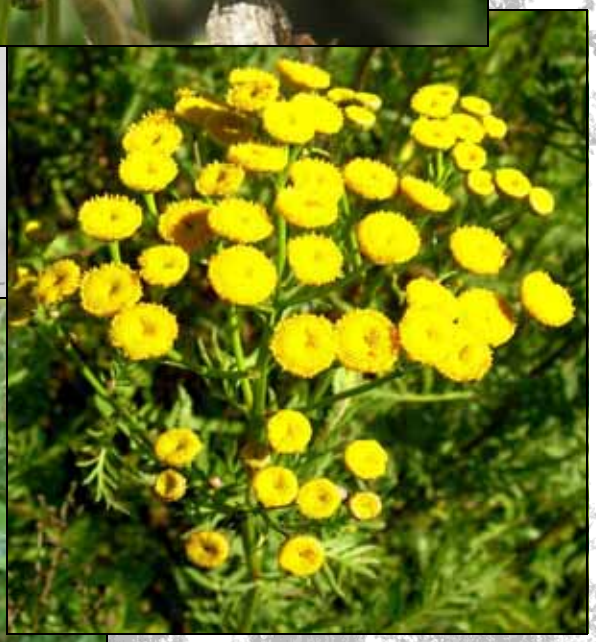
THE CITY OF Red Deer

INTEGRATED PEST MANAGEMENT MANUAL



Management of insect pests and invasive insects…mammal pests and pathogens…prohibited noxious and noxious weeds…invasive and other weed species

Red Deer recreation & parks & culture

Preface

To help guide and effectively manage pest problems in The City of Red Deer, the Parks Section has produced an Integrated Pest Management (IPM) Manual. The manual provides a source of information on pest management and an up-to-date list of pests and their corresponding management procedures. One of the primary goals of the manual is to present an overview of the subject of IPM in Red Deer and to unify pest control operations and pesticide application projects in one IPM program.

A manual of this nature must constantly reflect on and adapt to an ever-changing pest environment. Consequently it can only be considered complete until the next major pest arrives on the scene, pesticide or pest legislation changes, new products, technologies and methods of control become available, or the public seeks a change in the way pests are handled because of shifting points of view. With this in mind, the IPM manual can be considered a work in progress – one that is intended to act as a foundation for current operational, planning and technical pest control activities, but that also will require ongoing development and refinement over time.

Factors crucial to the success of an IPM program include carrying out government mandates such as the Weed Control Act and the Pest Act, integrating and using a diverse range of control products and methods while reducing the reliance on chemical pesticides, monitoring pest activity before and after control procedures, providing guidance and assistance to city staff and engaging external organizations and the community. With a solid IPM framework in place, the community can participate in various pest control initiatives, including working with city staff to identify and monitor new pest problems and to help establish practical and effective pest control targets and workable solutions.

There are numerous well written and valuable sources of information available on the subject of IPM. Sources include textbooks, municipal and other government level publications, academic technical journals, the press, online information, social media – the list of source information associated with potential pests and pest problems is exhaustive. With this manual, an attempt has been made to place some limitations and refinements on the broad base of information available to, in turn, specifically target the more pertinent pests and pest problems found in the Red Deer area. It is hoped that this approach will help to expedite any corrective pest control actions required.

When a pest problem is detected in the city, initially several questions and basic action steps come into play to help narrow its scope. These include:

- What type of identified pest is causing the problem
- Where does the pest and its host reside
- When during the season does the pest problem persist
- Why is the pest present at this particular time and place
- Who is qualified to decide on the proper course of action
- How will the pest be eliminated or reduced to lessen its impact

The IPM program and this manual do not presuppose that all pest problems are easily solvable. An attempt is made to pose the correct questions required to pinpoint the negative

impacts associated with a pest and then to provide the necessary answers and reasonable solutions required to adequately reduce or eliminate those impacts. The range of pests, however, is extensive. Consequently, input from city staff and from members of the community is vital and necessary – this input can help to enhance the operational, planning and technical results of the IPM program and the effectiveness of future versions of this manual.

To facilitate city staff in carrying out the IPM program, operations have been integrated into a citywide work management system. This will allow staff to effectively track and record work and asset information related to IPM. There is also a service request component to the system which will allow staff to respond to public inquiries related to IPM.

As a supplement to the manual, several paper modules have been developed to streamline the information related to the most common pests encountered in Red Deer. The four modules are simplified formats of the IPM manual and they are modified for use by Parks field staff. They provide a quick and simple reference and are designed to be carried on-site without the hindrance of the bulkier IPM manual. The modules will also eventually be available for uploading similar to an app onto a PDA or handheld electronic device. The four modules include the following:

› Module One – Insects
› Module Two – Mammals
› Module Three – Pathogens
› Module Four – Weeds

The modules are not referred to subsequently in the IPM manual itself.

There is no one overarching method in carrying out a successful IPM program. Each section of Parks operations must choose and apply the appropriate methods that pertain to the specific pest problem they are faced with. In the case of weed control, for example, it may be appropriate to choose several methods. This could include roughcut mowing in one area, to apply spot pesticide treatments in another and finally to pull and remove the weeds in more environmentally sensitive areas. Similarly, a number of approaches and combinations of methods for the control of insects may be the most appropriate procedure. Each of these situations requires a case-by-case assessment to decide the most effective approach. The IPM manual is intended as a guide and general resource to help identify and target pest problems and to provide a range of control methods within the context of the applicable regulatory process.

In the compilation of this manual numerous external references, substantial source material and a number of photographs on the subject of IPM have been reviewed, cited and used. All reasonable attempts have been made to properly reference and acknowledge this material. Any inaccuracies or omissions are strictly unintentional.

Collectively City of Red Deer Parks staff members have participated in implementing and carrying out an IPM program that has been largely successful at suppressing pest activity. Parks staff members have also enthusiastically contributed to the development of this manual. All are duly recognized and acknowledged for their contributions. Formal acknowledgements are found in the manual.

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1.0 INTRODUCTION

Rapid growth and development over the last number of years in Red Deer has resulted in new subdivisions and an increased compliment of associated parks and recreation sites. Along with this growth has come an increase in the number of insect, mammal, pathogen and weed pests and the need to manage those pest populations in an integrated manner.

To effectively do this, The City of Red Deer Parks Section has been implementing, practicing and refining Integrated Pest Management (IPM) methods. Over time several IPM manuals have been completed and updated to provide direction for pest management. The current IPM manual has been developed to provide a single and comprehensive source of information on pest management, along with an up-to-date list of pests and their corresponding management procedures. The IPM manual has numerous functions:

- To act as a foundation for ongoing development and future refinement of the IPM program
- To unify pest control operations and pesticide application projects under one IPM system
- As a reference of IPM technical procedures for City of Red Deer staff and the community
- As a reference for IPM City policy and government legislation
- For education and awareness about changing and alternative IPM methods
- As a reference to help establish staff and budgetary needs for pest management

The content and layout of the IPM manual is intended to present an overview of the subject of IPM in Red Deer in a comprehensive and organized manner with supporting appendices. The reader can also choose to quickly pinpoint and derive information on a specific pest problem if required. Briefly summarized below are the major sections of the IPM manual:
Section one, *Introduction*, describes the function and content of the IPM manual.

Section two, *Integrated Pest Management (IPM)*, identifies concerns and components of IPM in the City of Red Deer followed by a description of the current Parks operational sections and their relationship to IPM. The policy planning and developmental framework of the program is outlined, along with the key operational, planning and technical tools associated with IPM. The recent development of an 'IPM review process for pesticide application projects and other pest problems' is emphasized as a practical means to assist in IPM pesticide and non-pesticide use operations. City of Red Deer policy and provincial and federal legislation is also described.

Section three, *Integrated Pest Management Procedures*, has two main sections related to 'monitoring and control procedures'. These two procedure areas are further broken down to describe in detail 'description and process' and 'equipment and methods'. The above information is intended to give a thorough overview of field operations related to IPM. Reporting procedures is then discussed and this is tied in to the IPM review process. Concluding this section is a description of the education and awareness efforts coupled to IPM.

Sections four to six, *Glossary*, *References*, and *IPM Program Manual Development and Acknowledgements*, as well as *Appendix A-H* as supporting documentation, follow.

Section seven, *Pest Profile Index and Photographs (Details)*, is a detailed listing of the three groupings of pests including Invasive Insects and Insect Pests; Mammal Pests and Pathogens; and Weeds - Prohibited Noxious, Noxious, Invasive Species and Others.

2.0 INTEGRATED PEST MANAGEMENT (IPM)

2.1 IPM in the City of Red Deer

2.1.1 IPM Review Process for Pesticide Application Projects and Other Pest Problems

2.2 City of Red Deer Policy

2.3 Provincial and Federal Pesticide Legislation

"If you want to live and thrive, let the spider run alive" Quaker saying

2.0 INTEGRATED PEST MANAGEMENT (IPM)

2.1 IPM in the City of Red Deer

The City of Red Deer actively uses and continually refines its Integrated Pest Management (IPM) program. The IPM program has been defined in the following terms: 'Integrated Pest Management is the maintenance of detrimental insects, weeds and other organisms at tolerable levels utilizing a combination of cultural, physical/mechanical, biological, and microbial/chemical pesticide control methods to keep environmental impacts to a minimum'.

Reasons for monitoring and controlling pests in the City of Red Deer are based on the following ecological, economic and public concerns:

Ecological Concerns:

- Increased plant and animal susceptibility to pests if an infestation is over a tolerable level
- To maintain a native species balance and variety (biodiversity)
- Related to the Provincial Weed Control and/or Pest Act
- Permanent pest damage considerations if infestations are annual
- Short to long-term pest damage considerations
- Invasive species; eventually fatal to host if left untreated
- Damage to desired plants due to competition for space, water, nutrients and sunlight
- Uncertain distribution; likely widely distributed

Economic Concerns:

- Control spread from private property
- Control spread from private property using enforcement
- Control the spread to private property
- To evaluate, establish and maintain tolerable levels of damage
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to pests, which may lead to decreased landscape value
- Maintenance standards; may lead to increased maintenance costs if not controlled
- To prevent increased costs such as tree replacement
- Prevent equipment damage

Public Concerns:

- Aesthetically unpleasant in higher quality environments or park areas held at a higher maintenance standard
- Public perception and complaints, aesthetics, health and safety concerns
- Require increased education and awareness about pests
- Increased maintenance cost
- Related to the Provincial Weed Control and/or Pest Act
- Use of the most environmentally sound methods of control available
- Maintenance standards involve both negative and positive concerns

To be effective, IPM in the City of Red Deer has several required components. These include:

- Correctly identifying and recording activities of the potential pest problem
- Identifying the host or location of the pest
- Locating and confirming pest monitoring and control routes
- Determining injury and action thresholds (upper limits of damage/time for action) of pests
- Correctly estimating the percentage of an infestation
- Establishing the type of control activity

- Establishing and alleviating any concerns related to location of control activities
- Education and public notification
- Responsibilities of the pesticide applicator license holder

In conjunction with the above, the following additional components of IPM are also essential:

- Prevent pest problems by proper planning and management of ecosystems
- Recognize and identify pests from beneficial species
- Monitor and document populations of beneficial species
- Using a combination of methods such as cultural, mechanical/physical, biological, and microbial/chemical methods that result in minimal environmental impact, to achieve acceptable control levels
- Evaluating the results and the effectiveness of the strategies used for managing the pest
- Conform to all health and safety policies such as job site hazard assessments

The sections and operations within Parks engaged either directly or indirectly in IPM are:

□ Parks Amenities
- Cemetery:
  The cemeteries in Red Deer have been planted with a monoculture of maturing white spruce. Pest issues arising from these plantings have been approached from an IPM practice.
- Facilities and City Hall Park:
  Weed control around facilities is carried out within the context of IPM. Staff at facilities and City Hall Park practice IPM approaches on trees, shrubs and other vegetation.

□ Parks Landscape
- Parks Maintenance (Tree and Shrub Maintenance):
  The trees and shrub beds are managed with a combination of IPM methods. Mulching to modify soil temperature and to promote water conservation and weed control. Examples include physical/mechanical practices such as hand pulling weeds, and pruning for rejuvenation and disease control.
- Turf Construction (Landscaping/Tree Planting):
  Planting of trees and shrubs requires monitoring of material for visible pest problems.
- Turf Maintenance (Rough Cut and Turf):
  IPM methods included here involve rough cutting overgrown areas to facilitate weed control and other methods related to ensuring healthy turf.

□ Parks Planning and Technical Services
- Ecological Services:
  Involved with the coordination of IPM initiatives in the city, including education, monitoring and non-chemical control methods to reduce pests on select routes; also uses an IPM approach while operating the mosquito control program.
- Urban Forestry:
  Involved with the coordination of pest problems on the shrubs and trees in the city, including education, monitoring and when required application of pesticides to reduce pests on select routes.
- Parks and Open Space Design:
  IPM practices can include reducing monoculture plantings, promoting the use by developers of good quality, non-infested plant material for plantings in new

subdivisions and communication with other Parks sections to stay informed of emerging pest issues.

For IPM to work, effective communication and operational planning is required between all of the relevant Parks service sections noted above and often between other city departments as well. In some Parks sections, there is overlap in operational functions, monitoring and concerns resulting from pest problems. This overlap can be used as a source of knowledge and cooperation to help produce positive outcomes in controlling unwanted pests.

The policy planning and developmental framework of the IPM program is found within the context of the following City plans as outlined below. Following this is a section on the operational, planning and technical tools associated with the IPM program (see *Appendix A*, Page 34 for background information on several of the City plans and the planning and technical tools).

- In the Strategic Plan (2009-11) the City of Red Deer IPM program fits into several of the City‘s goals and objectives.

- The City has in place an Environmental Master Plan (2011) that reflects and supports the objectives of the IPM manual. In the plan, an objective for IPM is to “measure and decrease the amount of use of toxic pest control product on municipally owned land which contributes to air, water and ground contamination. Pest control chemicals pollute several ecological systems, including air, water and soil. Reducing or eliminating the use of toxic pest control products will contribute to a healthier Red Deer. Using natural solutions will benefit community members and restore natural ecosystem functions.”

- The Municipal Development Plan (2008), Section 9.10 states: The City shall enhance its Integrated Pest Management (IPM) program to help reduce the use and reliance on pesticides, fertilizers and other chemicals. This approach shall be encouraged in public and private developments in new city growth areas, helping to create a healthier environment.

- Previously, the Red Deer React Environmental Action Plan (1995) supported the priorities of water supply, air quality, preservation of natural areas and education for environmental issues, all of which provided support to an evolving process in the early to mid part of that decade to the development of a sound and effective IPM program. Several IPM approaches initiated in Parks at that time included the use of microbial pesticides, increased handpicking of insects and hand pulling of weeds, decreased use of chemical pesticides, decreased rough cutting to promote reforestation of weedy areas, biological control trials and so forth.

Operational, Planning and Technical Tools – Ecological Management System (EMS), Geographic Information System (GIS), Integrated Pest Management (IPM), *Parks*GIS and Work Management System:

1. The *Ecological Management System (EMS)* is a database/mapping inventory system. The EMS uses a common set of numbers and end codes to integrate all of the map sites (specific inventory items) of the city and surrounding district’s ecological assets. Map site locations and data associated with each site can then be used for effective planning,

management and operations. Field data sheets or electronic media are used for recording pertinent data related to each map site. Data is entered directly into the appropriate database for easy manipulation and use.

2. A *Geographic Information System (GIS)* allows for citywide and district EMS inventory information to be collected and manipulated in a GIS for use within and between city departments. GIS allows for the visualization, analysis, use and presentation of location related data and geographic information (mapping inventory). GIS can improve the thoroughness and accessibility of data and visual/graphic information for field use, maintenance purposes, management of ecological information and the integration of beneficial technical equipment.
3. *Integrated Pest Management (IPM)* activities are tracked and recorded in the EMS. Data is analyzed and operations are implemented to effectively reduce any unwanted pest activity.
4. *Parks*GIS is currently being developed and refined and is the result of merging the EMS and the City's GIS into a tool to help manage parks programs like IPM that are related to inventory map site locations. *Parks*GIS has two main themes: Parks Ecological Management System (PEMS) and Parks Amenities Management System (PAMS). *Parks*GIS ties all ecological and amenity features together with a tool that allows the user to see how they are interrelated, which provides accurate data for planning and managing projects. The asset data in *Parks*GIS is being used as a platform on which sits the recent 2012 Parks component of the *Hansen Work Management System*. This system allows for the management of IPM related work and service requests. IPM is associated with map site information and assets (see *Appendix B*, Page 38) and is one of numerous parks programs that can be effectively analyzed and managed within the context of *Parks*GIS. An example of several applications of *Parks*GIS will be to incorporate map sites such as individual trees with pest problems, weed or mosquito control sites into prescribed monitoring and treatment routes. This will allow for maps and related data to be printed for field use and for new routes to be generated as they emerge. Currently, numerous informal pest monitoring and control routes are established and used, however, City staff will derive greater benefits once the IPM program is fully merged with *Parks*GIS and the work management system. To facilitate the flow of IPM asset information and data from the field to *Parks*GIS, small handheld electronic devices (PDA's - personal digital assistants) with GPS and GIS capabilities will be employed.

The IPM manual is intended as a planning, technical and operational tool produced in both a paper format and online in the GIS and in other digital formats. Information and data collected will be combined with planning and technical tools like *Parks*GIS to help provide for an effective approach to IPM. In this way, as new pests, control information and photographs become available the various formats will be updatable on an ongoing basis.

A primary trajectory for IPM in the city is to effectively control pests while continuing to devise strategies to reduce the use of pesticides. This is a practical approach for many common and native pests. Some pests however can present vastly greater environmental and economic costs. Known as invasive species (see *Appendix C*, Page 39), this group of pests presents an ever-increasing and insidious threat and an effective IPM program can offer a range of strategies geared towards locating and contributing to their eradication.

2.1.1 IPM Review Process for Pesticide Application Projects and Other Pest Problems

In 2010 the Parks Department updated their approach to pest control by developing an *IPM Review Process for Pesticide Application Projects and Other Pest Problems* as a practical means to assist in IPM pesticide and non-pesticide use operations. The timely nature of this approach allowed for the inclusion of important changes in the Alberta Weed Control Act, the increasing importance of the threat from invasive species and the ongoing desire to reduce the reliance on the use of chemical pesticides. The current IPM manual will reflect these points.

The IPM review process is intended as a formal review and check-list of responsibilities prior to embarking on seasonal pesticide application projects involving an individual pest problem. A pesticide application project is defined as a project or program that requires the use of any type of registered pesticide to control a pest species on a host or other location along any defined or undefined route. In addition the review process is to be used to facilitate decision making related to other pest problems and projects not requiring the use of pesticides, thereby helping to document that the city is carrying out alternative IPM approaches.

Likewise the chart can be used as a *best management practice* to share with staff and if required illustrate to the public or government regulatory bodies that a formal pre-pesticide application review process for projects has taken place; it also allows for verification by way of pesticide application and monitoring records that a project has been successfully concluded at the end of the season. The review process shows that the appropriate checks and balances have been considered by pesticide applicator license holders and that all licensed staff involved in a project will have reviewed and considered the same information prior to pesticide control activities. The review process should help foster dialogue and cooperation and help establish the most effective IPM approach.

The following is a summary of the contents of the IPM Review Process and of the associated daily pesticide application records (see *Appendix D*, Page 40 for details of the review process):

- Project list for the year:
  The project list includes the IPM project number, pest number, project name, route, location and project review staff.
- Review and check-list chart for pesticide application projects and other pest problems:
  The chart is intended as a formal review and check-list of responsibilities prior to embarking on seasonal pesticide application projects involving an individual pest problem. It is also intended to facilitate decision making related to other pest problems not involving the use of pesticides.
- Parks Code of Practice for Pesticide Application Projects:
  The *Parks Code of Practice for Pesticide Application Projects* is to be followed by staff involved in each project.
- Supplemental comments, information and related guidelines:
  The supplemental comments and guidelines are for the appended review chart information.
- Daily Pesticide Application Record – Landscape Services 1.0*
- Daily Pesticide Application Record – Ecological Services 2.0
- Daily Pesticide Application Record – Urban Forestry 3.0
- Pre-monitoring, Post-monitoring or Non-pesticide Control Methods form 4.0**

*See *Section 3.2.1* for an explanation of the *Daily Pesticide Application Record* forms 1.0, 2.0, and 3.0 and of the *Non-pesticide Control Methods* part of Form 4.0
**See *Section 3.1.1* for an explanation of pre and post-monitoring in the *Pre-monitoring, Post-monitoring or Non-pesticide Control Methods* Form 4.0

2.2 City of Red Deer Policy

City of Red Deer employees in the performance of their work are subject to the health and safety policies of the Parks Section. In their yearly orientation all employees will have read and be familiar with and abide by the Parks Section health and safety policies and with safety procedures related to Integrated Pest Management. Refer to the following sections of the Parks Safety Procedure Manual for information related to Integrated Pest Management:

- Health and Safety Policies Index
- Hazard Identification List Index
- Safe Work Procedures Index
- Hazard Assessment Forms
- Staff Orientation
- Equipment Training Procedures
- Emergency Response Plan

At some point there may be a need to update and instill new terminology and principles related to Integrated Pest Management into current city pest bylaws and policies. The IPM manual should be used as a basis for updating and enhancing these bylaws and policies. The following information comprises the current City bylaws that directly or indirectly pertain to the management of pests in Red Deer:

City Bylaws that pertain to the management of pests in Red Deer:

- *Community Standards Bylaw No. 3383/2007 Part 2 – Nuisance, Unsightly Premises, Graffiti*. "Nuisance" for the purpose of this bylaw includes any use of or activity upon any property which is offensive to any person, or has or may have a detrimental impact upon any person or other property in the neighbourhood, and without limiting the generality of the foregoing, includes the following (Note: sections d, f, g, h, k, l, m, n and o of the bylaw that do not directly pertain to Integrated Pest Management have been removed):

(a) the failure to cut grass, weeds, shrubs, trees or other landscaping features incidental to a landscaped area;
(b) the failure to maintain grass, weeds, shrubs, trees or other landscaping features incidental to an approved landscaped area in a commercial, industrial, institutional, government or multifamily development;
(c) the failure to destroy prohibited weeds, control noxious weeds, or prevent the spread or scattering of nuisance weeds (*the new Weed Act (2010) designates weeds as either *prohibited noxious* or *noxious*; in the IPM manual, weeds not in the Weed Act are designated as *others*);
(e) the accumulation of any material that creates unpleasant odours, any material that attracts pests or any animal remains, parts of animal remains or animal feces;
(i) the use of any pesticide or herbicide which has significant detrimental or environmental effects on surrounding areas;
(j) the failure to control or eliminate insect pests harmful to the growth and development of trees and shrubs or any vegetable or plant life.
*This bracketed information is not part of the Community Standards Bylaw.

- *Weed Control Bylaw 2584/78*.

A Bylaw respecting the control of noxious weeds pursuant to the Weed Control Act being Chapter 96 of the Statutes of Alberta 1972, as amended, hereinafter called "The Weed Control Act". NOW THEREFORE THE COUNCIL OF THE CITY OF RED DEER ENACTS AS FOLLOWS: 4

1 This Bylaw may be cited as the "Weed Control Bylaw".
2 The occupant or owner of land shall for the purposes of this Bylaw and the Weed Control Act be deemed to be the occupant of all that portion of any boulevard which abuts or flanks such land, and of all that portion of any highway which adjoins his land or such boulevard, and which lies between his land and the centre line of such highway.

2.3 Provincial and Federal Pesticide Legislation

City of Red Deer employees in the performance of their work are subject to the regulations of various government agencies including provincial and federal.

Provincial Legislation

The sales, use, application, handling, storage, transport and disposal of pesticides in Alberta are controlled by the Environmental Protection and Enhancement Act (EPEA).

- The EPEA is administered by the provincial government department Alberta Environment. There are two regulations and a Code of Practice that specifically addresses all aspects and use of pesticides. They are as follows:
  - Pesticide (Ministerial) Regulation[1*]
  - Pesticide Sales, Handling, Use, and Application Regulation[2]
  - Environmental Code of Practice for Pesticides[3]
- The Weed Control Act[4] and Agricultural Pests Act[5], which are legislated guidelines, are used by municipalities to manage and maintain their land inventories in accordance with legal guidelines. In 2010 a new Alberta Weed Act came into enforcement. The act eliminates the designations *restricted, noxious* and *nuisance* weeds and replaces them with *prohibited noxious* and *noxious* weeds.
- The City of Red Deer makes all attempts to ensure its departments comply with legislation. This is accomplished by obtaining all the correct authorizations including a Pesticide Service Registration (see *Appendix E*, Page 50), Special Use Approval and pertinent Pesticide Applicator Certificates for pest control activities.
- The Parks section also provides yearly an orientation for all staff that will be handling pesticides. The provincial Environmental Code of Practice for Pesticides is reviewed and a Training Checklist for Pesticide Applicator Assistants[6] is then signed and dated by staff. It is the responsibility of the pesticide license holder to provide oversight and guidance to field staff and crews applying and storing pesticides[7].
- A yearly pesticide-use notification ad[8] is placed by the City of Red Deer in the local newspaper to provide the public with information regarding the application of pesticides in public open space areas.

Federal Legislation

All pesticides used in Canada must be registered under the Pest Control Products Act (PCP). The PCP Act is administered by the Pest Management Regulatory Agency (PMRA), Health Canada. The intent of the legislation is to ensure:

- That no person shall manufacture, store, display, distribute or use a pest control product (pesticide) under unsafe conditions
- That no person shall package, label or advertise any pest control product in a manner that is false, misleading or deceptive or is likely to create a false impression about the pest control product
- That no person shall sell in or import into Canada a pest control product unless it is registered
- The requirements for pesticides registered in Canada are rigorous

*Note: Superscript numbered documents 1-8 do not have page numbers and their title and content pages are referenced and located at the back of the manual as supplemental material after Page 220

3.0 INTEGRATED PEST MANAGEMENT PROCEDURES

3.1 Monitoring Procedures

3.1.1 Description and Process

3.1.2 Equipment and Methods

3.2 Control Procedures

3.2.1 Description and Process

3.2.2 Equipment and Methods

3.3 Reporting Procedures

3.4 Education and Awareness

"A weed is a plant that has mastered every survival skill except for learning how to grow in rows" Doug Larson

3.0 INTEGRATED PEST MANAGEMENT PROCEDURES

3.1 Monitoring Procedures

Monitoring procedures are critical to the success of an Integrated Pest Management program. Information in Section 3.1.1 includes a description of pest monitoring and the process involved in acquiring information about pests. This in turn is used to make the most informed decision about the type of control methods required and those available using an integrated pest management approach.

Section 3.1.2 describes the equipment and methods available for carrying out successful monitoring procedures in an IPM program.

3.1.1 Description and Process

Pest monitoring is a systematic approach where the identified pest population and damages are estimated and recorded. Tolerable levels are considered to indicate whether the pest has reached its upper limit of damage, known as its threshold level. Pest monitoring consists of two primary methods, *pre and post-monitoring* and *spot-checking*.

The first primary method of pest monitoring is a more systematic approach and involves the following: Prior to the start of a pesticide application project or a non-pesticide control project, sampling of pest population levels are recorded using an established pre-monitoring form (see *Appendix D*; Figure 8*; Page 49) to help assess the need and level of treatment required. After a project, sampling is carried out and results are recorded in a follow-up post-monitoring form** to assess the effectiveness of treatments.

The second method of monitoring involves spot-checking of known and new pest locations and populations. Spot checking is a more random and less formal approach to monitoring and is intended to provide a snap shot of one or more pests, not necessarily along any particular monitoring route. With the spot-checking method, the pest damage observations are also recorded in the monitoring forms noted above.

In all monitoring procedures the observer records date, time, crew involved, route, weather information, pest identification, pest host and location, pest impact, percentage of infestation and damage, season and any personal protective equipment used. In addition any concerns and public notification required that may be related to potential control methods used are also part of pre and post-monitoring procedures. The above help to establish the type of control methods and equipment required and any follow-up results based on the controls used.

Public perception and tolerance levels, expected pest damage, and the consequences if left untreated are reasons for monitoring a pest. The information collected from the monitoring process is the tool used in order to determine, if any, the range of potential methods of control available for that particular pest based on an integrated pest management approach.

*Note: the Non-pesticide Control Methods part of Form 4.0 does not pertain to Section 3.1.1 of the IPM manual

**Currently forms are in a paper format for field use; once available, the intent is to use handheld electronic input devices for field data collection

3.1.2 Equipment and Methods

The following describes the equipment and methods required to successfully carry out monitoring procedures in an IPM program. In conjunction with equipment and methods, proper safety precautions will be used in accordance with the Parks Section Health and Safety Manual Safe Work Procedures. At the monitoring location visually check for pedestrians, obstructions, and traffic.

Binoculars:
- Device used to identify pests from a distance and the extent of a possible infestation or infection.

Bucket truck:
- Associated form to be filled out by the field worker with all pertinent information.
- Used when investigating concerns in the canopy of trees too large for the safe use of a ladder.
- Must be operated by qualified trained operator.

Camera:
- Photos are taken to record unusual specimens and to record changes in situations from year to year.

Collecting equipment:
- Jars, nets, bags, containers, and dippers used to collect and transport pests.

Garbage bags:
- Must be used when transporting samples of pests that may be infectious or cause further infestations.
- Must be disposed of properly in a dumpster or at the landfill.

GPS unit:
- Hand held global positioning unit used to record locations and data.

PDA unit:
- Hand held GIS/GPS unit used to locate sites and record information.

Hand lens:
- A magnifying lens that assists in identifying pests and diseases.

Ladder:
- Is used when collecting samples or removing small infestations.

Laptop computers:
- Records IPM route information.
- Records documentation regarding pest finds and information relating to each location visited.

Measuring device:
- Tape measures (diameter breast height (DBH) tape) and rulers are used determining lengths and sizes of damaged areas, or insect infestation clusters.

Notebook:
- Used for recording location, type of pest and other useful information.

Pruning equipment:
- Loppers, pole lopper/saw, secateurs and pruning saws may be needed for collecting samples when monitoring.
- When removing diseased material equipment must be sterilized after every cut.

Recording methods (Pre and post-monitoring form):

- Pest population levels are recorded using an established pre-monitoring form to help assess the need and level of treatment required. After a project, sampling is carried out and results are recorded in a post-monitoring form to record the effectiveness of treatments.

Traps (light, pheromone lure, sticky):

- Traps are made in a variety of designs for trapping and collecting pests.

3.2 Control Procedures

Control procedures are a second critical phase to the success of an Integrated Pest Management program. Information in Section 3.2.1 includes a description of pest control methods and the process involved in evaluating and choosing the appropriate type of control method.

Section 3.2.2 describes the equipment and methods available for carrying out successful control procedures in an IPM program.

3.2.1 Description and Process

Controlling a pest requires a systematic approach that is based on the pest population and damages identified through the monitoring process. If a pest has reached its upper limit of damage, known as its threshold level, then a decision must be made using an integrated management approach as to the most appropriate type of control available.

The choice of pest controls used is based on effectiveness, environmental impact, site characteristics, worker and public health and safety, economics and other considerations. Pests are managed by a combination of control methods including:

- Cultural
- Physical/mechanical
- Biological
- Microbial/Chemical Pesticides

The various control methods are described below:

Cultural methods are preventative procedures. Sound plant health care practices that focus on the prevention of the pest by maintaining a healthy host through proper planting, pruning, mulching, use of fertilizers and sanitation practices.

Physical/mechanical methods consist of hand picking, hand pulling, mowing, pruning, raking, trapping, washing, rough cut mowing, use of traps (light, pheromone and sticky), truck mounted high pressure water tank sprayer, wire used as a barrier and weed eaters.

Biological methods involve the introduction and use of living organisms such as predatory or parasitic insects which interact with the pest in various ways and leads to a reduction in pest numbers.

Microbial/Chemical Pesticide methods consist of using a registered pesticide which can be applied by aerosol, bait feeding, foliar spray, granular application or by using a soil drench.

Prior to any control activity, the pest monitoring procedure is in place to help assess the need and level of control treatment required. From this the process then involves evaluating and choosing the appropriate type of control method. This is done with the help of the *Integrated Pest Management Review Process For Pesticide Application Projects and Other Pest Problems*. It allows for each pest problem to be put through a filtering process that offers a number of pest control methods.

An initial consideration should always be to look at the non-pesticide methods available. This may include a combination of cultural, physical/mechanical and biological/microbial methods. If none of these options suffice, then consider whether any of them may work in conjunction with limited use of pesticides. If pesticide use is the only remaining option, consider testing and using a reduced application rate on the target pest. Under all circumstances, best management practice must be taken into consideration.

Once control activities commence, pesticide applications shall only be applied onto a confirmed, identifiable pest population located on the host or at the target location. All information related to pesticide applications will be accurately recorded on a Parks Daily Pesticide Application Record (see *Appendix D*; Figure 5-7; Page 46-48). The following forms 1.0-4.0* are available for use by each section in Parks:

- Daily Pesticide Application Record – Landscape Services 1.0
- Daily Pesticide Application Record – Ecological Services 2.0
- Daily Pesticide Application Record – Urban Forestry 3.0

All information related to non-pesticide control projects (see *Appendix D*; Figure 8**; Page 49) will be accurately recorded on the following form:

- Pre-monitoring, Post-monitoring or Non-pesticide Control Methods 4.0

*Note: forms 1.0-4.0 are currently established for use however these forms can be modified accordingly by the various Parks sections to incorporate changes in operations and/or procedures

**Note: the Pre-monitoring and Post-monitoring part of Form 4.0 does not pertain to Section 3.2.1 of the IPM manual

3.2.2 Equipment and Methods

The following describes the equipment and methods required to successfully carry out control procedures in an IPM program. In conjunction with equipment and methods, proper safety precautions will be used in accordance with the Parks Section Health and Safety Manual Safe Work Procedures. All machinery must be operated by qualified trained personnel. At the control location, visually check for pedestrians, obstructions, traffic and ensure all appropriate signage is in place.

Aerosol Method:

- A control method using an aerosol insecticide to control wasp nests.
- Control is done in summer when insects are active.
- Used only in areas monitored first to determine if they pose a threat to humans.
- Aim spray directly at the entrance of the nest. Put contaminated debris in labeled garbage bags and discard in a designated hazardous waste container at the civic yards. Return all partially used and unused canisters to the foreman or supervisor for proper storage.

Bait/Feeding Methods:

- Procedure to control primarily a rodent pest using bait/feed; primarily in early spring.
- Used to control burrowing rodents, for example Richardson ground squirrel, because of health and safety issues. Only over-populated areas are monitored and treated if requested.
- Bait/feed is placed into the living quarters of the pest. Depending on weather conditions, sometimes a second feeding is needed. All bait/feed material is to be stored in a pesticide storage room when not in use

Biological Methods:

- The use of natural enemies to manage non-native organisms that have become pests, for example, beetles to control leafy spurge.
- Released on target pests during the growing season.
- It is a site-specific method of control that is used as an alternative to chemicals.

Foliar Spray Methods:

Backpack power applicator

- A small, motorized gas powered spray unit.
- Pest population, environmental conditions and life cycle of the pest determine timing of application.
- The backpack power applicator is used for insect control.
- It is carried on the back of the body and shoots control agents out of a hose.

Backpack sprayer

- A backpack sprayer is a pressurized spray unit with a plastic container on a backpack frame; used during the growing season.
- Used by an individual operator to apply pesticides, such as herbicides for weeds.
- Only designated areas will be sprayed.

NOTE: All empty containers are tripled-rinsed and properly stored when not in use. All equipment and leftover material must be returned to its proper storage area.

Roller sprayer

- A sprayer implement attached to a tractor used to apply herbicides.
- Used during the growing season on regular turf and naturalized areas for weeds.
- It covers large areas and reduces spray drift.
- Only pre-designated areas by the foreman will be roller sprayed. All operators must be operated by a qualified trained operator.

