A Landowner's Guide to

Managing and Controlling Invasive Plants in Ontario

Ontario Invasive Plant Council

Ontario's Invading Species Awareness Program

Ontario Ministry of Natural Resources

CVC Credit Valley Conservation

Foreword

Ontario presents a dilemma for conservation: how can we effectively conserve the land and waters of a province that has both more rare species and habitats, and more people than anywhere else in Canada? Ontario certainly has many important protected areas and conservation lands, including properties owned and managed by conservation authorities, Ontario Parks, Parks Canada and conservation organizations. While these protected areas are an important cornerstone for conserving nature and benefits we enjoy from it, long-term and meaningful conservation in Ontario can only be accomplished through thousands of individual actions carried out by private landowners.

Private landowners steward 93 per cent of southern Ontario and have an impressive track record of environmental management. While we don't often hear good news stories about the environment, slow, steady improvements in land and water management made by farmers, rural land owners and municipalities over the past few decades have resulted in an incredible change in the quality of our landscape, and quality of our lives. Over the last century, improvements in woodland management have increased the size of our forests; a better understanding of watersheds resulted in stewardship actions that have improved quality of many of our rivers and streams; many species that were rare and declining only a few generations ago, such as the Wood Duck and Beaver, are now again common because of good wildlife management and habitat restoration. As private landowners we all have an opportunity to manage our lands in a way that maintains and improves their values and contribute to a healthy environment in our community.

Invasive plants are a significant stewardship challenge for private landowners. These non-native plants have few natural controls and have an ability to degrade agricultural lands, reduce the values of forests, impact populations of native wildlife and plants, and in some cases threaten human health. The vigilance and participation of private landowners is essential to keep these alien invaders from permanently altering our landscape.

This manual is a primer for private landowners with tips and advice to help protect property from the negative impacts of invasive plants. It has been assembled by a group of organizations who are leading research and management of invasive plants in Ontario. Landowners do and will continue to play a critical role in invasive plant control. You are on the front lines of monitoring changes in the landscape and will be essential for early detection reporting and control of invasive plants. It won't be an easy task - many of these species very quickly spread to new areas, grow rapidly and may require continued management for many years. However, through actions of private landowners we can limit the impact of invasive plants on the ecology and economy of Ontario, and improve the health of our lands and waters for our children and grandchildren.

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Credits

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1.0 What Are Invasive Species?

Invasive Species are defined as non-native species, whose introduction or spread negatively impacts native biodiversity, the economy and or society, including human health.

Non-native species refers to any plants, animals and micro-organisms that have been accidentally or deliberately introduced into areas beyond their normal range. Other names may include introduced, alien and exotic. Not all non-native species are invasive, and many provide benefits to our economy and society. This manual will focus on those species which have been deemed to have a negative impact. While this manual is primarily focused on invasive plant species management, it should be noted that there are a range of invasive species across all taxa; including fish, invertebrates, fungus and diseases.

Native: A species that has existed in a given area prior to European settlement.

Non-native: A species that has been introduced from another geographic region to an area outside its natural range.

2.0 Why Should We Control Them? Impacts

Invasive plants pose a significant and growing threat to Ontario's economy and natural environment. These problem plants have become one of the most pressing biodiversity issues of our time, and have been recognized by many agencies as being one of the greatest threats to biodiversity second only to habitat loss.

While specific cost figures for invasive plant management in Ontario are scarce, the Invasive Species Strategy for Canada (2004) estimated the cost of invasive plants to Canada's agricultural and forestry sectors are as high as $7.5 billion annually, and is likely closer to $36 billion including invasive plant management on private properties, parks, and golf courses. Ontario has 441 known invasive plant species, which is the highest out of all of the provinces. This is likely due to Ontario's status as the most frequent import destination, and as the province with the largest population. As the province with the highest number of imports, Ontario has also been the first province affected by many invasive species.

Biodiversity

Is the variability among living organisms from all sources, including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems (inter alia means among other things). (Ontario's Biodiversity Strategy, 2005)

Over the last 100 years, the landscape in southern Ontario has changed drastically. The once vast expanses of uninterrupted forest were first cleared to make way for agricultural land, leaving fragments or patches of forest. The agricultural land then gave way to provide for housing, roads, and urban areas. The remaining forest cover continues to be reduced to make way for ongoing urban expansion. These disturbances to our natural ecosystems have resulted in the introduction and expansion of invasive plant species, which thrive in such disturbed situations.

As a landowner, you are a part of this ever changing landscape (the environment) and the threats and challenges it faces. As well, you may have set certain goals for your property, whether it is agriculture, forestry, supporting wildlife, or enjoyment of nature. Unfortunately, invasive plant species can affect all of these goals in varying ways:

Trilliums in a forest (Credit Valley Conservation)

Agriculture

Invasive plants can reduce crop yield and dramatically increase use of herbicides to control them, leading to increased costs for farmers and reduced crop values. Though the name may suggest that Canada Thistle (*Cirsium arvense*) is native, it is actually an invasive species that can reduce crop yields by up to 100 per cent and is listed as a noxious weed in Ontario. Some invasive plants, such as Cypress Spurge (*Euphorbia cyparissias*) can endanger livestock and diminish the growth of edible vegetation.

Forestry

Invasive plants can reduce forest regeneration through direct competition which reduces tree seedling density and growth. Dog-strangling Vine (*Vincetoxicum rossicum*) forms dense mats of vegetation which prevent natural forest regeneration, so the landowner will need to manage this vegetation while re-planting tree seedlings, resulting in an increased cost and a much less productive woodlot. Invasive plants can also affect forest productivity (growth) by effecting beneficial soil organisms and changing soil chemistry. Examples of plants that do this are Common Buckthorn (*Rhamnus cathartica*) and Garlic Mustard (*Alliaria petiolata*).

Natural areas

Invasive plants have a huge impact on species diversity and richness by affecting natural balances in an area. These plants ultimately reduce resources for wildlife such as water, available food and nutrients which are essential to all ecosystems. Invasive species destroy intricate linkages that make ecosystems strong and thriving, they provide little to no food value to native wildlife, and are a direct threat to native plant species. Garlic Mustard out-competes native woodland flowers, like White Trillium (*Trillium grandiflorum*), and changes the soil chemistry, making it unsuitable for native species.

Social and health

Hogweed burns - King County Noxious Weed Control Program (Seattle, Washington)

Some plants, like Giant Hogweed (*Heracleum mantegazzianum*) or Wild Parsnip (*Pastinaca sativa*), can cause human health issues through direct toxic effects. Recreational areas overrun with invasive plants often lack qualities that make them enjoyable. There could be fewer songbirds, tangled and dense growth that is difficult to walk through, natural areas lacking in biodiversity, and burs on clothing and pets.

As Ontario is one of the major ports of entry of invasive species to Canada, this province is particularly vulnerable to the invasive species threat. Preventing invasive plants from entering in the first place is the most effective way to deal with them, but once they

have arrived strategic planning to manage and control them on your property is important. Controlling invasive plants is no easy feat and will often take many years and a variety of mechanisms to maintain a successful eradication. However daunting the task may seem, each person can still do their part by controlling invasive species on their own property.

3.0 What Can You Do?

As landowners it is important to be aware of invasive plants that can threaten your property. Learn which invasive plants may be present in your area, and how to identify them. Watch along property boundaries, fence lines, and trails for early detection of an infestation. If you spot an invasive plant species early, with only a few plants present, it is much more cost-effective and efficient to control. However, if an existing infestation is too large, developing a monitoring and control plan for your property will help you determine the best use of your time and resources.

Tartarian Honeysuckle (*Lonicera tatarica*) removal (Credit Valley Conservation)

3.1 Know your species

One of the first steps is to familiarize yourself with invasive plants in your region. You'll need to learn to identify them so you can search for them on your property before taking steps to develop a plan to deal with them. The Invasive Species Education and Outreach: Compendium of Resources (**Appendix 1**) provides information about invasive species communications materials available in Ontario. Familiarize yourself with these species and identify which occur on your property. Share this knowledge with neighbours, as they may be affected by many of the same species.

The following is a list of resources found in **Appendix 1**.

- Invasive Species Education and Outreach: Compendium of Resources
- The original SER Ontario invasive species list. Invasive Exotic Species Ranking for Southern Ontario. This list rates species on four categories from the most invasive (**Category 1**) to potentially invasive plants (**Category 4**) and a watch list of species. You will need this number in Section 4.2 when determining plant aggressiveness and developing your priorities for implementing control of these species on your property.

3.2 Address pathways of introduction

Pathways are the route by which an invasive species gets introduced to Ontario, or spread to new areas once they have arrived. There are two types of pathways, natural and those created by humans:

- Natural pathways include wind, water and animal dispersal.
- Man-made pathways are routes by which the majority of invasive species are introduced. They include shipping, horticultural trade, recreation, agriculture, forestry, construction, travel, tourism, water garden and aquarium trade.

Goldfinch spreading thistle seed (Jon Clayton)

Success story: **Purple loosestrife**

Purple Loosestrife (*Lythrum salicaria*) was brought to North America in the early 1800s by settlers, where seeds were likely present in the soil ballast of their ships. Since its introduction, Purple Loosestrife has spread westward and can be found across much of Canada and the United States. It is estimated to have affected over 190,000 hectares of wetlands, marshes, pastures and riparian meadows each year prior to 1992. In 1992 the Canadian and U.S. governments approved a natural enemy of Purple Loosestrife as a biological control, the leaf-feeding beetles, Galerucella calmariensis and G. pusilla for continent-wide release.

For well over 20 years these insects have been utilized by agencies across North America to effectively reduce Loosestrife Populations and enable native vegetation to become reestablished. Through various partnership initiatives and with the assistance of many volunteers, over 400 release sites have been successfully established across the wetlands of Ontario. At many of these sites it is estimated that the beetles reduced Purple Loosestrife density by up to 80 per cent. The beetles also disperse to new locations, providing an additional benefit of control.

The biological control program for Purple Loosestrife has proven to be one of the most successful examples of control of an invasive species in North America.

Shipping

Ontario is the province with the highest number of imports which equates to a higher probability that species will be accidentally introduced as "hitchhikers" in a shipment. Asian Long-horned Beetle (*Anoplophora glabripennis*) and Emerald Ash Borer (*Agrilus planipennis*) are both believed to have been introduced to Ontario through untreated wooden shipping pallets.

Horticultural trade

The vast majority of horticultural species pose no threat and can be beautiful additions to any garden. However, some species can cause serious problems. These species can escape, or be intentionally or unintentionally introduced to new areas and become invasive in natural areas. Invasive species may also be accidentally introduced as "hitchhikers" or as seed contaminants in the soil containing nursery stock.

Recreation

Recreational activities, like hiking, boating and mountain biking, can spread seeds of invasive plant species, or parts of invasive plants to new areas. Even moving firewood from your home to the cottage can move invasive species to new areas and start a new infestation. For example, Emerald Ash Borer and Asian Long-Horned beetle could be spread to other areas in Ontario through the movement of firewood.

Construction and forestry/agriculture:

Machinery used during construction or for forestry or agricultural activities can harbor invasive plant parts or seeds, and spread them to new areas.

Travel and tourism:

Species can be either accidentally introduced through "hitchhiking" on clothing, luggage, equipment or pets, or intentionally brought from other areas.

Water garden and aquarium trade

Some species that are used in the water garden and aquarium trade can become invasive in Ontario waterways. Species like Water Chestnut (*Trapa natans*) and Water Soldier (*Stratiotes aloides*) have escaped into river systems and created dense mats of floating vegetation which impact biodiversity, property values and recreation.

3.3 Practice prevention

The best method of invasive species control is simple prevention. Think about the pathways discussed above and where they may apply to your property. The idea is to stop them before they even get started! As landowners you can prevent invasive species introduction and establishment on your property by following some simple practices:

- *Gardening* - Know what you're buying; research plants before planting them and request non-invasive or native plants at the nursery. Invasive plant seeds and insect larva can also be found in soil. For example European Fire (Ruby) Ants (*Myrmica rubra*) are becoming established in Ontario through the movement of nursery stock.
- *Aquarium and water gardens* - Never release aquarium or water garden plants or pets; these species can become invasive. Return them to the pet store or learn how to dispose of them properly.
- *Mulch/Soil* - Only purchase mulch or soil from reputable suppliers. Be aware that invasive plant parts or seeds may be hitchhiking, and if possible find out where the mulch/soil originated. Be careful with municipal mulch; it often contains seeds or plant parts and can harbor invasive plant species.
- *Landscaping* - Minimize soil disturbance and retain shade trees on your property to prevent establishment of invasive plants. Dispose of yard waste through your local municipality or in your backyard compost. Yard waste dumped into natural areas can disturb the native vegetation leading to erosion and the spread of invasive species.
- *Recreation* - Inspect and clean mud and plant parts from recreational vehicles, pets, hiking boots and equipment before leaving any site and returning to your property. Stay on trails; going off trail can spread invasive species to new areas. If other people visit your property, be careful of the species they could be bringing in with them on their clothes, equipment, boots or pets.

