** • Margins are **double toothed** (small teeth on edges of larger teeth) • Divided into **3 groups of 3 leaflets** (ternate), larger leaflets often lobed	• **Light to medium green** • Leaves are alternate and **surfaces are smooth to sparsely hairy** • Margins are **toothed** • Divided into **3 groups of 3 leaflets** (ternate), and further **divided into 3 additional leaflets** (twice ternate) • Mild anise fragrance when rubbed	• **Medium green** • Leaves are alternate and **surfaces are hairy** • Margins are **coarsely toothed (fern-like)** • Divided into **3 groups of 3 leaflets** (ternate), and further **divided into 3 additional leaflets** (twice ternate)	• **Medium green** • Leaves are alternate and **hairless** • Margins are **coarsely toothed** • Divided into 3 or 5 **leaflets**
Flowers	• **White**, 5-petal flowers arranged in umbels • Umbel is 6 – 12 cm across • **No bracts** at the base of each umbel	• **White**, 5-petal flowers arranged in umbels • Umbel is 5 – 10 cm across • **Bracts are present** at the base of each umbel • Solitary purple flower in the center of the umbel	• **White**, 5-petal flowers arranged in umbels • Umbel is 4 – 8 cm across • **No bracts** at the base of each umbel	• **White**, 5-petal flowers arranged in umbels • Umbel is 4 – 8 cm across • **Bracts are present** at the base of each umbel	• **White**, 5-petal flowers arranged in umbels • Umbel is sparsely arranged • **Bracts are present** at the base of each umbel	• **Yellow**, 5-petal flowers arranged in umbels • Umbel is 5 – 8 cm across • **Bracts are present** at the base of each umbel
Roots	• Rhizomes	• Carrot-like taproot	• Taproot	• Fibrous root system	• Fibrous root system	• Fibrous root system

Biology and Life Cycle

In North America, goutweed mainly spreads vegetatively via rhizomes, but it can also reproduce via seed. The leaves begin to develop in early spring and are typically fully expanded by May. The leaves may start to turn yellow in August, but tend to stay green into the later months. Typically, it will not die until the first frost.

The small, white flowers arranged in an umbel, bloom from June to August but can be seen as early as May in some areas. The flowers are pollinated by a wide variety of insects including beetles, bees, and small flies, and can produce viable seed. The flower produces a fruit that turns brown and ripens from mid-July to September. At maturity, the fruit divides into two sections and the seeds are dispersed. Most seeds fall close to the parent plant and may be carried short distances by wind. No information is available on how animals may assist in the dispersal of seeds. However, because the seeds are ribbed, this could suggest that they might be able to adhere to the coats of animals, which would aid in long distance dispersal (Waggy 2010). The seeds require a long period of cold stratification to germinate, with germination occurring the year after ripening (Phartyal *et al.* 2009). The amount of time that seeds remain viable in the soil is unknown, but it is likely they do not form long-lived seed banks (Lind 2011). Only plants on sunny sites will produce flowers and fruit, and the establishment of new seedlings in the shade is rare.

The branching network of rhizomes allows goutweed to grow aggressively away from the parent plant, spreading up to 70 cm per year. In its early development, goutweed has adventitious thick storage roots and thin feeding roots that allow it to spread to new sites and take advantage of additional resources. This explorative growth strategy requires the plant to consume all its carbohydrate reserves in the spring (Meyer and Hellwig 1997). New plants can grow from broken fragments of rhizomes and one of these rhizome fragments can live for more than four years in the soil.

Goutweed leaves remain green longer than other plant species.

Photo courtesy of: Brittany Finigan.

Seasonality:

Leaves:

April to October

Flowering:

June to August

Seed Ripening/Dispersal:

Mid-July to September

Habitat

Goutweed is an ecologically versatile species, being highly shade tolerant and able to withstand a variety of soil conditions, and able to adapt to many different habitats. Once established, it grows well in partial sun to full shade and prefers well-drained, evenly moist soils. It prefers nitrogen-rich and mildly acidic to mildly-alkaline soils (pH 6.1 – 7.8) but can grow in infertile soils (Lind 2011). Most often, it establishes in the understory of forests where the ground layer has recently been disturbed or where the soil is bare. It can invade closed-canopy forests where it inhibits the establishment of native tree species. It is often found in disturbed habitats such as abandoned fields, logged areas, grasslands, meadows, pastures, along forest edges, roadsides, ditches, and riparian areas. It can also be found in naturally disturbed sites, such as those that are disturbed by animals digging, and managed fields where regular mowing or grazing occurs.

In its native range, goutweed is primarily found in deciduous woodlands and forests, riparian areas, shrublands, wetlands and grasslands. It tends to occur with a mix of deciduous trees including ash (*Fraxinus* spp.), oak (*Quercus* spp.), beech (*Fagus* spp.), maple (*Acer* spp.), and elm (*Ulmus* spp.) (Waggy 2010). It is well-recognized from its occurrence along roadsides and riverbanks, and for its use in gardens and yards.

In North America, it expands aggressively in similar habitats and most eastern deciduous forests are vulnerable to an invasion. Goutweed is commonly found in neighbourhood gardens and flowerbeds, and around shrubs and other plantings. It will easily escape these areas by spreading rhizomes, seeds, or root fragments transported with other plants, and enter adjacent forests, meadows, and fields. It invades and establishes itself in lawns, hedges, gardens, roadsides and waste places, habitats in which it occurs most often in Southern Ontario. In North America, goutweed can be found in a variety of habitats including upland hardwood forests, riparian areas, forest borders, floodplains, wetlands and along the edges of bogs (Waggy 2010). In Toronto, it has been found creating dense monocultures in ravines with moist conditions.

Goutweed growing in a shaded ravine.

Photo courtesy of: Katherine Baird.

Pathways of Spread and Distribution in Ontario

Goutweed is native to most of Europe and northern Asia where it is primarily a species found in deciduous and southern boreal forests. It was first brought to North America as an ornamental groundcover, and it continues to be grown in gardens as an ornamental, medicinal herb, and potherb.

