

# Scots Pine

(*Pinus sylvestris*)

Best Management Practices in Ontario



# Foreword

These Best Management Practices (BMPs) provide guidance for managing invasive Scots pine (*Pinus sylvestris L.*) in Ontario. Funding and leadership for the production of this document was provided by Environment and Climate Change Canada, Canadian Wildlife Service - Ontario (CWS - ON). The BMPs were developed by the Ontario Invasive Plant Council (OIPC) and its partners to facilitate the invasive plant control initiatives of individuals and organizations concerned with the protection of biodiversity, agricultural lands, infrastructure, crops and natural lands.

These BMPs are based on the most effective and environmentally safe control practices known from recent research and experience. They reflect current provincial and federal legislation regarding pesticide use, habitat disturbance and species at risk protection. These BMPs are subject to change as legislation is updated or new research findings emerge. They are not intended to provide legal advice. 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](http://www.ontarioinvasiveplants.ca)) for updates.

---

Marinich, Allison and Powell, Kate. 2017. Scots pine (*Pinus sylvestris L.*) Best Management Practices in Ontario. Ontario Invasive Plant Council, Peterborough, ON.

Printed April 2017  
Peterborough, Ontario

ISBN: (to be confirmed)

This document was prepared for Environment and Climate Change Canada's Canadian Wildlife Service - Ontario by the Ontario Invasive Plant Council.

Support for the production and publication of this document was provided by:  
Environment and Climate Change Canada, Canadian Wildlife Service – Ontario.

Inquiries regarding this document can be directed to:

**Ontario Invasive Plant Council**  
PO Box 2800, 4601 Guthrie Drive  
Peterborough, ON, K9J 8L5  
Phone: (705) 748-6324 ext. 243 | Email: [info@oninvasives.ca](mailto:info@oninvasives.ca)

For more information on invasive plants in Ontario, please visit the following websites:

[www.ontario.ca/invasivespecies](http://www.ontario.ca/invasivespecies), [www.ontarioinvasiveplants.ca](http://www.ontarioinvasiveplants.ca), [www.invadingspecies.com](http://www.invadingspecies.com) or  
[www.invasivespeciescentre.ca](http://www.invasivespeciescentre.ca)

# Table of Contents

Foreword .....	i
Introduction.....	1
Identification .....	3
Biology and Life Cycle.....	8
Pathways of Spread and Distribution in Ontario .....	10
Impacts.....	11
Ecological .....	11
Economic.....	13
Legislation .....	14
Federal.....	14
Provincial .....	16
Municipal .....	17
Best Management Practices.....	18
Management Considerations .....	18
Mapping .....	19
Landscape Level Management .....	19
Long-term Management and Monitoring .....	22
After Management: Assessing Regeneration vs. Restoration .....	22
Control Measures.....	23
Mechanical .....	24
Stand Conversions.....	26
Biological.....	27
Chemical.....	28
Disposal of Plant Material .....	31
Restoration .....	32
Control Measures Summary .....	33
Preventing the Spread .....	34
Tracking the Spread (Outreach, Monitoring, Mapping).....	35
Sources.....	36
Acknowledgements.....	37



Scots Pine.

Photo courtesy of Caroline Mach



Scots pine is shade intolerant and tends to dominate niches such as old fields, roadsides, open bogs and open woods, structurally changing ecosystems as it shades previously open areas.

Photo courtesy of Don Tyerman.

## Introduction

Scots pine (*Pinus sylvestris L.*), also known as Scotch pine, Scots fir, Irish Giuis, common pine or red fir, is a tree belonging to the pine (*Pinaceae*) family. It is among the most widely distributed conifer species with a natural range from Western Europe (Scotland) to Eastern Siberia, south to the Caucasus Mountains and as far north to the Scandinavian Peninsula in the Arctic Circle.

Scots pine was among the first European tree species introduced to North America. In Ontario, it was used in an effort to control soil erosion by reforesting abandoned agricultural lands. Scots pine was imported to stabilize the soil system based on recommendations by forestry experts in Europe in the early 1900s. It gained recognition for its ability to survive and help stabilize sites with drier soil and erosion issues. Scots pine now exists as a significant species component in many stands contained in municipal and conservation authority forests in southern Ontario.

Between the 1950s and 1980s, Scots pine was one of the most sought after Christmas trees. Scots pine plantations emerged across southern Ontario as landowners saw the developing Christmas tree industry as a new economic opportunity. However, within a relatively short time period, species such as balsam fir (*Abies balsamea*), Fraser fir (*A. fraseri*) and Douglas fir (*Pseudotsuga menziesii*) became more popular Christmas tree options and as a result, Scots pine harvesters were reluctant to provide the necessary pruning and tending. This led to plantations of Scots pine growing to the point of no longer being marketable. Many of the Scots pine plantations in Ontario today were originally established for the Christmas tree industry.

In its natural range of Europe and parts of Asia, Scots pine is viewed as an important commercial species as it is commonly harvested for poles, posts, flooring, paper and construction lumber. In Ontario, it's now viewed less favourably by many landowners. Although it is widely naturalized, it still has invasive characteristics and is a vector or reservoir for some insect pests and diseases to valued tree species. There are more than 100 documented insect or disease issues associated with Scots pine in Ontario, several of which are introduced pests. For example, Scots pine is a vector for pine wilt disease which is spread through the pine wood nematode pathogen. Several of the associated insect pests, such as the pine shoot beetle (*Tomicus minor*), are of special concern as the potential ecological and economic impact extends to other valuable tree species.



Scots pine in plantations for the Christmas tree industry required much pruning and tending.

Photo courtesy of USDA Forest Service, Bugwood.org.

Scots pine produce many seeds that spread and develop into aggressively growing seedlings. These seedlings reach reproductive maturity quickly, allowing them to outcompete native wildflowers, grasses as well as native oak, maple and pine species by monopolizing root space and creating shade. In Ontario, Scots pine have invaded many sensitive ecosystems including oak savannas, tall grass prairies and sand dunes. Scots pine will also spread along roadsides, meadows, old fields and open woods as it is relatively shade intolerant.

This document was developed to help guide the effective and consistent management of this invasive tree across Ontario.



One female lesser pine shoot beetle (*Tomicus minor*) can lay up to 100 eggs, creating egg galleries across fibers deep within sapwood (shown here) leading to the death of the tree top.

Photo courtesy of Petr Kapitola, Central Institute for Supervising and Testing in Agriculture, Bugwood.org.

# Identification

## Size and shape:

A mature tree is large, growing up to 35 m in height and 1 m in diameter. They often have a crooked trunk with sparse branching and an irregularly-shaped crown.



Scots pine often have a crooked trunk with sparse branching and an irregular-shaped crown.

Photo courtesy of Sean James.

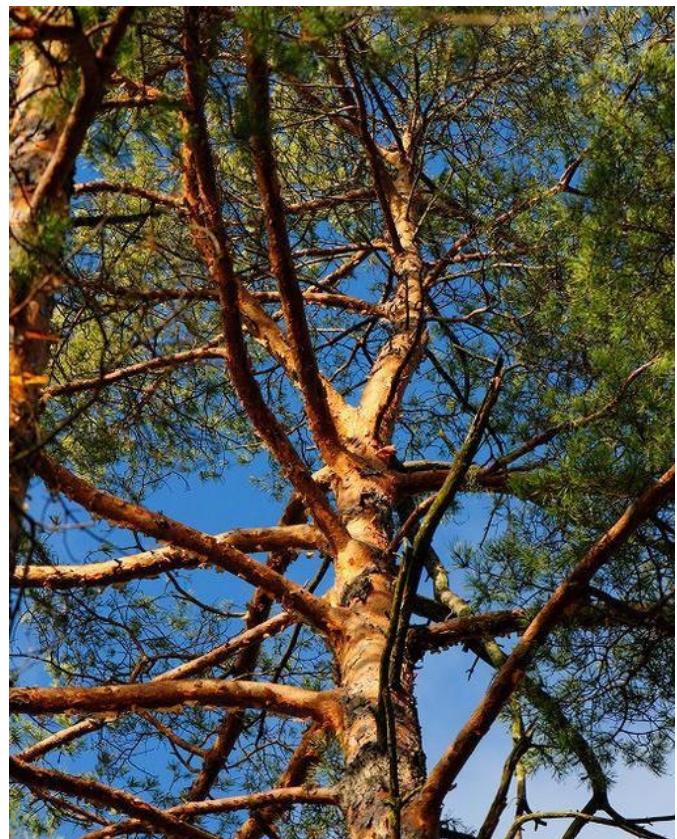
## Bark:

The bark is thick, scaly, dark grey-brown on the lower trunk and thin, flaky and orange-brown on the upper trunk and branches.



