

# *Invasive Plant Management for Urban Municipalities:*

## *A Planning and Decision Support Tool*

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Prepared for the City of Burnaby & the Greater Vancouver Regional District's Biodiversity Working Group

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INVASIVE PLANT MANAGEMENT FOR URBAN MUNICIPALITIES:  
A PLANNING AND DECISION SUPPORT TOOL

by

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M.A. (Educ), The University of Calgary, 1996

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We accept this project as conforming  
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## From the Author to the Reader

This project started as a typical university student research project, but quickly grew into a community-based effort to grapple with the challenges of invasive plant management within an urban setting. It is my hope that this decision support tool will be treated as a living document: used, tested, modified to be more effective, and shared with others. Please make full use of it, and let me know how you are doing ([bsuderman2005@gmail.com](mailto:bsuderman2005@gmail.com)).

Invasive plant management is a relatively new activity in cities, although it has been an on-going challenge in the agriculture, ranching, and forestry industries. The science called invasion biology is also very new, trying to understand the ecological implications of certain invasive plants and animals, in addition to their economic implications, which has been the primary concern with agriculture and ranching.

I first became interested in invasive plant management in the late 1990's, as Natural Resources Planner with the Hopi Indian Tribe in Arizona. In that position, I worked to restore wetlands infested with tamarisk with the goal of wildlife and bird habitat restoration, in a way that conformed to the Hopi world view. This was especially challenging for me because of the amount I had to learn about hydrology, birds, native plants, erosion, sedimentation, etc. – without a background in any of the hard sciences. However, I persisted, and we piloted a number of invasive plant management and ecological restoration initiatives.

Several years later, when investigating the potential of environmental planning as a career in cities, I met Robyn Wark, Ecosystem Planner for the City of Burnaby. In our first discussion, we hit on a common interest in invasive plant management. The concept of an invasive plant management planning and decision support tool, similar to that pioneered by the Garry Oak Ecosystems Recovery Team (GOERT), was quickly agreed upon, subject to verification by focus groups.

The focus group participants were generous with their ideas and analysis about what needed to be done to enhance invasive plant management in the region. Issues they identified included the need for better regional cooperation and collaboration, ways

to build political support for invasive plant management activities, better ways to communicate with the public about invasive plants given the particular invasion paths found in urban environments, and challenges due to the legal and regulatory climate within which they are working. While much needs to be done, they were interested in the development of a planning and decision support tool which would assist them with thinking through the complex issues related to invasive plant management activities. My research direction was confirmed.

Throughout this project, I received generous support from colleagues from south of the border, within Cascadia, our bioregion. Cities like Portland and Seattle are several years ahead of the Vancouver region in invasive plant management, in part because the regulatory regime within which they operate encourages city governments to aggressively pursue invasive plant management activities. A key contextual difference between Canada and the USA is that water temperature is a water quality parameter under US water quality regulations, as administered by the Environmental Protection Agency. This is not the case in Canada. Since one of the impacts of invasive plants adjacent to streams tends to be the lack of stream shading, thereby increasing the temperature of the water, American cities can quickly find themselves in regulatory violation, with the consequence of significant fines. Therefore, their choice becomes one of investing in invasive plant management or paying fines ... as compared with the BC situation, where the choice at this point is to spend money on invasive plant management or not.

One of the appealing features of the GOERT's Decision Support Tool is the clear, simple invasive plant ranking system provided to assist land managers to determine which species to tackle first. Unfortunately this work was only fully developed for three invasive species, which are the top priorities within Garry Oak Ecosystems – but not in the natural areas within our region of the Lower Mainland. What to do? I researched all the other ranking systems I could find, but none were compatible, and all were much more complex; some were still in the developmental stage and had not yet been tested.

In desperation, I decided that the best strategy would be to replicate the GOERT methodology for the species which had been identified as invasive within the GVRD. The participation rate in this community science initiative was wonderful, and reveals a hunger on the part of the invasive plant management community in the region to have region-specific tools to tackle the issues we face here.

The results were surprising and stimulated dialogue about what they meant. A key observation is that the plants fall into major groupings, so that a certain amount of what appears to be differences of opinion can be reconciled if we look at the groupings the 23 plant species fall into. The groupings could be characterized as high, medium, and relatively low significance.

Another consideration, given the great spread between participants in some of their rankings, is that the significance of individual species depends in large part on the primary concern of the individual doing the ranking. For example, an individual concerned about bird habitat will be less likely to rank blackberry as a very high problem, whereas people interested in biodiversity will rank its significance as very high. These differences of perspective became fairly obvious in the ranking process, and highlight the importance for urban land managers of knowing their specific purpose in undertaking invasive plant management, to assist them with choosing species to tackle.

People also disagreed with the final results based on current levels of impact. For example, this community-science initiative ranked Japanese Knotweed as #1 for the region, but blackberry is much more prevalent, and has much more biomass ... How to reconcile this seeming anomaly? It seemed to me that the reason that Japanese Knotweed ranked as highly as it did is because it is scarier than blackberry. We do not have a good idea about how to manage it, unlike blackberry, where we have a pretty good idea, but to date have been unwilling to put an adequate level of management resources into its control.

These issues, and others, need to be discussed more fully. I am hopeful that the Greater Vancouver Invasive Plant Committee, still in its infancy as an organization,

will be the venue where these types of discussions can happen, and where information about the management of various invasive plants can be shared. Due to the complexity of invasive plant management, a collaborative approach bringing together scientists, managers and planners will be most effective in discussing the various aspects of invasive plant management and choosing the approach which best suits the location and the situation.

The good news, and the bad news, of invasive plant management is that there is no one right answer to any particular situation. Best management practices must be site-specific and objective-specific, rather than highly generalized. That being said, there should be ways of translating one's learning about invasive plant management from one context into another, while always keeping the context-specific opportunities and constraints front and centre in one's planning. This challenge gets at the heart of the apparent conflict between science and management ... and provides the basis for potential collaboration within the Lower Mainland between urban land managers concerned about invasive plant management, and invasion biology scientists.

Increased collaboration is an essential ingredient to any successful strategy for invasive plant management. The seeds have been sown. With the appropriate nurturance and care, these seeds of collaboration will grow into a full-scale, integrated, regional approach to invasive plant management, supporting biodiversity and quality of life in the region.

## WHAT do I mean by the term “invasive plant”?

When I use the term “invasive plant” I am referring to non-native, introduced plant species that become problems because of their invasiveness, aggression, and ability to outcompete other plants native to the watershed. Usually invasive plants are those which are highly competitive, whether because they produce an enormous number of seeds, because they have multiple modes of revegetation, because they are capable of transforming their environment to better suit themselves, or because they are so flexible in terms of habitat. In these competitive tendencies, they are also favoured in



their new environments due to the lack of natural population controls on them, as they would have in their native environments.

Native plants can also behave invasively, but are not of concern in this document.

## WHY a planning and decision support tool for invasive plant management?

Invasive plants are over-running our parks and natural areas, interfering with our pleasure, as well as the natural functions and biodiversity of the region. These impacts cost municipalities money, and prevent them from maintaining quality of life goals for their communities. **This tool will help you, an urban land manager, make decisions regarding when, where, and how, to manage invasive plant species on municipal lands.**

This is a decision support tool, not a decision making tool. It will provide you with guidance regarding the identification of invasive plant problems, and management options for control. It is up to you to consider all the information at hand to make an informed decision, recognizing that invasive plant control is only one aspect of ecosystem management or restoration, and should be part of a larger management plan.

## WHO should use this planning and decision support tool?

**This tool is intended for urban land managers and planners who wish to undertake well-planned stewardship activities over a period of several years.** This includes municipal and regional governments, and local non-governmental organizations interested in invasive plant management activities in particular areas. Private landowners may also find it useful.

## WHY the focus on urban municipalities?

The natural environment provides many concrete, measurable benefits to cities, including cleaner air, cleaner water, and stormwater management. Trees and other vegetation cool and modulate the urban environment, mitigating the heat island effect. The quality of life for city residents is enhanced by opportunities to enjoy green space, whether for recreation, aesthetics, or quiet. To maximize these benefits, cities must do a better job of managing their ecosystems. This includes establishing policies and programs that work to manage invasive species within the context of maintaining natural biodiversity.

Invasive plants are of particular concern because they can overwhelm desirable plants and trees, or because they change stream dynamics, or because they increase erosion and sedimentation in waterways. Because of municipal investment in parks and other green spaces, municipalities have a direct, economic interest in the management of invasive plants. Invasive plants lead to lost investments in parks or street trees, and increased management costs to protect a municipality's investment in the urban forests.

An additional area of municipal concern is liability risk avoidance. Some invasive plants are toxic to humans, like Giant Hogweed (*Heracleum mantegazzianum*). Others, like English Ivy (*Helix hedera*), smother and eventually kill trees, leading to the risk of falling tree limbs, or even falling trees. Their presence on municipally managed lands, like parks, increases a municipality's risk of liability for injuries incurred by park users.

There are many benefits to invasive plant management within cities. Let's all do our part!

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## INTRODUCTION

So you've identified a problem: invasive plants are taking over your [fill in the blank] (storage yard, play park, natural area, salmon stream, river bank, etc.), and you need to do something about it. This might be because you want to protect the trees, or restore the stormwater management potential of a stream, or avoid the possibility of a lawsuit. Or it might be because you want to restore habitat for endangered species or salmon, or protect the integrity of the forest.

There are many reasons to tackle invasive plants. To be effective, you need to know the full extent of the invasive plant problem, know the specifics of each invasive plant that is causing a problem, know your own resources and constraints, and then make a choice about how to proceed. You need to know how to tackle the individual invasive plant, and what you need to do to be successful, and when the best time to manage the problem might be.

Because of the complexity of items to be considered in invasive plant management, this planning and decision support tool has been developed. It will walk you through a step-by-step process to gather the information you need, assist you with determining priorities, and once you've made the decision to proceed, assist you with developing an implementation strategy.

Conscientious use of this tool will provide you with a record of how you made your choices, so you can share your reasons with others. It will also provide you with a baseline to use in monitoring the success of your efforts. It may also help you to argue successfully for increased resources to tackle invasive plant management!

The goal of this planning and decision support tool is to assist you, as an urban land manager, to think through your options regarding invasive plant management on lands for which you are responsible, and to document the steps you have taken in coming to a decision. Through the use of a systematic process, your decision-making will be supported and you will be in a good position to argue your decisions to City Council or members of the public. It's a lot of work – but it will pay off.

*A planning tool is something that helps you to think through your options to accomplish something.*

*A decision support tool provides you with questions, and hints for answering these questions. The answers you develop help with making a decision as to what to do. The answers to these questions also provide a record of the steps taken in making a decision.*

## ***How to Use this Planning and Decision Support Tool***

*“As decision-makers, managers must put together the right information at the right time, think critically about it, and make important choices wisely. Further, they must make these choices swiftly and implement them forcefully in a site-specific and objective-specific manager – a formidable challenge indeed.” – McPherson (2001)*

This planning and decision support tool will help you, through a series of worksheets, to gather the information you need to make informed decisions, and then help you determine priorities.

You may have the ability to gather all of this data yourself, or you may have staff members who can do it for you. If you need help with data gathering, do not hesitate to ask for it – from other departments, from other levels of government, or from consultants that you hire to do this specific task.

Once the data is gathered, you may wish to consider working with others to complete the recording sheets, particularly up through the risk assessment section. The chance to learn from each other, and gain additional insights by working with other people who know the area or the subject well can make the task more enjoyable, less onerous, and most importantly, produce a better decision.

Whether you complete the forms yourself or work with others, ultimately you are the decision-maker. You need to know the quality of the data that you are gathering to use with this tool. You also need to understand why certain data is important, and how it helps you to make decisions. This decision support tool helps you take a systematic approach to decision-making about invasive plant management.

### ***What this Planning and Decision Support Tool is Not***

This planning and decision support tool has limitations. It focuses on addressing the management considerations of invasive plants only from an implementation perspective. It does not take a holistic approach to invasive plant management, which would include planning to prevent new plant invasions, or community education about invasive plant management, or looking at regulatory controls on invasive plants, although all of those things are needed in any comprehensive strategy.



It also does not serve to assist with policy development within your municipality, although enhanced experience with invasive plant management is a good basis from which to develop policy. My assumption, in developing this tool, is that you, as a land manager, are part of a larger organizational system. You and others within this system will develop a strategy that meets the needs of your organization with regard to invasive plant management.

This tool addresses the needs of a manager juggling scarce resources and needing to demonstrate success, by addressing managerial considerations, social and political dimensions, and scientific criteria of invasive plant management. Its focus is on the management of resources to accomplish the goal of invasive plant management, including strategies for working effectively with scientists, and a systematic approach (which provides the foundation for your own adaptive management research). My assumption is that you, in your role as a land manager as part of your adaptive management strategy, will join a group of like-minded individuals to ensure that you are kept current on developments in the field, whether by other land managers like yourself, or by specialists in the field of invasive plant management.

*Join a group of like-minded individuals to ensure that you are kept current on developments in invasive plant management.*

### ***The Logic of the Decision Support Tool***

This decision support tool has been developed to walk you through a series of steps preparatory to making a decision about invasive plant management.

The first step of the process is to assemble the necessary information, from a system-wide perspective. First you characterize your management area, and the values for which you are responsible for managing it. Then you characterize your management area from an ecological perspective, including the types of invasive plants that are present in each area. Lastly you gather relevant fact sheets about each of these plants, to learn more about the behaviour of these plants, and how best to manage them.

The second step of the process is to prioritize potential areas for management. This is the first “filter” through which you assess your management area. The prioritization is

How the DST works:

1. Assemble information
2. Prioritize potential management areas
3. Assess risks; identify mitigation options
4. Make a decision
5. Develop invasive plant management plan
6. Review, revise, adapt.

completed, based on the principle of “save your best first” (with “best” being defined by you), avoiding liability risk, and availing yourself of any opportunities to maximize your investment in invasive plant management.

The third step is to undertake a risk assessment to determine what risks (other than liability risk) there may be, and assess these risks for severity and potential for mitigation. This is the second “filter” through which you assess your management area. This step is conducted at a site-by-site level, rather than looking at the entire system.

The fourth step is to make a decision, on a site-by-site basis, as to whether or not to proceed with management and control of invasive plants, and if so, in which area, and for which species. This decision-point is the last step at the “birds-eye view” level of looking at your management area, and a necessary preliminary step before moving on to management or implementation planning.

The last step of this Decision Support Tool is to develop your invasive plant management plan, one for each site under consideration, based on your list of priorities. There are many decisions to be made in developing a management plan, including the necessary components for a comprehensive management plan, the information necessary to complete the plan, consideration of alternatives and available resources, timing and method of management, monitoring and follow-up activities. At this step, you will be provided with suggestions as to how to proceed, as well as model plans and various resources to assist you through this final step before implementation.

Various materials have been assembled to assist you with the tasks posed by the DST. The Reference Materials section, for example, contains a summary of invasive plant ecology and best management practices for those invasive plants found in the Lower Mainland. It also contains a Timing summary, to assist you with determining the best time of year to undertake invasive plant management. The Supporting Materials section outlines information related to the regulatory context of invasive plants, the

role of science in invasive plant management, and a full description of the methodology used in creating this DST.

Of course, your invasive plant management plans will be living documents. That means that as new information arises, whether from your experience or from the experience of others, you can and should go back to your planning documents and review whether or not the plan should be modified in light of this new information. If it should, make the revisions and adapt your planning accordingly, documenting as you go.

### ***Before You Start***

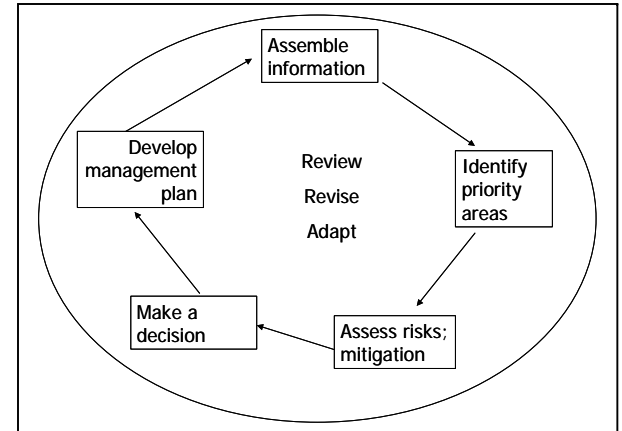
**Read through the whole tool before using it so you know what to expect.**

Be prepared to:

1. Make a long-term commitment,
2. Keep detailed records,
3. Undertake lots of assessment before taking action, and
4. Solicit expert help.

Why are these mental preparations important? Invasive plant management is not a simple task. Many invasive plant species can deposit millions of seeds into soils. Thus, despite success in removing vegetation, you may have re-sprouts for years to come. Therefore, long-term commitment is important. Without it, your investment of time and resources may be wasted.

Invasive plant management is a new science, and can be unpredictable. Therefore, it is important to be systematic and meticulous in your record-keeping, so that you can learn from your own experience about what works (and what does not), and you can monitor your progress. Keeping records, reviewing progress, and adapting your strategies, based on new information provided by your sites, and through your on-going professional education, will assist you to more effectively manage your invasive



plants, and to help you to share your experience with others. It also provides a solid foundation for working with community groups or scientific researchers, in terms of posing specific research questions, and systematically answering them.

*Work with others to complete the characterization, assessment and planning tasks.*

Assessment prior to action ensures that you are getting the best value in terms of where you choose to invest your resources and energy, as well as to ensure that you are “doing no harm.” The information you gather will assist you to make decisions about whether, and how, to manage invasive plants on your lands. Working through the data gathering process will require some field assessments, for which you will need the following equipment:

- This decision support tool
- “Illustrated Flora of BC” and “Plants of Coastal BC” reference books on plant identification
- Camera
- Map of the site(s)
- Trowel
- Tape measure (100 m)
- Pencil and eraser
- Clipboard with Recording Sheets (contained in this DST) and extra paper
- Flagging tape
- Magnetic bearing compass
- GPS mapping unit, if you have access to a GIS

Expert help may be necessary if you lack specific skills or knowledge; managers tend to be generalists rather than specialists. Experts, who tend to be specialists, can help you to answer specific questions, like how to identify plants you don’t recognize, or whether or not species at risk are present, or how your proposed action will affect water quality (to name only a few possibilities).

Do not hesitate to seek out the help you need to successfully plan for invasive plant management activities!

## ***General Principles of Invasive Plant Management***

This DST was developed in accordance with certain principles that reflect best management practices for invasive plants, based on the best information available at the time of writing.

The first of these is that an **integrated approach** to invasive plant management is necessary. By that I mean that a complete approach should include attention to prevention, community education, monitoring, and evaluation, as well as the actual plant management activities. This DST addresses only the management, monitoring and evaluation components of this integrated approach. As land manager, you will wish to determine how best to prevent the further spread of invasive plants in your area of responsibility, and what types or levels of involvement are appropriate for you in terms of prevention and community education.

The second principle is that of **saving your best areas first**. When choosing which areas to work on, you will get your best value for your dollar with this principle, as well as creating a beachhead in your struggle to control invasive plants within your management area. Please NOTE that the term “best” is deliberately vague. What is “best” is determined, in part, by what you are hoping to accomplish through invasive plant management. You will be encouraged to define ecological quality on your lands as part of the ecosystem characterization in Part B.

The third principle, related to the previous one, is that of **early detection and rapid response**. When areas that are pretty good suddenly have small patches of invasive plants here and there, jump on it right away, before those plants get a good foothold! The costs might be slightly higher on a per-unit basis in the short run, because you do not get economies of scale with this approach – but your chances of success are so much higher, that it makes the prompt attention worthwhile.