Boot brush station to remove invasive plant seeds (Credit Valley Conservation)

- *Woodlot management* - Talk to the contractors to make sure they clean their equipment prior to entering your property.
- *Firewood* - Firewood can contain insect larvae such as Emerald Ash Borer and Asian Long-Horned Beetle. Therefore, don't move firewood. Buy it where you burn it, and be aware of CFIA's Ministerial Orders which prohibit movement of potentially infested materials from specific areas of Ontario and Quebec. Maps of these locations are available at the CFIA website: www.inspection.gc.ca.

3.4 Report invasive species

If an invasive species is present on your property, you can report it a number of ways:

- Contact your local conservation authority or Ontario Ministry of Natural Resources office
- Call the provincial Invading Species Hotline at 1-800-563-7711
- Visit www.invadingspecies.com
- Share your knowledge locally, with your neighbours and others; raising awareness will help everyone prevent their spread.

3.5 Develop a plan for your property

It is important to realize that although you may not be able to eradicate all invasive species, you can pick those battles that can be won and manage for invasive plants to protect those things that you value on your land. Think about your property and your goals and objectives for it. Is it:

- Wildlife appreciation?
- Forestry (woodlot management and timber production)?
- Agriculture (rangeland production, crop, non-crop)?

Think about how invasive plants may threaten realization of these goals and objectives. On your property identify those features or 'high priority areas' that you want to protect, and focus on these first. High priority areas can be rare species/communities, or important habitats, and may also include quick win opportunities (a localized area where an invasive species may just be starting and can be removed quickly and easily). The next section discusses this further and begins to guide you through developing a plan of action.

4.0 Developing An Invasive Plant Management Plan

Now that you've decided to tackle the problem of invasive species on your property, and you've addressed ways you can stop the spread, your next action is to develop a plan of action.

There are two basic steps to developing a plan:

1) The first step is to document what invasive plants there are, their extent and numbers, and their location.

2) The second step is to decide where you are going to start your on-the-ground work (setting priorities project by project) and develop your plan of attack.

On the first, do not be overwhelmed by the number of species you think you need to know and identify. In **Section 3.1 (Know your species)** the Invasive Species Education and Outreach: Compendium of Resources can help identify key invasive species.

For the second step, the simplest place to start is a spot where there are no invasive species. These areas are good places to start and fan out from, looking for invasive plants and removing them as they occur.

Develop an invasive plant management plan (Credit Valley Conservation)

4.1 Doing an inventory and creating a map

4.1.1 Survey methods

Depending on the size of your property the way you map and locate invasive species can range from simple to complex. If you have a small property and only a few areas where invasive plants present a problem, you may not even need to develop a map. But if you have a larger property and are dealing with multiple locations a map is a great place to start to understand the scope of the problem. Ultimately, this will help you develop a step-by-step plan that can be implemented over time.

When thinking about how to map invasive plants there is no single method that applies to all situations. Whether you want to map locations of invasive plants as (1) points on a map or (2) as polygons (draw a line around them), the idea is simply to map all the information you need to make determinations later on what is where and how **extensive** (area covered) or **intensive** (density of species) the invasive plant species are. You can also combine mapping locations as both points and polygons. What matters is that it makes sense to you.

Three methods to map invasive plants are provided below. If you have a large property with a variety of habitat types, like a treed swamp, plantation forest and deciduous forest, you may decide to use different methods on different areas of your property.

For example:

- A coniferous plantation with its straight rows lends itself very well to transect sampling - walking straight lines to sample an area.
- You may not want to use transects if you are continually having to walk up and down steep hills. Polygon sampling may be more appropriate here.
- If the area is densely covered in trails you may want to walk the trails and sample off them.

Table 1 below provides a rough guide on what method might be most appropriate given the size of your property, or the areas you want to map.

Table 1: Woodlot size and recommended survey method

Woodlot Size	Method
0.5- 2 ha (1 ¼ - 5 acres)	Polygon
2- 10 ha (5 – 25 acres)	Polygon or Transect
10+ ha (25+ ha)	Transect

A. Method 1: Transect sampling

This method is often the simplest for a very large property. It provides a rough overview of the property through a sampling approach. In this method you walk across your property in parallel straight lines set a predetermined distance apart. There are two options to implement the sampling (i and ii below).

i. Transect sampling- Stratified continuous sampling

Lines of travel are oriented north-south or east-west, so you can easily establish them using a compass to navigate straight lines across your selected area. When there is an invasive plant, mark its location on the line on the air photo or use a GPS device to log the location. If it is a location with a small clump of plants, place a single point; if it is a patch that runs a distance along the line, mark the start and end point of the infestation **(Figure 1)**. Record on the map a unique number for the occurrence. For example in **Figure 1** a clump of Honeysuckle is marked on the map as a line along one of the transects (L1) and given the number one (1) as an identifying location.

Mapping invasive plants
(Credit Valley Conservation)

Distance between transects

With large properties the distance between the transect lines will need to be greater. Rather than 50 metres apart they instead should be 100 to 200 metres apart. See table below as a guideline

Size of woodlot or survey area	Distance between transects
0-5 ha	50 metres
5-20 ha	100 metres
20-100+ ha	200 metres

Tip

If you're not using a GPS device that you can download later onto a map in such free web based programs as Google Earth you may want to physically mark in the field the start and end points of each transect you run in order to locate mapped locations at a later date.

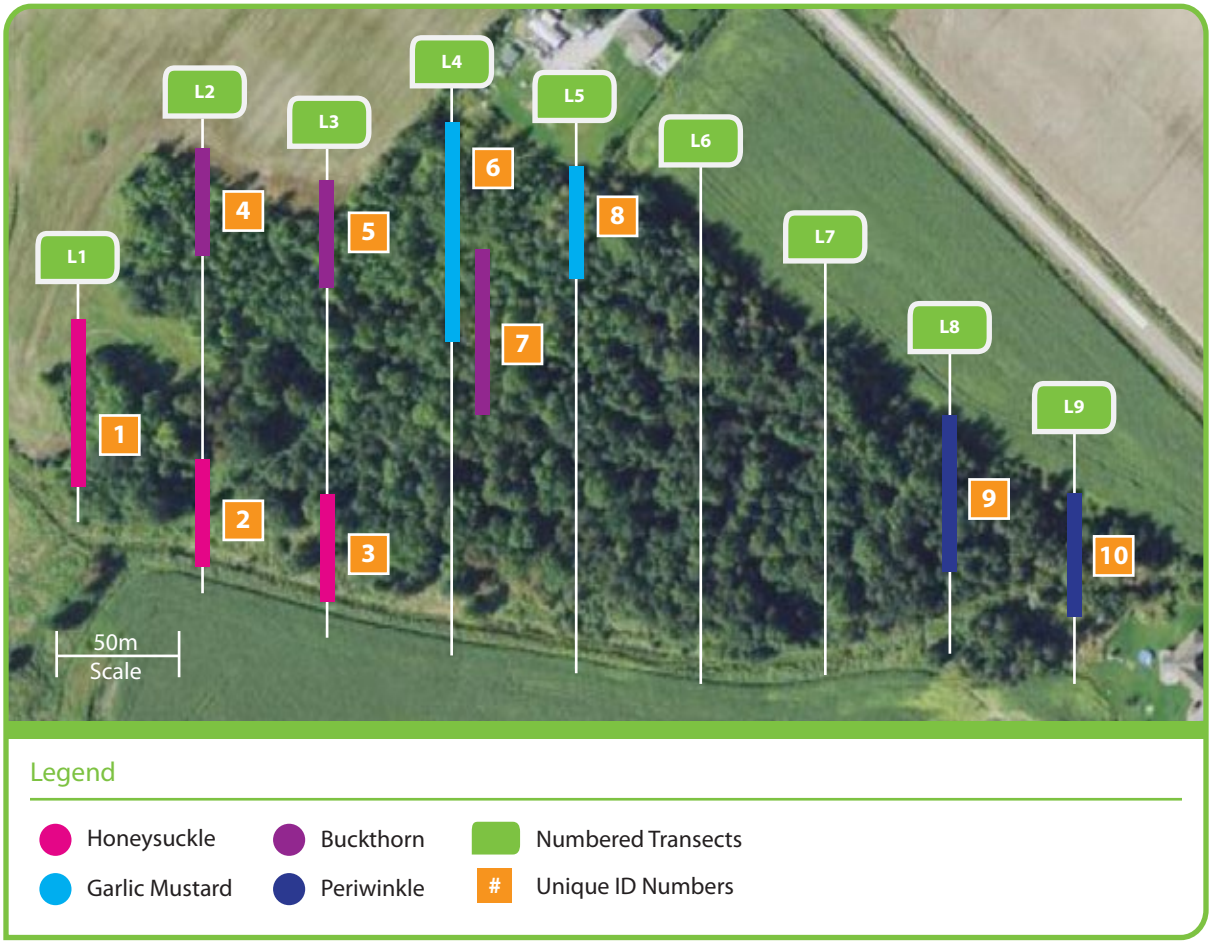

Figure 1: Transect sampling – Invasive plant mapping

After marking the location on the map take a separate piece of paper and write down the unique number and record some notes for that location, such as:

1. What the species is. Use short forms if it helps.
2. How many plants there are (number of individuals). Using ranges is sometimes easier. For example, 1 to 20 garlic mustard plants, 21-50, 51-100, or greater than 100 plants.
3. The extent of the patch or area. Was the clump concentrated in one area (local), was it scattered over the immediate area (widespread), or was it everywhere as far as you could see (extensive)? See example diagram below **(Figure 2)**.

Points 2 and 3 above are important to remember. This information will help when you sort through data later in order to assess how big a problem there is at each mapped location.

A sample data sheet that corresponds to **Figure 1** is shown below **(Figure 3)**. There is a blank template/worksheet in **Appendix 2**.

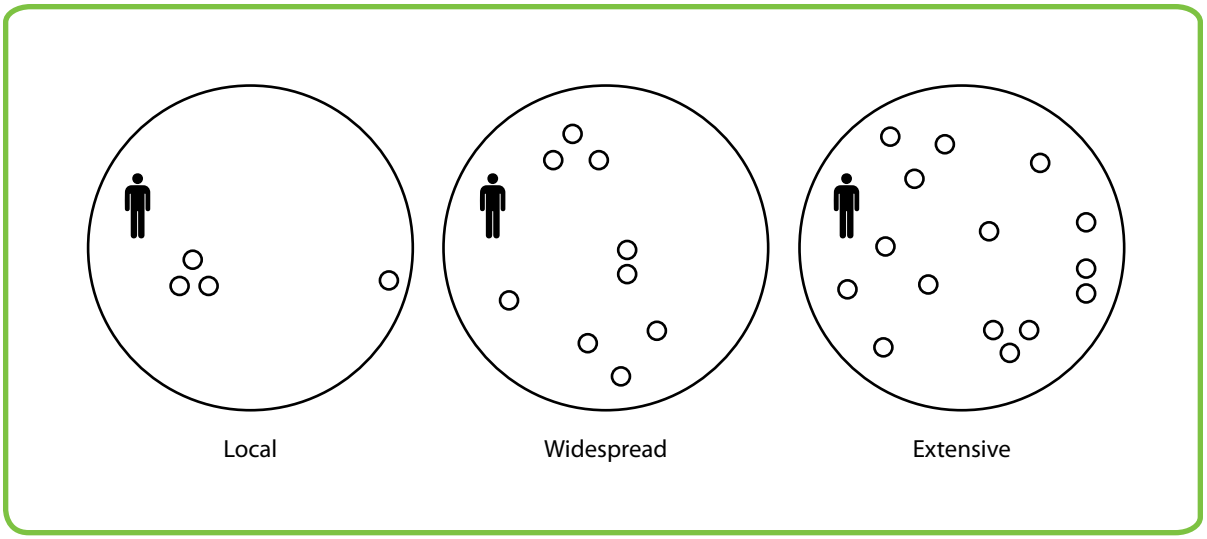

Figure 2: Measuring patch extent over an area

Mapping Data Form

Transect number	Occurrence ID number	Invasive species name	Numbers (population)	Extent	Comments
L1	1	Honeysuckle	1-20	Widespread	Scattered individuals
L2	2	Honeysuckle	21-50	Local	Dense patch
L2	3	Buckthorn	21-50	Widespread	Scattered in area
L3	3	Honeysuckle	6-20	Local	Small patch

Figure 3: Sample data sheet

ii. Transect sampling - Random trail based

Many invasive species are spread along trails by activities such as biking and hiking, so basing a survey along trails makes good sense because this is where many invasive plants start in the first place. Use this method if there is good coverage of an area by trails and you know your property well. With this method walk the trail and record what you observe. You should also run a few transects perpendicular to the trail every 25 (for small woodlots) or 50 metres (for larger woodlots) to get a good sample of conditions not immediately beside the trail. When you run transects or walk along trails and record invasive plants, use the continuous sampling method as discussed above. **Figure 4** below illustrates the concept.