NOTE: When encountered, citizens will be advised and asked to avoid travel on recently sprayed turf.

Truck mounted high-pressure tank sprayer

- High-pressure tank mounted on the back of a truck used for pesticide application, usually for insect control.
- Done in early morning hours when public activity is low.
- Used during the feeding stage of the targeted pest.

Granular Application Methods:

Backpack Power Applicator

- A small, motorized gas powered spray unit.
- Pest population, environmental conditions and life cycle of the pest determine timing of application.
- It is carried on the back of the body and shoots control agents out of a hose.

Hand-held applicator

- A small spreader held in the applicator's hand used to distribute microbial control products.
- Control agents are distributed from the bottom of the spreader when the crank is turned.
- Used when treating areas for mosquito control.

Handpicking/Pulling Methods:

Egg band removal

- Hand removal of insect pest eggs.
- Done in fall, winter, or early spring before hatching.
- An environmentally safe and simple method of control.
- Egg masses or bands are scraped off branches to lessen infestations.

Larval control on plants

- Hand removal of insect pest larvae.
- Used when an insect infestation is still at a stage when they are in close groups e.g. forest tent caterpillar.
- Used when removing the insects on an individual basis can lessen the damage.
- Larvae are hand picked off the host and destroyed.

Weeds

- The physical removal of weeds.
- Done when weeds are too advanced for spraying or are located in sensitive areas such as wetlands.
- Hand pulling of weeds is done to conform to the Provincial Weed Act, to eliminate competition with desired plants and to reduce the weed seed bank.
- Weeds are hand pulled or cut down using hand shears and disposed of in the dumpster at the civic yards or taken to the landfill.

Mowing Methods:

Rough-cut mower

- A flail or gyro mower used in areas that a riding mower is not able to access.
- Done throughout the growing season.
- Reasons for using a rough-cut mower include aesthetics, weed control and rough areas that are not accessible with other types of equipment.
- Areas mowed are recorded and kept on file

Weed eater

- Gas powered, hand-held used for trimming grass/weeds.
- Used at any time during the growing season.
- For weed control in areas where obstacles make it difficult for mower access.
  NOTE: If weeds have matured and gone to seed, pick up and dispose of clippings in the dumpster or landfill.

Pesticide and Water-Use Signage Methods:

Chemical pesticide use signage

- To post signage in specific areas warning the public and staff of pesticide use.

Water-use only signage

- To post signage in specific areas informing the public and staff of water-use only.

Physical Methods:

Mulching

- Mulching is the placement of deciduous or mixed wood chips in shrub beds and around the base of trees; mulch is occasionally applied in the fall.
- It is used as a form of weed control, moisture retention, and prevents soil erosion.

NOTE: Avoid applying chips close to the crown of shrubs or the trunks of trees as this may encourage decay organisms and rot to establish.

Wire

- The use of poultry wire around the base of deciduous trees prevents beavers from removing valuable vegetation and discourages them from remaining in the area.
- Each wired tree is inventoried and records are kept when wire is changed.

Pruning Methods:

Larval control

- Pruning cuts are used to remove pest larvae in situations where the insects are found inside the plant or when it is not suitable for handpicking.
- The affected part is removed with a pruning cut. The portion of the branch or plant left must be large enough to support growth and done with proper pruning techniques. The cut portion must be bagged and disposed of correctly.

Pathogen control

- Pruning cuts are used to remove plant parts infected with pathogens.
- Using sharp pruning tools, parts of the plant affected by a pathogen, e.g. black knot, are removed from the plant to prevent further infection.
- The cut is made well below the place of infection in accordance with proper pruning techniques. The tools are sterilized after each cut if dealing with a pathogen. The pruned off branches are disposed of by either burning or burying.

Preventative dead wood

- Dead wood is removed from plant material to ensure secondary infections do not become established e.g. Dutch elm disease.
- Dead wood is also removed so that the plant can properly heal a wound in order to prevent decay in the main stem.

Raking Methods:

- Raking is a control method used to prevent the larvae from pupating or for disrupting pupae.
- This method is done later in the season.

Recording Methods:

Parks Daily Pesticide Application Record & Non-pesticide Control Methods form

- All information related to pesticide applications will be accurately recorded on a *Parks Daily Pesticide Application Record Form*1.0, 2.0 or 3.0.
- All information related to non-pesticide control projects will be accurately recorded on the 'non-pesticide control methods' part of the *Pre-monitoring, Post-monitoring or Non-pesticide Control Methods Form* 4.0

Soil Drench Methods:

Chemical

- A method of punching holes or flipping up the sod in the ground along the drip line of a tree followed by an application of an insecticide.
- Preferably done in the early morning hours in high-density areas.

- The systemic insecticide is taken in through the roots and spreads throughout the plant. As the pest feeds on the foliage of the plant, it ingests the insecticide and mortality occurs.

Other

- Holes are poked into affected area with a garden fork 25cm deep and 15cm apart.
- Water and water-carrier is slowly applied to the area for an extended period e.g. for fairy ring

Trapping Methods:

Hiring of outside agencies

- Is used in situations where specialized services are required for pest control, for example beaver trapping.
- Detailed records are to be kept.

Light Traps

- Used during the night to attract insects by a light source on a trapping device e.g. mosquitoes.

Live Traps

- A humane method used to trap and relocate a live pest e.g. porcupines.
- Used during summer months when pests are active.

Pheromone traps

- Scents that are attractants for certain species of insects are placed on a sticky substance to lure insects to the trap e.g. elm bark beetles.

Sticky traps

- Mostly used while monitoring but also can be an effective method of control.
- Are sheets of cardboard with a sticky substance painted on them to trap insects.

Washing Method:

Truck mounted tank sprayer and water truck

- Insects are dislodged from the plant by a steady stream of high-pressure water and are prevented from continued feeding.

NOTE: Insecticide soap may be added to the water for increased control. Several treatments may be required within a short time period to ensure control.

3.3 Reporting Procedures

An important part of IPM is reporting accurate information in a systematic, orderly fashion. As noted in sections 3.1.1 and 3.2.1, pre-monitoring and post-monitoring forms, daily pesticide application records, and non-pesticide control forms are all used for recording decisive information related to the IPM process. Notebooks are also available for recording observations related to monitoring and control procedures. Information will be incorporated in the work management system for subsequent use. Electronic recording methods will eventually be employed for this purpose.

All of this recorded information constitutes the permanent record of pest problems and methods of control employed in the City of Red Deer. It also provides staff in the Parks section with a baseline of information that can be used as a tool for predicting where new pests will emerge and for tracking the re-establishment of any pests. The collection of the information is also necessary to satisfy some of the following reporting procedures:

- To document and report to government agencies when required the quantity and types of pesticides used and to record increases or decreases in pesticide use over time

- To document the use of alternative control methods and to show the public that Red Deer is making efforts to find alternatives where feasible
- To provide data that can be used for staffing and budgeting purposes.

Each Parks section should refine their information reporting methods in relation to the various pest control operations they carry out. Each section should also be vigilant about the use of the standardized forms to ensure the correct regulatory information is being recorded. For staff encountering pests listed in the manual and who work directly with an individual staff member who holds a pesticide applicator license (certificate), the pest information should be reported to the license holder for further action. For staff not associated with a license holder, the names of all license holders are posted on the bulletin board in the staff lunch room. Pest information should then be reported to one of those listed for subsequent action.

3.4 Education and Awareness

Education and awareness plays an important role in helping to ensure Parks staff, other city operations and the general public is informed about Integrated Pest Management. It is recognized that involvement with the community is vital to a successful IPM program. Providing key information of the benefits of an IPM program satisfies legislative requirements, provides staff with the resources they require to successfully complete pest management operations, reduces public concerns, ensures satisfaction with the management of pests on public land, encourages preparation for potential future pest problems and encourages public input. The Parks section employs various methods to provide the community and staff with IPM program education and awareness including:

- Placing yearly advertisements in the local newspaper regarding pesticide use notification and notice of application for pesticide special use approvals when required
- The use of on-site signage to inform the public of pesticide applications taking place in neighborhood areas
- The use of on-site signage to inform the public that non-pesticide applications of strictly water are being used to help control pests – the intent in this case is to alleviate any perceived concerns by the public about pesticide use
- City of Red Deer website and Tree Pest Alert (see *Appendix F*, Page 52)
- Providing information to local radio and television stations for broadcast
- Submitting various articles about mosquito control, weeds, assorted insect pests, Dutch elm disease and so forth in the Community Services Guide and the Community Services Activity and Program Guide
- Information inserts with City of Red Deer utility bills
- Periodic displays set up at different public and private venues to inform the public on IPM related issues
- Information packages distributed to individual homeowners on an as-need basis
- Public involvement with local schools for Dutch Elm Disease Awareness Week
- The use of signs along roadways indicating Dutch Elm Disease awareness
- Besides carrying out operational weed and pest duties, part of the roles of the Weed Inspector and Pest Inspector within the context of the IPM review process for pesticide application projects is to interact with parks staff and the public to provide education and awareness about IPM and community participation (see *Appendix G*, Page 54)

Ongoing and future education and awareness strategies include increased communication between other departments, developers, and contractors working with vegetation to encourage a citywide approach to IPM. This may include reduction of monoculture plantings and increased checks for pests on tree stock. IPM strategies are also helping to reduce the reliance on chemical pesticide controls. In this vein, the City of Red Deer encourages its staff and residents as well through education and awareness to be selective and moderate in their use of chemical pest control methods and to consider applying alternative IPM approaches (see *Appendix H*, Page 56) where feasible.

Another important aspect of education and awareness considers the threat and potential economic and environmental impacts of invasive species. This requires vigilance on behalf of a municipality and its citizens. Invasive species are present in the urban areas of Red Deer and levels of tolerance for these species vary depending on the nature of the incursion and the practicality of a response. Within this group, a number of significant threats hover on the horizon including Dutch elm disease (DED), emerald ash borer, and purple loosestrife to name a few that have the potential to cause substantial economic and environmental costs.

Even though impacted by invasive species, Alberta and its municipalities, including Red Deer, have so far been spared significant incursion from some of the more destructive threats. Various groups and government organizations continue to monitor invasive species and to offer education and awareness about this issue. In the City of Red Deer's IPM operation there is an ongoing awareness about invasive species and the potential threats they pose. The Parks workforce has experience in monitoring and other technical aspects related to invasive species, but many of the more potentially damaging species, particularly insects, have yet to establish in this area.

In preparation for this eventuality, the city should continue to develop, prepare and enhance its response to any potential incursion. This type of approach would offer not only a planning and operational response to the threat of invasive species, but also an education and awareness component for municipal staff preparedness and the general public. This approach would also include an assessment of the spectrum of invasive species that pose the greatest risk, a thorough and up-to-date inventory of all public and privately owned target species and locations, and an adequate and timely response to any threat. Preparedness may not completely eliminate the threat of invasive species, but it will help to reduce the potential economic and environmental impacts and losses.

Social media sites play a role in education and awareness and this applies equally to pest control. For example, the Association of Alberta Agricultural Fieldmen (AAAF) have produced sites on Facebook and Twitter that display a variety of quality photographs and information updates linked to prohibited noxious and noxious weeds that can be used to supplement photographs and information in the IPM manual. These media also provide a quick and accessible means for the public in Red Deer to actively engage in reporting observations, pest sites and problems and to provide feedback and describe damage requiring mitigable action related to pests.

4.0 GLOSSARY

Action Threshold Level - Is the point at which treatment should take place in order to prevent the pest population from reaching the injury threshold. The action threshold depends on the type of treatment and on the life cycle and reproductive rate of the pest.

Agricultural Pests Act - The Act and associated Pest and Nuisance Control Regulation are in place to manage, control and eradicate various pests and nuisances in the Province of Alberta.

Beneficial Insect Species - Beneficial insects are native to an area and feed on a variety of insect and weed pests.

Best Management Practice - Practices or techniques recognized to be the most effective and practical means for meeting goals, while minimizing adverse environmental and other effects.

Biodiversity - Consists of genetic (sum of genetic information contained in individuals and populations), species (number of biological organisms and their relative abundance) and ecosystem (habitat variety, biotic communities, landscape and ecological processes) diversity.

Biological Control - The use of natural agents, such as birds, insects, mammals or fungi, to control pests.

Chemical/microbial Pesticides – Selective and non-selective pesticides to be used according to label instructions to minimize harmful effects on non-target species and to reduce environmental hazards.

Control Products - Any product, device, organism, substance or thing that is manufactured, represented, sold or used as a means for directly or indirectly controlling, preventing, destroying, mitigating, attracting, or repelling any pest.

Cultural Control - Use of a combination of methods some of which include eliminating materials or places where pests live and reproduce, using trap strips to draw pest's away from their host, and reducing the incidence of plant monocultures.

Daily Pesticide Application Record - Is in a standardized format for recording all on-site pesticide application activities e.g. site location; control product; application method/time.

Ecology - The study of relationships between living things and with environments.

Ecological Management System (EMS) - Is a database/mapping inventory system (also see *Parks*GIS).

Ecosystem - A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

Environment Protection and Enhancement Act (EPEA) - The purpose of the Act is to support and promote the protection, enhancement and wise use of the environment. The Act also

recognizes the need for protection of the environment is essential to the integrity of ecosystems and human health and to the well being of society. The Act also provides legal framework for various environmental issues including the use of pesticides within Alberta (AR 126/93 and 127/93).

Fungicide - A chemical substance used to control or prevent the development of fungi.

Geographic Information System (GIS) - GIS allows for the visualization, analysis, use and presentation of location related data (database inventory) and geographic information (mapping inventory).

Herbicide - A chemical substance or cultured biological organism used to kill or suppress the growth of plants, also defined as chemical compounds used to kill or inhibit undesirable plant growth.

Host Species - A species that acts as a host for a pest e.g. a spruce tree is a host for the spruce budworm, an insect pest.

Infestation - A pest population that is large enough to overwhelm a host and potentially cause excessive damage.

Injury Threshold Level - When a pest population reaches numbers such that it causes unacceptable injury or damage sufficient to justify treatment. A few individuals of a pest population can usually be tolerated.

Insecticide - A chemical substance used to control insects.

Integrated Pest Management (IPM) - Alberta Environment defines IPM as the use of all suitable pest control methods to keep a pest population below the economic injury level. Methods include cultural practices, use of biological, physical, and genetic control agents, and the selective use of pesticides.

Integrated Pest Management (IPM) Review Process - Intended as a formal review and check-list of responsibilities prior to embarking on seasonal pesticide application projects involving an individual pest problem. Also, the review process is to be used to facilitate decision making related to other pest problems and projects not requiring the use of pesticides.

Invasive Alien Species - Introduced deliberately or unintentionally outside of their natural habitats; will usually displace beneficial native species.

Invasive Species - A plant or organism that simply ‘invades’ and takes over at the exclusion of other species in any one area.

Inventory - A survey, compilation and/or incorporation into a database or other information system e.g. GIS of selected natural resources not necessary including an assessment.

Larvae - Plural form for the name of an immature insect that emerges after the larval stage. The larva (singular), often in a recognizable caterpillar-like form, feeds until it pupates (undergoes metamorphoses) and becomes an adult.

Monitoring - Involves the regular surveying of sites and/or features to understand and identify the location and extent of potential pest management problems.

Monoculture - A uniform population or planting of vegetation.

Native - Species that have not been introduced by people or their direct activities.

Noxious Weed - Plants designated in accordance with the Weed Control Act regulations. Weeds in this category are to be controlled to prevent their spread.

PAMS (Parks Amenities Management System) - A system that uses a common set of numbers and end codes to integrate the amenity map sites of the city. Map site locations and data associated with each site can then be used for effective planning, management and operations.

*Parks*GIS - Is the result of merging the PAMS and PEMS (also see PAMS and PEMS) inventories and City GIS into one tool to help manage parks programs that relate to inventory map site locations. The tool is intended to help staff locate park assets, record and manage information related to those assets and plan operational and maintenance routes.

Pathogen - A bacterium, virus or other microorganism that can cause disease.

PEMS (Parks Ecological Management System) - A system that uses a common set of numbers and end codes to integrate the ecological based map sites of the city and surrounding district. Map site locations and data associated with each site can then be used for effective planning, management and operations.

Pest - Any injurious, noxious or troublesome insect, rodent, fungus, bacterial organism, weed or other plant and animal whereby the situation or size of its population adversely interferes with aesthetic, health, environmental, functional, or economic factors.

Pest Control Product Act - A Federal Act administered by Health Canada. The Act and regulations cover the following areas: registration, labeling, classification, import/export control, storage, packaging, advertising, display, distribution, and use. All pesticides used in Canada must be registered under the Pest Control Products Act.

Pesticide - A pesticide is a general name for substances used to control pests such as insects, rodents, fungal diseases and weeds. The term includes herbicides, insecticides, fungicides, rodenticides, microbial pesticides, and other registered products.

Pesticide Application Project - A project or program that requires the use of any type of registered pesticide to control a pest species on a host or other location.

Pesticide Applicator - An individual who has obtained a pesticide applicator license (certificate) and can apply pesticides under the authority of a pesticide service registration.

Pesticide Applicator Assistant (Non-certified) - An assistant must be trained by the supervising certified pesticide applicator. No formal training or examination is required.

Pesticide Applicator License (Certificate) - Is issued upon completion of the provincial certification exam and is valid for up to five years.

Pesticide Service Registration - A pesticide service registration falls under the Environmental Protection and Enhancement Act and is required by anyone applying pesticide services.

Pheromone - A substance given off by one individual that causes a specific reaction in other individuals of the same species e.g. alarm substances.

Physical/mechanical Control - Methods that may include mowing, pruning, raking, trapping, high pressure washing, traps, wire barriers, weed eaters, and hand picking and pulling.

Plant Health Care - An integrated approach to caring for trees; includes preventative monitoring, decision making, maintenance, treatments and care of trees.

Pre-monitoring, Post-monitoring or Non-pesticide Control Methods Form - Used to record pest population sampling information before and after pesticide and non-pesticide control activity.

Prohibited Noxious - Plants designated in accordance with the Weed Control Act regulations. Weeds in this category are to be eradicated to prevent their spread.

Rodenticide - A chemical substance used to control or prevent the development of rodents.

Selective Pesticide - Any pesticide which will kill some organisms but not others.

Special Use Approval - An approval issued under the Environment Protection and Enhancement Act (EPEA); it authorizes the use of pesticides in or within 30 meters of an open body of water.

Systemic - Something that is spread throughout and system-wide, effecting a body or object.

Target Pest - Pests that a pesticide is specifically designed to control. Anything else affected by the pesticide is a non-target organism.

Threshold Level - Upper limit of pest tolerance/injury; beyond which requires control action.

Tolerable Level - A point at which a pest infestation is still considered acceptable.

Weed Control Act - This Act aims to regulate noxious weeds, prohibited noxious weeds, and weed seeds through various control measures, such as inspection and enforcement.

Work Management System (Hansen) - A system designed to track requests, costs and activities associated with operational work management.

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6.0 IPM PROGRAM MANUAL DEVELOPMENT AND ACKNOWLEDGEMENTS

The Integrated Pest Management Manual (2012) has evolved through a series of steps over the last number of years prior to its current format. Part of this evolution has resulted from various development steps in the IPM program and associated manuals (see *Summary of Development of the IPM Program, Associated Manuals and 2012 Manual* below*)*. Parks staff contributions make up the other critical part of the ongoing development of the IPM program and 2012 manual (see *Staff Acknowledgements* below). Pest control in the City of Red Deer would be less cohesive, less innovative and less effective without this level of staff knowledge and involvement.

With the completion of this manual, it is believed that a comprehensive picture of IPM is now available for Parks staff to continue with IPM efforts and to move them forward accordingly. This manual is designed to be updated and refined by staff as additional pests emerge on the scene, new control innovations are incorporated, technical information becomes available and new policy and legislated regulations come into play.

At all times leading up to the final development of this manual, the different sections of City of Red Deer Parks have been implementing, practicing and refining integrated pest management methods. Over time several IPM manuals have been completed and updated to provide direction for pest management. The current 2012 IPM Manual has been developed to provide a thorough source of information on pest management, along with an up-to-date list of pests and their corresponding management procedures.

Following is a brief description of the *Summary of Development of the IPM Program, Associated Manuals and the 2012 Manual. A*cknowledgments in this section, generalized to Parks staff, refer to both previous* and current staff and management, all of whom have contributed over the years in developing the IPM program and manual.

Summary of Development of the IPM Program, Associated Manuals and the 2012 Manual

Pre-2006 Draft IPM Manual steps:

- Ongoing development occurred in the decade previous to 2006. This largely involved refining IPM monitoring methods and the shifting of emphasis away from the use of pesticide control methods to that of trying to establish alternative controls where feasible. Valuable information was also derived from the concurrent Weed and Pest operation during that timeframe. All pertinent information was assimilated and documented in various Parks reports and basic operational manuals. Information summarizing the program up to that point was compiled in the comprehensive *Integrated Pest Management (IPM) Program Manual (2002 – Draft).*
- Reformatting of the 2002 Draft Manual (text only) provided the detailed technical information that was used by Parks staff as a template for the text of the interim *City of Red Deer Integrated Pest Management (IPM) Manual – 2006 Draft*. The initial compilation of the pre-2006 Draft Manual utilized a City environmental priorities incentive grant in 2004-05.
- While the draft was being reinterpreted and compiled by Parks staff, several seasons (2005-2006) were required to gather the appropriate photographs of target species for incorporation in the 2006 Draft Manual.

Post-2006 Draft IPM Manual and development of the 2012 IPM Manual:

- The 2006 manual provided guidance over the last few years as Parks staff has further refined monitoring and control techniques, continued an ongoing trend of pesticide reduction and increased use of non-pesticide control methods.
- Sites related to IPM monitoring and control activities have been compiled and incorporated in the City GIS (2006-2007).
- More recently (2010), substantial changes related to pest control have occurred. These changes have been included in the 2012 IPM Manual.
- The main changes reflect the new Alberta Weed Control Act designations, the inclusion of the Parks *IPM Review Process for Pesticide Application Projects and Other Pest Problems*, inclusion of new information on invasive species, additional operational changes that reflect the ongoing adoption of the use of non-pesticide control efforts and the addition of a significant number of new pest profiles and photographs (particularly weeds).
- A significant rewriting of the 2006 IPM Manual has been required to reflect these changes. As a result, the 2012 IPM Manual incorporates the most up-to-date information and operational procedures, will be integrated online in *Parks*GIS and in the work management system, will be available to staff and the public, and offers a platform for the addition of new pest control information as it evolves.

Staff Acknowledgements

As noted the IPM program, culminating with the 2012 IPM Manual, has been based on the collective efforts of numerous current City of Red Deer Parks staff**. Overall the program has been successful at identifying, monitoring and suppressing undue pest activity. Recognition for this is to be extended to all planning and operational staff and field crews who participate in IPM activities throughout the season in a safe and efficient manner. In addition, a number of current Parks staff members are listed below and are gratefully acknowledged for contributing either directly or indirectly to the development of the following sections of the 2012 IPM Manual:

- *IPM Review Process for Pesticide Application Projects:* Doug Balogh[1], Paul Belliveau[1], Doug Gillespie[2], Jill Harrison[3], Jim Long[3], David Matthews[4], Trevor Poth[5], Celeste Sawyer[6]
- *IPM Review Process for Pesticide Application Projects; and Detailed Pest Profile Reviews*: Judy Adamson[7] (also guidance on weed photographs), Ashley Eistetter[8], Elaine Johnson[9], Margaret Stevenson[7]
- *IPM Review Process for Pesticide Application Projects; Detailed Pest Profile Reviews; 2012 IPM Manual Compilation; and Photographs (unless otherwise indicated in the individual pest profile)*: Grant Moir[10]
- *Detailed Pest Profile Reviews*: Jennifer Gabrielson[3], Susan Katzell[11] (also Page 159 photographs), Ken Lehman[12] (also review of Appendix C Page 39 and Appendix H Page 56)
- Indirect discussion with Parks Amenities staff
- City of Red Deer Mail and Printing Services staff
- See Page 59, Note 1 and 2 for information associated with non-staff related acknowledgements

Apologies are extended to any staff members that have been inadvertently missed.

*Note: Several Parks Staff of note who contributed to earlier versions of the IPM program and draft manuals but are no longer employed by the City of Red Deer in the following positions include the former Urban Forester (L. Feddes) who helped compile information for the pre-2006 Draft IPM Manual, Environmental Initiatives Coordinator (C. Dixon) who compiled and wrote portions of the initial pre-2006 Draft IPM Manual, sections of which are retained in the current manual, Weed and Pest Foreman (D. Rumsey) and Parks Superintendent (R. Kraft).
**Note (Parks Staff Positions): [1]Parks Foreman II, [2]Parks Landscape Supervisor, [3]Parks Labourer I, [4]Planning and Technical Services Supervisor, [5]Parks Superintendent, [6]Parks Gardener, [7]Ecological Services Technician, [8]Parks Labourer II, [9]Urban Forester, [10]Ecological Services Coordinator, [11]Urban Forestry Technician I, [12]Ecological Planning and Technical Specialist.

APPENDICES

APPENDIX A

- Appendix A contains information on the City of Red Deer Strategic Plan (2009-2011) and Environmental Master Plan (2011) as context for the IPM Manual and program
- Historical technical information from the *City of Red Deer Environmental Discussion Paper (2004)* including descriptive profiles of the following programs: Ecological Management System (EMS);Geographic Information System (GIS) and Integrated Pest Management (IPM)
- Information on *Parks*GIS and associated technology

City of Red Deer Strategic Plan, Environmental Master Plan, Environmental Discussion Paper and *Parks*GIS

City of Red Deer 2009-2011 Strategic Plan

What is a Strategic Plan?

A Strategic Plan provides purpose and direction for the organization. It is a map that provides a common course to ensure The City of Red Deer makes decisions based on a shared vision. It is not a comprehensive list of all the programs, services and activities The City provides, rather it identifies key areas of focus.
The 2009 – 2011 Strategic Plan focuses on The City's own operational initiatives – how internal business are run and how services are delivered to the community. It was developed through consultation and planning processes, assessment of the current environment and trends, and The City's primary purpose of providing services to citizens.

How does IPM fit with the Strategic Plan?

Goal: Be Strategic – Sustainable (SUST)

Objective – SUST 2: Increase the level of community participation in environmental stewardship.
• SUST 2.2: Actively engage, educate and partner with the community to encourage new and creative environmental initiatives.
Objective – SUST 3: Enhance The City's environmental reputation.
• SUST 3.1: Promote Red Deer's environmental stewardship.

Goal: Be Excellent – Collaborate for success (COLL)

Objective – COLL 2: Increase effectiveness of internal communication and consultation.
• COLL 2.2: Develop ways and means of ensuring employees have applicable and timely information.

Goal: Be Excellent – Innovate (INN)

Objective – INN 2: Create a culture where members of the organization are prepared to take calculated risks.
• INN 2.2: Encourage the use of pilots/trials to improve the quality and efficiency of our decisions and processes.

City of Red Deer Environmental Master Plan (EMP) (2011)

Why an Environmental Master Plan?

To answer these questions, The City of Red Deer has developed Our Environment, Our Future: Red Deer's Environmental Master Plan. The development of this Plan included extensive research and public engagement to identify the core environmental issues in Red Deer and determine what can be done to ensure Red Deer's environmental future is a bright one.
To this end, the intent of the Environmental Master Plan is to:
• Establish measurable targets to track environmental progress
• Identify actions that will help us achieve our environmental vision
• Establish a decision making framework for The City to align its day-to-day operations, policy making and programs with environmental goals

About the Plan

The Environmental Master Plan is connected to The City's Strategic Plan (2009-2011), a high level document that provides guidance for what The City of Red Deer does as an organization and provides as programs and services to its citizens. The Environmental Master Plan will be a key tool in the implementation of the environmental pillar of the Municipal Sustainability Framework and the *sustainability* objectives of the Strategic Plan.

Integrated Pest Management and the EMP

Metric: Volume of toxic *pest* control product used per acre of municipal owned land (ml/per acre).

Why use this Metric?

To measure and decrease the use of toxic *pest* control products on municipally owned land since they contribute to air, water and ground contamination. *Pest* control chemicals can pollute several ecological systems, including air, water and soil. Reducing or eliminating our reliance on toxic *pest* control will contribute to a healthier Red Deer. An integrated approach to *pest* management is required to ensure the most ecologically sensitive means of control are used. The ultimate result is benefit to the community members and restoration of natural *ecosystem* functions.

Section 5 of the EMP - Corporate Strategies and City-wide Policy Recommendations (modified)

Create, refine and align policies and plans tied to environmental targets outlined in the *EMP*. The Environmental Master Plan should be considered as one of The City's core documents similar to the *Municipal Development Plan* or Strategic Plan that guides policy development and decision making.

City of Red Deer Environmental Discussion Paper (2004)

Historical technical information from the *City of Red Deer Environmental Discussion Paper* including descriptive profiles of the following programs: Ecological Management System (EMS); Geographic Information System (GIS) and Integrated Pest Management (IPM):

Ecological Management System (EMS)

Parks Construction

Maintenance

Recreation, Parks and Culture

2002 – 2005 Strategic Plan Strategy 1.2.1 – Maintain and review environmental standards for municipal infrastructure and services.

REACT Priority
Water Supply
Air Quality
Preservation of Natural Areas
Environmental Education

Red Deer Growing Smarter: Community Design Elements
41. Integrate existing significant natural areas into the design of a neighbourhood in a manner that complements and links the open space system.

Sources

- Grant Moir, Biological Services Coordinator; Ron Kraft, Superintendent; Linda Feddes Urban Forester; City of Red Deer

- Moir, G. (1999) Proposal to make a final application to become the Alberta participant in the Sustainable Communities Initiative in partnership with Natural Resources Canada.

Program – Ecological Management System (EMS)

The Ecological Management System (EMS) is a database/mapping inventory system. Ecological assets (map site inventory locations) now in or requiring inclusion in the EMS: city and district natural habitat; mosquito control; integrated pest management; public trees; urban forestry program; shrub beds; neighborhood and open space parks; turf; urban forest wildfire management; subdivision enhancement plan; regional elms; plant health care management; weed and pest; trails; rough cut; beaver wire; wildlife and corridors. This program has been in development since the early 1990s.

Why Use an EMS?

There are over 30,000 ecological items inventoried through the EMS. Inventory data, map locations and related ecological information are used to:

1. Provide an integrated approach to effectively manage the ecology of the area;
2. Help establish and plan maintenance schedules and budgets;
3. Prepare ecological information for use in a Geographic Information System (GIS); and
4. More accurately valuate ecological assets and services.

How Does the EMS Work?

The EMS uses a common set of numbers and end codes to integrate all of the city and surrounding district's ecological assets into one system. Map site locations and data associated with each site can then be used for effective management and operations. Basically, it ties all ecological components together with a tool that allows the user to see how they are interrelated – providing better data for managing future projects. For example, mapping the location of every elm tree enables more comprehensive monitoring, surveys and follow-up pruning.

Environmental Impact

An established EMS will allow The City and its various departments to minimize environmental impacts by analyzing ecological information to more effectively manage the resources of the community.

Significance to Community

Help fulfill the desire for a healthy natural environment and well managed, sustainable parks system. The EMS approach complements other communities using tree inventories and other ecological based inventories and map systems.

Looking Forward

The majority of ecological assets have been mapped on paper. Approximately half of the maps in the EMS have been digitized in The City's computer system. Resources are required for digitization of the remaining maps, including the substantial tree inventory. The EMS is presently being used, but requires further development. An EMS operations manual will be developed.

Geographic Information System (GIS)

Parks Construction

Maintenance

Recreation, Parks and Culture

2002 – 2005 Strategic Plan Strategy 1.2.1 – Maintain and review environmental standards for municipal infrastructure and services.

REACT Priority
Water Supply
Air Quality
Preservation of Natural Areas
Environmental Education

Red Deer Growing Smarter: Community Design Elements
41. Integrate existing significant natural areas into the design of a neighbourhood in a manner that complements and links the open space system.

Sources: See EMS profile above.

Program – Geographic Information System (GIS)
The City of Red Deer Information Technology Services (ITS) department is currently developing a corporate level Geographic Information System (GIS). Database/mapping inventory information gathered in the Ecological Management System (EMS) is intended for eventual incorporation into a GIS. The significant amount of citywide and district EMS inventory information collected can then be manipulated in a GIS and effectively used within and between city departments.

Why Use a GIS?
GIS would improve the thoroughness and accessibility of data and visual/graphic information for field use, maintenance purposes and the management of ecological information and integration of beneficial technical equipment (e.g. Geographic Positioning System (GPS); Personal Digital Assistant (PDA)).

How Does a GIS Work?
GIS allows for the visualization, analysis, use and presentation of location related data (database inventory) and geographic information (mapping inventory).

Environmental Impact
An established GIS will allow the City to minimize environmental impacts by analyzing information obtained from the EMS and other sources of information to more effectively manage the ecological assets of the community.

Significance to Community
Help fulfill the desire for a healthy natural environment, sustainable parks system and community by using GIS to more efficiently manage ecological assets. Many other municipalities are now using GIS to manage their assets.

Looking Forward
For EMS related work in the Parks Construction/Maintenance Section, The City's RedGIS viewer, along with GPS technology is presently being used to help manage ecological information. Once the remaining EMS database/mapping inventory system is finalized and a corporate GIS is in place, integration of inventories and environmental information within the Parks Construction/Maintenance Section and multi-department (e.g. Engineering, Parks Facilities, Public Works, EL&P, Land and Economic Development) use of ecological inventories can be established. For more effective and compatible decision making.

Integrated Pest Management (IPM)

Parks Construction

Maintenance

Recreation, Parks and Culture

2002 – 2005 Strategic Plan Strategy 1.2.1 – Maintain and review environmental standards for municipal infrastructure and services.

REACT Priority
Water Supply
Air Quality
Preservation of Natural Areas
Environmental Education
Red Deer Growing Smarter: Community Design Elements
41. Integrate existing significant natural areas into the design of a neighbourhood in a manner that complements and links the open space system.
Sources - Grant Moir, Biological Services Coordinator; Ron Kraft, Superintendent; Linda Feddes Urban Forester; City of Red Deer

- Integrated pest Management (IPM) Program Manual (2002 Draft) Recreation, Parks and Culture Department, City of Red Deer

- Environmental Code of Practice for Pesticides (1997), Alberta Environmental Protection

Program – Integrated Pest Management (IPM)
Integrated Pest Management (IPM) is the maintenance of detrimental insects, weeds and other organisms at tolerable levels. A combination of cultural, mechanical, biological and chemical control methods are used resulting in minimal environmental impacts. Controls are based on seasonal monitoring and use of Ecological Management System (EMS) citywide database/mapping inventories. Both the Mosquito Control Program and Dutch Elm Disease Program would be examples of initiatives that fall within integrated pest management. Ultimately, the program provides a balance in methods to reduce impacts.

Why Use IPM?
- Provides a framework for unifying various pest control operations in one system
- Helps to reduce the reliance on chemical controls resulting in a healthier environment
- Provides for increased education and awareness surrounding the issue of pest control
- Allows for the use of established map inventories and monitoring methods to help plan citywide control strategies and maintenance schedules for pest management

How Does IPM Work?
Prioritize which pests warrant controls; inform the public about realistic expectations involved in controlling pests found in natural systems; monitor the pest populations; establish tolerable damage levels; use the least disruptive method of control and follow up with adequate monitoring to establish the effectiveness of the controls.

Environmental Impact
IPM helps reduce the use of chemicals in the community. This creates a positive impact on the environment – both people and wildlife benefit if the natural systems are not excessively tampered with.

Significance to Community
An IPM program allows for the adoption of new environmentally friendly products and control methods and fosters greater public health and wellness.

Looking Forward
The city-wide approach to IPM is closely tied in with the large database/mapping inventories of mosquito control, shrub beds and trees. For the IPM program to be fully effective, the remaining inventory maps require digitization. IPM represents the future direction of pest management and many municipalities are now using this approach.