The bark is thick, scaly and dark grey brown on lower trunk and thin.

Photo courtesy of Bill Cook, Michigan state university, Bugwood.org.



Thin, flaky orange-brown bark of the upper trunk and branches.

Photo courtesy of Verk Wilkins, Indiana University, Bugwood.org.

## Leaves:

On mature trees, leaves (needles) are dull, greyish blue-green and dark green to dark yellow-green in the winter. They are slightly twisted, 2.5-5 cm in length, 1-2 mm wide and bunched in groups of two with a grey 5-10 mm basal sheath. The needle-like leaves on young trees can grow up to twice as long and may occur in bunches of three or four.



Needles bunched in groups of two and grey basal sheaths.

Photo courtesy of Paul Wray, Iowa State University, Bugwood.org.



Bunches of two slightly twisted, 2.5-5 cm in length, 1-2 mm wide needles.

Photo courtesy of Keith Kanoti, Maine Forest Service, Bugwood.org.

## Flowers:

Scots pine is monoecious, which means it has both male and female flowers on one tree. Male flowers consist of yellow anthers at the base of shoots. Female flowers are smaller, globular, red-purple and grow on the tips of new shoots.



Pollen is released from 8-12 mm long cones in spring.

Photo courtesy of Robert Videki, Doronicum KFT., Bugwood.org.

## Fruit:

The male cones are yellow or sometimes pink, 8-12 mm long and release pollen in the spring. Once pollinated, female flowers turn green and develop into seed cones. In their first year, seed cones are globular and 4-8 mm in diameter. By the second or third year, seed cones are pointed, ovoid-conic and 3-7.5 cm long. It takes 2-3 years for cones to mature and release their seeds.



Seed cones 1-2 years after pollination which are pointed, ovoid-conic shaped.

Photo courtesy of Bill Cook, Michigan state university, Bugwood.org.

## Seeds:

Seeds are black, 3-5 mm long with a tan-coloured wing that is 12-20 mm long.



The seeds from this cone have already begun to drop.

Photo courtesy of Sean James.

## Roots:

Scots pine root system is usually shallow, it can develop a deep taproot on dry soils.

## Lookalikes

Table 1: The main identification features of Scots pine in comparison to four species that may appear similar (lookalikes).

	<b>Scots pine</b> ( <i>Pinus sylvestris</i> )	<b>Red pine</b> ( <i>Pinus resinosa</i> )	<b>White pine</b> ( <i>Pinus strobus</i> )	<b>Jack pine</b> ( <i>Pinus banksiana</i> )	<b>Mugo pine</b> ( <i>Pinus mugo</i> )
	 Photo courtesy of Paul Wray.	 Photo courtesy of Paul Wray, Iowa State University, Bugwood.org.	 Photo courtesy of Paul Wray, Iowa State University, Bugwood.org.	 Photo courtesy of Keith Kanoti, Maine Forest Service, Bugwood.org.	 Photo courtesy of Richard Webb, Bugwood.org
<b>Habitat</b>	<ul style="list-style-type: none"> <li>Native to Europe</li> <li>Fields, open areas, forests</li> <li>Can grow almost anywhere- shallow or sandy soil</li> <li>Can grow in degraded, shady conditions</li> </ul>	<ul style="list-style-type: none"> <li>Native to Ontario</li> <li>Forests, level or gently rolling sand plains, low ridges next to lakes and swamps, open and rocky areas</li> <li>Grows on drier soils</li> </ul>	<ul style="list-style-type: none"> <li>Native to Ontario</li> <li>Forests, fields and open areas</li> <li>Grows best in full sunlight, on dry/fresh, coarse, loamy soils</li> <li>Intolerant of road salts</li> </ul>	<ul style="list-style-type: none"> <li>Native to Ontario</li> <li>Can grow almost anywhere- on shallow or sandy soil, and even on rock or permafrost</li> <li>Gnarled and lopsided when grown on rocky, shallow soil</li> </ul>	<ul style="list-style-type: none"> <li>Native to the mountains of Europe including the Alps, Apennines, Pyrenees and Balkans</li> <li>Requires full sunlight for growth</li> <li>Drought and salt tolerant</li> </ul>
<b>Height</b>	Up to 35 m	Up to 35 m	Up to 40 m	Up to 24 m	Up to 1.5 m
<b>Bark</b>	<ul style="list-style-type: none"> <li>Bark is thick, scaly, dark grey-brown on the lower trunk and thin</li> <li>Flaky, orange-brown on the upper trunk and branches</li> </ul>	<ul style="list-style-type: none"> <li>Bark is reddish-brown in colour</li> <li>Flaky</li> <li>Bark becomes broken into wide, flat ridges separated by splits on older trees</li> </ul>	<ul style="list-style-type: none"> <li>On young trees, bark is greyish-green, changing to a dark-greyish-brown with age</li> <li>Mature bark has deep, thick ridges that are 1 – 5 cm wide</li> </ul>	<ul style="list-style-type: none"> <li>Bark is reddish-brown</li> <li>Flat</li> <li>Bark grays as tree matures</li> <li>Often has tufts of needles growing from the mature bark/trunk</li> </ul>	<ul style="list-style-type: none"> <li>Bark is rough and brownish-gray</li> <li>Scaly, pleated appearance but does not peel</li> </ul>

	<b>Scots pine</b> ( <i>Pinus sylvestris</i> )	<b>Red pine</b> ( <i>Pinus resinosa</i> )	<b>White pine</b> ( <i>Pinus strobus</i> )	<b>Jack pine</b> ( <i>Pinus banksiana</i> )	<b>Mugo pine</b> ( <i>Pinus mugo</i> )
Leaves	<ul style="list-style-type: none"> <li>Needles (leaves) are dull, greyish blue-green and dark green to dark yellow-green in the winter</li> <li>Slightly twisted, 2.5 – 5 cm in length, 1 - 2 mm wide</li> <li>Bunched in groups of two with grey 5 – 10 mm basal sheath</li> </ul>	<ul style="list-style-type: none"> <li>Needles (leaves) are shiny dark green</li> <li>Grow in bunches of two</li> <li>10 - 18 cm long</li> <li>Snap or break cleanly when bent</li> </ul>	<ul style="list-style-type: none"> <li>Needles are dark blue-green in colour</li> <li>Grow in bunches of five</li> <li>6 - 12 cm long</li> <li>Skinny with finely tooth edges</li> <li>Straight, flexible and soft to touch</li> </ul>	<ul style="list-style-type: none"> <li>Needles are light-green</li> <li>Grow in bunches of two</li> <li>2 - 4 cm long</li> <li>Slightly curved or twisted</li> </ul>	<ul style="list-style-type: none"> <li>Needles are dark green and dense on branches</li> <li>Grow in bunches of two</li> <li>3 - 7 cm long</li> <li>Stiff and curved</li> </ul>
Flowers	<ul style="list-style-type: none"> <li>Monoecious (has both male and female flowers on one tree)</li> </ul>	<ul style="list-style-type: none"> <li>Monoecious</li> <li>Males- roundish, light red and in large clusters at tips of branches; Females- short, round and reddish-brown</li> </ul>	<ul style="list-style-type: none"> <li>Monoecious</li> <li>Males- cylindrical, yellow, in clusters near tips of branches; Females- light green, red tinged, found at the ends of branches</li> </ul>	<ul style="list-style-type: none"> <li>Monoecious</li> <li>Males- cylindrical, yellow-green, in clusters near tips of branches; Females-oval, reddish, appearing in spring</li> </ul>	<ul style="list-style-type: none"> <li>Monoecious</li> <li>Males- yellow in colour; Females- Purplish to reddish-tan in colour, appearing in spring</li> </ul>
Fruit	<ul style="list-style-type: none"> <li>Yellow or sometimes pink pollen (male) cones (8 – 12 mm)</li> <li>Release pollen in spring</li> <li>Female flowers turn green after pollination and develop into seed cones</li> <li>Globular seed cones (4-8 mm) until second or third year when mature they become pointed (3 - 7.5 cm)</li> </ul>	<ul style="list-style-type: none"> <li>Purple before maturity</li> <li>Chestnut-brown at maturity</li> <li>Cones are egg-shaped, 3.5 - 7 cm long and 2.5 cm wide</li> </ul>	<ul style="list-style-type: none"> <li>Green before maturity</li> <li>Brown at maturity, often encrusted with white, sticky resin</li> <li>Slender, cylindrical and long (8 - 16 cm)</li> <li>Has thick, rounded scales</li> </ul>	<ul style="list-style-type: none"> <li>Light-brown at maturity but graying with age</li> <li>3 - 8 cm long, curved</li> <li>Scales open in high temperatures (e.g. forest fires) allowing release of seeds</li> </ul>	<ul style="list-style-type: none"> <li>Purplish-red before maturity</li> <li>Nut-brown at maturity</li> <li>2.5 - 7.5 cm long</li> <li>Oval</li> </ul>

# Biology and Life Cycle

Scots pine is an evergreen coniferous tree that can live for 80 years or longer under ideal growing conditions. It has been reported to produce seeds up to the age of 200 years, although seed quality and quantity become reduced.