The fourth principle is to treat the costs of invasive plant management as an investment in the ecosystem’s future. Invest wisely to get **maximum benefit** from your investment in invasive plant management. Maximum benefit means the most

### General Principles:

1. *Integrated approach*
2. *Save your best first*
3. *Early detection / rapid response*
4. *Maximum benefit / sustainable investment*
5. *Work with opportunities*
6. *Connectivity*
7. *Accept uncertainty*
8. *Do no harm*

results with the least effort, whether the effort is placed in initial invasive plant management, or in maintenance.

The best places to put our limited resources are in areas that are “winnable”, i.e. the effort to restore the natural vegetation will be rewarded by the area’s ability to sustain the gains. The goal is to achieve the most gain (most area free of invasive plants) with the least pain (smallest outlay of resources) – or if you are dealing with a big challenge with serious consequences for failure, the goal is to avoid as much pain as possible, even if it requires a big investment to do so. Either way, it has to be a **sustainable investment**.

The fifth principle is to **work with opportunities** as they present themselves. If you have a volunteer group that needs a little bit of training and support to effectively undertake invasive plant management, work with them.<sup>1</sup> If you have the chance to negotiate a private developer taking on invasive plant management in exchange for a permit, work with the developer. If there is funding available, jump on the opportunity. This is a way to amplify your efforts, with little cost to your budget. But keep in mind that long-term monitoring and maintenance may have to come back to the municipality – to protect its investments.

The sixth principle is to look at how the lands you are responsible for managing connect with others where the land managers are also concerned about invasive plant management. It is important, for wildlife and biodiversity values, to think about **connectivity**. If you have a few sites that are equally highly ranked in your system, but you can’t do all of them, you might wish to choose to do the one which will help to achieve the goal of connectivity.

The seventh principle is to **accept that there will be uncertainty** in your responses to the questions posed by the DST. Rather than being a reason for doing nothing (although there will be times when “no action” is the best decision, all things considered), uncertainty may provide an opportunity to learn through *adaptive*

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<sup>1</sup> See the section on the “Role of Volunteers in Management Planning,” in Part D.

*management*, an approach designed specifically to accommodate uncertain management situations. This approach is incorporated into Part D of the Tool.

Lastly, **do no harm**. It seems self-evident, but if we remove invasives improperly, so that we actually spread the invasive plant and cause a bigger problem, then we should not undertake the project in the first place. Also, we do not want to wipe out an endangered species, in the process of tackling an invasive plant. We need to take care as we are thinking through our proposed actions. Good planning and careful implementation, with excellent monitoring, are keys to successful invasive plant management.

### ***Management Principles***

In addition to a set of general principles regarding invasive plant management, there are a number of principles related to your role as a manager of invasive plants that are also important to consider.

The first of these management principles is to do your **research thoroughly**, and undertake **careful planning**. Invasive plant management is not a well understood activity, even by those individual land managers who have been doing it for a long time. The management of invasive plants is a complex business, with nuances related to each individual species and the harm that species can cause to various environments, as well as differences in how each species propagates, the best timing for management actions, the best intervention to get the results that you want, and so on.

The second principle is to stay abreast of **new information** as it develops. There are various list-serves linking together people who care about invasive plant management, who have a lot of experience. Through scanning these e-mails, you can quickly sort out which are of immediate interest, because they relate to plants you are currently dealing with, and those which are of limited interest, because not relevant

#### ***Management Principles:***

1. Thorough research & careful planning
2. Stay open to new information
3. Build community
4. Be transparent in management & decision-making

to your situation. This is one way to stay in touch with developments in new forms of treatment, and success stories. You may even have your own to contribute!

The third principle is to **build community** within your organization, and within your municipality, around the issue of invasive plant management. If you are in the Parks Department, for example, you may be able to effectively link with somebody in the Planning or Engineering Department, because it is likely that somebody in these offices is doing something on invasive plant management also. Keep talking about this issue. Your staff who are going to be implementing your plan need to understand why this is important, and why your instructions for management are so precise. Build your team!

Lastly, undertake your invasive plant management activities in such a way that they are transparent to others in your department, to your manager, to your staff, to City Council, and so on. This relates as much to your preparation of budgets, as it does to labour relations. **Transparency in management** is a way of building community, and learning how other people see the work of invasive plant management.

## INSTRUCTIONS

### Suggestion:

- Print document
- 3-hole punch it
- Place in binder
- Insert tabbed dividers

These instructions are the “guts” of the decision support tool. They pose the questions you need to answer in your decision making process, and they provide you with hints and clues to assist you in answering the questions. The instructions lead you sequentially through Parts A-D, and Questions 1-8 of this Decision Support Tool.

In the next section, you will find RECORDING SHEETS, which correspond with each question, and assist you to make a record of the data you are collecting, and the decisions you are taking. Make as many copies of these recording sheets as you require to document your various land areas.

The last section of this DST is supplementary information that may be helpful to you as you proceed with your invasive plant management planning.



You may wish to print out this entire document, 3-hole punch it, and place it into a binder, with tabbed dividers inserted to assist you with flipping between the instructions and the recording sheets.

While you are working with the recording sheets, and gathering your data, use maps as much as possible to help you geographically record the information you collect, and make your plans.

## **Part A. Management Area Characterization**

### **1. Identify the land system for which you are responsible**

On a map, identify the lands for which you are responsible.

Characterize the lands for which you, as an urban land manager, are responsible. Is the area of your responsibility a park? A system of parks? A bunch of street trees in a neighbourhood? A maintenance yard? Other municipal lands?

The purpose of this question, which should be straightforward based on your job description and land ownership, is to start with the big picture, so that in your planning and decision-making, you are balancing your choices with the needs of the whole system.

☞ **Include a map showing your area of responsibility.**

☞ **Write your answer on the RECORDING SHEET for Question 1.**

CAUTION: This DST has been designed to be of use where you, the urban land manager or planner, have authority over decision-making on those lands. It may be helpful to you for areas over which you have influence, but not authority, i.e. when a developer applies for a permit, but the DST has not been designed for that. If you wish to use it for lands where you have influence, but not authority, proceed with care, recognizing that collaboration is a critical part of invasive plant management.

### **2. Identify the land management values for which you are responsible in your management activities**

Include information such as the organizational mission, any existing plans, legal or regulatory requirements for invasive plant management (particularly related to the

use of chemicals or integrated pest management plans), guiding principles like ecosystem-based management or integrated pest management, and any other type of direction you may be responsible for implementing. Be sure to check your regional district level of government; they may have some resource documents which will be of use. The provincial government is also a good source of information.

The purpose of this question is to consolidate information regarding policy direction for these lands into one easily accessible place, together with information about your land management portfolio and responsibilities. This information should identify your authority to proceed with invasive plant management.

Why is this important? Building on what has been done before, or policies which are already in place, is a way of gaining political support for your invasive plant initiative. It shows that your initiative is logical in terms of the direction set by your municipality, and it shows how your initiative fits within the regulatory environment.

Please note this advice from an invasive plant manager in Portland, Oregon<sup>2</sup>: “Weed management is inherently a landowner responsibility, even when the landowner is a level of government. You may need to ‘speak up’ and declare your authority as a responsible land manager. Too often government staff look to upper level managers for permission to undertake their responsibilities, whereas the reality more often than not is that upper level managers need to be told that weed management is inherently a landowner responsibility. There is a respectful way of doing this with a superior, which requires assertiveness and confidence, as well as a compelling argument.”

**☞ Write your answers on the RECORDING SHEET for Question 2.**

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<sup>2</sup> Personal communication, Andi Gresh, March 2006.

### **3. Identify other departments, community groups, or other stakeholders with whom you share management of these lands, particularly related to invasive plant management**

This might include Streamkeepers, Weedbusters, Friends of ... groups, monitoring bodies, provincial departments, other units within your municipal government, Fisheries & Oceans Canada, or other stakeholders.

The purpose of this question is to identify allies, partners, resources, sources of information, or gaps in your network of stakeholders. Once identified, you can ask yourself whether effective relationships exist between these groups and your municipality around invasive plant management. If so, are invasive plant management efforts being coordinated? If not, what can you do to remedy the situation, to enhance invasive plant management?

 **Write your answer on the RECORDING SHEET for Question 3.**

### ***Part B. Ecosystem Characterization***

The previous questions looked at the lands you are responsible for managing. The next set of questions look at the ecological characterization of these lands. If you are responsible for one park, or one maintenance yard, please carry on with no further instruction. However, if you are responsible for a system of parks, or multiple maintenance yards, or street trees, **at this point is will be important to gather your data on a site-specific basis**. For example, answer the Part B questions on RECORDING SHEET 4, on a park-by-park basis, to ensure that you get a clear picture of each specific unit of your responsibility.

**Make as many copies of these recording sheets as you need.**

**4. Characterize the lands within your management area from an ecological perspective, including information about their uses.**

The purpose of this section is to identify the nature and uses of the lands within your management area, as well as to identify any special features that need to be taken into account in the planning process. At this point, the presence or absence of invasive plants is also important, as a basis for determining ecosystem quality.

If you are responsible for more than one park, or other type of land unit, complete a separate recording sheet for each, and make a separate map for each. Enter your responses in the RECORDING SHEET for Question 4 (one for each area you are including).

If you need help in characterizing the lands, whether with identifying habitat types, or identifying invasive plants, do not hesitate to ask for it! You may be able to find the assistance you need in books like:

- ❑ Pojar and MacKinnon (1994) *Plants of Coastal British Columbia*. Also published under the title of *Plants of the Pacific Northwest Coast*.
- ❑ Douglas, Straley, Meidinger, and Pojar. 1998. *Illustrated Flora of British Columbia*. Volumes 1, 3 & 4. Ministry of Environment, Lands and Parks, and Ministry of Forests, Victoria, BC
- ❑ Canning and Canning (1996) *British Columbia: A Natural History*. Chapter 5, “Forests of Rain” covers the ecosystems and habitats found in the Lower Mainland.
- ❑ BC Ministry of Forests (1991) *Ecosystems of British Columbia*. Special report series #6. Chapter 6: Coastal Western Hemlock Zone covers the ecosystems and habitats found in the Lower Mainland.

You may be able to obtain data from the following sources:

- ❑ Fraser River Estuary Management Plan (FREMP) Habitat Mapping
- ❑ GVRD Biodiversity Conservation Strategy mapping (1:5000)
- ❑ BC Sensitive Ecosystem Inventory mapping (data held by Environment Canada)

<b>Table 1: Invasive Non-Native Plant Species of Concern in the GVRD</b>
<i>Rubus armeniacus</i> (invasive blackberry spp.)
<i>Fallopia</i> spp. (formerly <i>Polygonum</i> spp.) (Japanese knotweed)
<i>Phalaris arundinacea</i> (Reed canary grass)
<i>Lythrum salicaria</i> (Purple loosestrife)
<i>Hedera</i> spp. (English ivy)
<i>Cytisus scoparius</i> (Scotch broom)
<i>Heracleum mantegazzianum</i> (Giant hogweed)
<i>Impatiens glandulifera</i> (Policeman’s helmet)
<i>Lamium galeobdolon</i> (Lamium; Dead or spotted nettle)
<i>Cirsium arvense</i> var. <i>horridum</i> (Canada thistle)
<i>Convolvulus arvensis</i> (Field bindweed; morning glory)
<i>Vinca minor</i> (Vinca; Common periwinkle)
<i>Ilex aquifolium</i> (English or European holly)
<i>Iris pseudacorus</i> (Yellow-flag iris)
<i>Ranunculus repens</i> (Creeping buttercup)
<i>Tanacetum vulgare</i> (Common tansy)
<i>Lonicera tatarica</i> (Honeysuckle)
<i>Daphne laureola</i> (Daphne-laurel)
<i>Prunus laurocerasus</i> (English or cherry-laurel)
<i>Humulus lupulus</i> (Common hops; European hops)
<i>Solanum dulcamara</i> (European bitter-sweet)
<i>Crataegus monogyna</i> (English hawthorn)

Or you may be able to find local biologists and ecologists through the Greater Vancouver Invasive Plant Committee (contact: Pam Zevit at [adamah@telus.net](mailto:adamah@telus.net)) or the Invasive Plant Council of British Columbia (contact: Gail Wallin at [gwallin@wlake.com](mailto:gwallin@wlake.com)). Alternatively, check in with your local university or college, expertise within another municipality or department, or hire a consultant.

The Recording Sheet will ask you to identify significant features of these lands, including:

- Ecological characteristics;
- Habitat types;
- Primary uses of this area;
- Protection status (if any);
- Status of neighbouring lands;
- Presence of species at risk, or habitats for species at risk;
- Presence of utility corridors (storm sewers, sanitary sewers, hydro lines, etc.) – important for determining the nature of plants you can consider for revegetation efforts
- Other important landscape features;
- Presence of invasive plants; and
- General assessment of the quality of this ecosystem.

Use your map to locate these features, as well as using the checklists on the RECORDING SHEET for Question 4. Use overlays with your map, so as not to crowd your map with too much data. If you have access to a GIS system, use its capacity to create data in layers that can be overlapped.

NOTE: Depending on the scope of your land management responsibilities, not all of these questions may seem relevant to you. For example, if your responsibilities are for equipment and storage yards, questions related to “natural areas” or “recreational uses” may not be relevant. In these cases, simply respond Not Applicable, or N/A.

Generally speaking, the most important invasive plants to target for management to protect natural plant communities are those that are just beginning their invasion into relatively undisturbed habitats, particularly those that have the greatest potential to damage the ecosystem once they are well established.

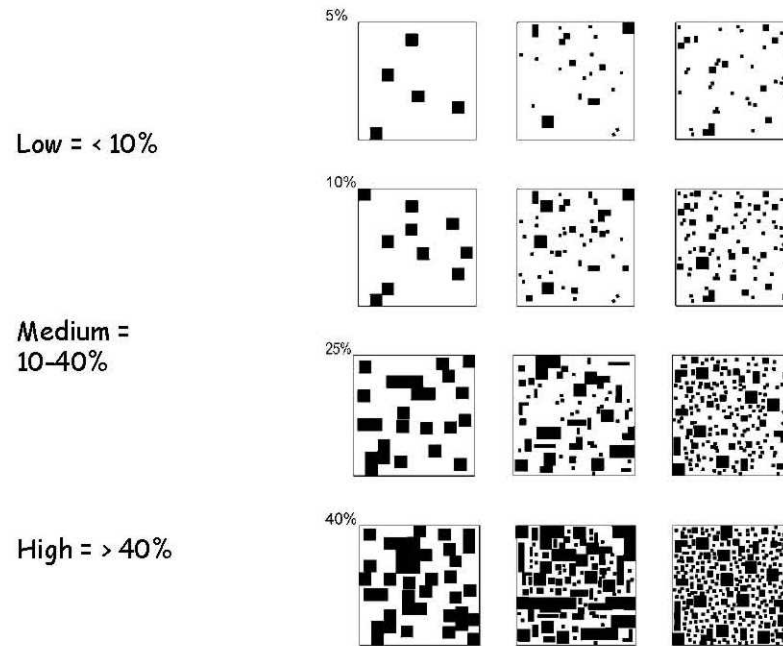
Based on the second and third general principles, you will best protect the natural areas within your management responsibility if you prioritize the protection of those areas that are in the best condition, i.e. most highly functioning with the fewest invasive plants – which means acting quickly on new reports of invasive plant invasions in these areas.

Two factors assist with determining the degree of invasion: a) the extent of land cover achieved by the invasive species (sometimes called density); and b) the degree of establishment of the species. In this section, we will deal with only the extent of land cover achieved by the invasive plant. The degree of establishment will be addressed in the Risk Assessment section (Question 5).

Use the following density diagrams<sup>3</sup> for guidance in identifying the percentage of coverage achieved by the invasive plant species:

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<sup>3</sup> Used courtesy of the Garry Oak Ecosystems Recovery Team members, particularly those involved in the development of their DST.



☞ **For each invasive plant species, select the most appropriate estimate of the extent of coverage, and record your answer on the RECORDING SHEET for Question 4.** (If a listed invasive species is not present, just ignore that row.)

The last step in this section of the Decision Support Tool is to make a preliminary assessment of the ecosystem quality of the lands in your management area. It is assumed that these lands will be in a state of moderate-to-high disturbance from a natural state, given that this tool has been prepared for urban land managers. However, within that constraint, you are asked to determine the current ecological functioning of your lands, and their resiliency, in terms of on-going ability to support biodiversity, including native vegetation and fauna, as well as the extent to which these lands have been colonized by invasive plants.



If you wish, you can use the definitions provided in this manual for the section of the RECORDING SHEET for Question 4 in answering the question about the quality of this ecosystem. These definitions are based on an assessment of ecosystem quality according to degree of invasion, and quality of natural environment, particularly the presence of trees. Or you can modify these definitions to meet your specific needs, objectives, and values for which you are managing (see Surrey Parks example). If this is the option you choose, please make sure that you write out your definitions, so that you use them consistently.

There are a variety of reasons for creating your own definitions, but the key one is to ensure that ecosystem quality is defined in a way that is most useful to the goals you have set for yourself. Other management goals might include:

- Protect/restore habitat for species at risk;
- Protect/restore biodiversity values;
- Stormwater management;
- Park vegetation management; and so on.

Please send me an e-mail to let me know the definitions you are using, at [bsuderman2005@gmail.com](mailto:bsuderman2005@gmail.com).

The City of Surrey Parks Department has developed its own priority rating system for its 464 parks. Each park is ranked according to five values. Each value receives a number between 1-4 to indicate its standing. Then each park is ranked through a weighting system:

- Adjacency value +
- 5x ESA value +
- 0.5x Fragmentation value +
- 2x Isolation value +
- 10x Natural Area Size value.

This system allows the City of Surrey to rank order each of the 464 parks, based on the value of each park. A high value park is one with significant natural areas, while a low value park has limited natural area qualities.

Get more information from Steve Godwin at City of Surrey Parks Department (SGodwin@surrey.ca).

*“The presence/ absence of invasive plants says little about overall ecosystem quality in the context of an urban environment. A natural area park, with up to 50% invasives, will still be better ecosystem quality than a residential area with limited trees and lots of grass.” – Ecosystem Planner, City of Burnaby*

### **Ecosystem Quality Definitions:**

- ❑ Good – Those rare cases where very little human disturbance has been imposed on the landscape, where there are no dams on the streams and they have fish, where there are no invasive plants in the forest or meadow, where the predator-prey relationships are intact, where there is a full range of age classes of native vegetation, and so on
- ❑ Fairly good – where there is still plenty of native vegetation, although invasive plants may have established a foothold; where there are flowing streams, but the presence of fish is unknown or there are no fish; where there has been active vegetation management, while leaving plenty of native vegetation of varying age classes
- ❑ Medium – where there are relatively few invasive plant species, but also relatively little native vegetation. This might characterize your average neighbourhood park, with lots of grass, some planted flowerbeds, and some native vegetation, particularly in the form of trees.
- ❑ Fairly poor – where native vegetation continues to be present, but is under threat from invasive plants or from development; where stream-side vegetation is characterized by, for example, Scotch broom, Himalayan blackberry, or Policeman’s Helmet, and Hardhack with some other less competitive native vegetation underneath or interspersed, or with a fair amount of impervious surface.
- ❑ Poor – where trees are being overloaded and smothered by English ivy; where Himalayan blackberry is shading out native vegetation; where no native vegetation is visible along stream corridors, with the possible exception of Hardhack; with lots of impervious surfaces.

### **Part C. Risk Assessment**

This section will ask you to rank order the areas you are responsible for, based on your assessment of their quality and ecosystem integrity, and then address three questions:

- Which invasive plant species pose the greatest threat?
- What are the risks of action versus no action on invasive plant in this area?
- Should you proceed with management and control?

After you complete this section of the DST, you will have identified those areas where you would like to proceed with management and control actions, and which species you would like to proceed with managing. Part D addresses planning for how you will undertake the management actions, including the identification of methods, timing, disposal, and making choices based on available resources.

Remember to gather your data on a site-specific basis in this section also. Make as many copies of the recording sheets as your need to be able to do this.