In North America, it occurs in at least 29 US states from Maine south to Georgia, west to Minnesota and Missouri, as well as in the Pacific northwest in Montana, Idaho, Oregon, and Washington. The importation and sale of goutweed is prohibited in Connecticut, Maine, Massachusetts, and Vermont, and it is listed as restricted in Wisconsin.

Goutweed has spread throughout most of Canada, being reported in every province except Alberta, Newfoundland, Yukon, Nunavut, and the Northwest Territories. In Ontario, it is found throughout the Greater Toronto Area including Mississauga, Toronto, Brampton and Vaughan. It is also found across the province in parts of southwestern Ontario including London, Kitchener, Hamilton and Niagara Falls, to the east in Peterborough, Kingston, and Ottawa, and to the north in Sudbury, Sault Ste. Marie, and Thunder Bay. The importation and sale of goutweed is not currently restricted or prohibited in Canada.

Humans are the primary pathway of spread for goutweed. Most infestations originate from the intentional planting of goutweed, which then spreads into nearby natural areas through its rhizomes. The variegated type of goutweed that was planted as a groundcover has been observed spreading beyond maintained plantings and displacing native species (Nawrocki *et al.* 2011). Its popularity in the horticultural trade is largely due to its ability to tolerate a wide range of soil and light conditions, its low maintenance requirements, and its ability to spread without much encouragement. Its ongoing nursery availability and popularity as an ornamental groundcover means that it will likely continue to escape from gardens and cultivated areas in the future, becoming more widespread in natural areas throughout Ontario.

Dumping yard waste that includes rhizome fragments into natural areas is another pathway by which goutweed can spread. Goutweed rhizomes break easily, and if broken, a rhizome fragment can re-root and grow new plants. The rhizome fragments can be carried or transported to new areas in contaminated soil or be carried downstream through waterways.

The seeds will generally fall close to the parent plant. In some instances, the seeds may be dispersed short distances by wind or water currents. The seeds are ribbed which might suggest that they are able to be dispersed greater distances by adhering to the coats of animals, but there is currently no information available on animal-aided dispersal (Waggy 2010). Seedling establishment in these situations is rare since the seedling requires recently disturbed soil and abundant, bright light to survive.

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

Goutweed spreads to natural areas via rhizomes and outcompetes native plants.

Photo courtesy of James Kamstra.

Impacts

Ecological:

Goutweed is an aggressive plant that spreads quickly by fast-growing rhizomes. The non-variegated form of goutweed is particularly aggressive. The solid green leaves are considered to have a higher photosynthetic rate than the leaves of the variegated type, allowing the plant to spread more vigorously. Research found that in a nursery setting, the photosynthetic rates for both types of goutweeds were comparable in full sun conditions; however, in shaded conditions, the photosynthetic rates for the solid green type were more than 50% higher than the rates for the variegated type (Waggy 2010). Variegated goutweed can, however, revert to the wild type (solid green leaves).

Its ability to tolerate a wide variety of soil and light conditions, make it highly adaptable to many different habitats. It aggressively invades forests, forest edges, fields, pastures, and disturbed areas where it develops leaves earlier than many native species, giving it a competitive advantage over native vegetation. Once established, it forms dense patches of vegetation that restrict the amount of available sunlight, nutrients, and moisture, displacing native species. Goutweed is highly shade-tolerant and is capable of invading closed-canopy forests where it will dominate the herbaceous layer of the forests. Floodplain forests can become overrun with goutweed because of the moist soil conditions. As a result, it is a particular threat to native plant populations that can be found in these areas. Where goutweed grows in natural settings, plant species diversity is severely reduced.

Goutweed raises the humidity, and reduces light levels near the forest floor, which reduces seedling recruitment and germination, and inhibits the establishment of native trees and shrubs such as black spruce (*Picea mariana*), and balsam fir (*Abies balsamea*) (Schimpf *et al.* 2013). It may also alter decomposition, nutrient cycling, and other ecological processes in forests and woodlands (Garske and Schimpf 2005).

Goutweed provides food and habitat for many different species of insects. It emits a fragrance and contains nectar that attracts various beetles, bees, and small flies that will pollinate the plant. The presence of goutweed may alter native plant-pollinator interactions (Waggy 2010). The overall impacts on wildlife are currently understudied; however, deer have been observed avoiding goutweed when grazing in forests (USDA Forest Service 2006).

Economic:

Goutweed is commercially available in Canada and several states, due to its popularity as an ornamental groundcover. Its popularity is largely because it is low-maintenance and can provide abundant groundcover in shaded or partially shaded areas and spread without much encouragement. Most infestations originate from the intentional planting of goutweed that has spread beyond maintained gardens and invaded nearby natural areas. The cost of goutweed prevention is minimal; however, once goutweed is established, the cost of management is high (Lind 2011). The import and sale of goutweed is currently banned in Connecticut, Maine, Massachusetts, and Vermont.

Goutweed growing in a garden as groundcover.
Photo courtesy of Brittany Finigan.

Variegated goutweed invading a natural area from private property.

Photo courtesy of: Dayna Laxton.

Societal:

The above ground parts of goutweed have been used in traditional medicine, although there is little research to support this. It is believed to be able to treat rheumatic diseases which includes autoimmune diseases and diseases that affect the joints and soft tissues. Extracts from the roots have purifying and anti-inflammatory properties and has been used for the treatment of gout in the past. It has also been used for hemorrhoids, as well as for kidney, bladder, and intestinal disorders (Lind 2011).

Parts of goutweed are poisonous if ingested and handling the plant may cause skin irritation in some people. Historically, goutweed was often used as a potherb, where the young leaves were considered edible. Once the plant flowers, all parts of the plant are poisonous and have a laxative and diuretic effect (Lind 2011). Currently, there is not enough research to confirm the safety of consuming goutweed.

Applicable Legislation

Goutweed flowers in bloom.

Photo courtesy of: Milla Carne, inaturalist.org/observations/51342336

Most of the control methods for plant species are regulated under federal and/or provincial legislation.