Scots pine is monoecious, meaning it has both male and female flowers on the same tree. Development of male flowers begins in late summer and for months their presence is noted as a slight swelling. Male flowers become more noticeable after about 2 weeks of growth in the spring when they enlarge to 0.6 to 0.7 cm long. Male flowers are yellow, shed pollen and are located at the base of new shoots.

Female flowers are also formed in late summer, however, they are not visible to the naked eye. They first become visible at the tips of new shoots after a 2 week growth period in the spring. At this point they are small, globular and reddish-purple. In early summer, female flowers are pollinated by the wind. A little more than a year after pollination, female flowers develop into small cones which rapidly elongate and reach full size by early summer.

Scots pine seeds mature and cones begin to open in October, however, most seeds remain with the tree until the spring. The cone will eventually break up in the wind, fall to the ground or be eaten by animals thereby allowing for seed dispersal. High seed crops are produced in intervals of every 3 to 6 years with light crops in-between. One kilogram (2.2 lb) of average-size cones produce ~ 3,300 seeds which remain viable for several years.

Once seeds are dispersed they begin to germinate and then grow into seedlings. These seedlings require abundant sunlight collected through their needles and nutrients from the soil to continue growing.

Eventually the seedlings develop into saplings with several branches filled with thousands of needles. These saplings produce flowers, seed cones and can grow up to 0.8 m (2.5 ft) per year as they mature, reaching heights of up to 35 m (115 ft).

Scots pine commonly develops a taproot that reach average depths of 1.5 to 3.0 m (4.9 to 9.8 ft). These taproots are common on dry and sandy soil.

In its native range, Scots pine grow tall and straight, allowing the wood to be harvested for lumber. Typically it is the inland trees which grow tall and straight, whereas the warped and haphazardly growing Scots pine stock is the variety of the tree that grows on the coast. The gnarled trees are adapted to coastal conditions including poor soils, harsh habitat, and high winds. In Ontario, Scots pine grow in a warped and haphazard manner. This is due to differences in climate and soil conditions between its native and invasive range, damage by pests and poor quality of stock with limited genetic diversity from Scots pine's initial North American introduction.



In Ontario, Scots pine often grow in a warped and haphazard manner with irregular shaped crowns.

Photo courtesy of Luana Vargas, Desert Botanical Garden, Bugwood.org.

## Habitat

Scots pine grows naturally in several habitats including open pine forests and woodlands, rocky hills, eskers, bogs and swamps. As indicated by its large natural range in Europe, Scots pine can grow in a wide variety of climates. It grows in areas with an annual precipitation over 1,780 mm and as low as 200 mm. Scots pine survives in the Verkhoyansk Mountains of Siberia where the temperature can be as low as -64° C during the winter months. In addition, Scots pine is capable of growing in areas with a permanently frozen subsoil. Conversely, Scots pine may also survive high temperatures, as it grows in the Mediterranean region of Europe.

Scots pine can tolerate a wide variety of soil types, however, it grows best on light, well-drained and sandy soils. Although it can grow on soils with pH ranging from 4.0 - 7.0, the optimal pH range is 4.5 - 6.0. It is intolerant of shade, therefore thrives in open disturbed areas near cities and suburbs, roadsides, meadows and open fields.



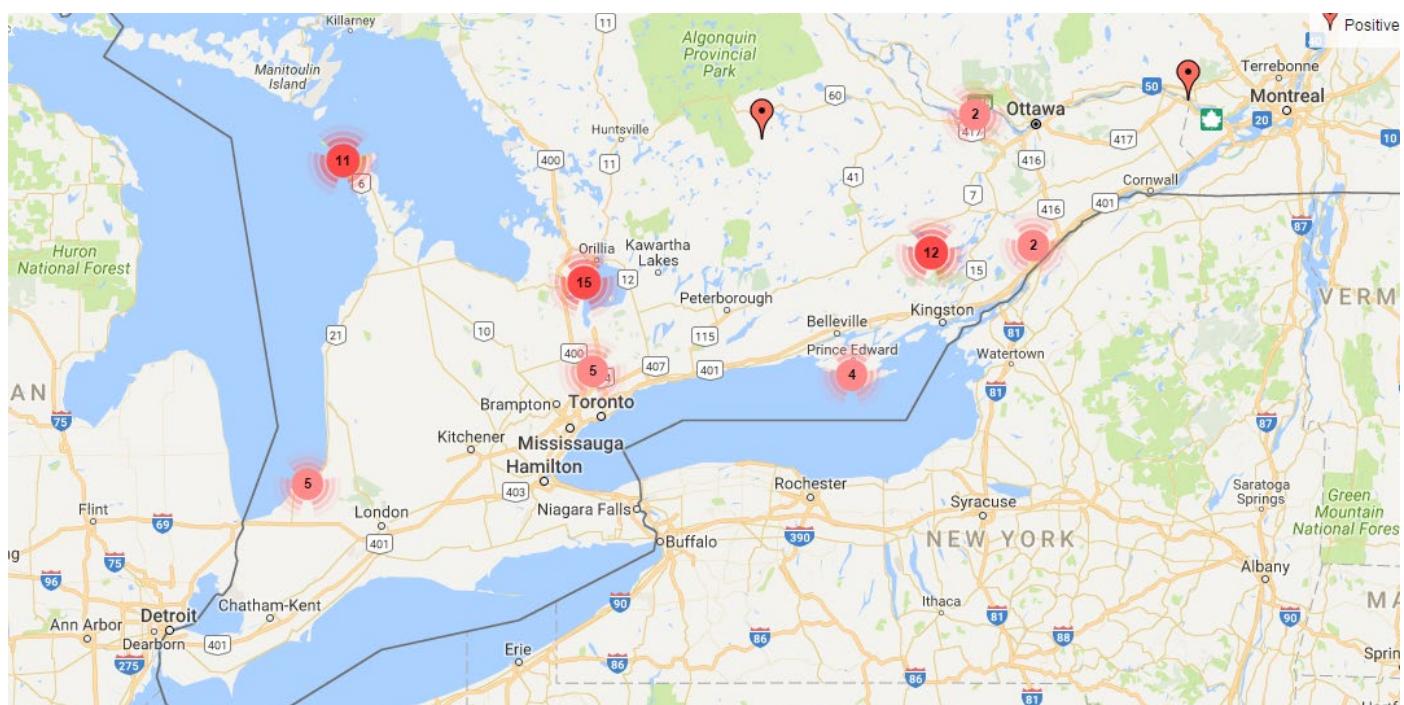
Scots pine dominant forest stands and reduce biodiversity.

Photo courtesy of Bill Mcilveen.

# Pathways of Spread and Distribution in Ontario

Scots pine is planted in windbreaks, to reduce soil erosion and in plantations as part of the Christmas tree industry. Scots pine produce many seeds that are dispersed great distance by wildlife, such as grazing deer, and wind. Seedling progression into open fields and meadows occurs when seed sources are nearby. Scots pine may also infiltrate forest stand interiors where light is plentiful through openings created by plantation thinning operations or a natural windthrow.

Although it is most abundant in southern Ontario, Scots pine can be found throughout Ontario. It has also been reported in British Columbia, Alberta, Saskatchewan, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Labrador.



# Impacts

## Ecological

### Vegetation Communities:

The aggressive and early growth of Scots pine gives it a competitive advantage against native tree species including black cherry (*Prunus serotina*), red maple (*Acer rubrum*), sugar maple (*A. saccharum*), American beech (*Fagus grandifolia*), quaking aspen (*Populus tremuloides*), black oak (*Quercus velutina*) and eastern white pine (*Pinus strobus*). When competing for establishment, Scots pine quickly forms a dense mat of seedlings that crowd out native tree species. Scots pine not only dominates above ground growth, but also spreads its roots below ground, further crowding out native species. The dominance of Scots pine over other species leads to a reduction in biodiversity.