### **5. Rank order the areas for which you are responsible**

NOTE: If you are responsible for one park, or maintenance yard, that will be your top priority. You can skip this step of prioritizing your land system.

Based on your assessment of the ecosystem quality of lands for which you are responsible (good, fairly good, medium, fairly poor, poor), create a list of these lands, with the best quality at the top of the list, and the poorest quality at the bottom of the list.

If you have multiple lands in each category, organize them alphabetically. The answers to the upcoming questions will assist with further ranking.

Invasive species that pose the greatest threat to managers in urban areas are those that pose a liability risk. Key areas of potential liability include those plants that are toxic to human beings, such as Giant Hogweed (*Heracleum mantegazzianum*). The negative human health implications of unprotected contact with Giant Hogweed have been well documented.<sup>4</sup> When it is present in municipal land management areas, it should be addressed as a top priority for management and removal, as a liability avoidance measure. Remember that your staff will require (if they don't already have it) special training in the management of this plant, and may require special equipment as well, to avoid injuries. Management of Hogweed is too dangerous to assign to volunteers. Check the municipality's liability insurance coverage before proceeding. – And before you decide to ignore it, remember that it is a challenge, but it will not go away or become a smaller problem with time.

Other plants which may pose a liability risk include:

- ❑ English ivy – which increases the risk of tree blow-down, or falling tree limbs in parks; and
- ❑ Japanese Knotweed, which can cause property damage, given its ability to grow through asphalt.<sup>5</sup>

If you are aware of a liability risk in relation to one or more of the areas, add it in the appropriate column, but do not let that modify the rank ordering at this point.

Some areas within your management area may present you with opportunities to maximize your resources or obtain other benefit from engaging in invasive plant management (General Management Principle #5). Opportunities might include potential funding, volunteer stewardship group in place, potential for public education because it is a highly visible site, accessibility, and so on. If you are aware of an opportunity in relation to one or more of the areas, add it in the column for

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<sup>4</sup> Nielsen, C. [et al](eds.)(2005) *The Giant Hogweed Best Practice Manual*, pp. 22-23; King County Noxious Weed Control Program (2004) *Best Management Practices: Giant Hogweed – Heracleum mantegazzianum*, p. 2 & 4.

<sup>5</sup> *Polygonum* genus part 1, <http://www.edfa.ca.gov/phpps/ipc/weedinfo/polygonum-knotweeds.htm>, p. 2.

“opportunities”, but do not let the presence of an opportunity modify your rank ordering at this point.

☞ **List your ranking on the RECORDING SHEET for Question 5.**

## 6. Which species pose the greatest threat?

Level of threat depends on three factors: *liability risk* (addressed in previous section), *degree of invasion* and *significance of impact*

Generally speaking, the most important invasive plants to target for management to protect natural plant communities are those that are just beginning their invasion into relatively undisturbed habitats, particularly those that have the greatest potential to damage the ecosystem once they are well established. Based on the second and third general principles (save your best first, and early detection/rapid response), you will best protect the natural areas within your management responsibility if you prioritize the protection of those areas that are in the best condition, i.e. most highly functioning with the fewest invasive plants – which means acting quickly on new reports of invasive plant invasions in these areas.

To determine the degree of invasion, consider two factors: a) the extent of land cover achieved by the invasive species (sometimes called density) – addressed in Question 4; and b) the degree of establishment of the species.

☞ **For each question, and for each invasive species, select the most appropriate answer in each cell in the table on the RECORDING SHEET for Question 6.** (If a listed invasive species is not present, just ignore that column.)

- a) Reference your assessments recorded for Question 4(h), and check whether each species is low, medium or high density within this management area.

- b) What is the degree of establishment in your area of concern? Is the species just beginning to establish (plants still young or immature) or is it well established (the plants will be old or mature)?

The degree of establishment is important for a number of reasons:

- I. If you have just noticed the plant, but it is mature, there will be more of them, so look again, to find them all.
- II. Some plants, like English ivy, change their propagation strategies with maturity. When young, English ivy propagates vegetatively. At about 10 years of age, it begins to flower and seed, as well as continue to propagate vegetatively. You might be able to minimize impact by managing the plant before it develops multiple methods of propagation.
- III. Early invasion stages mean that you have a better chance of saving whatever native vegetation may be concealed beneath the invasive growth. For example, you may have a better chance of saving the trees beneath the ivy growth, or the native grasses and shrubs beneath the blackberry growth.

While there is no easy way to measure the degree of establishment of a species, you can look for indicators within the environment. Older ivy and blackberry plants will have thicker vines than younger ones, for example. You can also try to find out more about degree of establishment by using your memory (when did you first notice these plants on these lands?) or other people's memories about when the plant(s) first appeared in the area. Historical photographs, mapping, or other documentation might also be available, to assist you with addressing this challenge.

There will be a certain amount of uncertainty in your answer to this question, but it is important to be on the lookout for hints about degree of establishment.

- c) In each column of the worksheet, add the numbers in the square brackets beside the answers you checked for questions (a) and (b) and write the sum in row "(c) degree of invasion" on the worksheet. See example below.

Name of management area:

Vancouver Anywhere Park

6. Which species pose the greatest threat?

	Japanese Knotweed	Blackberry spp.	Reed Canary Grass	English Ivy	Purple Loosestrife	Scotch Broom	Giant Hogweed	Policeman's Helmet
a) Density within the invaded areas	<input checked="" type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input checked="" type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input checked="" type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]
b) Degree of establishment	<input checked="" type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input checked="" type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input checked="" type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]
c) Degree of invasion (a + b) →	2	6			4			
d) Significance of impact	3.3	3.5	5.1	5.3	5.3	6.2	7.7	8.3
e) Total (c + d) →	5.3	9.5			9.3			
f) Rank of totals (=Threat rating) →	1	3			2			
	Lamium	Bindweed; Morning glory	Vinca; Periwinkle	Canada Thistle	Yellow-flag Iris	Holly	Creeping Buttercup	Common Tansy
a) Density within the invaded areas	<input checked="" type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input checked="" type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]
b) Degree of establishment	<input type="checkbox"/> Just beginning to establish [1] <input checked="" type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input checked="" type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]
c) Degree of invasion (a + b) →	4				2			
d) Significance of impact	9.1	11.4	12.0	12.0	12.7	12.7	12.8	15.3
e) Total (c + d) →	13.1				14.7			
f) Rank of totals (=Threat rating) →	4				5			

d) The “significance of impact” factor has already been determined for you by a Vancouver-based community science initiative. This number has been entered in row (d). See the Methodology section of this document to see how these numbers were determined, as well as the full set of data.

If a plant is invasive on lands in your management portfolio, and is not listed on the chart, you are breaking new ground! This simply means that with the data available at the time of developing this Decision Support Tool, the plant you are concerned with was not identified as invasive in the region. In such a case, using the principle of Early Detection/Rapid Response, you should prioritize treatment of this invasive

plant, and treat it as a high level of threat, targeting it for eradication. While preparing to do this, you should learn as much as you can about the plant's ecology, and talk with others about it so that they will be alert to the possibility of its invasiveness.

- e) For each column, add the numbers from rows (c) and (d), and write the sum in row "(e) Total."
- f) Rank order the species under consideration for management in row (f), based on the totals in line (e). The species that has the lowest, or smallest, number in line (e) should receive the highest priority in line (f), i.e. ranked #1. Similarly, the species that has the highest (biggest) number in line (e) will receive your lowest priority. This rank ordering shows you the threat rating of these species, based on current level of coverage, stage of invasion, and significance of impact. (See example.)

This may seem like the opposite of common sense – but it is not. The species that receives the lowest number in this system poses the greatest threat to the natural area, because of what it could do to that environment. If a plant invasion is already well established, there may be very little more damage that plant species can do there, so it is a low level of threat. Compare that to the situation of an area which does not yet have a particular invasive plant species. In this case, the area could be seriously damaged by that species, therefore posing a high level of threat, and getting ranked at the top of your priority list.

This is an illustration of why, as a general rule, it is important to work with those areas that have the least amount of invasion first – because you still have a chance of eradicating the invasive plant and protecting that area from its invasion.

- g) **Now that you have identified your priority ranking of the invasive plant species, now we can return to your site ranking list** (RECORDING SHEET for Question 5). Based on your ranking of invasive plant



species, re-order your site ranking list on the new table, identifying which site and which species are your top priorities.

Rank ordering tips:

- ❑ Those sites with liability risk factors at the top of your list.
- ❑ Then list those sites which are in the “best” condition, working down from there.
- ❑ Within those sites, your top priorities are those areas with your highest priority invasive plants.
- ❑ Within those areas, your highest priorities are those invasive plants with the least degree of establishment.
- ❑ Within your top ranked list of sites, integrate any opportunities that are presenting themselves, to make your budget stretch farther.

☞ **Enter your rank ordered site list on the RECORDING SHEET for Question 6(g).**

This rank ordered list will become the basis for developing your invasive plant management implementation plans. At this stage, before proceeding to the development of site-specific invasive plant management plans, we will consider the risks of managing these plants, and how best to mitigate those risks.

Does this list ring true for you?  
Does it make sense? Can you get excited about the possibility of eradicating those invasive plants from this land, which falls under your responsibility?

I hope so ... and would be intrigued to hear more about your experience to this stage. Please contact me at [bsuderman2005@gmail.com](mailto:bsuderman2005@gmail.com).

## 7. What are the risks of action versus no action? Can the risks be mitigated?

### SUGGESTION:

- Rather than pursuing all sites on your rank ordered list, choose the top 5 or other number that seems reasonable.
- Based on the principle of “saving your best first.”
- Include those areas which received a “good” or “fairly good” rating, as well as those that are liability risks.
- Ultimately, you may have to answer the questions for all sites ... but this may get you to the implementation planning stage for your top ranked sites sooner.
- If you are hiring a consultant, however, consider carefully. Start-up costs are often similar for a few sites, as for a significant number of sites.

In this section you will look at some of the risks posed by invasive species control actions, and how to mitigate these risks where possible. Categories of risk include:

- ❑ To wildlife and “species at risk”
- ❑ Legal risk
- ❑ Public opposition
- ❑ Potential for doing harm.

In undertaking a risk assessment, it is vital to be fully informed. Therefore, do an internet search and download fact sheets for all invasive plant species under consideration for management. Search for reputable sources of data, including The Nature Conservancy (<http://tncweeds.ucdavis.edu/esadocs.html>), King County, WA (<http://dnr.metrokc.gov/wlr/lands/Weeds/>), the Centre for Weed Management ([www.weedcenter.org](http://www.weedcenter.org)), and the Invasive Plant Council of BC ([www.invasiveplantcouncilbc.ca](http://www.invasiveplantcouncilbc.ca)).

Read the fact sheets carefully, and note the information they contain about the propagation strategies of the various invasive species, best time in the life cycle of the individual species for management actions to take place, as well as the recommendations about how to proceed, including mitigation recommendations.

A number of the fact sheets appear to emphasize the use of herbicides or biological control mechanisms. Many municipalities within the GVRD prohibit the use of herbicides on municipal lands, and discourage it on private lands. The presence or absence of such by-laws will provide you with some guidance as to possible management actions on the lands for which you are responsible.

Nevertheless, you may wish to educate yourself about the controversies surrounding the use of herbicides or biological control agents. A list of selected articles to provide you with background information can be found in the Supporting Information section

of this document, under the heading of “Issues related to Invasive Plant Management Practices.”

**☞ Write your answers on the RECORDING SHEET for Question 7. Include one sheet for each separate management area.**

### **Risk to wildlife and “species at risk”**

A key risk to wildlife and “species at risk” that invasive plant management can pose is that of habitat disruption. The thoughtful land manager asks which species use the area, and for what purposes, and whether or not invasive plant management can be done in such a way as to mitigate the risk for the wildlife. For example, if the area is used by migrating waterfowl, invasive plant management activities are best avoided during migration season. Based on what you know about the wildlife uses of your sites, and about the recommended best management practices for the species you wish to manage in this area, think about the following:

- Optimal timing of management activities to reduce impact on wildlife;
- Optimal method for undertaking management activities to reduce impact on wildlife; and
- Any strategies for mitigating potential impacts on wildlife or species at risk.

**☞ Enter your answers to the following questions on RECORDING SHEET for Question 7, using a separate sheet for each management area.**

To answer these questions, you will likely need to consult with someone knowledgeable about the wildlife and species at risk uses of this area.

NOTE: If there is a risk of species at risk being present within the local area or ecosystem, do not look only at the area immediately in the vicinity of the current invasions, but look thoroughly within the lands for which you are responsible, and within the region. Do this part of the assessment thoroughly.

- a) Identify wildlife species and species at risk that may be impacted by, or are vulnerable to invasive plant *control efforts*.
- b) Are the wildlife or species at risk using the invasive plants as a food source, as shelter?
- c) Is the vulnerability only during defined periods or seasons, which you might be able to avoid through careful scheduling of control activities? Identify the optimal period of time for management, considering both the plant ecology and the wildlife needs. (See summary table on the timing of invasive plant management, in the Reference Materials section.)
- d) Identify the elements of an impact mitigation strategy, including management method and replanting considerations.

### Legal risk

A key risk to your municipality is whether or not there is any legal liability posed by the invasive plant species. The legal liability could take one of two forms: 1) a legal obligation to manage for listed species, as the landowner; and 2) a liability or due diligence risk, if the municipality is sued for negligence because of the presence of a particular plant which creates a dangerous situation. The liability risk has been fully discussed in Section 5.

Check the provincial weed list at the Ministry of Agriculture & Lands website, at <http://www.agf.gov.bc.ca/cropprot/noxious.htm>, to determine whether or not any of the invasive plants on your lands can be found on the provincial weed list, and if so, what the municipality's responsibilities are. Clarify whether your municipality has any by-laws of its own related to invasive plant management.

- e) Are there any laws or bylaws that require landowners or land managers to control any of the invasive plants you have identified on those lands under your responsibility?

### ***Invasive plants that pose liability risks to municipalities:***

1. Giant Hogweed – human health risk: scarring, burning
2. English Ivy – human health risk due to falling tree limbs or dead trees
3. Japanese Knotweed – property risk due to ability of this plant to grow through asphalt.

- f) Are there invasive plants present, which can pose a liability risk to you, as land manager, or to your employer?

### **Risk of public opposition**

A key risk to the success of your project is lack of public support, or (even worse) public opposition. Are people receiving benefits from the presence of invasive plant species on the lands you are responsible for managing? If so, what are they? How will people react should they see these benefits threatened? Possible benefits include:

- Edible berries for pies or treats (Himalayan blackberry);
- Christmas decorations (English holly);
- Visual barriers to something unpleasant;
- Physical barrier to area where access is not desirable;
- Habitat for small birds and mammals.

There is some evidence that homeless people also rely on blackberries as a key food source during the season, as well as a source of privacy and shelter throughout the year.

No doubt you have observed people's use of the plants on the lands for which you are responsible, and you have some sense of who these users are, and what they may care about. If not, undertake some observations, and talk with people, so that you will have a better idea about what to expect when you undertake invasive plant management activities, and you can mitigate for these concerns.

Key categories of concern include:

- Loss of benefits provided by the invasive plants;
- Loss of wildlife habitat provided by invasive plants;
- Aesthetics – the plant management activities may appear to be messy or unsightly, and people generally prefer their public lands to be neat and tidy; and
- Management method, and its potential environmental impact.

See the **Reference Materials** section for the following tables, which will assist you to address these risk and mitigation concerns:

1. Invasive plant ecology & BMP summary
2. Invasive plant management timing summary

Mitigation strategies for these areas of concern can include:

- ❑ Public education/communication strategies about the negative impacts of invasive plant species on native species and the ecosystem as a whole. This can be done through public meetings as part of the invasive plant management planning process, interpretive signage on-site, on-the-spot trained staff or volunteers who can anticipate and answer questions from the public, and information at the visitor centre (if appropriate);
  - ❑ Using visual clues that this area is well cared for, through careful use of tarps and other clues that people who care about the environment are at work here;
  - ❑ Choice of management method that respects the public's concerns about use of herbicides or biological control methods (the usual concerns);
  - ❑ Directions to the nearest remaining patch of blackberry (or other species) so that they can continue to receive the benefits from this species.
- g) What sort of local reaction would you expect from efforts to control invasive plants?
- h) Will this reaction vary, based on the species?
- i) How might you mitigate this reaction in your planning process?

### **Potential for doing harm**

A guiding principle in the development of this Decision Support Tool is to “do no harm.” It seems self-evident, but if we remove invasives improperly, so that we actually spread the invasive plant and cause a bigger problem, then we should not undertake the project in the first place. Or if in the process of removing the invasive plants, we create a different or worse problem, then we should not undertake the project either. In these cases, the “no action” alternative is clearly preferable.

The following questions address the issues related to the principle of “do no harm.” You are asked to be brutally honest with yourself about the limits of your knowledge, and strategies for mitigating the risks posed by certain types of invasive plant management activities. Check the Invasive Plant Ecology & Best Management

Practices table, as well as the summary of management timing, in the **Reference Materials** at the end of this section. Check for your species of concern, and determine whether you agree with this writer’s assessment

- j) Some invasive plants are relatively new, and land managers have had relatively little success in their management, because the plant ecology and the plant’s susceptibility to management are not well understood. Are the control methods for the invasive plants in your area of responsibility well understood?
- k) Do the invasive plants on your list propagate from root (rhizome) and stem fragments, like Japanese Knotweed? If so, do you feel confident that you can remove the vegetation without creating new infestations? How will you mitigate this risk?
- l) Will effective control of these invasive plants require the use of herbicides? Biological control agents? Do you understand the legal and ethical implications of these technologies? Are you comfortable with potential consequences, given the potential for errors in applications or releases?
- m) Will effective management of these invasive plants leave the area vulnerable to further invasions by other plant species, or to severe erosion? If so, are there ways to mitigate the impacts through replanting or other strategies?

Given that invasive plant management is a relatively new activity, and that invasion biology is a relatively new science, the potential for effective collaboration between managers and scientists is very high. A full discussion of the challenges and benefits of such collaborations is included in the “Science in Invasive Species Management” section of this document. Based on your needs and challenges, answer the following question:

- n) Are you willing to address challenging invasive plants through experimental approaches in partnership with research scientists?

Vulnerability is a function of:

- Location and extent of invasion
- Patch size
- Soil disturbance regime
- Presence/absence of desired species
- Nature of adjoining area
- Presence/absence of seed bank.

## 8. Proceed with management and control?

This section will encourage you to consider all the relevant factors in helping you to decide whether or not you should proceed with management and control in each of the high priority site areas you have been considering.

For each question, think about whether your answer sways you towards ***proceeding*** with invasive plant management, or ***not proceeding***, and check the appropriate box in the table on the RECORDING SHEET for Question 8.

You are strongly encouraged to ***proceed with management and control*** activities, if you can answer yes to Questions (a), (e), and (g) below:

- a) Are you required legally to control for invasive plants in this area? Is there a liability avoidance issue in this area?

☞ **To answer this question, review your responses to Questions 7(f) and 7(g).**

- b) What is the **ecological value** of the land you are considering? Is it a strong candidate for management? Can you get the best value for your management dollar through investing in invasive plant management in this area?

☞ **To answer this question, review your responses to Questions 4 and 5.**

- c) What is the **degree of disturbance** on adjacent land? If all the surrounding land is subject to frequent physical disturbance, or comprises thick and expansive tracts of invasive plants, your efforts may be better spent elsewhere.

☞ **To answer this question, review your responses to Question 4(e).**



- d) Are invasive plant control efforts in line with the **management objectives** for the land you are considering?

☞ **To answer this question, review your responses to Question 2.**

- e) Can you mitigate the effects of invasive plant management on **wildlife or species at risk** that may be present in the area?

☞ **To answer this question, review your responses to Questions 7(a) through 7(d).**

- f) Would you expect a strong negative reaction from the **local community** if you take action against invasive plants in this area, with various mitigation strategies in place?