Information on *Parks*GIS and Associated Technology

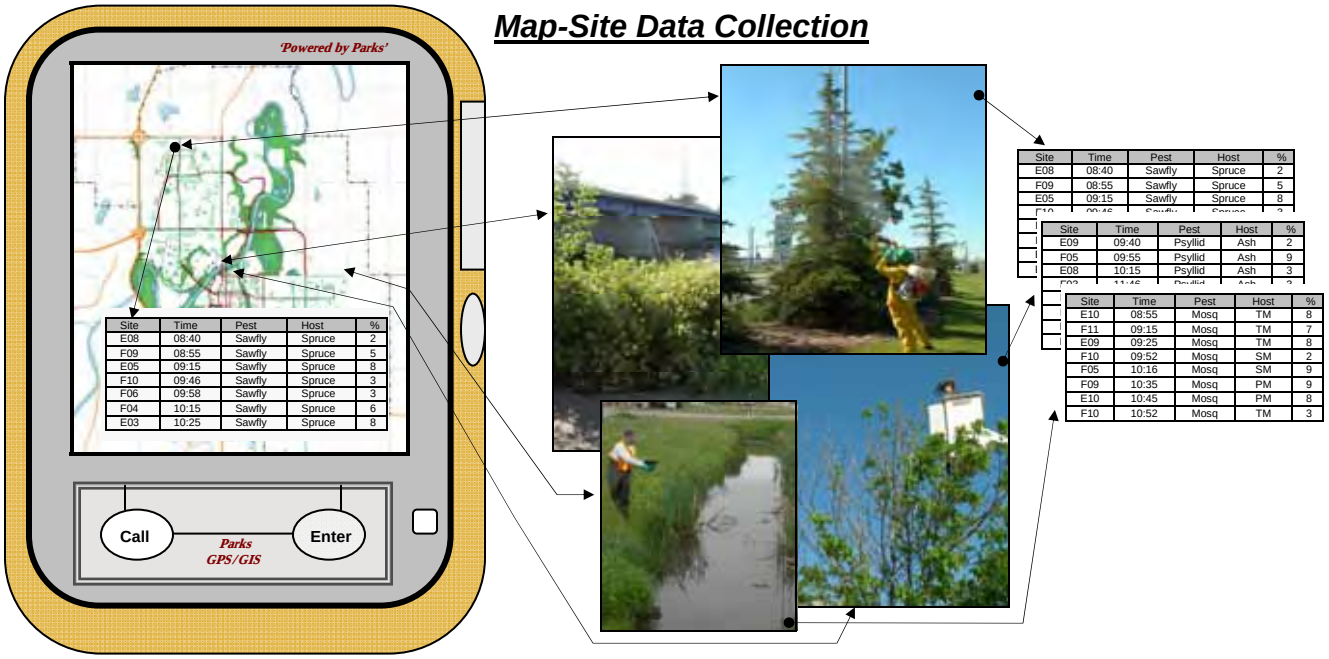
*Parks*GIS is currently being refined and is the result of merging the PEMS and PAMS inventories and the City GIS into one tool to help manage parks programs and assets that relate to inventory map site locations. PEMS refers to Parks Ecological Management System and PAMS refers to Parks Amenities Management System. PEMS ecological features include planted tree inventory, shrub beds, pests/weeds (IPM), wildlife, mosquito control, turf, tree, stream, and wetland natural areas and so on. PAMS amenity features include playgrounds, structures, sports fields and site furniture.

Both PEMS and PAMS use a common set of numbers and end codes to integrate the amenity and ecological based assets and map sites of the city and surrounding district. Map site locations and data associated with each site can then be used for effective planning, management and operations. For IPM this process will involve:

- Daily pesticide application records* and/or handheld electronic devices** used for collecting and recording pertinent asset, monitoring and treatment data related to activities at each map site.
- Asset data is entered into the *Parks*GIS database.
- Operational monitoring and treatment data associated with the various assets is integrated into a Parks Work Management System. This will allow staff to effectively track and record work information related to IPM. There is also a service request component to the system which will allow staff to respond to public IPM inquiries.

As a technical resource the IPM manual will be integrated into and be directly accessible as an informational adjunct in *Parks*GIS and in the work management system. As new information about IPM becomes available, the manual will be updatable.

Map-Site Data Collection

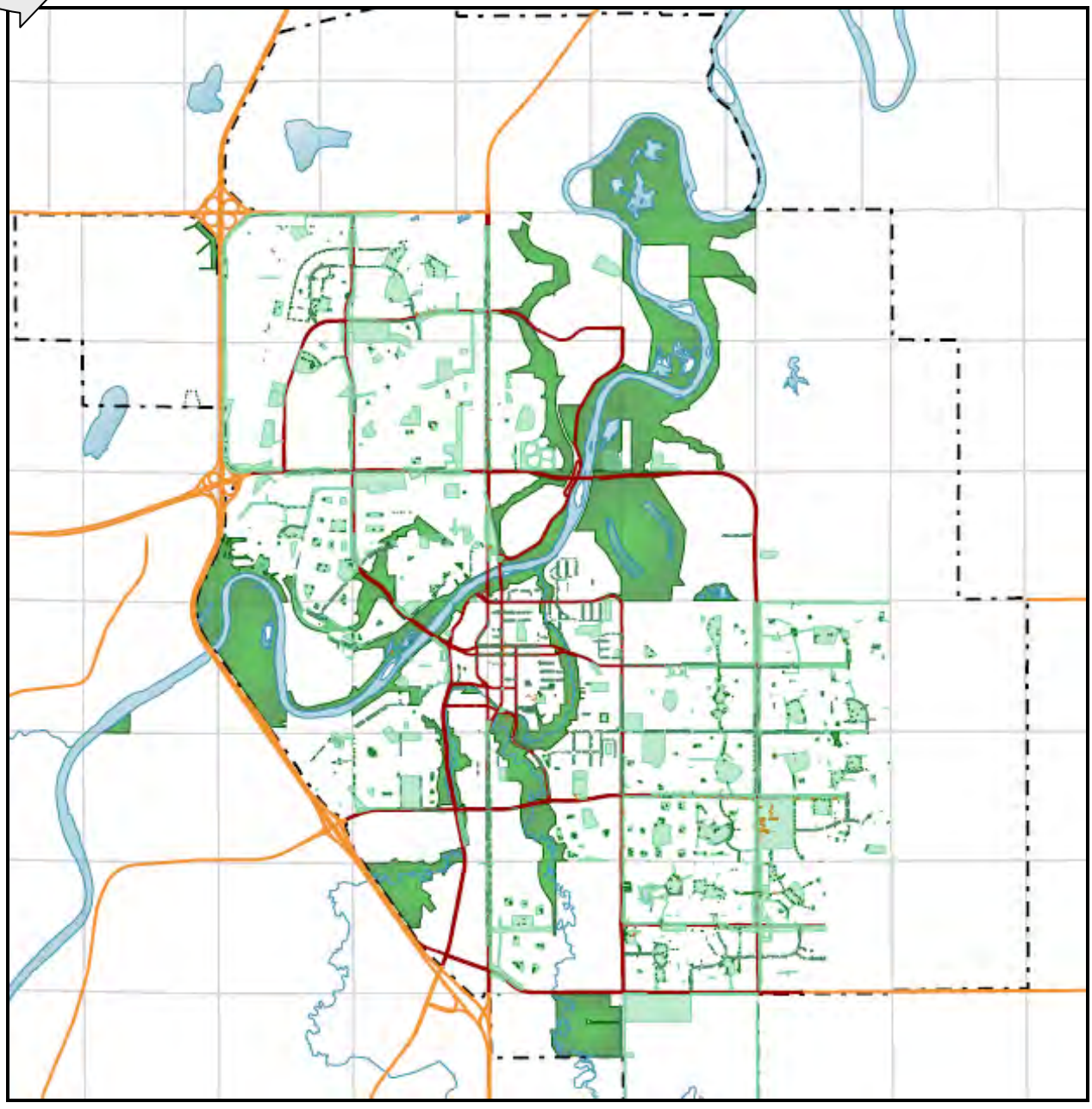


*Note: The established method of collecting field data.
**Note: This diagram is for illustration purposes only; it is a reproduction of a typical handheld electronic device, or PDA, and its intended use. One similar to this is currently being field tested by the Ecological Services Section of Parks for the collection of GIS park assets and monitoring and treatment data related to IPM. Information collected is intended for integration into *Parks*GIS and where pertinent the work management system. The use of PDA's for map-site monitoring, treatment data and other information collection has been proposed as part of the *Parks*GIS design. Use of PDA's for GPS inventory confirmation and data collection are currently established tools in the program.

APPENDIX B

- Appendix B contains a sample of a City of Red Deer *Parks*GIS map with various Integrated Pest Management (IPM) assets and related routes.

SAMPLE *PARKS*GIS MAP OF IPM ROUTES



Plant Health Care (P): Trees

Street Trees (SP)

Plant Health Care (P): Shrub Beds

Neighbourhood Beds (BP)

Integrated Pest Management (I)

Animal and Insect IPM (AI)

Park Category (Z)

Neighbourhood Parks (NZ)

ParksGIS

2011/01/31

Scale 1 : 79217.90986493

APPENDIX C

- Appendix C contains a definition of invasive species and related information:
  - The following includes a summary of the species that are found, or have the potential to be found, in Red Deer and are considered to be invasive in varying degrees. They are either established, monitored using traps and/or controlled.

INVASIVE SPECIES INFORMATION

Invasive species pose a threat to the ecology, economics and public perception of an area. Once invasive species are identified, an effective IPM program can offer a range of strategies that works towards the eradication or reduction of this group of pests.

Commonly known as *invasive* or *invasive alien* species, such terms are often used interchangeably and there are numerous technical definitions of invasive species. The term *invasive* can refer to a plant or organism that simply 'invades' and takes over at the exclusion of other species in any one area, whereas *invasive alien* is usually distinguished by the fact that the plant or organism is not originally from an area, has at some point been introduced and has the capacity to take over at the exclusion of other species.

The Alberta Invasive Plants Council's definition: "Invasive alien species introduced deliberately or unintentionally outside of their natural habitats" is a general guide for this manual. An additional reference used to help describe the categorization of weeds as invasive is the Alberta Native Plant Council 'Rouges Gallery' guidelines. A reference that offers several definitions of plant and animal invasive species, covers a broad range of useful background material and is an informative paper is *Costs and Threats of invasive Species to Alberta's Natural Resources (Alberta Sustainable Resources Development – 2004)*. The Canadian Food Inspection Agency and other federal, provincial and municipal government departments offer information on invasive species and support monitoring projects (see *References* Page 28). The above information is used to help establish the degree to which the following pest groups are considered invasive species:

Insects

Several species of invasive insects are currently established, monitored and/or controlled in Red Deer. These include the European elm bark beetle, cottony ash psyllid and the satin moth. Other invasive insects that have the potential for establishing in this area and have been monitored only, include the Asian long-horned beetle, emerald ash borer, European wood wasp and the Gypsy moth. All of these insects can be devastating to their host vegetation and can result in enormous ecological and economic impacts.

Mammals

The most significant mammal considered to be invasive in Red Deer is the Norway rat. There have been few known sightings, however their presence has been confirmed and they will remain a significant target for identification and eradication if located.

Pathogens

Dutch elm disease (DED) is an invasive pathogen that is currently monitored but has not been found in Red Deer. DED is transmitted by elm bark beetles, that are also invasive, and it has the potential for establishing and devastating elm trees in this area.

Weeds

All *prohibited noxious* weeds, *noxious* weeds and *'others – not in the weed act'* in Red Deer are considered invasive as identified by the Alberta Invasive Plants Council and/or the Alberta Native Plant Council. Weeds can result in substantial ecological and economic impacts and losses, in addition to increased concerns related to aesthetic values.

APPENDIX D

- Appendix D contains the *'City of Red Deer – Parks Integrated Pest Management (IPM) Review Process For Pesticide Application Projects and Other Pest Problems'*

CITY OF RED DEER
PARKS INTEGRATED PEST MANAGEMENT (IPM) REVIEW PROCESS
FOR PESTICIDE APPLICATION PROJECTS AND OTHER PEST PROBLEMS

CONTENTS OF THE REVIEW PROCESS AND SUMMARY OF FORMS:

- PROJECT LIST (*Figure 1* - Pg. 41)
  - IPM project number
  - Pest number
  - Project name
  - Route
  - Location
  - Project review staff
- REVIEW AND CHECK-LIST CHART FOR PESTICIDE APPLICATION PROJECTS AND OTHER PEST PROBLEMS (*Figure 2* – Pg. 42 & 43)
  - The chart is intended as a formal review and check-list of responsibilities prior to embarking on seasonal pesticide application projects involving an individual pest problem. It is also intended to facilitate decision making related to other pest problems not involving the use of pesticides.
- PARKS CODE OF PRACTICE FOR PESTICIDE APPLICATION PROJECTS (*Figure 3* - Pg. 44)
  - The *Parks Code of Practice for Pesticide Application Projects* is to be followed by staff involved in each project.
- SUPPLEMENTAL COMMENTS, INFORMATION AND RELATED GUIDELINES (*Figure 4* - Pg. 45)
  - Supplemental comments and guidelines for appended review chart information.
- DAILY PESTICIDE APPLICATION RECORD – LANDSCAPE SERVICES 1.0 (*Figure 5* - Pg. 46)
  - Required daily information
  - Map site number
  - Location description
  - PCP number
  - Time/Date
- DAILY PESTICIDE APPLICATION RECORD – ECOLOGICAL SERVICES 2.0 (*Figure 6* - Pg. 47)
  - Required daily information
  - Map site number
  - Date/Time
  - Treat/No treat/Dry
  - Product bag number
  - Quantity used
  - Size of site
- DAILY PESTICIDE APPLICATION RECORD – URBAN FORESTRY 3.0 (*Figure 7* - Pg. 48)
  - Required daily information
  - Map site number
  - Location description/Time
  - Reading and mixing information for chemicals
- PRE-MONITORING, POST-MONITORING OR NON-PESTICIDE CONTROL METHODS 4.0 (*Figure 8* - Pg. 49)
  - Required daily information
  - Map site number
  - Location description/Time
  - Estimation of % infestation and damage threshold

Figure 1

Integrated Pest Management (IPM) Project List - 2011

City of Red Deer - Parks

IPM Project Number		Pest #	Project Name	Route*	Location	Project Review – Staff
Insects						
1	(1)	1	Ants	*Pesticide*	▪ Non-sensitive areas**	
2	(2)		Ants	Non-pesticide	▪ Sensitive areas***	
3	(3)	12	European elm scale	Non-pesticide		
4	(4)	15	Larch sawfly	*Pesticide*	▪ Non-sensitive areas	
5	(5)		Larch sawfly	Non-pesticide	▪ Sensitive areas	
6	(6)	18	Mosquito control	*Pesticide*		
7	(7)	20	Cottony ash psyllid	Non-pesticide		
8	(8)	21	Rusty tussock moth	Non-pesticide		
9	(9)	22	Satin moth	Non-pesticide		
10	(10)	27	Yellowheaded spruce sawfly	*Pesticide*	▪ Non-sensitive areas	
11	(11)		Yellowheaded spruce sawfly	Non-pesticide	▪ Sensitive areas	
12	(12)	28	Bees/Wasps	*Pesticide*	▪ Non-sensitive areas	
13	(13)		Bees/Wasps	Non-pesticide	▪ Sensitive areas	
Mammals						
30	(14)	32	Gophers	*Pesticide*		
Pathogens						
40	(15)	33	Black knot	Non-pesticide		
*Weeds (Weed Act)***						
50	(16)	41	Canada thistle	*Pesticide*	▪ Non-sensitive areas	
51	(17)		Canada thistle	Non-pesticide	▪ Sensitive areas	
52	(18)	43	Common tansy	Non-pesticide		
53	(19)	46	Leafy spurge	*Pesticide*		
54	(20)	50	Scentless chamomile	*Pesticide*	▪ Non-sensitive areas	
55	(21)		Scentless chamomile	Non-pesticide	▪ Sensitive areas	
Invasive Species						
Other Projects						
80	(22)	54	Wild caraway	Non-pesticide		
90	(23)	44	Dandelion	*Pesticide*		
91	(24)	55	Quack grass	*Pesticide*		
92	(25)	56	Wild cucumber	Non-pesticide		

*All '*Pesticide'* routes require that the project review must be carried out by a pesticide applicator license holder(s); **Non-sensitive areas refer to non-ecologically sensitive areas; low public use areas; or other; ***Sensitive areas refer to ecologically sensitive areas; high public use areas; or other; ****'*Weeds (Weed Act), Invasive Species and Other projects*' occur in a number of locations on both pesticide and non-pesticide routes; locations may be in non-sensitive or sensitive areas and may include: 1. Shrub bed and tree well areas; hard surfaced areas (concrete; gravel) and account numbered sites (wastewater treatment plant and LED sites); 2. Thistle patches located in high cut turf areas (parkland mowing); fence and road lines; and annexation areas

Figure 2

Integrated Pest Management (IPM)
Review and Check-list Chart for Pesticide Application Projects and Other Pest Problems

Preamble:
The chart below is intended as a formal review and check-list of responsibilities prior to embarking on seasonal pesticide application projects* involving an individual pest problem; and to facilitate decision making related to other pest problems**; the chart is not intended for use as a check-list for pesticide control or other activities related to individual pests on a route – activities observed, recorded in pest control records and carried out on a route are considered to be components of a project; each seasonal pest project requires one chart only for the review process

*A pesticide application project is defined as a project or program that requires the use of any type of registered pesticide to control a pest/weed species on a host or other location along any defined or undefined route(s) e.g. larch sawfly project; shrub bed weed project; mosquito control program; **this chart is also intended for reviewing other pest/weed problems and projects to document that we are carrying out alternative IPM approaches

- In addition, the chart can be used as a *best management practice* to share with staff and if required show the public or government regulatory bodies that a formal pre-pesticide application review process for projects has taken place; it also allows for verification that a project has been successfully concluded at the end of the season
- The review process shows that the appropriate checks and balances have been considered by pesticide applicator license holders and that all licensed staff involved in a project will have reviewed and considered the same information prior to pesticide control activities; the review process should help foster dialogue and cooperation and help establish the most effective IPM approach
- This form of *due diligence* can be combined with any additional records related to pre and post-monitoring of pests or required records related to pesticide application activities; the chart should be signed by the pesticide application license holder(s) once the project review has been completed and it should be signed again at the conclusion of the project; in summary, the pesticide application license holders should have the answer to the *'who, what, where, why, when and how'* related to decision making for pesticide projects and pest problems
- An explanation of the numbered information found in the chart is located in *Reference and Check-list Information* below the chart; this document will be included in the IPM manual as a guide for staff

Briefly describe the pest control project or activity (attach additional page if required): _____IPM Project # _____

Potential Pest Problem	Pest #	Host or Location	Host #	Routes[1]	Thresholds (Upper Limits)	Estimate of % Infestation[2]	Type of Control	Location Re: Control Concerns	Education & Public Notification	License Holder Check-list
Insect		Trees		Established	Injury	0-20%	Cultural	Sensitive Area	Newspaper	- Confirm pest route[4] - Confirm methods[5] - Pre-monitoring records[6] - Pesticide application records:[7] ▪ Date ▪ Site locations ▪ Control product ▪ Label rate ▪ Calibration rate ▪ Application method/time ▪ Daily start/finish ▪ Daily weather data - Post-monitor/Non-pesticide records[8] - Pesticide manual check[9] - IPM manual check[10] - Safety/training check[11] - Sign-off procedure[12] - Other: Call Management inquiries
Mammal		Shrubs		Non-established	Action	21-40%	Mechanical	Non-sensitive Area	Letter	
Pathogen		Weed Sites		Pesticide	Economic	41-60%	Physical	Ecologically Sensitive	Signage	
Weeds (Weed Act)		Shrub Beds		Non-pesticide	Cosmetic	61-80%	Chemical	Non-ecologically Sensitive	Website	
Invasive Species		Turf / Rough Cut		Other	Aesthetic	81-100%	Biological	High Public Use Area	Utility bill	
Other		Turf / Other			Other	0-100% (Variable)	Microbial	Low Public Use Area	None Required	
		Wetlands					Other	No Concerns	Other	
		Other						Other		
	(See Pest List)[3]		(See Host List)							

Reference and Check-list Information *- this information is intended to encourage license holders to refer to the pertinent references during pest project reviews; following is a brief explanation of the numbered items in the chart:*

1. ***Routes*** are currently established and/or should be established by Parks staff for crews to follow and accurately record information related to pesticide use, non-pesticide use and monitoring activities.
2. ***Estimate of % infestation*** helps to establish the threshold and vice versa; % infestation will depend on the type of pest, #'s of pest, location of pest problem and other factors and can help guide the type of control used.
3. ***A pest list and host list*** are located on the back of this chart; the number corresponding to each pest or host should be entered in the chart above when reviewing a project.
4. ***Confirm the pest route***; this will allow for more efficient preparation and operations by staff; in the case of a non-established route, attempt to create and map one for use in *Parks*GIS.
5. ***Confirm methods*** that are to be used; this will include a review of application or other procedures, equipment, control products, control concerns, public notification required and so forth.
6. ***Pre-monitoring record*** is in a standardized format for recording pest-related observations e.g. establishing population levels and host damage prior to an application project.
7. ***Pesticide application record*** is in a standardized format for recording all on-site pesticide application activities e.g. site location; control product; application method/time and so forth.
8. ***Post-monitoring record or non-pesticide control record*** is in a standardized format for recording the follow-up results of the effectiveness of a pesticide application; or other type of control method used on a pest.
9. ***Pesticide Manual check*** is a reminder that the *Pesticide Applicator Home Study Course* contains a wealth of information and should be reviewed to help clear up any uncertainty related to pesticide applications and IPM.
10. ***IPM Manual check*** is a reminder that the *IPM manual* can be used as a supplement to help identify pest species and provide a review of procedures related to the City of Red Deer approach to pest problems.
11. ***Safety/training check*** is a reminder that the City of Red Deer safety/training procedures are to be incorporated in all pesticide applications or other procedures and be included as an integral part of any project review.
12. ***Sign-off procedure*** confirms that all pesticide applicator license holders involved in a specific pesticide application or other project have completed and agree with the project review and its follow-up conclusion.

▪ The following signature(s) verifies that the pesticide application project or other activity noted has been thoroughly reviewed prior to the project using the above chart and related information as a *best management practice*.
Pesticide Applicator License Holder Signature(s): _____Date: _____

▪ The following signature(s) verifies that the pesticide application project or other activity noted has been successfully concluded in the current season.
Pesticide Applicator License Holder Signature(s): _____Date: _____

Notes for changes or improvements in the project (attach additional page if required): _____

Figure 2 Cont. IPM Pest and Host List – 2011 Sample List

Pest List From IPM Manual		Pest Number	Pest List From IPM Manual – Continued		Pest Number	Host List From Parks/GIS	Host Number
A. Insects / Invasive Species						**Tree or Shrub**	
Group 1*:	Asian Long-horned beetle	70		Orange hawkweed	76	American elm	1
(Invasive Insects)	Elm bark beetle (European)[+]	10		Purple loosestrife	49	American larch	2
	Emerald ash borer	71	Group 2:	Black henbane	57	American mountain ash	3
	European wood wasp	72	(Noxious)	Canada thistle	41	Amur cherry	4
	Gypsy moth	73		Common baby's breath	59	Aspen poplar	5
	Psyllid (cottony ash)	20		Common mullein	60	Austrian Pine	6
	Satin moth	22		Dame's rocket	63	Balsam fir	7
				Field scabious	45	Balsam poplar	8
Group 2:	Ash bark beetle	3		Leafy spurge	46	Black ash	9
(Insect Pests)	Dogwood sawfly	9		Lesser burdock	65	Bur oak	10
	Elm bark beetle (Native)	11		Perennial sow thistle	48	Colorado spruce	11
	Forest tent caterpillar	13		Scentless chamomile	50	Crabapple	12
	Larch sawfly	15		Wooly burdock	67	Cutleaf weeping birch	13
	Rusty tussock moth	21		Yellow clematis	52	Dropmore Linden	14
	Spiny elm caterpillar	23				Eastern White Pine	15
	Spruce budworm	24	Group 3:	Common tansy	43	European Basswood	16
	Ugly-nest caterpillar	25	(Noxious)	Tall buttercup	66	European Mountain Ash	17
	White pine weevil	26				Golden Willow	18
	Yellowheaded spruce sawfly	27	Group 4:	Creeping bellflower	61	Green Ash	19
	Yellow jacket wasp	28	(Noxious)	Oxeye daisy	47	Griffin Poplar	20
				White cockle	53	Hawthorne	21
Group 3:	Ants (various)	1		Yellow toadflax	68	Jack pine	22
(Insect Pests)	Aphids (various)	2				Japanese elm	23
	Ash plant bug	4	Group 5:	Blueweed	58	Laurel leaf willow	24
	Birch leafminer	5	(Noxious)	Dalmatian toadflax	62	Little leaf linden	25
	Bronze birch borer	6				Lodgepole pine	26
	Cooley spruce gall adelgid	7	Group 6:	Bull thistle	69	Manchurian ash	27
	Cottonwood leaf beetle	8	(Others – not in weed act)	Dandelion	44	Manitoba maple	28
	Elm scale	12		Quack grass	55	Mayday	29
	Lace bug	14		White clover	77	Muckle plum	30
	Leaf roller (aspen)	17		Wild caraway	54	Northwest poplar	31
	Poplar borer	19		Wild cucumber	56	Paper birch	32
						Patmore ash	33
Group 4:	Mosquitoes[++]	18				Ponderosa pine	34
(Insect Pests)						Prairie sky poplar	35
B. Mammals						River birch	36
Group1:	Beaver	29				Royalty crabapple	37
(Mammal Pests)	Northern pocket gopher	30				Russian olive	38
	Porcupine	31				Schubert chokecherry	39
	Rat*	74				Scots pine	40
	Richardson ground squirrel	32				Sharp-leaf willow	41
						Siberian crabapple	42
						Siberian elm	43
C. Pathogens						Siberian larch	44
Group 2:	Black knot	33				Siberian white willow	45
(Pathogen Pests)	Cankers (various)	34				Silver maple	46
	Dutch elm disease**	35				Swedish columnar aspen	47
	Elm wilt	36				Thunderchild crabapple	48
	Fairy ring	37				Tower poplar	49
	Fire blight	38				Weeping birch	50
	Slime flux	39				White spruce	51
	Tree wilt	40				Not specified	52
						Additional Shrubs	
						Cornus species (dogwood)	53
D. Weeds (Weed Act) / Invasive Species* **						Fabaceae family (caragana)	54
Group 1:	Common buckthorn	75				Rosaceae family (incl. *prunus; cotoneaster*)	55
(Prohibited Noxious)	Himalayan balsam	64				*Salix* species (willow)	56

*Pest groups are arbitrary groupings based on City of Red Deer IPM planning, operational and technical priorities; the pest groups are not affiliated with any external formal classification system

[+]Elm bark beetles are monitored in conjunction with the external community organization named the Society to Prevent Dutch Elm Disease (STOPDED)

[++]The nuisance mosquito control program, based on the control of larvae with microbials, was promoted by the community organization the Red Deer River Naturalists (RDRN) as a viable alternative control program; RDRN also actively promotes the control of weeds, pests and invasive species

**A mammal or pathogen pest that is also considered an invasive species

***Invasive weed species as identified by the Alberta Invasive Plants Council and/or the Alberta Native Plant Council; by this definition, all listed *prohibited noxious* weeds, *noxious* weeds and *'others – not in the weed act'* are invasive unless otherwise indicated

Figure 3 **CITY OF RED DEER IPM REVIEW PROCESS FOR PESTICIDE APPLICATION PROJECTS 'CODE OF PRACTICE'**

In addition to carrying out reviews of IPM pesticide application projects by qualified Pesticide Applicator License Holder's, the following 'Parks Code of Practice for Pesticide Application Projects' shall be followed by staff involved in each project.

Parks Code of Practice for Pesticide Application Projects

1. Consider the implications of the 'Who, What, Where, Why, When and How' of the pesticide application project you are working on and associated due diligence.

2. All staff shall be familiar with Alberta Environmental Protection *'Environmental Code of Practice for Pesticides'* and conform to associated best management practice.

3. All staff shall have been properly trained as *Pesticide Applicator Assistants* according to the checklist found in the Environmental Code of Practice for Pesticides.

4. Prior to the start of an application project, pre-monitoring sampling* of pest population levels shall be carried out and recorded using the standardized Parks monitoring forms** to help assess the need and level of treatment required.

5. Once treatment commences, pesticide applications shall only be applied onto a confirmed, identifiable pest population located on the host or at the target location. All information related to pesticide applications will be accurately recorded on a *Parks Daily Pesticide Application Record* – reflecting pesticide products and rates used.

6. After the project, post-monitoring sampling shall be carried out and recorded using the Parks monitoring forms to assess the effectiveness of treatments.

7. At all times during a pesticide application project, consider the use of alternative IPM methods that could be considered for future use in a project.

8. If any pesticide applications conflict with public or staff safety concerns, the project shall be suspended until conflicts are resolved – public and staff safety come before concerns of pest populations, host species and/or locations.

9. If and when any conflict of interest arises Re: methods used, differing perceptions, use/misuse of chemical products, misunderstanding of roles and/or other concerns related to the project, the project shall then be reviewed by the qualified *Pesticide Applicator License Holder's* involved, to resolve conflicts.

10. Any conflict of interest that can not be resolved by qualified staff involved in the review process, is to be forwarded to the Parks Planning and Technical Services (PPTS) Supervisor and/or the Parks Landscape Services (PLS) Supervisor for their input.

*Sampling refers to visiting a representative portion of monitoring sites to help establish pest population levels.
**Standardized Parks forms are available for all monitoring procedures

Figure 4 **SUPPLEMENTAL COMMENTS AND INFORMATION APPENDED TO THE IPM REVIEW CHART AND GUIDELINES FOR THIS INFORMATION**

The review process for pesticide application projects and other pest problems is an initiative started in 2010. It is intended to consolidate all IPM and pesticide application projects and the collection of related data in a consistent format for more effective management and oversight from this point forward.

Each project review is carried out by the appropriate Pesticide Applicator License Holders. In addition to the project review, supplemental comments and information for each project is welcome and is to be appended to the review chart. The intent of supplemental information is:

- *To contribute additional educational information;*
- *To consolidate ongoing experience to help enhance the overall knowledge base of the process; and*
- *To emphasize newly acquired skills to improve methods.*

All of these shall be geared towards attaining positive outcomes.

The addition of supplemental comments and information is not intended as a review or forum for pesticide application projects prior to 2010. For previous projects, refer to the appropriate project files.

The following **Guidelines** shall be followed when adding supplemental comments and information to the review process of any pesticide application project. Reviewer's comments and information shall:

1. Offer constructive and objective information.
2. Offer supplemental educational information from external sources.
3. Provide knowledge, opinions and ideas of a non-personal nature.
4. Be mindful that Parks daily pesticide application records are the established forum for quantifying and recording chemical products, rates, volumes and methods of application and so forth.
5. Be mindful that Pesticide Applicator License Holders may in their decision-making use a variety of methods, procedures and reasons for choosing how to control a pest within the range and constraints of IPM options available.

Information falling outside of the scope of the above guidelines shall not be accepted within the context of the pesticide application project reviews.

Figure 5 **DAILY PESTICIDE APPLICATION RECORD – LANDSCAPE SERVICES 1.0**

THE CITY OF Red Deer	**Parks Daily Pesticide Application Record**			**Landscape Services**	**1.0**
DATE:	CREW:		ROUTE:		PROJECT #
TIME: START_____ FINISH_____	TEMPERATURE: START_____ FINISH_____	WIND: START_____ FINISH_____	HUMIDITY: START_____ FINISH_____	TOTAL PRECIPITATION:_____ PEST BEING CONTROLLED:	

1. Method of Application: UTV Backpack Roller spraying Rate:

Chemical Trade Name: Vantage PCP# 28840 Lontrel 360 PCP# 23545 Par 3 PCP# 27884 Curtail PCP# 22764 2,4–D Amine PCP# 14726

2. Crew Checked: Time: Licensee's Initial: | Crew: Time: Licensee: | Crew: Time: Licensee:

3. PPE: □ gloves □ boots □ clean shaven □ half mask □ white suit □ long pants/sleeves/coveralls □ safety glasses □ safety vest

Map Site #	Location Description	PCP#	Time/Date

Total Chemical Mixed:

Figure 6 **DAILY PESTICIDE APPLICATION RECORD – ECOLOGICAL SERVICES 2.0**

THE CITY OF Red Deer	**Parks Daily Pesticide Application Record**			**Ecological Services**	**2.0**
DATE:	CREW:		ROUTE:		PROJECT #
TIME: START_____ FINISH_____	TEMPERATURE: START_____ FINISH_____	WIND: START_____ FINISH_____	HUMIDITY: START_____ FINISH_____	TOTAL PRECIPITATION:_____ PEST BEING CONTROLLED:	
1. Method of Application:	Chemical Trade Name:		Rate:	PCP#	
2. Crew Checked:	Time Checked:		Licensee's Initial:	Applicators Initials:	
3. PPE: □ gloves □ boots □ clean shaven □ half mask □ white suit □ long pants/sleeves/coveralls □ safety glasses □ safety vest					

Map Site #	Date	Time	Treat (T)	No Treat (NT)	Dry (D)	Product Bag #	Quantity Used	Size of Site (Ha)	Comments

Figure 7 **DAILY PESTICIDE APPLICATION RECORD – URBAN FORESTRY 3.0**

THE CITY OF Red Deer	**Parks Daily Pesticide Application Record**			**Urban Forestry**	**3.0**
DATE:	CREW:		ROUTE:		PROJECT #
TIME: START_____ FINISH_____	TEMPERATURE: START_____ FINISH_____	WIND: START_____ FINISH_____	HUMIDITY: START_____ FINISH_____	TOTAL PRECIPITATION:_____ PEST BEING CONTROLLED:	
4. Method of Application:	Chemical Trade Name:		Rate:	PCP#	
5. Crew Checked:	Time Checked:		Licensee's Initial:	Applicators Initials:	
6. PPE: ☐ gloves ☐ boots ☐ clean shaven ☐ half mask ☐ white suit ☐ long pants/sleeves/coveralls ☐ safety glasses ☐ safety vest					

Map Site #	Location Description	Time	Initial Reading (ml or L)	Final Reading (ml or L)	Amt. Used (ml or L)	Unmixed Amt. of Chemical (ml, L or g)
				Chemical Total:		

Figure 8 **PRE-MONITORING, POST-MONITORING OR NON-PESTICIDE CONTROL METHODS 4.0**

THE CITY OF Red Deer	**Parks Pre-monitoring, Post-monitoring or Non-pesticide Control Methods**				**4.0**
DATE:	CREW:		ROUTE:		PROJECT #
TIME: START_____ FINISH_____	TEMPERATURE: START_____ FINISH_____	WIND: START_____ FINISH_____	HUMIDITY: START_____ FINISH_____	TOTAL PRECIPITATION: PEST BEING CONTROLLED: ACTIVITY:	

Control Method: ☐ Hand Pull ☐ Weed Eat ☐ Prune ☐ Hand Pick ☐ Other (specify)
☐ Dig ☐ High Cut ☐ Wash ☐ Sticky Barrier

PPE: ☐ gloves ☐ boots ☐ dust mask ☐ long pants/sleeves/coveralls ☐ safety glasses ☐ safety vest ☐ other (specify)

Map Site #	Location Description	Time	Estimation of % Infestation	Damage Threshold

APPENDIX E

- Appendix E contains the City of Red Deer Pesticide Registration and Approval

CITY OF RED DEER PESTICIDE SERVICE REGISTRATION AND APPROVAL

Alberta
ENVIRONMENT

Environmental Management
Central Region

3rd Floor Provincial Building
4920 – 51 Street
Red Deer, Alberta
Canada T4N 6K8

Telephone: (403) 340-7052
Fax: (403) 340-5022

PESTICIDE SERVICE REGISTRATION NO. 254731-00-00
(REPLACES REGISTRATION NO. 17449-02-00)

CITY OF RED DEER (Box 5008, Red Deer AB T4N 3T4) is hereby issued this registration under the *Environmental Protection and Enhancement Act* to **offer** a **pesticide service** involving the use and application of pesticides in accordance with the *Pesticide Sales, Handling, Use and Application Regulation*, the *Pesticide (Ministerial) Regulation*, and the *Environmental Code of Practice for Pesticides*.