Current regulations regarding chemical, manual and mechanical control of goutweed at the time of writing are summarized in this document. Please note that this is only for general guidance and is not intended as legal advice.

Land managers are responsible for ensuring that the management or control project complies with all relevant legislation. If protected species or habitats are present, an assessment of the potential effects of the control project could be required. Permits may be required for activities that may affect species listed in the *Endangered Species Act* (2007) (ESA), species listed on Schedule 1 of the *Species at Risk Act* (2002) (SARA), and for activities which contravene SARA's general or critical habitat prohibitions. Depending on the species and its location, applications should be directed to the appropriate authorities (see details below).

To find out which species are at risk in Ontario and for information on permit requirements consult: https://www.ontario.ca/page/how-get-endangered-species-act-permit-or-authorization.

Goutweed growing in an urban garden.

Photo courtesy of Lee Merrill, Credit Valley Conservation.

Federal

Plant Protection Act and Plant Protection Regulations

Under the *Plant Protection Act* (1990) and Plant Protection Regulations, the Canadian Food Inspection Agency (CFIA) is responsible for protecting plant resources in Canada by preventing the importation of new plant pests and limiting the movement and spread of pests within Canada. Invasive plants that are regulated under the *Plant Protection Act* (1990) are included in the list of Pests Regulated by Canada.

At the time of publication, goutweed is not listed under the Pests Regulated by Canada. For the full list, visit https://inspection.canada.ca/plant-health/invasive-species/regulated-pests/eng/1363317115207/1363317187811.

Weed Seeds Order

The Weed Seeds Order (2016) (WSO) is a ministerial order made under the *Seeds Act* (1985), which lists regulated invasive plants under the *Seeds Act* (1985). Under this order, the CFIA restricts the presence of weed species in commercially sold seeds to prevent the introduction and spread of new weeds.

At the time of publication, goutweed is not listed under the WSO. For the full list, visit https://laws-lois.justice.gc.ca/eng/regulations/SOR-2016-93/page-2.html#h-838559.

Pest Control Products Act

The management of pesticides is the joint responsibility of the federal and provincial governments. Under the *Pest Control Products Act* (PCPA) (2002), Health Canada's Pest Management Regulatory Agency (PMRA) registers pesticides for use in Canada with an approved label after conducting a stringent, science-based evaluation that ensures any risks are acceptable. The pesticide label is a legal document that prescribes how the pesticide can be used; pesticides must be applied in accordance with all label directions. Ensure you have the most current label and are aware of any re-evaluation decision.

Visit the Pest Management Regulatory Agency's product label search site at http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php.

Fisheries Act

The *Fisheries Act* (1985), administered by Fisheries and Oceans Canada (DFO) and Environment and Climate Change Canada (ECCC), applies to both the plant and pesticide use. It specifies that it is an offence to:

- Harmfully alter, disrupt, or destroy fish habitat, including streamside vegetation;
- Move or introduce aquatic organisms (including plants) to new habitats;
- Damage fish habitat or put harmful substances such as pesticides into water frequented by fish, including by pesticide drift.

To determine if you need a permit under the *Fisheries Act*, consult http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html.

Species at Risk Act

ECCC also enforces the *Species at Risk Act* (2002) (SARA), whose purpose is "to prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species that are extirpated (no longer exist in the wild in Canada), endangered, or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened." Permits are required by those persons conducting activities that may affect species at risk, such as invasive plant management.

To learn which species are at risk, for more information about critical habitat, or information on obtaining a permit, consult the SARA Public Registry at https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html.

Migratory Birds Convention Act

The *Migratory Birds Convention Act* (1994) (MBCA) administered by ECCC, provides for the protection of some bird species through the Migratory Birds Regulations and the Migratory Birds Sanctuary Regulations. For birds protected under the MBCA, it is an offence to kill, capture, injure, take or disturb a protected migratory bird as well as damage, destroy, remove, or disturb its nest without authorization under a permit issued under the Migratory Birds Regulations. To minimize the risk to breeding birds, consider operating outside nesting periods. Operating outside nesting periods is not a guarantee that birds will not be killed or disturbed; therefore, it is the individual's responsibility to ensure they do not contravene the *Act*.

For more information or to determine if you require a permit under the *Migratory Birds Convention Act*, visit: https://www.canada.ca/en/environment-climate-change/services/migratory-bird-permits.html.

To find out which birds are protected under the MBCA, visit: https://www.canada.ca/en/environment-climate-change/services/migratory-birds-legal-protection/convention-act.html.

For information on general nesting periods, visit: https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods/nesting-periods.html.

Provincial

Weed Control Act

The *Weed Control Act* (1990) (WCA) is administered and enforced by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). The intent of the WCA is to reduce negative impacts of noxious weeds on agriculture and horticulture; to reduce plant diseases by eliminating their host plants; and to reduce health hazards to livestock caused by poisonous plants.

A noxious weed includes a plant that has been listed in the schedule of noxious weeds found in Regulation 1096 made under the WCA. This list is commonly referred to as the "Noxious Weed List".

In general, a species designated as a noxious weed under the WCA has one or more of the following characteristics:

- Difficult to manage on agricultural land once established and will reduce the yield and quality of the crop being grown;
- Negatively affects the health and well-being of livestock;
- Poses a risk to the health and well-being of agricultural workers.

In Ontario, 25 weeds are currently designated as noxious under the WCA. Municipalities are responsible for appointing one or more weed inspectors at their discretion. The weed inspector is responsible for responding to calls made to the municipal clerk regarding a noxious weed that has been reported on someone's property. The weed inspector can order the landowner to destroy the weed within seven days.

At the time of publication goutweed is not regulated under the WCA's Noxious Weeds List. For the full list, visit: http://www.omafra.gov.on.ca/english/crops/facts/noxious_weeds.htm.

Invasive Species Act

Under the *Invasive Species Act* (2015) (ISA) there are rules to prevent and control the spread of invasive species.

At the time of publication goutweed is not listed as Prohibited or Restricted under the *Invasive Species Act*. For more information on which species are listed, visit: https://www.ontario.ca/page/stop-spread-invasive-species.