☞ **To answer this question, review your responses to Questions 7(h) through 7(j).**

- g) Control and management of invasive plants requires repeat treatments and long-term monitoring. Are you willing to make a **multi-year commitment** to this activity?
- h) Are there any other **opportunities** that present themselves at this point, to move a particular area higher up the list of possible projects?

Based on your responses to questions (a) through (h), total up your responses in each column, which will provide you with an indication as to whether or not you should proceed with invasive plant management on this particular site.

If the indications are that you should proceed with invasive plant management on a particular site, or in a particular area, you must now decide on **which species** to control.

If there is only one invasive species in the lands under consideration, then this decision is simple. Select the species that is present.

However, if there are several invasive species within the land base you are considering, you may not have the resources to tackle all of them and will need to prioritize them. The “Which Species?” table on the RECORDING SHEET for Question 8 will help you do this.

In answering the question of “which species?” refer back to your answer for Question 6 related to degree of invasion. The other values in the table have been provided for you, through a local community science project.<sup>6</sup> Then add up each column, and rank the species which has the lowest total number as your highest priority.

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<sup>6</sup> See methodology section for a full explanation of how these numbers were developed.

Name of management area:

Vancouver Anywhere Park

**For Which Species?**

	Japanese Knotweed	Blackberry spp.	Reed Canary Grass	Purple Loosestrife	English Ivy	Scotch Broom	Giant Hogweed	Policeman's Helmet
Degree of invasion (from line c of Recording Sheet #6)	2	4		4				
Significance of impact	3.9	2.2	5.2	4.9	3.6	5.7	9.4	7.3
Urgency of control	2.5	4.0	4.2	6.3	7/3	6.8	9.4	9.9
Difficulty of control	3.5	4.3	6.0	4.8	5.1	6.1	4.4	7.7
Column totals	11.9	14.5		20.0				
<b>Rank of totals (Lowest total = Highest threat rating)</b>	1	2		3				
	Lamium	Bindweed; Morning glory	Canada Thistle	Vinca; Periwinkle	Holly	Yellow-flag Iris	Creeping Buttercup	Common Tansy
Degree of invasion (from line c of Recording Sheet #6)	4					2		
Significance of impact	10.1	12.2	12.8	12.1	11.8	13.0	13.8	15.2
Urgency of control	8.2	9.7	10.8	12.5	13.7	11.8	10.8	14.6
Difficulty of control	8.9	12.2	12.3	11.4	12.5	13.3	13.8	15.9
Column totals	31.2					40.1		
<b>Rank of totals (Lowest total = Highest threat rating)</b>	4					5		

The species with the lowest total number presents the highest level of threat, because the extent and degree of the invasion is the smallest. You still have a chance of stopping this plant, and protecting your ecosystem values.

So – Have you decided?



**If you are not sure what to decide, seek outside help from other land managers, people with more experience than you have.**

These may be people within your stakeholder network (identified in Question 3) or people you have met through conferences or professional development opportunities. Alternatively, you can contact experienced land managers through the Greater Vancouver Invasive Plant Committee (Contact: Pam Zevit at [adamah@telus.net](mailto:adamah@telus.net) ).

With these land managers, review the questions for which you are the most uncertain, and then revisit your decision-making and this page.

☞ **If you decide not to proceed with control and management for invasive plants in the lands under your management control:**

- ❑ Fill out the decision box at the bottom of the recording sheet for Question 8, and start an official file to document your actions. This file should contain your working documents, background information and mapping that you have completed to get to this point. You may have to refer to it again later.

☞ **If you decide to proceed with invasive plant management and control:**

- ❑ Fill out the decision box at the bottom of the recording sheet for Question 8, and start an official file for your invasive plant management strategy for that site. Then carry on to Part D, to plan your management actions.

Remember ... At the end of this process, you should have an individual decision record for each site you have been considering.

**Congratulations!** You have reached a milestone in your invasive plant management planning.

The next step is to begin to plan the implementation of your decision, which is covered in Part D “Management Actions”.

## ***Part D. Management Actions***

It is time to begin developing your site-specific management plans to tackle the areas prioritized in previous sections. There are very many useful tools and resources to assist you, as an urban land manager, design your invasive plant management actions. The purpose of this document is not to reinvent the wheel, but to provide you with some general principles for planning to manage invasive plants, and refer you to some excellent resources that you can use as a model for your own plan.

Before moving on into this section, refresh your memory about the general principles and management principles related to invasive plant management planning, found in the Introductory Section of this document.

### **Invasive Plant Management Planning**

Key considerations in developing your management plan include deciding what action to take; where and when to implement; what site preparation activities are necessary; how to dispose of dead plant material; and how to monitor and evaluate the success of your invasive plant management efforts.

The Reference Materials section of this document includes a summary of invasive plant ecology and best management practices, and a chart outlining known considerations in the timing of invasive plant management. These tables are not meant to substitute for your own research, but may assist you in one of two ways: either as a preliminary overview of what the literature available on-line has to say about the management of these species, or as a trigger to your memory about the management of specific plants, based on your own reading and research.

Your planning should incorporate both a one-year detailed plan, and a five-year monitoring and maintenance plan. The City of Seattle, for example, assumes a 4-phase restoration approach in the Green Seattle initiative:

1. Year 1: Invasive removal,
2. Year 2: Secondary removal (i.e. resprouts, plants missed in year 1) and planting of native vegetation,
3. Year 3+: Plant establishment (monitoring and maintenance of replants, with on-going removal of invasives as necessary) – this phase is estimated to take up to 3 years,
4. Long-term maintenance.

Your management plan must clearly document:

- The invasive plant you are managing,
- The control method(s) you are planning to use to remove the invasive plant,
- The locations where you plan to manage invasive plants,
- The schedule for when you plan to do this, based on the best time of year for management of this particular plant, any mitigation considerations, and the availability of resources (including volunteer availability),
- Any site preparation activities which might take place before invasive plant management activities get underway, including an evaluation of your soils,
- Your expected results and any special considerations related to this implementation plan,
- The people who will be helping you, with an assessment of their skill levels in the chosen methods – include a training plan (if necessary) covering aspects of plant identification, tool usage, safe disposal of plant material, safety, and communicating with the public about the plant management activity,
- A liability risk coverage assessment, including the availability of insurance for volunteers, and addressing any Worker’s Compensation Board, union, or other requirements related to occupational health and safety,
- The tools you will need to use for the method(s) you have chosen,
- Plant material disposal plan,
- Your monitoring and maintenance plan, including schedule, and
- Any uncertainties you are monitoring.

There are two items on this list which may be surprising to you: a) site preparation activities; and b) plant material disposal. This brief discussion may help you to understand their importance within an overall management plan.

### **Site Preparation Considerations**

Site preparation can be almost anything that needs to be done before actually beginning to weed out your invasive plants. For example, if you anticipate a lot of public interest in your activities because your crew will be managing the invasive plants in a highly visible area, with the potential for a negative response, your mitigation action may be twofold: 1) ensure that interpretive signage is available on-site, so that people can understand how invasive plant management fits within an overall ecological restoration initiative, including an outline of your management plan; and 2) clear marking of the area, with neat flagging or other indicators that people who care about the environment are working on this project.

Another example is if you are working adjacent to a stream. In this case, you will want to use barriers to prevent sediment and vegetative debris from entering the water system, and creating downstream impacts.

Another, less obvious, example is that of soils preparation. One way in which invasive plants move around within the region is from contaminated soils, which are moved from one construction site to another, with their seed banks intact. Under the right conditions, these seeds emerge as invasive plants, and there is a new infestation.

If you are importing soils as part of your overall ecological restoration project, pay a visit to the soils storage sites of the potential vendors, to see how clean the soils are. If the mounds of soils are covered with undesirable plant species, known to be invasive, eliminate that vendor from consideration. If you are importing soils from another part of your municipality, pay a visit to the works yard to be sure that the soils are not covered with invasive plants. If they are, you might have to start your invasive plant management activities at the works yard, rather than importing new problems into your restoration area.

There may be other elements of site preparation required by your project, inspired by the various mitigation strategies you have chosen. These three examples should help you to understand what is meant by the phrase “site preparation.”

### **Plant Material Disposal**

Some invasive plants can be pulled out of the ground, piled up, and left to dry and/or compost on their own, without causing further trouble. Most, however, are not so simple to manage, because they have multiple survival strategies, and because they are, by nature, very aggressive plants.

Some plants should not contact the ground after pulling, but be piled on tarps, so they can be dragged away to trucks to carry them away to landfills. These plants, which generally have the ability to root and regenerate from small fragments, must be handled very carefully.

Some plants should have their flowering parts (with potential for seeds) wrapped in plastic bags before removing, to eliminate the risk of invasive plant spread. These plants, which have the potential to spontaneously release seed when threatened, must also be handled very carefully, if your invasive plant activities are to be effective.

Research the specifics of the invasive plant species you are planning to manage, and plan your plant material disposal very carefully.

### **Revegetation Planning**

Depending on the site and the species you are managing for, you may also need to add a revegetation component to your plan, including the type of plants you are planning to revegetate with, how and where you will obtain the plant materials (seeds, seedlings, planting poles, etc. – sometimes native vegetation is not available from nurseries, and needs to be collected from nearby natural areas), when you will



plant, and how you will protect the newly planted vegetation (erosion barriers, rabbit or beaver barriers, etc.). You may also wish to set targets for success in your revegetation planning, given the challenges. A target, i.e. 90% survivability for 3 years, gives you a measure from which to evaluate success in your revegetation efforts, as well as a time frame within which to measure it.

Check with a landscape architect who specializes in revegetation efforts using native plants, with a particular focus on landscape restoration, to see what is realistic for your site.

## **Monitoring and Maintenance Planning**

Any invasive plant management initiative will only be as good as the follow-through activities that support it. The purpose of monitoring and maintenance is to track your interventions, observe the results of your interventions, and follow up as necessary to achieve the goal of the intervention, which is the eradication or reduction of a particular invasive plant within an area.

Your monitoring and maintenance plan specifies how you will record your invasive plant management initiatives, specifically tracking the success of your initial interventions, and any follow-up activities that you undertake. Recommended monitoring strategies include making a record of the monitoring visit, together with a map showing the area of encroachment of the invasive plant(s), supported by a photograph of the area.

The record of the monitoring visit requires that whomever is undertaking the monitoring also make some observations. Naturally, these observations will concentrate on the invasive plant situation, as well as the well-being of the revegetation effort, assuming there has been one. It is important, if possible, to include an explanation for any unexpected results. Assume, for example, that you have revegetated a streambank after removing Policeman's helmet from the area. If, upon your monitoring visit, you note that the revegetation plantings have

disappeared, and there is evidence of a recent flood (debris in the higher bushes, or other similar evidence), make a note of it on the monitoring form. Then you can check with Environment Canada or other weather information source to determine whether or not an unusual rainfall event caused the flood, which provides an explanation for the failure of your revegetation effort.

Photo monitoring requires that you select a photo monitoring point from which you can take pre-management shots (i.e., this is what the area looked like before we took out the invasives) and post-management shots (i.e. this is what the area looked like after we took out the invasives). During each monitoring visit thereafter, you go back to precisely the same spot and take pictures showing the same area, from the same angle. These photographs then provide you with a visual record of the revegetation of the area, including information about the potential re-encroachment of invasive plants. To ensure that you find the same spot, time after time, it is helpful to take the photos from a landmark that is unlikely to change much from year to year, i.e. a prominent tree or other feature, or put in a monitoring marker, i.e. pound in a rebar marked with flagging that will be able to be found again.

Mapping the spread or retreat of invasive plants works in a similar way. While planning your management intervention, you will have mapped the invasive plants. Then, during the course of each monitoring visit, map the current extent of that plant on that site. You can also map the health of the replants, assuming you have undertaken some revegetation as part of your intervention.

Recommended maintenance strategies include weeding resprouts of the invasive plants before they have a chance to set seed or otherwise restore themselves. Depending on the invasive species that has been managed, maintenance activities can be more or less anticipated. For example, given that Scotch Broom seeds have a longevity of between 60-80 years, we can be sure that Scotch Broom seedlings will be emerging in our management areas for several years after the initial maintenance action. Therefore, at every monitoring visit, those individuals monitoring the area must be prepared to undertake the maintenance activity of seedling removal on the same visit.

If a new species of invasive plants is invading the area where management activities have taken place, an intervention needs to be quickly designed and implemented to protect the area from further invasions.

## Principles of Adaptive Management

As you develop and implement your plans, remember the principle of adaptive management:

1. Start with the small patches, where you have the best chance of eradicating the invasive plants, to test your methods.
2. Monitor, evaluate, and adjust your methods according to the schedule you have developed, and in response to your observations. This will build a basis of success, both in terms of protecting the lands for which you are responsible, but also in terms of knowledge about invasive plant management.
3. As you learn more about invasive plant management, and your implementation team gains knowledge and understanding also, work towards containment of invasive plants in the larger areas.

Remember -- invasive plant management is a poorly understood activity, so recommendations from one region may not work in another, based on differences in bioclimatic conditions, or disturbance regimes, or other dimensions of the ecosystem within which you are working.

It is important for you, as urban land manager, to do systematic planning, keep meticulous records, and share your results within your organization, and more broadly within the region. What you **do** and what you **learn** will make valuable contributions to the development of a broader base of knowledge about invasive plant management in BC's Lower Mainland.

## The Role of Volunteers in Municipal Invasive Plant Management

*Meeting the invasive plant challenge will have to include negotiating an acceptable division of labour between unionized staff and volunteers.*

A challenge for some municipalities in tackling their invasive plant management activities appears to be union sensitivities around the use of volunteers. Given recent experiences with outsourcing of unionized jobs, this is not surprising. However, the degree and extent of plant invasions within the GVRD ensure that there is enough work for everybody.

If only unionized staff members are permitted to address this challenge on municipal lands, we do not have a hope of changing the balance in favour of biodiversity. We also run the risk of not collaborating closely with stewardship groups who recognize the challenge and the risks posed by invasive plants, and who take upon themselves the initiative to be part of the solution. This raises all kinds of questions about proper disposal of plant material, proper timing of management activities, and so on. The risks far outweigh the benefits of not tackling this issue directly.

Part of meeting the invasive plant challenge will have to include negotiating an acceptable division of labour between unionized staff and volunteers. One suggestion, based on the Seattle experience, is that municipal staff work closely with volunteer groups, ensuring that the volunteers are properly trained in the identification and management of invasive plants, as well as working together in areas that are easily accessible and relatively safe. Municipal staff plan, train staff and volunteers, and monitor invasive plant management activities on municipal lands, as well as ensuring proper disposal of invasive plant material that is removed from an area. Municipal staff also undertake the invasive plant removal activities in areas that are less accessible, more dangerous, or require the use of power tools. In this way, the division of labour is clear, and collaboration is effective.

While working with volunteers is a way of working with your opportunities (general principle #5), there can be a trade-off involved. Because most volunteers like to work together in groups, this can mean that the average volunteer group would also work in fairly large patches of a particular invasive plant, which appears to violate principles #2 (save your best first) and #3 (early detection/rapid response).

However, even large patches of invasive plants need to be contained, so strategies can be devised to work with this social tendency.

Not all volunteers are like this, however. The Nature Conservancy in Maryland formed a special SWOT Team unit of unique volunteers who like to work alone. Several of them were trained to identify new invaders, and file reports on them. Then, after staff members checked out the plants on the ground, another select team of volunteers was assigned the task of eradication of these plants. In this way, the natural area was protected from new invasions; everybody had a chance to become educated about the new plants trying to invade the natural area; and volunteers who love to walk in the woods by themselves were valued for their unique ability to contribute to the organization.

There are a number of solutions to every challenge posed to the urban land manager by invasive plants. What will work best for you in your municipality?

## **Planning Resources**

Check these organizations on-line, because they have posted sample invasive plant management plans. You may find them useful as models, as you develop your own management plans.

The Nature Conservancy and the Global Invasive Species Initiative have posted adaptive management templates and planning examples at <http://tncweeds.ucdavis.edu/products.html>. This website features real invasive plant management plans developed by The Nature Conservancy for some of their natural areas, including one in our bioregion (the Cox Island Preserve Plan).

BC's *Seven Steps to Managing your Weeds* was developed for agricultural purposes, but pp. 30-39 have good suggestions for developing an integrated weed management

approach, including a good description of monitoring strategies. This document can be found at <http://www.weedsbc.ca/pdf/7StepstoManagingYourWeeds.pdf>.

Colorado's *Creating an Integrated Weed Management Plan: A Handbook for Owners and Managers of Lands with Natural Values* was developed for ranching and park management in a very different ecosystem, but the chapters on developing an integrated weed management plan and monitoring/evaluation are excellent resources for developing your own plan. It can be accessed on-line at [http://parks.state.co.us/cnap/IWM\\_handbook/IWM\\_index.htm](http://parks.state.co.us/cnap/IWM_handbook/IWM_index.htm).

The Center for Invasive Plant Management ([www.weedcenter.org](http://www.weedcenter.org)) is a clearing-house of information, and they have a special section on their website called "Tools for Weed Management." This section includes links for developing a weed management plan, assessment, mapping and inventory, monitoring, integrated pest management, managing aquatic weeds, and management resources.

The Invasive Plant Council of BC ([www.invasiveplantcouncilbc.ca](http://www.invasiveplantcouncilbc.ca)) has a resources section which includes fact sheets, brochures, technical reports, and other materials which may be of use.



**Templates for developing your own site-specific invasive plant management plan are included in the RECORDING SHEETS for Part D.** These include templates for the following components of your plan:

9. Invasive Plant Management: Implementation Design
10. Implementation Evaluation
11. Monitoring
12. Evaluation of plan effectiveness.

## **A Few Final Words**

Congratulations! You have now carefully thought through your invasive plant management initiatives, and made plans (and decisions) accordingly. Your next challenge is to implement these plans, and monitor them, using the principles of adaptive management to make any changes in your approach to this area, or other areas, to be more effective in achieving the specific goals for your site(s).

As you move forward with implementation, remember that there are many uncertainties in the new science of invasive plant management. Network with people, find out about their experiences, explore some of the controversies so that you are comfortable with your approach.

The key to success in this endeavour is to be brave. You do not have to have a perfect answer for every situation, because there is a lot of uncertainty in this work. You do need to exercise care, understand the choices that you have made, and adapt if a strategy is not working as you anticipated.

## RECORDING SHEETS

### **Part A. Management Area Characterization**

*Question A(1). Identify the land system for which you are responsible*

Start with a map showing your area of responsibility.

Characterize the lands for which you, an urban land manager, are responsible:

- A park
- A system of parks
- Street trees – Identify location: \_\_\_\_\_
- Non-park city land (Roads ROW, Maintenance yard, Other)
- Other (specify): \_\_\_\_\_

If the checklist does not adequately characterize the lands for which you are responsible, write a brief description here.



*Question A(2). Identify the land management values for which you are responsible in your management activities*

Attach, or write in on this recording sheet, information such as:

- the organizational mission
- any existing plans
- legal or regulatory requirements
- guiding principles like ecosystem-based management or integrated pest management,
- Regional district agreements or guidance documents, and
- any other type of direction you may be responsible for implementing.

Write a brief statement summarizing where your authority to proceed with invasive plant management comes from:

Any relationship building required to enhance invasive plant management?  
If so, outline your action plan here.

*Question A(3). Identify other departments, community groups, or other stakeholders with whom you share management of these lands, particularly related to invasive plant management*

<b>Group or Department Name</b>	<b>Role in the management area generally, or in invasive plant mgmt specifically</b>	<b>Relationship</b>

Any gaps in your network of stakeholders?

**Part B. Ecosystem Characterization**

Question B(4). Characterize the lands within your management area from an ecological perspective, including information about their uses.