Pesticide application services shall be limited to the following class(es) described in Schedule 5 of the Pesticide (Ministerial) Regulation:

INDUSTRIAL LANDSCAPE BITING FLY

The issuance of this registration is based on the information contained in the registration application submitted on April 24, 2009. Written permission must be obtained from the Director prior to any change in:

a) the class(es) of pesticide application activities offered by this operation,
b) the location of the operation base and pesticide storage facility at Plan No. 0722157, Block 1 Lot 1 (300, 7721 - 40 Avenue, Red Deer AB),
c) insurance coverage for the pesticide application service activities, or
d) the operation from information provided in the registration application.

This registration is transferable only with prior written permission from the Director and is valid from this date of issue until March 31, 2019, unless suspended or cancelled prior to that date.

Designated Director under the Act
ROBERT POLE

Date May 14, 2009

Questions regarding this Registration may be directed to Alberta Environment by contacting (403) 340-7052 (to be connected toll free first dial 310-0000).

Government of Alberta ■
Environment

APPROVAL
PROVINCE OF ALBERTA

ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
R.S.A. 2000, c.E-12, as amended.

APPROVAL NO. 17891-03-00

APPLICATION NO. 004-17891

EFFECTIVE DATE: March 11, 2010

EXPIRY DATE: DECEMBER 31, 2014

APPROVAL HOLDER CITY OF RED DEER

ACTIVITY: **the application of pesticides in, on or within30 horizontal metres of an open body of watar**

is subject to the attached terms and conditions.

Designated Director under the Act

Date Signed March 11, 2010

APPENDIX F

- Appendix F contains:
  - City of Red Deer Integrated Pest Management web site information (February 2012)
  - Example of a Tree Pest Alert: Yellowheaded Spruce Sawfly (facsimile of original)

INTEGRATED PEST MANAGEMENT WEB SITE

Home > City Government > City Services & Departments > Recreation, Parks & Culture > Parks > Trees, Wildlife, Weeds & Pests > Integrated Pest Management

Integrated Pest Management

Integrated Pest Management (IPM) is the maintenance of detrimental insects, weeds and other organisms at tolerable levels. A combination of cultural, physical/mechanical, biological and microbial/chemical pesticide control methods are used to keep environmental impacts to a minimum.

Control methods used are based on seasonal monitoring. IPM strategies are helping to reduce the need for chemical control. The City of Red Deer encourages residents to be selective in their use of control methods.

How Does IPM Work?

Integrated pest management involves a systematic approach to managing detrimental organisms in natural systems. It begins with prioritizing which pests warrant controls and then informing the public about realistic expectations involved in controlling such pests. The next step consists of monitoring the pest populations and establishing tolerable damage levels. City staff then use the least disruptive method of control and follow up with monitoring to establish the effectiveness of controls.

Significance to the Community

An IPM program allows for the adoption of new environmentally friendly products and control methods and fosters greater public health and wellness. It's all part of our approach to dealing with pest nuisances, and it means that we use pesticides sparingly, whether we're dealing with mosquitoes, tree pests or weeds. We try to balance the use of chemical pesticides with other control methods, including manual removal of pests where it's appropriate. We think it's important for the environment, and for everyone's health, to keep our use of pesticides to a minimum.

Pesticide Use Programs

This is to notify that The City of Red Deer intends to conduct pesticide control programs as necessary during the season. Control programs may include weed, insect pests and mosquitoes (in accordance with Pesticide Service Registration 254731-00-00, issued by Alberta Environment, for landscape and biting fly pesticide applications and Approval 17891-03-00 for mosquitoes). In addition, control of some weeds is required under the regulations of the Provincial Weed Control Act.

All pesticides used and control procedures will be in accordance with federally approved label recommendations and the requirements set by Alberta Environment.

The City of Red Deer uses an Integrated Pest Management (IPM) approach for pest problems. Where possible chemical pesticide controls for pests are only used when alternative control measures would not be effective. Control measures using physical/mechanical (e.g. hand picking weeds and insects, pruning out tree pathogens, use of machinery), biological, and microbial pesticide (e.g. *Bacillus thuringiensis* for mosquito control) methods are used where practical and effective.

For further information concerning dates and locations of pest control applications contact the Recreation, Parks & Culture Department at 403-342-8234.

Tree Pest Alert: Yellowheaded Spruce Sawfly

Parks has identified the Yellowheaded Spruce Sawfly in this area. This pest may ultimately kill your trees. Please read on for information on how to deal with this pest.

The Yellowheaded Spruce Sawfly is active in spring and summer, and may be controlled during these times. It has been present in Red Deer for several years but, recently, populations have increased dramatically. Trees in our community are endangered by this pest.

Damage to spruce needles

Hosts and damage

The Yellowheaded Spruce Sawfly attacks Engelmann, white, black, and blue spruce. Larvae eat most of the foliage/needles. Damage may appear on sections of the tree, not everywhere. Repeated attacks of the Yellowheaded Spruce Sawfly may severely retard the height and radial growth of the tree or kill it.

Larva

Physical characteristics

Larvae are tiny to begin with, often only 3-4 mm long. Mature larvae are 16-20 mm long and have yellowish-brown heads and shiny olive green bodies with paired greyish-green lines the length of the body.

Biology

The sawfly has one generation per year. It overwinters as larvae in soil-encrusted cocoons beneath trees. The adults emerge and lay eggs in mid-May and June. The larvae hatch and begin to feed on new foliage, then move on to old foliage subsequently.

Why should you manage this pest?

The Yellowheaded Spruce Sawfly increases trees' susceptibility to disease and other pests, and can kill your tree. Management of the sawfly will help to control its spread to other properties.

Control procedures

- Hand-picking larvae off trees and disposing of them in sealed garbage bags.
- Pruning (larval control): pruning the tips of branches where the larvae live, and disposing of them in sealed garbage bags.
- High pressure water spray: small larvae cannot crawl back onto the tree if blasted from it with a high-pressure hose. Later stage larvae may be able to crawl back up trees if they are not disposed of after spraying.

For more chemical controls, contact your local garden centre or a pest management company.

Recreation, Parks & Culture
P: 403-342-8234
www.reddeer.ca/parks

APPENDIX G

- Appendix G contains:
  - Description of Parks Weed Inspector and Pest Inspector functions as they apply to operational applications in integrated pest management and in the role of contributing to increased education & awareness about IPM and its requirements
  - Information on community participation

WEED INSPECTOR AND PEST INSPECTOR FUNCTIONS AND COMMUNITY PARTICIPATION

CITY OF RED DEER
PARKS ECOLOGICAL SERVICES TECHNICIAN / WEED INSPECTOR
FUNCTIONS AND RESPONSIBILITES UNDER THE WEED ACT

Introduction

The Weed Inspector is responsible for the following:

A) Monitor public sites for ***prohibited noxious*** and ***noxious weeds*** found in the Weed Act. Weeds and invasive* weed species occur in a number of locations on both pesticide and non-pesticide routes; locations may be in non-sensitive or sensitive areas and may include:
   - Shrub bed and tree well areas; hard surfaced areas (concrete; gravel) and account numbered sites (wastewater treatment plant and other sites)
   - Thistle and other weed patches located in high cut turf areas (parkland mowing); fence and road lines; annexation areas; parks; facilities and natural areas

B) Locate and map prohibited noxious and noxious weed sites.
C) Oversee the physical and mechanical control of prohibited noxious and noxious weeds on public property.
D) Direct the removal of prohibited noxious and noxious weeds along routes where chemical controls are used.
E) Enforcement of the Weed Act on private lands.

* Invasive weed species as identified by the Alberta Invasive Plants Council are often also the same weeds as per the Weed Act

Objectives

- To continue to develop and encourage an open level of communication and increase internal staff/external public education about prohibited noxious and noxious weeds and their acceptable thresholds e.g. tolerable levels
- To acquire a consistent systematic method of control throughout the city e.g. as per the Pesticide Review Process
- To acquire manpower to carry out controls in the required timeframe e.g. as per budget requests; staff re-allocations
- To responsibly delegate pre-monitoring, weed control and post-monitoring for the following site locations and categories:
  1. Seedling/CAGE or reforestation plantings
  2. Mowed parkland
  3. Sensitive areas
  4. Sites with an account # (e.g. Sewage Treatment Plant)
  5. Physical and mechanical control
  6. Herbicide control
  7. Alberta Invasive Plants Council
  8. Annexation lands
- To establish a realistic baseline level of control for all Weed Act species

Priorities

Weeds to be Controlled on City Public Land

Weed Group/Priority of Control Action**	Control Action (Estimated % Time Allocation)	Reason
Group 1	Eradicate (4%)	° Government mandate (Weed Act)
Group 2	Focus on controlling (60%)	° Widely distributed; poisonous/harmful; populations are manageable
Group 3	Control growth alongside creeks, river & roadways (25%)	° Concerns about proliferation in these areas
Group 4	Mowing/weed whipping required (10%)	° Non-chemical method of control
Group 5	Weeds currently controlled (1%)	° Limited sites

**Refer to Attachment I 'summary data table' for details of target weed groups

Recommendations

1. Continue to develop and encourage an open level of communication to increase cooperation and assistance to obtain objectives within the Parks Department to control prohibited noxious and noxious weeds.
2. Provide for summer staff with a focus on non-chemical controls in the mid-season timeframe.
3. Endeavor to provide for a seasonal weed monitoring assistant to help the Weed Inspector; and to establish a mentoring process of acquiring knowledge and training for the assistant.

CITY OF RED DEER
PARKS ECOLOGICAL SERVICES TECHNICIAN / PEST INSPECTOR
FUNCTIONS AND RESPONSIBILITES

Introduction

The Ecological Services Technician / Pest Inspector is responsible for the following:

A) Monitor public sites, and private sites when required, for prominent insect and other pests* noted in the IPM Manual, referred to in the 'Pesticide Review Process', and for rats in the Pest Act. Pest species occur in a number of locations on both pesticide and non-pesticide routes; locations may be in non-sensitive or sensitive areas and may include:
   - Shrub beds and trees
   - High cut turf areas; parkland mowed areas; fence and road lines; annexation areas; parks; facilities and natural areas
   - Wetlands

B) Locate and map pest sites.
C) Oversee and participate in the physical and mechanical control of pests in prescribed routes on public property.
D) Inform the appropriate staff about pest populations along routes where chemical controls are used.
E) Monitor and report on mosquito populations**
F) Enforcement of the Pest Act (e.g. rats) on public and private lands.

* Pest species include insects, some of which are invasive species as defined by various government jurisdictions, and mammals (rats) Re: the Pest Act.
**The Ecological Services Technician / Pest Inspector is not responsible for mosquito control operations

Objectives

- To continue to develop and encourage an open level of communication and increase internal staff/external public education about pests and their acceptable thresholds e.g. tolerable levels
- To acquire a consistent method of non-chemical control throughout the city e.g. as per the Pesticide Review Process
- To acquire manpower to carry out controls in the required timeframe e.g. as per budget requests; staff re-allocations
- To responsibly delegate and/or carry out pre-monitoring, pest control and post-monitoring for the following site locations and categories on public lands; and private lands specific to mosquito control activities and/or other:
  1. Sensitive areas and associated sensitive routes e.g. playgrounds; storm ponds/wetlands and other parkland
  2. Annexation lands
  3. Wetlands on private lands
  4. Other specified areas producing pests
  5. Control activities limited to physical, mechanical and other non-chemical methods
- To establish a realistic baseline level of non-chemical controls for relevant pest species

Priorities

Prominent Pests to be Monitored and Controlled

Pest Group/Priority of Control Action***	Monitor and Control Action (Estimated % Time Allocation)	Reason
Group 1	Eradicate (15%)	° Government mandate+ (Pest Act)
Group 2	Focus on controlling with non-chemical methods (35%)	° Widely distributed; harmful; populations are manageable
Group 3	Control when notified or causing harm – various methods (5%)	° Concerns about proliferation in select areas
Group 4	Monitor (45%)	° Establish control locations

***Refer to Attachment 'summary data table' for details of target pest groups
+Government mandate may be at municipal, provincial or federal level

Recommendations

1. Continue to develop and encourage an open level of communication to increase cooperation and assistance to obtain objectives within the Parks Department to control pests.
2. Provide for summer staff with a focus on non-chemical pest controls.
3. Endeavor to provide for a seasonal pest monitoring assistant to help the Pest Inspector; and to establish a mentoring process of acquiring knowledge and training for the assistant.

COMMUNITY PARTICIPATION

Engaging the community and external organizations is important to the success of an IPM program. The Strategic Plan and the Environmental Master Plan both promote community participation in city programs. The IPM manual provides a technical and operational foundation from which the community and organizations can continue to be engaged, within a reasonable and practical manner, to participate in various pest control initiatives. Activities of this nature can include working with City staff to identify pest problems, helping to identify the source of a pest problem, drafting up pest monitoring and control procedures, monitoring pests, supplying relevant pest information for updating the IPM manual (future on-line version), providing volunteer help in dealing with a pest problem and helping to prepare more concise plans for the elimination of destructive invasive pests. In addition, the community can continue to monitor for the presence of new weed arrivals found in the Weed Act and for other non-weed pest species as they are located in this area (see Page 59, Additional Notes).

APPENDIX H

- Appendix H contains:
  - A brief description of several alternative IPM approaches that are currently being tested in the Parks Department for effectiveness for limited and/or wide-scale use

ALTERNATIVE IPM APPROACHES

Over the last few years a number of alternative approaches to facilitate IPM practices have been tested in Red Deer for both limited and wide-scale use. In some cases this implies a re-thinking of traditional pest management approaches. Rather than trying to directly control a pest, an alternative method is used to enhance the health of the host, in turn lessening the need and quantity of any formal pest control product. In other cases, it merely means testing an unregistered control product that can attain the same result as a registered product.

The use of alternatives is often contingent on the changing perceptions of public acceptance of the control methods used and the level of tolerance for a pest problem. It also considers factors like the economic viability of integrating more expensive products like organic fertilizers.

As an example, organic fertilizers can improve turf quality, thereby helping to reduce the need for herbicides to control weeds normally attained by use of traditional pesticide control methods. Tests are being carried out to look at the feasibility of using these organic fertilizers on a wider scale. Previously, organic fertilizers have been tested in the Parks Department, however at the time they were not found to be cost effective. Cost benefit synergies are now more in line for wide-scale use.

In other cases, advantages resulting in increased pest control can come about by simple and relatively inexpensive means. Common household products like vinegar can be adopted and used in some cases and their use requires no regulatory oversight. In such cases, however, these products generally require more intensive labour activity and costs which must be factored in.

Several alternative IPM approaches are listed below:

- Organic fertilizers help to increase the quality of turf grass. In principle, this in turn gives turf a greater ability to naturally suppress weeds, thereby reducing the need for herbicides.
- Vinegar (acetic acid) is applied directly to weeds to help suppress growth activity.
- Corn gluten meal fertilizer, a natural source of protein and nitrogen, is used to increase the quality of turf grass.
- Super-heated water is applied to weeds to help suppress and eradicate growth.
- Infra-red thermal weed control is used in selective locations such as side walks and park areas to help suppress weed growth.

As other alternative methods and products for pest control become available, they will be tested for effectiveness and applied accordingly in Red Deer as additional approaches to IPM.

7.0 PEST PROFILE INDEX AND PHOTOGRAPHS (DETAILS)

Table 1 Invasive Insects and Insect Pests (Page 60)
Table 2 Mammal Pests and Pathogens (Page 61)
Table 3 Weeds - Prohibited Noxious, Noxious, Invasive Species and Others (Page 62)

[+]Not currently found in Red Deer; monitored only
[++]Beneficial insects are part of the natural surrounding environment and provide biological control of insect pests
[+++]Mammal/Pathogen pests considered invasive
*Invasive weed species as identified by the Alberta Invasive Plants Council and/or the Alberta Native Plant Council; by this definition, all listed *prohibited noxious* weeds, *noxious* weeds and *'others – not in the weed act'* are invasive unless otherwise indicated

Note 1: The pest profiles in the following Section 7.1 (Page 64) contain photographs of different pest target species and related hosts. In most cases, the photographs illustrate actual damage caused by the pest.

In some cases, however, photographs only illustrate an approximation of the pest or host damage which may or may not be fully descriptive and accurate. This is due to a lack of available pest species and actual host damage at the time the photographs were taken. An asterisk (*) is placed next to the letter of the photographs that fit the description of illustrating an approximation of pest or host damage.

In addition, photographs that have been used from some other source are acknowledged and credited at the end of the preceding descriptive page in each pest profile.

Note 2: Some of the text used to compile and describe the individual pest profiles, associated photographs, and other parts of the manual has been referenced from other source material. To the best of our care, all source material cited has been properly compiled and acknowledged in the reference section (See Page 28) of the manual. Any inaccuracies in citations, or omission of any source material, is strictly unintentional and all due credit is herewith extended to the appropriate source.

Additional Notes:
In the IPM manual Parks staff have identified and prioritized the current batch of pest groups largely based on legislation, established City of Red Deer maintenance priorities, and cumulative knowledge and experience. Individuals and community groups have also contributed valuable information that has been helpful in identifying and mapping pest locations, removing pests and helping to increase the level of overall awareness about pests.

To facilitate these activities, the complete list of *prohibited noxious* and *noxious* weeds described in the Weed Act is located at the back of the manual in the supplemental material. This list should be used as a guide to confirm other weeds that are located in this area, at which time they will be added to the weed groups in the IPM manual.

Community resources can also be applied to help locate and monitor pests that fall outside of legislated requirements where there is no mandate by the municipality to control. Much of this type of activity would remain a community driven endeavor; however, if such pests are established by all concerned parties to be deemed significant, practical solutions could be developed for ongoing monitoring and potential control with some of this activity facilitated on a technical level by Parks staff if resources permit.

Table 1 Invasive Insects and Insect Pests

Insect Groups	Priority of Control	IPM Pest #	Tree/ Shrub Host #	Host or Location for Each Group	Routes for Each Group	Thresholds (Upper Limits)	Estimate of % Infestation	Type of Control	Location Re: Control Concerns	Education & Public Notification	Seasonal* Timeframe of Controls
Group 1 ***(Invasive Insects**)***	1										
Asian Long-horned Beetle		70	Many	- Trees	- Established	- Injury	0-100%	- Mechanical	- Sensitive Area	- Newspaper	- Periodic (70)
Elm Bark Beetle (European)		10	1, 43	- Shrub Beds	- Non-established	- Action	(Variable)	- Physical	- Non-sensitive Area	- Letter	- All (10)
Emerald Ash Borer		71	19	- Other		- Eradicate		- Pesticide***	- Ecologically Sensitive	- Website	- Periodic (71)
European Wood Wasp		72	Many						- Non-ecologically Sensitive	- Utility Bill	- Periodic (72)
Gypsy Moth		73	Many						- High Public Use Area		- Periodic (73)
Psyllid (Cottony Ash)		20	9						- Low Public Use Area		- Mid (20)[2+]
Satin Moth		22	Many								- Mid (22)[2]
Group 2[++]	2										
Ash Bark Beetle		3	19, 27	- Trees	- Established	- Injury	0-100%	- Mechanical	- Sensitive Area	- Signage	- Mid/Late (3)[3]
Dogwood Sawfly		9	53	- Shrubs	- Non-established	- Action	(Variable)	- Physical	- Ecologically Sensitive	- Website	- Mid (9)[2]
Elm Bark Beetle (Native)		11	1, 43	- Shrub Beds	- Non-pesticide	- Cosmetic		- Pesticide	- High Public Use Area	- None Required	- All (11)
Forest Tent Caterpillar		13	Many	- Other		- Aesthetic		- Microbial	- No Concerns		- Early (13)[1]
Larch Sawfly		15	2, 44								- Early/Mid (15)[2]
Rusty Tussock Moth		21	Many								- Mid (21)[2]
Spiny Elm Caterpillar		23	Many								- Mid (23)
Spruce Budworm		24	51								- Early/Mid (24)
Ugly-nest Caterpillar		25	Many								- Mid (25)
White Pine Weevil		26	40								- All (26)
Yellowheaded Spruce Sawfly		27	51, 11								- Early/Mid (27)[2]
Yellow Jacket Wasp		28									- Mid/Late (28)[3]
Group 3	3										
Ants (Various)		1	Many	- Trees	- Non-established	- Injury	0-100%	- Mechanical	- Sensitive Area	- Website	- All (1)[4]
Aphids (Various)		2	Many	- Shrubs	- Non-pesticide	- Action	(Variable)	- Physical	- Non-sensitive Area		- Periodic (2)[5]
Ash Plant Bug		4	19	- Shrub Beds		- Cosmetic		- Pesticide	- Ecologically Sensitive		- Periodic (4)[2]
Birch Leafminer		5	32, 50	- Turf / Rough Cut		- Aesthetic		- Microbial	- Non-ecologically Sensitive		- Periodic (5)
Bronze Birch Borer		6	32, 50						- High Public Use Area		- All (6)
Cooley Spruce Gall Adelgid		7	51						- Low Public Use Area		- Periodic (7)
Cottonwood Leaf Beetle		8	8						- No Concerns		- Late (8)
Elm Scale		12	1, 43								- Periodic (12)[5]
Lace Bug		14	Many								- Late (14)[3]
Leaf Roller (Aspen)		17	5								- Early/Mid (17)[1]
Poplar Borer		19	5, 8								- Periodic (19)
Group 4	As Required										
Mosquitoes (Nuisance)		18		- Wetlands	- Established	- Injury	0-100%	- Mechanical	- Ecologically Sensitive	- Newspaper	- All (18)
Mosquitoes (e.g. WNv)[+++]						- Action	(Variable)	- Microbial	- High Public Use Area	- Letter	
									- Low Public Use Area	- Website	
										- Utility Bill	

*Definitions of seasonal timeframe of non-chemical control activity (and generally 'monitoring' which is closely tied to the timeframe of control activity): Early season (April - May); Mid-season (June - July); Late season (August - October); All season (Early/Mid/Late season); Periodic

**Several of the invasive insect species (Asian long-horned beetle; emerald ash borer; European wood wasp; Gypsy moth) listed have not currently been located in this region; however monitoring for these pests by Parks staff is ongoing

***Pesticide means the use of a chemical pesticide control product including e.g. herbicides, insecticides, fungicides, rodenticides, (excluding microbial pesticide products that are not classed as chemicals) and so forth

[+]The non-bracketed superscript number represents the seasonal timeframe when a chemical pesticide control product is used: 1 = Early season (April - May); 2 = Mid-season (June - July); 3 = Late season (August - October); 4 = All season (Early/Mid/Late season); 5 = Periodic

[++]If and when the mountain pine beetle or the banded elm bark beetle establishes a confirmed presence in the Red Deer area it will be added to the appropriate group

[+++]Involvement with mosquito monitoring/control associated with West Nile virus (WNv) is subject to direction received from Alberta Government departments. The City of Red Deer's IPM program will re-establish its involvement in WNv related activities if and when there is a request to do so. Over the last few seasons, through its regular use of light traps, the mosquito program has continued to monitor and track the number and locations of adult mosquito populations considered vectors of WNv

Table 2 Mammal Pests and Pathogens

Mammal and Pathogen Groups	Priority of Control	IPM Pest #	Tree/ Shrub Host #	Host or Location for Each Group	Routes for Each Group	Thresholds (Upper Limits)	Estimate of % Infestation	Type of Control	Location Re: Control Concerns	Education & Public Notification	Seasonal* Timeframe of Controls
Group 1 ***(Mammals)*****	As Required										
Beaver		29	Many	- Trees	- Established	- Injury	0-100%	- Mechanical	- Sensitive Area	- Newspaper	- All (29)
Northern Pocket Gopher		30		- Shrub Beds	- Non-established	- Action	(Variable)	- Physical	- Non-sensitive Area	- Letter	- Early/Mid (30)
Porcupine		31	Many	- Turf / Rough Cut	- Pesticide	- Eradicate (Rat)		- Pesticide***	- Ecologically Sensitive	- Website	- All (31)
Rat++		74		- Turf / Other	- Non-pesticide				- Non-ecologically Sensitive	- Utility Bill	- All (74)
Richardson Ground Squirrel		32		- Wetlands					- High Public Use Area		- Periodic (32)5+
				- Other					- Low Public Use Area		
Group 2+++ (***Pathogens***)	As Required										
Black Knot		33	39	- Trees	- Established	- Injury	0-100%	- Mechanical	- Sensitive Area	- Signage	- All (33)
Cankers (Various)		34	Many	- Shrubs	- Non-established	- Action	(Variable)	- Physical	- Ecologically Sensitive	- Website	- All (34)
Dutch Elm Disease++		35	1, 43	- Shrub Beds	- Pesticide	- Cosmetic		- Pesticide	- High Public Use Area	- None Required	- Periodic (35)
Elm Wilt		36	1, 43	- Other	- Non-pesticide	- Aesthetic			- No Concerns		- Periodic (36)
Fairy Ring		37	Turf	- Turf / Other							- All (37)
Fire blight		38	3								- All (38)
Slime Flux		39	Many								- All (39)
Tree Wilt		40	Many								- Periodic (40)

*Definitions of seasonal timeframe of non-chemical control activity (and generally 'monitoring' which is closely tied to the timeframe of control activity): Early season (April - May); Mid-season (June - July); Late season (August - October); All season (Early/Mid/Late season); Periodic
**No large mammals including ungulates (moose and deer), coyotes, fox and so forth (or birds e.g. crows, magpies) are considered 'pests' within the context of this IPM manual.
***Pesticide means the use of a chemical pesticide control product including e.g. herbicides, insecticides, fungicides, rodenticides, (excluding microbial pesticide products that are not classed as chemicals) and so forth
+ The non-bracketed superscript number represents the seasonal timeframe when a chemical pesticide control product is used: 1 = Early season (April - May); 2 = Mid-season (June - July); 3 = Late season (August - October); 4 = All season (Early/Mid/Late season); 5 = Periodic
++Mammal/Pathogen pests considered invasive
+++Other pathogens that are on the horizon of establishing a presence in Red Deer e.g. bronze leaf disease will be added to this group in subsequent manual updates

Table 3 Weeds - Prohibited Noxious, Noxious, Invasive Species* and Others

Weed Groups (Groups 1-5 are in the Weed Act)	Priority of Control	IPM Pest #	Host or Location for Each Group	Routes for Each Group	Thresholds (Upper Limits)	Estimate of % Infestation	Type of Control	Location Re: Control Concerns	Education & Public Notification	Seasonal[+] Timeframe for Controls
Group 1[+++]	1									
(Prohibited Noxious)										
Common Buckthorn		75	- Shrub Beds	- Non-established	- Injury	0-100%	- Physical	- Sensitive Area	- Newspaper	- Late (75)
Himalayan Balsam		64	- Wetlands	- Pesticide	- Eradication	(Variable)	- Pesticide**	- Non-sensitive Area	- Website	- Mid (64)
Orange Hawkweed		76	- Other	- Non-pesticide				- Ecologically Sensitive	- Utility Bill	- Early (76)
Purple Loosestrife		49						- Non-ecologically Sensitive		- Late (49)
Group 2	2									
(Noxious)										
Black Henbane		57	- Weed Sites	- Established	- Injury	0-100%	- Mechanical	- Sensitive Area	- Newspaper	- Mid (57)
Canada Thistle		41	- Shrub Beds	- Non-established	- Action	(Variable)	- Physical	- Non-sensitive Area	- Letter	- Mid (41)[2++]
Common Baby's Breath		59	- Turf / Rough Cut	- Pesticide			- Pesticide	- Ecologically Sensitive	- Website	- Mid (59)
Common Mullein		60	- Turf / Other	- Non-pesticide			- Biological	- Non-ecologically Sensitive	- Utility Bill	- Mid (60)
Dame's Rocket		63	- Wetlands					- High Public Use Area		- Mid (63)
Field Scabious		45						- Low Public Use Area		- Mid (45)
Leafy Spurge		46								- All (46)[2]
Lesser Burdock		65								- Late (65)[2]
Perennial Sow Thistle		48								- Mid (48)
Scentless Chamomile		50								- Early (50)[2]
Wooly Burdock		67								- Late (67)[2]
Yellow Clematis		52								- Mid (52)
Group 3	3									
(Noxious)			- Weed Sites	- Established	- Injury	0-100%	- Mechanical	- Sensitive Area	- Newspaper	
Common Tansy		43	- Shrub Beds	- Pesticide	- Action	(Variable)	- Physical	- Non-sensitive Area	- Website	- Mid (43)
Tall Buttercup		66	- Turf / Rough Cut	- Non-pesticide			- Pesticide	- Ecologically Sensitive	- Utility Bill	- Mid (66)
			- Turf / Other					- High Public Use Area		
			- Wetlands					- Low Public Use Area		
Group 4	4									
(Noxious)			- Weed Sites	- Established	- Injury	0-100%	- Mechanical	- Sensitive Area	- Newspaper	
Creeping Bellflower		61	- Shrub Beds	- Non-established	- Action	(Variable)	- Pesticide	- Non-sensitive Area	- Website	- Mid (61)
Oxeye Daisy		47	- Turf / Rough Cut	- Pesticide				- Ecologically Sensitive	- Utility Bill	- Mid (47)
White Cockle		53	- Turf / Other	- Non-pesticide				- Non-ecologically Sensitive		- Mid (53)
Yellow Toadflax		68	- Wetlands					- High Public Use Area		- Mid (68)
			- Other					- Low Public Use Area		
Group 5	5									
(Noxious)										
Blueweed		58	- Turf / Rough Cut	- Non-established	- Action	0-100%	- Physical	- Low Public Use Area	- Newspaper	- Mid (58)
Dalmatian Toadflax		62	- Wetlands		- Other	(Variable)			- Website	- Mid (62)
			- Other						- Utility Bill	
Group 6	As									
(Others – Not in Weed Act)	Required		- Weed Sites	- Established	- Action	0-100%	- Mechanical	- Sensitive Area	- Newspaper	
Bull Thistle		69	- Shrub Beds	- Non-established	- Other	(Variable)	- Physical	- Non-sensitive Area	- Website	- Mid (69)
Dandelion		44	- Turf / Rough Cut	- Pesticide			- Pesticide	- Ecologically Sensitive	- Utility Bill	- Mid (44)[1]
Quack Grass		55	- Turf / Other	- Non-pesticide				- Non-ecologically Sensitive		- Mid (55)[5]
White Clover		77	- Wetlands					- High Public Use Area		- Mid (77)[2]
Wild Caraway		54	- Other (Natural Area)					- Low Public Use Area		- Mid (54)
Wild Cucumber		56								- Mid (56)

*Invasive weed species as identified by the Alberta Invasive Plants Council and/or the Alberta Native Plant Council; by this definition, all listed *prohibited noxious* weeds, *noxious* weeds and *'others – not in the weed act'* are invasive unless otherwise indicated

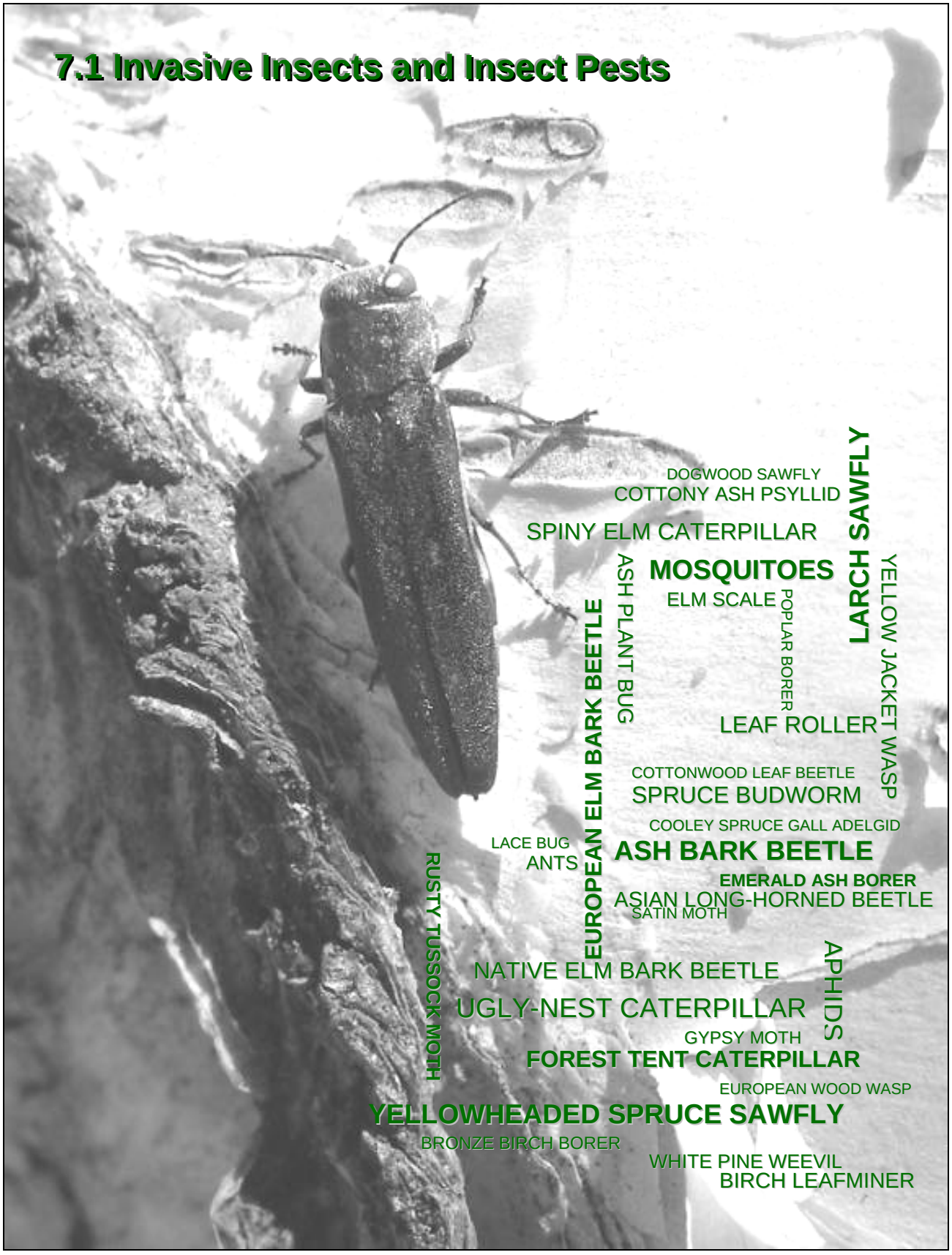
**Pesticide means the use of a chemical pesticide control product including e.g. herbicides, insecticides, fungicides, rodenticides, (excluding microbial pesticide products that are not classed as chemicals) and so forth

[+]Definitions of seasonal timeframe of non-chemical control activity: Early season (May - June) is monitoring & seedling control activity; Mid-season (July-August) is control activity; Late season (September-October) is monitoring & seed control activity

[++]The non-bracketed superscript number represents the seasonal timeframe when a chemical pesticide control product is used: 1 = Early season (May - June); 2 = Mid-season (July-August); 3 = Late season (September-October); 4 = All season (Early/Mid/Late season); 5 = Periodic

+++As additional prohibited noxious and noxious weeds are identified in Red Deer they will be added to the appropriate group in subsequent manual updates

7.1 Invasive Insects and Insect Pests



7.1 INVASIVE INSECTS AND INSECT PESTS

Group 1 – Invasive Insects

ASIAN LONG-HORNED BEETLE (*Anoplophora glabripennis*)

Refer to:
Table 1; Group 1 (Page 60)
Monitoring Season
Periodic
Control Season
None
Rating
Invasive species
Hosts and Damage
- Hardwood trees such as maple, birch, elm, poplar and willow
- Larval galleries in bark cause tree dieback and death; dripping sap is often seen to be flowing from the galleries

Physical Characteristics
- Adults black and shiny with white spots, 20-35 mm in length, have one prominent spine on each side of the thorax and long antennae that are banded with black and white

Biology
- Native to several Asian countries
- One or two generations per year
- The eggs, larvae and pupae can overwinter
- Young adults emerge from infested trees in May and may fly several hundred meters to search for a host; adults are active from early-summer to mid-fall periodically feeding on the bark of twigs throughout the mating and egg-laying period
- On sunny days adult beetles are most active from mid-morning to early afternoon; on cloudy days they usually rest in the canopy
- Females chew oval grooves in the bark in which they lay one egg about 5-7 mm in length; on average, each female will live 40 days and lay 25-40 eggs
- Eggs hatch in one to two weeks; young larvae begin feeding on bark and as they mature they migrate into the wood, creating tunnels as they feed
- Larvae become pupae, then adults, in the tunnels throughout the summer
- The new adults exit the tree through large round holes about 10-15 mm in diameter

Why Manage
- Government mandate
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures (Lure and trap)
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

Photograph A, B and C (Page 65) credit Re: http://www.inspection.gc.ca/english/plaveg/pestrava/agrpla/photoe.shtml#a1 See: Canadian Food Inspection Agency as source.