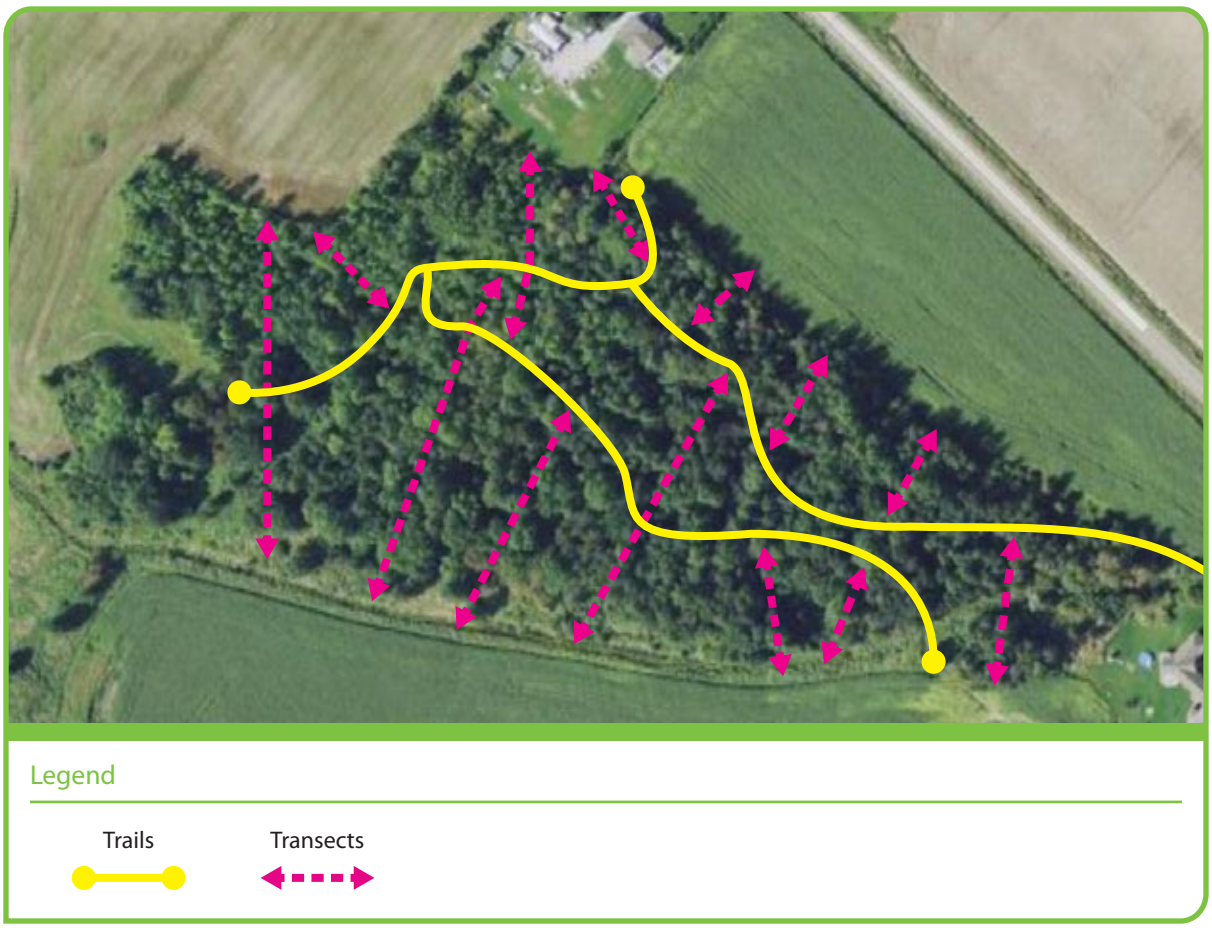

Figure 4: Random trail based transect sampling – Invasive plant mapping

B. Method 2: Polygon sampling

A polygon is a border you draw around an area that contains invasive species (e.g. You discover a 10 metre by 10 metre patch of garlic mustard in your forest. On your map you draw a line around this….this is called a polygon or 'enclosed area'). This is likely one of the simplest methods to follow on paper.

With this method you simply wander your property (*wandering transects*) making sure you get good coverage and record populations of invasive species as you come across them. Note the extent and intensity within the polygon you map. When you come upon a population of plants you simply find and draw its boundaries on a map, give the polygon a unique ID number, and record notes and information similar to that on the sample data sheet shown in **Figure 3** (a blank template/worksheet is provided in **Appendix 2**). The challenges you may come across with this method are:

1. Determining what a population boundary is. For example, when to map small isolated clumps of plants as individual polygons or when to map several clumps of plants together as one population or polygon.

On this challenge a few pointers or questions to ask yourself:

A. Is it a pioneer population, which is in the process of establishing itself or is it localized? If yes, map this area as its own polygon.

B. Is it a population that has established itself within a niche of the dominant vegetation community? For example, is it one of the top four most abundant trees, or shrubs or plants in the area? If yes, then map at the broader scale and consider lumping it into a larger polygon.

C. Can the population be split up or managed by features such as trails or watercourses or community type? If yes, consider splitting a polygon on this basis as these features can be used as good stopping points when subdividing areas into manageable units to implement a control program.

> ***Vegetation community***
>
> This represents a collection of plants that can be classified into a distinctive community type. For example, an area could be classified as a grass meadow, a Maple-Beech forest or an Oak–Maple forest.

Figure 5 below illustrates the process.

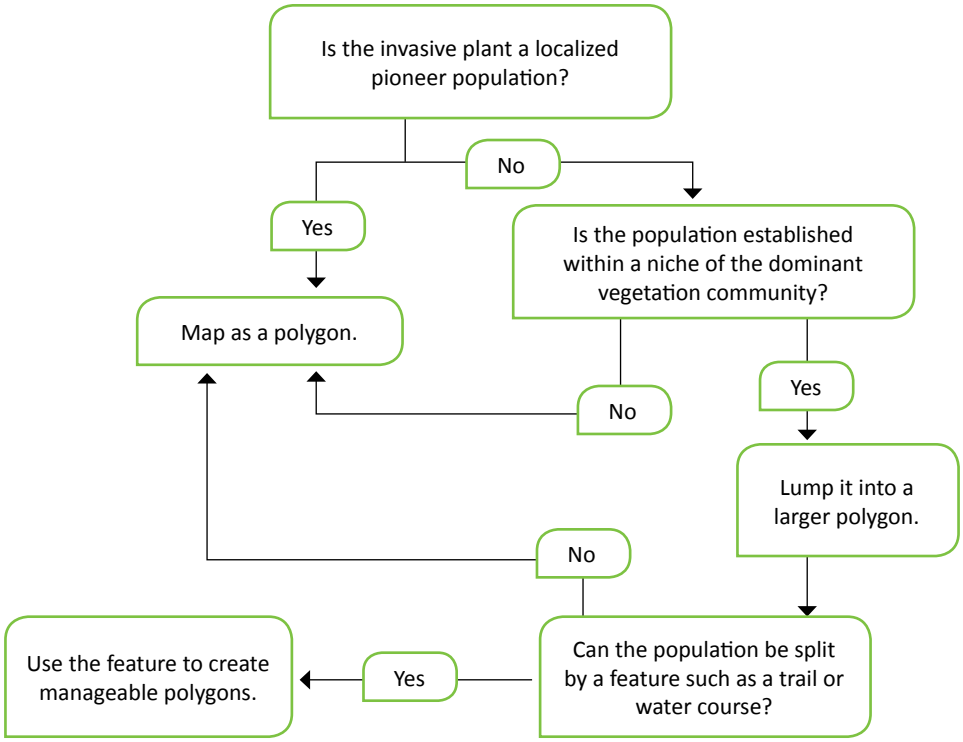

Figure 5: Determining how to map invasive plants as polygons

2. The second challenge deals with using air photos. To ensure mapping is accurate, it's important to locate yourself accurately on an air photo while in the field. A GPS device can help with this if available and you are comfortable with its use. Practice in the field is the best way to become comfortable with using air photos.

Figure 6 below gives an example of an area mapped with the polygon method using the same woodlot and information used in the previously discussed methods.

Figure 6: Polygon sampling – Invasive plant mapping

4.1.2 Other information to collect

With your map in hand, you probably have a good understanding of where problems are. The next step is determining if there is other information you will need in order to develop your plan. At this point keep in mind the overall goals you have for your property (wildlife appreciation, forest production, agriculture) and how they may fit into the final look of your plan as well as the information you will need to inform the goals.

> ***Don't panic.***
>
> Don't be overwhelmed if there is little information on rare species or rare community types. The minimum information to develop a plan is to know where invasive species are and where they aren't; essentially locating the most natural and pristine areas of your woodlot.

Agricultural goals: think of important pasturelands that need protection from invasive plants which may reduce the land's forage quality and abundance.

Forestry goals: if you're planning to establish a new plantation in a meadow full of Crown Vetch (*Securigera varia*), it might figure more prominently in your plan than if this was not an intention.

Overall, there are three main principles in developing a plan of action for invasive species control. These are:

- Protect first, areas where invasive species are absent or just starting
- Protect rare species. These include federal, provincial, and regionally listed rare species in that order of importance. (See **Section 10.0 Resources and Contacts** for additional information.)
- Protect rare community types. Examples of this include features such as alvars (a limestone plain) or prairies.

These three main principles, plus a few more will be discussed further in the **Setting Your Priorities** section, but here we need to think about these and what they mean and what information we will need to collect to be able to speak to these in the final plan.

The first part is simple and in the process of mapping the invasive species you may have already done this in your head. As you walked your property and looked at your mapping you should have noticed areas where **invasive species just weren't there**, or were just creeping in. In effect we are looking for the most undisturbed and 'natural' areas of your property (see text box).

Selecting undisturbed and natural areas of your woodlot

Certain woodland plants can indicate a healthy forest. An area with an abundance of native woodland plants is a high-priority area for removing any invasive plants. Where plants are sparse, this may indicate an area impacted by a number of environmental factors which could include invasive species.

Secondly, it is important to note where rare species are located. Ontario MNR district offices or conservation authorities are good sources for information on federal, provincial and regional rare species that may have been identified in previous historical surveys. They may also have lists of rare species if you are capable of conducting your own survey and recognizing these species. There are many resources including field guides to help identify species of plants, birds, frogs, and mammals. (See **Appendix 6 Resources and Contacts** for these).

Lastly, and trickiest, is identifying rare community types. Local MNR and conservation authorities may be able to provide historic information or lists on what community types are rare or uncommon. **Appendix 3** provides a list of rare community types in the broader geographic areas of southern Ontario (south of the Canadian Shield) and northern Ontario (Canadian Shield and north). Examples of these community types might include things such as tallgrass prairies, Black Walnut (*Juglans nigra*) forests or fens dominated by species like Black Spruce (*Picea mariana*), Tamarack (*Larix laricina*) and Leatherleaf (*Chamaedaphne calyculata*).

If at all uncertain about identifying rare or uncommon features contact your local Conservation Authority or MNR office. They may be able to provide assistance.

Whether locations are provided or you are surveying for these features yourself, try to map this information as a point or polygon on your map either through air photo interpretation or locating the features with a GPS device.

4.1.3 Your final map

At the end of this process, depending on the invasive species mapping method chosen, you may have a single map in which you have summarized all your data (**Figure 7**), or a number of maps showing information you have collected.

The above section on creating an inventory is meant as a guideline. At a minimum consider what was said at the beginning as the key information we want to collect:

- What are the invasive plants on your property?
- Where are they, and how much of them is present at each location?
- Are there areas of your property that have values you want to protect such as rare plants or areas that are currently 'invasive free'?