Scots pine may also move into sensitive Ontario ecosystems including tallgrass prairies, oak savannas and sand dunes. More specifically, the invasion of Scots pine puts Presqu'ile Provincial Park's panne (flat, wet and largely open sandy areas) at risk. This rare ecosystem is one of only 20 habitats like it in the world and is home to grasses and wildflowers unable to grow elsewhere. Some of these species include fen grass-of-Parnassus (*Parnassia glauca*), ladies tresses (*Spiranthes spiralis*), purple false foxglove (*Agalinis purpurea*) and closed bottle gentian (*Gentiana andrewsii*). Presqu'ile's panne also supports Wilson's Snipe (*Gallinago delicata*) and the Western chorus frog (*Pseudacris triseriata*).

Scots pine tends to only dominate certain niches as it is shade intolerant. These niches include old fields, roadsides, open bogs and open woods. Therefore, Scots pine has the capability to structurally change an ecosystem, as it brings shade and cover to previously open areas. Scots pine also generates significant needle litter that alters nutrient cycling and therefore affects regeneration and/or growth of other community components. Scots pine also tends to invade outward from the edge of established stands. Rarely do young Scots pine trees grow among mature Scots pine trees, rather you see dense thickets of them developing around the fringes.

### Wildlife

Wherever Scots pine establishes, it reduces plant species richness and diversity. This is especially concerning for the species designated under the *Species at Risk Act* (SARA) as being extirpated, endangered or of special concern in Canada. Many of these may be impacted by this reduction in biodiversity. The following is a list of Species at Risk for which Scots pine is named as a specific threat to the species in Ontario in either the federal Recovery Strategy (for species listed as Threatened or Endangered) or in the federal Management Plan (for species listed as Special Concern). More information can be found at the *Species at Risk Act* (SARA) Registry ([www.sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1](http://www.sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1)).



Scots pine grows in dense stands reducing habitat available for wildlife including Species at Risk.

Photo courtesy of Stanislaw Kinelski, Bugwood.org.

**Table 2:** Species at Risk for which Scots pine is named as a specific threat in Ontario.

Species at Risk	Status	Habitat / Details	Primary Threat(s) from Scots pine
<b>White Colicroot (<i>Aletris farinosa</i>) (high threat)</b>	<ul style="list-style-type: none"> <li>Threatened</li> </ul>	<ul style="list-style-type: none"> <li>Herbaceous perennial in the Bog Asphodel family (Nartheciaceae)</li> <li>Restricted to four geographic regions in southwestern Ontario: the City of Windsor-Town of LaSalle; Walpole Island; near Eagle (Municipality of West Elgin); and is presumed to be extirpated near Turkey Point (Haldimand-Norfolk County)</li> <li>Grows in open, moist, sandy ground associated with tallgrass prairie habitats and damp sandy meadows</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss due to invasion/competition</li> </ul>
<b>Swamp Rose Mallow (<i>Hibiscus moscheutos</i>) (high threat)</b>	<ul style="list-style-type: none"> <li>Special Concern</li> </ul>	<ul style="list-style-type: none"> <li>Perennial growing to 2 m in height</li> <li>Found only in southern Ontario</li> <li>Grows in open, coastal marshes, but it is also sometimes found in open wet woods, thickets and drainage ditches</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss due to invasion/competition</li> </ul>

Species at Risk	Status	Habitat / Details	Primary Threat(s) from Scots pine
<b>Skinner's False Foxglove</b> <i>(Agalinis skinneriana)</i> <b>(high threat)</b>	<ul style="list-style-type: none"> <li>Endangered</li> </ul>	<ul style="list-style-type: none"> <li>Annual herb growing to 60 cm in height</li> <li>Occurs in extreme southwestern Ontario. In 1987, there were 11 sites known on Walpole and Squirrel islands in Lambton County, and one small site in neighbouring Essex County. Only five of the Lambton sites still contained specimens in 1997; the current status of the Essex site is unknown</li> <li>Grows in dry prairies, open woods, rocky open glades, bluffs or pockets among sand dunes, where the soil is shallow</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss due to invasion/competition</li> </ul>
<b>Purple Twayblade</b> <i>(Liparis liliifolia)</i> <b>(high threat)</b>	<ul style="list-style-type: none"> <li>Endangered</li> </ul>	<ul style="list-style-type: none"> <li>Orchid which can reach a height of 25 cm</li> <li>In Canada it is found only in southern Ontario</li> <li>In 1989, it was known from a total of eleven locations, since then, a few small sites have been found in Windsor, but the plant has not been relocated at some former sites, and has generally declined</li> <li>Requires open oak savannah and secondary successional, deciduous or mixed forest habitats</li> <li>It will grow in partial shade, but does not tolerate dense shade; it is thus dependent on natural disturbances for its survival</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss due to invasion/competition</li> </ul>
<b>Forked Threeawn Grass</b> <i>(Aristida basiramea)</i> <b>(low/potential threat)</b>	<ul style="list-style-type: none"> <li>Endangered</li> </ul>	<ul style="list-style-type: none"> <li>Annual plant restricted to North America</li> <li>Five known populations in Canada; four in Ontario</li> <li>Restricted to areas that are dry, open, and sandy or disturbed</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss due to invasion/competition</li> </ul>

## Economic

### Agricultural

Due to the large-scale planting of Scots pine after the Second World War in response to the Christmas tree industry, followed by the loss of demand for this species due to overplanting and more suitable Christmas tree species, economic viability of this species for many landowners was lost. The former Midhurst Forest Station reported peak sales of 3.3 million Scots pine seedlings in 1958, which declined to 500,000 seedlings by 1967. Sales of Scots pine remained steady until 1980, when eventually, production was phased out.

# Legislation

Many plant species and control methods are regulated under federal and/or provincial legislation. Regulations regarding Scots pine and chemical and biological control of Scots pine at the time of writing are also summarized in this document. **Please note that this is for clarity only and not legal advice.**

You are responsible for ensuring that your project follows all relevant legislation. If protected species or habitats are present, an assessment of the potential effects of the control project could be required. Not all of the legislation below will apply to your project, therefore read carefully to determine the applicable legislative requirements needed for your project.

Consult with your local MNRF district office early in your control plans for advice (<https://www.ontario.ca/page/ministry-natural-resources-and-forestry-regional-and-district-offices>) or visit <https://www.ontario.ca/environment-and-energy/how-get-endangered-species-act-permit-or-authorization> to learn more about specific permitting requirements.



Scots pine encroaches into open areas, such as Presqu'ile Provincial Park's rare panne habitat.

Photo courtesy of David Bree.

## Federal

### **Plant Protection Act and Plant Protection Regulations**

Under the *Plant Protection Act* 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* are included in the list of [Pests Regulated by Canada](#).

Scots pine is not listed under the Pests Regulated by Canada.

## Weed Seeds Order

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

Scots pine is not listed under the Weed Seeds Order.

## 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) 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. 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*, administered by Fisheries and Oceans Canada (DFO) and Environment and Climate Change Canada (ECCC), applies to both the plant and pesticide use as it specifies that it is an offence to (for example):

- 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 pesticide drift.

To find out 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* (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 find out which species are at risk, for more information about critical habitat, or information on obtaining a permit, consult the SARA Public Registry (<http://www.sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1>).

## Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) administered by ECCC, provides for the protection of migratory birds through the Migratory Birds Regulations and the Migratory Birds Sanctuary Regulations. For birds protected under the MBCA (<http://www.ec.gc.ca/nature/default.asp?lang=En&n=496E2702-1>), it is not permitted to kill a bird and/or disturb or destroy its nest or eggs anywhere they are found in Canada except under the authority of a permit issued under the Migratory Birds Regulations. Information on general nesting periods is available to minimize the risk to breeding birds (<https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1>). However, 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. To find out if you need a permit under the *Migratory Birds Convention Act*, visit: <https://www.ec.gc.ca/nature/default.asp?lang=En&n=2D16D723-1>.