A

B

C

A) Larva in the bark of a tree. B) Adult Asian long-horned beetle; male and female are similar in appearance. C) Tree with the bark removed exposing a large exit hole created by an emerging adult beetle.

ELM BARK BEETLE (EUROPEAN) (*Scolytus multistriatus*)

Refer to:
Table 1; Group 1 (Page 60)
Monitoring Season
All season (April – October)
Control Season
Periodic for non-pesticide control activity
Rating
Invasive species; eventually fatal to host if left untreated
Hosts and Damage
- All species of elm
- Dutch elm disease can kill mature elm tree in one season

Physical Characteristics
- Adults are small, reddish brown or black usually less than 3 mm long
- The rear end of the abdomen is concave on the underside and has a prominent projection
- Larvae are white, legless grubs with pale yellowish brown heads

Biology
- Originating from Europe
- Vector (transmits) that causes Dutch elm disease
- Overwinters in larval stage in elm firewood and dead or dying elm trees
- Adults emerge in spring or early summer
- Adults feed in the crotches of small twigs on healthy trees where they penetrate into the cambial area. They excavate egg galleries parallel to the grain of the wood in weakened or dying elms

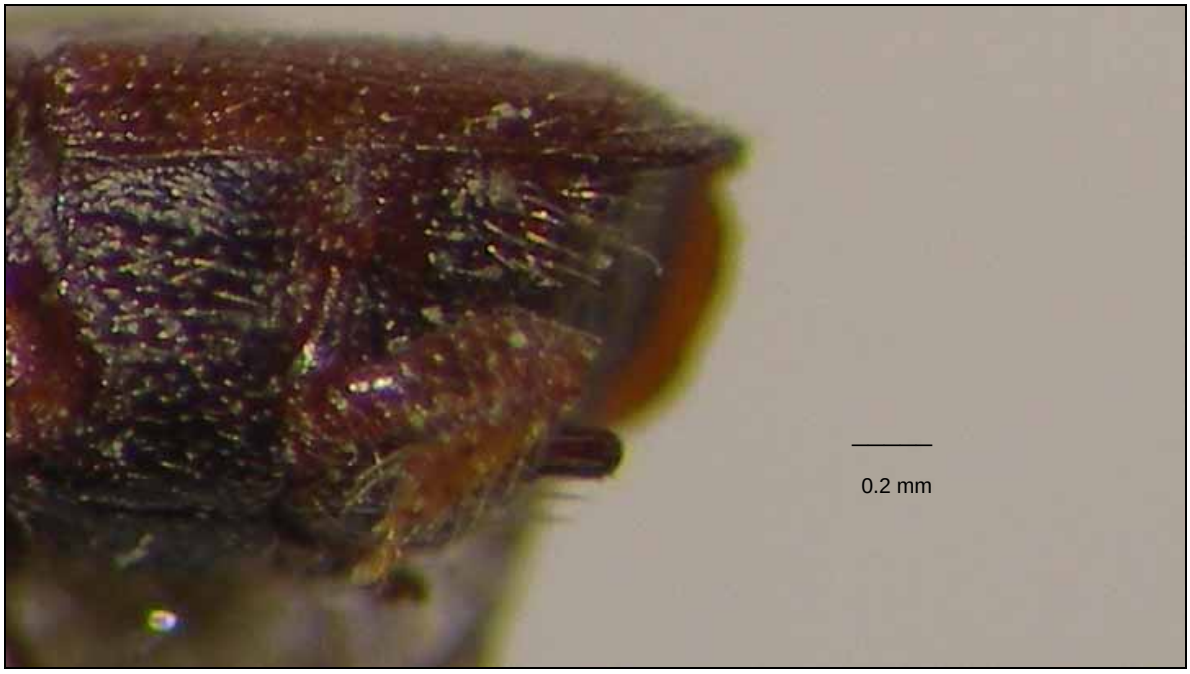
Why Manage
- Government mandate
- Uncertain distribution; likely widely distributed
- To maintain native species balance and variety (biodiversity)
- Control spread from private property using enforcement
- Control spread to private property
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled
- Increased need for vegetation replacement; reduced vegetation value

Monitoring Procedures (Lure and trap)
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: Preventative deadwood pruning October 1 to March 31
- Pesticide: None used at present
- Biological: None used at present

A

B



C

A) Pinned sample of an adult European elm bark beetle; dorsal view. B) Lateral view. C) The posterior part of the beetle's abdomen is concave on the underside with a prominent rounded spine extending from the lower portion.

EMERALD ASH BORER (*Agrilus planipennis*)

Refer to:
Table 1; Group 1 (Page 60)
Monitoring Season
Periodic
Control Season
None
Rating
Invasive species
Hosts and Damage
- Attacks and kills all species of Ash (except mountain ash, which is not a true ash)
- Tree decline may include: thinning crown, diminished density of leaves, evidence of adult beetle feeding on leaves, long shoots growing from the trunk or branches, vertical cracks in the trunk, small D-shaped emergence holes and S-shaped tunnels under the bark filled with fine sawdust

Physical Characteristics
- Larvae are creamy white in colour, with a brown head, a flat, broad shaped body, a 10-segmented abdomen and a mature length of 26-32 mm
- Pupae are 10 -14 mm long and creamy white in colour
- Adults are a metallic blue-green and have a flat head and an elongated body (8.5-14 mm long)

Biology
- Native to eastern Asia
- One generation per year in the east; potentially 2 generations per year in northern distribution but presently unknown
- Adult emergence and mating begins in June and ends in late July
- Following mating the female lays eggs, one at the time, in bark crevices; during lifespan a single female will lay between 60 and 90 eggs
- Within 2 weeks eggs hatch into larvae which chew s-shaped galleries into the inner bark of the tree where they overwinter until pupation in the spring
- Adults are active during the summer months, eating small amounts of foliage, but it is the larvae that cause tree damage and death

Why Manage
- Government mandate
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures (Lure and trap)
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

Photograph A, B, C, D and E (Page 69) credit Re: http://www.inspection.gc.ca/english/plaveg/pestrava/agrpla/photoe.shtml#a1 See: Canadian Food Inspection Agency as source.

A

B

C

D, E

A) The ash borer is a destructive pest of ash trees during the summer months. B) Larvae feeding under the bark create serpentine gallows or tunnels. C) Galleries filled with sawdust and frass range in length from 9-30 cm; adult exit holes are visible. D) Larvae have a broad shaped flat body, are creamy white with a brown head and 26-52 mm long at maturity E) Adult is a metallic blue-green beetle.

EUROPEAN WOODWASP (*Sirex noctilio*)

Refer to:
Table 1; Group 1 (Page 60)

Monitoring Season
Periodic

Control Season
None

Rating
Invasive species

Hosts and Damage
- Main host is pine but will also attack spruce and fir; attacks living trees
- Wasps serve as a vector for a fungus that kills pine trees
- Symptoms of an infestation may include dead branches, beads of resin or drips flowing from holes, wilted or yellow-headed needles on branches and 3-8 mm exit holes in tree

Physical Characteristics
- Eggs elongate-oval, white, soft, smooth and 1.0 x 0.3 mm
- Larvae are creamy white, legless, have distinctive tail spike and grow to 30 mm long
- Adults have a metallic blue-black colouration, a stout upturned spine (cornus) at the end of the abdomen, four clear yellow membranous wings and a pointed abdomen and are 9-36 mm in length
- Female bodies have a prominent ovipositor located beneath the spine and legs are reddish-yellow; males have orange middle abdominal segments and black hind legs

Biology
- Native to Europe, Asia and northern Africa
- One to two year life cycle
- Females use ovipositor to cut holes 12 mm deep into outer sapwood where they inject up to 3 eggs, a symbiotic fungus and toxic mucus in each hole; fungus and mucus act together to kill the tree and create a suitable environment for larval development
- Females lay 25-450 eggs, depending upon size of the female
- The number of larval instars varies from 6 to 12 over a period of 10-11 months
- Larval feeding creates galleries 50-200 mm long; mature larvae pupate near bark surface
- In mid-summer adults emerge as strong fliers through circular holes 3-8 mm in diameter, following which they are attracted to stressed trees where they lay their eggs

Why Manage
- Government mandate
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures (Lure and trap)
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

Photograph A, B, C and D (Page 71) credit Re: http://www.inspection.gc.ca/english/plaveg/pestrava/sirnoc/tech/sirnoce.shtml See: Canadian Food Inspection Agency as source.

A

B

C

D

A) Adult male European wood wasp. B) Adult female. C) Long tunnel created by a feeding larva in the wood of a tree. D) Sap from a pine tree weeping from holes drilled by female wasps to lay eggs.

GYPSY MOTH (*Lymantria dispar)* (European & Asian Varieties)

Refer to:
Table 1; Group 1 (Page 60)
Monitoring Season
Periodic
Control Season
None
Rating
Invasive species
Hosts and Damage
- Hosts include wide range of trees and shrubs such as oak, maple, alder, willow, elm and trembling aspen; the Asian variety also does well on some coniferous species
- Damage caused exclusively by the caterpillars which feed on leaves in the spring

Physical Characteristics
- Hairy larvae reach 30-65 mm at maturity and have yellowish brown bodies with a mid-dorsal row of blue and red tubercles
- Pupae reddish brown with yellow hairs; females (>35 mm) larger than males (>20 mm)
- Males are brown with irregular black wing markings, have a feather-like antennae; wingspan of 35-40 mm. Females whitish with dark wavy bands; wingspan of 55-70 mm

Biology
- Native to Europe, Asia and northern Africa; one generation per year
- Overwinters in the egg stage and hatches when weather warms (April to May)
- Normally 5 male and 6 female larval instars
- Larvae disperse when numerous and food becomes insufficient
- By late June or early July, after 6-8 weeks feeding, most larvae move to protected locations, such as bark crevices, to pupate
- Pupal stage lasts an average of 10 days for individual females and 13 days for males, and occurs over a month (July) or more for a local population
- Moths emerge mid-summer, mate, and lay of egg masses from mid-summer to early fall
- Females of the European variety are flightless, but those of the Asian variety are strong fliers thus increasing the spread of distribution

Why Manage
- Government mandate
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures (Lure and trap)
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

Photograph A, B, C and D (Page 73) credit Re: http://www.inspection.gc.ca/english/plaveg/pestrava/agrpla/photoe.shtml#a1 See: Canadian Food Inspection Agency as source Re: Thérèse Arcand, Natural Resources Canada, Canadian Forest Service, Laurentian Forestry Centre

A

B

C

D

A) Mature larva depicting the long tufts of yellow hair and rows of blue and red tubercles. B) Adult female Gypsy moth. C) Adult male; only the male can fly. D) A Gypsy moth pupa attached to the side of a branch; the brown casing and yellow hairs are indicators of this species.

PSYLLID (COTTONY ASH) (*Psyllopsis discrepans*)

Refer to:
Table 1; Group 1 (Page 60)
Monitoring Season
Mid season (June – July)
Control Season
Mid season (June – July) for both pesticide and non-pesticide control activity
Rating
Invasive species
Hosts and Damage
- Black and Manchurian ash (Fraxinus nigra and Fraxinus mandshurica)
- The nymphs have piercing and sucking mouth parts and do not chew leaves
- Leaves become curled and extremely distorted
- Twig and branch die back
- Repeated attacks may kill the tree

Physical Characteristics
- Eggs are elongated, white and barely visible
- Nymphs or immature psyllid are extremely tiny (0.5-1 mm) with orange eyes
- Adults are 2 mm and resemble a cicada or aphid
- Adults have wings and also jump to other host leaves

Biology
- Two generations per year
- Overwinter as eggs on buds, twigs and bark crevices
- First generation larvae emerge at the same time as the leaves (mid to late May)
- Nymphs cause leaf distortion and feed within the leaf curl
- Nymphs produce and live in a cotton like substance within the deformed leaf
- Adults emerge, mate and lay eggs late June and early July
- Second generation emerge mid to late July to repeat the cycle

Why Manage
- Government mandate
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: Pruning (larval control; preventative deadwood)
- Pesticide: Insecticidal soap; dormant oil
- Biological: None used at present

A

B

C, D, E

F, G

A) Severe defoliation on an ash tree. B) Pruning out defoliated branches. C) Leaves curled from the outer edges to the inner rib. D) Severely curled leaf. E) Canker on the tree trunk. F) Nymph (immature stage) with cottony substance exuding from its hind section in a curled up leaf. G) Early nymph stage.

SATIN MOTH (*Leucoma salicis*)

Refer to:
Table 1; Group 1 (Page 60)
Monitoring Season
Mid season (June - July)
Control Season
Mid season (June - July) for pesticide and non-pesticide control activity
Rating
Invasive species
Hosts and Damage
- Main hosts include poplar and willow species
- Defoliation damage by caterpillars

Physical Characteristics
- Light green, flat eggs are laid on leaves, branches and trunks in oval batches of up to 400; eggs covered with a glistening, white secretion
- Larvae are grayish-brown with a dark head and back, with one row of large, oblong white or pale-yellow patches along the middle of the dorsal surface and two sub-dorsal yellowish lines; two lateral and two sub-dorsal rows of orange tubercles have tufts of long brownish hairs attached to them; larvae are 35-45 mm long when full grown
- Pupae are shiny black, 15-22 mm long, and have tufts of yellowish hairs
- Adult moths have stout, black bodies covered in dense white hairs and wings that are satiny white and have no markings; wingspans of 24-47 mm

Biology
- Native to Europe
- One generation per year and 7-8 larval instars
- In early fall eggs hatch and young larvae move to the leaves, which they skeletonize as they develop through two instars
- Second instar larvae seek out hibernation sites on the trunk or branches of a host tree and molt after spinning silken coverings (hibernacula) covered with bark and mosses
- After overwintering, larvae emerge and commence feeding on new leaves
- Upon completion of feeding in late June or early July, larvae construct conspicuous loosely woven silken cocoons in rolled leaves, on twigs, or in bark crevices, in which they pupate
- Moths emerge from pupae after about 10 days, appearing in July and August

Why Manage
- Government mandate
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: Larval control: handpicking and pruning
- Pesticide: Malathion (foliar spray; backpack and truck mounted high pressure sprayer)
- Biological: None used at present

A*

B

C

A) Severe defoliation on NW poplar can occur; it would appear similar to these normally defoliated poplar trees in the fall time. B) Crevices on the bark covered with webbing. C) Abundant larvae in the webbing.

Group 2 – Insect Pests

ASH BARK BEETLE (*Hylesinus californicus*)

Refer to:
Table 1; Group 2 (Page 60)

Monitoring Season
All season (April – October)

Control Season
All season (April – October) for non-pesticide control activity
Late season (August – October) for pesticide control activity

Rating
Insect pest; eventually fatal to host if left untreated

Hosts and Damage
- Patmore green ash, black ash, Manchurian ash
- Initially attack and kill small twigs and branches, but as the tree becomes weaker they may attack larger branches and eventually the bole of the tree causing death
- Branches girdled by larval tunnels exhibit yellow leaves by late June or early July

Physical Characteristics
- Larvae are C-shaped, legless and white with a brown head
- Adults are 2.0 – 3.0 mm long; grey and brown in colour

Biology
- One generation per year
- Overwinter as adults in litter at base of tree
- Adults emerge in late May or early June
- Females construct galleries with rows of ventilation holes and lay eggs
- When larvae hatch, they tunnel parallel to grain and create exit holes above girdle line toward the end of the branch

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Pruning (larval control; preventative deadwood)
- Pesticide: Malathion (backpack sprayer)
- Biological: None used at present

A

B

C

D

A) Damage and defoliation on an ash tree branch. B) Details of the branch damage; stunted leaf growth is evident. C) Adult egg gallery under the bark; enlarged egg ventilation holes encircle the branch; as larvae mine chambers under the bark the branch eventually dies; a round adult exit hole is present above the egg gallery. D) Adult western ash bark beetles are minute in size and do not directly contribute to branch damage.

DOGWOOD SAWFLY (*Macremphytus tarsatus*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
Mid season (June – July)
Control Season
Mid season (June – July) for pesticide and non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- All species of dogwood
- Larvae skeletonize the leaves of dogwood shrubs

Physical Characteristics
- Adults are rarely seen
- Larvae have shiny black head and after second molt the body is covered with a white powder-like material that can be rubbed off
- When nearly full grown, the back is creamy yellow marked with grayish-black bands or spots and yellowish legs.
- Full grown larvae are 35 mm long

Biology
- One generation per year
- Overwinters as pre-pupae larvae in cocoons in cells constructed in rotting wood lying on the ground
- Pupation occurs in spring
- Adults emerge from late May to July
- Eggs are laid on underside of leaves
- Larvae are present from July to October
- May remain dormant for one or more years

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Handpicking and pruning (larval control)
- Pesticide: Malathion (foliar spray; backpack sprayer)
- Biological: None used at present

A

B*

C

A) Leaves of the red osier dogwood shrub. B) Larvae (preserved samples) of the dogwood sawfly are present late in the season and strip the shrub; feeding damage on the shrub does not necessarily look like this. C) The appearance of the larva changes through various stages; initially it appears powdery white, followed in its latter stages as yellowish-green with prominent black head and spots.

ELM BARK BEETLE (NATIVE) (*Hylurgopinus rufipes*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
All season (April – October)
Control Season
Periodic for non-pesticide control activity
Rating
Insect pest; eventually fatal to host if left untreated
Hosts and Damage
- All species of elm
- Dutch elm disease can kill a mature elm tree in one season

Physical Characteristics
- Adults are small, dark brown to black beetles between 2.0 and 3.5 mm long
- Larvae are white, legless grubs with pale yellowish brown heads

Biology
- Vector (transmits) that causes Dutch elm disease
- One generation in prairies
- Most over-winter as adults
- Some over-winter as larvae
- Over-wintering adults emerge from excavated tunnels near the base of healthy elms in the spring to feed on the bark in crotches of healthy elm branches. They then fly to dead or dying elms to build brood galleries, mate and lay eggs. More galleries are constructed by the larvae, which feed on the fungus until becoming adult beetles.
- Adult beetles fly to healthy elms to feed before overwintering
- Beetles that overwinter as larvae develop in spring and emerge as adults in late June or July

Why Manage
- Uncertain distribution; likely widely distributed
- Control spread to private property
- Control spread from private property using enforcement
- To maintain native species balance and variety (biodiversity)
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures (Lure and trap)
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling; eradication)
- Physical/mechanical: Preventative deadwood pruning October 1 to March 31
- Pesticide: None used at present
- Biological: None used at present

A

B

C

A) Pinned sample of an adult native elm bark beetle; dorsal view. B) Lateral view. C) The posterior part of the beetle is convex and it lacks a prominent spine extending from the lower portion.

FOREST TENT CATERPILLAR (*Malacosoma disstria*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
Early season (April – May)
Control Season
Early season (April – May) for pesticide and non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Prefers aspen but also other broadleaf trees and shrubs including birch, mayday and Saskatoon
- Defoliation by larvae, if light, has little effect or lasting damage
- Two or more years of defoliation can cause severe reduction in growth

Physical Characteristics
- Adults are stout-bodied moths light yellow to buff brown in colour with two dark bands on the fore wings and a wingspan of 35-45 mm
- Eggs are found on small twigs in bands that appear silvery in color when laid but turn dark brown with maturity
- Young larvae are black and hairy about 3 mm long and mature to 45-55 mm long with broad bluish lateral bands and white keyhole shaped markings on a brownish black background emerge when aspen buds begin to break
- Larvae leave a trail of silk wherever they go and when not feeding cluster together in crotches of larger branches and on the trunk of the tree; spin a yellowish-white cocoon

Biology
- One generation per year
- Larvae hatch in early spring (5 instars) and are gregarious (colony feeding)
- Outbreaks typically last 4 or 5 years

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

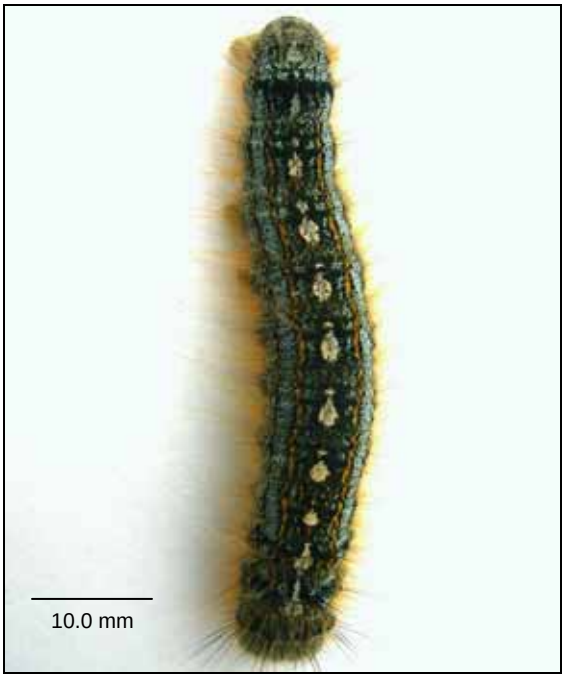
Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Handpicking (egg band removal; larval control)
- Pesticide: Microbial pesticide *Bacillus thuringiensis kurstaki* (Btk); Malathion (foliar spray; truck mounted high pressure tank sprayer)
- Biological: None used at present

A

B

C



D

A) Damage and defoliation of a tree. B) Egg bands are usually attached around a branch that is approximately the size of a pencil. C) As the caterpillars mature they often cluster on tree trunks; this affords a good opportunity to control large numbers of larvae by physically removing and disposing of the cluster. D) Full grown larva.

LARCH SAWFLY (*Pristiphora erichsonii*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
Early/mid season (April – July)
Control Season
Mid season (June – July) for pesticide and non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Larch species
- Moderate to severe defoliation
- Prolonged defoliation will cause twig and branch mortality and may eventually kill the tree, although the tree can generally withstand a surprising amount of defoliation

Physical Characteristics
- Larvae have three pairs of thoracic legs and 7 pairs of abdominal prolegs, are pale green with brownish or black heads, and are 16 mm long at maturity
- Female adults are about 10 mm long, predominantly black with an orange band around the abdomen and orange or yellowish markings on the legs

Biology
- Normally one generation per year
- Adults emerge over a prolonged period in late May or early June
- Eggs are laid in slits cut into elongating shoots causing shoots to curl
- Larvae are gregarious and feed in colonies
- Overwinters as a larvae in tough leathery cocoons spun in moss or duff

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Handpicking (larval control); pruning; washing with water
- Pesticide: Malathion; insecticidal soap (foliar spray; backpack and truck mounted high pressure sprayer)
- Biological: None used at present

A

B

C, D

A) New larch buds exhibit a slight bend where larvae initiate feeding. B) Larvae are very small and feed on a single needle. C) Fully grown larvae feed in clusters, stripping branch tips clean; note black head capsule and dual shade of green. D) Adult sawflies have an orange band around the abdomen.

RUSTY TUSSOCK MOTH (*Orgyia antiqua*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
Mid season (June – July)
Control Season
Mid season (June – July) for pesticide and non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Feeds on a variety of hosts, including most conifers and all hardwoods
- Normally does not cause sufficient defoliation to damage trees

Physical Characteristics
- Larvae are 25-30 mm long, very hairy with dense whitish or yellowish tufts of hair along the back**;** black pencil tufts – two at the front, two on the sides and one at the rear along back
- Male moths are brownish with a wingspan of 25-30 mm
- Female moths are wingless, brown and 20 mm long

Biology
- One generation per year
- Over-winters in egg stage; eggs laid in a mass on the female cocoon – uncovered
- Larvae emerge in June and move onto foliage
- European species accidentally introduced

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Handpicking and pruning (larval control)
- Pesticide: Malathion (foliar spray; backpack and truck mounted high pressure sprayer)
- Biological: None used at present

A, B

C, D

E

F

A) Caragana is a common host of rusty tussock moth. B) Damage usually entails complete stripping of vegetation from branches. C) Egg masses are laid on the female's cocoon; small, very hairy larvae emerge. D) Peeling back the egg mass reveals the underlying cocoon. E) Larvae mature and add distinctive tuft-like features as they grow. F) Mature larvae can reach a length of 3 cm and they have four prominent yellow tufts of hair along their back.

SPINY ELM CATERPILLER (*Nymphalis antiopa*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
Mid season (June – July)
Control Season
Mid season (June – July) for non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Feeds on willow, white elm, trembling aspen and a variety of other hosts
- Causes moderate to severe defoliation in localized infestations
- Little permanent damage is done to the plant

Physical Characteristics
- Adults are known as mourning cloak butterflies and have a wingspan of 60-80 mm
- Their bodies are almost black with wings that are a rich purplish brown with a row of blue dots, a broken whitish line and a creamy-colored border
- Mature larvae are 50 mm long, black with numerous white dots and have larger red dots on their backs
- Their bodies are covered with numerous branched spines

Biology
- One generation per year
- Overwinters as an adult
- Adults emerge from hibernation in early spring and lay clusters of eggs on small twigs
- Larvae are gregarious and often completely defoliate one branch before moving to another

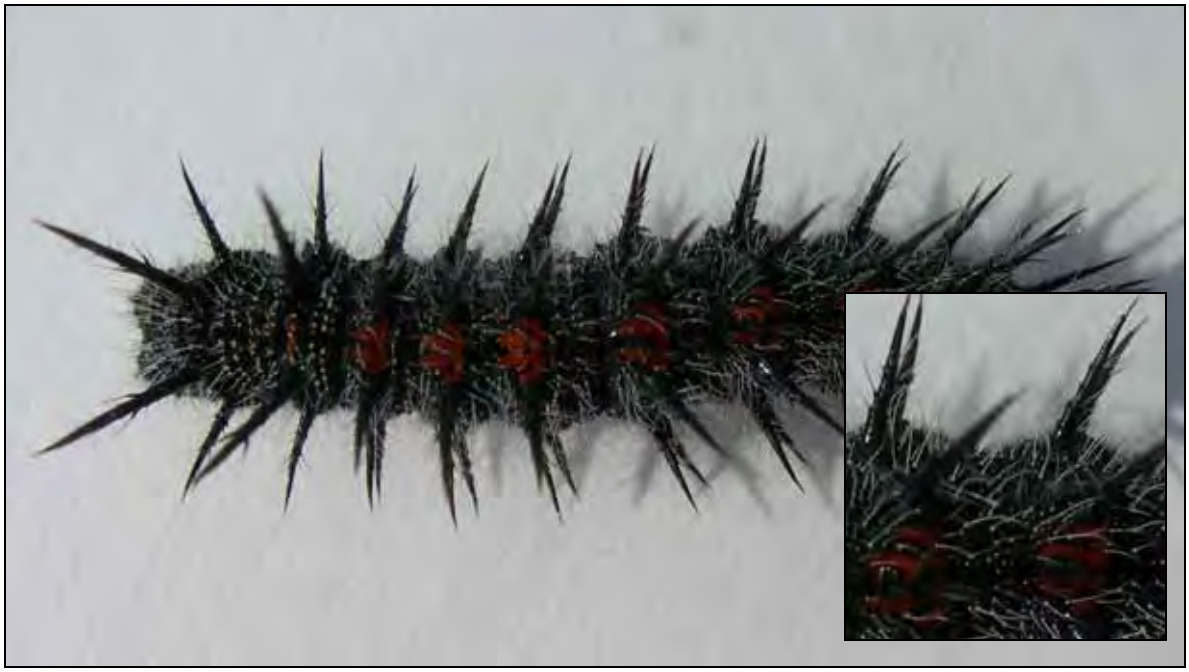
Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Hand picking (larval control on plants)
- Pesticide: None used at present
- Biological: None used at present

A, B*

C, D*



E, F

A&B) Elm trees and leaves are fed upon by this insect. C&D) Similarly, poplar trees and leaves are also a food source; in both cases, leaf damage is representational only. E) The larval stage, with prominent spines and red dorsal markings, is the feeding stage that causes damage to the leaves. F) Close-up of the large spines and small white hairs covering the larva.

SPRUCE BUDWORM (*Choristoneura fumiferana*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
Early/mid season (April – July)
Control Season
Early/mid season (April – July)
Rating
Insect pest
Hosts and Damage
- Hosts include balsam fir, white spruce, and black spruce. A wasteful feeder – eating needles at the base and leaving remainder entangled in a mass of silk
- Foliage dries reddish colour; prolonged outbreaks cause severe branch mortality
- Ultimately causing tree mortality

Physical Characteristics
- Adults have wingspan of 20 mm; usually have dull grey forewings with bands and spots of brown; hind wings are usually grey
- Young larvae are yellowish and have dark brown heads
- Mature larvae are 18-24 mm with black heads, reddish brown bodies and lighter in colour on sides

Biology
- One year lifecycle
- Adults emerge June or July
- Green eggs (1-60) on needles, hatch in 10 days
- First instar larvae spin hibernacula under bark scales and molt to second instar without feeding
- Second instar larvae emerge from hibernation in April or May
- Pupae form on foliage in June

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

A

B

A) Spruce budworm is often found in areas of native spruce trees found throughout the river valley (no budworm presently at this location) where larval populations can be substantial; if present, the trees would exhibit an overall brownish hue in the canopy. B) The spruce covered escarpment area on the far left is typical of where larger budworm outbreaks can occur.

UGLY NEST CATERPILLAR (*Archips cerasivorana*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
Mid season (June – July)
Control Season
Mid season (June – July) for non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Usually feeds on choke cherry but sometimes attacks pin cherry and other hardwood trees and shrubs
- Larvae skeletonize and devour most leaves and fruit
- Unsightly due to nests; in some cases nest can envelop entire shrub
- Best control – removal of nest at early stage

Physical Characteristics
- Adult has dull reddish orange head, thorax, and forewings with a wingspan of 20-24 mm; hind wings are bright orange
- Larvae are 20-23 mm long and have yellowish bodies with dark brown or black heads
- All larval stages live in a silk-covered tent that become filled with frass (insect waste) as the larvae grow

Biology
- One generation per year
- Overwinter as eggs on trunks and branches
- Eggs hatch in late spring (approximately the same time as leaves appear); all eggs hatch at the same time
- Larvae crawl to the top of host and begin feeding and constructing webbing nests
- Pupation in silken cells from late June to early September
- Adults emerge and are active from July to September

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Handpicking and pruning (larval control)
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Web covered shrubs in a naturalized area. B) Close-up of the shrub indicates leaf defoliation; note the lack of infestation on surrounding shrubs that are not the same species. C) Webs are thick and strongly build, binding leaves and branches firmly together. D) Caterpillars feed, grow and deposit frass (droppings) within the web massed leaves.

WHITE PINE WEEVIL (*Pissodes strobi*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
All season (April – October)
Control Season
All season (April – October) for non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Attacks most species of pine and spruce
- Kill or seriously injure leaders on host tree
- Two or more years growth is affected and repeated attacks cause crooked or bushy trees

Physical Characteristics
- Adults are dark brown or black, 4-6 mm long with a slender curved snout; wing covers are marked with patches of brown and white scales
- Larvae are white, legless grubs with light brown heads

Biology
- One generation per year
- Overwinters as sexually immature adults in duff beneath the trees
- Adults emerge in spring and begin feeding, leaving wound on the tender bark below dormant terminal buds
- Eggs are deposited in feeding punctures and larvae hatch in about 10 days
- Larvae feed in cambial area and congregate into a feeding ring – girdling stem
- Adults emerge in late August or early September, feed for a brief period, then enter duff

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Pruning (larval control; preventative deadwood)
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Spruce tree with its leader de-needled; damage is typically found on individual trees in the urban setting rather than in native spruce stands. B) Close up of the dead central leader. C) Adult weevil exit holes in the leader. D) Close up of exit holes.

YELLOWHEADED SPRUCE SAWFLY (*Pikonema alaskensis*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
Early/mid season (April – July)
Control Season
Mid season (June – July) for pesticide and non-pesticide control activity
Rating
Insect pest; eventually fatal to host if left untreated
Hosts and Damage
- Attacks Engelmann, white, black, and blue spruce
- Damage is speckled unless in large populations
- Repeated attacks may kill or severely retard height and radial growth

Physical Characteristics
- Larvae are 16-20 mm long and have yellowish brown heads and shiny olive green bodies with paired grayish green lines the length of the body

Biology
- One generation per year
- Overwinters as larvae in soil-encrusted cocoons beneath trees
- Adults emerge mid May and June
- Larvae feed on new foliage then move to old foliage

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Larval control: handpicking and pruning; washing with water
- Pesticide: Malathion; insecticidal soap (foliar spray; backpack and truck mounted high pressure sprayer)
- Biological: None used at present

A

B

C, D

E

A) Damage and needle defoliation on a white spruce tree. B) Yellowheaded spruce sawfly larvae feed indiscriminately on needles throughout the tree; when younger they blend well with the tree's needles; the brown head capsule is a distinguishing feature. C) Mature larvae are darker green with prominent black stripes along the back; they reach 2 cm in length. D) Needle damage is unsightly appearing. E) Insecticide application to control larvae.

YELLOW JACKET WASP (*Vespula Spp.*)

Refer to:
Table 1; Group 2 (Page 60)
Monitoring Season
All season (April – October)
Control Season
Mid/late season (June – October) for non-pesticide control activity
Periodic for pesticide control activity
Rating
Insect pest
Hosts and Damage
- Meat and liquid sweets are very attractive food materials so wasps can become a serious nuisance around homes and recreational areas
- They are capable of stinging repeatedly when annoyed and may attack in force if their nest is endangered

Physical Characteristics
- Adults are 12-25 mm long, black with yellow markings
- Eggs are milky white, 1-2 mm long and sausage-shaped
- Larvae are creamy white legless grubs

Biology
- Overwinter as fertilized females (queens) in protected places, frequently near homes and buildings
- Beneficial, social insects that live in colonies that attack and destroy harmful insects
- Queens emerge in April or May and select nest sites. Nests may be above or below ground and are made of wood fibre chewed to resemble paper. Often found hanging from a tree branch, they are papery, grey and egg-shaped with an entrance at the bottom
- Most wasps are scavengers, primarily feeding on other insects and food remnants, often congregating at garbage cans

Why Manage
- Widely distributed; populations are manageable
- Public perception and complaints; control spread to private property
- Reduced use of parks
- Reduced recreation opportunities

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Focus on controlling with non-pesticide methods)
- Physical/mechanical: Physical removal of nest
- Pesticide: Wasp and Hornet Blaster (aerosol)
- Biological: None used at present

A

B

C

D

A) Wasp nests are often large and are found in natural tree areas, shrub beds, hedges, and in and around built structures; wasps hover for some distance near the nest and are very territorial. B) When undisturbed, wasp numbers around the nest are often low; however when disturbed, hundreds of wasps can suddenly emerge and be dangerous to bystanders. C) Wasps deliver a painful sting from the end of their abdomen. D) Control measures require protective clothing and extreme caution.