Even if it's just an air photo printed from the internet (Google Maps or Google Earth) with a few notes scribbled on it (see example in **Figure 8**), this will help during the next steps of developing a plan - setting priorities and deciding on best removal methods and the costs.

a) Polygon method

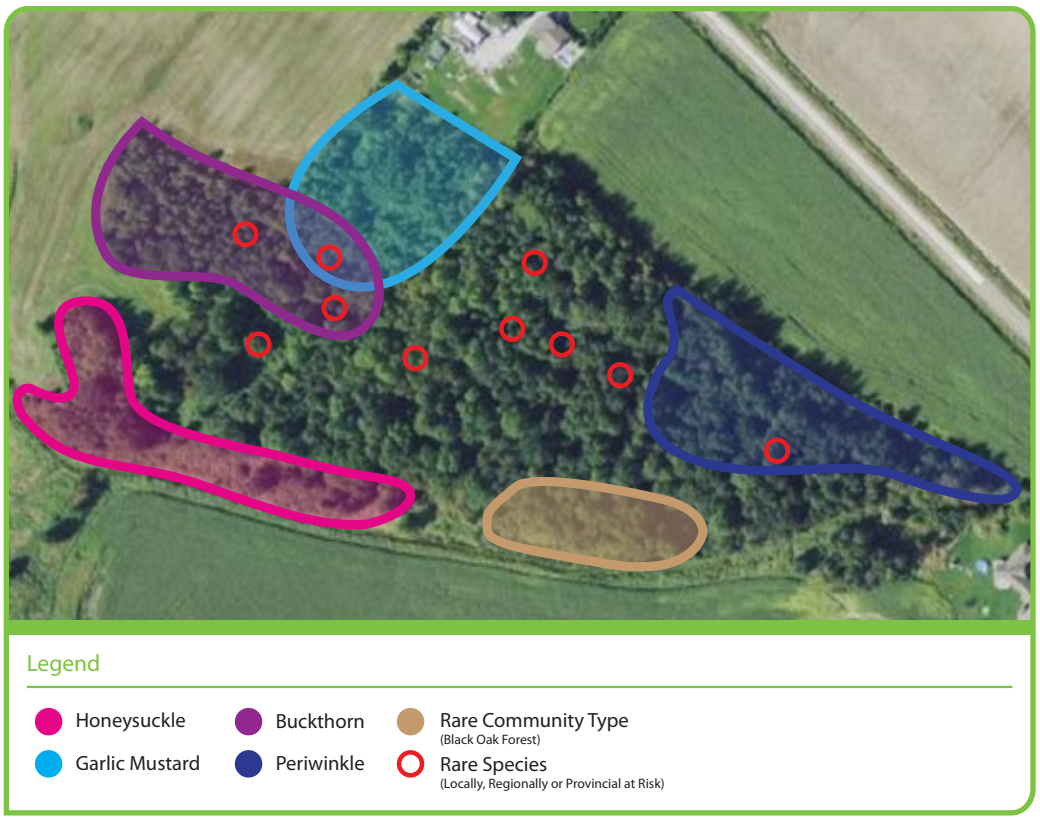

Figure 7a: Map summarizing invasive species and rare species and communities – Polygon method

b) Transect method

Figure 7b: Map summarizing invasive species and rare species and communities – Transect method

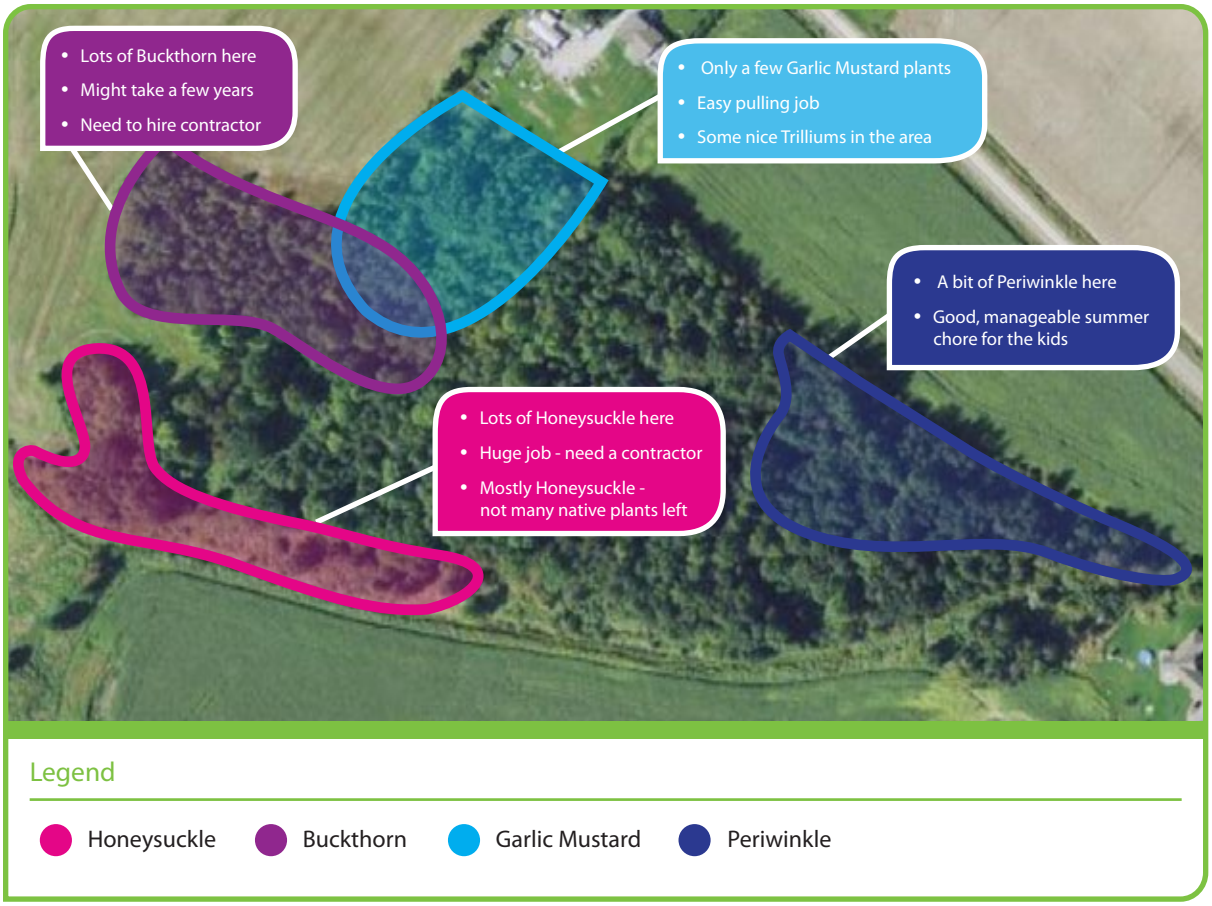

Figure 8: The basic of basic maps

4.2 Setting your priorities

After mapping invasive species on your property, you are ready to start developing a plan of action. Depending on the number of issue areas identified on your property, you may feel either pretty good at this point - "Hey, my property is not too bad, there's only a few issues" - or you may be feeling overwhelmed - "Good grief I didn't realize it was this bad! This is going to take forever and where on earth do I start?" If you're the latter, don't panic. Removing invasive species can be a long-term project. The aim is not to do it all at once, but to break it up into sensible chunks of work that can be implemented as time and resources permit.

Some areas of your property may be so extensively dominated by invasive species that you'll never be able to address the issues in your lifetime. We have to acknowledge that some invasive species are here to stay and we'll never get rid of them. The objective in these situations is to contain the infestation in the worst areas and to protect those areas where invasive species have not arrived yet. Once you have taken this first step, then you can take the next step in starting to gradually reclaim areas where they are more extensive and there is a realistic chance of success given the resources you have.

What are the principles to developing a plan? We began introducing some of the concepts in the previous section (**Other information to collect**). Again, the main principles to consider are:

1. Protect first areas where invasive species are absent or just starting.

Protect areas with high biodiversity value.

2. Protect rare species. These include those federal, provincial, and regionally listed rare species in that order of importance.

3. Protect rare community types such as alvars and prairies.

An additional principle to consider is budget.

4. **Cost and effort:**

   a) How hard is it to control? What treatments are effective? How costly/time consuming are they? Does the plant spread rapidly? Here you may have to jump ahead to **section 5.0** (**Control Methods**) to familiarize yourself with control methods.

   b) Will the area require restoration after invasive plants are removed or can the area be left to regenerate naturally?

Now is the fun part and where all the hard work starts to come together. Starting with Principle # 1 (above) and **Figure 9** below as a working example, look for areas where there are no invasive species (areas not 'whited out'). Select out this area. This is the core area that should be protected from further invasion and ensure it remains that way. Monitor for any new invasions and act quickly when new invasive plants are found. Next, we can also see that there are only 10 Garlic Mustard plants in one area (an 'early' invasion). Removal of these plants will be our first task.

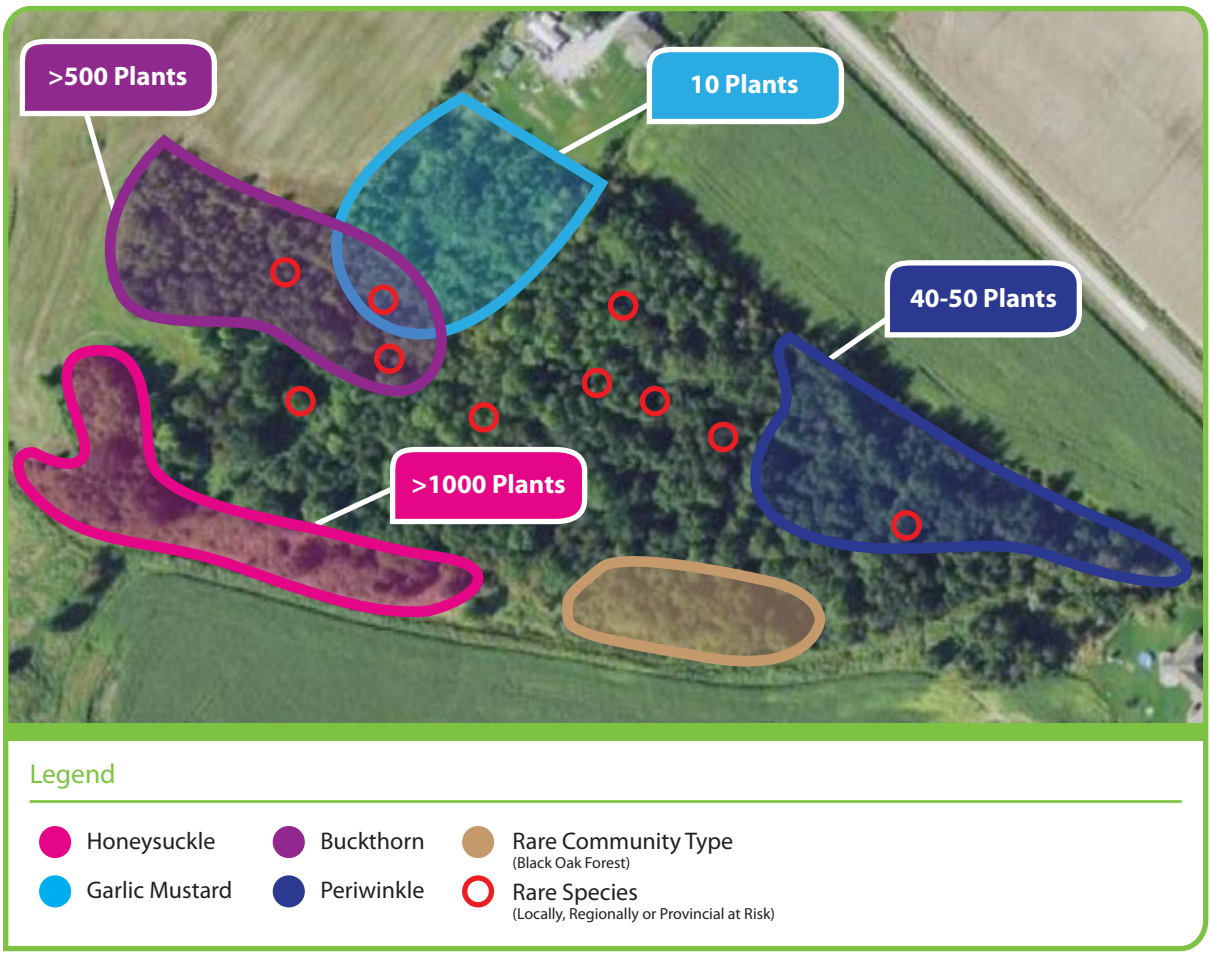

Figure 9: Setting priorities – Where to start

Moving on to Principle #2, there are several nodes where rare species are present. Circle or cluster these nodes (**Figure 10**). In these areas focus efforts on control using these species as focal points.