Pesticides Act

Before a pesticide can be sold, stored, or used in Ontario, it must be registered under the federal Pest Control Products Act (2002) (PCPA) by Health Canada's Pest Management Regulatory Agency (PMRA) and be classified under the provincial Pesticides Act (1990) by the Ministry of the Environment, Conservation and Parks (MECP).

The provincial classification of federally registered pesticides can be found at https://www.ontario.ca/page/pesticide-classification-guideline-ontario.

For Commercial (Class C) and Restricted (Class B) herbicides, only appropriately licensed pesticide exterminators can legally purchase, store, and apply these herbicides. The most effective herbicides used for treating goutweed are both in the Commercial (Class C), and therefore not available for homeowner use. However, homeowners may be able to hire a contractor who has the appropriate licence and access to herbicides for controlling goutweed. To undertake the project, a Letter of Opinion must be obtained by the licensed technician from the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) Regional or Branch Director.

To obtain a written Letter of Opinion, the licensed technician should contact your local Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) office https://www.ontario.ca/page/ministry-northern-development-mines-natural-resources-and-forestry-regional-and-district-offices.

It is important that pesticides be applied in accordance with all label directions. The pesticide label is a legal document and prescribes how the pesticide can be legally and safely used. Ensure you have the most current label and are aware of any re-evaluation decisions.

For an up-to-date list of pesticides labelled for goutweed control and to access the most current label, visit the Pest Management Regulatory Agency's product label search site at http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php.

In addition to being used in accordance with label directions, pesticides may only be used for purposes allowed under Ontario's Cosmetic Pesticides Ban The allowed uses are for pesticides in, on, or over land if the active ingredient in the pesticide is included on the Allowable List, or if its use is permitted under an exception to the Ban. Examples of exceptions include, uses for:

Agriculture

- The agriculture exception allows farmers to use Commercial (Class C) and Restricted (Class B) pesticides for the purposes of the agricultural operation that they own or operate. This exception may apply to the control of invasive plants if it impacts their agricultural or horticultural operation. Agricultural operations include agriculture, aquaculture, and horticulture activities.

  Examples include:

  - Growing, producing, or raising farm animals;
  - Production of crops, including greenhouse crops, maple syrup, mushrooms, nursery stock, tobacco, trees, turf grass, and any additional agricultural crops prescribed under the *Nutrient Management Act* (2002);
  - Activities that are part of an agricultural operation such as maintenance of a shelterbelt for the purposes of the agricultural operation;
  - The production of wood from a farm woodlot, if at least one of the activities described above is carried out on the property where the farm woodlot is located.
  - Some activities such as a household vegetable garden and lawn are not included in the definition of an "agricultural operation".

Forestry

- A forest is defined as a treed area of land that is one hectare in size or larger.

Commercial (Class C) and Restricted (Class B) pesticides may be used in a forest for the purposes of harvesting, renewing, maintaining, or establishing a forest, protecting forest resources derived from a forest, and accessing a forest for these purposes under the forestry exception. The control of invasive plants may fall under the forestry exception; a Forestry Class Land Exterminator license is required to use commercial pesticides in a forest.

Natural Resources

- The "natural resources" exception exists for the use of prohibited pesticides to manage, protect, establish, or restore a natural resource. To qualify for this exception, your project must meet the criteria specific in Section 28 of Ontario Regulation 63/09, including the use of pesticides in accordance with Integrated Pest Management principles outlined in this BMP guide. As noted above, the licensed technician will need to obtain a written Letter of Opinion.

Public Works

- The public works exception includes things such as roads, buildings, and structures, provided certain conditions are met. For example, an exemption for a Commercial (Class C) active ingredient may apply if a plant interferes with the essential maintenance of public works.

To determine if a permit is required for your invasive species management project, contact your local Ministry of Northern Development, Mines, Natural Resources and Forestry (MNDMNRF) office https://www.ontario.ca/page/ministry-northern-development-mines-natural-resources-and-forestry-regional-and-district-offices.

Endangered Species Act

The Ministry of the Environment, Conservation and Parks (MECP) enforces the *Endangered Species Act* (2007) (ESA), whose purpose is to provide protection for species and habitat classified by the province of Ontario as endangered or threatened. Permits are required by those persons conducting activities that may affect species at risk, such as invasive plant management.

To learn which species are at risk in Ontario or for information on obtaining a permit, consult www.ontario.ca/environment-and-energy/species-risk-ontario-list.

Conservation Authorities Act

Conservation Authorities (CAs), formed under the *Conservation Authorities Act* (1990), are watershed-based resource management agencies with a mandate that includes a number of roles and responsibilities in the land use planning and development processes. CA responsibilities include ensuring development is not at risk from natural hazards including flooding or erosion, with an aim to protect and restore the ecological health and function of natural systems. Under the Act, CAs regulate development and other activities in or adjacent to river or stream valleys, watercourses, wetlands, Great Lakes and large inland lakes' shorelines, and hazardous lands. CAs also regulate the straightening, changing, diverting, or interfering in any way with the existing channel of a river, creek, stream, or wetland.

To find out if you need a permit to undertake your control project, consult your local conservation authority at http://conservationontario.ca/.

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 the *Weed Control Act* (1990) to reduce the infestation of noxious weeds that negatively impact agricultural and horticultural land. Subject to the Ministry of Agriculture, Food and Rural Affairs (OMAFRA) approval, municipalities can designate additional plants not listed on the Ontario Noxious Weed list in their own jurisdictions.

Invasive Plant Management Planning

Management Considerations

Avoiding the planting of goutweed, particularly in areas where it poses a significant risk should it escape (e.g., near natural areas), and preventing its spread before it becomes locally established will reduce its impacts on biodiversity, the economy, and society.

It is important to use a control plan that incorporates Integrated Pest Management (IPM) principles. This means using existing knowledge about the invasive species and its surrounding environment to prevent and fight infestations and may require more than one type of control measure to be successful.