Group 3 – Insect Pests

ANTS (Various Species)
E.g. CARPENTER ANT (*Camponotus herculeanus*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
All season (April – October)
Control Season
All season (April – October) for pesticide and non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- All tree species in decline are susceptible
- Carpenter ants prefer to nest in moist decaying wood however they will tunnel through dry wood; generally inhabit trees with decaying wood resulting from wounds or age

Physical Characteristics
- Carpenter ants are the largest and most conspicuous ants on the prairies
- Workers are brownish or blackish from 6–13 mm in length
- Queens are winged and may be over 25 mm in length

Biology
- All ants are social insects living in nests with all stages of their life cycle present
- Carpenter ants make nests out of wood, they do not eat wood, but use softened (rotten) wood to make galleries in which to rear young
- Principal food is honey dew produced by aphids
- Piles of sawdust at the bases of trees and posts indicate nest activity

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints of biting park users; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Removal of nest
- Pesticide: Ant and grub killer (bait/feeding)
- Biological: None used at present

A

B

C

A) Ants are social insects living in nests with all growth stages present; nests are found in forested natural areas, manicured parks and residential areas. B) Ants are usually black or red and are very active collecting nest materials and food. C) One method to avoid pesticide use and to deal with a problem hill is to physically relocate it away from private property into a native area.

APHIDS (Various Species)
E.g. WITCHES' BROOM APHID (*Hyadaphis tataricae*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
Periodic
Control Season
Periodic for non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Various species including honeysuckle and Manitoba maple
- The piercing and sucking behavior of aphids feeding on honeydew produces various abnormal growths such as large, warty growths on the bark, curling and swelling of leaves, and gall formations on foliage and stems
- Aphids attacking flowers cause the flowers to wilt and drop off
- Severely infested plants will weaken and dry up
- Some species are capable of transmitting fungal and viral diseases

Physical Characteristics
- Aphids are pear-shaped and less than 2 mm in length with long antennae
- Generally pale green in colour but some are yellowish, brown, pink or black
- They have a pair of tube-like structures known as cornices protruding from the back
- Adults may be winged or wingless with both forms appearing at the same time

Biology
- All aphids have several generations per year; females lay eggs or give birth to live young
- Aphids overwinter as small, hard-shelled eggs attached to stems of plants which will serve as food hosts for the newly hatched nymphs
- Eggs hatch in the spring about the time of active bud development

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning; high pressure wash
- Pesticide: None used at present
- Biological: None used at present

A

B

C

A) Aphids are minute pear shaped insects, generally green, black or yellowish in color; there are numerous daughter generations during the growing season which accounts for there abundance. B) Aphids feed by inserting their mouth parts into plant tissue; they are usually found facing downward. C) Large maple trees provide honeydew for aphids – which in turn can often cause a problem by creating sticky benches in parks.

ASH PLANT BUG (*Tropidosteptes amoenus*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
Periodic
Control Season
Mid season (June – July) for pesticide control activity
Rating
Insect pest
Hosts and Damage
- Green ash
- Leaf sucking, severe damage causes a scorched appearance and premature leaf drop

Physical Characteristics
- Adults are light tan in colour with pinkish markings approximately 5 mm long

Biology
- Two generations per year
- Overwinters in egg stage on the bark of host
- Nymphs emerge in spring when the leaves are unfurling and feed on underside of leaves**;** young nymphs become more like an adult with each molt
- First generation adults appear in midsummer
- Second generation appear in late summer and are active until first severe frost

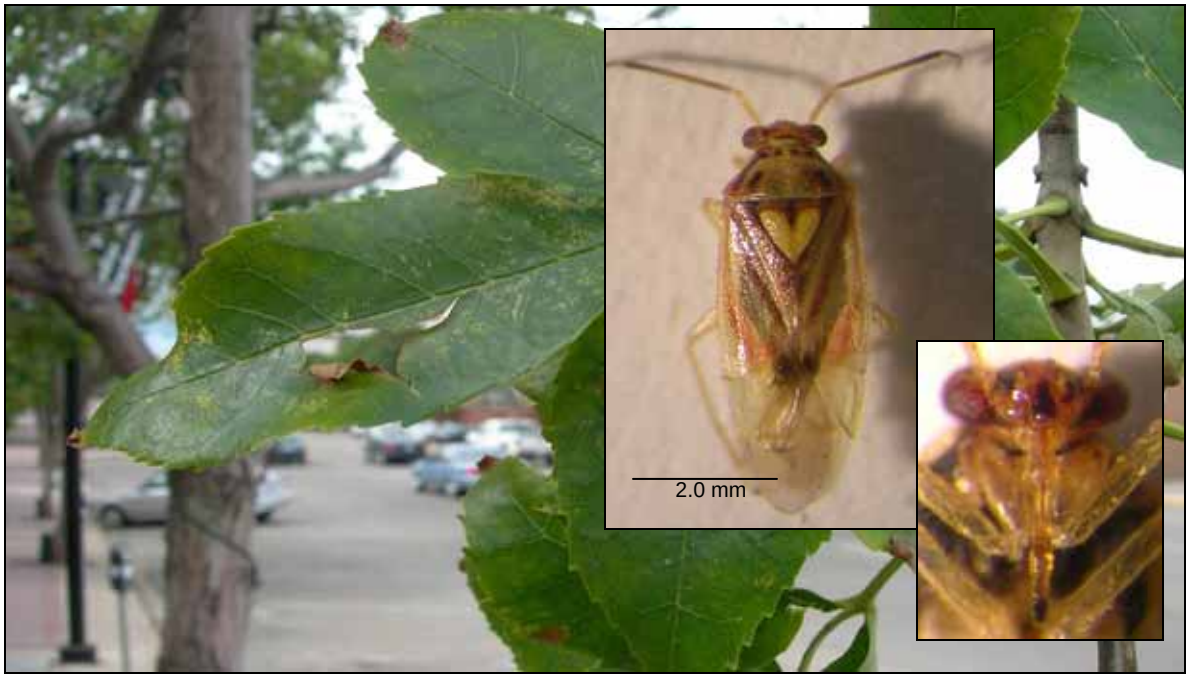
Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

A

B



C, D, E

A) Damage and defoliation on an ash tree. B) The ash plant bug causes damage to the host by inserting its mouthparts into the leaf tissue and sucking out the plant sap. C) Damage ranges from yellow stippling on the upper leaf surfaces to wilted and deformed leaves. D) Adults range in color from green to black, with pinkish markings. E) Close up of the piercing mouthparts of an adult.

BIRCH LEAFMINER (*Fenusa pusilla*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
All season (April – October)
Control Season
Periodic
Rating
Insect pest
Hosts and Damage
- Native and ornamental birches are attacked; trees become very unsightly
- Causes leaves to dry out and turn brown; this does not seriously affect health of trees unless unusually severe and prolonged

Physical Characteristics
- Eggs are ovoid and translucent when laid gradually turning opaque white
- Larvae are 7 mm in length, flattened with a brown head and white body that may have black spots on the underside.
- Pupae are white, 3.3 mm in length and gradually turn brown
- Adults are jet black, wasp-like insects 3.5 mm long with 7 mm wing span

Biology
- Two generations per year
- Overwinters as prepupal larva in earthen cells beneath the trees; pupate in the spring
- Adults emerge in late May (5 instars), mate, and lay eggs in the upper leaf surface
- Larvae hatch then feed between the top and bottom layers of the leaf
- Mature larvae emerge from leaf in early July and drop to the ground to pupate in earthen cells (2.5 – 5 mm below surface)
- Approximately two weeks later, they emerge as adults and the life cycle is repeated
- Second generation develops 45-50 days after first females lay eggs in slit cuts in the upper surface of young leaves

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Damage on a birch tree presents an overall appearance of brown leaves. B) Details of tree damage showing scattered brownish leaf damage throughout. C) Leaf showing larval damage between its two layers. D) Frass (droppings) left behind by the larva between leaf layers; generally each damaged leaf has only one insect in it.

BRONZE BIRCH BORER (*Agrilus anxius*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
All season (April – October)
Control Season
All season (April – October) for non-pesticide control activity
Rating
Insect pest; eventually fatal to host if left untreated
Hosts and Damage
- All native and introduced birches may serve as hosts
- Light infestations kill upper branches; severe infestations may kill entire tree
- A sign of borer is die-back in the uppermost branches
- Distinctive D-shaped entrance holes in tree trunks

Physical Characteristics
- Adults are slender, 7.5-11.5 mm long, olive to copper-bronze colored beetles
- Males are greenish-faced and are slightly smaller than the copper-faced females
- Eggs are oval, flattened, creamy white and measure 1.5 mm long by 1 mm wide
- Larvae are white, narrow, flattened and legless with a light brown head capsule. Two brown, hardened spines are located at the end of the thorax
- Larvae measure up to 35 mm in length
- Pupae resemble adults but are creamy white at first and gradually darken to a brownish-black

Biology
- Two years to complete life cycle; adults emerge in late June; have life span of 3 weeks
- Active beetles are present until August
- Females are strong fliers and search actively for suitable egg laying sites in bark crevices – usually on sunny side of open growing trees
- Larvae hatch in about 2 weeks and burrow into cambial area (5 instars)

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

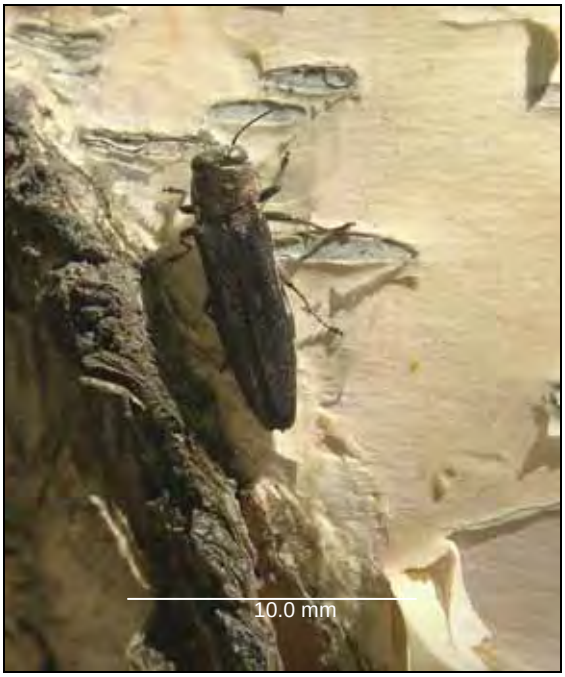
Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning (larval control; preventative dead wood)
- Pesticide: None used at present
- Biological: None used at present

A

B

C



D

A) Damage and defoliation on the upper branches of a birch tree. B) Details of branch damage; branch dieback appears clumped. C) Adult borehole into the tree branch or trunk; boreholes have a characteristic 'D' shape; orange-brown sap often oozes and stains the area around the hole. D) Adult bronze birch borer; adults are not often seen except for a short time during their emergence period.

COOLEY SPRUCE GALL ADELGID (*Adelges cooleyi*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
Periodic
Control Season
Periodic for non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- White and Colorado spruce
- Yellowing of foliage and premature needle drop
- Unsightly cone-shaped galls left on trees
- Damage not extensive

Physical Characteristics
- Nymphs feeding on new needles produce a terminal (end of branch) gall on primary host trees
- Gall is 2-2.5 cm in length and it gradually changes colour from light green to dark purple
- When nymphs mature and leave (July or August) galls become brown, dry and hard

Biology
- Two years to complete it's complicated life cycle
- Winged adult aphids emerge in late summer
- Two types of adults are winged and wingless
- Nymphs overwinter on new needles with adults following in the spring
- Brown egg clusters

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning (larval control)
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Spruce tree in a naturalized area. B & C) Eggs with protected cottony covers; these cottony covers appear as white specks early in the spring and continue throughout the summer and can cover an entire tree during a severe infestation. D) Cone shaped gall; galls are green at first but later turn a reddish-purple color.

COTTONWOOD LEAF BEETLE (*Chrysomela scripta*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
Late season (August – October)
Control Season
Late season (August – October) for non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Hybrid poplar, occasionally willow and alder are attacked, not trembling aspen
- Skeletonized leaves turn brown
- Does not injure tree, but trees become unsightly

Physical Characteristics
- Adults are 8 mm long, slightly oval with black heads and thorax edged in yellow or red Wing covers are yellow with seven elongated dark spots
- Eggs are bright yellow
- Mature larvae are blackish and may reach 12 mm in length with two whitish spots on each segment
- Larvae have scent glands that emit a pungent odor when disturbed
- Pupae hang head down from leaves, bark, or weeds and grasses under host trees

Biology
- Two generations per year
- Overwinters as immature adults
- In spring immature adults emerge from leaf litter and feed on new foliage and bark
- Immature adults are gregarious; more mature adults feed singly
- Eggs are little clumps of yellow capsules on the undersides of leaves
- Pupae hangs head down from the leaf

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

A

B

C*

D

A) Damage and skeletonization on a poplar tree. B) Damage on the underside of a leaf. C) Mature larvae are blackish with white lateral spots on each segment; they may reach 12 mm in length; removed portion of leaf damage likely not due to larval damage. D) An adult leaf beetle can appear similar to a ladybird beetle.

ELM SCALE

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
Periodic
Control Season
Periodic for pesticide control activity
Rating
Insect pest
Hosts and Damage
- Elm, white birch, ash, flowering plum, some apple varieties, variegated dogwood as well as many other plants are attacked
- The accumulation of sticky honey dew, which is an excellent site for the formation of black sooty mold tends to accumulate on objects under the tree, is a frequent problem
- The sooty black mold can block photosynthesis
- Light infestations do little damage
- Large populations may weaken or kill stems and branches
- Damage is usually confined to individual stems and branches on small groups of trees

Physical Characteristics
- Scales are shell-like, oval in shape, strongly convex and mottled brown
- When fully grown may measure up to 5-6 mm in length

Biology
- One generation per year
- Overwinter as nymphs which crawl to twigs and secrete scales from late March to early May
- Winged males emerge in late May and mate with stationary females
- Female lays eggs or gives birth to live young under scale
- Eggs hatch from late June to late July nymphs crawl to leaf to form scales and feed
- Nymphs move to hibernation sites in bark crevices or old scales in late August

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To establish tolerable levels of damage
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: None used at present
- Pesticide: Dormant oil (foliar spray; backpack power applicator)
- Biological: None used at present

A

B

C

D

A) Elm scale can leave the bark on the trunk and branches of the elm tree appearing black and mottled. B) Details of branch damage and discoloration of the bark. C) Scales are shell-like, oval in shape and strongly convex. D) Nymphs crawl about finding locations to form scales and feed; scales are often clustered together, presenting an unaesthetic appearance.

LACE BUG (*Corythucha mollicula*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
Late season (August – October)
Control Season
Late season (August – October)
Rating
Insect pest
Hosts and Damage
- Collected on willow and balsam poplar
- Causes mottling of the foliage
- Leaves become leathery and tend to drop prematurely especially in dry weather

Physical Characteristics
- Adults are 4 mm long and have a modified wing structure that looks like lace
- Egg clusters are cylindrical; found on the underside of leaves
- Late instar nymphs are more or less circular in outline, blackish with white markings and have prominent spines around the edge of the abdomen

Biology
- Two generations per year
- Overwinters as an adult under loose bark or under fallen leaves
- Eggs are laid in clusters on the underside of the leaves in early spring
- Nymphs feed on the underside of the leaves and deposit dark specks of tarry excrement while feeding
- After five nymphal instars, emerges as first generation adults in midsummer
- The second generation completes its development by early fall

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

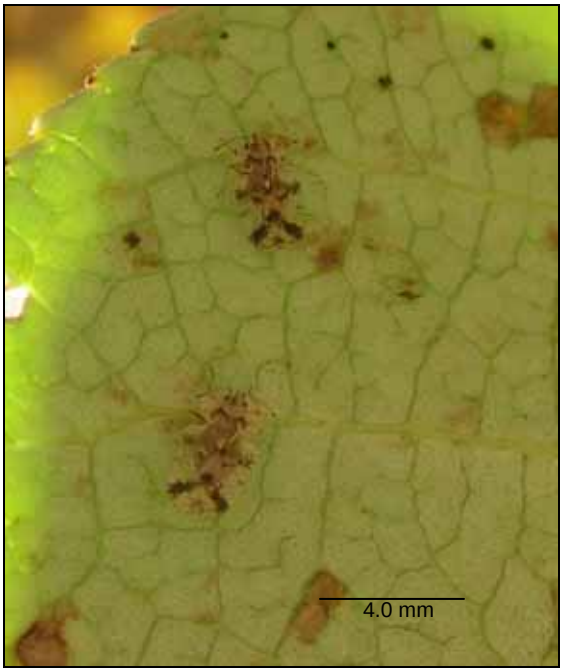
Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

A

B

C



D

A) Poplar tree with leaf damage, some of which is foliage mottling due to the lace bug feeding. B) Mottling damage due to feeding. C) Nymphs on the underside of a leaf and frass (droppings) leave a dark spotted appearance. D) Adult stage of the bug.

LEAF ROLLERS (Various Species)
E.g. ASPEN LEAF ROLLER (*Pseudexentera oregonana*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
Early/mid season (April – July)
Control Season
Mid season (June – July)
Rating
Insect pest
Hosts and Damage
- Aspen and broad leafed trees and shrubs are hosts
- Wasteful feeders – lasts from two weeks to two months
- Rolled up leaves may make host trees unsightly
- Rarely will population be great enough to damage host tree

Physical Characteristics
- Many species of leaf rollers with the Aspen leaf roller being of importance in this area
- Adult are small moths with wing spans under 25 mm and forewings mottled yellow, brown or grey
- Eggs are oval, flattened and translucent
- Larvae are small, less than 20 mm in length, with a soft cylindrical body and a hard head
- Pupae are spindle-shaped, less than 15 mm in length and vary in colour from brown to green

Biology
- One generation per year; overwinter in egg, larvae or pupae stage (aspen leaf roller)
- Eggs are laid singly or in flat clusters on leaves, twigs or bark of host
- Larvae hatch in spring; larvae form a webbed shelter of either tied needles and/or leaves together; also may roll the edges of leaves
- Adult moths emerge from pupae in spring or summer

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

A, B

C

A) Leaf damage due to leaf rollers is usually scattered on tree branches and often only involves several leaves per branch; damage will have little effect on the tree besides an undesirable appearance. B) Leaf rolled tightly around a larva. C) A typical stand of aspen poplar that often harbors leaf roller populations.

POPLAR BORER (*Saperda calcarata*)

Refer to:
Table 1; Group 3 (Page 60)
Monitoring Season
Periodic
Control Season
Periodic for non-pesticide control activity
Rating
Insect pest
Hosts and Damage
- Attacks trembling aspen, balsam poplar and occasionally attacks willow species
- The larvae spend four growing seasons tunneling throughout the trunk of the tree
- The trees exude a sap which stains the wood an amber colour
- The weakened stems are liable to breakage in wind storms

Physical Characteristics
- Adult beetles are large, 20-30 mm long, covered with dense grey hairs, orange-yellow markings on the wing covers and very long antennae
- Eggs are creamy white, oval in shape and about 4 mm in length
- Mature larvae are large, 50 mm long, dirty white legless grubs
- Pupae are yellowish-white, 20-35 mm long and found in boring galleries

Biology
- Most require 4 growing seasons to complete development
- The adults emerge in late June and July and live for up to 6 weeks
- They feed on aspen and willow foliage and begin laying eggs

Why Manage
- Concerns about proliferation in select areas
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks
- Increased need for vegetation replacement; reduced vegetation value
- Increased plant susceptibility to disease and other pests
- Maintenance standards; may lead to increased maintenance costs if not controlled

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning (larval control)
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Aspen poplar is a typical host tree. B) Trunk with damage caused by an adult female cutting into the bark to lay eggs. C) On closer inspection, the holes appear to be quite damaging with boring dust exuding from the holes. D) Varnish-like resin flows from the holes staining the bark.

Group 4 – Insect Pests

MOSQUITOES (Nuisance)

Refer to:
Table 1; Group 4 (Page 60)

Monitoring Season
All season (April – October)

Control Season
All season (April – October) for pesticide control activity

Rating
Insect pest

Hosts and Damage
- Nuisance to people and livestock
- Several species are persistent biters and good fliers
- Some health risks e.g. West Nile virus

Physical Characteristics
- Larvae are elongate, soft-bodied, dark-coloured, 5-10 mm long, with a head, swollen thorax and cylindrical abdomen that hatch in standing water. Larvae have a breathing tube at the end of the abdomen through which they breathe at the water surface. They "wriggle" from the surface to hide under leaf matter and other material when disturbed.
- Pupae are comma-shaped

Biology
- Spring mosquitoes have one generation per year; overwinter as eggs deposited around margins of slough, above the water line in ditches or in depressions in grassy terrain that are subject to flooding due to snowmelt or rainfall
- Summer mosquitoes can have up to four generations each season; overwinter as mated females eggs hatch only when immersed in warm water
- Both spring and summer groups go through the following growth stages: egg, four larval instars, pupa and adult

Why Manage
- Requires establishment of control locations
- Public perception and complaints; control spread to private property
- Control spread from private property
- Reduced recreation opportunities and use of parks
- To maintain native species balance and variety (biodiversity)
- To establish tolerable levels of damage; prevent reduced use of parks

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Monitor and control)
- Physical/mechanical: None used at present
- Pesticide: Microbial product *Bacillus thuringiensis israelensis* (Bti) (granular application using hand held spreader)
- Biological: None used at present

A

B

C

D

A) Mosquito larvae have four growth stages; the second and fourth stages are noted here. B) An adult female mosquito feeding; blood in its abdomen provides nourishment for eggs. C) The microbial insecticide *Bacillus thuringiensis israelensis* (Bti) is used to control mosquito larvae. D) Staff in personal protective equipment apply Bti to a variety of wet areas that produce mosquito larvae, controlling them before they emerge as adults.

BENEFICIAL INSECT EXAMPLES:
GREEN LACEWING (*Chrysoperla carnea*)
LADYBIRD BEETLE (*Adalia bipunctata*)
PAINTED LADY BUTTERFLY (*Vanessa cardui*)

Refer to:
NA
Monitoring Season
All season (April – October)
Control Season
NA
Rating
Beneficial insects; these are naturally occurring and feed on a variety of pests and weeds
Damage
- Green lacewing: Larvae and adults are predacious on other insects; larvae feed mostly on aphids
- Ladybird beetle: Larvae and adults are predacious on other insects, mostly aphids
- Painted lady butterfly: Larvae feed on Canada thistle

Physical Characteristics
- Green lacewing: A common insect; adults are green in colour and larvae often pile debris on their backs
- Ladybird beetle: Adults are orange with varying numbers of black spots; larvae are grey, elongate and flattened, usually with several bright spots
- Painted lady butterfly: Adults are orange-brown with white spots on the forewing

Biology
- Green lacewing: Often found on foliage of trees and shrubs; eggs are laid at the end of a tiny stalk; larvae pupate in cocoons attached to leaves
- Ladybird beetle: Adults hibernate in clusters; larvae are usually found amongst aphids
- Painted lady butterfly: On occasion, adults show up in this region in large numbers; subsequent large populations of larvae live and feed on Canada thistle, often to the point where thistle is visibly degraded and reduced in size

Why Manage
- No management necessary

Monitoring Procedures
- Spot checking

Control Procedures
- None: Observation only

A

B

C

D

A) Adult green lacewing. B) Several ladybird beetle adults clustered together. C) Larva of a painted lady butterfly. D) Larva feeding on Canada thistle results in almost complete destruction of the plant. Note: the presence of a ladybird beetle larva on the upper part of the stalk in the upper right hand corner of the photograph.

7.2 Mammal Pests and Pathogens

7.2 MAMMAL PESTS AND PATHOGENS

Group 1 – Mammal Pests

BEAVER (*Castor canadiensis*)

Refer to:
Table 2; Group 1 (Page 61)

Monitoring Season
All season (April – October)

Control Season
All season (April – October) for control activity

Rating
Mammal pest; fatal to the host if left untreated

Damage
- Caused by felling trees and feeding on the twigs, buds and bark largely of poplar
- Dam building by the beavers creates flooding

Physical Characteristics
- Large semi-aquatic rodent with dense, dark brown fur
- Adults weigh from 16 to 32 kg including the tail; it can measure up to 1.3 m in length
- Broad flat tail used for communicating, balance and as a rudder when swimming
- Large, webbed hind feet with five blunt claws used for swimming; small dexterous forepaws with sharp claws used for digging
- Long, sharp, strong, continuously growing incisors used for felling trees

Biology
- Live and reproduce in aquatic environments including wetlands, streams and rivers
- Take on one lifelong mate and produces one litter yearly, offspring are called kits
- Each litter averages 3 to 4 kits that are born May or June after a 100 day gestation
- Influence the surrounding habitat and ecology through dam building and tree felling which contributes to flooding and species diversification

Why Manage
- Dam removal is part of watercourse management, bank stabilization, flood prevention and protection of outfall structures
- To prevent the loss of native and city park trees and to maintain biodiversity
- To evaluate, establish and maintain tolerable levels of damage
- To prevent increased maintenance costs such as tree replacement
- Public perception and complaints, aesthetics, health and safety concerns

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Outside agency trapping; trees wrapped with wire
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Beaver dams are an engineering feat made from logs, branches, mud, rocks and vegetation; they vary in height and length and are found in moving water. B) Beavers cut down trees for food and building materials; they are most active at night and usually do not go farther than 100 m from water. C) Base of a deciduous tree wired to prevent beavers from removing valuable vegetation. D) Old beaver stump re-growth.

NORTHERN POCKET GOPHER (*Thomomys talpoides*)

Refer to:
Table 2; Group 1 (Page 61)
Monitoring Season
All season (April – October)
Control Season
Early/mid (April – July) for non-pesticide control activity
Rating
Mammal pest
Damage
- Dirt mounds interfere with equipment and may ruin aesthetics of well kept turf grass
- Feeding of both root and above ground garden or field crops
- Occasionally pocket gophers damage trees by girdling or clipping stems and pruning roots

Physical Characteristics
- Small rodent rarely appearing above ground
- They have small eyes and ears; large upper and lower incisors; heavy claws; short, strong forelegs and sparsely haired tail
- Tube shaped body with short thick fur varying from dark brown or yellow brown to pale grayish yellow often resembling local soil colour. White markings appear under chin
- Weighs less than 110g and between 165-250mm in length with tail 45-75mm
- Fur-lined external pouches or “pockets” on each side of face; used to carry food

Biology
- Lives and reproduces almost entirely underground in a variety of soils and vegetation types
- Strictly herbivores eating mostly broad-leafed plants and grasses with the occasional tree and shrub roots. Preferred food is alfalfa and dandelions
- Does not hibernate
- Solitary mammals apart from April or early May when breeding occurs. Only one litter per year having 1–8 dependent young
- Influences the surrounding habitat by bringing soil from below to the surface thus “plowing” and aerating the soil. On average each pocket gopher turns over 2844 to 5511 pounds of soil per hectare. Burrows also allow water to reach deeper soil levels

Why Manage
- Public perception and complaints, aesthetics, health and safety concerns
- Prevent equipment damage

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Various trap methods
- Pesticide: None used at present
- Biological: None used at present

A

B

C

A) Mounds of fresh soil are the best sign of northern pocket gopher presence; several mounds can be created in one day and are formed as the gopher digs tunnels pushing loose dirt to the surface. B) Mounds are typically crescent or horse shoe shaped; the hole is off to one side of the mound. C) Burrow entrances are kept plugged with soil and extend 50-150m laterally and up to 3m below the surface.

PORCUPINE (*Erethizon dorsatum*)

Refer to:
Table 2; Group 1 (Page 61)
Monitoring Season
All season (April – October)
Control Season
All season (April – October) for control activity
Rating
Mammal pest; fatal to the host if left untreated
Damage
- Feeding on the bark can kill the branch or the tree if it has been girdled, since all the capacity for water and mineral transport has been removed

Physical Characteristics
- Is a rodent that is 1.6 meters, including the tail in length
- Has long brownish-black fur interspersed with long white hairs concealing short barbed spines

Biology
- Lives in coniferous, deciduous, and mixed forests. In the west it can be found in scrubby areas
- Solitary, nocturnal, herbivorous and feeds at night on leaves, buds, and bark

Why Manage
- To prevent the loss of native and city parks tree species and to maintain biodiversity
- To evaluate, establish and maintain tolerable levels of damage
- To prevent increased maintenance costs such as tree replacement
- Increased need for vegetation replacement
- Increase plant susceptibility to disease and pests
- Reduced vegetation value
- Public perception and complaints, aesthetics, health and safety concerns

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Live traps
- Pesticide: None used at present
- Biological: None used at present

A

B

C

A) Porcupines are excellent climbers spending most of their time in trees feeding on the bark, twigs, buds and leaves of deciduous and coniferous trees. B) Bark feeding can range from a small patch to an entire tree stripped of its bark depending on the tree species and needs of the porcupine. C) Porcupines de-bark trees to feed on the inner cambium layer of the bark.

RAT (*Rattus norvegicus*)

Refer to:
Table 2; Group 1 (Page 61)
Monitoring Season
All season (April – October)
Control Season
All season (April – October)
Rating
Mammal pest; invasive species
Damage
- The Norway rat is a shy and primarily nocturnal animal. It seeks shelter to hide from enemies including other rats. A rat shelter can be under almost any object including planks, plywood, buildings or structures resting on the ground

Physical Characteristics
- Adult males weigh an average of 450 grams (1 pound) and average length 18 to 25 centimeters (from nose to tip of tail)
- The Norway rat has a wide range of colours from reddish to grey brown or completely black on the back and sides; the under-parts are tinged with grey to a buff or yellowish-white. Both front and hind feet are small, delicate and pink
- The most distinguishing feature of true rats is the tail. It is cylindrical, tapering and nearly hairless. The hairs are short and bristle like and grow out from well defined hairline ridges along the entire length of the tail
- The tail is always shorter than the body

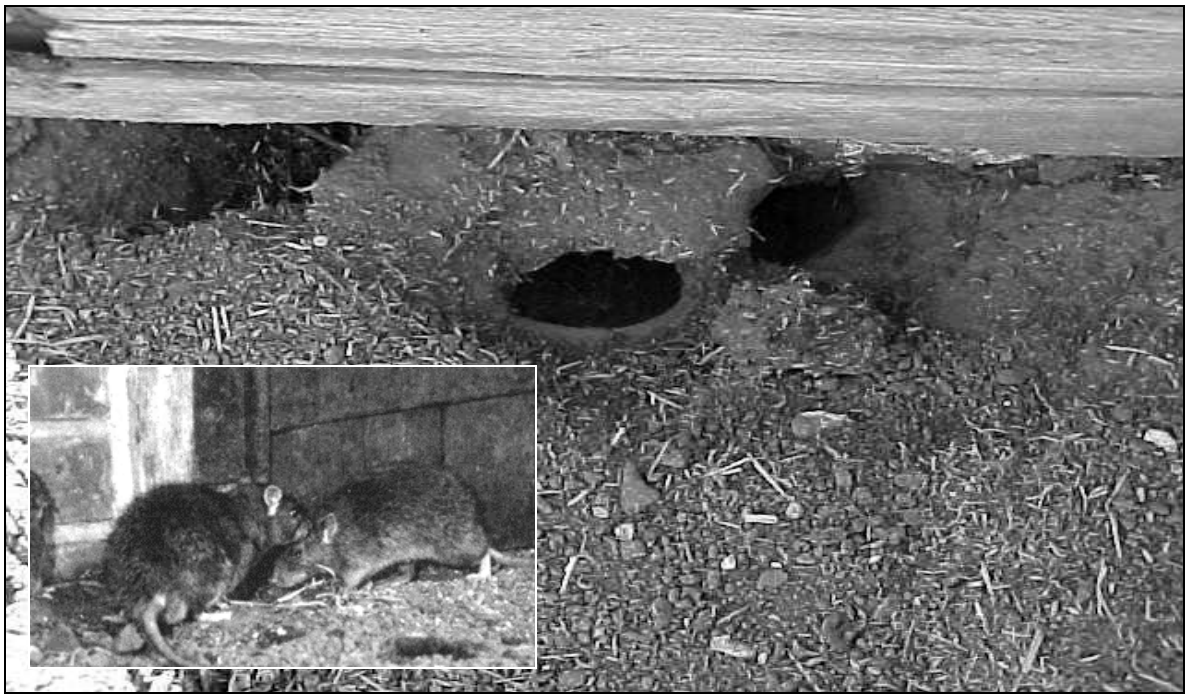
Biology
- Following about a 3 week gestation period, 12 to 18 rats are born to a female rat that can be as young as 8 weeks of age
- A Norway rat can produce up to 12 litters per year
- It has been estimated that, under ideal conditions, a single pair of Norway rats could produce 15,000 offspring in 1 year
- Male rats are sexually mature at approximately 90 days of age
- Norway rats can live up to 18 months in the wild

Why Manage
- Government mandate (Pest Act)
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: None used at present
- Pesticide: None used at present
- Biological: None used at present

Photographs A and B (Page 137) credit Re: http://www.agriculture.gov.sk.ca/Default.aspx?DN=8ca2fbe5-d241-4cb0-8cc2-8234929070f4 See: PDF Rat Control in Saskatchewan, Fact Sheet.
Photograph C (Page 137) credit Re: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex816?opendocument See: Alberta Agriculture and Rural Development as source.



A, B

C

A) Rat burrows are often found next to buildings and along the underside of sheds and other fixtures. B) Rats are prolific breeders with the ability to produce numerous litters per year. C) The cylindrical, hairless looking tail is the most distinguishing feature of the rat; it is always shorter than its body length.

RICHARDSON GROUND SQUIRREL (*Spermophilus richardsonii*)

Refer to:
Table 2; Group 1 (Page 61)
Monitoring Season
Periodic
Control Season
Periodic
Rating
Mammal pest
Damage
- Burrows can damage sports grounds, cemeteries and park areas making them a hazard to the users

Physical Characteristics
- A rodent with grey or yellowish grey fur, with its under parts whitish or pale buff (dull-yellow)
- The squirrel known as a 'gopher' has a stubby tan tail and short legs

Biology
- Feed on vegetation, seeds , fruits and insects
- Lives in burrow and tunnels beneath the ground in pastures and open areas
- Males emerge very early in the spring; breeding takes place in late April to early May when females emerge; six weeks later they give birth; two weeks following, young emerge and feed; this is when the most damage occurs
- Populations increase very quickly
- Control begins usually in early April

Why Manage
- To evaluate, establish and maintain tolerable levels of damage
- Control spread to private property
- Increased need for vegetation replacement
- Reduced vegetation value
- Negative and positive public perception of pests
- Public perception and complaints, aesthetics, health and safety concerns

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: None used at present
- Pesticide: Gopher Doom (bait/feeding)
- Biological: None used at present

A

B

C

D

A) Adult ground squirrel sitting characteristically on its hind feet in an upright stance. B) Typical habitat of open, short grass fields. C) Burrow entrance with a mound of dirt on one side; burrows are four to ten meters long, sloping gradually one to two meters below surface; there is an average of eight entrances to the burrow. D) Ground squirrels are often heard before they're seen, with a strong, loud, high pitched "chirp".