# Provincial

## Weed Control Act

The *Weed Control Act* is administered by Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and enforced locally. The intent of the *Weed Control Act* is to reduce negative impacts of noxious weeds on agriculture and horticulture; to reduce plant diseases by eliminating plant disease hosts such as common barberry (*Berberis vulgaris*) and European buckthorn (*Rhamnus cathartica*); 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 *Weed Control Act*. This list is commonly referred to as the "Noxious Weed List".

In general, a species designated as a noxious weed under the *Weed Control Act* 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 designated as noxious under the *Weed Control Act*. 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 in regards to a noxious weed that has been reported on someone's property. The weed inspector can order the person in possession of the land to destroy the weed within seven days.

Scots pine is not regulated under the *Weed Control Act*'s Noxious Weeds list at this time. The noxious weeds list can be found: [http://www.omafra.gov.on.ca/english/crops/facts/noxious\\_weeds.htm](http://www.omafra.gov.on.ca/english/crops/facts/noxious_weeds.htm).

## Invasive Species Act

Under the *invasive Species Act*, there are rules to prevent and control the spread of invasive species. However, Scots pine is not listed under this Act. For more information on which species are listed, visit: <https://www.ontario.ca/page/stop-spread-invasive-species>.

## Pesticides Act

A federally registered pesticide must also be classified by MOECC under the *Pesticides Act* before it can be sold, stored or used in Ontario. The provincial classification of federally registered pesticides can be found at [www.lrcsde.lrc.gov.on.ca/PCDWeb/home.action](http://www.lrcsde.lrc.gov.on.ca/PCDWeb/home.action). Pesticides must also only be used for purposes allowed under Ontario's Cosmetic Pesticides Ban. The Ontario's Cosmetic Pesticides Ban specifies exceptions for the use of certain pesticides (Class 9), including the use of pesticides related to protecting public works including roads, buildings and structures, and provided certain conditions are met. For example an exemption for a Class 9 active ingredient may apply if a plant interferes with the essential maintenance of a public works.

## Endangered Species Act

The Ministry of Natural Resources and Forestry (MNRF) enforces the *Endangered Species Act*, whose purpose is to provide protection for species classified by the province as endangered or threatened, as well as to provide habitat protection for species classified by the province as endangered or threatened. Permits are required by those persons conducting activities that may affect Species at Risk, such as invasive plant management. To find out 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](http://www.ontario.ca/environment-and-energy/species-risk-ontario-list).

## **Conservation Authorities Act**

Ontario's Conservation Authorities were formed under the *Conservation Authorities Act* to ensure conservation, restoration and responsible management of water, land and natural habitat through programs that balance human, environmental and economic needs. They provide approval for projects that are close to or affecting bodies of water, or above the high water mark, but not for projects that are directly in water, or below the high water mark\*.

*\*The high water mark is the level where a body of water reaches its highest point in the season. Sometimes, an impression of the high water mark is left on the landscape, such as a line on rocks.*

Consult your local conservation authority here: <http://conservationontario.ca/> to determine if you need a permit to undertake your project.

## **Municipal**

Under the *Building Code Act*, municipalities are able to pass bylaws to address the presence of invasive plants. Municipalities can 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* to reduce the infestation of noxious weeds that negatively impact on agriculture and horticulture lands. Municipalities can designate additional plants not listed on the Ontario Noxious Weed list as noxious within their own jurisdiction.

Check with your local municipality to determine if there are further restrictions regarding Scots pine in your community.

# Best Management Practices

## Management Considerations

Preventing the spread of and controlling Scots pine before it becomes locally established will reduce its impacts on human health, 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 pest species and its surrounding environment to prevent and fight infestations and may require more than one type of control measure to be successful.

Once Scots pine has been confirmed at a location, a control plan can 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 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 to surrounding wildlife and native plant species.



Preventing the spread of and controlling Scots pine before it becomes locally established will reduce its impacts on human health, biodiversity, the economy, and society.

Photo courtesy of Gil Wojciech, Polish Forest Research Institute, Bugwood.org.

## Mapping

If you are unsure if you have Scots pine on your land, survey and map your area to determine if there are any infestations. For large land managers, such as conservation authorities or municipalities, hiring summer students or recruiting volunteers, can assist with this. For an individual landowner with a smaller property, mapping is more manageable on your own. If you know you have Scots pine in one area of your property, ensure you map the rest of your property to identify other infestations to create a plan to prevent them from spreading. For detailed information on mapping techniques consult the Landowners Guide for Managing and Controlling Invasive Plants in Ontario here: <http://www.ontarioinvasiveplants.ca/resources/technical-documents>.

To see what might already be in your area, visit EDDMapS Ontario here: <http://www.eddmaps.org/ontario/>

## Landscape Level Management

If Scots pine has become widely established, a more detailed management strategy should be developed. A detailed management strategy should consider, where possible, a landscape-level management approach. This means engaging surrounding landowners and managers in your management strategy. Focusing on individual local challenges without looking at the broader landscape can lead to intense labour and increased management costs and does not always have a strategic impact across larger areas. 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. This approach makes it easier to efficiently use and balance resources, coordinate activities, and accomplish shared strategic management goals.

Effective management and control requires a number of treatments and a combination of control measures. It's 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.



Before (top) and after (bottom) landscape view of Scots pine removal at Ontario's Presqu'ile Provincial Park. Large mature trees require a significant amount of time and resources to eradicate.

Photo courtesy of Don Tyerman.

## **Setting Priorities**

Determining what your highest priority locations for control are prior to management will help to determine your best course of action. Therefore, when developing a management strategy, it's important to take into account the following considerations to help inform control decisions:

1. Begin by focusing on smaller areas, and progress to larger areas.
2. If you have limited resources, remove the outlying populations (isolated plants or satellite populations) first, to prevent further spread.
3. If you have more resources, once the outliers are removed, working into larger, "core" populations of Scots pine is an important step which can reduce the quantity of seed dispersing 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.
4. Concentrate on 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, a favourite natural area, or the side of a trail where people may come into contact with the plants. 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.
5. Protect rare species and communities. These include federal, provincial and regionally listed rare species.
6. 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.
7. Ensure land ownership is defined before control takes place.
8. Consider dedicating a certain time each year to control efforts, and make it a joint effort with neighbouring landowners/land managers.
9. Begin to assess regeneration versus restoration, and if seeding or planting of native plants is needed to help jump-start natural succession and increase biodiversity in the area (see page x for more information)
10. Follow-up monitoring is crucial to remove seedlings that may sprout after initial control efforts. Scots pine seedbanks may exist for subsequent years after control.

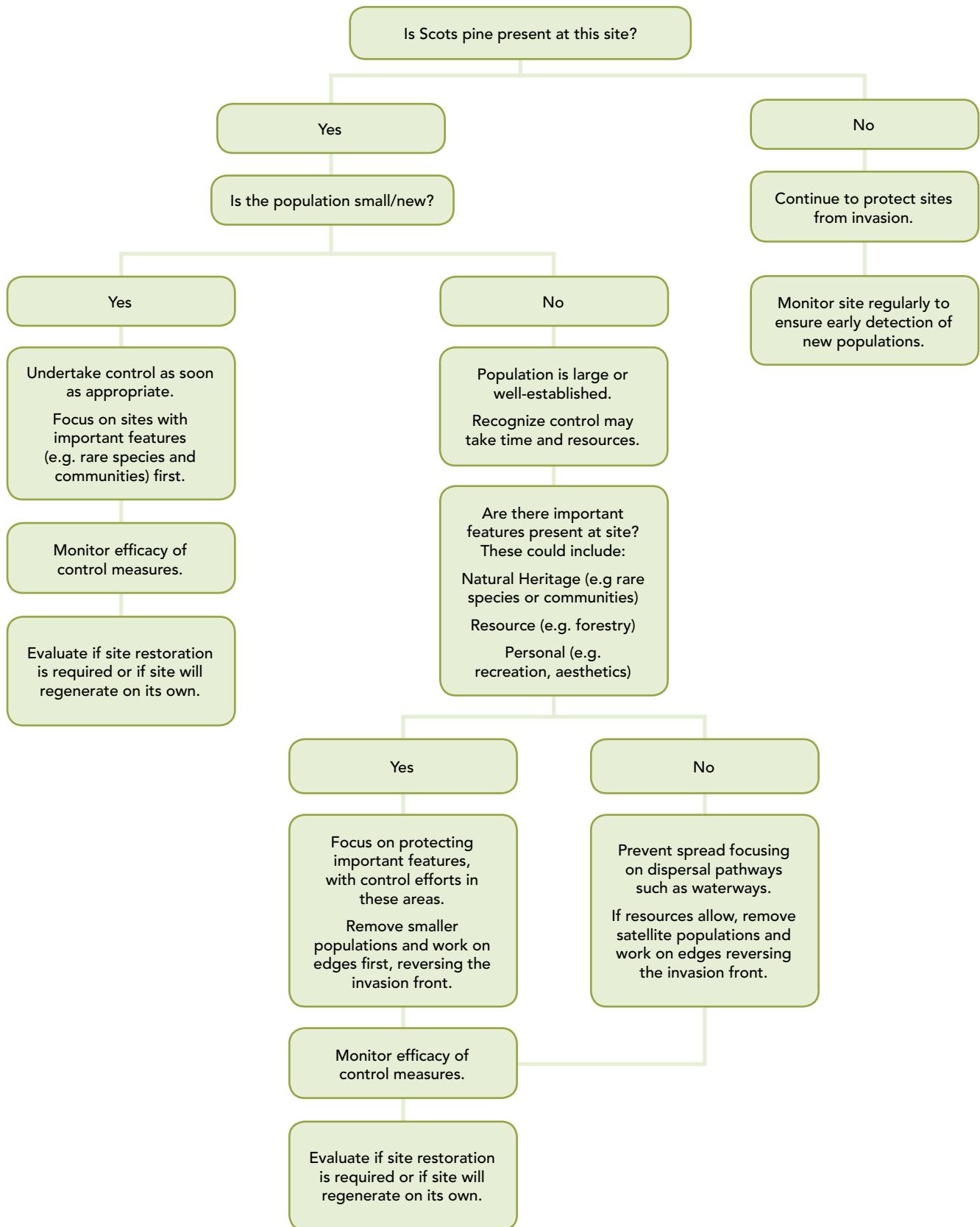
## **Prioritizing within a Control Area**