Name of management area:
--------------------------

a) What habitat types are present in your land management area? (Check all that apply)

- Old-growth coniferous forests
- Young seral and managed second-growth forests
- Mixed coniferous and deciduous forests
- Rocky cliffs, talus, and sparsely vegetated rocks
- Avalanche tracks and seepage sites
- Upland grassy areas
- Agricultural areas
- Riparian areas, wetlands, meadows, floodplains, lakes, and streams
- Offshore forested islands
- Offshore grassy and shrubby islands
- Marine cliffs and rocky islets
- Estuaries, shallow bays, intertidal and sub-tidal marine
- Urban: Low density development (impervious surfaces: 60% or less)
- Urban: High density development (impervious surfaces: 61% or more)
- Other (please specify): \_\_\_\_\_

b) How would you classify the types of land present in your land management area? (Check all that apply)

- Natural area park
- Manicured/active park
- Designated conservation area
- Street trees and boulevards
- Ravine or stream protection areas

- Other municipally owned lands (please specify):

\_\_\_\_\_

c) For what purposes are lands managed in your land management area?  
(Check all that apply)

- Hiking, cycling, or other recreational activity
- Wildlife habitat
- Ecosystem values
- Aesthetic values
- Stormwater management
- Agricultural production/Nursery
- Logging, or other resource extraction (please specify):

\_\_\_\_\_

- Municipal infrastructure or urban uses (please specify):

\_\_\_\_\_

d) Do these lands have any protection status, i.e. conservancy, conservation easement, park designation?  Yes  No

If “yes”, describe:

e) How are neighbouring lands being used?

- Urban: Low density development (impervious surfaces: 60% or less)
- Urban: High density development (impervious surfaces: 61% or more)

Are land uses neighbouring your area creating an invasive plant problem for you? Describe:

f) Are there any known “species at risk” on these lands? Yes No

If “yes”, list them:

g) Is there any habitat to support species at risk? If so, mark it on the map.

h) Are there any other important landscape features on these lands that must be taken into consideration when planning management actions, i.e. culturally important places, unique characteristics, First Nations archaeological site, agricultural reserve lands, viewsapes, etc.? Yes No

If “yes”, list them and locate them on your map:

Be sure to include the following elements on your sketch map:

- Paths, roads, and access points
- Utility corridors (storm sewers, sanitary sewers, hydro, etc.)
- Buildings and other man-made structures
- Water courses and water bodies – including those that may not have water year round
- Hazard lands (steep areas, ravines, etc.)
- Locations of species at risk and/or their habitat
- Locations of important landscape features
- Habitat types

□ Arrow showing north

h) Are the following invasive plant species present? If so, based on your best estimates, what is their density/coverage? Use the chart in Part B to assist you.

<b>Invasive Non-Native Plant Species of Concern in the GVRD</b>	<b>Presence (Y/N)</b>	<b>Density/Coverage (%)</b>
<i>Cirsium arvense</i> var. <i>horridum</i> (Canada thistle)		
<i>Convolvulus arvensis</i> (Field bindweed; morning glory)		
<i>Crataegus monogyna</i> (English hawthorn)		
<i>Cytisus scoparius</i> (Scotch broom)		
<i>Daphne laureola</i> (Daphne-laurel)		
<i>Fallopia</i> spp. (formerly <i>Polygonum</i> spp.) (Japanese knotweed)		
<i>Hedera</i> spp. (English ivy)		
<i>Heracleum mantegazzianum</i> (Giant hogweed)		
<i>Humulus lupulus</i> (Common or European hops)		
<i>Ilex aquifolium</i> (English or European holly)		
<i>Impatiens glandulifera</i> (Policeman's helmet)		
<i>Iris pseudacorus</i> (Yellow flag iris)		
<i>Lamium</i> spp. (Lamium; Dead or spotted nettle)		
<i>Lonicera tatarica</i> (Honeysuckle)		
<i>Lythrum salicaria</i> (Purple loosestrife)		
<i>Phalaris arundinacea</i> (Reed canary grass)		
<i>Prunus laurocerasus</i> (English or cherry-laurel)		
<i>Ranunculus repens</i> (Creeping buttercup)		

<b>Invasive Non-Native Plant Species of Concern in the GVRD</b>	<b>Presence (Y/N)</b>	<b>Density/Coverage (%)</b>
<i>Rubus armeniacus</i> (invasive blackberry spp.)		
<i>Solanum dulcamara</i> (European bittersweet)		
<i>Tanacetum vulgare</i> (Common tansy)		
<i>Vinca minor</i> (Vinca; Common periwinkle)		
Other:		

Map the locations of the invasive plants, using a piece of trace paper over your original sketch map (or if you have access to a GIS system, with GPS units, do this digitally).

i) The quality of this ecosystem is

- Good
- Fairly good
- Medium
- Fairly poor
- Poor

(See definitions in Instructions section of this tool)

If you wish to make any notes, include them here.

**Part C. Risk Assessment**

Question C(5). Rank order the areas for which you are responsible

Based on your assessment of the management areas' ecosystem quality, rank order these lands, with the best quality at the top of the list, and the poorest quality at the bottom. If there are any invasive plant species that pose a liability risk, particularly with negative human health implications, like Giant Hogweed, make sure that they are identified. If there are any opportunities, also make sure that they are identified

Rank	Area Name	Assessment G,FG,M,FP,P	Liability risk species present? If so, identify.	Opportunities?
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

If necessary, extend the table to include all the management areas for which you are responsible.



Name of management area:

Question C(6). Which species pose the greatest threat?

	Japanese Knotweed	Blackberry spp.	Reed Canary Grass	English Ivy	Purple Loosestrife	Scotch Broom	Giant Hogweed	Policeman's Helmet
a) Density within the invaded areas	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]
b) Degree of establishment	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]
c) Degree of invasion (a + b) →								
d) Significance of impact	3.3	3.5	5.1	5.3	5.3	6.2	7.7	8.3
e) Total (c + d) →								
<b>f) Rank of totals (=Threat rating) →</b>								
	Lamium	Bindweed; Morning glory	Vinca; Periwinkle	Canada Thistle	Yellow-flag Iris	Holly	Creeping Buttercup	Common Tansy
a) Density within the invaded areas	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]	<input type="checkbox"/> Low [1] <input type="checkbox"/> Medium [3] <input type="checkbox"/> High [5]
b) Degree of establishment	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]	<input type="checkbox"/> Just beginning to establish [1] <input type="checkbox"/> Somewhat established [3] <input type="checkbox"/> Well established [5]
c) Degree of invasion (a + b) →								
d) Significance of impact	9.1	11.4	12.0	12.0	12.7	12.7	12.8	15.3
e) Total (c + d) →								
<b>f) Rank of totals (=Threat rating) →</b>								

*Question 6(g) Combining the priority area ranking, with priority invasive plant species to manage*

Refer back to table in response to Question 5, then re-rank your sites in response to new information from Question 6, and taking into account the rank ordering tips provided.

Rank	Area Name	Priority Species	Liability risk species present? If so, identify.	Opportunities?
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Rank ordering tips:

- Those sites with liability risk factors at the top of your list.
- Then list those sites which are in the “best” condition, working down from there.
- Within those sites, your top priorities are those areas with your highest priority invasive plants.
- Within those areas, your highest priorities are those invasive plants with the least degree of establishment.
- Within your top ranked list of sites, integrate any opportunities that are presenting themselves, to make your budget stretch farther.

Name of management area:

*Question C(7). What are the risks of action versus no action? Can the risks be mitigated?*

Are there wildlife species or species at risk that will suffer habitat disruption due to *control efforts* for invasive plant species? Yes No Don't know

If yes, identify the type of potential impact. Check the Timing Table (Reference Materials section) for potential mitigation through timing of activities. Then fill out this table with your thoughts ...

If don't know, check back to your answers to Question 4, and check in with a wildlife biologist to assist you with determining the answer to this question.

If no, jump to the next question.

a) Wildlife species or species at risk	b) Potential impact due to control measures	c) Optimal timing of management	d) Impact mitigation strategy (preliminary)

If necessary, extend the table to ensure all affected species are included and planned for.

Is there a legal requirement to control for the invasive plants you have identified?

Species	f) Legal requirement (Y/N)	Source of requirement	g) Liability risk (Y/N)

If necessary, extend the table to ensure all invasive species are included.

On a species by species basis, what sort of local reaction to invasive plant management do you anticipate? What is the basis of any negative reactions you might anticipate? How might you mitigate for these?

Species	h) Potential Responses	i) Potential category of concern	j) Mitigation strategies
	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Neutral <input type="checkbox"/> Mixed	<input type="checkbox"/> Loss of benefits <input type="checkbox"/> Loss of habitat <input type="checkbox"/> Aesthetics <input type="checkbox"/> Management method	<input type="checkbox"/> Public education/ communication strategies – specify: <input type="checkbox"/> Using visual clues – specify: <input type="checkbox"/> Choice of management method – specify: <input type="checkbox"/> Other:
	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Neutral <input type="checkbox"/> Mixed	<input type="checkbox"/> Loss of benefits <input type="checkbox"/> Loss of habitat <input type="checkbox"/> Aesthetics <input type="checkbox"/> Management method	<input type="checkbox"/> Public education/ communication strategies – specify: <input type="checkbox"/> Using visual clues – specify: <input type="checkbox"/> Choice of management method – specify: <input type="checkbox"/> Other:
	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Neutral <input type="checkbox"/> Mixed	<input type="checkbox"/> Loss of benefits <input type="checkbox"/> Loss of habitat <input type="checkbox"/> Aesthetics <input type="checkbox"/> Management method	<input type="checkbox"/> Public education/ communication strategies – specify: <input type="checkbox"/> Using visual clues – specify: <input type="checkbox"/> Choice of management method – specify: <input type="checkbox"/> Other:
	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Neutral <input type="checkbox"/> Mixed	<input type="checkbox"/> Loss of benefits <input type="checkbox"/> Loss of habitat <input type="checkbox"/> Aesthetics <input type="checkbox"/> Management method	<input type="checkbox"/> Public education/ communication strategies – specify: <input type="checkbox"/> Using visual clues – specify: <input type="checkbox"/> Choice of management method – specify: <input type="checkbox"/> Other:
	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Neutral <input type="checkbox"/> Mixed	<input type="checkbox"/> Loss of benefits <input type="checkbox"/> Loss of habitat <input type="checkbox"/> Aesthetics <input type="checkbox"/> Management method	<input type="checkbox"/> Public education/ communication strategies – specify: <input type="checkbox"/> Using visual clues – specify: <input type="checkbox"/> Choice of management method – specify: <input type="checkbox"/> Other:

If necessary, extend the table to ensure all invasive species are included.

k)-n) Is there potential for doing harm with invasive plant management?

Species	Risk of Doing Harm	Risk Mitigation strategy
	<input type="checkbox"/> Control not well understood <input type="checkbox"/> Create new infestations <input type="checkbox"/> Environmental contamination <input type="checkbox"/> Increased environmental vulnerability	
	<input type="checkbox"/> Control not well understood <input type="checkbox"/> Create new infestations <input type="checkbox"/> Environmental contamination <input type="checkbox"/> Increased environmental vulnerability	
	<input type="checkbox"/> Control not well understood <input type="checkbox"/> Create new infestations <input type="checkbox"/> Environmental contamination <input type="checkbox"/> Increased environmental vulnerability	
	<input type="checkbox"/> Control not well understood <input type="checkbox"/> Create new infestations <input type="checkbox"/> Environmental contamination <input type="checkbox"/> Increased environmental vulnerability	
	<input type="checkbox"/> Control not well understood <input type="checkbox"/> Create new infestations <input type="checkbox"/> Environmental contamination <input type="checkbox"/> Increased environmental vulnerability	

o) Are you willing to address challenging invasive plants through experimental approaches in partnership with research scientists? Yes No – Explain:

Name of management area:

Question C(8). Proceed with management and control?

<i>Factors to consider:</i>	<i>This factor suggests to "proceed"</i>	<i>Neutral</i>	<i>This factor suggests "do not proceed"</i>
a) Legal requirement/liability			
b) Ecological value of the land			
c) Degree of disturbance on adjacent land			
d) Management objectives			
e) Species at risk/wildlife			
f) Local community reaction			
g) Sufficient resources for multi-year commitment			
h) Opportunities			
TOTALS:			

Name of management area:

*For Which Species?*

	Japanese Knotweed	Blackberry spp.	Reed Canary Grass	Purple Loosestrife	English Ivy	Scotch Broom	Giant Hogweed	Policeman's Helmet
Degree of invasion (from line c of Recording Sheet #6)								
Significance of impact	3.9	2.2	5.2	4.9	3.6	5.7	9.4	7.3
Urgency of control	2.5	4.0	4.2	6.3	7.3	6.8	9.4	9.9
Difficulty of control	3.5	4.3	6.0	4.8	5.1	6.1	4.4	7.7
Column totals								
<b>Rank of totals (Lowest total = Highest threat rating)</b>								
	Lamium	Bindweed; Morning glory	Canada Thistle	Vinca; Periwinkle	Holly	Yellow-flag Iris	Creeping Buttercup	Common Tansy
Degree of invasion (from line c of Recording Sheet #6)								
Significance of impact	10.1	12.2	12.8	12.1	11.8	13.0	13.8	15.2
Urgency of control	8.2	9.7	10.8	12.5	13.7	11.8	10.8	14.6
Difficulty of control	8.9	12.2	12.3	11.4	12.5	13.3	13.8	15.9
Column totals								
<b>Rank of totals (Lowest total = Highest threat rating)</b>								



**Record of Decision:**

***Proceed with control and management for invasive plant species?***

No Reason: \_\_\_\_\_

Yes, for \_\_\_\_\_

(list species here)

Name:

Date:

Name of management area:

**Part D. Management Planning**

Question D(9). Invasive Plant Management: Implementation Design

**Action Plan for Invasive Plant Management:**

(identify species to be managed here)

Remember to include detailed information for your first year of management planning, with more general statements about the upcoming 4 years, using the Seattle model (Invasive Plant Mgmt Planning, Part D).

Area Name	Control Method	Scheduled Date(s)	Expected Results	Special Considerations (Site preparation; Soils mgmt; other)

Briefly describe any site preparation activities required before invasive plant management:

Briefly describe any soils management activities to be undertaken, either to prevent re-invasion of the area, or to facilitate revegetation activities:

Briefly describe any follow-up planting or seeding you plan to do (specify areas):

Labour force considerations: (Include size and skill levels of field crews; training plan; liability coverage; etc.)

List of Tools required for the method(s) chosen:

Disposal Plan:

Monitoring & Maintenance Plan:

- Photo monitoring point location
- Mapping
- Maintenance
- Frequency

Uncertainties:

*Question D(10). Implementation Evaluation*

<p>Was the <b>Action Plan</b> successfully implemented?</p> <p>Were any modifications made during implementation? If so, what and why?</p> <p>Other notes, comments:</p>
<p>Was the <b>Disposal Plan</b> successfully implemented?</p> <p>Were any modifications made during implementation? If so, what and why?</p> <p>Other notes, comments:</p>

Question D(11). Monitoring/Maintenance Record Sheet

Visit Number:			
Visit Date:			
Name of Person Conducting Monitoring/Maintenance:			
<input type="checkbox"/> Use one recording sheet per monitoring visit <input type="checkbox"/> Make duplicate copies of this recording sheet, once completed (if not digital) <input type="checkbox"/> Attach monitoring photos to recording sheet <input type="checkbox"/> Map areas of encroachment or retreat by the individual plant species in each area, either manually or with assistance of GPS technology, and attach			
Area Name:	Observations (including any explanation, if known):	Photo?	Map?

Question D(12). Evaluation of plan effectiveness

<b>Documenting Your Learning; Preparing to Share Your Story</b>
What methods worked? Any observations?
What methods didn't work? Why not?
What would you do differently next time?
Were there any surprises? What were they? What did you do about them?

## REFERENCE MATERIALS

### ***Invasive Plant Management: Plant Ecology & Best Management Practices Summary***

As for all weeds, there is no single “best” control strategy .... The choices you make will hopefully be guided by understanding the ecology of the plant, your native system and the costs and effectiveness of the various treatment options discussed here, your project goals and your (or your organization’s) capacity to execute them.<sup>7</sup>

The following summary of invasive plant ecology and best management practices (BMPs) is not meant to substitute for your own research, but rather to serve as a preliminary overview of what the literature available on-line has to say about the management of these species.

Factors which affect your choice of strategy, and what becomes a BMP for you in your situation, include the resources you have at your disposal (staff and volunteer time, money, equipment, etc.), the regulatory environment within which you are making decisions (whether or not herbicide or biological control methods are permitted), and your management goals and objectives.

Please note that information sources for the material on these tables is listed at the end, with numerical references after the name of each species.

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<sup>7</sup> Controlling Knotweed (*Polygonum cuspidatum*, *P. sachalinense*, *P. polystachyum* and hybrids) in the Pacific Northwest  
<http://tncweeds.ucdavis.edu/moredocs/polspp01.pdf>



Table 2: Invasive Plant Ecology & Summary of Best Management Practices

<b>Species:</b>	<i>Cirsium arvense var. horridum</i> (Canada thistle) (4)(9)				
<b>Well understood?:</b>	N -- Limited experience with mgmt in natural areas				
<b>Propagation Strategies:</b>	Deep, creeping rhizomes & wind-blown seeds				
<b>Mgmt Timing:</b>	Dependent on control method				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• The BC Weed Control Act has listed <i>Cirsium arvense var. horridum</i> as a provincial noxious weed. Therefore, there is a legal requirement to control this species, should it occur within your municipality.</li> <li>• Vegetative reproduction is key to establishment of colonies.</li> <li>• Above-ground portions of plant do not overwinter, but regenerate from stored reserves in the roots.</li> <li>• Keys to control:             <ul style="list-style-type: none"> <li>○ Eliminate seed production</li> <li>○ Reduce the plant's nutrient reserves in root system through persistent mgmt.</li> </ul> </li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X	X – during dormant season	Requires combination of methods	X	

<b>Species:</b>	<i>Convolvulus arvensis</i> (Field Bindweed; morning glory) (4)(9)				
<b>Well understood?:</b>	N – Limited experience with mgmt in natural areas.				
<b>Propagation Strategies:</b>	Rhizomes & seed				
<b>Mgmt Timing:</b>	Not specified				
<b>Special Considerations:</b>	Seeds may be viable up to 60 years Must be actively managed for several years to bring it under control Keys to control: <ul style="list-style-type: none"> <li>• Contain and persistently control existing stands of field bindweed to exhaust the root system and deplete the soil seed bank.</li> <li>• Maintain a healthy cover of perennial plants to discourage field bindweed establishment.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X	X – In combination with other methods	X – Planting competitive crops		

<b>Species:</b>	<i>Crataegus monogyna</i> (English hawthorn)				
<b>Well understood?:</b>	N -- No management/control information available on-line.				
<b>Propagation Strategies:</b>	Root, cuttings, or seed				
<b>Mgmt Timing:</b>	Not specified				
<b>Special Considerations:</b>	Unknown – This plant is still considered desirable from a horticultural perspective, according to the on-line material available.				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>

<b>Species:</b>	<i>Cytisus scoparius</i> (Scotch broom) (1)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Primarily by seed; some ability to reproduce vegetatively				
<b>Mgmt Timing:</b>	Oct-early May: pull seedlings July-Sept: cut mature bushes				
<b>Special Considerations:</b>	Do not manage during blooming or seed set season; act to prevent new seeds; follow up with resprouts. Small seedlings can be controlled by handweeding; more mature bushes can be removed with weed wrenches. Exhaust the root system. Avoid spreading seed. Wipe off boots and clothing before leaving infested area. Seeds may be viable for up to 80 years. Need long-term management strategy to deplete seedbank.				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X	X	Disposal – do not compost at home	X	X