Once goutweed has been confirmed at a location, a control plan should be developed based on infestation size, site accessibility, potential for spread, and the risk of environmental, economic, or social impacts. Site specific conditions such as native plant richness and diversity, wildlife usage, and water table fluctuations should also be considered when developing control plans. A detailed inventory of each site is strongly recommended before starting control efforts to help ensure proper methods and timing are used to minimize negative impacts on wildlife and native plant species.

Mapping

If you think goutweed is nearby or on your property, you may wish to conduct an ecological survey. While managers of large land areas, such as conservation authorities or municipalities, may hire or recruit appropriately qualified staff or volunteers, private landowners with smaller properties may be able to conduct their own surveys, or contact an expert. If you know you have goutweed in one area of the property, survey the rest of the property to identify other infestations and to document current and future distribution.

For detailed information on mapping techniques, consult the Landowners Guide for Managing and Controlling Invasive Plants in Ontario at http://www.ontarioinvasiveplants.ca/resources/technical-documents.

Goutweed infestation in a planting site.

Photo courtesy of: City of Toronto.

Landscape Level Management

If goutweed has become widely established, a more detailed management strategy should be undertaken. A strategic and integrated landscape-level approach to management, conservation, and planning serves to bring partners, landowners, and land managers together to work toward common and shared goals that consider both site-level needs and wider landscape considerations. Focusing only on individual, local challenges without also examining the site within a broader landscape context may increase management costs, be more labour intensive, and may not result in strategic impacts across larger areas. Effective management and control of goutweed requires several interventions and a combination of control measures. It is not always realistic, especially for large infestations, to try and eliminate the infestation all at once. Determine the desired plant community and the land use objective and then 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 considerations to help inform control decisions:

1. If you have limited resources, try to remove the outlying populations (isolated plants or satellite populations) first, to prevent further spread.
2. If you have more resources, working into larger, "core" populations of goutweed can prevent spread into un-infested areas. In many cases, resource limitations may prohibit immediate removal of entire core populations. Under these circumstances, core areas should be prioritized and addressed strategically.
3. Concentrate on preventive strategies in high-priority areas or areas where the plant is 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 favourite natural area.
4. Protect federally, provincially, and regionally rare species and communities by removing invasive plants and ensuring rare species are not negatively impacted by control efforts.
5. Review the different control options and costs with considerations to surrounding water, habitat, time of year, and type of land use (i.e., high-traffic recreational areas, agriculture, etc.).
6. Ensure all landowners have been identified and consulted before control takes place.
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 plants that may emerge after initial control efforts.

Goutweed growing in a ravine in spring.

Photo courtesy of Katherine Baird.

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:

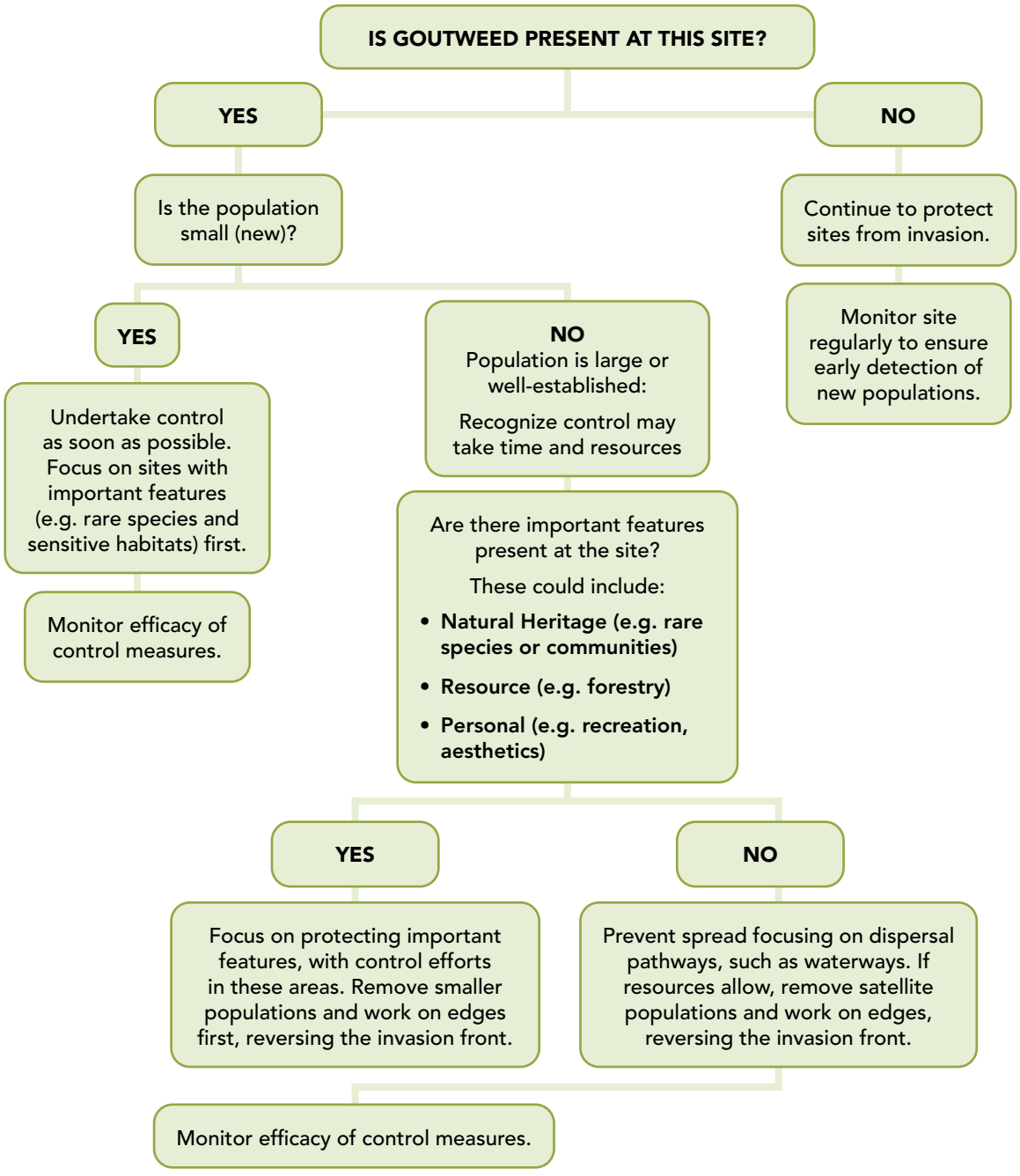


Figure 1: How to prioritize goutweed sites for effective control.