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

1. Control small, younger, outlier (satellite) populations first.
2. Keep large blocks of un-invaded areas free of invaders.
3. Remove outlying plants.

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 Scots pine sites for effective control with limited resources**



## Long-term Management and Monitoring

Because of the persistent and aggressive nature of Scots pine and its ability to re-colonize quickly, a long-term management and monitoring plan is imperative to achieve control success. A long-term management and monitoring plan should be created prior to control implementation. Monitoring will provide data to determine the effectiveness of the initial control treatments, and enable assessment of the initial control measures used as well as the types of follow-up treatments that are necessary. Long-term management is important because after removal, there are still other factors to consider including the seed bank left by Scots pine, other Scots pine populations that might be nearby, and other invasive plant seed banks. One of the most important factors to consider is which native plant species will return to the control area after control has been achieved.

Monitoring could be as simple as capturing photos or a visual inspection, or more complex and include extensive surveys. In general, annual treatment is imperative and should focus on selectively removing isolated populations as they appear. Spot treatment will assist in allowing for native plant regeneration. For more information on monitoring see the *Landowners Guide for Managing and Controlling Invasive Plants in Ontario*: <http://ontarioinvasiveplants.ca/resources/technical-documents>

## After Management: Assessing Regeneration vs. Restoration

Consider the following factors:

1. **Level of disturbance at the site:** What is the level of disturbance at the site? Was it a heavily invaded site (e.g. a lot of disturbance was caused during control measures)? Will it continue to be disturbed (e.g. through beach use or trail use/management)?
2. **Invasive species biology:** What is the biology of the invasive species removed and is there a seed bank to consider (e.g. there is a long-lived Scots pine seedbank, but you should consider seedbanks of other invasive plants)?
3. **Re-invasion risk:** Is there other Scots pine nearby which could re-invade? Are there other invasive species which could invade the site from nearby trails, watercourses or other pathways of introduction?
4. **Existing native vegetation:** What native vegetation is left? How long before it regenerates by itself? Does it need help? Species with specific habitat requirements or reproductive strategies resulting in low fecundity may require re-introduction, such as species at risk. 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 above, it is most likely that the site will be invaded or re-invaded before it has a chance to regenerate on its own. The invasive species could continue to invade and be present among the native species, resulting in annual control. Restoration will be needed to reduce the risk of invasion and re-invasion. See page 32 for restoration methods.

# Control Measures

It is advisable for most landowners to consider undertaking some form of control in limiting Scots pine succession on their property. Seedling to sapling-sized Scots pine that have encroached into fields, meadows, fencerows or shelterbelts and are scattered as individuals, can easily be controlled by hand pulling or clipping at ground level. Larger treatment areas with larger tree diameters can be controlled by brush saws (clearing). The control of Scots pine successional growth should also be accompanied by identification and removal of the seed source.

The conversion through natural succession of Scots pine plantation to a mixed or hardwood forest is highly desirable. Landowners with Scots pine located in proximity to hardwood or mixed forest seed sources may find a significant understorey of desirable species such as sugar maple, beech, ash, black cherry, oak, white pine, or other species have naturally developed within their plantation. Landowners can shift their management emphasis toward encouraging successional growth.

If Scots pine is a minor component within a mixed species plantation, it can be effectively managed through thinning or specific treatment applications. Early removal reduces the time span in which Scots pine can spread seed, effectively reducing future efforts to control establishing regeneration.



**Focus first on saplings to stop the advancement of the Scots pine stand.**

Photo courtesy of Nancy Melcher.

## Mechanical

### Pulling and Digging:

<b>Infestation Size:</b>	most effective in controlling small, recent infestations
<b>Goal:</b>	eradication
<b>Timing (season):</b>	before tree grows in height and diameter; either at seedling or sapling stage
<b>Treatment Frequency:</b>	as Scots pine seed can remain viable for several years, periodic retreatment may be necessary
<b>Best Practices:</b>	remove as much of root system as possible, tamping the soil down afterwards
<b>Advantages:</b>	inexpensive, simple, effective and selective
<b>Disadvantages:</b>	labour intensive
<b>Ideal For:</b>	landowners with restricted access to chemical control, with small, recent infestations requiring immediate control
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act</i>



Manual cutting is most effective in controlling small, recent infestations.

Photo courtesy of David Bree.

## Cutting:

<b>Infestation Size:</b>	most effective in controlling small, recent infestations
<b>Goal:</b>	eradication
<b>Timing (season):</b>	before tree grows in height and diameter; either at seedling or sapling stage
<b>Treatment Frequency:</b>	as Scots pine seed can remain viable for several years, periodic retreatment may be necessary
<b>Best Practices:</b>	hand clip or cut off at ground level, below the lowest photosynthesizing branch
<b>Advantages:</b>	inexpensive, effective and selective
<b>Disadvantages:</b>	labour intensive
<b>Ideal For:</b>	landowners with restricted access to chemical control, with small, recent infestations requiring immediate control
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act</i>

## Girdling:

<b>Infestation Size:</b>	most effective in controlling small infestations of mature trees as individual trees must be treated
<b>Goal:</b>	eradication
<b>Timing (season):</b>	trees are most vulnerable early in the growing season just after rapid tissue growth has depleted carbohydrate resources. Bark is also "loose" in the spring and early summer when cambium is active, making bark easier to peel.
<b>Treatment Frequency:</b>	follow-up treatments must be continued for at least two years
<b>Best Practices:</b>	remove bark and phloem layer from a 10 cm band around trunk. Do not damage xylem layer as this may encourage suckering. Check girdle for redevelopment of bark and remove if necessary. There are few tools specifically for girdling, but many can be used as girdling tools. With a chain saw or hand saw, cut parallel, horizontal grooves through the bark several inches apart. Afterward, the bark and cambium layers between the cuts can be peeled away. The most effective method with an axe involves hacking a line around the tree with a series of down-ward blows, then hacking a second line three inches above the first. The material between the two lines must be pried out with the ax blade.
<b>Advantages:</b>	girdling is a highly selective method therefore impacts on adjacent native species are low
<b>Disadvantages:</b>	time consuming if the infestation is large and may promote suckering. This method could also create dangerous standing dead trees therefore it is not advised for use near with high pedestrian presence such as trails.
<b>Ideal For:</b>	landowners with restricted access to chemical control
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act</i>

## Stand Conversions

A stand conversion requires the use of one or more silvicultural treatments designed to change the dominant species. Stand conversions can take advantage of desirable, established vegetation, tree planting and seeding, or all three. It also may include some removal of established Scots pine trees, site preparation for tree planting, and monitoring to assist in successful growth of planted trees.