Looking at Principle #3, identify rare community types (**Figure 10**) and begin to implement control in the location noted on the figure, if it is required. In this example, no invasive species are present, so no action is needed.

Lastly, consider Principle #4. What are the associated costs for each project number/area identified and how aggressive (difficult to control) are the invasive plants in each project area? To assess how difficult a species may be to control refer to the plant aggressiveness score mentioned in **Section 3.1 - (Know your species)** to see how aggressive the species is to control. In this example refer to **Figure 11** and **Table 2** where we look at each project and assign a level of difficulty and cost as well as summarizing the thought process up to this point. This becomes a decision making process that weighs all four priorities and helps us determine the order of project implementation. In **Appendix 2** you will find a blank worksheet of this "summary approach method" (**Table 2**) to use for summarizing your own planning process.

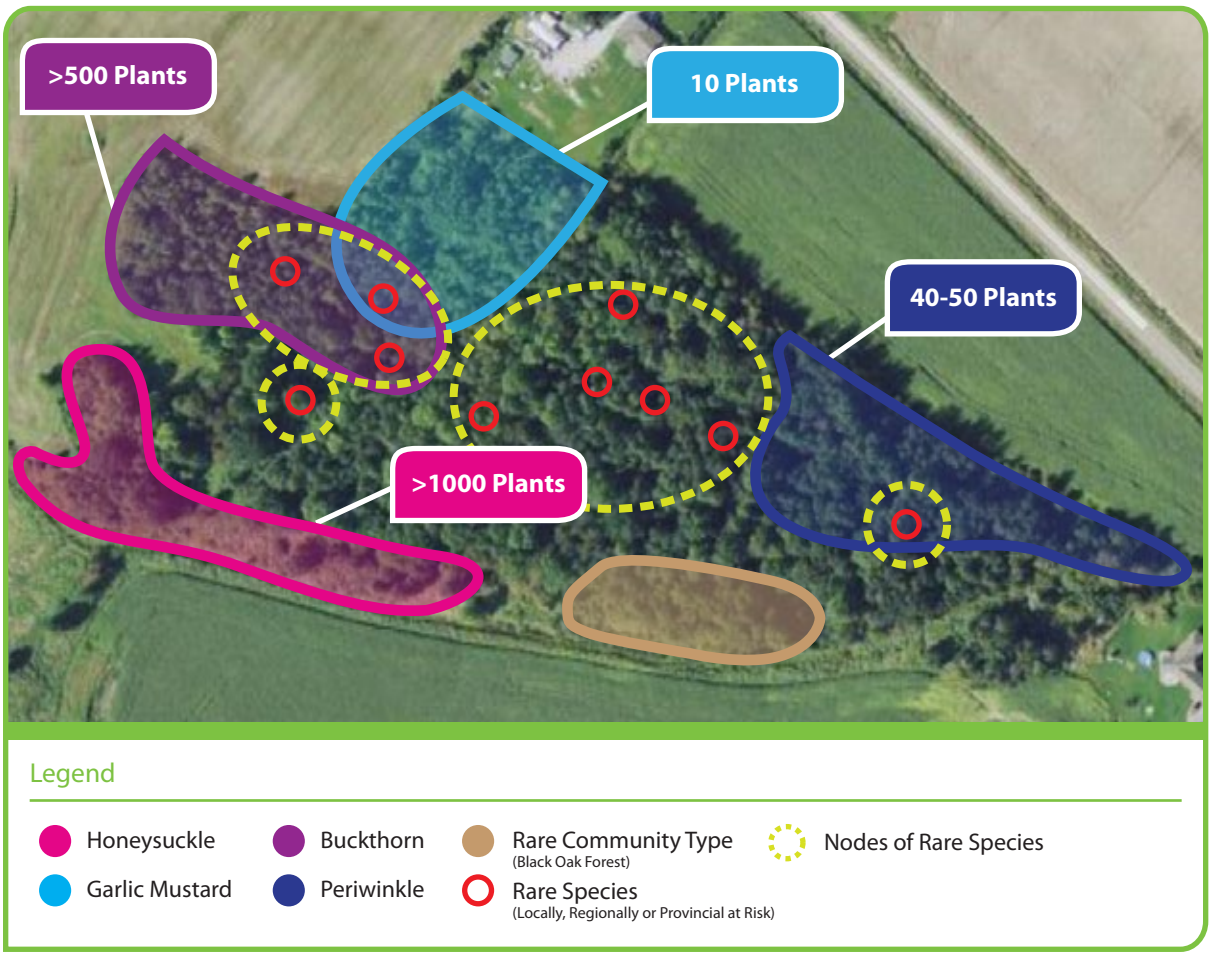

Figure 10: Setting priorities – Rare plants and communities

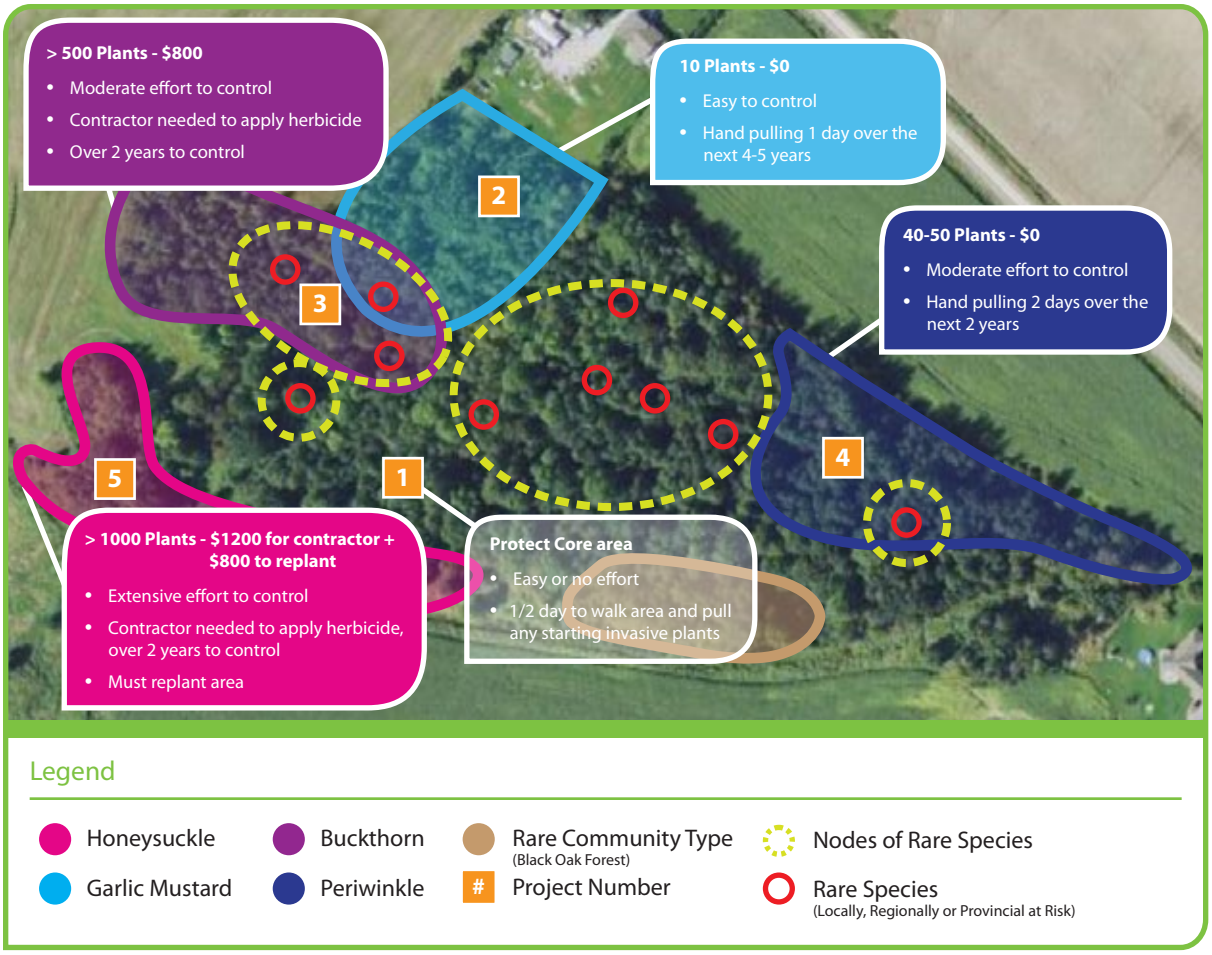

Figure 11: Setting priorities – Bringing the plan together

Table 2: Identifying the priority of projects

Project Number	Removal method to be used	Cost of method	Time required	Biodiversity value High Medium Low	Comments	Summary and assigned priority (1) High (5) Low
1	Hand pulling mostly, some herbicide application possible	$0*	½ day to walk area	High - many rare plants	Protect un-invaded area. Low effort and no cost. Buckthorn highly invasive	1
2	Pulling	$0*	1 day over next 4-5 years	Medium - a few rare plants	Has some rare species. Low in effort and no cost. Garlic Mustard highly invasive	2
3	Mostly herbicide application, some hand pulling of smaller shrubs	$800 for contractor*	Contractor to spray over 2 days, with touch-ups next 4-5 years	High - many rare plants	Both #3 and# 4 are moderate effort. #3 has more rare species and Buckthorn is much more aggressive than Periwinkle, but also costs more to remove. I don't have the money right now to do #3, so will have to choose #4 as the higher priority	3
4	Hand pulling	$0*	2 days over next 2 years	Medium - a few rare plants	See comments above.	4
5	Herbicide application, some hand pulling of smaller shrubs	$1200 for contactor $800 for needed replanting*	Contractor to spray over 3 days, with touch-ups next 4-5 years	Low - no rare plants	Lots of effort needed and costs the most, plus there are no rare species or communities here. Low priority.	5

* Note, these costs are examples only. Costs can vary considerably based on a number of variables

It may seem a difficult process to assign priorities, but following the thought process as above should help determine the best way to proceed. If this is difficult, another approach is to take each project and run it through a scoring system as shown below.

A Scoring System for Evaluating Project Priority

(This section modified from a paper published by Ellen Jacquart, Indiana Chapter of The Nature Conservancy. October 26, 2009)

Ask yourself these questions about each project and record the points for each:

1. How many invasive plants do I have?

1 point- Just a small amount but it's spreading
2 points - A fair amount and it's spreading
3 points - A lot! It's all over the area

2. Are there features within the area I want to protect?

1 point - There are many rare plants or community types in the area
2 points- There are a few rare plants or community types in the area
3 points - The invasion is happening near disturbed edges or areas I don't really care about

3. What impact is it having and how aggressive is the plant? Please see the Ontario priority invasive plant species list (Appendix 1) to help you rank plant aggressiveness if you are unfamiliar with the plant.

Category 1
1 point - It is so aggressive and it changes the area so much that few other species survive.
Category 2
2 points - It invades undisturbed areas and outcompetes native species.
Category 3
3 points - It doesn't out-compete native species but natives don't regenerate.
Category 4
4 points - It only invades disturbed areas such as edges.

4. How hard is it to control?

1 point - Fairy easy, one treatment and it's pretty much gone
2 points - Takes multiple treatments, but eventually it's gone and native species will replace it
3 points - Takes multiple treatments, but native plants won't regenerate, and will need replanting
4 points - No effective treatment has been found for this species.

When you are done, total the points from all categories for each project. The **lower the score, the higher the priority** rating the project should receive. Below we have used the previous project and provided an example of how these projects would be scored:

Cont'd on next page...

Project #	1. How Many?	2. Feature to Protect?	3. How aggressive is the plant?	4. How hard is the plant to control?	Final Score
1	0 (none)	1	0 (none)	0 (none)	1
2	1	2	1	2	6
3	3	2	1	2	8
4	2	2	2	2	8
5	3	3	1	3	9

Other factors to consider when setting priorities

- Seed dispersal by wildlife. Consider species whose fruit may be eaten by wildlife and spread by this avenue around your property. Birds are prolific spreaders of seed such as Buckthorn. Deer in large numbers can carry seed around on their hooves and fur. Consider targeting mature plants/shrubs/trees that produce abundant fruit first.
- Pathways of invasion. Seeds may be moved along trails by people and wildlife. Consider ways to manage this such as installing boot brushes or prioritize removal in high risk areas. Seeds may also be moved along watercourses, such as Giant Hogweed. Consider prioritizing removal in these locations.
- Adjacent properties. If the invasive plant is coming from your neighbour's property, consider working with them to effect complete removal of the problem.
- Keep sight of your goals. You are managing to protect something, not just managing against invasive species. Remember the goals for your property, whether it's forest production, wildlife appreciation, or agricultural production and weed abatement.