<b>Species:</b>	<i>Daphne laureola</i> (Daphne-laurel)				
<b>Well understood?:</b>	N -- No management/control information available on-line.				
<b>Propagation Strategies:</b>	Seed				
<b>Mgmt Timing:</b>	Not specified.				
<b>Special Considerations:</b>	All parts of the plant are poisonous. Skin contact with the sap can cause dermatitis.				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>

<b>Species:</b>	<i>Fallopia spp. (formerly Polygonum spp.)</i> (Japanese knotweed) (4)(5)(8)(10)(11)				
<b>Well understood?:</b>	N – reproduction by seed less important than vegetative reproduction by rhizomes				
<b>Propagation Strategies:</b>	Vegetative propagation from rhizomes; potential for viable seed				
<b>Mgmt Timing:</b>	Literature does not specify				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• A Pulaski is useful for digging out mature clumps. Entire root system must be removed to prevent resprouting.</li> <li>• Remove material, dry and burn it if possible – do not compost.</li> <li>• Integrated pest management, using a combination of methods, considered most useful.</li> <li>• Some success with stem injections of herbicide, but not yet proven.</li> <li>• Some sources recommend removing when soils are moist &amp; soft, to reduce risk of creating root fragments. Caution re flood risk for mgmt crews in the field, and risk of root fragments being dispersed in high water.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X – for small infestations only;			Shading of cut stems, in combination with repeated cutting (4+ times/season) Disposal: do not compost; dry & burn plant material if possible	X – Cut stem treatment; foliar spray; injection	

<b>Species:</b>	<i>Hedera spp.</i> (English ivy) (1)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Juvenile form: vegetative propagation Mature form: Vegetative & seed propagation				
<b>Mgmt Timing:</b>	All year round				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Wear gloves: toxins in the roots &amp; stems can cause blistering in some individuals.</li> <li>• Tree climbing ivy can be cut at shoulder level, and lower level ivy pulled away from the tree to the extent of 6 feet. Do not pull the upper ivy down. (You risk bringing a branch down on your head.)</li> <li>• Prevent contact with soil after mgmt activities – dry on tarp or in plastic garbage bags.</li> <li>• Stop flower production and the further spread of seed.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X		Mulching Disposal: dry before composting		

<b>Species:</b>	<i>Heracleum mantegazzianum</i> (Giant Hogweed) (1)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Vegetative & seed				
<b>Mgmt Timing:</b>	Mar-June – early growing season				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Avoid all skin contact with plant sap because it can cause burns, blisters &amp; scarring.</li> <li>• For mature plants, dig up at least the first 4-6” of central root.</li> <li>• Prevent new seeds.</li> <li>• Monitor at least 7 years, and treat resprouts.</li> <li>• Use more than one method to obtain best effect.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X			X	

<b>Species:</b>	<i>Humulus lupulus</i> (Common hops; European hops)				
<b>Well understood?:</b>	N -- No management/control info available on-line.				
<b>Propagation Strategies:</b>	Seed, cuttings, runners, & roots				
<b>Mgmt Timing:</b>	Not specified				
<b>Special Considerations:</b>	Skin contact can cause dermatitis.				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>

<b>Species:</b>	<i>Ilex aquifolium</i> (Holly)				
<b>Well understood?:</b>	N -- No management/control info available on-line.				
<b>Propagation Strategies:</b>	Seed				
<b>Mgmt Timing:</b>	Not specified.				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Minimize soil disturbance if hand pulling.</li> <li>• Protect desirable vegetation.</li> <li>• Work first in least infested areas, moving towards more heavily infested areas.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>

<b>Species:</b>	<i>Impatiens glandulifera</i> (Policeman's helmet) (1)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Primarily by seed, but can also spread vegetatively. Seeds viable for approx. 18 months.				
<b>Mgmt Timing:</b>	March-July				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Prevent new seeds from being added to the seed bank. Do not manage during seed set season.</li> <li>• Use barriers to prevent sediment and vegetative debris from entering the water system.</li> <li>• If plants are in flower, carefully place a bag around entire flower cluster, then remove.</li> <li>• Maintain a healthy cover of perennial plants.</li> <li>• Any control effort should be followed up the same growing season and for several years afterwards.</li> <li>• Post-mgmt – prevent contact of uprooted plants with soil.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X		Disposal: compost	X	X

<b>Species:</b>	<i>Iris pseudacorus</i> (Yellow-flag iris) (3)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Rhizomes & seeds				
<b>Mgmt Timing:</b>	Not specified.				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Invader of wet areas; can be difficult to access.</li> <li>• Remove flower stocks and/or heads to prevent seed set.</li> <li>• Prevent seed set.</li> <li>• Dig out rhizomes.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X					

<b>Species:</b>	<i>Lamium galeobdolon</i> (Lamium; Dead or spotted nettle) (2)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Perennial & stoloniferous				
<b>Mgmt Timing:</b>	Not specified.				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Dig out rhizomes.</li> <li>• Contain and persistently control existing stands to exhaust the root system.</li> <li>• Maintain a healthy cover of perennial plants to discourage establishment.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X			X – Planting competitive ground cover	X	

<b>Species:</b>	<i>Lonicera tatarica</i> (Honeysuckle)				
<b>Well understood?:</b>	N -- No management/control info available on-line.				
<b>Propagation Strategies:</b>	Self-seeding				
<b>Mgmt Timing:</b>	Not specified.				
<b>Special Considerations:</b>	Recognized as invasive in Connecticut, but little info re control on-line. Most info is horticultural in nature.				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>



<b>Species:</b>	<i>Lythrum salicaria</i> (Purple Loosestrife) (1) (9)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Seed and root fragmentation				
<b>Mgmt Timing:</b>	March - August				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Prevent new seeds from being added to the seed bank; Do not manage during seed set season.</li> <li>• Do not compost.</li> <li>• Brush off boots and clothes before leaving infested area.</li> <li>• Best time to survey for plants is July-August when in flower.</li> <li>• Maintain a healthy cover of perennial plants.</li> <li>• Any control effort should be followed up the same growing season and for several years afterwards.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X-Prior to seed set.	X		Disposal: do NOT compost Minimize seed dispersal Bag plants & roots; deposit in landfill or other approved site	X	X

<b>Species:</b>	<i>Phalaris arundinacea</i> (Reed canary grass) (3)				
<b>Well understood?:</b>	N				
<b>Propagation Strategies:</b>	Rhizomes, rhizome fragments & seeds				
<b>Mgmt Timing:</b>	Control can take 2-3 years, with 5-10 years of monitoring to prevent re-invasion				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Control can take 2-3 years, with 5-10 years of monitoring to prevent re-invasion.</li> <li>• Keys to control: <ul style="list-style-type: none"> <li>○ Control/removal of existing plants &amp; rhizomes</li> <li>○ Exhaust seed bank</li> <li>○ Active restoration of native (desirable) vegetation</li> <li>○ Prevention of new seeds or stem fragments from entering area</li> </ul> </li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X		Planting water tolerant trees (conifers) or other strategies for shading RCG	X - Rodeo	

<b>Species:</b>	<i>Prunus laurocerasus</i> (English or Cherry laurel) (20)				
<b>Well understood?:</b>	N -- No management/control info available on-line.				
<b>Propagation Strategies:</b>	Seed				
<b>Mgmt Timing:</b>	Not specified.				
<b>Special Considerations:</b>	Unknown.				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>

<b>Species:</b>	<i>Ranunculus repens</i> (Creeping buttercup)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Vegetative and seed propagation – seeds may remain viable for 20+ years. Stoloniferous				
<b>Mgmt Timing:</b>	Not specified.				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• All parts of the plant are poisonous. Sap can cause skin to blister.</li> <li>• Contain and persistently control existing stands to exhaust the root system and deplete the soil seed bank.</li> <li>• Maintain a healthy cover of perennial plants.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X			X		

<b>Species:</b>	<i>Rubus armeniacus</i> (Himalayan Blackberry) (1)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Vegetative through root & stem fragments, & by seed				
<b>Mgmt Timing:</b>	All year round				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• At least 4 mgmt interventions/year to prevent regrowth &amp; protect revegetation efforts.</li> <li>• Minimize soil disturbance if hand pulling; protect desirable vegetation.</li> <li>• Work first in least infested areas, moving towards more heavily infested areas.</li> <li>• Starve root system through management of vines. Several cuttings per year over several years are necessary to exhaust roots of reserve energy.</li> <li>• Dig out root crowns, or dig up root balls if possible. Cut to roots at least 4x/year.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X			X	

<b>Species:</b>	<i>Solanum dulcamara</i> (European bittersweet) (23)(24)(25)				
<b>Well understood?:</b>	Most information on-line appears to be horticultural in nature. Appears to be similar to English ivy in its behaviour (twining vine that smothers trees).				
<b>Propagation Strategies:</b>	Rhizomes and other vegetative fragments; seeds.				
<b>Mgmt Timing:</b>	Not specified.				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• A member of the nightshade family – very toxic, but believed to have medicinal powers</li> <li>• The berries of this plant undergo color transformation during their growing season. Beginning as a green berry, they change first to yellow, then to orange, and finally to red. Not all the berries reach these color stages at the same time. It is not uncommon to see a bittersweet nightshade plant bearing berries of three different colors.</li> <li>• Dig it out and pick up all pieces of the plant; any piece of the plant left on the ground is capable of resprouting. One commentator used Round Up on it.</li> <li>• Wear gloves when working with this plant or you might end up with a nasty rash.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X	X			X	
<b>Species:</b>	<i>Tanacetum vulgare</i> (Common tansy) (4) (9)				
<b>Well understood?:</b>	Y				
<b>Propagation Strategies:</b>	Seed & vegetative fragments				
<b>Mgmt Timing:</b>	Not specified				
<b>Special Considerations:</b>	Mechanical methods, such as mowing or hand-cutting, are most effective in combination with other management measures because this plant is rhizomatous. Plants can regrow from severed roots, and cut stems may still produce viable seed. Manage the spread of common tansy by preventing seed production and dispersal, minimizing the spread of cut rootstocks, and establishing vigorous stands of perennial plants. Re-seed controlled areas with desirable species.				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X – wear gloves & protective clothing	X – Before flowering & seed set		X – Minimize disturbance & seed dispersal, eliminate seed production & maintain healthy native communities.	X – metsulfuron (Escort); Picoloram or dicamba; glyphosate	

<b>Species:</b>	Vinca minor (Vinca; Common periwinkle) (2)(6)(7)				
<b>Well understood?:</b>					
<b>Propagation Strategies:</b>	Vegetative and seed propagation				
<b>Mgmt Timing:</b>	Not specified				
<b>Special Considerations:</b>	<ul style="list-style-type: none"> <li>• Contain and persistently control existing stands to exhaust the root system and deplete the soil seed bank.</li> <li>• Maintain a healthy cover of perennial plants.</li> </ul>				
<b>Manual:</b>	<b>Mechanical:</b>	<b>Fire:</b>	<b>Cultural/Preventive:</b>	<b>Herbicides:</b>	<b>Biocontrol:</b>
X – raise runners with rake & cutting close or digging by hand			X – Use of hand-held propane torches, where feasible & appropriate		

*Information Sources:*

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2. Purdue University Cooperative Extension Service “Spreading Ornamental Plants: Virtues & Vices” by Kelly A. Frank & Michael N. Dana [http://www.hort.purdue.edu/hort/ext/Pubs/HLA/HLA\\_001.pdf](http://www.hort.purdue.edu/hort/ext/Pubs/HLA/HLA_001.pdf)
3. Lake Leland Integrated Aquatic Plant Management Plan: Integrated Treatment Action Plan <http://www.ecy.wa.gov/programs/wq/plants/leland/actionplan.html>
4. Center for Invasive Plant Management: Worst Weeds in the West [http://www.weedcenter.org/management/weed\\_mgmt\\_profiles.html](http://www.weedcenter.org/management/weed_mgmt_profiles.html)
5. Steve Godwin, City of Surrey Parks Dept
6. US Forest Service Charles C. Deam Wilderness Invasive Plant Species Control Project Decision Memo: [http://www.fs.fed.us/r9/hoosier/project\\_docs/dn\\_dm/CCDW\\_%20InvPlant\\_Control\\_DM.pdf](http://www.fs.fed.us/r9/hoosier/project_docs/dn_dm/CCDW_%20InvPlant_Control_DM.pdf)
7. West Multnomah Soil & Water Conservation District, Dirty Thirty list of invasives. <http://www.westmultconserv.org/dirty30.html>
8. Nick Page, Raincoast Consulting, Personal Communication, May 10, 2006.
9. Colorado, *Creating an Integrated Weed Management Plan*, Species Profiles section.
10. <http://www.cdfa.ca.gov/phpps/ipc/weedinfo/polygonum-knotweeds.htm>
11. The Nature Conservancy, Controlling Knotweed in the Pacific Northwest
12. The Nature Conservancy, Reed Canary Grass Control & Management in the Pacific Northwest

13. The Nature Conservancy, Controlling Scotch (Scots) Broom in the Pacific Northwest
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18. The Nature Conservancy, Stewardship Abstract: Field Bindweed: <http://tncweeds.ucdavis.edu/esadocs/documnts/convam.pdf>
19. <http://www.hort.uconn.edu/plants/l/lontat/lontat3.html>
20. <http://oregonstate.edu/dept/ldplants/prla.htm>
21. <http://www.nappo.org/PRA-sheets/Ranunculusrepens.pdf>
22. Burrill, Larry C. (1992) Creeping Buttercup (*Ranunculus repens* L.):  
<http://eesc.orst.edu/agcomWebfile/edmat/html/pnw/PNW399/pnw399.html>
23. David Beaulieu, Your Guide to Landscaping, [http://landscaping.about.com/cs/groundcovervines1/a/bittersweet\\_2.htm](http://landscaping.about.com/cs/groundcovervines1/a/bittersweet_2.htm) .
24. Dave's Garden, Detailed information on Woody Nightshade, Climbing Nightshade, Bittersweet (*Solanum dulcamara*),  
<http://davesgarden.com/pf/go/68211/index.html>.
25. Missouri Flora, [http://www.missouriplants.com/Bluealt/Solanum\\_dulcamara\\_page.html](http://www.missouriplants.com/Bluealt/Solanum_dulcamara_page.html).

## Invasive Plant Management: Timing Summary

Please note that this information is not complete, in part because the information available on-line is not comprehensive. As you work with the invasive species of concern in your area, you will be able to complete this table for those species of concern to you in your invasive plant management planning.

**Table Key:**









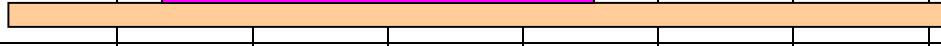
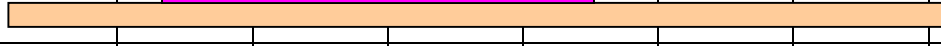

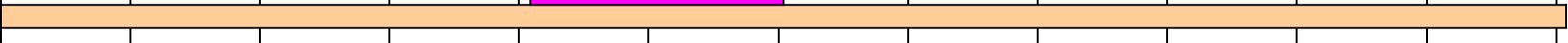
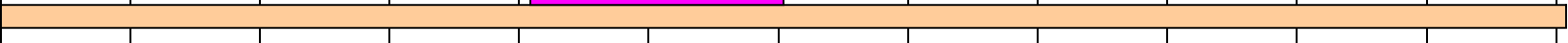
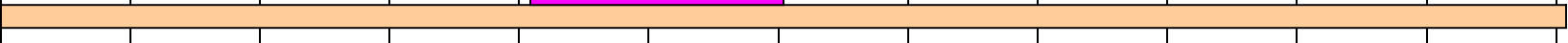
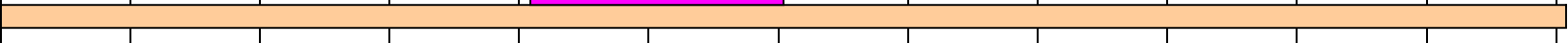
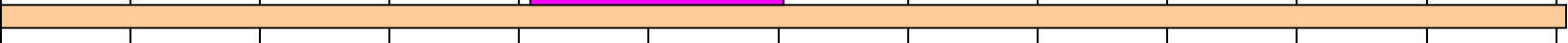
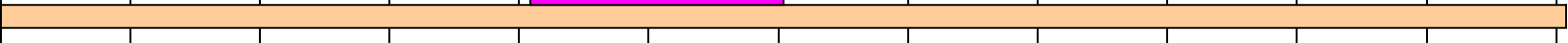
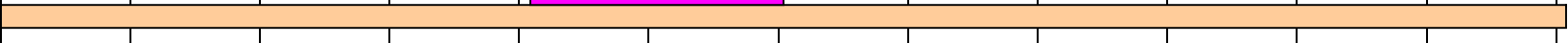
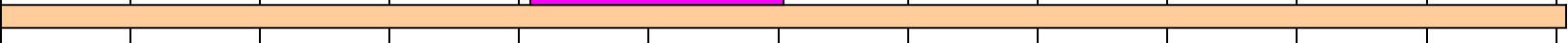
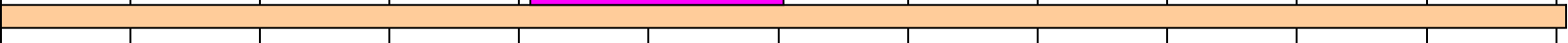
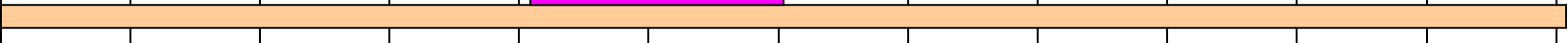
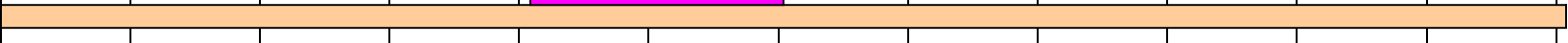
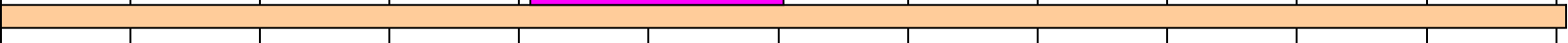
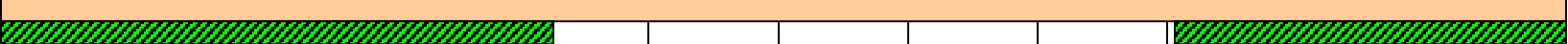
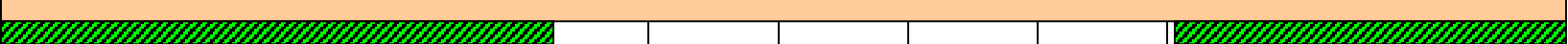
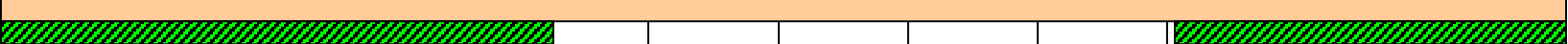
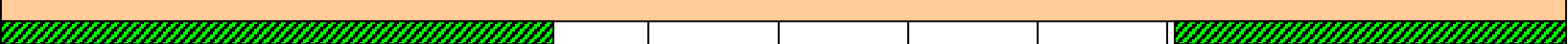
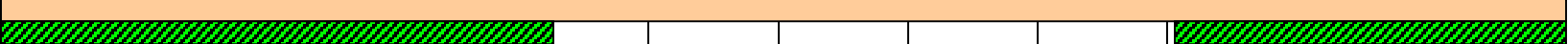
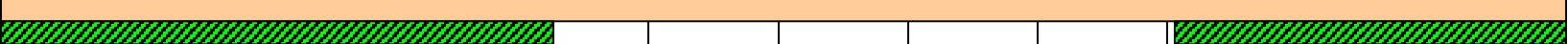
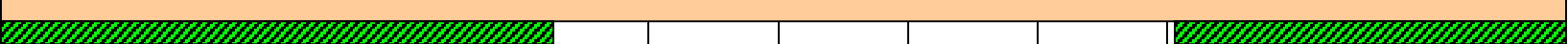
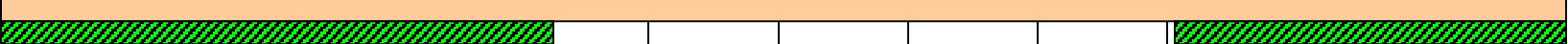
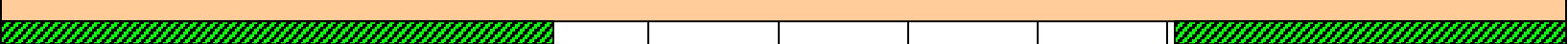
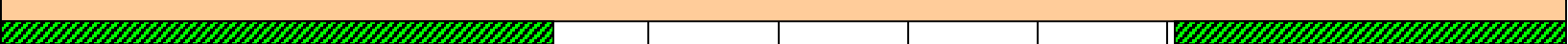
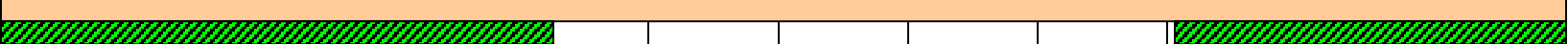
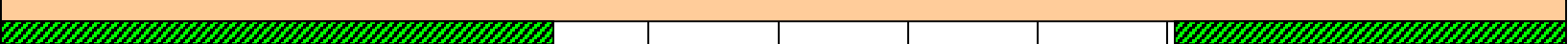