Long-term Management and Monitoring

To prevent the re-establishment of goutweed, a long-term management and monitoring plan should be created prior to the implementation of control efforts. Monitoring will enable assessment of the initial control measures, including their effectiveness, as well as the types of follow-up treatments that are necessary. Ongoing management is critical to the success of a project; after removal, a site remains at risk of reinvasion by nearby populations or another invasive species.

Monitoring could be as simple as taking photos or performing a visual inspection, or it could be more complex and include extensive vegetation surveys. In general, annual treatment is imperative and should focus on selectively removing isolated populations as they appear. Follow-up spot treatment will help to ensure the invasive population remains under control and allows for the regeneration of native plant species.

For more information on monitoring, consult the Landowners Guide for Managing and Controlling Invasive Plants in Ontario at http://ontarioinvasiveplants.ca/resources/technical-documents.

After Management: Assessing Regeneration vs. Restoration

Consider the following factors:

1. **Level of disturbance at the site:**
    a. Was this a heavily invaded site (e.g., was much disturbance caused during control measures)?
    b. Will it continue to be disturbed (e.g., through urban management activities or recreational use)?
2. **Biology of the invasive species removed:**
    a. Is there a seed bank to consider?
    b. Are there seedbanks from other invasive plants in the area?
3. **Re-invasion risk:**
    a. Are there invasive species nearby that could re-invade the site from nearby trails, watercourses or other pathways of introduction?
    b. Are people dumping yard waste that could contain goutweed?
4. **Existing native vegetation:**
    a. Will any native vegetation that still exists on the site regenerate quickly?
    b. Does the existing native vegetation need help? 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 goutweed will continue to invade and be present among the native species so that annual control of goutweed may be required. Restoration will need 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

Variegated goutweed.

Photo courtesy of: Christian Grenier, inaturalist.org/observations/40080977

Practice Prevention:

The best method to control and prevent the spread of goutweed is to stop planting it close to natural areas. There are a variety of native alternatives to consider in residential gardens that provide groundcover and are low maintenance. They provide the added benefit of attracting birds, butterflies, and other pollinators. Some alternatives to consider include:

- Canada anemone (*Anemonastrum canadense*)
- Canada wild ginger (*Asarum canadense*)
- golden alexanders (*Zizia aurea*)
- heart-leaved foamflower (*Tiarella cordifolia*)
- large-leaved aster (*Eurybia macrophylla*)
- May-apple (*Podophyllum peltatum*)
- ostrich fern (*Matteuccia struthiopteris*)
- pearly everlasting (*Anaphalis margaritacea*)
- running strawberry-bush (*Euonymus obovatus*)
- Virginia waterleaf (*Hydrophyllum virginianum*)
- wild strawberry (*Fragaria virginiana*)
- zigzag goldenrod (*Solidago flexicaulis*)

Control Strategies:

Goutweed can be successfully controlled with a combination of methods. Although it is not known to have a long-lived seed bank in the soil, its ability to re-root from rhizome fragments can make control challenging. Digging and hand-pulling can often be counterproductive because these methods fragment the root systems and stimulate reproduction. Small patches can be eliminated through careful and persistent hand-pulling or digging, ensuring that all the rhizomes are removed. The rhizomes break easily so care should be taken when manually removing plants to prevent spread of root fragments. Hand-pulling is easiest and most effective when the soil is moist and loose.

Goutweed employs an explorative growth strategy which requires the consumption of all the plants' reserved carbohydrates in the spring (Meyer and Hellwig 1997). Preventing the plant from photosynthesizing in the early spring will likely deplete the plant of its reserves and would be lethal, allowing for successful control. Once all the plants have fully leafed out (April – May), cut them back and then cover the entire area (at least 90 cm beyond the patch boundaries) with a black tarp or plastic sheeting for several years to starve the plant of any light. For best results, use in combination with another method.

Systemic herbicides that are translocated to the roots and kill the entire plant are the most effective control method for goutweed. Contact herbicides are usually ineffective because it readily leafs out again after defoliation. Repeat applications may be required throughout the growing season to reduce the density.

Care should be taken to limit disturbance to the soil and damage to nearby native plants with any control method. Continue to monitor the sites periodically for several years. Remove any new growth by hand-pulling and removing the entire root system, as required.

Goutweed growing in a natural area, out-competing native species.

Photo courtesy of James Kamstra.

Manual

Pulling and Digging:

Small patches of goutweed can be eliminated by careful and persistent hand-pulling or digging. Take care to ensure the entire plant, along with its rhizomes, is removed from the soil. Hand-pulling and digging can be completed from April to October, however; it is best to pull/dig in June or July when the plant is at its maximum growth stage and the roots have a depleted carbohydrate reserve. Several years of control will be required before eradication is complete.

For hand-pulling, grab the plant at the base of the stem and pull the entire plant from the soil, ensuring the entire root system is removed. It is easiest to hand-pull plants when the soil is moist. For plants with deep growing rhizomes, digging tools may be required and repeated digging/excavation may be required. For best results, dig down to a depth of 60 cm and then sift the soil through a screen to remove all the roots and rhizomes. Rhizomes that are even deeper will be unlikely to regenerate from such a depth (Hodgson 2016). Properly sifting the soil can be a time- and labour-intensive process.

Hand-pulling and digging can be less effective than some of the other methods because it can be difficult to remove all the rhizomes from the soil. Any rhizomes left behind will re-root and sprout new plants. The site should be monitored throughout the growing season and for several years. For any new growth, hand-pull or dig out the plants immediately to prevent re-establishment.