### Conversions Using Tree Planting:

<b>Infestation Size:</b>	medium to large, established infestations
<b>Goal:</b>	conversion to a forest with more desirable tree species; eradication
<b>Timing (season):</b>	anytime
<b>Treatment Frequency:</b>	over a number of years to ensure success
<b>Best Practices:</b>	tree planting enhances natural regeneration and is effective if there is no presence of species to support natural regeneration. Planted trees compete with and eventually replace undesirable species. Most tree planting follows harvesting and site preparation, but with Scots pine plantations in decline, planting trees in the understorey may be effective. Select appropriate tree species that are suitable for the planting site associated with Scots pine and ensure they aren't susceptible to Scots pine diseases and pests.
<b>Advantages:</b>	effective substitute for in the absence of natural regeneration
<b>Disadvantages:</b>	laborious and can take a significant amount of time and resources
<b>Ideal For:</b>	landowners with resources to undertake significant tree planting
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act</i>



After harvesting unwanted Scots pine it is important to consider light availability if conducting restoration planting.

Photo courtesy of Kate Powell.

## Conversions Using Harvesting:

<b>Infestation Size:</b>	medium to large, established infestations
<b>Goal:</b>	conversion to a forest with more desirable tree species; eradication
<b>Timing (season):</b>	anytime
<b>Treatment Frequency:</b>	requires significant resources over a number of years to ensure success
<b>Best Practices:</b>	use a brush saw or a bush hog type mower, which may be more cost effective alternative to a brush saw in field applications where vegetation removal doesn't need to be selective. Chainsaws are also effective. Small patch cuts reduce risk and potential costs associated with the regeneration aspect of Scots pine stand conversions.
<b>Advantages:</b>	can eliminate Scots pine seed source and the impact of insect or disease issues associated with Scots pine
<b>Disadvantages:</b>	laborious and can take a significant amount of time and resources; potential for invasion of other invasive species
<b>Ideal For:</b>	large established stands and areas such as roadsides, hydro corridors and for tallgrass prairie restoration for example
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act</i>

## Biological

Biological control is the use of a herbivore, predator, disease or other natural enemy to reduce established populations of invasive species. Most invasive species have few natural enemies in their new habitats. Biological control aims to re-establish relationships between invasive species and its natural enemies by selecting highly host-specific natural enemies from the country of origin, and moving them to the country where the invasive species is a problem. This is only done after extensive host-range testing in the country of origin or quarantine, to ensure that the potential biocontrol agent is host-specific to the targeted invasive species. This method has been used successfully for invasive plants in North America, including purple loosestrife (*Lythrum salicaria*), leafy spurge (*Euphorbia esula*) and St John's-wort (*Hypericum perforatum*). Biological control agent selection, testing, and initial release is coordinated by agencies of the federal government.

Scots pine pests previously mentioned can cause considerable damage to the trees [e.g. pine root collar weevil (*Hylobius radices*), pales weevil (*Hylobius pales*) and pine false webworm (*Acantholyda erythrocephala*)] but there are no approved biocontrol agents for this species in Canada.

## Chemical

The management of pesticides is a joint responsibility of the federal and provincial governments. Before a pesticide can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act) by Health Canada's Pest Management Regulatory Agency (PMRA) and be classified under the provincial *Pesticides Act* by the Ministry of the Environment and Climate Change (MOECC).

It is important that pesticides are 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 Scots pine plant 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>. To determine if a federally registered pesticide is also classified for use in Ontario, visit: <https://www.lrcsde.lrc.gov.on.ca/PCDWeb/home.action>

In addition to being used in accordance with label directions, pesticides must also only be used for purposes allowed under Ontario's cosmetic pesticides ban.

The province's cosmetic pesticides ban contains exceptions for the use of pesticides (class 9), including the use of pesticides related to agriculture, forestry, and the protection of natural resources (provided certain conditions are met) which may allow chemical control of Scots pine on your property (see below).

Furthermore, non-domestic (i.e. commercial, restricted etc.) herbicides can only be purchased, stored and applied by appropriately licensed exterminators.

For more information on pesticides and all aspects of weed control, The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)'s Publication 75, Guide to Weed Control 2014-2015 can be found at: <http://www.omafra.gov.on.ca/english/crops/pub75/pub75toc.htm>.



A Scots pine management area; once the trees have become established, required time, effort and resources increases as well.

Photo courtesy of Alyssa Therkildsen.

## Exceptions to the Ontario Pesticides Ban

### Are you protecting a Natural Resource?

The “natural resources” exception exists for the use of prohibited pesticides to manage, protect, establish or restore a natural resource. In order to qualify for this exception your project must meet the criteria specified in Section 33 of Ontario Regulation 63/09, including the use of pesticides in accordance with Integrated Pest Management (IPM) principles outlined in this BMP guide. You will need to contact the Ontario Ministry of Natural Resources and Forestry ([www.ontario.ca](http://www.ontario.ca)) to obtain a written letter of opinion from the MNRF Regional or Branch Director.

### Are you a farmer?

The agriculture exception allows a farmer to use Class 9 pesticides for the purposes of the agricultural operation that he or she owns or operates. This exception may apply to the control of Scots pine if it impacts agricultural or horticultural operations. 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 and 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, and;
- the production of wood from a farm woodlot, if at least one of the activities described earlier is carried out on the property where the farm woodlot is located.

Some activities are not included in the definition of an “agricultural operation”. Please refer also to the Ministry of Environment and Climate Change’s factsheet titled “*Pesticides Act and Ontario Regulation 63/09 Agriculture May 2011*” [www.ontario.ca/document/technical-guidance-pesticides-act-and-ontario-regulation-6309-agriculture](http://www.ontario.ca/document/technical-guidance-pesticides-act-and-ontario-regulation-6309-agriculture).

### Herbicides and Scots pine:

Although herbicides can be used, it is most often not necessary due to the fact that Scots pine does not re-sprout when cut. However if applied great care should be exercised to avoid getting any of the mixtures on the ground near the target plant since some non-target species may be harmed. Any herbicide should be applied while backing away from the treated area to avoid walking through the wet herbicide. By law, herbicides only may be applied according to label directions.

## Cutting and Herbicide Application:

<b>Infestation Size:</b>	most effective in controlling small infestations
<b>Goal:</b>	eradication
<b>Timing (season):</b>	before seed maturation but for optimal results complete prior to flowering
<b>Treatment Frequency:</b>	follow-up treatments must be continued for at least 2 years
<b>Best Practices:</b>	stems are cut with shears, loppers, brush saw or a chainsaw to ground level or just above and herbicide is applied from a squirt bottle, backpack sprayer or with a paint brush
<b>Advantages:</b>	selective
<b>Disadvantages:</b>	does not always eliminate suckering
<b>Ideal For:</b>	landowners who have access to chemical control and who are comfortable with mechanical equipment
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act, Pesticides Act</i>



A brush saw, bush hog or chainsaw can be used to manage larger, established infestations.

Photo courtesy of Gil Wojciech, Polish Forest Research.

# Disposal of Plant Material

## Do not backyard compost Scots pine material:

Home composters do not reach the necessary temperature to kill viable parts (seeds and roots) of the plant.

## Municipal disposal:

Call ahead to your local municipality about disposal availability for invasive plant material. If your local municipality accepts invasive plant material in the local landfill, carefully place reproductive plant material in black plastic garbage bags. Seal the bags tightly and leave in direct sunlight for one to three weeks, to kill any living plant material. Check the bags to make sure the plant material has died and deposit in the landfill.

## Municipal compost:

Parts of invasive plants capable of reproducing (seeds and roots) should only be composted if the material is taken to a large-scale municipal composting facility where temperatures in the compost pile reach 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 seeds or roots 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.

## Let decompose:

The branches and wood of Scots pine do not reproduce (unless still bound to the soil via roots i.e. a stump). Therefore as long as you carefully remove the seeds and dispose of properly (see above) you can leave the branches on site to decompose on their own.



The haphazard and irregular shaped crowns can lead to breakage.

Photo courtesy of Joseph O'brien.

# Restoration

## Types of Restoration

### During Control

#### Mulching:

Applying a 3 inch layer of mulch (at minimum) to sites immediately after invasive species control (i.e. manual or chemical control) may aid in the recovery of native species and prevent immediate re-colonization by other invaders. Mulching reduces light availability, allowing more shade-tolerant native plant species to germinate and colonize the gaps left by Scots pine removal. This will also limit the amount of re-growth due to the seed bank.

#### Seeding:

Seeding an area with native tree 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. See "stand conversion" for more information.