At this point you should have your management plan just about put together. Your mapping is complete, and priorities have been assigned to each project based on the 4 principles introduced in section **4.2 (Setting priorities)**. The following sections introduce you to the other elements that you will need to refine your plan.

1. *Control methods*
   These you probably have already accessed to help you determine your priority setting
2. *Relevant legislation*
   Any permits, regulations or safety guidelines you may need to think about.
3. *Monitoring*
   Keeping track of your progress and effectiveness.
4. *Restoration*
   What comes after removing invasive species? Do you need to restore and help the natural area recover?
5. *Funding*
   Government programs that may help with funding.
6. *Resources and contacts*
   Useful information and contacts that may be able to assist you with your efforts.

Tools of the trade (Credit Valley Conservation)

5.0 Control Methods

Applying the appropriate method of control is the key to success of any plan. The main objective is to provide the best method of control at the least cost to the landowner in terms of resources and time. Where chemicals (*herbicides*) are involved, reducing their use and impacts on the environment is also a key objective.

Control methods can be broken into 3 categories:

Mechanical - These methods involve strictly manual labour and include such things as cutting, pulling, mowing, solarisation (smothering vegetation with plastic), girdling (removing outer layer of bark from around a stem) or even a prescribed burn.

Biological - This involves using biological predators or agents to control invasive plants including: insects, fungal agents, bacteria or viruses. Most often insects are the agents referred to here such as the Purple Loosestrife eating beetle. Agents for biological control must be approved by federal and provincial authorities before release (see **Relevant Legislation** section).

Chemical - This involves the use of herbicides (targets weeds and other plants). Herbicides that people may be most familiar with are the over-the-counter (domestic) products e.g. Round-Up or Eco-sense. These domestic herbicides as well as some commercial herbicides may be used to control invasive plants if your project falls under the category of an exception to the Ontario Cosmetic Pesticides Ban Act, 2008. A licensed exterminator will be required if your project involves the use of commercial herbicides. Exceptions to the cosmetic pesticide ban such as the control of invasive plants are discussed more in the following section (**Relevant Legislation**). Where use of pesticides is proposed in this manual it is advised that their use as a control method for managing invasive species be carefully considered using all measures of environmental impact as criteria. Even though chemical pesticides can be harmful their use is accepted as a final control method in situations where they are considered warranted. In circumstances where other more desirable control options are unsuccessful or not possible, chemical pesticides may need to be used to control invasive plants that are considered safety risks or environmentally damaging. Generally, the decision to use pesticides depends on the balance of what represents the greater risk or detriment. For example, if leaving an invasive species is worse than using pesticides to control them, then clearly pesticide use is warranted as a biodiversity issue; conversely, if spraying is more environmentally damaging than not controlling an invasive plant location, then not using chemical pesticides is the prudent decision. Because this manual's primary objective is protection of the natural environment, pesticide use remains a valid control option only if the net benefit to the environment is positive.

Of all of the above methods, often the most effective is a combination of all or several to exert maximum impact and control. This is known as Integrated Pest Management.

Before applying a treatment for controlling an invasive species there are many factors to consider. The table below broadly outlines some advantages and disadvantages of a number of control methods which should assist with determining the most appropriate method of control in a given context. The final decision will depend on a complex number of issues dictated by site context, condition, extent and intensity of the infestation, the invasive species itself and ultimately available resources.

Table 3: Guidelines for implementing control [Below tables from CVC Invasive Species Strategy, 2009]

Method	Description	Advantages	Disadvantages	Notes
Mechanical Control				
Overgrazing	Cattle, goats, sheep, and even geese may be used to control weeds.	Is a way to reduce the vigor of palatable invasive plants like Kudzu Vine (Pueraria lobata).	Rarely yields eradication and may spread seeds.	Animals should be brought into an infested area at a time when they will be most likely to damage the invasive species without significantly impacting the desirable native species. Grazing during seed or flower production can be especially useful. On the other hand, some weeds are palatable only during part of the growing season.
Pruning, cutting, digging and girdling terrestrial plants; or mechanical harvest of aquatic plants	Directly removes or kills plants or prevents reproduction.	Immediate results. Can replant with preferred species.	Labour intensive. Disturbs area for recolonization or requires replanting. May also require proper disposal of waste matter.	Success can vary depending on time and completeness of removal. Seed banks or roots can regrow.
Prescribed Burning (PB) *refer to Appendix 6 (Resources and Contacts) for licensed operators	Destroys vegetation by fire, or sets it back enough that native species adapted to fire are given a competitive advantage. The most effective fires for controlling invasive plant species are typically those administered just before flower or seed set, or at the young seedling / sapling stage.	Natural control that benefits some native communities and species. Large areas can be covered. Burning treatments can increase mortality of herbicide-weakened plants and have a place in an integrated pest management program.	Invasives may recolonize from seed bank or roots. Safety concerns. Requires PB professionals and permits from appropriate agencies.	Needs to be repeated over many years, not effective for all invasives e.g. fire encourages Dog-strangling Vine. PB cannot control root crowns or rhizomes of perennial plants and usually only kills deadens small above ground shoots, providing only temporary above ground control.

Method	Description	Advantages	Disadvantages	Notes
Blanketing / Solarization	Using black blanket materials to block the sun and theoretically raises soil temperature to sufficiently kill underlying seeds.	Can cover areas with less effort. Easily seen for interpretive opportunities.	-Can be expensive over large areas. -Aesthetic concerns and ecological impacts, such as destruction of native vegetation and seed banks, soil organisms. -Vandalism. -May take a few years. -Plants can grow through some fabrics and rips.	Area needs to be replanted immediately after blanket removal. Solarization can often damage soil health and therefore the reintroduction of beneficial soils organisms (e.g. microrhizal fungi) may be needed. There are commercial products available such as the Myke© line of products.
Biological Control				
	Use of natural predators, parasites or diseases.	Effective use via natural pathways.	Strictly regulated by government agencies. Significant research must demonstrate that there will be no unknown impacts on other species, habitats or the economy.	Currently, there are a few biological controls available. An example of a plant where a biological control is available is Purple Loosestrife (for more information see text box on pg. 10)
Pesticide Control				
	Directly kills vegetative growth or the entire plant.	Can be both cost effective and time consuming depending on context	May be impacts on other species. Public aversion to pesticide use.	Requires licensed personnel and permits or government review for many applications.
Integrated Pest Management				
	Integration of all methods	Most effective method	Requires intensive planning. Pre-planning can be time consuming	It is important when considering hiring a licensed contractor to make sure they are following integrated pest management practices.

5.1 Using pesticides?

When deciding to use pesticides the following must be considered and planned for:

- Method and tools: spraying, painting, or injecting herbicides.
- Determine what permits are required, from MOE, MNR, or Department of Fisheries and Oceans if near or in water.
- A licensed applicator is necessary to address proper safety considerations: protective equipment, public safety (See **Relevant Legislation** section).

The following must also be considered when deciding which chemical to use and its properties (Tu, M., Hurd, C., & J.M. Randall, 2001. Weed Control Methods Handbook, The Nature Conservancy, http://tncweeds.ucdavis.edu, Version: April 2001):

1. Effectiveness of method against target species.
2. Mechanisms of dissipation (persistence, degradation, and likelihood of movement via air or water to non-target organisms).
3. Behaviour in the environment - soils, water, and vegetation.
4. Toxicity to birds and mammals, aquatic species, and to other non-target organisms including algae, fungi, and soil organisms.
5. Application considerations.
6. Safety.
7. Human toxicology.

5.2 Where to start control at the site level

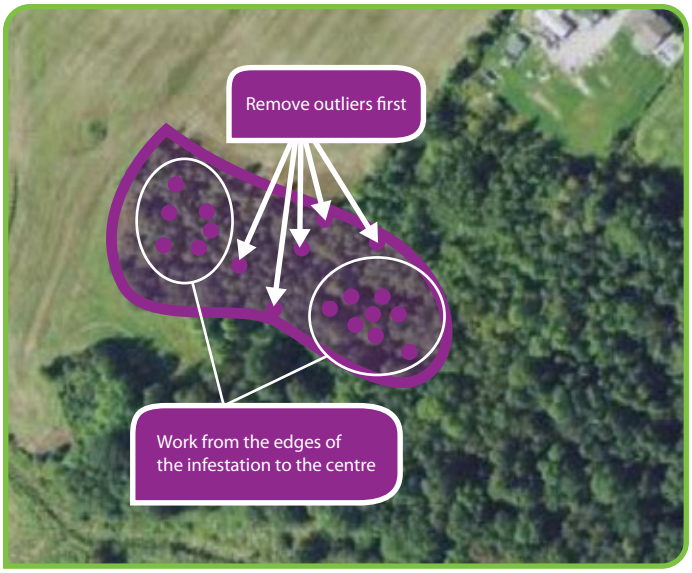

Figure 12: Where to start removal

Before you start to get in there and get dirty controlling invasive plants there's a final piece of planning, and that is where do you start when removing an invasive plant at the site/project level?

Let's take the example woodlot from **Figures 9** through **11**. We'll zoom in on the area with Buckthorn (**Figure 12**). Always start with satellite or outlier populations of the main infestation. Circled areas indicate the main infestation area. Once outlier populations are dealt with, move onto the main infestation and work from the edges in towards the heart of the infestation.

5.3 Disposal of invasive plant species

When pulling/cutting plants or shrubs consider where this material will be disposed of. If the area is lightly invaded, it may be okay to leave material onsite provided it has no seeds. Be cautious that even if the seeds appear immature at time of removal, there may be enough energy in the plant to allow the seeds to mature once pulled. If the plant's biology suggests it reproduces from root fragments then remove material from the site.

If the site is highly invaded or plants have gone to seed/reproduce from root fragments you may need to remove material from the site. Options include:

- Check with the municipality on how it treats organic compost since many regions heat compost to destroy weed seeds.
- Check local by-laws to see if material can be burned.
- The plant may need to be disposed of in a landfill.

Disposal of Garlic Mustard in municipal compost bags (Credit Valley Conservation)

5.4 What are the suggested control methods?

Once project priorities have been developed, and you know which species to control and the methods available, the next step is to select the method that is most appropriate and effective in terms of labour and cost. In **Appendix 4** there is a set of guidelines and best practices based on the top invasive plant species. This appendix will be refined over time as new information becomes available. Species are organized by Upland Shrubs, Upland Flora, Wetland Flora and Trees.

The choice of methods may vary depending on a number of criteria; for example, whether you are opting for non-chemical methods, the size and intensity of the infestation, whether there a non-target plants in the vicinity that must be preserved, and proximity to water or other public safety concerns. The tables in **Appendix 4** provide some guidance.

5.5 Some tools to consider

Based on the methods selected in the previous section there are many tools on the market for mechanical and chemical treatment methods. Considering the methods selected in **Appendix 4**, we have listed in **Appendix 5** a summary of tools and commercial operators that these can be sourced from.

Endangered American Ginseng (Credit Valley Conservation)

6.0 Relevant Legislation

Once an invasive plant control plan has been developed for your property, it's time to determine whether the plan requires any permits or approvals from government agencies that may enforce regulations over activities planned for your property.

6.1 What you need to know to control invasive plants on your property

Fortunately most control projects do not require any type of government approval, but depending on the types of control measures planned for your property, you may need to seek/obtain some government approval or permits.

This process can be confusing, so it is often a good idea to seek advice from your local conservation authority, or MNR district office to help navigate the approvals process. **Table 4** provides a quick guide to the agencies you may need to contact prior to implementing a project. Further details are provided in the following paragraphs.

Table 4: Legislative summary

Type of Project	Issue	Relevant Legislation	Responsible Agency to Contact
Any Project	Species at Risk Plants/Animals	Endangered Species Act, 2007	Ministry of Natural Resources • Consult with your local MNR office to inquire about the presence of any Species at Risk on your property. If there are provincially listed species on your property, you will need to identify if your plan requires any permits or approvals to proceed.
	Species at Risk Plants/Animals	Species at Risk Act	Environment Canada /Canadian Wildlife Service • If there are federally listed species on your property or pass through your land, or if their critical habitat exists on your property, you will need to identify if your plan requires any permits or approvals to proceed.