Mechanical

Mowing/Cutting:

Frequent mowing close to the ground may control or slow the spread of goutweed but it is unlikely to exhaust large patches if not used in combination with another method (tarping or herbicide application). Mowing or cutting may eliminate goutweed by removing its leaves and preventing photosynthesis. It is best to mow early in the year (April – May) after it has fully developed leaves. Mowing or cutting alone will help slow the spread but will not eradicate it.

Using a weed cutter or mower, cut the stem as close to the ground as possible, ideally under 2.5 cm. Mow at least once during the growing season (mid-April to mid-October) and repeat for at least 3 – 5 years. Goutweed's reaction to having its leaves cut is to produce new leaves as soon as possible. For better results, mow early in the year (April – May) and several times throughout the growing season.

Since mowing is non-selective, care should be taken to reduce the impacts on the surrounding native species. Mowing should not be done in environmentally sensitive areas or where species at risk are present.

Cutting the flowers before seed set may help control goutweed; however, is considered ineffective since goutweed rarely establishes new populations via seed.

Tilling/Rototilling:

NOT RECOMMENDED.

Tilling will chop the goutweed rhizomes into small pieces and spread them throughout the site. The rhizome fragments will re-root and sprout new plants, resulting in an even denser patch than the original.

Cultural

Tarping:

Preventing goutweed photosynthesis in early spring can control the plant by depleting it of its carbohydrate reserves. After it has fully developed leaves (April – May), cover the patch with landscape fabric, black plastic tarps, sheeting or cardboard, as long as the material is completely opaque, and no sunlight is able to penetrate. The tarp should cover an area larger than the infestation (at least 1 m beyond the patch boundaries) and the edges should be secured to the ground with sandbags, bricks, or landscape staples. The area surrounding the tarp should be monitored and checked regularly to see if the goutweed has escaped beyond the tarp. The tarp needs to be left in place for two or more years to deprive the plant of sunlight and is ideal for small areas or to prevent the spread of localized populations. Without sunlight, the plants will be unable to carry out photosynthesis, causing them to weaken and die.

Goutweed consumes all its carbohydrate reserves during leaf development. Covering the infestation in mid- or late summer will be much less effective since it will have gained a substantial carbohydrate reserve. For the best results, mow or cut the patch prior to covering with a tarp. This control method should be done in an area of full sun; on smooth, flat areas; and in areas where the tarp will not be disturbed to be most effective. Provided that the tarp is black or dark coloured, solarization will kill the plants under the tarp. Adding signage explaining the purpose of the tarp will help to prevent it from being stolen or thrown out. Tarping is a non-selective control method and care needs to be taken not to suppress native plant populations. In addition, site selection should also take into consideration that tarping may damage soil microbial activity and potentially altering soil nutrient cycling.

Tarping done by Red Fox Forestry using a black plastic tarp.

Photo courtesy of: Christen Dschankilic, Red Fox Forestry

Tarping done by Hamilton Conservation Authority using a layer of wet paper and a layer of cardboard.

Photo courtesy of: Diana Gora, Hamilton Conservation Authority

Mulching:

NOT RECOMMENDED.

Similar to tarping, mulching acts by depriving goutweed of sunlight and preventing it from carrying out photosynthesis. At least 30 cm of mulch (ideally shredded bark mulch or similar to completely cut off light) will be required to effectively shade out goutweed. For mulch to be effective, it is best to mow the site first and then cover with mulch (similar to tarping). Alternatively, placing cardboard over the patch before covering with mulch has yielded positive results. Revisit the site frequently throughout the growing season to ensure the mulch is still an adequate depth. Recover the site with mulch as required.

Prescribed Fire:

NOT RECOMMENDED.

Goutweed will likely be top-killed by fire and resprout from the root crown. Goutweed may survive if the rhizomes are deep enough in the soil to protect it from fire. If it is a very large infestation, prescribed burning more than once may be beneficial in gaining some control over the infestation prior to another control method.

Biological

Biological control is the use of a herbivore, predator, disease or other natural control to reduce established populations of invasive species. Many invasive species have no natural controls in their new habitats. Biological control aims to re-establish an ecological balance between the invasive species and its natural controls by selecting highly host-specific natural controls, such as predatory insects or diseases, from the country of origin and moving them to the country where the invasive species is a problem. This is done after extensive host-range testing in the country of origin or under quarantine, to ensure that the potential biocontrol agent is host-specific to the targeted invasive species.

At the time of publication, there are no biological control agents currently available for goutweed. For more information on the status of biological control agents in Canada, visit: https://inspection.canada.ca/plant-health/invasive-species/biological-control-agents/eng/1514956211166/1514956212112

Chemical

Foliar Spray:

Chemical application may be done using a foliar spray method. Systemic herbicides that are translocated to the roots and kill the entire plant are the most effective control method for goutweed. This method is most effective with a product containing the active ingredients glyphosate or triclopyr.

Herbicides should be applied to the plants between May and October. It is most effective to apply the herbicides earlier in the growing season, after it has fully leafed out and before it flowers. Spray until the leaves are just covered and the herbicide is not dripping off the leaves. A subsequent application that targets missed or emerging plants may be necessary but may not be permitted for some herbicides. Check the pesticide label for further restrictions regarding treatment frequency.

For older growth, first mow/cut the plants short (~2.5 cm) and monitor the site throughout the growing season for any new growth. Manually remove (pull or dig) entire plants, along with the rhizomes, from the soil or spray any new growth with the herbicide (if multiple treatments per year are permitted).

Systemic herbicides such as glyphosate and triclopyr are non-specific and can damage or kill desirable native plants that may be accidentally sprayed during treatment. Exercise caution if goutweed is interspersed with desirable native species. These herbicides are not for use near water. Consult pesticide label and carrier agent/surfactant labels for information on how the pesticide can legally and safely be used.

Disposal

Do not backyard compost

Home composters do not reach the temperature necessary to kill the seeds or rhizomes. Do not compost viable plant material (e.g., seeds, fruit, or rhizomes).