Species present	
Flowering	
Fruiting	
Best time for management	

Table 3: Invasive Plant Management Timing Summary

Species	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
<i>Cirsium arvense</i> <i>var. horridum</i> (Canada thistle)												
<i>Convolvulus arvensis</i> (Field Bindweed; morning glory)												
<i>Crataegus monogyna</i> (English hawthorn)												
<i>Cytisus scoparius</i> (Scotch broom)												
												

Species	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
<i>Daphne laureola</i> (Daphne-laurel)		█	█	█	█							
<i>Fallopia</i> <i>spp.</i> (formerly <i>Polygonum spp.</i> ) (Japanese knotweed)							█	█	█	█		
<i>Hedera spp.</i> (English ivy)	█	█	█	█						█	█	█
<i>Heracleum</i> <i>mantegazzianum</i> (Giant Hogweed)			█	█	█	█	█	█				
<i>Humulus lupulus</i> (Common hops; European hops)				█	█	█	█	█	█	█		
<i>Ilex aquifolium</i> (Holly)	█	█	█	█	█	█	█	█	█	█	█	█
<i>Impatiens</i> <i>glandulifera</i> (Policeman's helmet)			█	█	█	█	█	█	█	█		
<i>Iris pseudacorus</i> (Yellow-flag iris)												



Species	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
<i>Lamiastrum galeobdolon</i> (Lamium; Dead or spotted nettle)												
<i>Lonicera taterica</i> (Honeysuckle)												
<i>Lythrum salicaria</i> (Purple Loosestrife)												
<i>Phalaris arundinacea</i> (Reed canary grass)												
<i>Prunus laurocerasus</i> (English or Cherry laurel)												
<i>Ranunculus repens</i> (Creeping buttercup)												
<i>Rubus armeniacus</i> (Himalayan Blackberry)												
<i>Solanum dulcamara</i> (European bittersweet)												
<i>Tanacetum vulgare</i> (Common tansy)												

<b>Species</b>	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
<i>Vinca minor</i> (Vinca; Common periwinkle)												

## **SUPPORTING INFORMATION**

### ***Planning and Governance Context***

#### **Applicable legislation and governance**

Given the constitutional division of powers between federal and provincial governments in Canada, the primary role of the federal government related to invasive species is in regard to international trade, specifically the prevention of invasive species to enter Canadian borders through trade. The Canadian Food Inspection Agency is the primary federal agency responsible for invasive plant matters. There are two major pieces of relevant federal legislation:

- The Seeds Act (R.S. 1985, c. S-8) – which governs the testing, inspection, quality and sale of seeds; and
- The Plant Protection Act (1990, c. 22) – which is designed to prevent the importation, exportation and spread of pests injurious to plants and to provide for their control and eradication, and for the certification of plants and other things.

The Province of BC has two major pieces of legislation which affect invasive plant management within the province:

- BC Weed Control Act – which requires land owners and occupiers (including municipal lands under the ownership of municipal governments) to control all plant species identified under the Provincial Noxious Weed List; and
- BC Forest and Range Practices Act – which governs the behaviour of leasees of Crown land, with specific attention to the forestry and ranching industries. The regulations under FRPA contain a weed list applicable to forest stewardship, woodlot licence, range use, and range stewardship plans.

The BC Weed Act permits municipalities to establish their own by-laws related to invasive weed management. To date, only two municipalities in the region are known to have invasive weed management by-laws:

- Delta, which has a weed specialist on staff, possibly due to the extensive agricultural lands within the municipal boundaries; and
- Saanich, which has passed a by-law related to Giant Hogweed.

Port Moody, Vancouver, and Burnaby appear to be moving in the direction of by-laws, but have not yet adopted them.

In October 2003, the Integrated Pest Management Act was passed by the BC legislature, requiring all pesticide and herbicide applicators to use integrated pest management principles, effective December 31, 2004. In March 2004, the BC Minister of Water, Land and Air Protection introduced legislation that allows municipalities to regulate, prohibit, and impose requirements in relation to the application of pesticides, except exempted pesticides, for the purpose of maintaining outdoor greenery on residential or municipal lands. This legislation was brought into force as a result of Section 9 of the Community Charter, which introduces the concept of concurrent regulatory authority, whereby municipalities and the province have a shared interest in regulating certain activities.<sup>8</sup>

The Greater Vancouver Regional District (GVRD) has undertaken the development of a Biodiversity Conservation Strategy for the Region, as well as a number of other initiatives including:

- Collaboration with the BC Landscape and Nursery Association in identifying challenges related to pest management. A focus group indicated the need for improved access to localized, problem-specific information on organic or low-toxicity pesticide alternatives.
- “Natural yard care” providing information on a number of environmental issues, including pesticide and solid waste

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<sup>8</sup> City of Burnaby Environment Committee Report, 2005 January 17

reduction, composting and water conservation. Planned dissemination strategies include brochures and educational materials geared at public school educators.<sup>9</sup>

A number of municipalities within the GVRD, including the City of Burnaby, have adopted the policy that no herbicides will be used on municipal lands. In Burnaby this policy is supported by its *Let It Grow, Naturally!* program, to encourage private homeowners to reduce their use of cosmetic herbicide products and fertilizers. In support of this initiative, the City offers free workshops in partnership with the Burnaby School Board's Adult and Continuing Education program, on topics such as "managing your lawn organically" and the management of specific turf pests, like the European chafer, as well as composting and yard waste collection services.

On January 15, 2004, the City of Vancouver passed a pesticide by-law in-principle which is modelled after a Toronto bylaw.<sup>10</sup> Final approval was expected in 2005, but is still in process. In 2005, the Vancouver Board of Parks and Recreation developed a *City-Wide Strategy for Invasive Plant Species*, currently at the final draft stage. Given budgetary cutbacks, the Parks Board has been unable to move this planning effort into final stages.<sup>11</sup> The Parks Board's Strategic Plan 2005-2010, and its proposed *Waterfront Policy Plan* calls for the Parks Board to address invasive plant species because:

- There is a growing concern at all levels of government with the spread and impacts of invasive species,

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<sup>9</sup> Ibid.

<sup>10</sup> That by-law, which came into force on April 1, 2004, banned the outdoor use of pesticides on public and private property, except in the case of infestations. However, as a result of the difficulty in defining guidelines and action thresholds for infestations (including dandelions), by-law implementation has been modified to extend homeowner education until Sept. 1, 2007, and enforcement staff will only begin issuing warnings in 2007. As part of the modified implementation, golf courses, lawn bowling greens and cemeteries will now be exempt from the bylaw, provided they follow IPM principles. (Source: City of Burnaby Environment Committee Report, 2005 January 17)

<sup>11</sup> Personal communication, Sophie Dessureault, April 12, 2006.

- Invasive plant species have yet to be specifically prioritized as an issue within Vancouver Parks Board operations; only limited budget or Parks Board staff time has been formally allocated to manage this issue;
- To date the primary focus for management (by Parks Board staff) has been centered on the four parks with 'natural areas', i.e. Stanley Park, Renfrew Ravine, Everett Crowley Park, and Jericho Beach Park, and typically only when physical park amenities were directly threatened;
- Generally, most invasive species removal activities have been done by volunteer groups;
- At present, it appears there is limited sharing of information or experience between groups or districts; and
- There is no formal monitoring or tracking of invasive plant species within Vancouver parks.

A number of other municipalities are vigorously pursuing invasive plant management objectives as well, including the City of Coquitlam, as part of its natural areas strategy, and the City of Surrey, through its parks board.

## International Instruments related to Invasive Species Management

A variety of binding and non-binding international instruments address invasive species, Some are well established, while others are very recent. Most focus on a particular dimension of alien-related issues, whether it be protection of a particular objective, like migratory species, or containment of a particularly damaging organism. Nearly all of these instruments have their own institutional mechanisms and decision-making procedures.

The International Plant Protection Convention was adopted approximately 50 years ago. It imposes binding rights and obligations on its Parties, related to agro-biodiversity, and includes considerations of plant pests.

The relationship between the World Trade Organization (WTO) rules and trade-related controls on alien species introductions is still unclear to many governments. Currently regulations are in place, through the WTO-SPS Agreement in the areas of food safety, animal and plant health. These do not address biodiversity concerns.

The Convention on Biodiversity, initially adopted in 1992, provides a comprehensive legal basis for taking preventive and mitigation measures to address the full range of threats posed by alien invasive species, i.e. to genetic diversity, species diversity, and ecosystem diversity. However, there is only a single provision related to invasive species in the Convention, Article 8(h), and it is short, general, and reliant on Parties' best endeavours. It provides little or no direction to Parties on how to go forward on implementation. The focus of the related institutions from 1995-2000 has been on integrating alien species issues into the Convention's work programmes and on developing guiding principles, which were in interim form in 2000. <sup>12</sup>

At the 5<sup>th</sup> Conference on Bio-Diversity Conference of Parties, governments and other relevant bodies were urged to apply the ecosystem approach to their work on invasive

*“This human population growth is not merely a concern for intensively managed lands. Our increasing presence and consumptive and non-consumptive demand for resources threaten every natural area and resource.” – McPherson (2001)*

<sup>12</sup> IUCN, Guide to Designing ... p. 30

alien species. An ecosystem approach needs to be based on the best available science, while recognizing that science is continually adjusting to adapt to new information. From a legal perspective, implementation of the ecosystem approach provides two particular difficulties:

1. Jurisdictional boundaries within which legal systems operate seldom correspond to those of ecological units which are affected by invasives, and
2. Sectoral legal approaches often prevail over integrated ones. This means that inter-jurisdictional cooperative management agreements and other mechanisms to facilitate cross-sectoral integration is essential, both within national boundaries and between nations.<sup>13</sup>

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<sup>13</sup> Ibid, p. 31.



## ***Definition of Invasive Species, and How Specific Target Species were Identified***

Land managers typically rely on the classification of a plant species as being “native” or “introduced” in their management decision-making.<sup>14</sup> As straight-forward as that sounds, in practice it is not so simple. Ecologists typically use nine different criteria in their attempts to determine the indigenous or nonindigenous status of species: fossil evidence, historical evidence, habitat, geographic distribution, frequency of known naturalization, genetic diversity, reproductive pattern, possible means of introduction, and relationship to insects, i.e. whether generalized or specific. The key problems faced by ecologists include:

1. “Definitive categorization of the species is often difficult
2. Plant status information is often not presented in local floras, and
3. Plant status information found in floras is occasionally ambiguous, conflicting, or wrong.”<sup>15</sup>

All of this is complicated by the fact of ongoing climatic change, which results in the continuous fluctuations of plant populations. “Nonetheless, the pre-European settlement period is the most frequently used time horizon in North America and elsewhere” for dating the start of plant invasions. “This time horizon is used because it is biologically important; it represents the beginning of a time period marked by a dramatic increase in the rate at which species were transported by humans across formerly insurmountable distribution barriers.”<sup>16</sup>

Invasive plant species in the Greater Vancouver Regional District have been identified as problems based simply on their invasiveness, aggression, and ability to outcompete other plants native to the watershed. Many on the list are garden escapees, whereas many of the officially listed invasive plant species have economic impacts on the

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<sup>14</sup> Schwartz, p. 8.

<sup>15</sup> Ibid.

<sup>16</sup> Ibid., p. 10.

powerful agricultural or forestry industries. Very few of the species found to be invasive within the Greater Vancouver Regional District are listed on the BC Weed List. From the list compiled for this research, from four existing lists within the region, a total of 22 identified plant species are identified invasive within the region. Of these, only one is classified as noxious provincially (*Cirsium arvense* var. *horridum* (Canada thistle)), and only one is listed as being regionally invasive (*Tanacetum vulgare* (Common tansy)).<sup>17</sup> The story is somewhat different with the provincial Forestry weed lists, where six of the invasive plants of the Greater Vancouver Regional District are listed as invasive plants: *Cirsium arvense*, *Tanacetum vulgare*, *Polygonum* spp., *Lythrum salicaria*, *Cytisus scoparius*, and *Iris pseudacorus*.<sup>18</sup> However, the Forestry listing does not have implications for municipal governments.

### ***Science in Invasive Species Management Decision-making***

According to McPherson (2001), there is great potential for integrating the science and management of invasive species, but such integration faces substantial obstacles based on the differences between science and management.<sup>19</sup> Specifically, science strives for generality (laws, predictions, and explanations with maximum applicability), while management of natural resources is necessarily a site-and objective-specific endeavour that often is conducted within a localized cultural arena. This means that while certain management actions may be effective for specific objectives, species and sites, these same actions may be ineffective or inappropriate for another objective, species or site. Additionally, social, political or economic factors often constrain management actions, and these vary from site to site. Management is

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<sup>17</sup> <http://www.agf.gov.bc.ca/cropprot/weedman.htm#PROVINCIAL%20AND%20REGIONAL>

<sup>18</sup> Invasive plants regulation, <http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/invplants/ipr.htm>, Accessed December 1, 2005.

<sup>19</sup> It is important to note that McPherson was writing specifically about the issues of the use of fire in ecosystem restorations, and their broader applicability to invasive species management, but these issues are more broadly applicable also.

always strongly influenced by human values, whereas science seeks logic and facts independent of human values.<sup>20</sup>

While that may seem to be explanation enough for the challenges of integrating the science of plant invasions into the management of invasive plant species, McPherson goes on to identify a number of weaknesses within the scientific literature that make it difficult for managers to use science. So why do managers seem to ignore science? McPherson identifies three specific issues within the scientific literature:

1. Weak inference – the literature is descriptive and reliant on post hoc, correlative research, rather than experimental research allowing direct comparisons within a single set of conditions. This means that the scientific literature suggests courses of action, which may be a good fit with the manager’s preferences (or set of constraints), rather than providing insights into best management practices for the manager’s particular set of issues.
2. Research is characterized by case studies with limited applicability beyond the local site. Because of the limitations of the case study method, broad-scale principles for guiding management are not generated. Where experimental research is undertaken, it is almost always restricted to areas smaller than the fundamental units of management – and there are barriers to scaling up.
3. Ecosystems change over time, which confounds attempts to conserve them, and complicates attempts to monitor them.<sup>21</sup> With ecosystems in general, and those adapting to the presence of invasive species in particular, understanding the past will not ensure that we can predict the future.

Nevertheless, all is not lost. There are ways that scientists and managers can collaborate together to bridge some of these issues, and engage in mutual learning, so as to enhance the effectiveness of invasive plant management. Managers can contribute to scientific inquiry by:

- Posing tractable questions,

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<sup>20</sup> McPherson (2001), p. 141.

<sup>21</sup> Ibid, p. 142.

- Helping to design ecological experiments,
- Seeking management implications from published research,
- Understanding the difference between hypotheses and predictions,
- Understanding weak inference,
- Assessing experimental techniques and research methods, and
- Facilitating insightful research experiments on lands within their jurisdiction.

Scientists can assist managers in their quest to manage invasive plant species by:

- Focusing on questions that address important management issues within their program of research,
- Synthesizing relevant findings from their research & research conducted by other scientists,
- Supplying information in outlets accessible to managers, and
- Responding to requests for information and advice in a timely & thoughtful way.

The science of ecology offers a number of tools that can be used to evaluate the success of management actions, including monitoring protocols and analytical techniques which have been developed to assess ecosystem structure and function. McPherson argues that data derived from monitoring will be most useful if based on structural and functional attributes of the ecosystem, rather than on poorly defined concepts such as ecosystem “health,” “integrity,” and “sustainability.”

### ***Issues Related to Invasive Plant Management Practices***

Invasive plant management in natural areas is a relatively new activity, and invasion science is a new science. Some practices from the world of industrial agriculture are being used in ecological restoration projects, leading to controversy. Specific areas of dispute include the use of biological controls or herbicides/pesticides to control an invasive species.

Herbicide use is controversial because of the risks to native or desirable vegetation in a natural area. Herbicides pose risks because of the risk of accident in their application, the risk of ineffective applications, the risk of plant adaptations to the

presence of herbicides, and because of the potential for long-term effects, which have not yet been identified. DDT is the classic cautionary tale about the use of pesticides, in that its use had unintended consequences that were very pervasive throughout the ecosystem, and with long-term viability in the soils. DDT is still leaching into watercourses in the USA (and probably Canada), although its use has been banned for 30+ years.

Most of the on-line literature about the controversies surrounding the use of herbicide focus on controversies related to genetically modified crops which are “Roundup Ready.” However, I found<sup>22</sup> the following articles that present, in a fair way, both sides of the issue of herbicide use:

- Topanga On-line – a 2003 newsletter pointing out the arguments for and against herbicide use on an invasive plant in a natural area ([www.topangaonline.com/tasc/tasc41-1.html](http://www.topangaonline.com/tasc/tasc41-1.html))
- Seattle Post Intelligencer, May 30, 2003 article regarding roadside pesticide use to control blackberry ([http://seattlepi.nwsourc.com/local/124253\\_spray30.html](http://seattlepi.nwsourc.com/local/124253_spray30.html))
- Glyphosate – outline of attributes of one commonly used herbicide, Glyphosate, and various implications for toxicity (<http://www.poptel.org.uk/panap/pest/pe-gly.htm>)

Biological control is controversial because some people see it as introducing yet another non-native species into the ecosystem thereby compounding the invasion issue, particularly in terms of ecological disturbance. Others argue that, if done right, the introduced species is so specialized that once the invasive plant is controlled, the introduced biological control will exist in harmony with its host, and not cause any problems with its host. There are ample examples in the literature to support both points of view.

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<sup>22</sup> Google searches conducted May 22, 2006.

A quick search of the web revealed an interesting bias in the information available on the internet. Almost all items reporting on the controversy about the use of biological control were not available to the average reader because of access requirements. Potential readers were required to have a subscription to the academic journal to access the article. Almost all items in support of biological control for invasive plants were freely available. Nevertheless, a few sources that are readily available may outline the challenge for you:

- The Nature Conservancy's *Weed Control Methods Handbook*, Chapter 4 on Biological Controls, prepared by John M. Randall & Mandy Tu, can be found on-line at <http://www.wilderness.net/toolboxes/documents/Invasive/Chapter%204%20BiologicalControl.pdf>
- Biocontrol: nontarget effects, research outline by Dr. Jane Memmott, University of Bristol, which can be found at <http://www.bio.bris.ac.uk/research/community/nontarget.html>
- CRS Report for Congress, Harmful Non-Native Species: Issues for Congress III, April 8, 1999. <http://www.cnire.org/NLE/CRSreports/Biodiversity/biodv-26b.cfm#Biological%20Controls>.