Group 2 – Pathogens

BLACK KNOT (*Apiosporina morbosa*)

Refer to:
Table 2; Group 2 (Page 61)

Monitoring Season
All season (April – October)

Control Season
All season (April – October) for non-pesticide control activity

Rating
Pathogen

Hosts and Damage
- Fungus affecting *Prunus* species
- Smaller twigs usually die within a year after being infected
- Larger branches may live for several years before being girdled and killed by the fungus
- Heavily infected trees become progressively worse during each growing season and often become stunted and deformed as the disease interferes with the transport system

Physical Characteristics
- Spindle-shaped green swellings starting in late spring rupture and enlarge turning into black “knots” in fall that continue to enlarge from year to year and range in size from 1.5 cm to 30 cm in length

Biology
- Overwinters in the “knots” on infected branches
- Spores produced from “knots” are the source of infection to other parts of the plant or to other plants
- Youngest growth and wounded tissues are most susceptible

Why Manage
- To prevent the loss of native and city parks tree species and to maintain biodiversity
- To evaluate, establish and maintain tolerable levels of damage
- To prevent increased maintenance costs such as tree replacement
- Increased need for vegetation replacement; reduced vegetation value
- Increase plant susceptibility to disease and pests
- Public perception and complaints, aesthetics, health and safety concerns
- Control spread to and from private property
- Maintenance standards

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning (pathogen control); prune off 10 cm below point of infection; disinfect pruning tools after each cut
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Black knot is commonly found on Schubert chokecherry, mayday and pin cherry trees. B) The fungus occurs only on woody parts of the tree, deforming branches, stunting growth and eventually contributing to the death of the tree. C) Corky, black spindle-shaped swellings or knots are found on branches and twigs. D) Fungus starts as a small light brown swelling and progresses to a hard dark knot enlarging every year.

CANKERS (Various Species on Deciduous Trees)
E.g. *Cytospora and Hypoxylon*

Refer to:
Table 2; Group 2 (Page 61)
Monitoring Season
All season (April – October)
Control Season
All season (April – October) for non-pesticide control activity
Rating
Pathogen
Hosts and Damage
- Both are fungi affecting *Populus* and *Salix* species
- Cytospora canker is a weak parasite causing damage when trees are under stress Young trees are especially at risk
- Hypoxylon canker is a serious problem in aspen, often causing mortality. Breakage often happens at point where canker is found

Physical Characteristics
- Cytospora cankers are often slightly sunken, discoloured areas in the bark which often splits along the canker margin; wood below the canker infected bark is stained brown and is odorous as it deteriorates
- Hypoxylon cankers are orange-yellow, deformed and expanded areas that become rough and full of blisters and cracks

Biology
- Both cause branch dieback and cankers on trees of any age; infects only through openings in the bark, most often attacking stressed trees
- Control by pruning back to a live branch
- Prune during dry weather and disinfect pruning tools after each cut

Why Manage
- To prevent the loss of native and city parks tree species and to maintain biodiversity
- To evaluate, establish and maintain tolerable levels of damage
- To prevent increased maintenance costs such as tree replacement
- Increased need for vegetation replacement; reduced vegetation value
- Increase plant susceptibility to disease and pests
- Public perception and complaints, aesthetics, health and safety concerns
- Control spread to and from private property
- Maintenance standards

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning (pathogen control)
- Pesticide: None used at present
- Biological: None used at present

A, B

C

D

E

A) Poplar tree trunk with canker. B) Canker margin splitting. C) Cankers can appear on trees at any age. D) Canker infected bark is stained brown and is odorous as it deteriorates. E) Canker oozes during moist weather.

DUTCH ELM DISEASE (*Ophiostoma ulmi*)

Refer to:
Table 2; Group 2 (Page 61)
Monitoring Season
All season (April – October)
Control Season
Periodic for non-pesticide control activity
Rating
Pathogen; eventually fatal to host if left untreated
Hosts and Damage
- All species of elm
- Dutch elm disease (DED) can kill a mature elm tree in one season

Damage and Hosts
- Fungus affecting *Ulmus* species transmitted by elm bark beetles
- A deadly fungus that can kill a mature tree in one season
- DED is currently not found in this area; pruning restrictions apply

Physical Characteristics
- Primary symptoms include loss of water conducting ability
- Secondary symptoms include leaf wilting and browning early in the season
- Yellowing and defoliation in summer and branch death
- All branches may die within a few weeks or over several years

Biology
- Beetles are attracted to the scent of dead wood
- Infection begins when leaves reach full size
- Preventative pruning in the winter season from October 1 to March 31
- Disinfect tools after each cut; material must be buried or burnt

Why Manage
- Government mandate
- Control spread to private property
- Control spread from private property using enforcement
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures (Not currently found in the Red Deer area)
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: Preventative deadwood pruning October 1 to March 31
- Pesticide: None used at present
- Biological: None used at present

A*

B

C*

D*

A) American Elm tree showing DED 'yellow flagging' symptoms. B) Educating the public is crucial in preventing the spread of DED. C) Details of a flagged branch in the summer timeframe. D) Infection spreads to the rest of the tree increasing branch dieback and eventual tree mortality. Important Note: Photographs A*, C* and D* indicate flagging that is similar to DED (for illustrative purposes only); there is currently no DED present in Red Deer.

ELM WILT (*Dothiorella ulmi*)

Refer to:
Table 2; Group 2 (Page 61)
Monitoring Season
All season (April – October)
Control Season
Periodic for non-pesticide control activity
Rating
Pathogen; may eventually be fatal to host if left untreated
Hosts and Damage
- Fungus affecting *Ulmus* species causing a vascular disease
- Disease may progress slowly; 2 – 4 years to kill a large tree
- Smaller trees and seedlings are killed in one season

Physical Characteristics
- Symptoms sometimes confused with DED and *Verticillium* wilt
- Symptoms include wilting, curling, and yellowing of foliage, followed by defoliation and gradual dieback of branches
- Affected branches contain brownish discolouration in the outer annual rings

Biology
- Overwinters in infected tissue
- Is dispersed in spring by wind, rain or insects
- Invades through wounds in leaves and tender shoots then spreads to other parts of the tree through the vascular system
- Prune infected branches a meter below the last visible discolouration in the wood
- Infected branches should be burnt or buried
- Disinfect tools between cuts

Why Manage
- Control spread to and from private property
- To evaluate, establish and maintain tolerable levels of damage
- To prevent increased maintenance costs such as tree replacement
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Preventative deadwood pruning October 1 to March 31
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Siberian elm tree shows progressive branch dieback from elm wilt. B) Yellowing leaves is a classical symptom of the fungus. C) Visual symptoms of elm wilt are difficult to distinguish from Dutch elm disease. D) Detailed view of elm wilt symptoms; wilting, drooping, curling and yellowing of leaves and branch dieback.

FAIRY RING (*Marasmius oreades*)

Refer to:
Table 2; Group 2 (Page 61)
Monitoring Season
All season (April – October)
Control Season
All season (April – October) for non-pesticide control activity
Rating
Pathogen
Hosts and Damage
- Fungus affecting turf areas
- A problem in turf grass that causes unsightly rings of dead turf to form

Physical Characteristics
- First sign may be a ring of tan to buff coloured mushrooms followed later by rings of dark green grass 10 – 20 cm wide
- Rings and semi-circles of dark green or brown grass appear
- Mycelium (roots) of fungus prevent water and air getting to the roots of the grass causing death and brown rings to form

Biology
- May be spread by using soil containing the fungus or by contaminated tools and mowers
- Most common on sandy, low fertility lawn areas
- Symptoms can be masked by poking 25 cm deep holes at 10 – 15 cm intervals followed by intense continuous watering and fertilization

Why Manage
- Control spread to and from private property
- Maintenance standards
- Reduced vegetation value

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Soil drench
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Mature symptoms of fairy ring; includes a characteristic ring or semi-circle of dead turf shadowed by dark green grass. B) Detailed view of the ring depicting grass dieback, dark green grass edges and mushrooms. C) Small tan colored mushrooms and/or dark green grass are common first signs. D) Detailed view of tan mushrooms.

FIREBLIGHT (*Erwinia amylovora*)

Refer to:
Table 2; Group 2 (Page 61)
Monitoring Season
All season (April – October)
Control Season
All season (April – October) for non-pesticide control activity
Rating
Pathogen; eventually fatal to host if left untreated
Hosts and Damage
- Bacteria affecting plants in the *Rosaceae* family
- A severe infection can kill mature trees in one season, but some trees can survive for many years after infection
- Once infection occurs, no chemical can cure it. Pruning of diseased twigs and branches is the only effective method of control

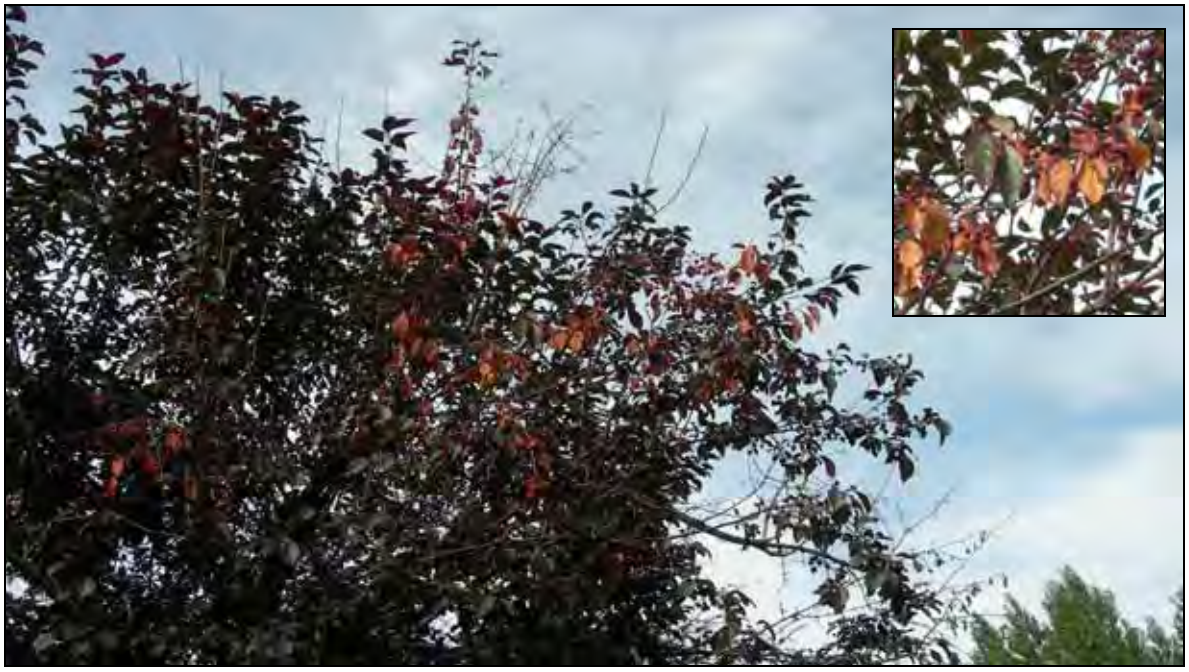
Physical Characteristics
- Symptoms include sudden wilting and dying; later twigs and leaves appear as if scorched by fire
- The end of twigs may have a shepherds hook shape

Biology
- Bacteria overwinter in infected stem cankers; also seem to be able to survive as surface organisms and can contribute to initial infection in the spring
- Disease spreads rapidly by wind, rain, and insects from winter cankers and invades supporting branches and leaves
- Secondary infections can occur when bacteria are disseminated by rain, wind, insects and birds; also by man on pruning equipment, transported fruits, or nursery stock
- Control by pruning off affected parts 20 cm below cankers or margins, when plants are dry; disinfect tools after each cut

Why Manage
- To prevent the loss of native and city parks tree species and to maintain biodiversity
- To evaluate, establish and maintain tolerable levels of damage
- To prevent increased maintenance costs such as tree replacement
- Increased need for vegetation replacement; reduced vegetation value
- Increase plant susceptibility to disease and pests
- Public perception and complaints, aesthetics, health and safety concerns
- Control spread to and from private property
- Maintenance standards

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning (pathogen control)
- Pesticide: None used at present
- Biological: None used at present



A, B

C, D

A) Overall view of fire blight bacteria affecting the tree. B) When an infection is severe the blight spreads to the leaves, turning them brown and often bending branches. C) Advanced stage of fire blight in the upper canopy. D) Leaves turn from brown to black giving the tree a scorched appearance.

SLIME FLUX (*Enterobacter cloacae*)

Refer to:
Table 2; Group 2 (Page 61)
Monitoring Season
All season (April – October)
Control Season
All season (April – October) for non-pesticide control activity
Rating
Pathogen
Hosts and Damage
- Bacteria affecting *Ulmus* and *Populus* species; also called wet wood
- Normally not serious in most trees but as a chronic disease it can contribute to tree decline, especially in older trees growing under conditions of stress
- Prevents callus tissue from forming

Physical Characteristics
- Wet wood is found in the trunk and branches and has a dark colour; air-borne bacteria, yeast, and other fungi contaminate the sap
- 'Bleeding' or slime-fluxing from trunk wounds and cracks is the most conspicuous symptom resulting in a frothy, slimy, foul-smelling liquid; upon drying it leaves light grey to white crust

Biology
- Enters through wounds or pruning cuts via insects, pruning tools, birds, and wind
- Colonizes heartwood and parts of sapwood tissue; bacteria within infected tissues release gases which cause pressure to build up and force the sap outward through wounds and branch stubs forming the slime-fluxing on the exterior of the tree
- Severely affected trees and limbs should be removed in the spring with proper disinfecting methods

Why Manage
- To prevent the loss of native and city parks tree species and to maintain biodiversity
- To evaluate, establish and maintain tolerable levels of damage
- To prevent increased maintenance costs such as tree replacement
- Increased need for vegetation replacement; reduced vegetation value
- Increase plant susceptibility to disease and pests
- Public perception and complaints, aesthetics, health and safety concerns
- Control spread to and from private property
- Maintenance standards

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning; tree removal (pathogen control) if required
- Pesticide: None used at present
- Biological: None used at present

A

B, C, D

E

F, G

A) Tree with an internal bacterial infection (slime flux) near the base of its trunk. B) Discolored bark symptomatic of slime flux. C) Sap leaks out of pruning scars or wounds. D) Detailed appearance of the sap once exposed to the air. E) Slime flux at base of tree. F) Yellow streaking and sap oozing from the wound. G) Sap exposed to air quickly colonizes bacteria, yeast or other fungi resulting in slime flux.

TREE WILT (*Verticillium albo-atrum*)

Refer to:
Table 2; Group 2 (Page 61)
Monitoring Season
All season (April – October)
Control Season
Periodic for non-pesticide control activity
Rating
Pathogen; may eventually be fatal to host if left untreated
Hosts and Damage
- Soil borne fungi affecting many deciduous trees
- Can kill small/young trees but larger trees may take several years to die or may recover completely

Physical Characteristics
- Acute symptoms: curling, drying, yellowing of leaves defoliation, wilting, dieback, death of branches or entire tree
- Yellowing and defoliation often progress upward
- Chronic symptoms: slow growth, sparse foliage, stunted leaves and twigs, leaf scorch, and dieback

Biology
- Enters through roots and spreads systemically through water conducting vessels causing vascular problems
- Plugs vascular system resulting in wilt symptoms by approximately midsummer
- Acute symptoms may appear in consecutive growing seasons or skip years; the plant may appear normal in the interim
- Prune infected branches several feet below the last visible symptom
- Infected branches should be burned or buried; disinfect tools between cuts

Why Manage
- To prevent the loss of native and city parks tree species and to maintain biodiversity
- To evaluate, establish and maintain tolerable levels of damage
- To prevent increased maintenance costs such as tree replacement
- Increased need for vegetation replacement; reduced vegetation value
- Increase plant susceptibility to disease and pests
- Public perception and complaints, aesthetics, health and safety concerns
- Control spread to and from private property
- Maintenance standards

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Control when notified or causing harm)
- Physical/mechanical: Pruning (pathogen control)
- Pesticide: None used at present
- Biological: None used at present

A

B, C

D

E, F

A) Symptoms of tree wilt may look similar to adverse environmental conditions and herbicide damage. B) Tree wilt can cause sudden and total collapse of a tree. C) Acute symptoms of tree wilt. D) Root infection spreads upward through the tree via its vascular system. E) Young tree exhibiting tree wilt. F) Fungus returns to soil as plant parts die and fall to ground.

7.3 Weeds - Prohibited Noxious, Noxious, Invasive Species and Others

7.3 WEEDS - PROHIBITED NOXIOUS, NOXIOUS, INVASIVE SPECIES AND OTHERS

Group 1 – Prohibited Noxious

COMMON BUCKTHORN (*Rhamnus cathartica*)

Refer to:
Table 3; Group 1 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Late season (September – October) for non-pesticide control activity

Rating
Prohibited noxious

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Woody shrub or small tree can grow up to 7 m tall
- Leaves are opposite or sub-opposite appearing, slightly alternate, glossy, oval-shaped with jagged edges and a pointed tip
- Flowers have 4 yellowish green petals, with the male and female flowers on separate plants
- Seeds/fruit are small and black with 3-4 seeds per fruit
- Roots are woody

Biology
- An introduced plant originating from Eurasia
- A perennial that reproduces by seed that can readily regrow from cut or damaged stems
- Tolerant of wide range of conditions

Why Manage
- Provincial Weed Act
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: Control and disposal in the garbage (landfill)
- Pesticide: None used at present
- Biological: None used at present

Photographs A, B and C (Page 159) credit Re: S. Katzell

A

B

C

A) An introduced woody small tree or shrub often located in natural areas. B) Its bark is grey-brown in colour and rough in texture. C) It has three to four sided black fruit in clusters, attached with a short stem to the branch; leaves with serrated edges.

HIMALAYAN BALSAM (*Impatiens glandulifera*)

Refer to:
Table 3; Group 1 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Prohibited noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Hollow smooth stems, having a tinge of red-purple colouring on them, grow 1-3 m tall and may have some branching
- Leaves are opposite in whorls; oblong to lance shaped with saw toothed edges
- Flowers vary in colour from white to a deep pink and are shaped like an English policeman's helmet
- Seeds are small dark brown and contained in a capsule; when ripe and disturbed, capsule explodes and ejects the seeds
- Shallow fibrous root system with adventitious roots growing out from the base of the stem anchoring the plant

Biology
- Introduced as an ornamental plant from India
- Annual fast growing plant reproducing by seed
- Plant produces an average of 700-800 seeds which require cold stratification
- Thrives best in nutrient rich soils of disturbed riparian habitats and wet woodlands; tolerates partial shaded areas
- Plants are frost sensitive and intolerant to drought
- Sheep and cattle have been known to graze the plant
- Flowers from July until frost

Why Manage
- Provincial Weed Act
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: Control by hand removal and disposal in the garbage (landfill)
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D, E

A) Planted as a garden ornamental. B) Showy pink, purple or white flowers. C) Simple shape leaf with serrated edges. D) Seedling stage. E) Hollow stem with a slight pinkish colour at the node.

ORANGE HAWKWEED (*Hieracium aurantiacum*)

Refer to:
Table 3; Group 1 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Early season (May – June) for non-pesticide control activity
Rating
Prohibited noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems are 30-90 cm tall with bristly hairs and usually leafless
- Rosette (first year leaves) are narrow and spatula shaped and hairy, sometimes reduced stem leaves
- Flowers are bright orange-red clustered a the top of the stem
- Seeds are dark brown or black with ridges and bristly plumes attached and are viable up to 7 years in the soil
- Shallow fibrous creeping root system

Biology
- Introduced form Europe as an ornamental plant
- Perennial with milky juice, spreading by seeds and leafy runners
- Escaped plants are found in old fields and pastures, meadows, roadsides, open woods usually on poorer acid soils
- Flowers from June to August

Why Manage
- Provincial Weed Act
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: Control by hand removal; digging up; and proper disposal in the garbage (landfill)
- Pesticide: None used at present
- Biological: None used at present

Photographs A, B, C and D (Page 163) credit Re: http://www.invasiveplants.ab.ca/photogallery.htm See: Alberta Invasive Plants Council Photo-gallery as source.

A

B

C

D

A) A shallow, fibrous creeping perennial introduced as an ornamental. B) Vibrant coloured red-orange petals with notched tips are contained in compact flower heads. C) Bristly plume seed heads with attached dark brown or black seeds. D) The stem and leaves are covered with short stiff hairs.

PURPLE LOOSESTRIFE (*Lythrum salicaria*)

Refer to:
Table 3; Group 1 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Late season (September – October) for non-pesticide control activity
Rating
Prohibited noxious
Damage
This weed replaces native vegetation in a wetland, creating a dense purple landscape nearly devoid of wildlife
Physical Characteristics
- Stems are square, woody with several stalks per plant and grow 1-1.5 m tall
- Leaves are smooth lance-shape, clasping, opposite whorled on the stem
- Flowers are long pink/purple on terminal spikes
- As the flowers begin to drop off, capsules containing tiny seeds appear in their place
- Dense woody tap root with short branching rhizomes

Biology
- A plant introduced over a century ago from Europe as an ornamental
- Perennial; spread by seed
- Seeds can remain viable 2-3 years when submerged in water
- Poses a threat to aquatic sites such as stream banks or shorelines of ponds
- Commonly called Lythrum, flowers from mid-July through September
- Plant strives and spreads rapidly because it has no natural enemies on this continent

Why Manage
- Provincial Weed Act
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (Eradicate)
- Physical/mechanical: Control by digging up and disposal in the garbage (landfill)
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) This attractive plant has been found in residential gardens and on the banks of city creeks. B) The pink-purple flowers are arranged in long vertical racemes. C) Each flower has 5-7 petals with stamens of different lengths. D) The leaves are simple, entire, and opposite or whorled on the stem and the leaves within the flowers are alternate and smaller.

Group 2 - Noxious

BLACK HENBANE (*Hyoscyamus niger*)

Refer to:
Table 3; Group 2 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Mid season (July – August) for non-pesticide control activity

Rating
Noxious

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Stems are upright and widely branched, covered in short stiff hairs and grow up to 1 m tall
- Leaves are alternate, shallowly lobed, coarsely toothed, covered with fine sticky hairs and have a heavy fowl odor
- Flowers are pale yellow, funneled shaped with purple veins at the center and arranged in spike-like clusters
- Tiny dark seeds are contained in an urn-shaped capsule with a thickened lid that pops off at maturity
- Fleshy taproot system

Biology
- A Mediterranean native that was introduced as an ornamental plant and for medicine
- Annual or biennial (forming a rosette the first year) reproducing by seed
- Seeds are viable for 4 years and a single plant can produce as many as half a million seeds in a season
- Plant grows in a wide range of soil textures and doesn't tolerate shade. It is a strong competitor of habitats in disturbed places and all parts are poisonous

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; digging up; weed eating; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A, B

C

D

E

A) Scattered basal rosettes appear in its first year. B) Coarsely toothed leaves of the rosette. C) Overview of the plant laden with seed capsules. D) Brownish-yellow flower with a purple centre and purple veins. E) Urn shaped seed capsule holds numerous tiny seeds.

CANADA THISTLE (*Cirsium arvense*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for pesticide and non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems are erect, hollow with clear sap, up to 1.5m tall, branching at top
- Leaves alternate, lacking petioles, irregularly lobed, spiny toothed, slightly clasping the stem
- Flowers form in clusters at the end of the plant; colours vary from purple, pink or occasionally white, male flower globular, female flower flask-shape with each sex on separate plants
- Seeds are tan, long, slightly curved, with a tuft of loosely attached downy white hairs

Biology
- Originated in Europe; common aggressive weed found in every province
- Perennial; spreads by seeds and freely sprouting horizontal rootstalks
- Seeds germinate within a year but can stay dormant for up to 20 years
- Grows under a wide variety of soil and moisture conditions such as cultivated fields, pastures, roadsides, right-of-way, waste areas, and shrub beds
- Thistles grow vigorously and have extensive underground creeping root systems that spread below the normal cultivated depth
- By asexual reproduction, it is possible that a colony of male plants can maintain itself but produce no fruit
- Control plant at bud stage when the plant is weak, as it has used up most of its' food reserves to produce the flower buds; flowering mid June into September

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; mowing; weed eating; and disposal in the garbage
- Pesticide: Clopyralid (monoethanolamine salt); apply pesticide after weed eating area
- Biological: None used at present

A

B

C

D

A) Canada thistle at the full bloom stage, in an undeveloped area; infestations of this weed can be significant in size. B) The bud stage of the thistle plant. C) The plants are either globular (male) or flask-like (female) as in this picture of a female flower. D) The seeds are attached to downy white hairs which enable it to travel in the wind over a distance.

COMMON BABY'S BREATH (*Gypsophila paniculata*)

Refer to:
Table 3; Group 2 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Mid season (July – August) for non-pesticide control activity

Rating
Noxious

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Stems are numerous, branched with swollen nodes, often with a bluish waxy covering
- Leaves are opposite, lance shaped, with two leaves per node
- Seeds are black, kidney shaped and bumpy; seeds are contained in a capsule
- Roots develop into a thick fleshy taproot

Biology
- Introduced as an ornamental plant from Europe to Asia
- Perennial
- Spreads by seed; a prolific seed producer with little or no dormancy
- An escapee from cultivation; an invader in roadsides, hayfields and pastures
- Plant is drought tolerant once established
- Flowers end of July into August

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by digging up and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Intended as a garden ornamental, this plant is now commonly found in native settings. B) Numerous small five petal white flowers give the plant the appearance of a tumble weed from a distance. C) Narrow leaves are arranged in pairs opposite on the stem. D) Numerous branches on each stem.

COMMON MULLEIN (*Verbascum thapsus*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems are woolly and can be 2.5 m tall which grows upward from a large rosette of leaves
- Leaves are opposite arranged, large and very woolly at the base with smaller leaves towards the top
- Flowers are five petals, yellow, forming on a dense spike
- Seeds are small and are contained in a hairy capsule
- Deep taproot system

Biology
- Introduced as a medicine plant from Europe by early settlers
- Biennial (rosette the first year) and reproduces by seed
- Each plant can produce over 180,000 - 300,000 seeds which can remain viable for more than 100 years
- Grows in a wide variety if habitats, but prefers disturbed soil sites
- Flowering from June to September

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; digging up; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C, D

E

A) A weed of disturbed and unmaintained areas; often found growing in mixed soil and gravel. B) Yellow flowers arranged on a spike that attract a wide variety of insects. C) Rosette in the first year of growth. D) Dense woolly leaves give an unusual appearance that is not common to other local plants. E) A stand of seed spikes from the previous year.

DAME'S ROCKET (*Hesperis matronalis*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Erect stems 0.5 to 1 m tall, often branched on the upper part of stem
- Leaves are stalkless, alternately arranged, long, thin and sharply toothed
- Fragrant flowers and varies in colour from purple to shades of pink or white
- Seeds are in long pod with a slight constriction between the seed
- Shallow root system

Biology
- Introduced as an ornamental plant from Europe
- Biennial or short live perennial (first year a rosette)
- Reproduces by seed; can produce up to 20,000 seeds per plant
- Common in damp soils along roadsides as it naturalizes freely
- Prefers full sun exposure and does well in any soil type
- Flowers from June into August

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; digging up; and disposal in the garbage
- Pesticide: None use at present
- Biological: None used at present

A

B

C

D

A) A garden ornamental plant now established in native settings. B) Four petal lavender-pink flowers grouped in loose clusters. C) Serrated edge leaves alternately arranged on the stem. D) Vegetative stage in the spring.

FIELD SCABIOUS (*Knautia arvensis*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems sparsely branched above, more or less covered with short stiff hairs, often with purple spots
- Leaves are two per node on opposite sides of the stem, more or less covered with short stiff hairs, the lowest ones coarsely toothed, the middle ones pinnately lobed, the upper ones reduced
- Flowers are violet blue to purple florets (fused into a tube) grouped into heads attached to a long leafless stalk, with each head having a ring of narrow green bracts around the outside
- Seeds are one per flower, 4 angled, covered with long straight hairs
- Has a large tap root, a straight to tapering root growing vertically downward from which other roots sprout laterally

Biology
- Originated in Europe; introduced as an ornamental plant
- A perennial; spreading by seed
- Can produce up to 2000 seeds and remains viable for many years
- Habitats are roadsides, pastures and waste places
- An effective competitor in crops and pastures; once established difficult to remove
- Flowers July to September

Why Manage
- Provincial Weed Act
- Public perception and complaints
- Control spread from private property using enforcement; control spread to private property
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; mowing; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) The plant stems are erect, hairy, sparsely branched and can grow up to 1.5 m in height. B) Flower heads are blue-to-purple small clusters of tube shape florets. C) Growth stage just before the plant sends up a tall stem for the flowers to develop on. D) Leaves are opposite on the stem and take on two shapes: lanced with pointed tips and deeply lobed.

LEAFY SPURGE (*Euphorbia esula*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
All season for pesticide and non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight; plants are poisonous to livestock, excluding sheep
Physical Characteristics
- Stems grow up to 1 m tall, smooth hairless or with a few hairs near the top, with milky greenish-white sap
- Leaves are alternate, one per node, numerous and stalkless, 3-7 cm long and less than 5 mm wide, a whorl of leaves marks the start of the flowering portion of the stem.
- Yellow green flowers lack petals and sepals, clustered forming, and supporting a group with a pair of bracts surrounding the cluster so it resembles a single flower; flowering stalks may also be produced from the base of leaves below the male flower
- Seeds are three per seed capsule, about 2mm long, smooth, grayish to yellow or brownish, usually with a yellow bump near the base
- Roots are brown with pink buds able to maintain high root reserves due to the plants external root system

Biology
- Naturalized from Europe; introduced as an ornamental plant or crop seed contaminant
- Perennial; spreading mainly by seeds and creeping roots
- Germination in the field can occur throughout the growing season whenever adequate moisture is available; however early spring is most favorable for germination
- Development and maturation of seeds extends for some 30 days beyond the appearance of the last flower, with a large plant producing up to 130,000 seeds
- Escaped into roadside ditches , pastureland and other uncultivated areas
- Flowers develop and bloom mid-May, ceasing between the end of June and mid-July

Why Manage
- Provincial Weed Act

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by digging up; and disposal in the garbage
- Pesticide: Picloram TIPA & 2,4-D TIPA
- Biological: Spurge beetles

A, B

C, D

E, F

A) The plant's creeping root system forms dense patches. B) Fenced area where biological control with beetles is used. C) Plants have small yellow-green flowers. D) Two-green, heart shape, leaf-like bracts that enclose the flowers/seed capsules. E) Adult flea beetle feeds on shoots and leaf tips (larvae feed underground on the roots). F) Black spurge beetle on a stem.

LESSER BURDOCK (*Arctium minus*)

Refer to:
Table 3; Group 2 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Late season (September – October) for non-pesticide control activity

Rating
Noxious

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Stems are erect, hollow, branched and thick and grow 1-3 m tall.
- Leaves are large (rhubarb-like), hairy, triangular shaped, woolly underneath and alternately arranged with wavy edges.
- Flowers are purple pink in colour and surrounded by hooked bracts with short stalks clustered along the stems.
- Large seed pods with hooks attached containing small angular brown seeds
- Large fleshy taproot.

Biology
- A native plant to Europe introduced and cultivated as a vegetable throughout North America or used for medicinal purposes
- Biennial plant (forming a rosette first year) and reproducing by seed
- A mature plant produces from 6,000 to 16,000 seeds
- Found in places where the soil is disturbed but not cultivated
- Burr-like seed heads are readily dispersed by attaching to clothing and animals
- Flowering usually June to August

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; digging up; and disposal in the garbage
- Pesticide: Picloram TIPA & 2,4-D TIPA / Fluroxypyr 1-methylheptyl ester & 2,4-D 2-ethylhexyl ester ‘or’ 2,4-D Amine 600
- Biological: None used at present

A

B

C, D

E

A) Unripened green seed pods on a mature plant. B) A cluster of purple flowers surrounded by hooked bracts. C) Large basal leaves develop the first year. D) Wavy-edged heart shaped leaves; has a general resemblance to a rhubarb plant. E) An upright thick hollow stem.

PERENNIAL SOW THISTLE (*Sonchus arvensis*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems are erect, hollow, and smooth, with a milky juice and branching at the top
- Leaves are alternate with slightly toothed margins. Lower leaves are deeply cut into backward pointing lobes. Upper leaves are smaller
- Flowers are small bright yellow in colour; dandelion-like and grouped in clusters at the end of the stems
- Seeds are small, brown, ridged and crowned with a tuff of fine hairs
- Extensive shallow long vertical rhizome-like (underground runner) root system

Biology
- Common weed that originated from Europe and Asia; probably introduced as a seed contaminant
- Perennial; reproducing by seed and underground creeping roots
- The seeds are widely dispersed by wind or by water, and may germinate almost at once, or lie dormant for up to four years
- Grows in a wide variety of soils and in habitats including cultivated fields meadows, roadsides, rights-of-way, and waste areas
- Flowers mid-June into September

Why Manage
- Provincial Weed Act
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; mowing; weed eating; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A, B

C, D

E, F

A) A grassy roadside infested with thistle. B) Completely opened flower resembles a dandelion flower. C) Closed flower bud surrounded by leaf-like bracts. D) Yellow flower bud beginning to open. E) Clasping leaves are alternate with slightly toothed margins. F) Detail of toothed margins that develop along the edges of the leaf.

SCENTLESS CHAMOMILE (*Tripleurospermum perforatum*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Early season (May – June) for non-pesticide control activity
Mid season (July – August) for pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems are erect, smooth, multi-branched, and growing up to 1m tall
- Leaves are alternate, very finely divided into many short segments, leaves have almost no smell when crushed, hence the name “Scentless”
- Flowers are daisy-like with white petals (ray florets) around the margin and numerous yellow tubular flowers in the center, with several flowers on each flowering stem
- Tiny dark brown seeds and slightly grooved, about 2 mm long
- Dense fibrous root system

Biology
- Originated in Europe; introduced as an ornamental plant or seed contaminant
- An annual, biennial, or short lived perennial; reproducing by seeds
- Chamomile plant can produce up to 300,000 seeds per plant
- Predominantly found growing on right-of-way, undisturbed waste areas, fields, roadsides and forage crops
- The fibrous roots allow the plant to cling to large soil clumps enhancing its chances of survival in heavy soils
- Seeds survive for longer periods in undisturbed soil than in cultivated soil
- Flowering occurs from June to October

Why Manage
- Provincial Weed Act
- Public perception and complaints; control spread from private property using enforcement
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; mowing and disposal in the garbage
- Pesticide: Clopyralid (as monoethanolamine salt)
- Biological: None used at present

A

B

C

D, E

A) Scentless chamomile infestation alongside a fence line. B) Stems are erect and smooth with many flowers on the multi-branched stems. C) Flowers are daisy-like with yellow center surrounded by numerous white petals. D) Leaves of the plants are alternate, very finely divided several times into many narrow segments. E) Typical reddish coloring of the lower stem of the plant.

WOOLY BURDOCK (*Arctium tomentosum*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for pesticide control activity
Late season (September – October) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Bushy erect stems growing up to 71 cm tall
- Large coarse egg shaped leaves, woolly underneath, with the lower leaves heart shaped and the leaf stalks generally hollow
- Flower heads are round, thistle-like, purple and covered in hairy spines
- Seeds are contained inside a seed pod covered with white woolly bracts
- Taproot system

Biology
- An introduced plant from Europe that has been used medicinally and cultivated as a vegetable
- A biennial plant (forming a rosette the first year) and reproducing by seed
- Found in a variety of disturbed areas
- The dried flower heads are easily detached and become attached to passing animals
- Can be confused with giant burdock, which has naked bracts and lower leaves, with solid stalks
- Flowers usually from June to August

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; digging up; and disposal in the garbage
- Pesticide: Picloram TIPA & 2,4-D TIPA / Fluroxypyr 1-methylheptyl ester & 2,4-D 2-ethylhexyl ester ‘or’ 2,4-D Amine 600
- Biological: None used at present

A

B

C

D

A) Plants can be found growing anywhere in disturbed soil areas. B) Woolly cottony seed pods with hooks. C) Purple-pink flower heads surrounded by hooked bracts. D) Large rhubarb-like heart shaped leaf.