Type of Project	Issue	Relevant Legislation	Responsible Agency to Contact
Aquatic Plant Control (Mechanical and chemical)	In-water project affecting fish/ amphibians and other aquatic life For all projects consult with the responsible agencies	Fisheries Act-Fish Habitat Public Lands Act (MNR) Pesticides Act (MOE)	-Fisheries and Oceans Canada -Conservation Authority -Ontario Ministry of Environment (MOE) -Ontario Ministry of Natural Resources (MNR)
Mechanical Control (Trees)	Invasive tree removal. (e.g. Scot's Pine removal from a forest)	Conservation (Tree Cutting) Bylaws	Consult with your municipality if bylaws exist.
Chemical Control (General)	Control/ eradication	Pesticides Act and Ontario Regulation 63/09	Ontario Ministry of Environment. • Pesticides available to landowners and those that require an exterminator's license are outlined in Figure 12.
Chemical Control (Forest woodlot > 1ha)	Control/ eradication	Pesticides Act and O. Reg. 63/09- forestry exception under the cosmetic pesticides ban	Ontario Ministry of Environment • No special permitting required if you have a forest applicators licence and no other issues apply.
Chemical Control (Forest woodlot <1ha or non-forested terrestrial habitat)	Control/ eradication	Pesticides Act -natural resource exception under the cosmetic pesticides ban	Ontario Ministry of Natural Resources • You will need an application for a Written Opinion.
Chemical Control (Plants poisonous to humans by touch)	E.g. Poison Ivy, Poison Sumac, Giant Hogweed control	Pesticides Act- health or safety exception under the cosmetic pesticides ban	Ontario Ministry of Environment • No special permitting required if you have the appropriate pesticide exterminator's licence and no other issues apply.
Biological Control	E.g. Galerucella beetles for control of Purple Loosestrife	Plant Protection Act Fish and Wildlife Conservation Act Biological control agents require extensive screening and risk assessment to determine potential impacts to native species, habitats and the economy (i.e.Agriculture).	Ontario Ministry of Natural Resources and Canadian Food Inspection Agency • Permissions from both federal and provincial agencies may be required for the release of biological control agents depending on the species and environment proposed for release. Consult with MNR and the Canadian Food Inspection Agency for assistance prior to proceeding with biological control options.

Endangered Species Act, 2007 (Species at risk)

Prior to implementing any control project, you should contact the local MNR office to inquire about the presence of species at risk on your property. MNR can provide advice on how to avoid adverse effects from your project on these species, which are protected under Ontario's Endangered Species Act, 2007. Where adverse affects on species at risk cannot be avoided, an authorization under the Endangered Species Act, 2007 would be required. Authorizations may be issued where the activity will support the protection or recovery of the species at risk or where an overall benefit will be provided to the species.

Aquatic plant control

Control projects for aquatic plants such as Eurasian Water-milfoil (*Myriophyllum spicatum*), and Yellow Floating Heart (*Nymphoides peltata*), may fall under the fish habitat protection provisions within the federal Fisheries Act and require approvals from one or more agencies. The agencies involved and the number of approvals required depends on the location of work, size of control area, and method of control - chemical or mechanical.

Agencies which may be involved in review and approval of aquatic plant control projects include: Fisheries & Oceans Canada, Parks Canada Agency, MOE, MNR, and local conservation authorities.

Species at risk

These are species listed either provincially or federally as endangered, threatened or of special concern. These species are protected under the Endangered Species Act, 2007 and the federal Species at Risk Act where it applies (Note: The federal Species at Risk Act is applied on federal lands and all waters where federal SARA species occur. It does not generally apply to private lands except for specific groups of species, such as migratory birds and aquatic species.

The *Working Around Water Factsheet Series; Fish Habitat and Controlling Aquatic Plants (Ontario edition)* outlines specific requirements for aquatic plant control projects:

www.dfo-mpo.gc.ca/regions/central/pub/factsheets-feuilletsinfos-on/i2-eng.htm

Mechanical control

For this type of removal there may be some permitting considerations if removing large trees. Many municipalities in Ontario have tree conservation bylaws, formerly know as tree cutting bylaws, which regulate tree cutting in privately owned forests. These bylaws are generally intended to prevent unregulated clear-cutting of forest tracts. If your project involves tree removal you may still be required to obtain a permit from your local municipality even if trees you plan to remove are invasive. These bylaws can require trees to reach a certain minimum size before they can be harvested, which could impact removing invasive tree species, such as Scots Pine. For these reasons it is very important to consult with your municipality prior to undertaking your project.

Chemical control

The cosmetic pesticides ban provides specific exceptions for the use of prohibited pesticides to control invasive plants that are a threat to natural resources management and also plants that are poisonous to humans by the touch that may affect public health or safety. These exceptions enable the use of prohibited herbicides for control of invasive plants on your property provided your project meets specific conditions, and you obtain the necessary approvals.

Refer also to MOE factsheet – *Pesticides Act and Ontario Regulation 63/09 Private Land and Woodlot Owners May 2011.* It can be found at www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_085367.pdf.

Exceptions to the cosmetic ban are as follows:

i) Forestry

Using pesticides for forestry is permitted to protect trees from pests and to control competing vegetation. The exception to the cosmetic pesticides ban allows a licensed forestry exterminator to apply prohibited pesticides (Class 9 - see **Figure 12**) for pest management purposes that include a range of forestry activities including harvest and reforestation. Refer to MOE Technical Guidance – Pesticides Act and Ontario Regulation 63/09 – Forestry May 2011 for details on the forestry exception to the cosmetic pesticides ban.

The definition of a forest according to O. Reg. 63/09 under the Pesticides Act is "a treed area of land that is one hectare in size or larger and that is not used for the production of an agricultural crop as part of an agricultural operation";

Forestry means activities relating to any of the following:

1. harvest, renewal, maintenance or establishment of a forest
2. protection of forest resources derived from a forest such as removing invasive species to regenerate native trees and shrubs
3. accessing a forest for a purpose mentioned in points 1 or 2.

If your project occurs in a forest greater than one hectare and invasive plant control is required to protect trees from forest pests, control competing vegetation or to undertake forestry activities on your property, you are eligible for a forestry exception under the ban. However, you must obtain the services of a licensed exterminator with a forestry licence or hold a valid forestry exterminator licence yourself if your control project involves using a commercial or domestic prohibited pesticide (see **Figure 12**). To ensure your project meets requirements of the forestry exception, you should contact MOE for advice.

Giant Hogweed: A highly invasive and poisonous plant (Credit Valley Conservation)

ii) Agriculture

If using a woodlot to produce maple syrup you may be considered a farmer, as defined in O. Reg. 63/09 under the Pesticides Act, and exempted from the cosmetic pesticides ban for purposes of agriculture. The use of commercial prohibited pesticides would be allowed under this exception if you are a farmer and hold a valid grower's certificate. Refer to MOE publication – *Technical Guidance Pesticides Act and Ontario Regulation 63/09 Agriculture May 2011* www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_080128.pdf for further information on this exception to the cosmetic pesticides ban.

iii) Public health or safety

Pesticides may be used to control plants poisonous to humans by touch, such as Poison Ivy, Wild Parsnip and Giant Hogweed. For these types of projects you may directly apply Class 5 or 6 domestic herbicide products containing Class 11 pesticide ingredients such as acetic acid, herbicidal soap, iron F FeHEDTA or Class 7 herbicide products containing Class 9 ingredients such as glyphosate and glufosinate ammonium according to label directions. Class 7 products are only displayed in areas not accessible to the general public in local hardware/garden stores. If the project requires using a more concentrated commercial herbicides, such as a Class 2, 3 or 4, a licensed exterminator should be hired or you should obtain the necessary training, certification and licensing.

iV) Natural resources

With a regional or branch director of MNR, a written letter for Class 9 pesticides can be used to control invasive species that affect Ontario's natural resources. Your project may be eligible for an exception to the ban, if it:

- controls an invasive species that may be detrimental to the health of a person, the environment or the economy of Ontario, or
- benefits a species of plant or animal native to Ontario through the protection of the species or its habitat, or the establishment, restoration or management of the species habitat, or
- aims to protect or restore a rare ecosystem or its components.

To be eligible for this exemption, you must apply to MNR. An application guide is available from MNR district offices. See the **Resources and Contacts** section. Upon review of the application, MNR may issue a written opinion that using a Class 9 pesticide ingredient is necessary for natural resources management and use of Class 9 pesticides must be in accordance with integrated pest management principles. If MNR provides a written opinion, you may purchase and use a pesticide (a retail domestic herbicide labeled for the specified use) for the excepted use described in the written opinion or hire a licensed exterminator authorized to use a commercial or domestic Class 9 pesticide.

Classification of pesticides

A pesticide must be registered by Health Canada's Pest Management Regulatory Agency and classified by MOE to be sold and used in Ontario. Please refer to section 6 of the Pesticides Act and section 9 of O. Reg. 63/09. Products must be used according to label directions and for purposes allowed under the ban.

As set out in subsection 4(5) of O. Reg. 63/09, Ontario has established a pesticide classification system consisting of 11 classes under provincial legislation as set out below:

- Class 1 pesticides are products intended for manufacturing purposes
- Class 2, 3 and 4 pesticides are restricted or commercial products (examples are fumigants, Garlon (triclopyr), and commercial brands of Roundup (glyphosphate) not available to the general consumer)
- Class 5 and 6 pesticides are domestic products intended for household use (ant bait for example)
- Class 7 pesticides are controlled sale products, domestic or restricted (for example, ready- to-use Roundup for poison ivy control)
- Class 8 pesticides are domestic products that are banned for sale and use
- Class 9 pesticides are ingredients in products for use only under exceptions to the ban
- Class 10 pesticides are ingredients in products for the poisonous plant exception
- Class 11 pesticides are ingredients in products for cosmetic uses under the ban
- Class 9 pesticides are ingredients in products that cannot be used in, on or over land unless otherwise excepted.

Figure 13: Classes of pesticides in Ontario

7.0 Monitoring

Once you have started controlling the invasive plants on your property, the project area(s) need to be monitored to ensure the effectiveness of your control efforts. By measuring things like patch size annually, long-term monitoring of the targeted invasive plant species and native plants will allow you to assess the effectiveness of your control strategies, and help determine if there is a need for changing your management strategy.

In some situations multiple control applications may be necessary to ensure the invasive species have been removed. However, before you start any removal project it is a good idea to collect baseline data (a 'before' snapshot of the area) of the invasive species to provide you with a comparison later on for determining the effectiveness of your control efforts. Here are a few suggestions that can ensure successful monitoring:

- Summer monitoring is recommended to capture the greatest diversity of native vegetation and what effect the control is having on the targeted invasive species. For example, because Garlic Mustard populations alternate annually between high and low density (some years it may appear more abundant than in others years) and have first and second year growth forms, several years of data is required to determine an actual increase or decrease in Garlic Mustard populations (see **Figure 14**).

Figure 14: Appearance of Garlic Mustard through the year

- Effective monitoring programs should be designed to be cost-efficient so that resources available for control are not unreasonably depleted.
- Also monitor for native plants. This is useful in determining how degraded the site is and if native plantings are required during site restoration.
- Monitoring after control is implemented is also important to make sure any invasions of new invasive species are caught. This is especially important if the site has been heavily disturbed, for not only can plants from the existing seed bank start to take over, but other species could move in from the surrounding area.

7.1 Monitoring techniques

There are many techniques to monitor invasive species control projects, ranging from detailed time consuming methods such as plot monitoring to quick and simple methods such as photo monitoring, staking, or walking and observing. The monitoring technique you choose should be based on the number of control projects and their size, the amount of time available and your comfort level.

7.1.1 Plot monitoring

This is a research based technique and is very detailed and time consuming; therefore, it is probably best used for very complicated sites and probably not necessary for the average landowner. This technique involves recording all the species present in a given plot (e.g. a 5m by 5 m square) before control efforts begin, including percentage of coverage and stem counts. Subsequent counts will record how many of each species were removed and exact numbers of what plants returned or were planted.

7.1.2 Photo monitoring

This is a fairly simple and straightforward technique, and is adaptable to the amount of work you are willing to invest. The process consists of repeat photography of the site over a period of time, with the photos taken from the same location and with the same field of view. The bare necessities for this technique are a camera and log book. If more detailed and accurate results are required then a reference pole and photo board are useful. See the photo monitoring text box for details on the procedure. An example of a photo monitoring plot is provided below in **Section 8.5: Case study 1- Common Buckthorn removal.**

Photo monitoring protocol

Materials needed:

Camera, extra batteries, memory card, photo board (dry erase board) and marker, reference pole, field/log book and GPS (optional).