## ***Project Methodology***

The project idea was developed in collaboration with Robyn Wark, Ecosystem Planner for the City of Burnaby, and Susan Haid, Senior Environmental Planner with the Greater Vancouver Regional District. Under the umbrella of the GVRD Biodiversity Conservation Strategy development, a number of initiatives on invasive plant management were moving forward simultaneously, including the development of a framework for invasive plants in GVRD Parks<sup>23</sup> and an inventory of invasive plants in the Still Creek watershed with restoration prescriptions.<sup>24</sup>

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<sup>23</sup> Page (2006a)

<sup>24</sup> Page (2006b)

## Research Goals

At the project outset, a number of research goals were identified, to assist with the formation of focus group and interview protocols, as well as to focus the work. These included:

- Identification of barriers to effective invasive plant species management.
- Constructive strategies and recommendations to systematically overcome these barriers.
- Improved invasive plant species management structures, potentially including better planning, better relationships between volunteer groups and city agencies, and better methods of communicating about invasive plant management to City Council and to various publics, including:
  - Assembling the data required to make effective and informed decisions;
  - Formulating the necessary plans and decisions;
  - Developing a complete record of the information-gathering, analytical, and decision-making processes, useful in case of challenges from members of the general public; and
  - Providing the basis from which it may be possible to develop a tool that is of use to land managers within the entire GVRD.
- Enhanced decision-making capabilities about invasive plant species management.

To meet these goals, a three-part research strategy was developed: scoping, drafting and testing, and revising.

### Step One: Undertake Scoping Process

The research began with a scoping process, including a literature review (print materials and internet) and two focus groups in December 2005:

- A Still Creek Watershed focus group, made up of representatives from the Cities of Burnaby and Vancouver (13 participants); and

- The GVRD Biodiversity Working Group, made up of representatives from most of the municipalities which make up the GVRD (16 participants).

The goal of these scoping processes was to identify the management components most useful to planners and land managers early in the research.

The literature review revealed that the materials available to assist urban (municipal) land managers with invasive plant management decision-making was sparse. In all, nine invasive plant management frameworks were examined to identify crucial elements for consideration (see Table 5). Critical elements varied somewhat, dependent on the audience for whom the framework and/or publication was intended, but most fell into one of three categories:

- Integrated pest management planning, specifically for ranchers, farmers, foresters, and other rurally-based land managers;
- Invasive plant legal and policy frameworks, for policy-makers and governance bodies;
- Technical documents meant to support one or the other of the above categories.

The one exception to this finding is the Garry Oak Ecosystems Recovery Team's *Decision Support Framework*, which has elements of integrated pest management planning, but emphasizes up-front assessment activities over invasive species management planning (although it includes a significant component of that in the framework as well). This holistic approach was immediately appealing.

In reviewing the critiques of the *Decision Support Framework* contained in their evaluation report, as well as discussions with participants in the development of the Framework, it became apparent that improvements, as well as modifications, would be necessary. Much of the Garry Oak Team's work is applicable to municipal lands, although their focus on a specific ecosystem type which is not present in BC's Lower Mainland meant that significant modification would be required to adapt to the local context. Also, because their focus was on specific ecosystem types, their tool excluded



specific constraints faced by municipalities in undertaking invasive plant management activities, requiring further adaptation.

The issues that emerged in the focus groups were far-ranging in nature, and indicative of the myriad challenges facing urban land managers in their struggle to contain invasive plants. Key issues included lack of understanding within the general public and political leadership, lack of support from the legal system, and lack of resources with which to tackle invasives. At the GVRD Biodiversity Working Group Focus Group, a clear mandate to develop a decision support tool was given to the researcher. The project started to take shape.

### Step Two: Draft and Test Decision-Support Tool

Based on the information gathered in Step One, a planning and decision-support tool was drafted for the GVRD, although initial focus was on the Still Creek/Burnaby Lake watershed. The decision support tool was originally envisioned to look like an extensive checklist supported by a handbook, and has stayed true to that vision, although more background material has been included than was originally anticipated. The draft “tool” was tested with selected land managers, through a combination of interviews and test cases, and revised in response to the experience of using it. Comments were also sought from members of the Garry Oak Ecosystems Recovery Team (GOERT), as well as from the Manager of the Watershed Revegetation Program for the City of Portland’s Bureau of Environmental Services.

A key challenge that emerged is that the risk assessment methodology used by the GOERT in their Decision Support Tool was only available for three invasive plant species: Scotch broom, English ivy, and Blackberry. During the test cases, it emerged that these are not necessarily the top three invasive plants within the GVRD watersheds. It also became apparent that none of the other sources

Table 4: Invasive Plant Management Frameworks
<i>Seven steps to managing your weeds</i> – BC Ministry of Agriculture/Open Learning Agency
<i>Creating an integrated weed management plan: A handbook for owners and managers of lands with natural values</i> – Colorado State Parks
<i>Handbook for ranking exotic plants for management and control</i> – US National Park Service
<i>Global Invasive Species Initiative: Adaptive Management Templates and Planning Examples</i> – The Nature Conservancy
<i>Decision Support Tool for Invasive Species in Garry Oak and Associated Ecosystems</i> – Garry Oak Ecosystem Recovery Team
<i>Pacific Northwest Landscape Integrated Pest Management (IPM) Manual: Culture of Key Trees &amp; Shrubs, Problem Diagnosis and Management Options</i> – Washington State University, Cooperative Extension
<i>Prioritizing Invasive Plants and Planning for Management</i> – Ron Hiebert (an update of US National Park Service handbook)
<i>A Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species</i> – IUCN
<i>IAP Reference Guide – Part 1, Module 1.4: Planning of Invasive Alien Plant Programs</i> – BC Ministry of Forests

which ranked invasive plants based on significance were compatible with the GOERT system, because they are much more complex; neither did they include the majority of plant species which had been identified as invasive within the GVRD.

In response to this challenge, the researcher duplicated the GOERT methodology, and invited 30 individuals with a strong interest in and commitment to invasive plant management to participate in a community science project to rank order the invasive plants identified for the GVRD. Of the 30 individuals invited to participate, 15 responded with rankings – although not all respondents ranked all species.<sup>25</sup> This was in part because some of the plants were unfamiliar to respondents, because they are not equally invasive throughout the region.

The participants were invited to rank order 23 species of plants identified as invasive within the GVRD against each other on the basis of three criteria:

1. Significance of impact;
2. Difficulty of control or management; and
3. Urgency of control or management.

The list of invasive non-native plant species was drawn up from the Weedbusters Manual (Burnaby Lake), Vancouver Parks Board's City-Wide Strategy for Invasive Plants (DRAFT), Steve Godwin's presentation at the Greater Vancouver Invasive Plant Committee's First Conference on April 12, 2006 related to the species of concern in Surrey, and Nick Page's inventory of invasive plant species in the Still Creek Watershed.

In determining "significance of impact," participants were asked to think of the individual plant species' impacts on the normal disturbance regimes of the ecosystem, areal extent of the species, dominance of the species within the various ecosystems where it is found, effect on natural ecological processes (i.e. increase in erosion or

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<sup>25</sup> This response rate was better than that of the GOERT effort, where 20 participants were invited, but only 6 responded. Of these 6 respondents, not all ranked all species of invasive plants either. (Murray & Pinkham, p. 59-67)

other) and its innate ability to become a pest due to reproductive strategies, seed dispersal mechanisms, longevity of seeds, and so on.

In determining “difficulty of control or management”, participants were asked to think about the likelihood of successful control of this species, based on knowledge of other communities’ experience of eradication, and whether or not there are methods in place which can effectively control this species.

In determining “urgency of control or management,” participants were asked to think in terms of whether delay in management will result in a very little increase of effort to management this species, or a huge increase of effort to manage it.

While it is important not to overstate the validity or reliability of this data, it does give an indication of the GVRD invasive plant management community’s perceptions of which invasive plant species present the greatest threat to natural areas within the region. Based on the results (raw data available in Appendix A), the species which present the greatest threat within the GVRD include:

Table 5: Top 10 GVRD Invasive Plants

<i>Species Name</i>	<i>Ranking (All criteria)</i>	<i>Significance of Impact</i>	<i>Difficulty of Control or Mgmt</i>	<i>Urgency of Control or Mgmt</i>
1. <i>Fallopia spp. (formerly Polygonum spp.)</i> (Japanese knotweed)	3.3	3.9	2.5	3.5
2. <i>Rubus armeniacus</i> (invasive blackberry spp.)	3.5	2.2	4.0	4.3
3. <i>Phalaris arundinacea</i> (Reed canary grass)	5.1	5.2	4.2	6.0
4. <i>Lythrum salicaria</i> (Purple loosestrife)	5.3	4.9	6.3	4.8
5. <i>Hedera spp.</i> (English ivy)	5.3	3.6	7.3	5.1
6. <i>Cytisus scoparius</i> (Scotch broom)	6.2	5.7	6.8	6.1
7. <i>Heracleum mantegazzianum</i> (Giant hogweed)	7.7	9.4	9.4	4.4
8. <i>Impatiens glandulifera</i> (Policeman's helmet)	8.3	7.3	9.9	7.7
9. <i>Lamium galabdolon</i> (Lamium; Dead or spotted nettle)	9.1	10.1	8.2	8.9
10. <i>Convolvulus arvensis</i> (Field bindweed; morning glory)	11.4	12.2	9.7	12.2

Based on these indications, the risk assessment components of this DST were completed for the species of concern within the GVRD. However, these results should be verified by a group of ecologists who specialize in invasive plant science, with knowledge of the behaviour of the invasive plants within the region. They should also be tested rigorously, and protocols developed to:

- a) manage these invasive plants within the region; and
- b) regularly redo these results (and release them to the invasive plant community), so that they are kept current in light of greater experience in the management of these species within the region, and are updated as new invasive plant species are identified.

Ultimately only the top ranked 16 species were used in the Decision Support Tool, primarily because those species at the bottom of the ranking scale were ranked by too few of the participants, so that there was no ability to rely on the information.

### **Step Three: Revise Decision-Support Tool and Gather Feedback**

Based on feedback from the land managers and comments from reviewers of the draft document, the decision-support tool was revised, and presented to the City of Burnaby (client) and Dr. William Rees (advisor) for comment, prior to finalization. The first presentation of the final document occurred on June 16, 2006 at the Planners for Tomorrow conference, the Canadian Association of Planning Students' 2006 annual event, held in Vancouver. It was anticipated that the first presentation of this planning and decision support tool would be to the participants in the two focus groups, but that proved not to be possible. A presentation is scheduled for August 10, 2006 with the GVRD Biodiversity Working Group.

### ***Next Steps/Recommendations***

If our goal is to achieve control of invasive plant species in natural areas in BC's Lower Mainland, this project is only one milestone along the way. We have a great distance left to go on this journey, to achieve our goal or destination. From where I sit, further milestones include community-based projects or initiatives in invasive plant management, further developments and evolutions in our thinking about invasive plant management, and further research in invasive plant management. Based on my perceptions of what needs to be done, here is a list of recommendations and next steps for the community's consideration:

#### Use of the Planning and Decision Support Tool (DST)

1. This DST is a very preliminary effort, based on my best efforts, which now needs to be fully tested in the field by land managers, working within their particular field of constraints and requirements. While I have tried to be comprehensive, it may be that further information is required in some sections, or there are gaps due to lack of knowledge about the specifics of natural area management within municipalities, or that new information emerges about planning for the management of invasive plants. As you use this DST, please keep me informed as to the various adaptations you make to it. I can be reached at [bsuderman2005@gmail.com](mailto:bsuderman2005@gmail.com).
2. Because this document is preliminary, it should be used with the appropriate level of caution. Caution should particularly be applied in the use of the summary tables about the ecology and best management principles for the management of individual invasive plant species. For example, during the development of this document, the official name of Japanese Knotweed changed from *Polygonum spp.* to *Fallopia spp.* Without Nick Page's information about this, I would not have known. For several years it will be confusing to access management information about this plant because some information sources will still have the old name, and some will have the new name.
3. Information about the "top 10 species" of concern within the GVRD should also be treated with care. What may be true in a perception study about invasive plants may not be true on the ground in your particular areas of management. Based on your research and investigations into the issues facing the sites you are particularly concerned about, you will be able to make your own list of species of concern, and plan accordingly.

#### Further Development of the Decision Support Tool (DST)

4. For all of the reasons listed above, an adaptive management strategy for testing and modifying this DST should be undertaken. Unfortunately it is beyond the capacity of this writer to undertake this task. Any organization

that is interested in undertaking this task and wishes to volunteer would be most welcome!

5. Because the discipline of invasive plant management is relatively new, and because it can seem to be overwhelmingly complex in nature, the focus of this DST has been to take a systematic approach to the various inter-connecting aspects of planning for invasive plant management. There are many bodies of theory which have contributed to this DST, including ecological theory, plant invasion theory, theories of human behaviour and psychology, management theory, and so on. The theoretical framework for this DST has not been comprehensively outlined in this document, in part due to lack of time, and in part because of the nature of the professional project. However, over time it could prove helpful to have these theoretical frameworks articulated more clearly, so that the theory could be more fully developed.<sup>26</sup> Any student interested in taking on this challenge is most welcome!
6. To be able to more clearly and effectively articulate the theory behind invasive plant management will require a basis of experience, including a number of pilot projects at varying scales, so that clear patterns can emerge. There are a number of pilot projects, or other projects which can be characterized as pilots, underway within the GVRD's member municipalities. If an organization like the GVRD's Biodiversity Working Group were to work together with an academic institution interested in invasive plant management within urban areas, an effective partnership could be formed to develop a theoretical and management framework that would meet the needs of urban land managers here.

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<sup>26</sup> When I use the word "theory" in this context, it means that ability to explain why certain things happen. The theory of plant invasions, for example, attempts to explain why certain plants become invasive, how the invasion will proceed once these invasive plants become introduced into an area, and what measures may be effective in controlling the invasion, including the explanation of why those measures may be effective.

7. This DST was developed for the use of those urban land managers with authority to make decisions about invasive plant management on those lands within their jurisdiction. However, within municipal governance structures, there is a continuum between authority and influence. Most municipal governance tasks require cooperation and collaboration within the municipal government, and between the municipal government, other levels of government, community-based groups, private property owners, and the general public. In developing this DST, I understand that urban land managers do not have unfettered authority, and are often influenced by others.

However, municipal governments face other situations where invasive plant management is a desired outcome, but there is limited authority to mandate it, i.e. with private property owners, specifically developers. The modification of this DST, or the development of a comparable DST, for the use of the urban planner with influence over land use within municipalities, suitable for policy development and related tasks, would be helpful, and compensate for a short-coming of this DST for that purpose.

#### For the Invasive Plant Management Community

8. Increased collaboration within the invasive plant management community will dramatically enhance the capacity of the region to manage and control invasive plants. The GVRD's Biodiversity Working Group, which brings together municipal representatives from the entire region, is a good start, as is the Greater Vancouver's Invasive Plant Committee, bringing together representation from all levels of government (with the possible exception of First Nations), as well as community groups, industry, and other major stakeholders. At this point, collaboration is focused on information sharing, which is a very important component of developing capacity and enhanced decision making.

However, if collaborative efforts could also begin to result in more comprehensive invasive plant management activities, and the application of a



consistent management and monitoring approach to those activities, with a commitment to sharing the results with a wider community, the impact on the ecosystems of the Lower Mainland would be profoundly beneficial.

9. Urban land managers cannot work in isolation on invasive plant management. One of the issues which emerged very clearly through the focus groups was the lack of political support/will to tackle invasive plants in a serious way, as demonstrated by the lack of resources available for undertaking invasive plant management work. Part of the reason for the lack of political support is due to the lack of public education and awareness of the issues related to invasive plant management. In parallel with any control methods that are developed and implemented, the various collaborative groups may also wish to turn their attention to issues of public education, making the general public (including gardeners, homeowners, industries, and others) more aware of what a healthy natural area landscape should look like, and increasing their awareness of the negative effects caused by invasive plants. It may be that a social marketing approach would be the most successful vehicle for such a public education campaign.
  
10. Lastly, the response of the invasive plant management community to this research effort was profoundly generous, meaning that there is a hunger for region-specific invasive plant management material. A good focus for further investigation and capacity-building would be the results of the community science component, ranking invasive plants of the Lower Mainland. These results should be taken to the community at large, as well as invasion biology specialists. Bringing the two groups together in a workshop situation, the results should be explored, with workshops designed to address the various dimensions of “significance of impact”, where the greatest level of disagreement seemed to occur, as well as “difficulty of control and management.” Then, based on the results of the workshop, the ranking should be revised according to the new results that would emerge. Then, in conjunction with this workshop, protocols for the management of these less well understood invasive plants, developed for the ecological and governance

climate of BC's Lower Mainland with full recognition of the ban on use of pesticides, could be developed.



<i>Iris pseudacorus</i> (Yellow flag iris)	13 14 14 10 4 16 14	18 13	16 10 14	13.0	9 14 10 14	3 15 14	15 14	17 3 14	11.8	15 15 13	8 4 7 14	19 14	16 20 15	13.3	12.7
<i>Ranunculus repens</i> (Creeping buttercup)	20 15 8 15 20 7 19	10 15 10 10 17 13	13.8	19 16 6 7	13 21	6 4 11 3 6 17	10.8	21 16 3 16	20 19	4 15 12 7 16 17	13.8	12.8			
<i>Tanacetum vulgare</i> (Common tansy)	19 12 10 16 11 17 20	20 17 6 15 19 16	15.2	23 12 9 9 16 16 20	10 21 7 15 17 15	14.6	22 13 8 13 17 21	18 18 8 19 18 16	15.9	15.3					
<i>Equisetum arvense</i> (Common horsetail) -- NATIVE	12 17 11 23 21 17	19 14	23 18 12	17.0	13 17 5 4	20 15	7 5	23 7 16	12.0	14 17 9 23 15 18	20 19	23 17 14	17.2	15.4	
<i>Daphne laureola</i> (Daphne-laurel)	15 20 12 12 18 11 22	16 19	22 20 23	17.5	15 20 19 17 10 19 18	20 17	16 18 21	17.5	9 20 17 6 5 9 20	16 13	15 12 21	13.6	16.2		
<i>Prunus laurocerasus</i> (English or cherry-laurel)	14 18 21 14 13 18 18	17 18	21 16 19	17.3	18 18 21 20 11 21 16	22 18	19 16 23	18.6	16 18 21 15 13 17	15 17	22 15 23	17.5	17.8		
<i>Humulus lupulus</i> (Common hops; European hops)	21 23 16 17 9 13 15	22 20	20 11 24	17.6	21 23 14 21 14 17	23 16	20 8 20	17.9	19 23 18 19 14 15	23 22	17 10 20	18.2	17.9		
<i>Crataegus monogyna</i> (English hawthorn)	17 21 15 19 20 21	23 21	17 21 22	19.7	17 21 20 18 17 22 23	19 20	21 15 22	19.6	17 21 19 18 19 22	21 16	21 19 22	19.5	19.6		
<i>Solanum dulcamara</i> (European bittersweet)	22 19 23 22 19 23	12 23	19 18	20.0	22 19 23 23 18 22	16 23	22 18	20.6	20 19 23 22 4 21 23	12 23	18 18	18.5	19.7		
<i>Lonicera tatarica</i> (Honeysuckle)	18 22 22 21 16	21 22	18 22 20	20.2	14 22 22 22 19	21 19	18 19	19.6	18 22 22 21 16	22 21	20 21 19	20.2	20.0		
Other:															
<i>Rubus allegheniensis</i>															
<i>Rubus laciniatus</i>															
<i>Convolvulus sepium</i>															
<i>Typha angustifolia</i>															
<i>Buddleia davidii</i> (Butterfly bush)															
<i>Betula pendula</i> (European birch)															

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