YELLOW CLEMATIS (*Clematis tangutica*)

Refer to:
Table 3; Group 2 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Branched twining vine, 3-4 m long, with young stems green and older stems becoming woody
- Leaves are compound with spear shaped leaflets, pointed tips and coarsely toothed edged leaves that grow on new and old wood
- Flowers are lemon yellow, with four petals turned downward shaped like bells
- Seeds are oval shaped with a long silky tail
- Long tap root

Biology
- Native to Asia; introduced and sold as an ornamental plant
- Perennial vine; reproduces both by seed and vegetatively from stem pieces
- Numerous seeds with long silky tufts
- Has escaped into natural areas and found thriving in open woodland, grassy areas, graveled areas and along creek banks.
- Prefers sun but is tolerable of cold, drought, nutrient poor soils and partially shaded areas
- Blooms from July to September

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) An ornamental perennial vine often attached to a fence or upright structure. B) Bell-shaped four petal flower. C) Long coarsely-toothed compound leaf. D) Round cluster of seeds attached to a long silky tail.

Group 3 - Noxious

COMMON TANSY (*Tanacetum vulgare*)

Refer to:
Table 3; Group 3 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Mid season (July – August) for non-pesticide control activity

Rating
Noxious

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Several branched stems per plant and can grow up to 1.5 m tall, hairless often purplish red and dotted with glands
- Leaves are alternate, deeply divided with toothed margins and edges
- Flowers are small, yellow, grouped into button-like heads resembling a single flower
- Seeds are small, 1.5 mm long, grey or tan, with longitudinal ridges
- Aromatic, strong smelling plant when crushed

Biology
- Originated in Europe, introduced probably for its supposed medicinal properties
- Perennial; spreading mainly by seed but also spreading by rhizomes (roots)
- Seeds can be viable up to 25 years
- Widespread distribution, because once introduced, tansy spreads rapidly
- Can be a serious problem in pastures because its unpalatable to livestock and thus tends to increase in grazed pastures; it is poisonous and can cause abortion or death in animals forced to eat it by lack of more suitable forage
- Flowers from July to September

Why Manage
- Provincial Weed Act
- Public perception and complaints
- Control spread from private property; control spread to private property
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; digging up; mowing; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Typical common tansy infestation site. B) Once established the plant forms dense patches in unmaintained areas. C) The individual yellow flowers are small and grouped into button-like heads resembling a single flower. D) The leaves are without a stem and divided into many leaflets (small leaves); these are often divided again.

TALL BUTTERCUP (*Ranunculus acris*)

Refer to:
Table 3; Group 3 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Erect stems, somewhat hairy, branched in the upper part, and grows up to 90 cm tall
- Leaves are hairy, deeply lobed into three or five segments, with each segment lobed again. Upper leaves are fewer and progressively smaller
- Flowers are glossy, bright yellow lacquered appearance with 5 petals
- Tiny seeds are grouped in a cluster, black-brown in colour, each with a short hook
- Roots are fibrous, occasionally rhizomatous

Biology
- Introduced from Europe and sold as an ornamental plant
- Perennial; reproduces by seed and vegetatively from stem pieces
- Plant capable of producing 250 seeds which can remain viable for 2-4 years
- Weed of moist pastures, meadows, roadsides and coarse soils of gravel pits
- Toxic with a bitter acrid juice which causes severe pain and inflammation when grazed by livestock
- Flowers mid summer

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; mowing; weed eating; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) Plant stems are erect and branched in the upper part. B) Flowers have five petals which are glossy bright yellow in color. C) Leaves on the lower stem are on long stalks, are deeply divided and are much larger than the upper leaves. D) Leaves can be soft and hairy on both surfaces.

Group 4 - Noxious

CREEPING BELLFLOWER (*Campanula rapunculoides*)

Refer to:
Table 3; Group 4 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Mid season (July – August) for non-pesticide control activity

Rating
Noxious

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Erect stems growing up to 1 m tall
- Leaves are heart shaped, alternately arranged on the stem with a short stalk
- Purple bluebell shaped flowers fused together and arranged on a spike
- Seeds are small and light brown with many in a capsule
- Invasive rhizomatous creeping extensive root system

Biology
- Introduced as a ornamental plant from Europe
- Perennial; spreading by creeping roots and seed
- Each plant is capable of producing 3,000 seeds annually
- Tends to take over flower beds and moves out onto lawns
- Not a problem in croplands, but its creeping rootstalk could become a problem in hay and pasture lands
- Resistant to some chemicals
- Flowers from June into August

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; mowing; digging up; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C, D

A) Creeping bellflower growing in a native area. B) Light purple bell shaped flowers. C) Lower leaves are round heart-shaped and on a stalk. D) Upper leaves are longer, arrow-like and stalkless.

OXEYE DAISY (Leucanthemum vulgare)

Refer to:
Table 3; Group 4 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Mid season (July – August) for non-pesticide control activity

Rating
Noxious

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Erect, multiple, unbranched, smooth stems growing up to 1 meter tall
- Rosette basal leaves are spoon shaped and stalked and broad toothed; stem leaves, becoming smaller and stalkless, alternately arranged with wavy edges
- Flowers have white petals with a yellow centre and one flower per stem
- Seeds are small black with ridges
- Shallow fibrous root system with rhizomes

Biology
- Escapee from flowerbeds, introduced from Eurasia as an ornamental plant
- Shallow rooted perennial; spreads by seeds and short rhizomes forming patches
- One plant can produce 500 seeds and they can remain viable up to 3 years
- Habitats are roadsides, pastures and waste places in the forested area of Alberta
- Does not develop flowers in its first year from seed, but remains a rosette; agriculture concern is when eaten by cattle it imparts a disagreeable taste to the milk; the seed of oxeye daisy is difficult to separate from small grass seeds such as timothy
- Flowers from June to August

Why Manage
- Provincial Weed Act
- Public perception and complaints
- Control spread from private property using enforcement; control spread to private property
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by digging up; mowing; and disposal in the garbage
  Pesticide: None used at present
- Biological: None used at present

A, B

C

D

A) Oxeye daisy infestation growing in a natural area. B) Flower with a yellow center surrounded by white petals. C) Flowers are solitary at the end of the branch. D) The lower leaves are spoon-shaped with wavy edges and a long leaf stem.

WHITE COCKLE (*Silene latifolia*)

Refer to:
Table 3; Group 4 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Several stems from the branched crown of the plant, usually unbranched, with swollen nodes, covered by short stiff hairs, up to 1.1 m tall
- Leaves are in pairs from each node, narrowly oval-shaped, broadest near the middle or towards the free end, to 2 cm wide and 10 cm long, lower leaves stalked, upper ones not stalked
- White (or pinkish) fragrant flowers arranged in spreading clusters on a stalk.
- Seeds are numerous found in capsules opening by 10 teeth; the seeds are kidney shaped, grey colored with warty bumps on them
- Initially forming a tap root followed by spreading lateral roots

Habitat and Biology
- Originating from Eurasia
- Fleshly rooted biennial or short-lived perennial; reproducing by seed
- Prolific seed producer that can spread rapidly
- Habitats are undeveloped waste places, hay fields, and grain fields
- Plants are either male or female
- Flowers set seeds all summer

Why Manage
- Provincial Weed Act
- Public perception and complaints; control spread to private property
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; mowing; weed eating; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B, C

D, E

F

A) An undeveloped area infested with white cockle. B) Female flower attached to an ovary; female and male plants are separate. C) Frontal view of a male flower with stamens that produce pollen. D) Flowers are arranged on individual branched stalks. E) A 10 veined capsule. F) Leaves are opposite on the stem.

YELLOW TOADFLAX (*Linaria vulgaris*)

Refer to:
Table 3; Group 4 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristic
- Stems are erect hairless, green, unbranched and 20-60 cm tall
- Leaves are alternate, numerous one per node, essentially stalkless, 2-10 cm long by 1-5 mm wide, hairless and narrowed towards the base
- Yellow snapdragon-like flowers, arranged alternately on short stalks in dense spikes at the end of the stems and having a long spur extending from the base of the flower
- Seeds have a winged margin, and are dark brown to black in a capsule
- Extensive horizontal spreading roots and secondary fibrous roots

Biology
- Introduced from Europe as an ornamental plant
- Perennial; spreading by creeping roots and by seed
- Seeds survive for longer periods in undisturbed soil than in cultivated land and seed survives up to 10 years
- Now an escaped ornamental, found on roadsides, rail lines and uncultivated areas.
- Prolific production of strongly winged, readily dispersed seeds and tenacious creeping root system make toadflax a potential menace
- Flowering occurs from June through fall, with shoots flowering earlier than seedlings
- Toadflax is a strong competitor and generally found growing in clumps

Why Manage
- Provincial Weed Act
- Public perception and complaints
- Control spread from private property using enforcement; control spread to private property
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand removal; digging up; mowing; weed eating; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D

A) An escaped ornamental found on roadsides, rail lines and uncultivated land. B) Flower blossoms grow in clusters along the stem. C) The flowers are bright yellow 'snapdragon like' with an orange center. D) Stalkless leaves are bluish-green in color, numerous, alternate, narrow, pointed, smooth and spread in all directions.

Group 5 - Noxious

BLUEWEED (*Echium vulgare*)

Refer to:
Table 3; Group 5 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Mid season (July – August) for non-pesticide control activity

Rating
Noxious

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Stems are covered in short hairs, often with swollen dark bases that form noticeable flecks; grows up to 1 m tall
- Leaves are rough and hairy with narrow basal leaves and alternate narrow stalkless stem leaves
- Bright blue short tube flowers fused together at the base and arranged on the upper side of short stems
- Seeds are grayish brown, angular, rough and wrinkled nutlets clustered in groups of four
- Taproot system

Biology
- Introduced as an ornamental plant from Africa and grown as an oilseed crop
- Biennial to short lived perennial (rosette the first year); reproduces by seed
- Produces 500-2,000 seeds per plant; contaminates clover and crop seeds
- Not usually found in cultivated crops but can invade pastures and rangelands
- Toxic to horses and sheep
- Flowering June to July

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand digging up; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

Photographs A, B, C and D (Page 203) credit Re: http://www.invasiveplants.ab.ca/photogallery.htm See: Alberta Invasive Plants Council Photo-gallery as source.

A

B

C

D

A) Plants grow up to 90 cm tall with their stems covered in short hairs. B) Reddish-purple flower buds become bright blue upon opening. C) The rosette stage of the biennial plant has its leaves covered with stiff hairs. D) Taproots have small fibrous lateral growing roots.

DALMATIAN TOADFLAX (*Linaria dalmatica*)

Refer to:
Table 3; Group 5 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Noxious
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Upright narrow stems that grow 20-60 cm tall with multiple stems growing from a single woody stem
- Leaves are short, waxy, bluish green in colour, heart shaped, and alternately clasp the stem
- Bright snapdragon like flowers with a orange throat forming dense clusters at the end of the stem
- Seeds are irregularly angled in a two cell capsule
- Vigorously-growing root system producing taproot and creeping roots

Biology
- Native to the Mediterranean; introduced sometime around 1900 possibly as an ornamental plant
- Perennial; spreads by horizontal roots and seed
- Plant can produce up to 500,000 seeds; remains viable in soil up to 10 years
- Tolerates low temperature and course soils
- Competes with native grasses and wildflowers
- Toxic to animals; poisoning is rare as livestock will generally not eat
- Has a long flowering period generally from May to August

Why Manage
- Provincial Weed Act
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures
- Physical/mechanical: Control by hand digging up; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

Photographs A, B and C (Page 205) credit Re: http://www.invasiveplants.ab.ca/photogallery.htm See: Alberta Invasive Plants Council Photo-gallery as source.

A

B

C

A) Plant stems are erect and grow up to one meter tall with some branching in the upper part. B) Flowers resemble a snapdragon, bright yellow with a yellow-orange throat. C) The taproots have lateral growing rhizomes and are deeply rooted.

Group 6 – Others (Not in the Weed Act)

BULL THISTLE (*Cirsium vulgare*)

Refer to:
Table 3; Group 6 (Page 62)

Monitoring Season
Early (May – June) and late (September – October) season

Control Season
Mid season (July – August) for non-pesticide control activity

Rating
Other – not in the Weed Act

Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight

Physical Characteristics
- Stems can grow up to 0.5 to1.5 m tall and become woody and branched
- Alternate long leaves are sword shaped and end in a long protruding yellow spine; upper surface of leaf has short prickles and under surface is cottony
- Flower heads are purplish pink to purple with prickled tipped bracts
- Shiny brown seeds covered with fluffy white bristles
- Tap root system

Biology
- Native to Europe, Asia and Africa; accidently transported in crop seed
- Biennial plant (rosette the first year) that spreads by seed
- Hundreds of seeds per head, with seeds viable for a decade
- Plant invades disturbed areas and forms dense thickets displacing other vegetation
- Unpalatable to wildlife and livestock due to its spiny nature
- Grows in full sun to light shade under moist to dry conditions
- Plant spreads by reseeding itself and occasionally forms colonies
- Flowers July through August

Why Manage
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (As required)
- Physical/mechanical: Control by digging up; mowing; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

A

B

C

D, E

A) This weed is commonly found in industrial sites. B) The biennial lifecycle is characterized by a rosette in its first season. C) Leaves are covered with spiked prickles on their edges and tips. D) Flowers are pinkish-purple. E) Fruit is topped by a circle of plume-like white hairs.

DANDELION (*Taraxacum officinale*)

Refer to:
Table 3; Group 6 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Early season (May – June) for pesticide control activity
Mid season (July – August) for non-pesticide control activity
Rating
Other – not in the Weed Act
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems are upright, round and hollow
- Leaves are spoon shaped, deeply lobed, clustered at the top of the root crown
- Flowers are bright yellow, in a head resembling a single flower at the end of a stem
- Seed is attached to a parachute of white hairs, enabling it to drift with the wind
- Plants have a thick tap root, filled with a white milky substance

Biology
- Native of Eurasia but a cosmopolitan (familiar all over the world) weed
- Perennial; spreading by seed
- Prolific seed producers that start producing seed early in the spring; seedlings appear early summer; mid to late June, and a significant proportion of these seedlings become fall rosettes
- Common lawn weed, also found in undisturbed areas and fields
- Dandelions are more susceptible to herbicides applied in the fall
- Can be found flowering early in the spring
- **Why Manage**
- Control spread to private property
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (As required)
- Physical/mechanical: Control by hand removal; digging up; mowing; weed eating; and disposal in the garbage
- Pesticide: 2,4-D Amine 600
- Biological: None used at present

A

B

C

D, E

A) This site is heavily infested with dandelions and many of the plants have gone to seed. B) Bright yellow petal-like ray flowers are clustered in a head; this resembles a single flower. C) Dispersal is approximately 2 weeks from bloom to seed. D) Flower heads are solitary at the end of hollow stalks. E) The yellow flowers go to seed and develop into a showy, circular ball; seeds are distributed widely by the blowing wind.

QUACK GRASS (*Agropyron repens*)

Refer to:
Table 3; Group 6 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Periodic for pesticide control activity
Mid season (July – August) for non-pesticide control activity
Rating
Other – not in the Weed Act
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stem erect, hollow, smooth, growing up to 1.2 m tall
- The flower spike is 10-20 cm long with spikelets (florets) 3-8 on each side of the stem
- Seeds 10 mm long, pale yellow, often with a short awn-slender bristle at the end
- Roots are long slender white rhizomes with a yellowish sharp pointed tip

Biology
- Native grass to Europe and Western Asia; moved in cereal crops from its point of origin
- Aggressive perennial; reproduces by creeping rhizomes and seeds
- Seeds produced are very viable and may lie dormant in the soil for many years before germinating. Produces 25-40 seeds per stem on the plant
- Distribution in meadows, pastures, waste sites and an extremely troublesome weed in cultivated areas
- Known as a temperate or cool season grass; is reasonably drought tolerant
- Inconspicuous flowering stage occurs late June to July

Why Manage
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (As required)
- Physical/mechanical: Control by hand removal; digging up; mowing; weed eating; and disposal in the garbage
- Pesticide: Isopropylamine salt
- Biological: None used at present

A

B

C

A) An aggressive grass capable of filling in an area often at the exclusion of other vegetation. B) Leaf blades are wide, flat and pointed with small auricles (ear-like appendages). C) Difficult to control mechanically and it is often found growing in close proximity to built structures.

WHITE CLOVER (Trifolium repens)

Refer to:
Table 3; Group 6 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for pesticide and non-pesticide control activity
Rating
Other – not in the Weed Act
Damage
Causes damage to desired turf grass plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems are long, creeping, stoloniferous to erect, often forms mats rooting at the nodes
- Leaves are trifoliate; commonly referred to as a shamrock leaf
- Many flowered heads 1.5-2 cm; flowers are pea-like 5-9 mm long, white to cream often pink tinged
- Flowers between May and July, however in prolonged hot and dry conditions plant goes semi-dormant
- Fruit pod known as a legume, 1-3 seeded

Biology
- Mostly glabrous perennial
- Fibrous root system with stems that root at the nodes
- Native to South Africa, Europe and West Asia
- Widely introduced as a pasture crop and is now common in most grassy areas
- Common lawn weed, found in a variety of native habitats such as mountain meadows
- Can tolerate low mowing height conditions and can grow in many different soil pH types, but prefers clay
- Considered to be a beneficial plant due to its ability to fix nitrogen in soil and compete with many common lawn weeds
- **Why Manage**
- Control spread to private property
- Public perception and complaints
- Aesthetically unpleasant in higher quality turf grass environments or park areas held at a higher maintenance standard
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (As required)
- Physical/mechanical: Mowing
- Pesticide: Dicamba, 2,4-D, Mecoprop-P (dimethylamine salt)
- Biological: None used at present

A

B

A) An introduced perennial pasture crop now commonly found worldwide growing in grassy areas; tolerates close mowing. B) Herbaceous, low growing, with heads of whitish flowers; considered beneficial to organic or natural lawn care because of its ability to fix nitrogen and out-compete lawn weeds.

WILD CARAWAY (*Carum carvi*)

Refer to:
Table 3; Group 6 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Other – not in the Weed Act
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- Stems are erect, branched and can grow up to 60-90 cm tall
- Leaves are alternate and very finely divided
- Flowers are white but occasionally pinkish occurring in groups at the top of the stem with both male and female flowers on the same plant
- Each flower produces two crescent-shaped narrow brown seeds that have a fine distinct tan linear rib
- Root is a narrow parsnip-like taproot with a black skin and white core

Biology
- An introduced spice crop native to Europe; now escaped from cultivation
- Biennial (rosette in the first year); reproduces by seed
- Each plant can produce several thousand seeds
- Extremely invasive and persistent plant; competes with native plants
- Grows in a wide variety of soil types
- Seed heads are extremely brittle and fall apart upon contact
- All parts of the plant are edible
- Flowers early summer

Why Manage
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (As required)
- Physical/mechanical: Control by hand removal; digging up; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

Photographs A, B, C and D (Page 215) credit Re: http://www.invasiveplants.ab.ca/photogallery.htm See: Alberta Invasive Plants Council Photo-gallery as source.

A

B

C

D

A) The erect biennial plant can grow up to a meter tall. B) Small, white, sometimes pink flowers form in groups (compound umbels) at the top of stems. C) The plant has a narrow taproot. D) Leaves are finely divided alternately on the stem; carrot-like in appearance.

WILD CUCUMBER (*Echinocystis lobata*)

Refer to:
Table 3; Group 6 (Page 62)
Monitoring Season
Early (May – June) and late (September – October) season
Control Season
Mid season (July – August) for non-pesticide control activity
Rating
Other – not in the Weed Act
Damage
Causes damage to desired plants due to competition for space, water, nutrients and sunlight
Physical Characteristics
- A rapid climbing vine 3-8 m long that uses branched tendrils to climb
- The leaves are alternate and attached to the stem by long stalks; each leaf is palmated shaped (spreading like fingers from the palm) with 5 triangular pointed tips
- White-greenish, frilly bell shaped, with 6 petal flowers
- A fleshy, egg-shaped, weak prickled fruit with 4 dark brown seeds inside. When ripened it opens from the bottom dropping its watermelon-like seeds
- Fibrous root system

Biology
- Native to Eastern North America; introduced as an ornamental plant
- Annual; completes its life cycle in one season to reseed
- Likes moist soil and sheltered areas from direct sunlight
- Found growing in native treed areas and along creeks and river banks
- Flowers July and August

Why Manage
- Public perception and complaints
- To maintain native species balance and variety (biodiversity)

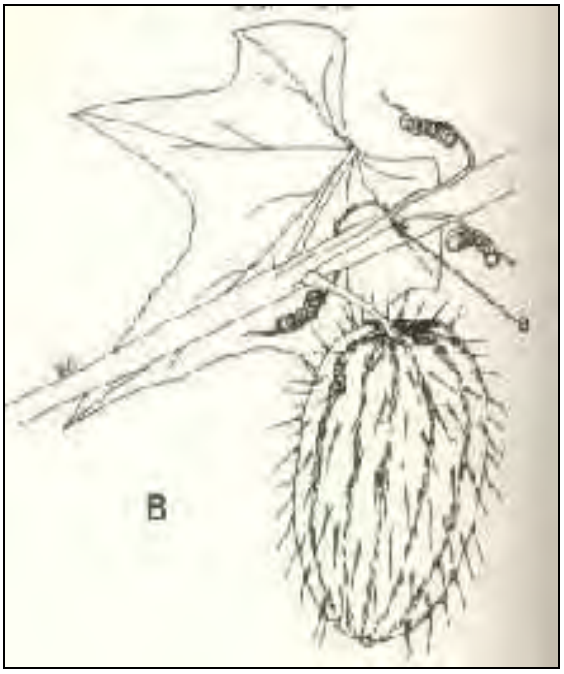
Monitoring Procedures
- Pre-control monitoring
- Post-control monitoring
- Spot checking

Control Procedures (As required)
- Physical/mechanical: Control by hand removal; and disposal in the garbage
- Pesticide: None used at present
- Biological: None used at present

Photographs A, B and C (Page 217) credit Re: http://www.omafra.gov.on.ca/english/crops/facts/ontweeds/wild_cucumber.htm See: Minister of Agriculture Food and Rural Affairs, Government of Ontario Re: Ontario Weeds: Wild cucumber as source.

A

B



C

A) An annual herbaceous vine; flowers with separate sexes. B) Leaves are bright green and usually five lobed attached to the stem with a petiole; each leaf is usually paired with a long, curly tendril on its opposite side. C) The oblong shaped, weakly prickled fleshy fruit opens up upon maturity releasing four flat seeds.

Notes

Notes

Notes

Province of Alberta

ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT

PESTICIDE (MINISTERIAL) REGULATION

Alberta Regulation 43/1997

With amendments up to and including Alberta Regulation 315/2003

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(Consolidated up to 315/2003)

ALBERTA REGULATION 43/97

Environmental Protection and Enhancement Act

PESTICIDE (MINISTERIAL) REGULATION

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Province of Alberta

ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT

PESTICIDE SALES, HANDLING, USE AND APPLICATION REGULATION

Alberta Regulation 24/1997

With amendments up to and including Alberta Regulation 222/2009

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ALBERTA REGULATION 24/97

Environmental Protection and Enhancement Act

PESTICIDE SALES, HANDLING, USE AND APPLICATION REGULATION

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Government of Alberta

ENVIRONMENTAL CODE OF PRACTICE FOR PESTICIDES

Effective May 12, 2010

Made under the Environmental Protection and Enhancement Act, RSA 2000, cE-12

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ENVIRONMENTAL CODE OF PRACTICE FOR PESTICIDES

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WEED CONTROL ACT

WEED CONTROL REGULATION

Alberta Regulation 19/2010

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ALBERTA REGULATION 19/2010

Weed Control Act

WEED CONTROL REGULATION

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Schedule

1 The following plants are designated as prohibited noxious weeds in Alberta:

autumn olive — *Elaeagnus umbellata* Thunb.
balsam, Himalayan — *Impatiens glandulifera* Royle
barberry, common — *Berberis vulgaris* L.
bartsia, red — *Odontites vernus* (Bellardi) Dumort
buckthorn, common — *Rhamnus cathartica* L.
cinquefoil, sulphur — *Potentilla recta* L.
crupina, common — *Crupina vulgaris* Pers. ex Cass.
dyer's woad — *Isatis tinctoria* L.
Eurasian water milfoil — *Myriophyllum spicatum* L.
flowering rush — *Butomus umbellatus* L.
garlic mustard — *Alliaria petiolata* (M. Bieb.) Cavara & Grande
goatgrass, jointed — *Aegilops cylindrica* Host
hawkweed, meadow — *Hieracium caespitosum* Dumort.
hawkweed, mouse-ear — *Hieracium pilosella* L.
hawkweed, orange — *Hieracium aurantiacum* L.
hoary alyssum — *Berteroa incana* (L.) DC.
hogweed, giant — *Heracleum mantegazzianum* Sommier & Levier
iris, pale yellow — *Iris pseudacorus* L.
knapweed, bighead — *Centaurea macrocephala* Puschk. ex Willd.
knapweed, black — *Centaurea nigra* L.
knapweed, brown — *Centaurea jacea* L.
knapweed, diffuse — *Centaurea diffusa* Lam.
knapweed, hybrid — *Centaurea* × *psammogena* Gáyer
knapweed, meadow — *Centaurea* × *moncktonii* C. E. Britton
knapweed, Russian — *Rhaponticum repens* (L.) Hidalgo
knapweed, spotted — *Centaurea stoebe* L. ssp. *micranthos* (Gugler) Hayek
knapweed, squarrose — *Centaurea virgata* Lam. ssp. *squarrosa* (Willd.) Gugler
knapweed, Tyrol — *Centaurea nigrescens* Willd.
knotweed, giant — *Fallopia sachalinensis* (F. Schmidt Petrop.) Ronse Decr.
knotweed, hybrid Japanese — *Fallopia* × *bohemica* (Chrtek & Chrtková) J. P. Bailey
knotweed, Japanese — *Fallopia japonica* (Houtt.) Ronse Decr.
loosestrife, purple — *Lythrum salicaria* L.
medusahead — *Taeniatherum caput-medusae* (L.) Nevski
nutsedge, yellow — *Cyperus esculentus* L.
puncturevine — *Tribulus terrestris* L.
ragwort, tansy — *Jacobaea vulgaris* Gaertn.
rush skeletonweed — *Chondrilla juncea* L.
saltcedar — *Tamarix ramosissima* Ledeb.
saltlover — *Halogeton glomeratus* (M. Bieb.) C.A. Mey.
St John's-wort, common — *Hypericum perforatum* L.
starthistle, yellow — *Centaurea solstitialis* L.
tamarisk, Chinese — *Tamarix chinensis* Lour.

tamarisk, smallflower — *Tamarix parviflora* DC.
thistle, marsh — *Cirsium palustre* (L.) Scop.
thistle, nodding — *Carduus nutans* L.
thistle, plumeless — *Carduus acanthoides* L.

2 The following plants are designated as noxious weeds in Alberta:

baby's-breath, common — *Gypsophila paniculata* L.
bellflower, creeping — *Campanula rapunculoides* L.
bindweed, field — *Convolvulus arvensis* L.
blueweed — *Echium vulgare* L.
brome, downy — *Bromus tectorum* L.
brome, Japanese — *Bromus japonicus* Thunb.
burdock, great — *Arctium lappa* L.
burdock, lesser — *Arctium minus* (Hill) Bernh.
burdock, woolly — *Arctium tomentosum* Mill.
buttercup, tall — *Ranunculus acris* L.
chamomile, scentless — *Tripleurospermum inodorum* (L.) Sch. Bip.
clematis, yellow — *Clematis tangutica* (Maxim.) Korsh.
cockle, white — *Silene latifolia* Poir. ssp. *alba* (Miller) Greuter & Burdet
daisy, oxeye — *Leucanthemum vulgare* Lam.
dame's rocket — *Hesperis matronalis* L.
henbane, black — *Hyoscyamus niger* L.
hoary cress, globe-podded — *Lepidium appelianum* Al-Shehbaz
hoary cress, heart-podded — *Lepidium draba* L.
hoary cress, lens-podded — *Lepidium chalepense* L.
hound's-tongue — *Cynoglossum officinale* L.
mullein, common — *Verbascum thapsus* L.
pepper-grass, broad-leaved — *Lepidium latifolium* L.
scabious, field — *Knautia arvensis* (L.) Coult.
sow thistle, perennial — *Sonchus arvensis* L.
spurge, leafy — *Euphorbia esula* L.
tansy, common — *Tanacetum vulgare* L.
thistle, Canada — *Cirsium arvense* (L.) Scop.
toadflax, Dalmatian — *Linaria dalmatica* (L.) Mill.
toadflax, yellow — *Linaria vulgaris* Mill.

Province of Alberta

AGRICULTURAL PESTS ACT

Revised Statutes of Alberta 2000
Chapter A-8

Current as of November 1, 2010

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AGRICULTURAL PESTS ACT

Chapter A-8

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APPENDIX "A"

TRAINING CHECKLIST
FOR AUTHORIZED AND NON-CERTIFIED PESTICIDE APPLICATOR ASSISTANTS

THE TRAINING CHECKLIST MUST BE COMPLETED YEARLY FOR ALL ASSISTANTS, KEPT BY THE PLACE OF EMPLOYMENT (WITH COPIES OF THE AUTHORIZED ASSISTANT CERTIFICATE), AND BE MADE AVAILABLE TO ALBERTA ENVIRONMENT UPON REQUEST.

THE TRAINING CHECKLIST IS SPECIFIC TO THE PLACE OF EMPLOYMENT SPECIFIED.

A NEW TRAINING CHECKLIST MUST BE COMPLETED:
- **WHEN THE ASSISTANT CHANGES EMPLOYMENT, OR**
- **PRIOR TO USING A NEW TYPE OF TREATMENT (e.g. pesticide or equipment change).**

ASSISTANT'S NAME: _____

AUTHORIZED ASSISTANT CERTIFICATE NUMBER: _____
(indicate not applicable if the assistant is a non-certified assistant)

CERTIFICATION CLASS (please check all that apply):

_____ AERIAL	_____ AGRICULTURE	_____ AQUATIC
_____ FORESTRY	_____ STRUCTURAL	_____ FUMIGATION
_____ GREENHOUSE	_____ INDUSTRIAL	_____ LANDSCAPE
_____ BITING FLY	_____ OTHER (please specify) _____	

ADDRESS: _____

_____

NAME OF EMPLOYER: _____

ADDRESS OF EMPLOYER: _____

I, _____, Pesticide Applicator Certificate # _____,
(name of certified applicator)

have thoroughly reviewed with the above "Assistant", the following subject areas (directly related to the certification class(es)indicated above) and find this person competent to perform supervised pesticide applications in this (these) certification class(es):

(a) _____ Demonstrated the proper fitting, use and maintenance of the protective equipment;

(b) _____ Reviewed all labels and MSDS for pesticide products that will be used;

(c) _____ Can correctly identify the pest(s) to be controlled;

(d) Can use the application equipment specific to this operation, including:
- (i) _____ daily calibration procedures to ensure accurate and even distribution of pesticide,
- (ii) _____ proper mixing and loading procedures as specified by the applicator,
- (iii) _____ familiarity with all mechanical / operating parts of the equipment,
- (iv) _____ proper use and maintenance procedures,
- (v) _____ drift control measures, and

(vi) _____ clean-up of equipment when changing pesticides or at the end of the day.
(vii) List the types of equipment for which the use has been reviewed:

_____

(e) Understands the employer's pesticide application policies, including:
(i) _____ environmental conditions (wind, temperature, probability of rain) that would stop or modify a pesticide application, and
(ii) _____ proximity to non-target areas that may require them to stop or modify a pesticide application.

(f) Understands the legislative requirements (including the *Environmental Code of Practice for Pesticides* and the *Pesticide Storage Guidelines* published by Alberta Environment) and employer's procedures, including:
(i) _____ restrictions for pesticide applications near water,
(ii) _____ pesticide transportation,
(iii) _____ temporary and permanent pesticide storage,
(iv) _____ pesticide container disposal, and
(v) _____ record-keeping related to all pesticide applications.

(g) Understands the employer's Emergency Response Plan procedures and equipment available for:
(i) _____ spill clean-up and reporting,
(ii) _____ fire and theft,
(iii) _____ first aid.

(h) _____Is able to operate the communication equipment and understands the proper communication procedures;

(i) _____Understands how to handle complaints.

(j) _____ (for forestry applications only -) Understands the Risk Management Section of the *Forest Management Herbicide Reference Manual.*

_____ _____

Date Signature of certified applicator

I have reviewed and understood the information as noted above, and believe that I am competent to perform pesticide applications in the certification classes noted above.

_____ _____

Date Signature of Assistant

Alberta
ENVIRONMENT

PESTICIDE STORAGE:

Regulatory Requirements and Guidelines
(Schedule 1 & 2 Pesticides)

Release Date: February 7, 1997

Revision Date: June 15, 1999

Alberta
ENVIRONMENT

PESTICIDE STORAGE:
Regulatory Requirements and Guidelines (Schedule 1 & 2 Pesticides)

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Provincial Regulation of Storage of Pesticides

The storage of pesticides is regulated provincially under:

(1) the *Environmental Protection and Enhancement Act* (EPEA) for aspects of pesticide storage related to spill cleanup and containment;

(2) the *Safety Codes Act* (Alberta Building and Fire Codes) for aspects related to structural integrity and fire prevention; and

(3) the *Occupational Health & Safety Act* for aspects related to worker exposure to pesticides.

In addition, municipal bylaws may restrict the location of pesticide storage facilities to specific industrial areas. Any person who stores pesticide is responsible to ensure that they have met all regulated requirements.

Purpose of Document

robot on space station

BY THE CANADIAN PRESS

LONGUEUIL, Que. — The Canadian Space Agency is singing the praises of Dextre, a two-armed $200-million robot, for its latest feat.

The space agency says that between March 7 and 9, the 3.7-metre-high robot accomplished what it calls the most intricate work ever performed by a robot in space.

Dextre was used for a mission designed to demonstrate the ability to use robots to refuel and service existing satellites in space.

CSA president Steve MacLean says in a statement the mission required surgical precision.

He compared it to the robotic equivalent of threading a needle while standing on the end of a diving board.

One of Dextre's tasks was to slide a tiny hook under a wire with only about a millimetre of clearance.

It was described as the most precise task ever attempted by Canada's state-of-the-art robot.

The mission, a collaborative effort between NASA and the Canadian Space Agency, involved a mock satellite roughly the size of a washing machine.

It was fitted with various caps, nozzles and valves like those found on satellites and Dextre used four specialized tools to interact with the mockup.

Dextre will resume its robotic refuelling operations in May.

It was delivered and installed on the International Space Station in 2008.

Where's that cab? Uber launches with slick cars tracked by GPS

THE CANADIAN PRESS

TORONTO — Betting that Canadian big-city dwellers are tired of dealing with cabs that take forever to arrive and the discomfort of sliding across grimy backseats, high-tech car service company Uber has brought its business north of the border, with a fleet of GPS-trackable luxury cars to compete with unreliable cabs and expensive private drivers.

Customers can use a smartphone app to trace exactly where their car is and precisely when it'll arrive. A text message is also sent by Uber just before the car pulls up.

CUSTOMERS CAN USE A SMARTPHONE APP TO TRACE EXACTLY WHERE THEIR CAB IS AND PRECISELY WHEN IT'LL ARRIVE. A TEXT MESSAGE IS ALSO SENT BY UBER JUST BEFORE THE CAR PULLS UP.

At the end of the ride, the transaction occurs digi-

have on top of taxis."

Kalanick says two-thirds of its rides are personal,