Reference pole: Provides a size reference for quantifying change over time. This can be easily made using PVC piping with measuring units spray-painted on.

Photo board: Write the necessary information for each photograph (site name, photo identification and date).

Field book: To store photos and notes taken at each visit.

Choosing a site:

The site should be representative of the area in which the invasive species are being removed. It should also have a permanent feature in the background that can be used as a reference landmark, such as a geologic feature or a mature tree.

Taking a photo:

An initial photo should be taken before any work is done at the site. Photos are also taken after removal and restoration work has taken place. Subsequently, the site should be visited at the same time once a year to the monitor changes over time.

1. Set up the photo board (foreground) and reference pole.
2. Line up the reference landmark in the camera's viewfinder.
3. Ensure that the reference landmark, photo board and reference pole are visible in the camera's viewfinder.

Recording site evaluation:

1. Record the location, plot name and date.
2. Record the Reference Landmark (RL), location where the photo is taken from or photo point (PP), photograph number, and GPS information - if using a GPS.
3. Draw a quick map of the site with any distinguishing features. Mark the photo point where the reference pole is placed and what the reference landmark is and any distances.
4. Write down any observations and changes to vegetation. For example the percentage of cover of the invasive species using the following categories: <10%, 10-25%, 26-50%, 51-75%, 76-100%.

7.1.3 Staking

Staking can refer to two things:

1. Staking your point of observation as to where you take the annual photo, for photo-monitoring.

2. Staking out the boundary of the infestation so a comparison can be made. For example, the yearly increasing size of an untreated patch of Dog-strangling Vine or how much a patch of Garlic Mustard has shrunk after control has taken place.

7.1.4 Walking and observing

This is a very simple technique, where you walk around the removal area and look for any changes. Unfortunately, it can be easy to miss small changes or to forget what you have previously seen. Therefore, this may be best for small simple control projects with little site disturbance. To provide more information, take notes on changes observed or a few photos.

8.0 Restoration

Once a site has been adequately managed for invasive plants, it is important to determine whether it will need to be actively restored, by planting trees, shrubs, plants or to seed the area, or if it is in a condition that if left alone it will be able to naturally regenerate itself. Deciding this can often incorporate a bit of 'gut instinct'. A starting place is to ask these four questions:

Replanting native woodland plants (Credit Valley Conservation)

1. What is the level of disturbance at site? Was it a highly invaded site that caused a lot of disturbance when things were removed?

2. What is the biology of the invasive species removed and is there a seed bank to consider?

3. Are there invasive species in the area that could re-invade the site from certain pathways of introduction, such as nearby trails or watercourses?

4. What native vegetation is left? How long before it regenerates by itself? Does it need help?

8.1 Level of disturbance

Here we must consider the degree to which the site was impacted by the invasive species in question and secondly what disturbance did we create in removing it? If we used chemicals, did we alter or damage the soil biota (*organisms*) creating ''unhealthy' soils in which to reestablish native vegetation or to allow for natural regeneration? If solarisation (smothering the plants with plastic) was used this could have also harmed soil biota and native seed banks leaving a sterile 'unhealthy' soil. If a highly invaded site by a species with allelopathic effects (e.g. Garlic Mustard: some species release 'toxins' into the soil to suppress other plants), these affects may linger making native plant reestablishment more difficult. If it is a lightly invaded site and only mechanical methods were used, soils may be in good condition, so concerns here may be negligible.

Consider the above questions and think about what this means to restoration.

- You may need to add soil amendments like compost, mulch or beneficial mycorrhizal fungi. Commercially the most widely available product known is called Myke© and it can be bought at most garden centres, to help restore healthy soils.
- The native seed bank is gone. You will definitely have to reseed or replant.
- The site is heavily disturbed making it a great opportunity for other disturbance-loving invasive plants to colonize. Be vigilant and consider using a cover crop to keep out other invasive plants until perennial native vegetation can be re-established.

> ***Cover crop***
>
> Usually an annual plant that will cover the ground for a year in order to keep out competing plants. Annual oats and annual rye are the most common and can be purchased at most farm co-ops.

8.2 *Invasive species biology*

Many invasive species have seed that can lie dormant for many years suppressed as seed on or in soil. When vegetation is removed and the soil disturbed this seed then sprouts. Know your species and their behaviors (example, Garlic Mustard seed can be viable for up to 7 years in the soil) so you know how to manage for this. For example, don't remove Garlic Mustard one year and then replant the next, as you may be faced with working around and potentially destroying things you have planted in order to get at the 'new' Garlic Mustard plants that have magically appeared the next season. As mentioned previously consider using a suitable cover crop to bridge the years between removal and replanting. Mulching the area with a good weed–free mulch is another option to contain the seed bank prior to replanting. Simply tolerating and managing 'bare' ground may be another option.

As touched on earlier some species may drastically alter soil chemistry and biota, so reestablishing native vegetation may require patience and experimentation or soil additives.

8.3 *Re-invasion risk*

> ***Niche***
>
> Refers to the position or function of a plant or animal within a particular community

Consider the previous sections on **disturbance** and **invasive species biology.** You are working on a site removing invasive species and thus creating a 'disturbance' which all invasive species absolutely love, plus you are opening a 'niche' in the community that something must fill. Are there other invasive plants in the area and pathways that could allow other invasive plants to take over your control site? Address this risk in your planning by taking preemptive measures such as temporary trail diversions or closures, expanding your control area or controlling off-site seed sources as examples of some possible actions.

8.4 Existing native vegetation

Consider what native vegetation is left on the site after the invasive species have been removed:

Mulching after Tartarian Honeysuckle removal (Credit Valley Conservation)

- Are there enough native plants, trees and shrubs left that the site will naturally regenerate and self propagate? If no, then replant.
- Is there too much bare ground, or too many open niches, that will allow undesirable plants to colonize? If yes, replant or consider using a cover crop or mulch.
- Of the plants left, is there enough diversity to recreate the community type you are trying to restore? If no, then you must introduce diversity through replanting e.g. If it is an Oak savannah forest type that you are trying to restore and there is nothing but some scattered young ash saplings and some ubiquitous weeds, then you may want to consider encouraging this community type by replanting with Oak and prairie affiliated species such as Big Bluestem Grass, Butterfly Milkweed, etc.

8.5 Making the call on restoration

Restoration is as much art as it is science. It is a feel for what the site needs and what guidelines should be followed to assess and restore the site. Consider the main points suggested above and use them to guide decisions. Fortunately, you are not alone in this process. Many MNR and conservation authority extension staff provide advice and consultation free of charge on restoration. As well, many non-governmental agencies provide similar services along with consultants. Refer to **Appendix 6** (**Resources and Contacts**) for more information. Here are a few case studies to help illustrate how the above questions are important when evaluating a project.

Case Study 1: Common Buckthorn removal

In this case Buckthorn was quite heavy in this woodlot and had been here for many years. There was also some garlic mustard in the woodlot scattered about. So, we are dealing with:

- An established seed bank of Buckthorn and most likely Garlic Mustard
- Opening the canopy up to more light may cause dormant Buckthorn seeds to sprout and encourage the Garlic Mustard to proliferate now that they too have more light
- The forest now has very little understory. Native shrubs and saplings are sparse. Such a drastic change in the structure of the understory by removing Buckthorn will have significant effects on the micro-climate and use by wildlife in the woodlot
- Native forest groundcover is scattered or absent.

Action:

1. Light may encourage growth of dormant native plant seed, but also Garlic Mustard. Buy plant stock to give native plants a head start. Consider mulch or a cover crop to keep Garlic Mustard and Buckthorn at bay until native cover establishes. You will need to treat Garlic Mustard and young Buckthorn plants as they emerge over the next several years
2. Replant understory with native shrubs and saplings appropriate to the woodlot to help the regeneration process along and to minimize impacts to wildlife. In this case it was Oak, Maple, Hickory, Choke Cherry, Dogwood and a few others
3. Monitor.

Case Study 2: Norway Maple (Acer platanoides) removal

In this scenario there are established Norway Maple trees composing about 50% of the area (marked with an X)

1. There is still native groundcover such as Trout Lily and Trillium, but there is very little plant diversity.
2. There are no native trees or shrubs regenerating at all. There is no understory in this forest.
3. The forest is on a moderate slope. There is a potential for erosion if all the Norway Maples are removed at once.

Action:

1. Need to remove Norway Maples in a phased approach to reduce erosion risk. Remove mature prolific seed producers first. Plant with native trees and shrubs to secure the slope and begin restoration of the understory.
2. Monitor area for the first year to see if native plants in the seed bank germinate after being encouraged by more light now being able to penetrate to the forest floor. Monitor for invasive plants too. You may consider after the first year to purchase native plants or seed the area to diversify the groundcover if there is little to no response from the native seed bank.
3. Monitor.

9.0 Funding

There are many ways in which you can apply to obtain financial assistance with invasive species removal projects on your property. Many MNR and conservation authority staff can help find funding opportunities that may fit with your project. Refer to **Resources and Contacts** section below for contact information. Depending on the type of property you own and where it is situated the following could be applicable:

1. The Ministry of Natural Resources (MNR) may provide financial help, expertise, equipment and materials for approved projects under the following programs:

   - Land Stewardship and Habitat Restoration Program (LSHRP): This program offers eligible organizations support to undertake land stewardship and habitat restoration for biodiversity conservation. www.mnr.gov.on.ca/en/Business/LetsFish/2ColumnSubPage/STEL02_166030.html
   - Conservation Land Tax Incentive Program (CLTIP): This program is designed to recognize, encourage and support the long-term private stewardship of Ontario's provincially significant conservation lands by providing property tax relief to landowners who agree to protect the natural heritage values of their property. www.mnr.gov.on.ca/en/Business/CLTIP/index.html
   - Ontario Managed Forest Tax Incentive Program (MFTIP): Landowners with least four hectares of forested property who are willing to commit to good forest stewardship (this can include invasive species removal) can prepare a Managed Forest Plan. If it is approved by a certified Managed Forest Plan Approver then they qualify for reduced land taxes on their property. www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_166346.html
   - Species at Risk Farm Incentive Program (SARFIP): A cost-share program for eligible farms registered under the Canada-Ontario Environmental Farm Plan to encourage greater protection and conservation of habitat for species at risk. www.ontariosoilcrop.org/en/programs/species_at_risk.htm

- Species at Risk Stewardship Fund (SARSF): Intended to support the protection and recovery of SAR in Ontario by providing financial support to individuals and organizations for stewardship activities. www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STEL01_131229.html

2. The Ministry of Agriculture Food and Rural Affairs can provide financial assistance to farmers through the Canada-Ontario Environmental Farm Plan Program (EFP).

   - This is a voluntary assessment prepared by farm landowners to increase their environmental awareness in up to 23 different areas on their farm. Through the workshop process, farmers highlight their farm's environmental strengths, identify areas of environmental concern, and set realistic action plans with time tables to improve environmental conditions. As part of this, there are environmental cost-share programs available to assist in project implementation. www.omafra.gov.on.ca/english/environment/efp/efp.htm

3. Environment Canada offers the following funding programs:

   - Habitat Stewardship Program for Species at Risk (HSP): Provides funding to "stewards" for implementing activities that protect or conserve habitats for species designated as nationally at risk, endangered, threatened, or of special concern. www.ec.gc.ca/hsp-pih/default.asp?lang=En&n=59BF488F-1

   - Environment Canada's Invasive Alien Species Partnership Program: Supports invasive alien species projects at the provincial and national level focused on prevention, detection, management and control. www.recovery.gc.ca/IASPP-PPEEE/index.cfm?lang=e

4. Local conservation authorities may have incentives through some of their programs, or may be able to provide support in other ways such as project consultation. Please contact your local conservation authority to see how they can help you. If you are not sure which conservation authority serves your area, refer to **Appendix 7** where there is a map and contact information for Ontario's conservation authorities.

10.0 Resources and Contacts

Even with all the information provided in this manual, invasive species removal and control may seem like a daunting undertaking. There are many websites, books and organizations for guidance and help. Refer to **Appendix 6 (Resources and Contacts)** for information on the following:

- **Restoration advice and assistance**
- **Potential funding sources**
- **Information on provincially or regionally rare species**
- **Invasive species information**
- **Reporting invasive species**
- **Native plant species information (plant identification, species lists, species habitat conditions, etc)**
- **Potential removal assistance**

Additionally, contact information and a map to find your local conservation authority can be found in **Appendix 7**; while a detailed contact list for MOE regional offices (Pesticides specialists) can be found in **Appendix 8.**