### After Control

#### Planting:

If there are invasive plants nearby or in the seedbank which may colonize the control area, planting larger native species stock (potted etc.) will help restore the site, outcompeting invasive seedlings. It may however be better to monitor and remove invasive species over several seasons before investing in restoration planting. Wait until all management is completed before doing a large stock re-planting if you find it difficult to distinguish between newly planted native species and invasive seedlings.

When completing planting at control sites, consider light availability (have any trees recently been removed which have opened up an area?). These environmental changes should be taken into account when choosing plant species for restoration, as they will affect the growing and soil conditions. Also, additional management activities may disturb the newly planted materials, so it is best to postpone planting until all invasive plant control is complete.



The haphazard nature of Scots pine often results in tree failure.

Photo courtesy of Joseph OBrien USDA Forest Service.

# Control Measures Summary

**Table 3:** A summary of management strategies appropriate for Scots pine management.

Size of Area to be Managed		
Isolated plants	Small infestation < 0.5 hectare	Medium > 0.5 hectares
<ul style="list-style-type: none"><li>• Pulling/Cutting</li></ul>	<ul style="list-style-type: none"><li>• Pulling/Cutting</li><li>• Girdling</li></ul>	<ul style="list-style-type: none"><li>• Conversion using tree planting/harvesting</li><li>• Chemical</li></ul>



Planting larger native species stock will help restore the site, outcompeting invasive seedlings.

Photo courtesy of Don Tyerman.

# Preventing the Spread

Early detection is the most effective tool for controlling the spread of Scots pine and everyone can help. Follow these tips:

---

## Report it.

If you think you see Scots pine take a picture, record the location and report it using the tools listed below.

## Watch for it.

Learn what Scots pine looks like and then monitor hedges, property boundaries, riparian 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 Scots pine or other invasive species.

## Stop the spread.

Follow Clean Equipment Protocol; inspect, clean and remove mud, seeds and plant parts from clothing, pets (and 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 aren't 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. Don't plant Scots pine and if you have removed it, replant with native species. Encourage your local garden centre to sell non-invasive or native plants. [The Grow Me Instead guides list alternatives to plant instead of invasive species.](#)

# Tracking the Spread (Outreach, Monitoring, Mapping)

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

- 1) EDDMapS: an online reporting tool where users can view existing sightings of Scots pine and other invasive species in Ontario, and document their sightings. This tool, at [www.eddmaps.org/ontario](http://www.eddmaps.org/ontario), is free to use.
- 2) Toll-free Invading Species Hotline: a telephone number (1-800-563-7711) which individuals can use to report sightings verbally. Hours of operation: 9:00am – 5:00pm Monday to Friday EST, with the option to leave a recorded message.
- 3) Invading Species Website: an online reporting tool ([www.invadingspecies.com](http://www.invadingspecies.com)).

If you think you have Scots pine on your property or if you see it in your community, please report it. You will be asked to send in photos of the leaf/needle, stem and trunks for identification.

## **Best Management Practices Documents Series:**

- Black Locust Best Management Practices for Ontario
- Common (European) Buckthorn Best Management Practices for Ontario
- Dog-strangling Vine Best Management Practices for Ontario
- European Black Alder Best Management Practices for Ontario
- Garlic Mustard Best Management Practices for Ontario
- Giant Hogweed Best Management Practices for Ontario
- Invasive Honeysuckles Best Management Practices for Ontario
- Japanese Knotweed Best Management Practices for Ontario
- Phragmites (Common Reed) Best Management Practices for Ontario
- Phragmites (Common Reed) Best Management Practices for Ontario Roadways
- Purple Loosestrife Best Management Practices for Ontario
- Reed Canary Grass Best Management Practices for Ontario
- Scots Pine Best Management Practices for Ontario
- Spotted Knapweed Best Management Practices for Ontario
- White Sweet Clover Best Management Practices for Ontario
- Wild Parsnip Best Management Practices for Ontario

## **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

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

Landowners Guide to Controlling Invasive Woodland Plants

Phragmites Site Prioritization Tool

## Sources

Catling, P.M. and Carbyn, S. 2005. Invasive Scots pine, *Pinus sylvestris*, Replacing *Corema*, *Corema conradii*, Heathland in the Annapolis Valley, Nova Scotia. Can. Field Nat. 119, 237-244.

Dodds, K.J., de Groot, P., Orwig, D.A. 2010. The Impact of *Sirex noctilio* in *Pinus resinosa* and *Pinus sylvestris* stands in New York and Ontario. Can. J. For. Res. 40, 212-233.

Environmental Canada. 1999. Invasive Plants of Natural Habitats in Canada - An Integrated Review of Wetland and Upland Species and Legislation Governing their Control. Retrieved from <https://www.ec.gc.ca/eee-ias/78D62AA2-55A4-4E2F-AA08-538E1051A893/invasives.pdf>

Gilman, E.F. and Watson, D.G. 1994. Mugo Pine (*Pinus mugo*). Environmental Horticulture Department, University of Florida. Gainsville, Florida.

Gilman, E.F. and Watson, D.G. 1994. Scotch Pine (*Pinus sylvestris*). Environmental Horticulture Department, University of Florida. Gainsville, Florida.

Kaufman, S.R. and Kaufman, W. (2012). Invasive Plants: A Guide to Identification, Impacts, and Control of Common North American Species. Stackpole Books, Mechanicsburg, PA.

Landowner Resource centre. (2005). Extension Notes: Scots pine in Ontario. Retrieved from [http://www.lrc.on.ca/Extension\\_Notes\\_English/pdf/Scots\\_Pine.pdf](http://www.lrc.on.ca/Extension_Notes_English/pdf/Scots_Pine.pdf)

Landowner Resource centre. (1995). Extension Notes: Eastern White Pine. Retrieved March 2007 from [http://www.lrc.on.ca/Extension\\_Notes\\_English/pdf/wht\\_pn.pdf](http://www.lrc.on.ca/Extension_Notes_English/pdf/wht_pn.pdf)

Mariquita Sheehan, 2007. *Pinus sylvestris* L. Retrieved from [http://dnr.wi.gov/topic/Invasives/documents/classification/LR\\_Pinus\\_sylvestris.pdf](http://dnr.wi.gov/topic/Invasives/documents/classification/LR_Pinus_sylvestris.pdf)

United States Department of Agriculture. 2002. Plant Fact Sheet - Scots pine. Natural Resources Conservation Service.

Richardson, D. (1998). Forestry Trees as Invasive Aliens. Conservation Biology , 18-26.

Richardson, D., Williams, P., & Hobbs, R. (1994). Pine invasions in the Southern Hemisphere: determinants of spread and invadability. *Journal of Biogeography*, 511-527.

Robledo-Arnuncio, J.J. and Gill, L. 2005. Patterns of pollen dispersal in a small population of *Pinus sylvestris* L. revealed by total-exclusion paternity analysis. *Heredity*. 94, 13-22.

USDA Forest Service. 2006. Weed of the Week- Scots pine (*Pinus sylvestris* L.) Newton Square, PA. Retrieved from [https://www.na.fs.fed.us/fhp/invasive\\_plants/weeds/scots-pine.pdf](https://www.na.fs.fed.us/fhp/invasive_plants/weeds/scots-pine.pdf)

Wright, J. W., W. A. Lemmien, J. N. Bright, M. W. Day, and R. L. Sajdak. 1976. Scotch pine varieties for Christmas tree and forest planting in Michigan. Michigan Agricultural Experiment Station, Research Report 293. East Lansing. 1-15.

## Acknowledgements

### Reviewers

Bettina Heckelman  
Bill McIlveen  
Iola Price  
Jon Foster  
Jon Peter  
Ken Towle  
Lee Voisin  
Mhairi MacFarlane  
Val Deziel  
Kate Powell  
Kellie Sherman  
Colin Cassin  
Gurpreet Mangat

### Photographs

Bill McIlveen  
Caroline Mach  
David Bree  
Don Tyerman  
EDDMMaps  
Gil Wojciech  
Kate Powell  
Keith Kanoti  
Luana Vargas  
Nancy Melcher  
Paul Wray  
Pests and Diseases  
Image Library  
Petr Kapitola  
Richard Webb  
Robert Vidéki  
Bill Cook  
Sean James  
Stanislaw Kinelski  
USDA Forest Service  
Vern Wilkins  
Joseph O'Brien

### Design by

Adam Connor,  
[www.AdamConnor.ca](http://www.AdamConnor.ca)