After control

Following control, plant material should be removed from the site to prevent re-rooting or re-establishment. Place all material in a black garbage bag and dispose of it in a landfill. Ensure you are disposing of all rhizomes. If any rhizome fragments are left behind, they can re-root and sprout new plants.

Municipal compost

Viable plant material (seeds, fruit, and rhizomes) should only be composted if the material is taken to a large-scale municipal composting facility where the compost pile reaches temperatures high enough to kill the living material. Composting operations that demonstrate strict adherence to pathogen kill processes and maintain optimal moisture conditions may provide sufficient conditions to destroy most reproductive material of invasive plants. Ontario composting facilities are required to routinely monitor the compost process and meet strict, provincially regulated time-temperature parameters for pathogen kill. Consult your local municipality to determine if this is an appropriate course of action.

Solarize

If seeds are present, plant material can be placed in black plastic bags. Seal the bags tightly and leave them in direct sunlight for 2 – 3 weeks to cook or kill the viable plant material. Tarps can also be used if there is a large amount of biomass to solarize. Place the tarp below and above the plant material, ensuring all plant material is in the center of the tarp and is not in contact with the soil. Secure the edges to the ground with sandbags, bricks, or landscape staples, and leave in place for 2 – 3 weeks. The rotten material can then be composted or disposed of in a landfill.

Goutweed growing through leaf litter.

Photo courtesy of: Tomas Pocius, inaturalist.org/observations/11414270

Restoration

During Control

Mulching:

Covering sites with mulch immediately after invasive species control can reduce further invasive seedling establishment and growth, and prevent colonization by other invaders before restoration planting takes place. Spread approximately 15 – 30 cm of mulch across the site. Ensure the equipment and mulch used does not contain any other invasive plant material. Monitor the site for several weeks and remove any new growth of invasive plants. Leave the mulch on site to biodegrade before beginning restoration.

Note that this technique is not appropriate for nutrient poor soils like savannas, because mulching adds nutrients to the soil and the increase of nutrients would drastically alter the function of these ecosystems. One must also take care when using this method not to suppress known populations of native plants. A floral inventory of the site prior to control would be beneficial if employing this method.

Seeding:

Broadcasting seeds of native plant species immediately after management activities may be useful to prevent the establishment of new invasive species. This can give desirable native species the chance to establish themselves. It is important to wait until all management activities are completed before attempting seeding. This prevents the new plants from being killed by ongoing management activities.

Native plants planted following removal of invasive plants.

Photo courtesy of Jaclyn Scobie, City of Toronto

After Control

Planting:

Once goutweed has been removed from a site, consider restoration by planting site-appropriate native species. This is particularly important on sites where erosion is a concern or where other invasive plants are likely to colonize the site. Wait until all management activities are completed if doing a large stock (e.g., potted) re-planting to ensure newly planted stock is not damaged or killed by ongoing management. When planting after control, consider space and light availability (have any trees recently been removed that 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. A diverse mix of plants suited to the growing conditions on site and suited to the project goals should be considered for replanting.

Preventing the Spread

Prevention and early detection are the most effective tool for controlling the spread of goutweed and everyone can help. Follow these tips:

☑ Report it.

If you think you see goutweed, take a picture, record the location, and report it using the following tools: contact the Invading Species Hotline at 1-800-563-7711 or report online at www.eddmaps.org/ontario or www.inaturalist.ca. For more information, call the Invading Species Hotline at **1-800-563-7711** or visit www.invadingspecies.com or contact the Ontario Invasive Plant Council at info@oninvasives.ca.

☑ Watch for it.

Learn to recognize goutweed 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.

☑ Stay on trails.

Avoid traveling off-trail and in areas known to have goutweed or other invasive species.

☑ 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.

☑ 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. Do not plant goutweed and if you have removed it, replant with native species. 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/.

Tracking the Spread (Outreach, Monitoring, Mapping)

Several reporting tools have been developed to assist the public and resource professionals to report goutweed sightings, track the spread, detect it early and respond to it quickly. These include:

1) **EDDMapS Ontario:** an online reporting tool and FREE mobile application (iPhone and Android) where users can report sightings, review distribution maps, and explore educational resources of invasive plants and other invasive species. This tool is free to use at www.eddmaps.org/ontario, and can be downloaded from your app store.

2) **The Invading Species Hotline:** a toll-free telephone number (**1-800-563-7711**) operated by the Invading Species Awareness Program where individuals can report sightings verbally.

3) **iNaturalist:** an online citizen science reporting tool where users can report sightings and review distribution maps. This tool is free to use at http://www.iNaturalist.ca/ and can be downloaded from your app store.

If you suspect you have encountered goutweed or other invasive species, please take detailed photographs (e.g., entire plant, leaves, stem, flowers, or other identifying features), mark your location, and report it using one of the above methods.

Additional Resources

Advice from a professional: Ground Elder and how to kill it [video].

https://www.youtube.com/watch?v=IJCOIjJSfV0

Garden Invaders – Goutweed [video].

https://www.youtube.com/watch?v=-x-f8-oPCE4

How to kill goutweed using leaves – MartimeGardening.com [video].

https://www.youtube.com/watch?v=-9bKL54Oe-A

Best Management Practices Documents Series from the OIPC

Autumn Olive

Black Locust

Erect Hedge-parsley

European Black Alder

European frog-bit

Eurasian Water-milfoil

Flowering Rush

Garlic Mustard

Giant Hogweed

Goutweed

Invasive Common (European) Buckthorn

Invasive Dog-strangling Vine

Invasive Honeysuckles

Invasive Reed Canary Grass

Japanese Knotweed

Multiflora Rose

Norway Maple

Oriental Bittersweet

Phragmites (Common Reed)

Phragmites (Common Reed) Best Management Practices for Ontario Roadways

Purple Loosestrife

Scots Pine

Spotted Knapweed

White Mulberry

White Sweet Clover

Wild Parsnip

Winged Euonymus

Additional Publications from the OIPC

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 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

Invasive Plant Technical Bulletin Series

The Landowners Guide to Controlling Invasive Woodland Plants

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